# REFU*sol*
## energy for life



**User Manual**
**Photovoltaic String Inverter**

**REFU*sol* 350K-8T**
**REFU*sol* 250K-6T**

# Contents

**REFU**sol

# 1. Basic Safety Information

**Outlines of this Chapter**

Please read the instruction carefully. Faulty operation may cause serious injury or death.

| | |
|---|---|
| **Note** | If you have any question or problem when you read the following information, please contact REFU Elektronik GmbH. |

**Safety Instruction**

Introduce the safety instruction during installation and operation of REFUsol 250~350K series.

**Symbols Instruction**

This section gives an explanation of all the symbols shown on the inverter and on the type label.

## 1.1 Requirement for Installation and Maintenance

Installation of REFUSOL 250~350K series on-grid inverter must conform with laws, regulations, codes and standards applicable in the jurisdiction.

Before installing and adjusting the produce, please read all of instructions, cautions and warnings in this manual.

Before connecting the product to the electrical utility grid, contact

the local utility company for allowance. Also, this connection must be made only by qualified electrician.

If the failure persists, please contact the nearest authorized maintenance center. If you don't know which service center is closest to you, please contact your local distributor. Don't repair the product by yourself, which may lead serious injury or damage.

Prior to installing and maintaining the equipment, a DC switch should be utilized to disconnect the high voltage DC from the PV array; otherwise, the resulting high voltage may cause serious injury.

## Qualified Person

When inverter is working, it contains lethal voltages and went hot in some area. Improper installation or misoperation could cause serial damage and injury. To reduce the risk of personal injury and to ensure the safe installation and operation of the product, only a qualified electrician is allowed to execute transportation, installation, commissioning and maintenance. REFU Elektronik GmbH does not take any responsibility for the property destruction and personal injury because of any incorrect use.

## Label and Symbols

REFUSOL 250~350K series has type label attach the side of product which contact important information and technical data, the type label must permanent attached to the product.

REFUSOL 250~350K series has warming symbol attached the product which contact information of safety operation. The warming symbol must permanent attached to the product.

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## Installation location requirement

Please install the inverter according to the following section. Place inverter in an appropriate bearing capacity object (such as solid brick wall, or strength equivalent mounting surface, etc.) and make sure inverter vertical placed. A proper installation location must have enough space for fire engine access for maintenance if faulty occur. Ensure the inverter is installed in a wall ventilated environment and have enough air cooling cycle. Air humidity should less than 90%.

## Transportation Requirement

Inverter is in the good electrical and physical condition when it ship out from factory. During transport, inverter must be placed in its original package or other proper package. Transportation company should responsible for any damage during transport period.

If you find any packing problems that may cause the damage of inverter or any visible damage, please notice the responsible transportation company immediately. You can ask your installer or REFUsol for help if necessary.

## Electrical Connection

Please comply with all the current electrical regulations about accident prevention in dealing with the current inverter.

| ⚠️ **Danger** | Before the electrical connection, use opaque material to cover the PV modules or disconnect PV string DC switch. PV arrays will produce dangerous voltage if it is exposure under sun |
|---|---|

| ⚠️ **Warming** | All operation must accomplish by certified electrical engineer. <br><br> ● Must be trained; <br><br> ● Completely read the manual operation and understand all information |
|---|---|
| ⚠️ **Attention** | Must get permission by local utility company before connecting to grid and the connection must be done by certified electrical engineers |

**Operation**

| ⚠️ **Danger** | Touching the utility grid or the terminal conductors can lead to lethal electric shock or fire! <br><br> Do not touch non-insulated cable ends, DC conductors and any live components of the inverter. <br><br> Attention to any electrical relevant instruction and document. |
|---|---|
| ⚠️ **Attention** | Enclosure or internal components may get hot during operation. Do not touch hot surface or wear insulated gloves. <br><br> Keep it away from kids! |

**Maintenance and repair**

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| | |
|---|---|
| ⚠️<br><br>**Danger** | Before any repair work, turn OFF the AC circuit breaker between the inverter and electrical grid first, then turn OFF the DC switch.<br><br>After turning OFF the AC circuit breaker and DC switch wait for at least 25 minutes before carry any maintenance or repair work. |
| ⚠️<br><br>**Attention** | Inverter should not work again until removing all faults. If any repair work is required, please contact local authorized service centre.<br><br>Should not open the inverter cover without authorized permit, REFUsol does not take any responsibility for that. |

## EMC/Noise Level

Electromagnetic compatibility (EMC) refers to that on electrical equipment functions in a given electromagnetic environment without any trouble or error, and impose no unacceptable effect upon the environment. Therefore, EMC represents the quality characters of an electrical equipment;

the inherent noise-immune character; immunity to internal electrical noise ;

external noise immunity; immunity to electromagnetic noise of external system ;

noise emission level; influence of electromagnetic emission upon environment.

| | |
|---|---|
| ⚠️ **Danger** | Electromagnetic radiation from inverter may be harmful to health! <br><br> Please do not continue to stay away from the inverter in less than 2m when inverter is working. |

## 1.2 Symbols and Signs

| | |
|---|---|
| ⚠️ **Danger** | High voltage of inverter may be harmful to health! <br><br> Only certified engineer can operate the product; <br><br> Juveniles, Disable, should not use this product; |
| ⚠️ **Caution** | Caution of burn injuries due to hot enclosure (Enclosure surface temperature limit up to 100℃)! <br><br> Only touch the screen and pressing key of the inverter while it is working. |
| ⚠️ **Attention** | PV array should be grounded in accordance to the requirements of the local electrical grid company. |
| ⚠️ **Warning** | Ensure the maximum DC voltage input is less than the maximum inverter DC voltage (including in low temperature condition). Any damage cause by overvoltage, REFUsol will not take the responsibility including warranty. |

Signs on the Product and on the Type Label

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REFUSOL 250~350K series has some safety symbols on the inverter. Please read and fully understand the content of the symbols before installation.

| Symbols | Name | Explanation |
|---------|------|-------------|
| | This is a residual voltage in the inverter! | After disconnect with the DC side, there is a residual voltage in the inverter, operator should wait for 25 minutes to ensure the capacitor is completely discharged. |
| | Caution of high voltage and electric shock | The products operates at high voltages. Prior to performing any work on the product, disconnect the product from voltage sources. All work on the product must be carried out by qualified persons only. |
| | Caution of hot surface | The product can get hot during operation. Avoid contact during operation. Prior to performing any work on the product, allow the product to cool down sufficiently |
| CE | Comply with the Conformite Europeenne (CE) Certification | The product comply with the CE Certification |

| | | |
|---|---|---|
| ⏚ | Grounding Terminal | This symbol indicates the position for the connections of an additional equipment grounding conductor |
| 📖ℹ | Observe the documentation | Read all documentation supplied with the product before install |
| +− | Positive pole and negative pole | Positive pole and negative pole of the input voltage (DC) |
| 🌡 | Temperature | Indicated the temperature allowance range |
| ⚠ | RCM logo | RCM (Regulatory Compliance Mark)<br><br>The product complies with the requirements of the applicable Australian standards. |
| ♻ | WEEE designation | Do not dispose of the equipment with household garbage at its end of life.<br><br>Dispose of it according to local laws and regulations or send it to the manufacturer. |

# 2. Product Characteristics

**Outlines of this Chapter**

**Product Dimensions**

Introduce the filed of use and the dimensions of the product.

**Function Description**

Introduce working principle and internal components.

**Circuit Topology Diagram**

The main inverter circuit topology diagram is presented.

**DC SWITCH DC Switch Description**

Describes the operation of the REFU 250~350K series inverter DC switch.

## 2.1 Intended Use

REFUSOL 250~350K series is a transformerless on grid PV inverter, that converters the direct current of the PV array to the grid-compliant, three-phase current and feeds into the utility grid.

| PV Module | Inverter | Transformer | Grid |
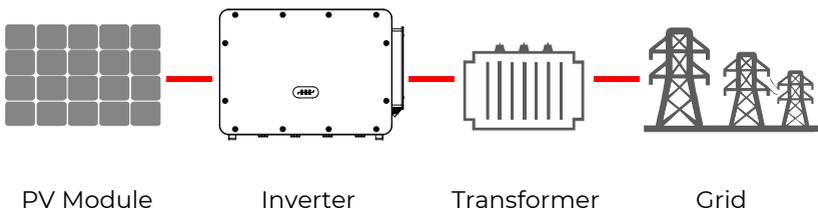
Figures 2-1 PV Grid-Tied System

REFUSOL 250~350K series may only be operated with PV arrays (photovoltaic module and cabling) for on grid condition. Do not use this product for any other or additional purposes. Any damage or property loss due to any use of the product other than described in this section, REFUsol will not take the responsibility. DC input of the product must be PV module, other source such like DC sources, batteries will against the warranty condition and REFUsol will not take the responsibility.

Supported grid types

**NOTE:**This model supports IT grid form.
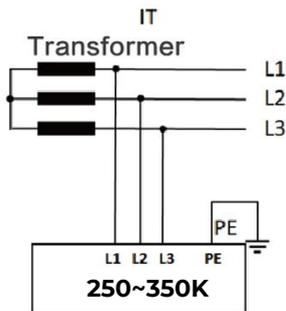


**Product Dimensions**

The choice of optional parts of inverter should be made by a qualified technician who knows the installation conditions clearly.

Dimensions Description

● REFUSOL 250~350K series

H× W × D = 828×1159×366mm
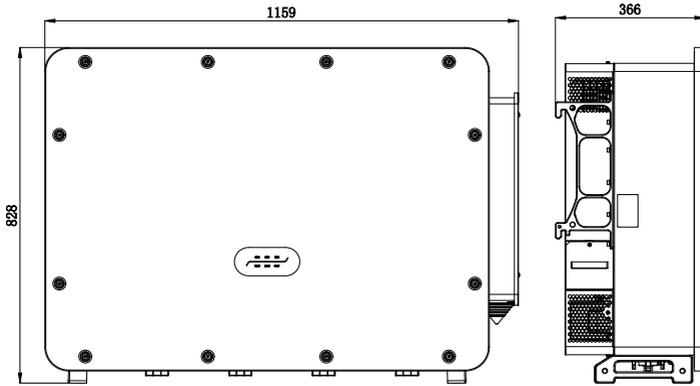
Figure 2-2 Product front view and left view dimensions
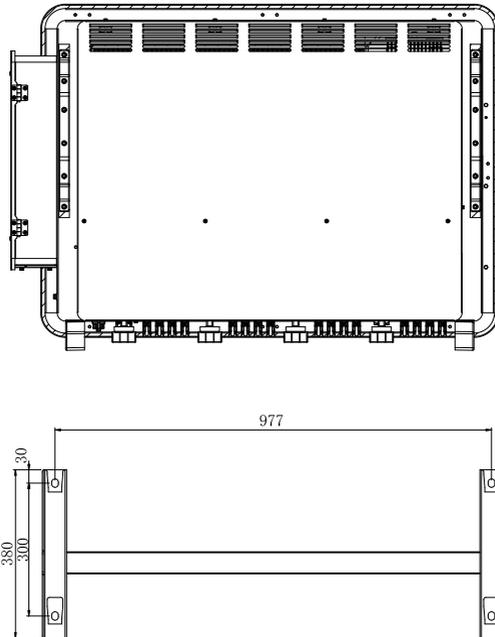




Figure 2-3 Product back view and bracket dimensions

REFUsol 250K-6T/350K-8T

◆ Labels on the equipment

Note: label must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.,); they must be cleaned regularly and always kept visible.
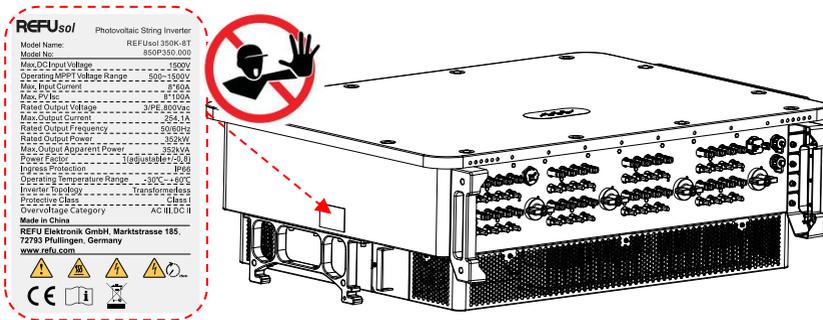


Figure 2-4 Product label

## 2.2 Function Description

DC power generated by PV arrays is filtered through Input Board then enter Power Board. Input Board also offer functions such as insulation impedance detection and input DC voltage/ current detection. DC power is converted to AC power by Power Board. AC power is filtered through Output Board then AC power is fed into the grid. Output Board also offer functions such as grid voltage/ output current detection, GFCI and output isolation relay. Control Board provides the auxiliary power, controls the operation state of inverter and shows the operation status by Display Board. Display Board displays fault code when inverter is abnormal operation conditions. At the same time, Control Board can trigger the replay to protect the internal components.

# 2.3 PID Function

When the inverter is not running at night, if the PID repair function is enabled, the PID function module raises the potential between the negative terminal of the PV array and ground to a positive value to suppress the PID effect.



| PV Module | Inverter | PE | Transformer | Grid |
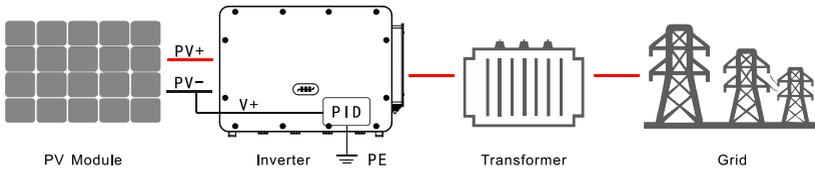
**Note**

- Before using the PID repair function, make sure that the ground voltage polarity of the PV module meets the requirements. If in doubt, contact the PV module manufacturer or read its corresponding user manual.

- The voltage of the built-in PID protection/repair function needs to meet the P-type components.

- Before turning on the PID repair function, make sure that the inverter has been applied to the IT system.

- When the inverter is not running, the PID module will apply reverse voltage to the photovoltaic module to restore the degraded module.

- Before turning on the PID repair function, you need to calibrate the working time of the inverter, and the PID defaults to work from 0:00 to 4:00.

- After the PID recovery function is enabled, the PV series voltage to ground is 650Vdc by default. You can change the default value through the App.

## 2.4 SVG Function

After the SVG is enabled, the inverter can continue to be connected to the grid at night, and can respond to the reactive power scheduling instructions, saving the investment cost of the reactive static compensator.

1. It is necessary to turn on the SVG enable bit when PV is powered. If SVG is enabled at night, the inverter cannot start the grid connection at night. If you have any questions, please contact the photovoltaic module manufacturer or read its corresponding user manual.

2. When the inverter operates in SVG state, the LED display green light (POWER) is always on.

3. In SVG state, the maximum reactive power of the inverter is 30% of the maximum apparent power.

4. SVG only works at night. If PV is powered, the inverter will automatically switch to the "grid connected state".

The inverter is a four-quadrant operation, through the rectification mode, to maintain the bus voltage to ensure the machine loss, and at the same time output reactive power to maintain the reactive power loss of the grid;

The nighttime SVG function of the inverter operates under the condition of no input voltage, firstly, it needs to enable both the "real-time reactive power control enable bit" and the "SVG enable

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bit", and when the DC input voltage decreases to the set threshold, the inverter starts to switch from the "grid-connected mode" to the "grid-connected mode". When the DC input voltage drops to the set threshold, the inverter starts to switch from "Grid-connected mode" to "Night SVG mode", and the desired reactive power output can be controlled through the APP, while the inverter stays in the "Night SVG mode" mode. Currently, the   REFUSOL 250~350K series supports SVG settings in the range of ±30% of rated power.

## Attention:

After turning on the SVG enable, the inverter can continue grid-connected operation at night and can respond to reactive power dispatch commands to save reactive static compensator investment cost.

1. It is necessary to turn on the SVG enable bit when the PV has power. If the SVG is enabled at night, the inverter cannot start grid connection at night. If in doubt, please contact the PV module manufacturer or read its corresponding user manual.

2. When the inverter is running in SVG state, the LED display green light (POWER) is always on.

3. In SVG state, the maximum reactive power of the inverter is 30% of the maximum apparent power.

SVG only works at night, if there is power in the PV, the inverter will switch to "grid-connected state" by itself.

## 2.5   Reactive Power Regulation

The inverter is capable of generating reactive power, so the amount of reactive power input to the grid can be controlled by setting the

phase shift factor (power factor). Grid connection management can be realized by a host computer via RS485 or PBUS communication control.

The inverter can support the grid by providing reactive power in different ways.

**Reactive mode I:** reactive power regulation through fixed power factor

The adjustable range of power factor PF is 0.8 to 1, -1 to -0.8. After the fixed power factor is set, the reactive power is calculated according to the current active power. The shaded part of the figure below shows the reactive power calculated from the fixed power factor and active power:
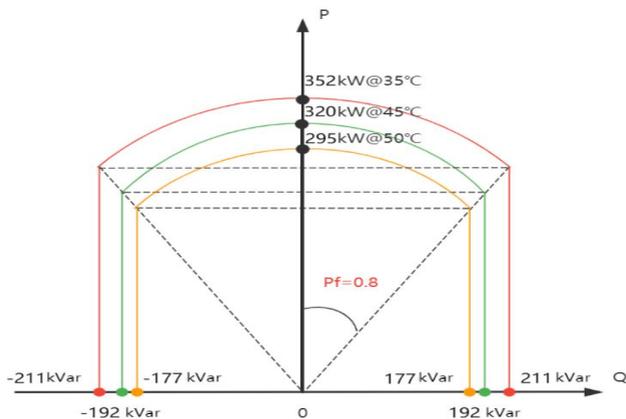


**Reactive mode 2:** reactive power regulation through fixed reactive power percentage

The adjustable range of reactive power percentage is -60% to 60%.

In this mode, set a fixed reactive power percentage, and the system will calculate the power factor angle according to the set reactive power percentage, and then calculate the corresponding reactive power according to the current active power.

For example, the Maximum active power of REFUsol 350K-8T is 352KW. If the reactive power percentage is set to 40%, the reactive power output is 352 * 40%= 140.8kvar.

**Reactive mode 3:** the reactive power of inverter will follow the change of active power

By setting the four level active power load reduction point, the reactive power is calculated according to the power factor corresponding to the set active power. When the active power changes, the corresponding reactive power also changes. The corresponding relationship between active power and power factor is shown in the figure:
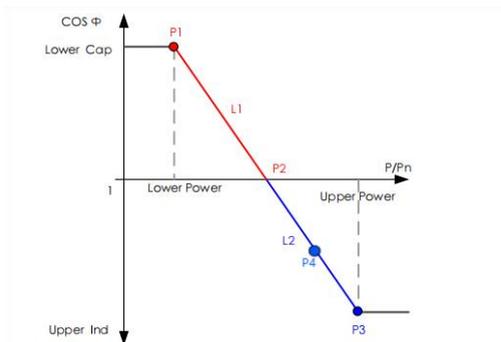
| Parameter | Explain | Range |
|---|---|---|
| P_P1 | Cos φ (P) Output active power at point p1 on the mode curve | Optional |
| P_P2 | Cos φ (P) Output active power at point P2 on the mode curve | Optional |
| P_P3 | Cos φ (P) Output active power at point P3 on the mode curve | Optional |
| P_P4 | Cos φ (P) Output active power at point P4 on the mode curve | Optional |
| Cosφ_P1 | Cos φ (P) Power factor angle at point p1 on the mode curve | 0.8~1 |
| Cosφ_P2 | Cos φ (P) Power factor angle at point p2 on the mode curve | 0.8~1 |
| Cosφ_P3 | Cos φ (P) Power factor angle at point p3 on the mode curve | -1~-0.8 |
| Cosφ_P4 | Cos φ (P) Power factor angle at point p4 on the mode curve | -1~-0.8 |
| Sgn(Cosφ)_P1 | Cos φ (P)Symbol of the power factor angle at point p1 on the mode curve | leading |
| Sgn(Cosφ)_P2 | Cos φ (P)Symbol of the power factor angle at point p2 on the mode curve | leading |
| Sgn(Cosφ)_P3 | Cos φ (P)Symbol of the power factor angle at point p3 on the mode curve | lagging |

| Sgn(Cosφ)_P4 | Cos φ (P)Symbol of the power factor angle at point p4 on the mode curve | lagging |
|---|---|---|

Note: this mode has a voltage entry enable bit. If it is enabled, it is necessary to set the lockinv voltage percentage and lockoutv voltage percentage. When the grid voltage percentage is greater than the lockinv voltage percentage, this mode is normally enabled; When the grid voltage percentage is less than the lockoutv voltage percentage, the reactive power is 0.

**Reactive mode 4:** inverter reactive power continuously changes with grid voltage

The reactive power is adjusted by setting the high-voltage starting point, high-voltage ending point, low-voltage starting point and low-voltage ending point of the grid voltage, in which the grid voltage changes continuously. The following figure shows the relationship between reactive power and grid voltage:

| Parameter | Explain | Range |
|-----------|---------|-------|
| P1 | P1 on the Q (U) mode curve is the starting voltage point of low voltage | Optional |
| P2 | P2 on the Q (U) mode curve is the ending voltage point of low voltage | Optional |
| P3 | P3 on the Q (U) mode curve is the starting voltage point of high voltage | Optional |
| P4 | P4 on the Q (U) mode curve is the ending voltage point of high voltage | Optional |

**Note:** this mode has a voltage entry enable bit. If it is enabled, it is necessary to set the lockin voltage percentage and LockoutV voltage percentage. When the grid voltage percentage is greater than the LockinV voltage percentage, this mode is normally enabled; When the grid voltage percentage is less than the LockoutV voltage percentage, the reactive power is 0. (response

waiting time during detection can be set)

Among them, the reactive power at point P1 is the maximum lagging reactive power, the reactive power at point P2 is the reactive power at the low voltage starting voltage point, the reactive power at point P3 is the reactive power at the high voltage starting voltage point, and the reactive power at point P4 is the maximum leading reactive power.

**Reactive mode 5:** inverter reactive power continuously changes with grid voltage

The reactive power is adjusted by setting the high-voltage starting point, high-voltage ending point, low-voltage starting point and low-voltage ending point of the grid voltage, in which the grid voltage changes step by step. The following figure shows the relationship between reactive power and grid voltage:



| Parameter | Explain | Range |
|-----------|---------|-------|
|           |         |       |

| P1 | P1 on the Q (U) mode curve is the starting voltage point of low voltage | Optional |
|----|---------------------------------------------------------------------------|----------|
| P2 | P2 on the Q (U) mode curve is the ending voltage point of low voltage | Optional |
| P3 | P3 on the Q (U) mode curve is the starting voltage point of high voltage | Optional |
| P4 | P4 on the Q (U) mode curve is the ending voltage point of high voltage | Optional |

**Note:** this mode has a voltage entry enable bit. If it is enabled, it is necessary to set the lockin voltage percentage and LockoutV voltage percentage. When the grid voltage percentage is greater than the LockinV voltage percentage, this mode is normally enabled; When the grid voltage percentage is less than the LockoutV voltage percentage, the reactive power is 0. (response waiting time during detection can be set)

Among them, the reactive power corresponding to P1 and P4 points is the maximum reactive power point. (both can be set by self selection)

**Reactive mode 6:** the inverter calculates the current output reactive power through constant apparent power

That is, when the active power does not reach the rated value, the reactive power is calculated according to the rated apparent power, and the calculation formula is $Q = \sqrt{S^2 - P^2}$; When the active power

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reaches the rated value, the reactive power is 0.

**Note:** phase type can be set: 1 Zero reactive power: reactive power is 0; 2. lagging reactive power: reactive power is negative; 3. leading reactive power: the reactive power is positive.

## 2.6 Other Function Modules

**A.** Energy management unit

Remote control to start/ shunt down inverter through an external control.

**B.** Limited the active power fed into grid

If enable the limited of active power function, inverter can limit the amount of active power fed into the grid to the desired value (expressed as percentage).

**C.** Self-power reduction when grid is over frequency

If grid frequency is higher than the limited value, inverter will reduce the output power to ensure the grid stability.

**D.** Data transmission

Inverter or a group of inverters can be monitored remotely through an advanced communication system based on RS485 interface or PBUS communication.

**E.** Software update

USB interface for uploading the firmware, remotely uploading is available.

**F.** AFCI (optional function)

When the DC connector is not assembled in place, it is easy to cause arcing or overheating of the connector. This function can detect whether there is a fault arc at the input end of the inverter. When an arc occurs, the inverter stops grid connection and gives an alarm reminder, to build a safe barrier for the whole system.

# 2.7 Circuit Diagram

The following figure shows the main circuit of the inverter.
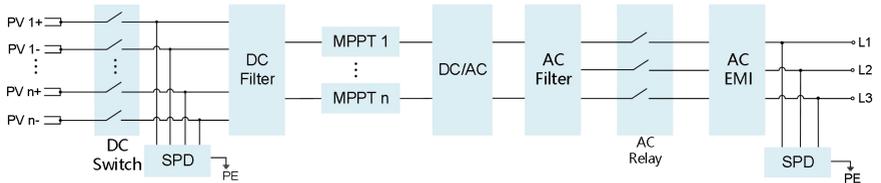


Figure 2-5 Circuit Diagram

REFUSOL 250~350K series utilizes multiple MPPT trackers to uesd to ensure a maximum power from PV arrays at different PV input conditions.

DC Switches can safely disconnect the PV input when necessary to ensure the safe operation of the inverter and the safety of personnel.

Both DC and AC side has Surge Protection Device (SPD).

## 2.8 DC Switch Descriptions

The inverter is equipped with four DC switches, and per DC switch controls two MPPTS which can safely disconnect it from PV strings. Each switch controls the DC terminals in the area where the switch is located.
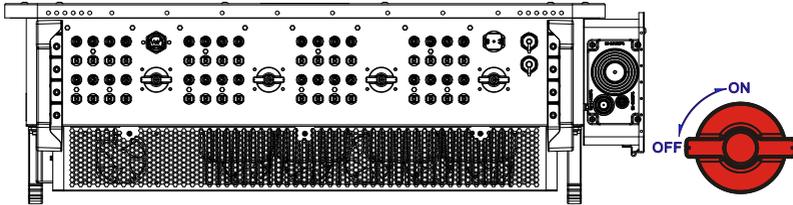


DESCRIPTIONS:

| SWITCH | DESCRIPTIONS | |
|---|---|---|
| DC SWITCH | "ON" | The DC switch is closed and has breaking protection. |
| | "OFF" | The DC switch is disconnected. |

DC SWITCH automatically breaks and disconnects when a fault occurs.

Please check the type of fault through the "REFU SETTING" APP first, wait at least 3min after troubleshooting, and operate under the guidance of the technical support staff.

DC SWITCH BREAKING：

● DC SWITCH carries out automatic breaking and de-coupling in the event of inverter malpractices such as PV string reversal, string

overcurrent, and string current back feeding.

● DC SWITCH also automatically breaks and disconnects when the inverter has an internal fault. The FAULT indicator light is always on, and all four DC switches are automatically disconnected. Please contact the company's technical support staff after the switches are disconnected, and do not close the DC switches by yourself.

# 3. Inverter Storage

If inverter is not installing immediately, storage condition need meet below requirements:

● Place inverter into the original package and leave desiccant inside, sealed tight with taps.

● Do not tilt or invert the box.

● Store in a clean and dry place and protect from dust and moisture. Do not subject to rain or ground water erosion.

● When stacking, place the inverter carefully to avoid personal injury or equipment damage caused by tipping the equipment.

● Keep the storage temperature around -40℃ ~ 70℃. Relative humidity 5 ~ 95%, no condensation.
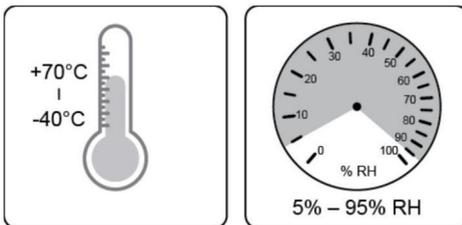


Figure 3-1 Storage temperature and humidity

● The maximum stacking layer number cannot exceed 4 layers.

● If the inverter be storage for more than half years, the inverter needs to be fully examined and tested by qualified service or technical personnel before using.

# 4. Installation

**Outlines of this Chapter**

This topic describes how to install this product, please read carefully before install.

| | |
|---|---|
| ⚠️ **Dangers** | Do not install the product on flammable material. Do not store this product in potentially explosive atmospheres. |
| ⚠️ **Caution** | The enclosure and heat sink will get hot during operation, please do not mount the product at a easy to reach location. |
| ⚠️ **Attention** | Consider the weight of this product when doing transport and moving. Choose an appropriate mounting position and surface. At least four persons for installation. |

## 4.1 Installation Process



Start ⇒ Check before installation ⇒ Prepare installation tools ⇒ Determine the installation position ⇓

End ⇐ Install the Inverter ⇐ Install the wall bracket ⇐ Moving the Inverter
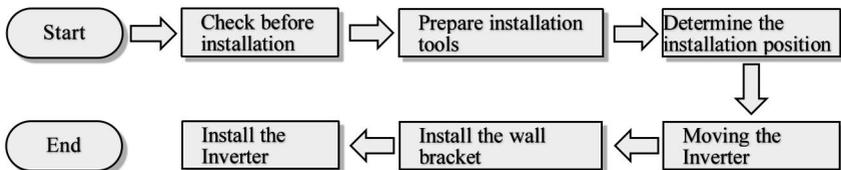
## 4.2 Checking Before Installation

**Checking Outer Packing Materials**

Before unpacking, please check the condition of the outer package materials if any damaged found, such as holes, cracks, please not unpack the product, contact your distributor immediately. Recommend installing the product within 24 hours after unpacking the package.

**Checking Deliverable**

After unpacking, please check according to following table, to see whether all the parts were included in the packing, please contact your distributor immediately if anything missing or damage.

Table 4-1 Components and mechanical parts that inside the package

| No | Pictures | Description | Quantity |
|----|----------|-------------|----------|
| 1 |  | REFUSOL 250~350K series | 1 pcs |
| 2 |  | Wall Bracket | 1 pcs |

| 3 | | PV+ input connector<br><br>*24 pcs(REFUSOL 250 K-6T) | 32/24 pcs |
|---|---|---|---|
| 4 | | PV- input connector<br><br>*24 pcs(REFUSOL 250 K-6T) | 32/24 pcs |
| 5 | | PV+ metal pin<br><br>*24 pcs(REFUSOL 250 K-6T) | 32/24 pcs |
| 6 | | PV- metal pin<br><br>*24 pcs(REFUSOL 250 K-6T) | 32/24 pcs |
| 7 | | M12*50 Hexagon screws | 4 pcs |

| 8 | | M6*30 Hexagon screws | 2 pcs |
|---|---|---|---|
| 9 | | Documents | 1 pcs |
| 10 | | COM 16pin connector | 1 pcs |
| 11 | | M12 lifting bolt | 2 pcs |
| 12 | | Auxiliary Handle | 4 pcs |
| 13 | | Spare screw <br> M6*16 Hexa-gon | 4 pcs |
| 14 | | DC switch Handle | 1 pcs |
| 15 | | Single-core Over-wire plug | 1 pcs |
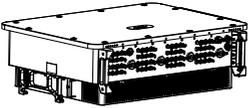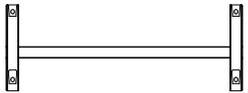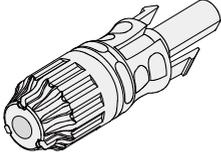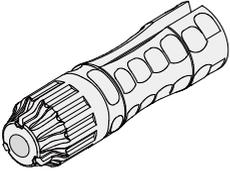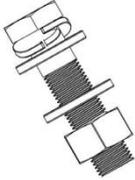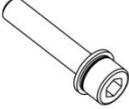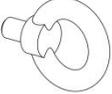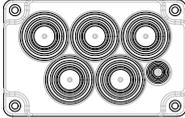
## 4.3 Tools

Installation tools include, but are not limited to, those

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recommended below. Other auxiliary tools may be used in the field if necessary.Prepare tools required for installation and electrical connection as following table:

Table 4-2 Installation tools

| No | Tool | Description | Function |
|---|---|---|---|
| 1 | | Hammer Drill Recommend drill @ 12mm | Used to drill holes on the wall |
| 3 | | Screwdriver | Use to tighten and loosen screws when installing AC power cable<br><br>Use to remove AC connectors from the product |
| 4 | | Removal Tool | Remove PV Connector |
| 5 | | Wire Stripper | Used to peel cable |
| 6 | | With an open end of larger than or greater than | Used to tighten expansion bolts |

| | | 32 mm | |
|---|---|---|---|
| 7 | | Rubber Mallet | Used to hammer expansion bolts into holes |
| 8 | | M6 | M6 use to uninstall and install the front top cover and down cover |
| 9 | | Torque wrench | Connect AC connector |
| 10 | | Crimping Tool | Use to crimp AC/DC cables and RS485 communication cables |
| 11 | | Multimeter | Check grounding cable, PV positive and negative pole |
| 12 | | Marker | Mark signs |
| 13 | | Measuring Tape | Measure distance |

| 14 | | Level | Ensure the wall bracket is properly installed |
|---|---|---|---|
| 15 | | ESD gloves | Installer wear when installing product |
| 16 | | Safety goggles | Installer wear when installing product |
| 17 | | Mask | Installer wear when installing product |
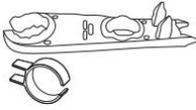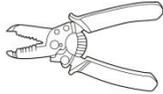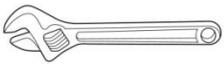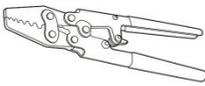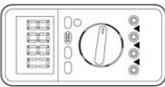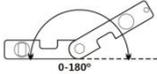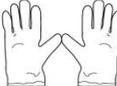
## 4.4 Determining the Installation Position

Select a appropriate location to install the product to make sure the inverter can work in a high efficiency condition. When selecting a location for the inverter, consider the following:

Note

- The mounting carrier has a load-bearing capacity of at least 4 times the weight of the inverter and matches the inverter size.

- The inverter has an IP66 protection rating and can be used for indoor or outdoor installation.

- Avoiding the inverter from direct sunlight, direct rain and snow will prolong the life of the inverter. It is recommended to choose a sheltered installation location or build an awning.

- Do not install outdoors in salt-infested areas, which mainly refer to coastal areas within 500m from the coast. The amount of salt spray deposition varies greatly depending on the characteristics of the seawater in the neighboring sea, sea breeze, precipitation, air humidity, topography and forest cover.

- Flammable and explosive materials must not exist within the installation environment.

- The installation location should be convenient for electrical connection, operation and maintenance.

- The inverter will generate some noise during operation and is not recommended for installation in living areas.

- Do not install in locations accessible to children.

- It is very important to ensure that the inverter is well ventilated for heat dissipation, please install the inverter in a ventilated environment.

- The inverter should be installed in a location greater than 30m from third party wireless communication facilities and living environments.

It is necessary to select a location for mounting the inverter that has sufficient load-bearing capacity to ensure that the inverter can work properly and efficiently. When selecting a mounting location, consider the following requirements:
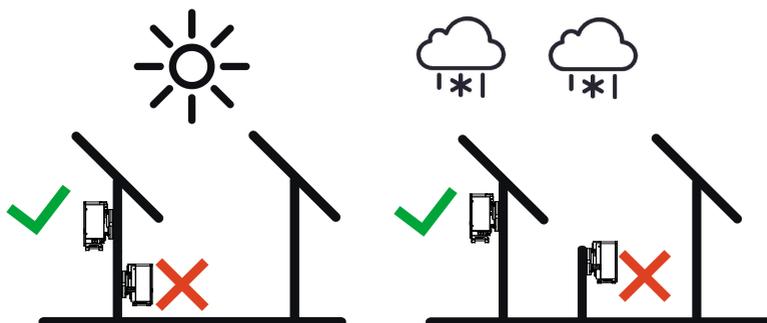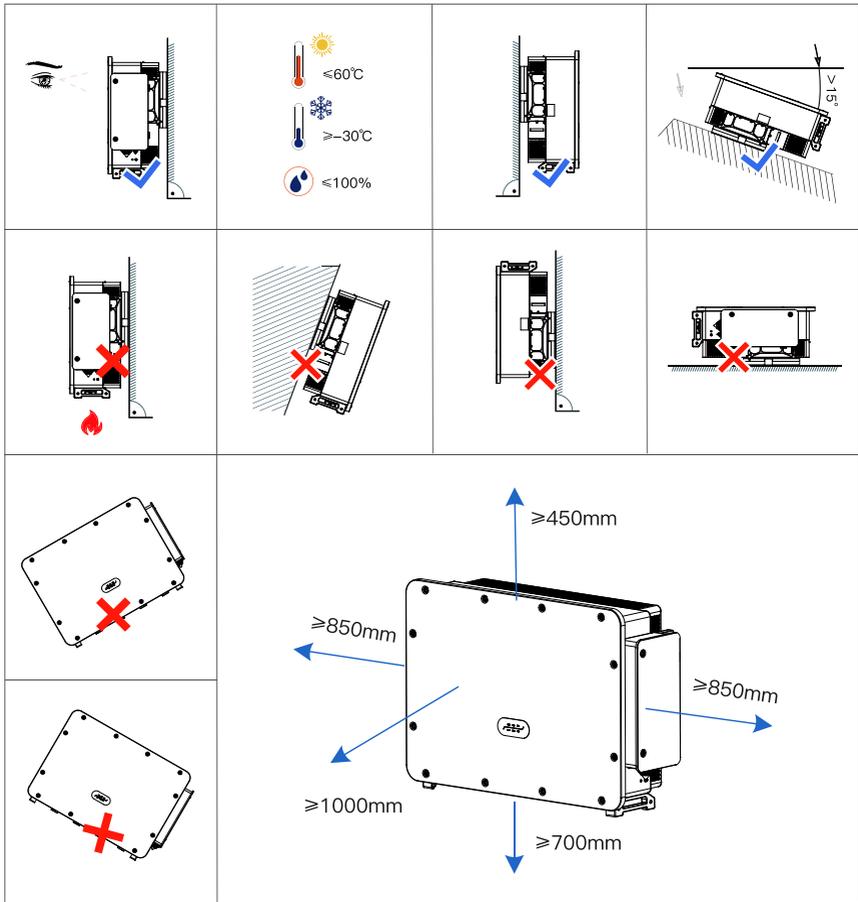
Figure 4-1 Installation Position Selection

For multiple inverter installation scenarios, zigzag installation is recommended when there is enough space. Zigzag, back-to-back and wall mounting are not recommended. Zigzag, back-to-back and near-wall mounting require users to provide their own windshield to isolate the inverters from the incoming and outgoing

air.
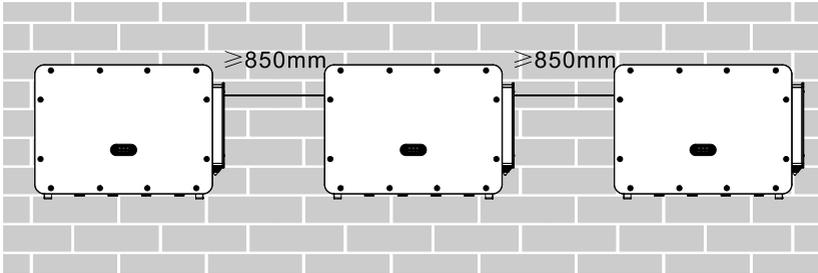


Figure 4-2 a) Recommended Installation
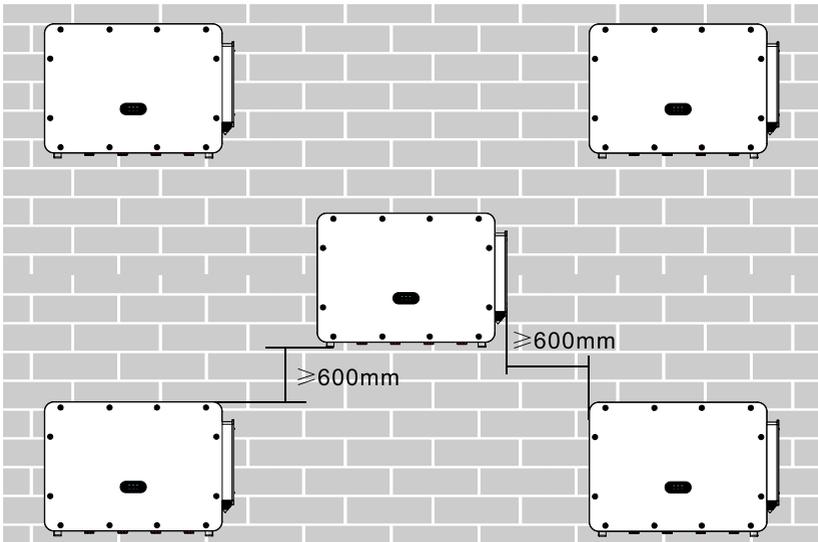


Figure 4-3 b) Unrecommended Installation Method

Figure 4-3 Clearance for multiple inverters

Note:

Other requirement for install position:

● Install position should obstruct the disconnect of power.

● Place inverter in an appropriate bearing capacity objects.

● Location should be avoid touch by children.

## 4.5 Moving of Inverter

### 4.5.1 Manual handling

Unload the inverter from package, horizontally move to the install position. When open the package, at least four operator insert the hands into the slots on both side of the inverter and hold the handles.
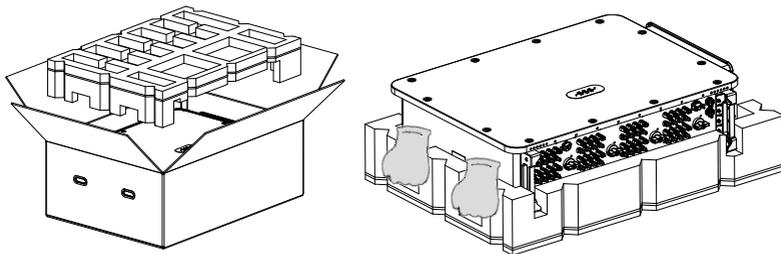


Figure 4-4 Move inverter from package

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| | |
|---|---|
| ⚠️ | Keep the balance when lift the inverter. Required at least four operators for lifting or use forklift. Inverter is heavy, dropped while being transported may cause injuries.<br><br>Do not put the inverter with wiring terminals contacting the floor because the power ports and signal ports are not designed to support the weight of the inverter.<br><br>When place inverter on the floor, put it above foam or paper to avoid the damage of the shell of inverter. |
| Attention | Use auxiliary handle inside the package for moving the inverter. After use, keep it well for future usage. |
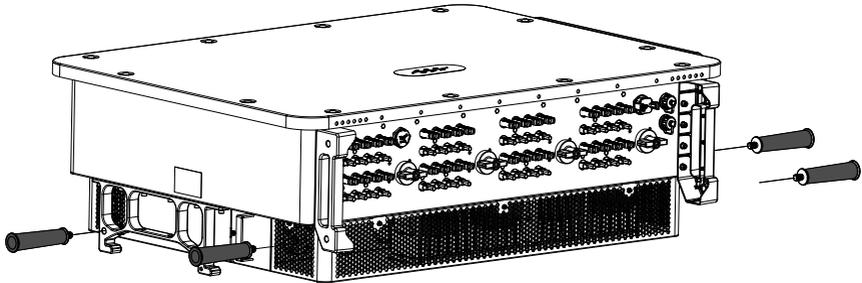


Figure 4-5 auxiliary handle position

### 4.5.2　Lifting Equipment

1. Tighten the screws of two M12 rings into the inverter sides according to the instruction diagram below (Note: M12 rings need self-preparation).
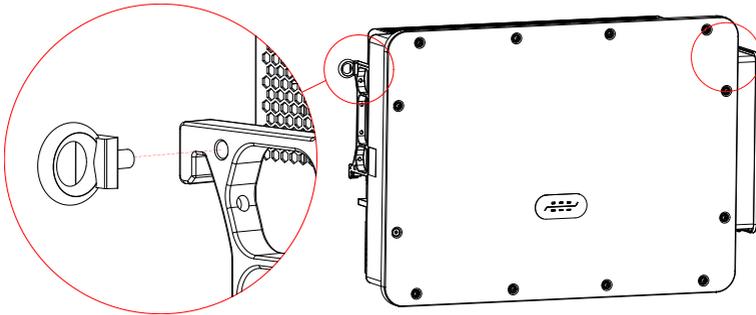
Figure 4-6 Installation of Rings

2. Fastened and tied the rope through two rings. Lifting inverter 50 mm above ground by using lifting equipment, check the tightening device of the hoisting ring and rope. After confirming that the binding connection is secure, lift the inverter to the destination.
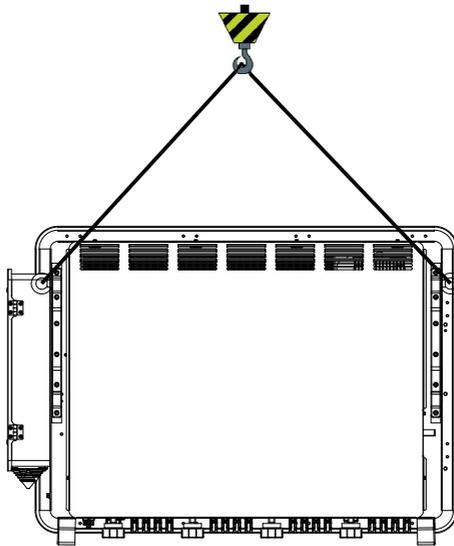
Figure 4-7 crane

| ⚠️ **Attention** | Keep balance when lifting the inverter, avoid to crash on wall or other objective. <br><br> Stop working in bad weather condition such as raining, heavy fog, winding. |
|---|---|

## 4.6 Installation

Always make sure the inverter is free of any electrical connections before installing the inverter. Before drilling, make sure that you avoid any utility alignments in the wall to avoid any hazards!

### Bracket Installation：

**Step1:** Use wall bracket, ensure the pole position are in same level by using level rule and take a mark with maker.
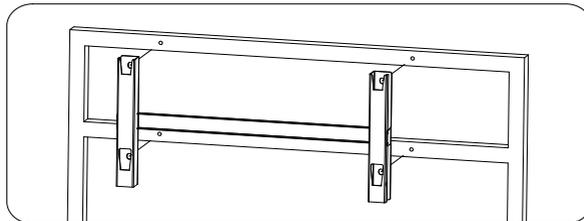


Figure 4-8 Ensure hole position

**Step 2:** Drilling hole by using Hammer Drill, recommend to do a stain proofing.
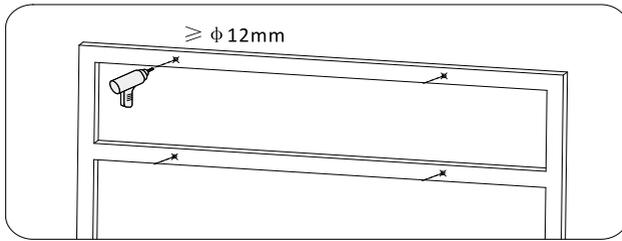
Figure 4-9 Drilling holes

**Step 3:** Use M12*50 Hexagon screws to secure the wall bracket.
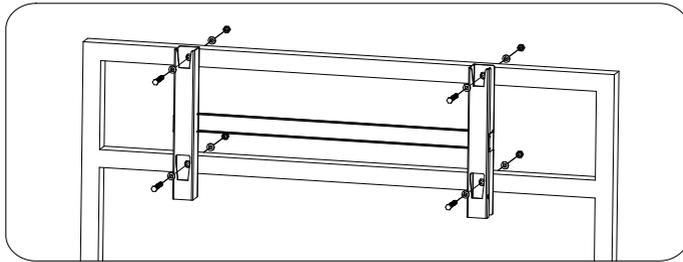


Figure 4-10 Fix wall bracket

**Step 4:** Lift the inverter and hang it on the wall bracket, and fixing both side of inverter with M6 screw.
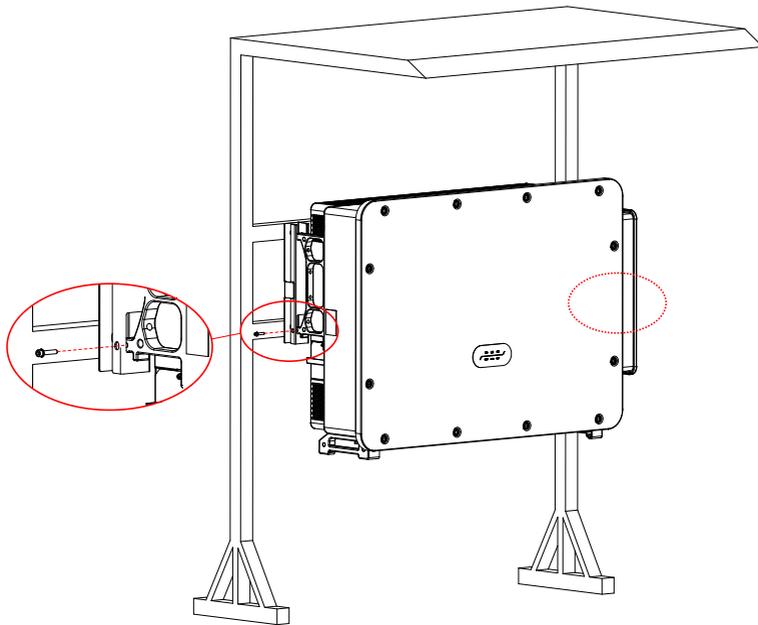
**Note:** If height between ground and bracket is less than 1.5m, use auxiliary handle for installation. Otherwise, use lifting equipment.
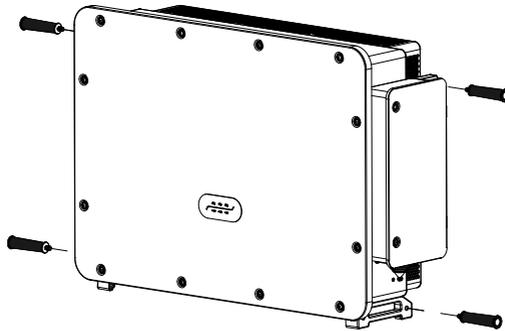


Figure 4-11 Installation position of auxiliary handle

REFUsol 250K-6T/350K-8T

# 5. Electrical Connection

## Outlines of this Chapter

This section introduces the electrical connection for the product. Please read the information carefully, it may helpful to understand the grounding wiring, DC input connection, AC output connection and communication connection.

**Caution:**

Before performing electrical connections, ensure the DC switch is OFF and AC circuit breaker is OFF. Waiting 25 minutes for the capacitor to be electrically discharged.

| | |
|---|---|
| ⚠️ **Attention** | Installation and maintenance should be done by certified electrical engineer. During electrical operations, the professional must wear protective equipment. |
| ⚠️ **Danger** | Before the electrical connection, use opaque material to cover the PV modules or disconnect PV string DC switch. PV arrays will produce dangerous voltage if it is exposure under sun. Do not close the AC/DC circuit breaker before completing the electrical connection and prevent misconnection. |

| | For this product, the open circuit voltage of PV strings should not greater 1500V. |
|---|---|
| Note | The cables used in the PV system must be firmly connected, undamaged, well insulated and of the appropriate size. |

## 5.1 Electrical Connection
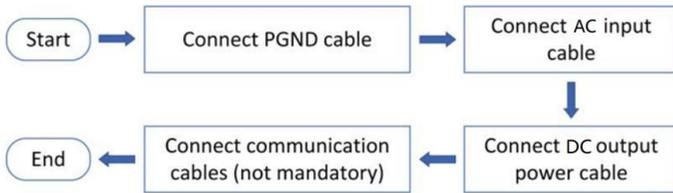


Figure 5-1 Flowchart for connecting cables to the inverter

## 5.2 Terminal Connector

Connector description as below:
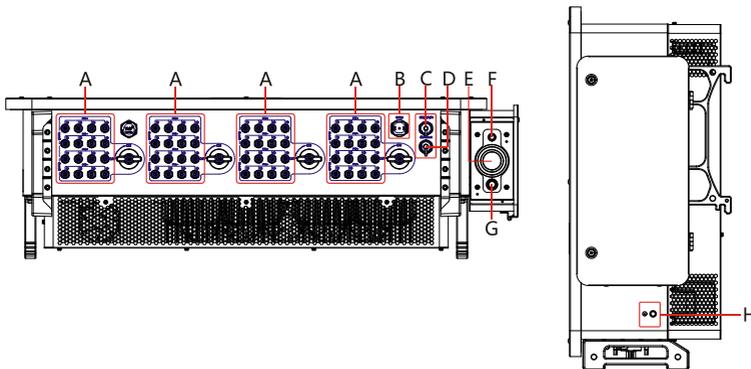
*Take picture as reference

| No | Name | | Description |
|---|---|---|---|
| A | DC input terminals | PVX+/PVX- | PV connector |
| B | RS485 | COM | RS485 Communication port/ DRMs port |
| C | USB port | USB/Wi-Fi | USB port |
| D | RJ45 | Ethernet | Ethernet port |
| E | AC output terminals | AC | AC output terminal |
| F | Tracking Axis Power Terminal | | Tracking System Power Wiring |
| G | Grounding |  | Connecting terminal of the ground , choose at least one for grounding connection |
| H | Grounding | | Reliable grounding for inverters |

## 5.3 Grounding Connection (PE)

Connect the inverter to the grounding electrode usingground cable

| | REFUSOL 250~350K series is a transformerless inverter which requires the positive pole and negative pole of the PV array are NOT grounded. Otherwise, it will cause inverter failure. In the PV system, all non-current-carrying metal parts (such as mounting frame, combiner box enclosure, etc.) should be connected to earthed. |
|---|---|
| ⚠️ **Note** | |

**NOTE:** Good grounding is helpful in resisting surge voltage impulses and improving EMI performance. Before connecting AC, DC, and communication cables, connect a ground wire that protects the grounding point.

Inverter proximal grounding is recommended. It is necessary to connect the grounding points of all inverters in the same subarray to each other to ensure an equipotential connection of the ground wire.

Preparation: prepare the grounding cable (recommend S/2 mm² ('S' is the cross-sectional area of the AC output cables) yellow-green outdoor cable.

## Procedure:

**Step1:** Remove the insulation layer with an appropriate length using a wire stripper shown as figure 5-2) .
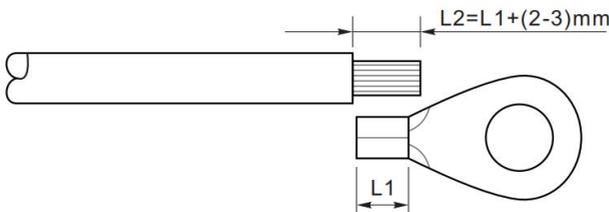
Figure 5-2 Grounding connection instruction（1）

**Note**：The length of L2 should 2~3mm higher than L1.

**Step 2:** Insert the exposed core wires into the OT terminal and crimp them by using a crimping tool, as shown as figure 5.3. Recommend using OT terminal: OTM8, Cable: ≥16mm$^2$.
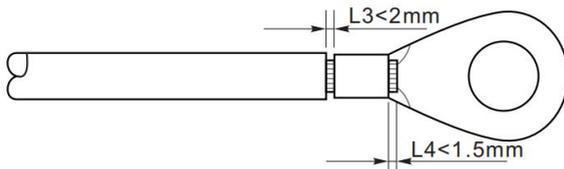


Figure 5-3 Grounding connection instruction（2）

**Note 1:** L3 is the length between the insulation layer of the ground cable and crimped part. L4 is the distance between the crimped part and core wires protruding from the crimped part.

**Note 2:** The cavity formed after crimping the conductor crimp strip shall wrap the core wires completely. The core wires shall contact the terminal closely.

Step 3: Remove the screw from the bottom side of inverter (Shown as figure 5-4), connect the grounding cable to the grounding point and tighten the grouping screw. Torque is 6-7N.m.
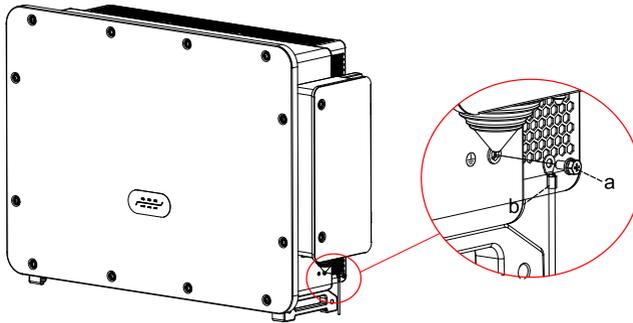
a.M8hexagon screw    b. grounding cable

Figure 5-4 Inverter external grounding instruction diagram

**Note:** For improving anti-corrosion performance, after ground cable installed, apply silicone or paint is preferred to protect.

## 5.4  Connect Grid Side of Inverter (AC-Output)

Each inverter's AC output must be connected to an external automatic separation device that meets the requirements of the local grid operator, such as the AC circuit breaker.

Specifically in Belgium, if an external automatic separation system is used (instead of the more common internal one, it must have single-fault tolerance and be of a type approved by Synergrid as listed in the C10/21 or other relevant standards.

Inverter has a standard and integrated residual current monitoring unit (RCMU), when inverter detected leakage current excess 300mA, it will cut off with utility grid for protection. For external Residual Current Device (RCD), the rated residual current shall be 300mA or higher.

Precondition：

● Inverter AC side should connect a three phase circuit current to

ensure inverter can be cut off with utility grid for abnormal condition.

● The AC cable need to meet the requirement of local grid operator.

### 5.4.1 Open the wiring box

Note ：

● Forbid to open then main board cover of inverter.

● Before open the wiring box, please ensure there is not DC and AC connection.

● If open the wiring box on snowing or raining day, please take protective measures to avoid the snow and rain enter wiring box. Otherwise, should not open the wiring box.

● Please do not keep unused screw in the wiring box.

Use M6 driver to unscrew the two screws on the wiring box,open wiring box cover.
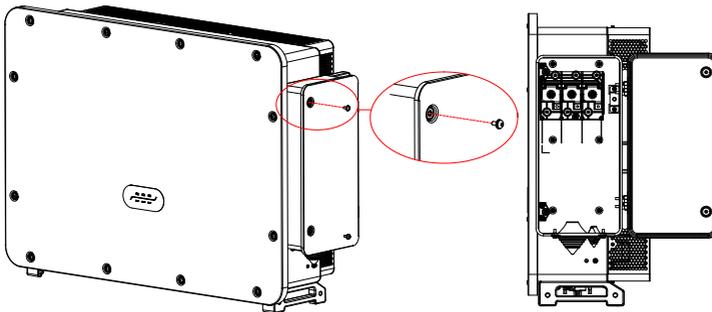


Figure 5-5 Open wiring box

## 5.4.2 Wiring Terminal and Precautions

Note：

● Before connect to grid, please ensure the grid voltage and frequency of local grid meet the requirement of inverter, any question please seek local grid company for help.

● Inverter can only connect to grid after get the permission from local grid company.

● Should not connect any loads between inverter and AC circuit breaker.

OT/DT Requirement:

● When use copper core cable, please use copper terminal connector.

● When use copper clad aluminum cable, please use copper terminal connector.

● When use aluminum core cable, please use Copper and aluminum transition terminal connector or aluminum terminal connector.
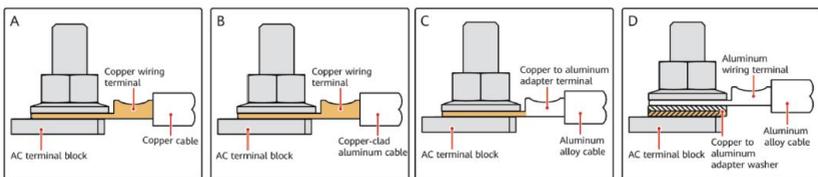


Figure 5-6 OT/DT Requirement for terminal connection

**CAUTION:** Direct contact between copper and aluminium conductors will cause galvanic corrosion and affect the reliability of the electrical connection.

When using copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition spacers, the requirements of IEC 61238-1 must be met.

When using copper-aluminum transition spacers, please pay attention to the front and back to ensure that the aluminum side of the spacer and the aluminum terminal contact, the copper side and the terminal block contact.
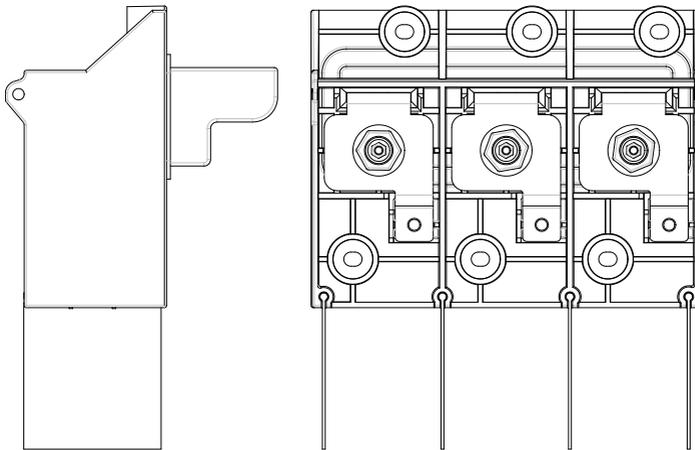
Figure 5-7 AC Terminal

### 5.4.3 Wiring Procedure

The section will use a multi-core wire as a sample, single-core wire has same connection process.

Table 5-1 Recommend AC cable size

| Name | Type | Area(mm²) | Outer Diameter |
|---|---|---|---|
| AC output power cables(multi-core) | ●If the ground point on the enclosure is used, three-core (L1, L2, and L3) outdoor cables and M12 OT/DT terminals (L1, L2, and L3) are recommended.<br><br>●If the ground point in the maintenance compartment is used, four-core (L1, L2, L3, and PE) outdoor cables, M12 OT/DT terminals (L1, L2, and L3), and M10 OT/DT terminals (PE) are recommended. You do not need to prepare a PE cable. | ●Copper cable:<br>S: 120-300mm²<br>Sp ≥ S/2<br>●Aluminum alloy cable or copper-clad aluminum cable:<br>S: 150–400 mm²<br>Sp ≥ S/2 | 24–66 mm |

| | | ●Copper cable: | 14–40 mm |
| AC output power cables(single-core) | (Recommended) Single-core outdoor cable and M12 OT/DT terminal | S: 120–300 mm² Sp ≥ S/2 ● Aluminum alloy cable or copper-clad aluminum cable: S: 150–400 mm² Sp ≥ S/2 | |

The value of Sp is valid only if the conductors of the PE cable and AC power cable use the same material. If the materials are different ensure that the conductor cross-sectional area of the PE cable produces a conductance equivalent to that specified in this table. The specification of the PE cable are subject to this table or calculated according to IEC 60364-5-54

**NOTE:** The maximum copper terminal type suitable for AC terminal blocks is RNB300-12; The maximum copper-to-aluminum transition terminal type suitable for AC terminal blocks is DTL-400.

**Step1:** Open the cover, refers to section 5.4.1.

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**Step 2:** Turn OFF the AC circuit breaker and secure against reconnection.

**Step 3:** Unscrew the nut of the AC terminal block and select the sealing ring according to the outer diameter of the cable. Insert the nut, sealing ring into the cable in sequence.

**Step 4:** Remove the insulation layer of an appropriate length according to figure below.
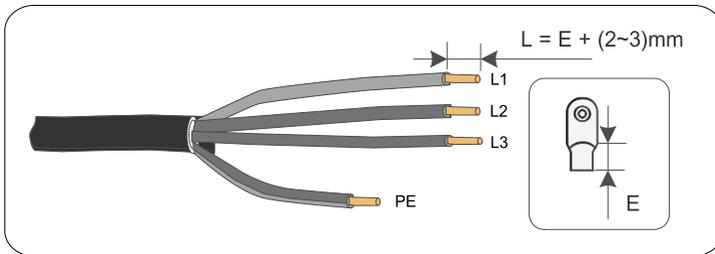


**Step 5:** Crimp the terminal.
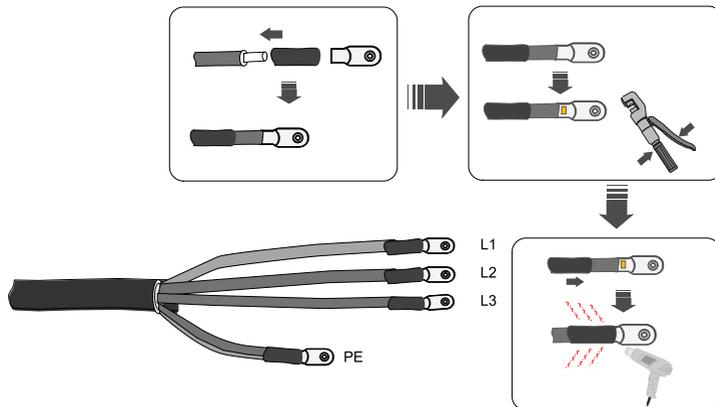
**Step 6:** Depending on the grid configuration, connect L1, L2, L3 and N to the terminals according to the label and tighten the screw on the terminal using a screwdriver.

Multi-core wire wiring diagram:



| | |
|---|---|
| 线缆外径≥35mm | 线缆外径≥50mm |
| 线缆外径≥60mm | 线缆外径≥70mm |
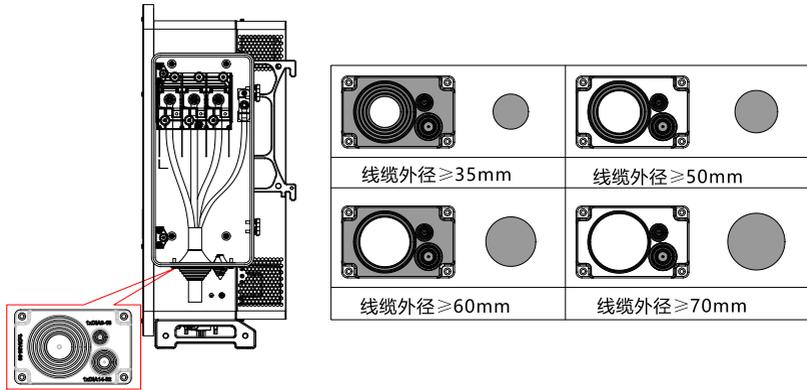
Single core wire wiring diagram:

Select single-core wire, before wiring, you need to replace the already installed in the machine plug with the single-core over-wire plug supplied with the shipment.



| | |
|---|---|
| OD≥18mm | OD≥26mm |
| OD≥36mm | |
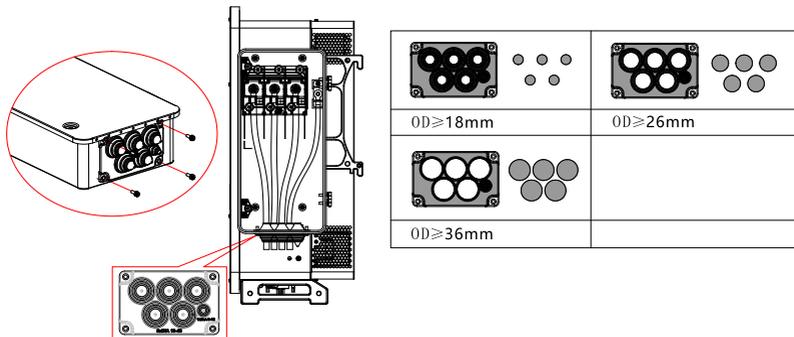
**Note：**

Phase lines use M12 terminal connector, PE line use M8 terminal connector.

**Step 7:** Close the junction box cover and tighten the junction box screws. Recommended torque 5-7N.m.

prerequisites:

1. When using armored wire, need to pay attention to the AC cable bending radius requirements, when using three-wire or four-wire core armored, the bottom of the cable bending radius must be greater than or equal to 12 ~ 15 times the outer diameter of the cable;

2. Need to keep the AC cable vertically into the junction box;

3. Power line armored ends should be reliably grounded, grounding resistance should be no greater than 10 ohms, cable joints should maintain the continuity of the metal sheath;

4. The power line armored screen ground is not connected to the inverter grounding point, it is recommended that it can be connected to the nearby wall-mounted column grounding point;

5. Inverter protective grounding is recommended to give priority to the chassis shell grounding point, in the grounding terminal external silicone or paint for protection. The terminal box grounding point is mainly used to connect the multi-core AC line contains the ground wire; ground wire diameter size as table 5-1 described in the requirements.

| M12(L1,L2,L3) |
| --- |
| 40-45N.m |

| M8(PE) |
| --- |
| 15N.m |
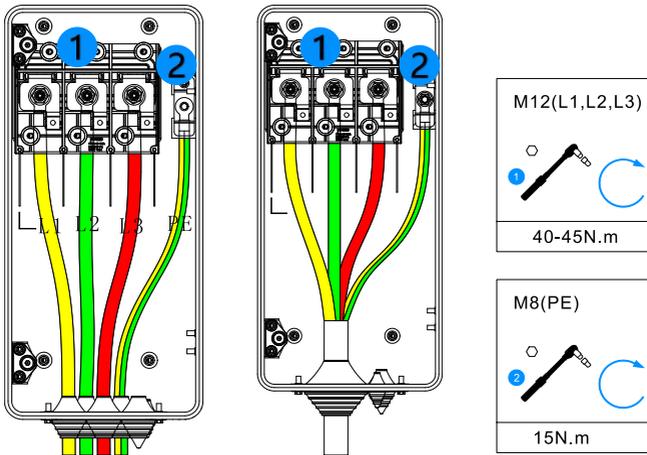
6.The length of the protective earth wire should be reserved to ensure that the protective earth wire is the last to bear the stress when the AC output wire is subjected to tensile force due to force majeure.

7. After wiring is completed, the cables should not be pressed against the inter-phase baffle and should not be cross-wound.
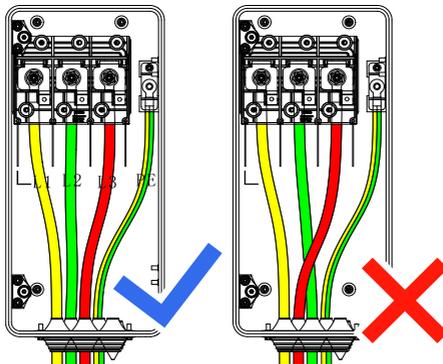


Attention：

Inverter protective grounding is recommended to prioritize the chassis enclosure grounding point. The chassis grounding point is mainly used to connect the grounding wire contained in the multi-core AC line;

It is recommended that the inverter be grounded near the end, and the grounding is stable and reliable, and the lap resistance is less than 0.1Ω. In order to improve the anticorrosion performance of the grounding terminal, it is recommended that after the installation of the grounding cables is completed, the outside of the grounding terminal should be coated with silica gel or brushed with paint for protection;

A three-phase AC switch is required to be configured outside the AC side of the inverter, and each inverter is required to be equipped with an AC output switch, and multiple inverters cannot be connected to an AC switch at the same time. In order to ensure that the inverter can be safely disconnected from the grid under abnormal conditions, please select the appropriate overcurrent protection device according to the local power distribution regulations;

The outside diameter of the cables can be measured according to the straightedge label on the hole of the terminal box, and make sure that the cable sheath is located inside the terminal box, and that the AC cable enters vertically into the inside of the terminal box;

Ensure that the AC output cables are tightly connected, otherwise the equipment may not operate, or the inverter terminal block may be damaged due to heat generated by the unreliable connection,

etc. Damage caused by this will not be covered by the warranty of the equipment;

The cable must be protected by a wire pipe to avoid short-circuiting caused by damage to the insulation layer;

In order to quickly dispatch scenarios accordingly, please follow the same wiring sequence for connecting the AC cables between the terminal box and the box transformer L1, L2 and L3.

## 5.5 Connect the Power Cord of the Tracking System (optional)

Photovoltaic tracking system: tracking any sun's altitude angle and azimuth angle, so that the radiation receiving surface is always perpendicular to the sun's incidence direction, i.e., the sun's incidence angle within the tracking range is always zero, so as to maximize the use of solar energy resources.

Tracking system power line: power is taken from the AC three-phase grid to supply power to the tracking system, and the rated voltage of the power supply is the rated output voltage of the inverter.

Be careful:

● Between the inverter and the tracking control box, it is necessary to connect the protection disconnector fuse group or fuse disconnector. Specification: voltage ≥ 800V, current 16a, protection type GM.

● The cable length between the power line terminal and the disconnector fuse group or fuse disconnector shall be ≤ 2.5m.

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- The AC output line must be connected before the power line of the tracking system, otherwise it will cause rework.

- The tracking power cord needs to be provided by the user, and the manufacturer does not provide the power cord.

Recommended power cord specifications:

| Type | Cable outer diameter(mm) |
|---|---|
| Three core outdoor copper cable | 15~18 |

**Step 1:** Use wire strippers to strip the insulation layer of the tracking power line to an appropriate length.

**Step 2:** Thread the wire core stripped of the insulation layer into the conductor crimping area of the OT terminal and press it tightly with a crimping pliers.

**Step 3:** Thread the fabricated cable into the waterproof joint.

**Step 4:** Connect the cable with the corresponding terminal, tighten the nut and fix the terminal.

线缆外径≤18mm



The Power Cord of the
Tracking System

AC Output Line
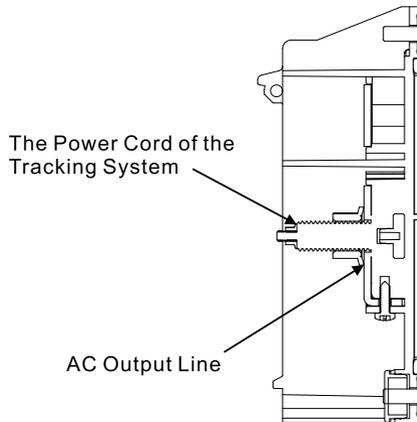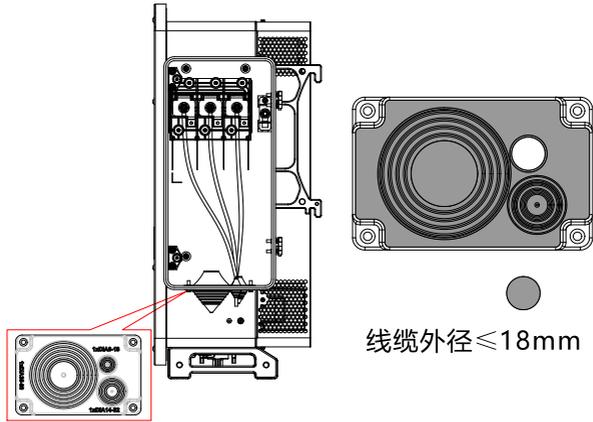
## 5.6 Connect PV Side of Inverter (DC-Input)

Note：

● Connecting PV strings into inverter must following the below
procedure. Otherwise, any faulty cause by inappropriate
operation will be including in the warranty case.

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- Ensure the maximum short circuit current of PV strings should less than the maximum inverter DC current input. And four "DC switch" is in OFF position. Otherwise, it may cause high voltage and electric shock.

- Ensure PV array have good insulation condition in any time.

- Ensure same PV string should have the same structure, including: same model, same number of panels, same direction, same azimuth.

- Ensure PV positive connector connect to inverter positive pole, negative connector connect to inverter negative pole.

- Please use the connectors in the accessories bag. The damage cause by incorrect is not including in the warranty.

Table 5-2 Recommend DC cable size

| Copper cable cross section area （mm$^2$） | | Cable OD(mm) |
|---|---|---|
| Range | Recommend | |
| 4.0~6.0 | 4.0 | 4.5~7.8 |

**Step1:** Find the metal contact pins in the accessories bag, connect the cable according below diagram (1. Positive cable, 2. negative cable).
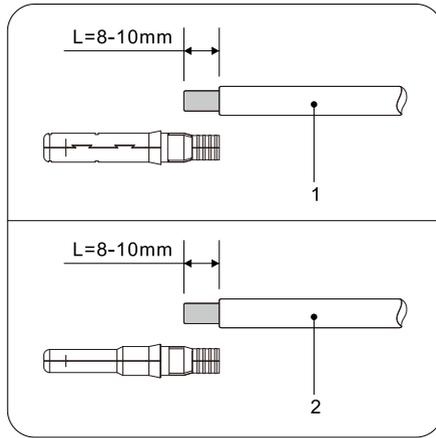
Figure 5-8 DC cable connection  (1)

**Step2:** Crimp the PV metal contact pin to the striped cable using a proper crimping pliers.
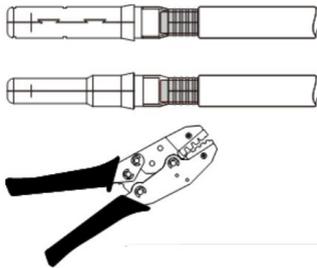


**Step3:** Insert wire into the connector cap nut and assemble into the back of male or female plug, When you heard a "click", the pin tact assembly is seated correctly. (3. Positive Connector, 4. negative connector).
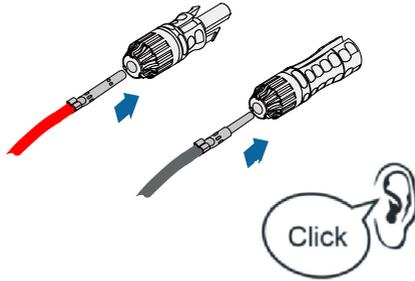
**Step 4:** Measure PV voltage of DC input with multimeter, verify DC input cable polar and connect DC connector with inverter until hearing a slight sound indicated connection succeed.
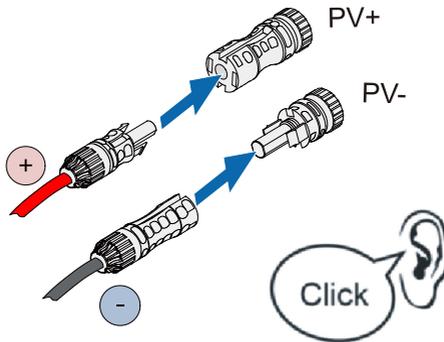


Figure 5-9DC cable connection

REFUsol 250K-6T/350K-8T
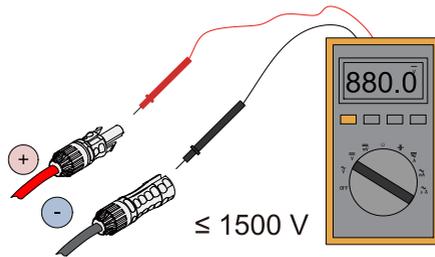
**Note**：Please use multimeter to make sure the PV array positive pole and negative pole!

When wiring in the field, the DC input line should be naturally sagging not less than 50mm, the axial tension on the PV connector should not exceed 80N, and it is prohibited to generate radial stress or torque on the PV connector.

**Dealing**：If need to remove the PV connector from inverter side, please use the Removal Tool as below diagram, move the connector gently.

|  NOTE | Before, moving the positive and negative connector, please make sure "DC Switch" is on OFF position. |
| --- | --- |
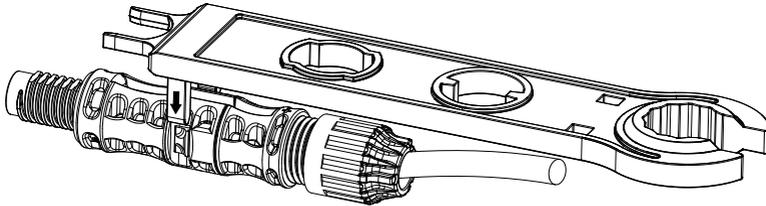
Figure 5-10 Removal DC connector

## 5.7 Recommended Wiring Methods

The inverter has a total of 32 DC input terminals, of which the branches of MPPT1 to MPPT2 are controlled by DC SWITCH 1, the branches of MPPT3 to MPPT4 are controlled by DC SWITCH 2, the branches of MPPT5 to MPPT6 are controlled by DC SWITCH 3, and the branches of MPPT7 to MPPT8 are controlled by DC SWITCH 4.

It is recommended that all PV input terminals be divided equally among MPPT1 to MPPT8 branches, and the maximum current of each MPPT is controlled at 60A, and the maximum current of each branch of MPPT is 20A.

For example, when the number of input strings is 20 to 31, the recommended connection of DC input terminals is as follows.

| Strings number | Terminal Selection | Strings number | Terminal Selection |
|---|---|---|---|
| | | | |

| | | | |
|---|---|---|---|
| 20 | MPPT1/MPPT3/MPPT5/MPPT7 are connected to 3 strings respectively, MPPT2/MPPT4/MPPT6/MPPT8 are connected to 2 strings respectively. | 26 | MPPT1/MPPT8 are connected to 4 strings respectively, MPPT2/MPPT3/MPPT4/MPPT5/MPPT6/MPPT7 are connected to 3 strings respectively. |
| 21 | MPPT1/MPPT3/MPPT5/MPPT7/MPPT8 are connected to 3 strings respectively, MPPT2/MPPT4/MPPT6 are connected to 2 strings respectively. | 27 | MPPT1/MPPT7/MPPT8 are connected to 4 strings respectively, MPPT2/MPPT3/MPPT4/MPPT5/MPPT6 are connected to 3 strings respectively. |
| 22 | MPPT1/MPPT2/MPPT3/MPPT5/MPPT7/MPPT8 are connected to 3 strings respectively, MPPT4/MPPT6 are connected to 2 strings respectively. | 28 | MPPT1/MPPT3/MPPT5/MPPT7 are connected to 4 strings respectively, MPPT2/MPPT4/MPPT6/MPPT8 are connected to 3 strings respectively. |
| 23 | MPPT1/MPPT2/MPPT3/MPPT4/MPPT5/MPPT7/MPPT8 are connected to 3 strings respectively, | 29 | MPPT1/MPPT3/MPPT5/MPPT7/MPPT8 are connected to 4 strings respectively, |

| | | | |
|---|---|---|---|
| | MPPT6 are connected to 2 strings respectively. | | MPPT2/MPPT4/MPPT6 are connected to 3 strings respectively. |
| 24 | MPPT1 ~ MPPT8 are connected to 3 strings respectively, | 30 | MPPT1/MPPT2/MPPT3/MPPT5/MPPT7/MPPT8 are connected to 4 strings respectively, MPPT4/MPPT6 are connected to 3 strings respectively. |
| 25 | MPPT8 are connected to 4 strings respectively, MPPT1 ~ MPPT7 are connected to 3 strings respectively, | 31 | MPPT1/MPPT2/MPPT3/MPPT4/MPPT5/MPPT7/MPPT8 are connected to 4 strings respectively, MPPT6 are connected to 3 strings respectively. |

## 5.8  Communication Connection

**Note：** When layout the wiring diagram, please separate the communication wiring and power wiring in case the signal be affected.

### 5.8.1  USB Port

Port Description：

| USB port | Use for updating the software |
|----------|-------------------------------|

**Procedure：**
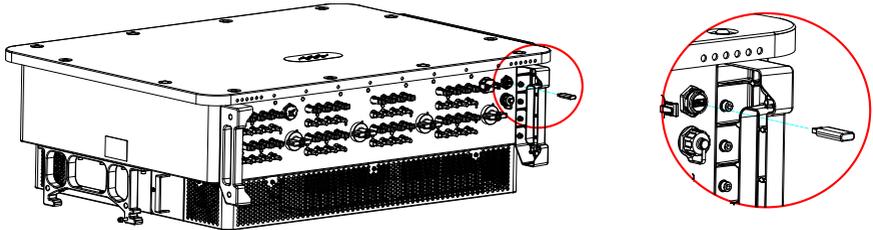


Figure 5-11 USB access schematic

## Wi-Fi/GPRS

By the USB acquisition stick (Wi-Fi/GPRS), transfer the inverter power output information, alarm information, operation state to the PC terminal or local data acquisition device, then uploaded to the server. Register remote monitoring of REFUSOL 250~350K series at its relevant website or APP according to monitoring device SN.

## 5.8.2　COM—Multi function communication port
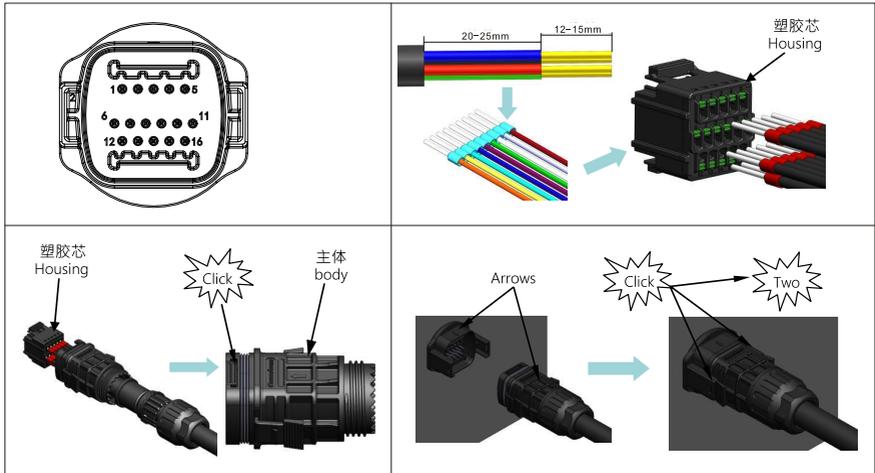


Port Description：

| PIN | Define | Function | Note |
|---|---|---|---|
| 1 | RS485A | RS485 signal+ | Wire connection monitoring or multiple inverter monitoring |
| 2 | RS485A | RS485 signal+ | |
| 3 | RS485B | RS485 signal- | |
| 4 | RS485B | RS485 signal- | |
| 5 | Electric meter RS485A | Electric meter RS485 signal+ | Wire connection Electric meter |
| 6 | Electric meter RS485B | Electric meter RS485 signal- | |

| 7 | GND.S | RS485 signal ground | |
|---|---|---|---|
| 8 | DRM0 | Remote shunt down | DRMS port |
| 9 | DRM1/5 | | |
| 10 | DRM2/6 | | |
| 11 | DRM3/7 | | |
| 12 | DRM4/8 | | |
| 13 | GND.S | Communication Ground | |
| 14-16 | Blank PIN | N/A | N/A |

Procedure：

Communications Port Description

Logic interface

(a) Logic interface for AS/NZS 4777.2:2020, also known as inverter demand response modes (DRMs).

The inverter will detect and initiate a response to all supported demand response commands within 2 s. The inverter will continue to respond while the mode remains asserted.

Table 5-3 Function description of the DRMs terminal

| Pin NO. | Function |
|---------|----------|
| 9 | DRM1/5 |
| 10 | DRM2/6 |
| 11 | DRM3/7 |
| 12 | DRM4/8 |
| 13 | GND |
| 8 | DRM0 |

**NOTE:** Supported DRM command: DRM0, DRM5, DRM6, DRM7, DRM8.

(b)  Logic interface forEN50549-1:2019 and VDE-AR-N 4105:2018-11, is in order to cease active power output within five seconds following an instruction being received at the input interface.
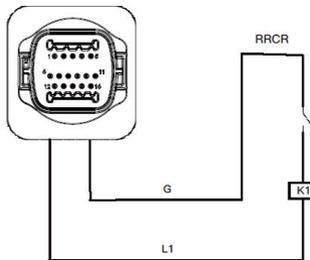


Figure 5-12 Inverter – RRCR Connection

Table 5-4 Function description of the terminal

| Pin NO. | Pin name | Description | Connected to (RRCR) |
|---------|----------|-------------|---------------------|
| 9 | L1 | Relay contact 1 input | K1 - Relay 1 output |
| 13 | G | GND | K1 - Relay 1 output |

Table 5-5 The inverter is preconfigured to the following RRCR power levels.

Relay status: close is 1, open is 0

| L1 | Active Power | Power drop rate | Cos(φ) |
|----|--------------|-----------------|--------|
| 1 | 0% | < 5 seconds | 1 |
| 0 | 100% | / | 1 |

RS485

By RS485 interface, transfer the inverter power output information, alarm information, operation state to the PC terminal or local data acquisition device, then uploaded to the server.
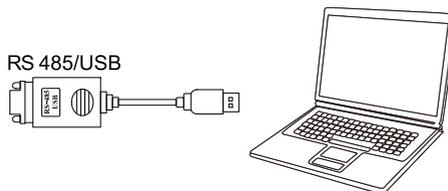


Figure 5-13 Picture of the RS485/USB converter and PC terminal

If only one　REFUSOL 250~350K series is used, use a communication cable, refer to **section 5.6.2** for COM pin definition, and choose either of the two RS485 ports.
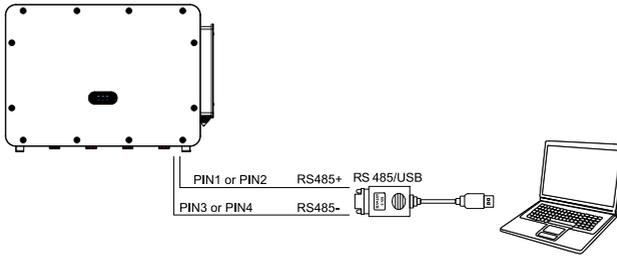


Figure 5-14 A single　REFUSOL 250~350K series connecting communications.

| ⚠️ Note | • The length of the RS485 communication cable should be less than 1000 m. |
|---------|---------------------------------------------------------------------------|

# 5.8.3   PBUS COMMUNICATION  (Multi inverter

## monitoring system)
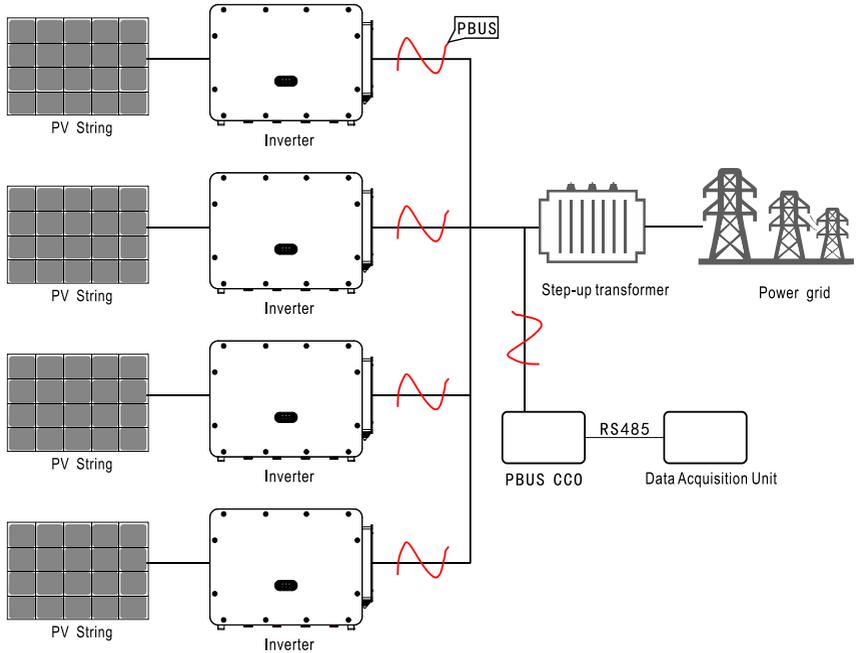


Figure 5-15 Multi inverter monitoring system

PBUS Technical parameters of communication module：

| Technical Index | Parameter |
| --- | --- |
| Maximum communication distance | 1000m |
| PBUS Input Voltage | line voltage 320～ |

| | 920VAC/50/60HZ/three-phase |
|---|---|
| Communication | RS232/PBUS |

PBUS installation and cable routing specifications:

1、Inverter installation location requirements: inverter installation location can not be close to the place of serious magnetic field interference, to avoid interference to the PBUS communication signals.

2、Requirements of load side: There should be no big capacitance load between the load phase and phase of the AC output side of the connected inverter, if there is capacitance, the capacitance value is suggested to be less than 600PF.

3、Cable requirements: generally use multi-core cable. If each phase of a separate cable, the PBUS communication distance should be reduced to less than 800 meters, and the three-phase cable should be wired close to each other; if the three-phase use of multi-core cable, then the PBUS communication distance can reach a maximum of 1000 meters.

4、wiring environmental requirements:

a.  Soil buried wiring: if the cable line is wired by burying under the soil, the PBUS communication distance can reach a maximum of 1000 meters.

b.  Tin roof plus trunking wiring: if the cable is laid on the tin roof of the plant, it is recommended that the PBUS communication distance is controlled below 500 meters.

# 6. Commissioning of Inverter

## Outlines this Chapter

Introduce  REFUSOL 250~350K series safety inspection and start processing.

## 6.1  Check Before Power-On

| ⚠️ <br> Attention | Before starting up the equipment for the first time (test run), all operations performed on the equipment should be thoroughly checked. In particular, check that the DC terminal voltage and the AC terminal voltage are in accordance with the range permitted by the inverter. |
|---|---|

Before switching on the inverter for the first time, the following checks need to be done.

- The AC switch connecting the inverter and all DC switches on the inverter are disconnected.

- Check that the inverter is mounted in place and is firm and reliable.

- Check that the earth wire is reliably connected and that the grounding resistance is less than 0.1Ω.

- Check that the AC cables and DC cables are wired correctly and that the various wiring must be firm and reliable.

- The AC circuit breaker is selected in accordance with the requirements of this manual and local standards.

- Check that the communication cables are connected correctly

and reliably.

● Check that the vacant terminals have been sealed.

## 6.2 Start Inverter

| | |
|---|---|
| ⚠ | ● DC switch has the function of automatic breaking, if the wiring has the phenomenon of string reverse connection, string overcurrent, etc., it will trigger the DC switch automatic breaking protection, refer to the instructions in section 9.3 to check the alarm, and confirm that the alarm disappears before you close the DC switch.<br><br>● Do not allow any obstacles (e.g. cables or operators holding down the handle) within the rotational travel of the DC switch handle during system power-up or operation, otherwise the DC switch will not be able to break automatically.<br><br>● Do not close the DC switch when the grid connection indicator is green (the inverter is in grid connection), otherwise the inverter may be damaged due to lack of insulation impedance test. |
| Attention | |

If all of the above items are in order, perform the following steps to start the inverter for the first time.

**Step 1:** Wear PPE and disconnect all DC switches.
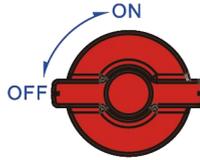


**Step 2:** Measure the voltage of a group of strings with a multimeter and connect PV+ and PV- to the input of PV1 of the inverter respectively. Close the DC SWITCH1 switch, within 3 minutes, you can see the POWER lamp is always on, ALARM lamp is always on (not connected to AC), that means the first set of string PV+ and PV- access is correct. If you do not see the POWER lamp is always on/ALARM lamp is always on within 3 minutes, it means that the first set of string PV+ and PV- are connected incorrectly. Disconnect the DC SWITCH1 switch, re-exchange the PV+ and PV- access, and re-access the test according to the second step. If the POWER/ALARM light is not on for 3 minutes, please contact the technical support engineer.
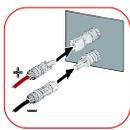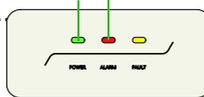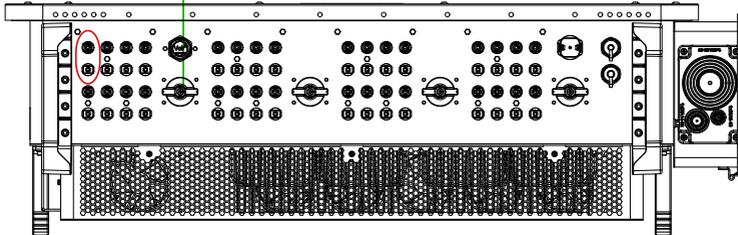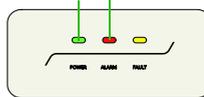
**Step 3:** After the PV1 branch is correctly connected, light up the LED condition. After connecting the six-channel string of MPP3~MPPT8 to the PV input of the inverter according to PV+ and PV- correspondingly, close the three DC switches of DC SWITCH2/3/4. If there is no DC switch decoupling, it means that all the branches are connected correctly. If there is a DC switch debounce, it means that the DC switch corresponding to the PV branch has a reverse connection phenomenon, after re-checking the defective, correctly connected to the inverter, close the debounce DC switch.
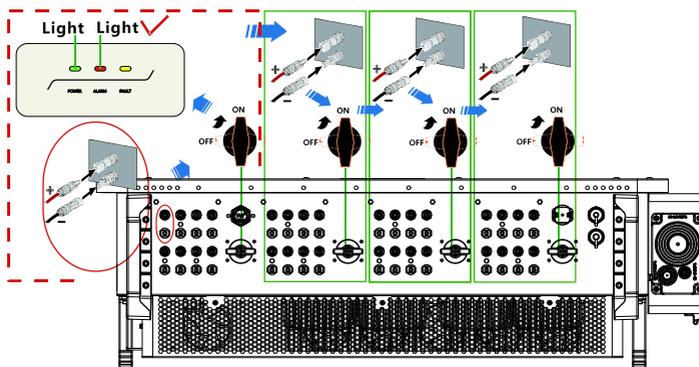


If the switch trips to "OFF" in the above steps, it means that the string has reverse connection and reverse injection problems, and the corresponding string needs to be troubleshooted. Before closing the switch, confirm that the inverter is in the shutdown state, use the reset handle of the switch, move the switch beyond the position of the silk screen "ON" on the bottom of the inverter, and stay for about 6S to ensure that the switch is closed.

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**Step 4:** Disconnect the DC SWITCH1 switch, connect the remaining strings to the MPP1 and MPPT2 branches correctly, and close the DC SWITCH1 switch. If there is no DC switch release, it means that all strings are connected correctly. If there is a DC switch debounce, it means that the DC switch corresponding to the PV branch has a reverse connection phenomenon, after re-checking the defective, correctly connected to the inverter, close the debounce DC switch.
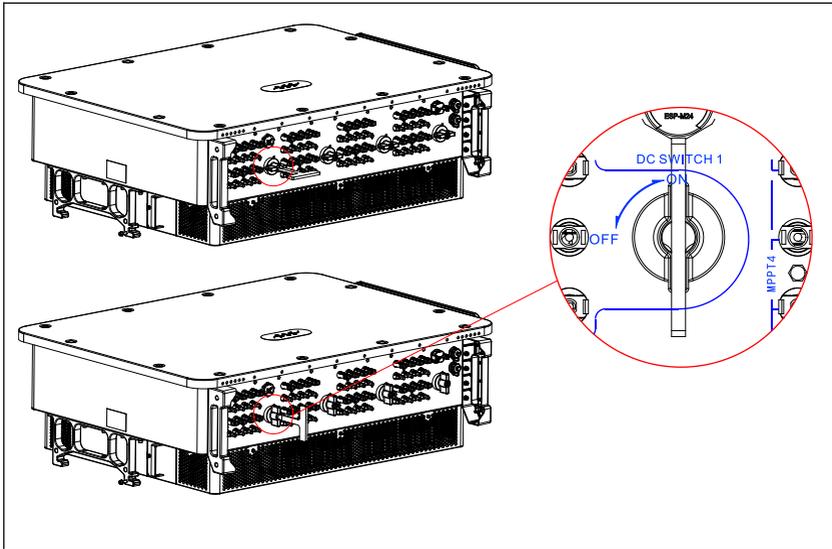
**Step 5:** Close the switch between the inverter and the AC power grid. within 3 minutes the ALARM light is off and the POWER light is always on, the inverter is successfully connected to the grid. If the FAULT light is on or there are other defects, disconnect all switches and contact the technical support engineer in time.

**DC switch 1~4 without tripping**

**Close the switch**

**Light  Stop light** ✓

**Grid-connected successfully**
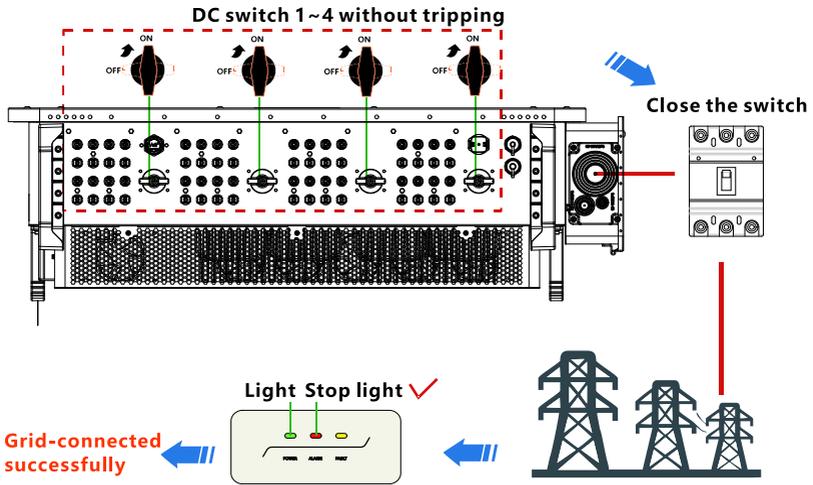
If the inverter is faulty, please refer to section 9.3 of this manual for one by one troubleshooting.

# 7. Monitoring

**Note:** - Please refer to the extended instructions related to Monitoring, commissioning, and software upgrade via REFU App.

# 8. Operational Interface

## About This Chapter

This section describes the REFUsol 250~350K-8T display, operation, and LED indicators.
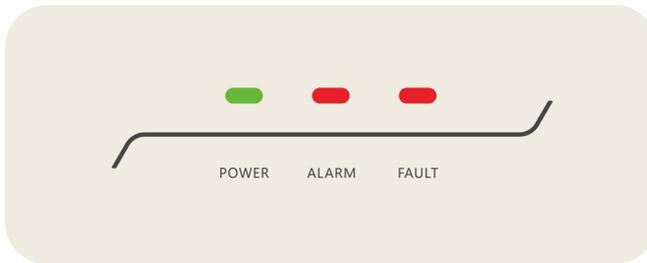


Indicator Lights:

Green light (POWER) on = Normal: Always on;

In upgrading: fast flashing (on for 200ms/off for 200ms);

In detection: slow flash (200ms on/ 1s off).

Red (ALARM) = Recoverable fault or permanent fault status.

Red (FAULT) on = GFCI leakage current fault or low insulation impedance alarm, LED on and buzzer sounding.

## Online software upgrade

Note: - Please refer to the extended instructions related to monitoring, commissioning, and software upgrade via REFU App.

# 9. Troubleshooting and Maintenance

## 9.1 Normal shutdown and power down operation

**Step 1:** Remote shutdown setting through the machine display, or sending shutdown command in Bluetooth APP or management system, for details, please refer to the user manual of the corresponding product or consult the after-sales personnel;

**Step 2:** After the remote shutdown is successful, make sure the output power of the inverter is 0, and then disconnect the switch between the inverter and the power grid;

**Step 3:** Disconnect the DC switch;

Caution:

When the machine is working normally, it is strictly forbidden to disconnect the AC and DC side switches directly, so as not to damage the switches by arcing danger. It may also cause damage to the inverter in serious cases.

## 9.2 Fault power-down operation

Operation steps

**Step 1:** Wear personal protective equipment and avoid touching the electrically charged parts of the inverter before performing the maintenance and power down operation, otherwise it may lead to electric shock or arcing fire.

**Step 2:** If the inverter is not fault shutdown, set the remote

shutdown through the machine display, or send the shutdown command in the Bluetooth APP, management system side.

**Step 3:** Disconnect the AC switch.

**Step 4:** Determine whether there is DC loop current or reverse connection; use a current clamp meter to measure the DC current of each input string of the inverter first. If the current is not higher than 0.5A, please execute port DC switch operation. If the current is higher than 0.5A, you need to wait until the current is lower than 0.5A at night before performing the disconnect DC switch operation.

**Step 5:** Use a multimeter to measure the AC terminal line voltage as well as the voltage of each phase of the chassis to ensure that the AC side of the inverter is disconnected.

**Step 6:** After the display indicator goes off, wait for 25min to perform fault analysis or overhaul operation on the inverter.

Attention:

1. When the inverter has smoke or obvious abnormality in appearance, it is strictly forbidden for maintenance personnel to open the upper cover panel of the mainframe for overhauling, please follow the operation to disconnect the inverter in time.

2. When the inverter appears non-smoking and other special abnormal faults, please contact the after-sales personnel in time for consultation to assist in troubleshooting, in the process of restarting the inverter, avoid standing in front of the inverter.

# 9.3  Troubleshooting site information

This section describes the potential errors for this product. Please read carefully for the following tips when doing the troubleshooting:

1)  Check the warning message or faulty codes on the inverter information panel.

2)  If not any error code display on the panel, please check the following lists:

— Is inverter be installed in a clean, dry, ventilated environment?

— Is the DC switch turn off?

— Are the cable cross section area and length meet the requirement?

— Are the input and output connection and wiring in good condition?

— Are the configuration settings correctly for the particular installation?

This section contains the potential errors, resolution steps, and provide users with troubleshooting methods and tips.

The process to check the event list can refers to REFU Monitor APP.

Table 9-1 Even list

| Code | Name | Description | Solution |
|------|------|-------------|----------|
| ID001 | GridOVP | The grid voltage is too high | If the alarm occurs occasionally, the possible cause is that the electric grid is abnormal occasionally. |
| ID002 | GridUVP | The grid voltage is too low | |

| ID003 | GridOFP | The grid frequency is too high | Inverter will automatically return to normal operating status when the electric grid's back to normal. If the alarm occurs frequently, check whether the grid voltage/frequency is within the acceptable range. If yes, please check the AC circuit breaker and AC wiring of the   inverter. If the grid voltage/frequency is NOT within the acceptable range and AC wiring is correct, but the alarm occurs repeatedly, contact technical support to change the grid over-voltage, under-voltage, over-frequency, under-frequency protection points after obtaining approval from the local electrical grid operator. |
|-------|---------|-------------------------------|------------------------------------------------------------------------------|
| ID004 | GridUFP | The grid frequency is too low | |
| ID005 | GFCI | Charge Leakage Fault | Check for inverter and wiring. |
| ID006 | OVRT | OVRT function is faulty | ID006-ID041 If the alarm occurs occasionally, the possible cause is that the electric grid is abnormal occasionally. Inverter will automatically return to normal operating status when the electric grid's back to normal. If the alarm occurs frequently, check whether the grid voltage/frequency is within the acceptable range. If yes, please check the AC circuit breaker and AC wiring of the   inverter. If the grid voltage/frequency |
| ID007 | LVRT | LVRT function is faulty | |
| ID008 | IslandFault | Island protection error | |
| ID009 | GridOVPInstant1 | Transient overvoltage of grid voltage 1 | |
| ID010 | GridOVPInstant2 | Transient overvoltage of grid voltage 2 | |
| ID011 | VGridLineFault | Power grid line voltage error | |

| ID | Name | Description | |
|---|---|---|---|
| ID013 | RefluxFault | Anti-Reflux function is faulty | is NOT within the acceptable range and AC wiring is correct, but the alarm occurs repeatedly, contact technical support to change the grid over-voltage, under-voltage, over-frequency, under-frequency protection points after obtaining approval from the local electrical grid operator. |
| ID014 | VGridUnbalance | Grid voltage imbalance | |
| ID015 | InvOVPInstant | Inverter instantaneous overvoltage | |
| ID016 | GridPhaseMutation | Sudden change in grid phase | |
| ID017 | HwADFaultIGrid | Power grid current sampling error | |
| ID018 | HwADFaultDCI(AC) | Wrong sampling of dc component of grid current | |
| ID019 | HwADFaultVGrid(DC) | Power grid voltage sampling error (DC) | |
| ID020 | HwADFaultVGrid(AC) | Power grid voltage sampling error (AC) | |
| ID021 | HwGFCIFault(DC) | Leakage current sampling error(DC) | |
| ID022 | HwGFCIFault(AC) | Leakage current sampling error(AC) | |
| ID023 | HwADFaultDCV | Load voltage DC component sampling error | |
| ID024 | HwADFaultIdc | Dc input current sampling error | |
| ID025 | HwADErrDCI(DC) | DCI Sampling Error (DC) | |
| ID026 | HwADErrIdcBranch | \ | |
| ID027 | PVLowImpedance | PV- Low impedance to PE | |
| ID028 | PIDAbnormalOut | PID Abnormal Output | |
| ID029 | ConsistentFault_GFCI | Leakage current consistency error | |

| ID030 | ConsistentFault_Vgrid | Grid voltage consistency error | |
|---|---|---|---|
| ID031 | ConsistentDCI | DCI consistency error | |
| ID033 | SpiCommFault(DC) | SPI communication error (DC) | |
| ID034 | SpiCommFault(AC) | SPI communication error (AC) | |
| ID035 | SChip_Fault | Chip error (DC) | |
| ID036 | MChip_Fault | Chip error (AC) | |
| ID037 | HwAuxPowerFault | Auxiliary power error | |
| ID038 | InvSoftStartFail | Inverter soft startup failed | |
| ID039 | ArcShutdownAlarm | Arc shutdown protection | |
| ID040 | LowLightChkFail | Low light detection failure | |
| ID041 | RelayFail | Relay detection failure | |
| ID042 | IsoFault | Low insulation impedance | Check the insulation resistance between the photovoltaic array and ground (ground), if there is a short circuit, the fault should be repaired in time. |
| ID043 | PEConnectFault | Ground fault | Check ac output PE wire for grounding. |
| ID044 | ConfigError | Error setting input mode | Check the input mode (parallel/independent mode) Settings for the inverter. If not, change the input mode. |
| ID045 | CTDisconnect | CT error | |
| ID046 | ReversalConnection | Input Reverse Error | |
| ID047 | ParallelFault | ParallelFault | / |
| ID050 | TempErrHeatSink1 | Radiator 1 temperature protection | Please ensure that the inverter is installed in a cool/well ventilated area. |

| ID051 | TempErrHeatSink2 | Radiator 2 temperature protection | Make sure that the inverter is mounted vertically and that the ambient temperature is below the inverter temperature limits |
|---|---|---|---|
| ID052 | TempErrHeatSink3 | Radiator 3 temperature protection | |
| ID053 | TempErrHeatSink4 | Radiator 4 temperature protection | |
| ID054 | TempErrHeatSink5 | Radiator 5 temperature protection | |
| ID055 | TempErrHeatSink6 | Radiator 6 temperature protection | |
| ID056 | NTCFault | NTC fault | |
| ID057 | TempErrEnv1 | Ambient temperature 1 protection | |
| ID058 | TempErrEnv2 | Ambient temperature 2 protection | |
| ID059 | TempErrInv1 | Module 1 temperature protection | |
| ID060 | TempErrInv2 | Module 2 temperature protection | |
| ID061 | TempErrInv3 | Module 3 temperature protection | |
| ID062 | TempDiffErrInv | Temperature difference error of inverter module | |
| ID065 | BusRmsUnbalance | Unbalanced bus voltage RMS | Internal faults of inverter, switch OFF inverter, wait for 25 minutes, then switch ON inverter. Check whether the problem is solved. If no, please contact technical support. |
| ID066 | BusInstUnbalance | The transient value of bus voltage is unbalanced | |
| ID067 | BusUVP | Busbar undervoltage | |

| | | during grid-connection | |
|---|---|---|---|
| ID068 | BusZVP | Bus voltage low | |
| ID069 | PVOVP | PV over-voltage | Check whether the PV series voltage (Voc) is higher than the maximum input voltage of the inverter. If so, adjust the number of PV modules in series and reduce the PV series voltage to fit the input voltage range of the inverter. After correction, the inverter will automatically return to its normal state. |
| ID072 | SwBusRms OVP | Inverter bus voltage RMS software overvoltage | ID072-ID104 Internal inverter fault, turn off the inverter, wait 25 minutes and turn on the inverter. Check if the problem is resolved. If not, please contact technical support. |
| ID073 | SwBusIOVP | Inverter bus voltage instantaneous value software overvoltage | |
| ID074 | FlyingCapO VP | | |
| ID075 | FlyingCapU VP | | |
| ID076 | PVUVP | PV undervoltage protection | |
| ID082 | DciOCP | Dci overcurrent protection | |
| ID083 | SwIOCP | Output instantaneous current protection | |
| ID084 | SwBuckBoo stOCP | BuckBoost software overcurrent protection | |
| ID085 | SwAcRmsO CP | Output effective value current protection | |

| ID086 | SwPvOCPInstant | PV overcurrent software protection | |
|-------|----------------|-----------------------------------|--|
| ID087 | IpvUnbalance | PV flows in uneven parallel | |
| ID088 | IacUnbalance | Unbalanced output current | |
| ID089 | SwPvOCP | PV overcurrent software protection | |
| ID090 | IbalanceOCP | Inverter bus balance current protection | |
| ID091 | ResOver | Resonant protection | |
| ID092 | SwAcCBCFault | Software current limited protection | |
| ID093 | SwPvBranchOCP1 | PV branch software overcurrent 1(enabled by default) | |
| ID098 | HwBusOVP | Inverter bus hardware overvoltage | |
| ID099 | HwBuckBoostOCP | BuckBoosthardware overflows | |
| ID102 | HwPVOCP | PV hardware overflows | |
| ID103 | HwACOCP | Ac output hardware overflows | |
| ID104 | HwDiffOCP | Hardware differential overcurrent | / |
| ID105 | MeterCommFault | Meters communication fault | Check whether the meters wiring is correct. |
| ID106 | SNMachineFault | Serial number machine error | / |
| ID107 | HwVerError | Hardware version | / |

| | | mismatch | |
|---|---|---|---|
| ID110 | Overload1 | Overload protection 1 | Please check whether the inverter is operating under overload. |
| ID111 | Overload2 | Overload protection 2 | |
| ID112 | Overload3 | Overload protection 3 | |
| ID113 | OverTempD erating | Internal temperature is too high. | Make sure the inverter is installed where there is no direct sunlight. Please ensure that the inverter is installed in a cool/well ventilated place. Ensure the inverter is installed vertically and the ambient temperature is below the inverter temperature limit. |
| ID114 | FreqDeratin g | AC frequency is too high | Please make sure the grid frequency and voltage is within the acceptable range. |
| ID115 | FreqLoadin g | AC frequency is too low | |
| ID116 | VoltDeratin g | AC voltage is too high | |
| ID117 | VoltLoading | AC voltage is too low | |
| ID123 | PermOutSh ortCircuitFai l | Output short circuit fault | / |
| ID129 | PermHwAc OCP | Permanent hardware overcurrent failure | ID129-ID143 Internal faults of inverter, switch OFF inverter, wait for 25 minutes, then switch ON inverter. Check whether the problem is solved. If no, please contact technical support. |
| ID130 | PermBusO VP | Permanent Bus overvoltage failure | |
| ID131 | PermHwBu sOVP | Permanent Bus hardware overvoltage failure | |
| ID132 | PermIpvUn balance | Permanent PV unbalance failure | |

| ID134 | PermAcOCPInstant | Output transient overcurrent permanent failure | |
|-------|------------------|------------------------------------------------|---|
| ID135 | PermIacUnbalance | Permanent failure of unbalanced output current | |
| ID136 | PermInvStartFail | Permanent INV start failure | |
| ID137 | PermInCfgError | Input mode setting error permanent failure | |
| ID138 | PermDCOCPInstant | Input overcurrent permanent fault | |
| ID139 | PermHwDCOCP | Input hardware overcurrent permanent failure | |
| ID140 | PermRelayFail | Permanent relay failure | |
| ID141 | PermBusUnbalance | Bus voltage unbalanced permanent failure | |
| ID142 | PermSpdFail(DC) | PV surge protection | |
| ID143 | PermSpdFail(AC) | Grid surge protection | |
| ID145 | USBFault | USB fault | ID145-ID156 Internal inverter fault, turn off the inverter, wait 5 minutes and turn on the inverter. Check if the problem is resolved. If not, please contact technical support. |
| ID146 | WifiFault | Wi-Fi fault | |
| ID147 | BluetoothFault | Bluetooth fault | |
| ID148 | RTCFault | RTC Clock fault | |
| ID149 | CommEEPROMFault | Communication board EEPROM error | |
| ID150 | FlashFault | Communication board FLASH error | |
| ID152 | SafetyVerFa | Safety version | |

| | ult | error | |
|---|---|---|---|
| ID153 | SCILose(DC) | SCI communication error (DC) | |
| ID154 | SCILose(AC) | SCI communication error (AC) | |
| ID156 | SoftVerError | Inconsistent software versions | |
| ID161 | ForceShutdown | Force shutdown | The inverter is performed a forced shutdown |
| ID162 | RemoteShutdown | Remote shutdown | The inverter is performed a remote shutdown. |
| ID163 | Drms0Shutdown | Drms0 shutdown | The inverter is performed with a Drms0 shutdown. |
| ID164 | PSCommFault | Power station communication failure | / |
| ID169 | FanFault1 | Fan 1 fault | Please check whether the fan 1 of inverter is running normally. |
| ID170 | FanFault2 | Fan 2fault | Please check whether the fan 2 of inverter is running normally. |
| ID171 | FanFault3 | Fan 3 fault | Please check whether the fan 3 of inverter is running normally. |
| ID172 | FanFault4 | Fan 4 fault | Please check whether the fan 4 of inverter is running normally. |
| ID173 | FanFault5 | Fan 5 fault | Please check whether the fan 5 of inverter is running normally. |
| ID174 | FanFault6 | Fan 6 fault | Please check whether the fan 6 of inverter is running normally. |
| ID175 | FanFault7 | Fan 7 fault | Please check whether the fan 7 of inverter is running normally. |
| ID386 | FanFault8 | Fan 8 fault | Please check whether the fan 8 of inverter is running normally. |

![REFUsol logo]

| ID191 | PID_Output _Fail | PID function is failed | / |
|-------|------------------|------------------------|---|
| ID381 | DcSwitchTri p1 | DC switch 1 tripped | If the switch trips to "OFF" in the above steps, it means that the string has reverse connection and reverse injection problems, and the corresponding string needs to be troubleshooted. Before closing the switch, confirm that the inverter is in the shutdown state, use the DC switch handle of the switch, move the switch beyond the position of the silk screen "ON" on the bottom of the inverter, and stay for about 6S to ensure that the switch is closed. |
| ID382 | DcSwitchTri p2 | DC switch 2 tripped | |
| ID383 | DcSwitchTri p3 | DC switch 3 tripped | |
| ID384 | DcSwitchTri p4 | DC switch 4 tripped | |
| ID442 | ARMDSPPr oVerFault | ARM_DSP protocol version inconsistency | / |
| ID462 | FireToGrou ndWireShot | Live wire earth wire short circuit fault | / |
| ID463 | Unrecover_ Fire_To_Gro und_Wire_S hort | Live wire earth wire short circuit permanent fault | / |

## 9.4 Maintenance

Inverters generally do not need any daily or routine maintenance. But ensure heat sink should not be blocked by dust, dirt or any other items. Before the cleaning, make sure that the DC SWITCH is turned OFF and the circuit breaker between inverter and electrical grid is turned OFF. Wait at least for 25 minutes before the Cleaning.

✧ Inverter cleaning

Please clean the inverter with an air blower, a dry & soft cloth or a soft bristle brush. Do not clean the inverter with water, corrosive chemicals, detergent, etc.

✧   Heat sink cleaning

For the long-term proper operation of inverters, ensure there is enough space around the heat sink for ventilation, check the heat sink for blockage (dust, snow, etc.) and clean them if they exist. Please clean the heat sink with an air blower, a dry & soft cloth or a soft bristle brush. Do not clean the heat sink with water, corrosive chemicals, detergent, etc.

In order to make the inverter operate stably and reliably for a long period of time and to provide a good working environment for the inverter, please carry out relevant maintenance and inspection work on the inverter according to the inspection table.

Table 9-2: Routine Maintenance and Overhaul Points

| Inspection content | Method of determination | maintenance cycle |
|---|---|---|
| Fan | Check for abnormalities in fan operation, lagging, etc. | At least half a year/1 time |
| Air inlet and outlet | 1. Regularly check whether there is dust accumulation in the air inlet and outlet, and remove the air inlet baffle plate to clean up when necessary; | At least half a year/1 time |

| | 2. The surrounding area should not be affected by plants and grasses that affect the heat dissipation in front of the inverter, and it is necessary to inspect and get rid of grasses in time.<br><br>3. The inverter should not be surrounded by piles of objects that affect the air inlet and outlet of the inverter, thus affecting the heat dissipation effect of the inverter; | |
|---|---|---|
| Electrical Connection | 1. Check whether the cable connection is detached or loose.<br><br>2. Check the cable for damage, emphasizing the skin of the cable in contact with metal surfaces for signs of cuts.<br><br>3. Check whether the sealing plug of the unused DC input terminal is detached.<br><br>4. Check that the waterproof | At least half a year/1 time |

| | covers of the unused COM ports and USB ports are not locked.<br><br>5. Check whether the AC port is blackened and heated abnormally, and check whether the screws of the distribution box are all locked; | |
| --- | --- | --- |
| Ground point inspection | 1. Check whether the grounding point is connected normally and whether the grounding impedance is <1Ω;<br><br>2.Check whether the grounding point is loose, rusty, etc. If so, please replace the screws and re-lock them in time; | Half a year or 1 year/1 time |
| Equipment operation status check | 1. Whether the status of each indicator light is normal when the equipment is running, and whether there is any fault alarm message in the control panel;<br><br>2. Check whether the | At least half a year/1 time |

| | parameters of inverter operation are within the prescribed range, focusing on DC voltage, DC current, DC power, AC voltage, AC current, frequency, power generation, daily power generation, cumulative power generation and other parameters are normal;<br><br>3.Whether the equipment is normal without abnormal noise and odor; | |
|---|---|---|

## 9.5  Fan Replacement and Maintenance Instructions

### 9.5.1  Fan replacement

Attention：

●  Before replacing the fan, it is necessary to perform a de-energizing operation on the inverter.

●  When replacing the fan, insulated tools must be used and personal protective equipment must be worn.

**Step 1:** Remove the fan bracket fixing screws and secure them.
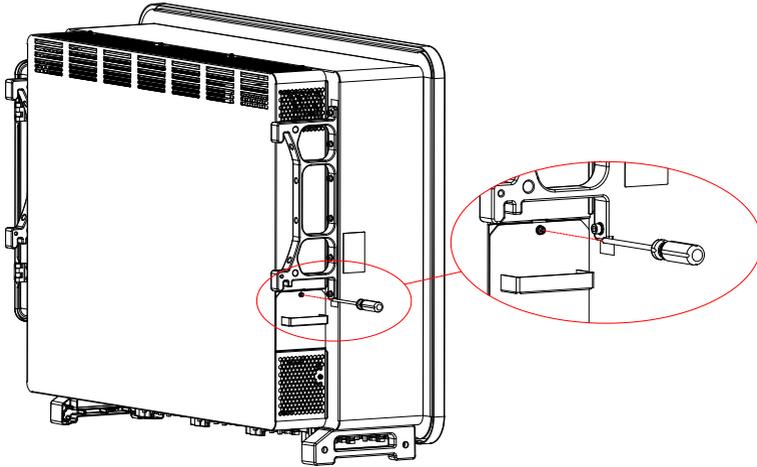
**Step2:** Cut off the cable ties holding the fan cable and then disconnect all the connecting terminals in turn.

**Note:** You can't use brute force to pull out the terminals, you can use your fingernail (tweezers or a small screwdriver are recommended) to press the movable buckle, and then pull out the two ends.
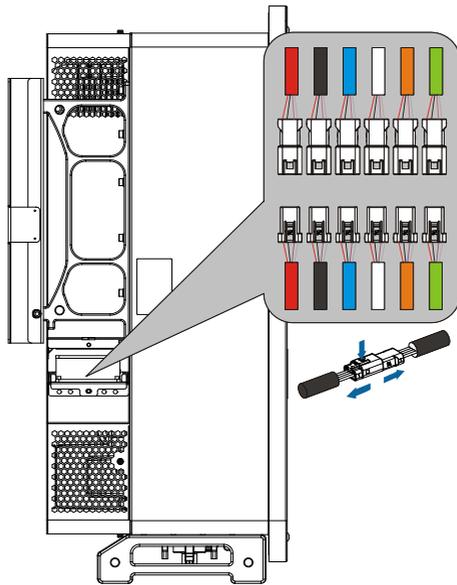
**Step3:** Remove the screws securing the fan bracket and pull the fan mounting bracket all the way out
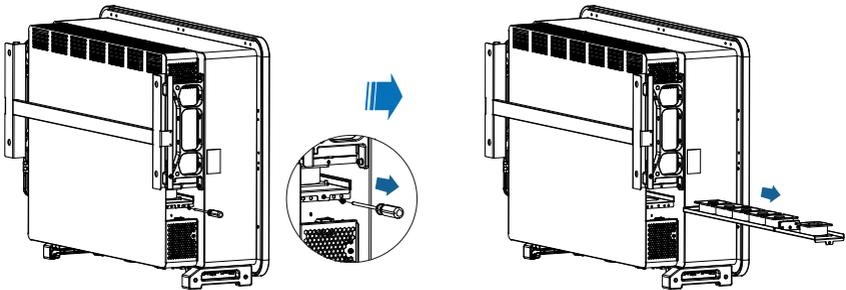


**Step4:** Cut off the tie-wraps of the defective fan (the outermost FAN 7 is used as an example below, and the other fans work in the same way).

FAN 8　FAN 3　FAN 4　FAN 5　FAN 6　　　FAN 7
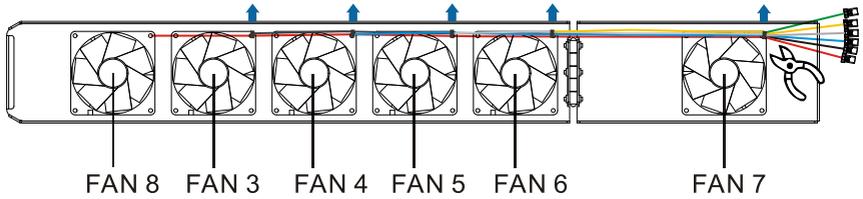
**Step5:** Remove the defective fan and keep the removed screws in a safe place.
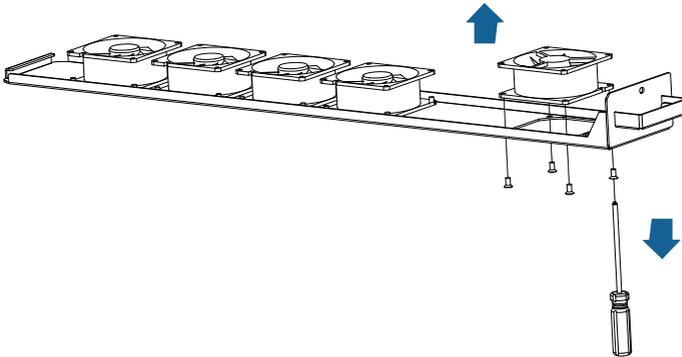


**Step 6:** Lock the new fan in place.
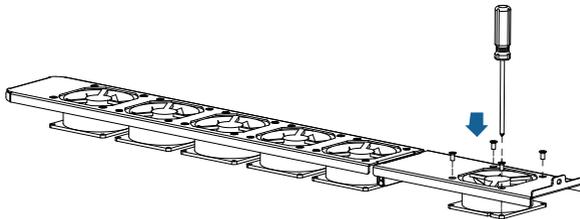


**Step7:** After the new fan is installed, tie the fan cable in the same position as the original cable tie.

![REFUsol logo]

**Step8:**Push the fan bracket completely in against the mounting position and tighten the screws.
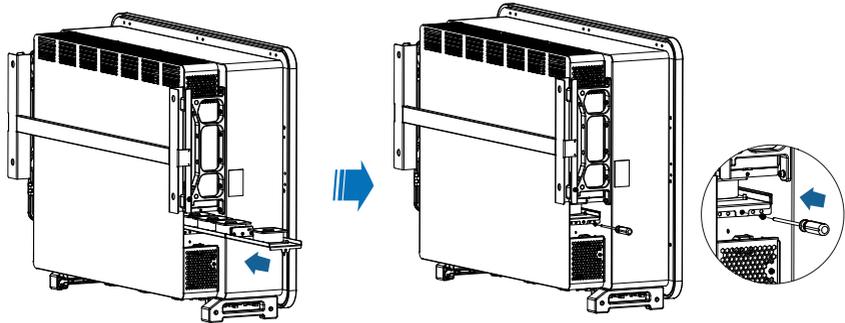


**Step9:** Connect the connectors according to the color and serial number of the fan.

Table 9-3 Comparison of Fan Failure Messages

| Fan Name | FAN 3 | FAN 4 | FAN 5 | FAN 6 | FAN 7 | FAN 8 |
|---|---|---|---|---|---|---|
| Color | black | blue | white | yellow | green | red |
| Correspon-ding PCBA port | CN23 | CN22 | CN27 | CN26 | CN29 | CN28 |
| Correspon-ding fault code | Fan 3 failure | Fan 4 failure | Fan 5 failure | Fan6 failure | Fan7 failure | Fan 8 failure |
| | FanFault3 | FanFault4 | FanFault5 | FanFault6 | FanFault7 | FanFault8 |

**Step 10:** Push the fan mounting bracket all the way in and tighten the screws.
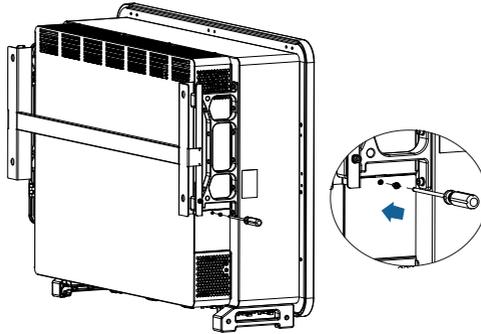
## 9.5.2   Fan Maintenance

Attention

Before replacing the fan, it is necessary to perform a power-down operation on the inverter.

When replacing the fan, insulated tools must be used and personal protective equipment must be worn.

**Step 1:** Unscrew the screws and remove the small baffles and keep them in a safe place.
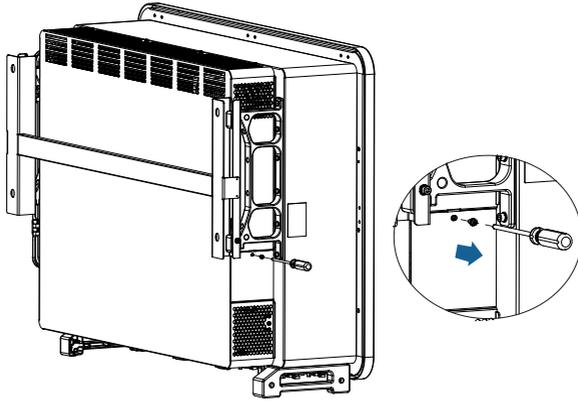
**Step 2:** Cut off the cable ties holding the fan cables and disconnect all the connecting terminals in turn.
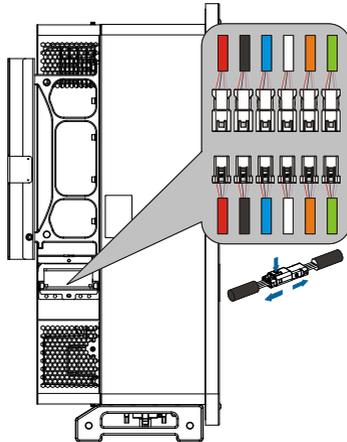


**Step 3:** Remove the screws securing the fan bracket and pull the fan mounting bracket all the way out.
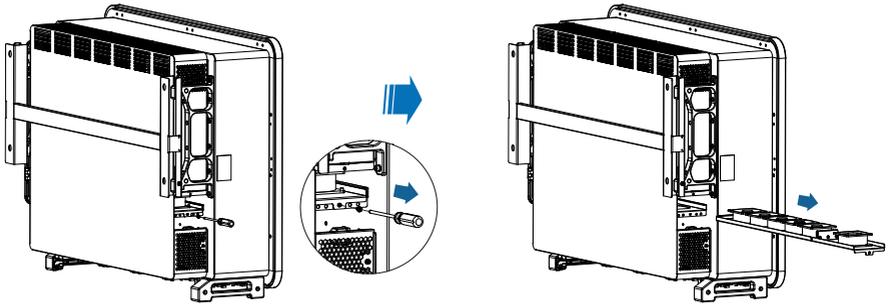
**Step 4:** Clean the fan using a sofbristled brush / vacuum cleaner to remove any debris or mud left on the fan bracket.

**Step 5:** Push the cleaned fan bracket fully in against the mounting position and tighten the screws.

**Step 6:** Connect the connectors according to the color and fan serial number.

**Step 7:** Put the small baffle back on and tighten the screws.

# 10. Technical Data

## 10.1 Input Parameters (DC)

| Model | REFUsol 250K-6T | REFUsol 330K-8T | REFUsol 350K-8T |
|---|---|---|---|
| Max. input voltage | 1500V | | |
| Rated input voltage | 1160V | | |
| Start-up voltage | 550V | | |
| MPPT operating voltage range | 500~1500V | | |
| Full power MPPT voltage range | 860~1300V | | |
| Number of MPP trackers | 6 | 8 | |
| Number for DC inputs | 24 | 32 | |
| Max. input MPPT current | 6*60A | 8*60A | |
| Max. input short-circuit current | 6*100A | 8*100A | |

## 10.2 Output Parameter (AC)

| Model | REFUsol 250K-6T | REFUsol 330K-8T | REFUsol 350K-8T |
|---|---|---|---|
| Rated output power | 250kW | 330kW | 352kW |
| Maximum apparent power | 250kVA | 330kVA | 352kVA |
| Max. Output current | 180.5A | 238.2A | 254.1A |
| Nominal grid voltage | 3/PE, 800Vac | | |
| Grid voltage range | 640~920Vac | | |
| Nominal frequency | 50Hz / 60Hz | | |
| Grid frequency range | 45~55Hz / 55~ 65Hz | | |
| Active power adjustable range | 0~100% | | |
| THDi | <3% | | |
| Power factor | -0.8. leading ..+0.8 lagging | | |

## 10.3 Performance Parameter

| Model | REFUsol 250K-6T | REFUsol 330K-8T | REFUsol 350K-8T |
|---|---|---|---|
| Max efficiency | 99.05% | | |
| European Weighted efficiency | 98.80% | | |
| MPPT efficiency | >99.9% | | |
| EMC | EN 61000-6-2, EN 61000-6-4 | | |
| Safety standard | IEC62109-1/2, IEC62116, IEC61727, IEC-61683, IEC60068-2-1/2/14/30 | | |
| Grid standard | VDE-AR-N 4110/4120, CEI 0-16, UNE 217002, NTS 631, EN50549, EN50530, IEC 62910 | | |
| Protection | Leakage current/Anti-islanding /DC reverse polarity /ZVRT/AC and DC secondary lightning protection | | |
| Ground fault monitoring | Yes | | |
| PV-array string fault monitoring | Yes | | |
| Protection class | Class I | | |
| Overvoltage category | AC: III, PV: II | | |
| Input/ output SPD | PV: type II standard, AC: type II Standard | | |

## 10.4 General Data

| Model | REFUsol 250K-6T | REFUsol 330K-8T | REFUsol 350K-8T |
|---|---|---|---|
| Topology | Transformless | | |
| Ambient temperature range | -30℃ ~ +60℃ | | |
| Relative humidity | 0% ~ 100% | | |
| DC Switch | Yes | | |
| Cooling | Smart forced air cooling | | |
| Max. operating altitude | 4000m | | |
| Communication | RS485 / PBUS | | |
| Display | LED& Bluetooth +APP | | |
| Degree of protection | IP66 | | |
| Dimension (W× H × D) | 1159×828×366mm | | |
| Weight | < 111 kg | < 113 kg | |

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