

# User Manual

## R Series

In order to prevent improper operation before use, please read this manual carefully.

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# 1. Notes on This Manual

## 1.1 Scope of Validity

This manual describes the assembly, installation, commissioning, maintenance and troubleshooting of the following model(s) of Fox ESS products:





**R75, R100, R110**

## 1.2 Target Group

This manual is for qualified electricians. The tasks described in this manual only can be performed by qualified electricians.




## 1.3 Symbols Used







The following types of safety instructions and general information appear in this document as described below:

|   |  |
|---|--|
|    | <p><b>Danger!</b></p> <p>“Danger” indicates a hazardous situation which, if not avoided, will result in death or serious injury.</p>     |
|   | <p><b>Warning!</b></p> <p>“Warning” indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>  |
|  | <p><b>Caution!</b></p> <p>“Caution” indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p> |
|  | <p><b>Note!</b></p> <p>“Note” provides important tips and guidance.</p>  |

## 1.4 Symbols Explanation

This section explains the symbols shown on the inverter and on the type label:

| Symbols   | Explanation  |
|---|--|
|  | <p>CE mark.</p> <p>The inverter complies with the requirements of the applicable CE guidelines.</p>                |
|  | <p>Beware of hot surface.</p> <p>The inverter can become hot during operation. Avoid contact during operation.</p> |
|  | <p>Danger of high voltages.</p> <p>Disconnect from the grid and the PV generator before opening the device.</p>    |

|  |  |
|--|--|
|   | <p>Danger.<br/>Risk of electric shock!</p>   |
|   | <p>Danger to life due to high voltage.<br/>There is residual voltage in the inverter which needs 15 min to discharge. Wait 15 min before you open the cover.</p> |
|   | <p>Read the manual.</p>  |
|   | <p>Product should not be disposed as household waste.</p>  |
|   | <p>This mark indicates that the product meets UK safety certification requirements.</p>  |
|  | <p>This mark indicates that the product meets EU environment protection certification requirements.</p>  |

## 2. Safety Precautions

### 2.1 Appropriate Usage

This series inverter is designed and tested in accordance with international safety requirements. However, certain safety precautions must be taken into account when installing and operating this inverter. The installer must read and follow all instructions, cautions and warnings in this installation manual.

- All operations including transport, installation, start-up and maintenance, must be carried out by qualified, trained personnel.
- The electrical installation & maintenance of the inverter shall be conducted by a licensed electrician and shall comply with local wiring rules and regulations.
- Before installation, check the unit to ensure it is free of any transport or handling damage, which could affect insulation integrity or safety clearances. Choose the installation location carefully and adhere to specified cooling requirements. Unauthorized removal of necessary protections, improper use, incorrect installation and operation may lead to serious safety and shock hazards or equipment damage.
- Before connecting the inverter to the power distribution grid, contact the local power distribution grid company to get appropriate approvals. This connection must be made only by qualified technical personnel.
- Do not install the equipment in adverse environmental conditions such as in close proximity to flammable or explosive substances; in a corrosive environment; where there is exposure to extreme high or low temperatures; or where humidity is high.
- Do not use the equipment when the safety devices do not work or are disabled.
- Use personal protective equipment, including gloves and eye protection during the installation.
- Inform the manufacturer about non-standard installation conditions.
- Do not use the equipment if any operating anomalies are found. Avoid temporary repairs.
- All repairs should be carried out using only approved spare parts, which must be installed in accordance with their intended use and by a licensed contractor or authorized Fox ESS service representative.
- Any time the inverter has been disconnected from the public network, please be extremely cautious as some components can retain charge sufficient to create a shock hazard. Prior to touching any part of the inverter please ensure surfaces and equipment are under touch safe temperatures and voltage potentials before proceeding.

### 2.2 PE Connection and Leakage Current

All Fox ESS inverters incorporate a certified internal RCD (Residual Current Device) to protect against possible electrocution in case of a malfunction of the PV array, cables or inverter (DC). The RCD in the Fox ESS inverter can detect leakage on the DC side. The RCD limit is set to 30mA, and the RCD must be type B and not type A or AC RCD (IEC 60755). There are 2 trip thresholds for the RCD as required by NB/T32004-2018. A low threshold is used to protect against rapid changes in leakage typical of direct contact by people. A higher threshold is used for slowly rising leakage currents, to limit the current in grounding conductors for the safety. The default value for higher speed personal protection is 30mA, 60mA, and 150mA per unit, and 1A per unit for lower speed fire safety.

### **2.3 Surge Protection Devices (SPDs) for PV Installation**

Lightning will cause damage either from a direct strike or from surges due to a nearby strike. Induced surges are the most likely cause of lightning damage in majority of installations, especially in rural areas where electricity is usually provided by long overhead lines. Surges may impact on both the PV array conduction and the AC cables leading to the building. Specialists in lightning protection should be consulted during the end use application. Using appropriate external lightning protection, the effect of a direct lightning strike into a building can be mitigated in a controlled way, and the lightning current can be discharged into the ground.

## 3. Introduction

### 3.1 Product Introduction

R75, R100, and R110 are three-phase transformerless grid-tied inverters, which are important components of PV power generation system. The inverter converts the direct current generated by the photovoltaic cells into alternating current that meets the requirements of the grid and feeds into the grid.

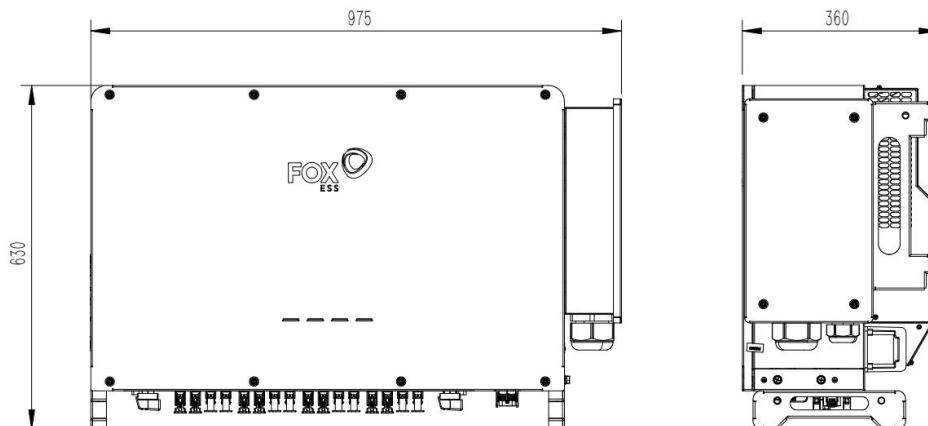
### 3.2 Basic Features

The series of three-phase high performance inverters cover 75kW to 110kW, wherein R75 and R100 are integrated with 9 MPP trackers, and R110 is integrated with 10 MPP trackers. The conversion efficiency is high, and the product is stable and reliable.

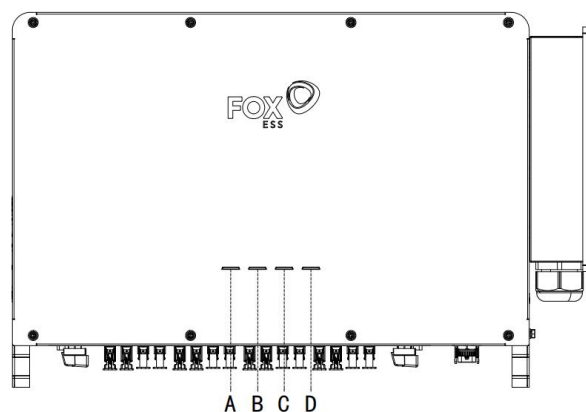
System advantages:

- Integration with PID recovery function
- Optimized MPP tracking technology
- 9 MPP trackers and 10 MPP trackers
- Wide MPPT input range
- Max. Efficiency up to 98.6%, CN efficiency up to 98.2%, EU efficiency up to 98.2%, THD<3%
- IP66 protection level
- Side wiring without opening the cover
- LED status indications
- Remote monitoring via PC or APR

### 3.3 Size



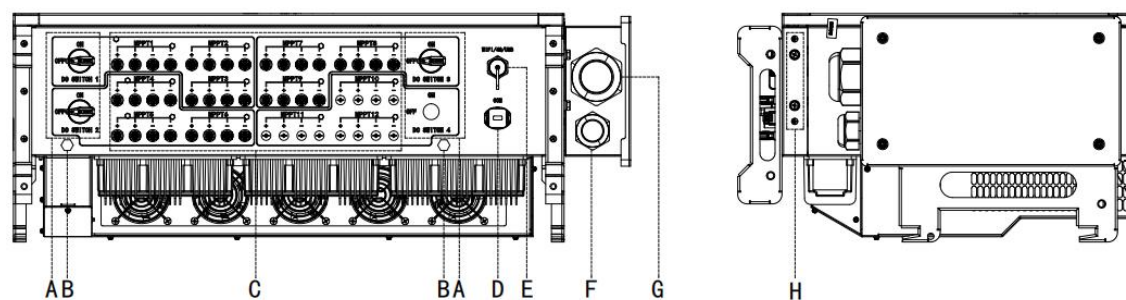
### 3.4 LED Indicator Panel



| No. | Indicator                            | Status                      | Description  |
|-----|--------------------------------------|-----------------------------|--|
| A   | PV connection indicator (Light blue) | Steady On                   | At least one PV string is properly connected, and the DC input voltage of the corresponding MPPT circuit is at least 200 V. The solar inverter is in grid-tied mode.     |
|     |                                      | Blinking (1s on and 1s off) | At least one PV string is properly connected, and the DC input voltage of the corresponding MPPT circuit is at least 200 V. The solar inverter is not in grid-tied mode. |
|     |                                      | Off                         | The solar inverter disconnects from all PV strings, or the DC input voltage of all MPPT circuits is less than 200V. The solar inverter is not in grid-tied mode.         |
| B   | Grid indicator (Light blue)          | Steady On                   | Grid voltage is in normal range. The solar inverter is in grid-tied mode.  |
|     |                                      | Blinking (1s on and 1s off) | Grid voltage is in normal range. The solar inverter is not in grid-tied mode.  |
|     |                                      | Off                         | Grid voltage is not in normal range. The solar inverter is not in grid-tied mode.  |
| C   | PID Recovery indicator (Light blue)  | On                          | PID recovery is on.  |
|     |                                      | Blinking (1s on and 1s off) | An alarm of PID recovery is generated.   |
|     |                                      | Off                         | PID recovery is off.   |
| D   | Alarm indicator (Red)                | On                          | An alarm is generated.   |
|     |                                      | Off                         | No alarm.  |



### 3.5 Terminals of Inverter



| Item | Name                      | Description   |
|------|---------------------------|---|
| A    | DC Switch                 | It is used for controlling DC input.  |
| B    | Waterproof Vent Valve     | It is undetachable and usable for making the case waterproof and air-permeable.   |
| C    | DC Input Terminal         | R75 and R100 have 18 pairs of PV connectors; R110 has 20 pairs of PV connectors.  |
| D    | Communication Terminal    | It is used for RS485 communication and DI/DO wiring.  |
| E    | Communication Terminal    | It matches with the communication module.   |
| F    | M40 Cable Gland           | Cable diameter range is 14-32mm. If the PE cable is connected separately, pass through the spare waterproof cable head.           |
| G    | M75 Cable Gland           | Cable diameter range is 38-56mm. It is used for AC output wiring.   |
| H    | Secondary Ground Terminal | There are two secondary ground terminals for reliable grounding of the inverter, at least one of which is selected for grounding. |

## 4. Technical Parameters

### 4.1 DC Input/AC Output

| MODEL  | R75                        | R100                       | R110                       |
|--|----------------------------|----------------------------|----------------------------|
| <b>INPUT (DC)</b>                                  |                            |                            |                            |
| Max. Input Voltage                                 | 1100V                      | 1100V                      | 1100V                      |
| Start-up Input Voltage                             | 250V                       | 250V                       | 250V                       |
| Rated Input Voltage                                | 600V                       | 600V                       | 600V                       |
| MPPT Operating Voltage Range (Full Load)           | 550V-850V                  | 550V-850V                  | 550V-850V                  |
| MPPT Operating Voltage Range                       | 200-1000V                  | 200-1000V                  | 200-1000V                  |
| No. of Independent MPPT/No. of PV Strings per MPPT | 9/2                        | 9/2                        | 10/2                       |
| Max. Input Current of Each MPPT                    | 26A                        | 26A                        | 26A                        |
| Max. Short-circuit Current of Each MPPT            | 40A                        | 40A                        | 40A                        |
| <b>OUTPUT (AC)</b>                                 |                            |                            |                            |
| Rated Output Power                                 | 75kW                       | 100kW                      | 110kW                      |
| Max. Apparent AC Power                             | 75*/82.5kVA                | 110kVA                     | 121kVA                     |
| Max. Output Current                                | 113.7A*/119.6A             | 166.7A                     | 175.3A                     |
| Rated Grid Voltage                                 | 380/400V,<br>3W+N+PE       | 380/400V,<br>3W+N+PE       | 400V, 3W+N+PE              |
| Grid Voltage Range                                 | 320-460VAC                 | 320-460VAC                 | 320-460VAC                 |
| Grid Frequency Range                               | 45-55Hz/55-65Hz            | 45-55Hz/55-65Hz            | 45-55Hz/55-65Hz            |
| Adjustable Power Factor                            | 0.8 leading~0.8<br>lagging | 0.8 leading~0.8<br>lagging | 0.8 leading~0.8<br>lagging |
| THDi   | <3%                        | <3%                        | <3%                        |

Note: \* Only for Brazil market.

### 4.2 Efficiency, Protection, and Safety

| MODEL                          | R75 | R100     | R110 |
|--------------------------------|-----|----------|------|
| <b>EFFICIENCY</b>              |     |          |      |
| Max. Efficiency                |     | 98.6%    |      |
| Euro. Efficiency               |     | 98.2%    |      |
| <b>PROTECTION</b>              |     |          |      |
| DC Switch                      |     | Yes      |      |
| DC Reverse Polarity Protection |     | Yes      |      |
| AC Overcurrent Protection      |     | Yes      |      |
| AC Short-circuit Protection    |     | Yes      |      |
| DC Surge Protection            |     | Class II |      |
| AC Surge Protection            |     | Class II |      |
| PID Recovery                   |     | Yes      |      |
| Insulation Monitoring          |     | Yes      |      |

|                                |  |
|--------------------------------|--|
| Residual Current Monitoring    | Yes  |
| AFCI                           | Optional   |
| PV String Current Monitoring   | Optional   |
| <b>STANDARD</b>                |  |
| Safety, EMC, and Certification | IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, IEC 61000-6-3, EN 50549 |

### 4.3 General Data

| MODEL                               | R75                       | R100 | R110 |
|-------------------------------------|---------------------------|------|------|
| <b>GENERAL DATA</b>                 |                           |      |      |
| Dimensions (W*H*D)                  | 975*630*360mm             |      |      |
| Weight                              | 90kg                      |      |      |
| Operating Ambient Temperature Range | -30°C ~ 60°C              |      |      |
| Cooling Method                      | Smart air cooling         |      |      |
| Operating Altitude                  | 4000m                     |      |      |
| Relative Humidity Range             | 0 ~ 100% (non-condensing) |      |      |
| Ingress Protection Rating           | IP66 (for outdoor use)    |      |      |
| Isolation Method                    | Transformerless           |      |      |
| Display                             | LED, Wi-Fi+APP            |      |      |
| Communication                       | RS485/USB/Wi-Fi+LAN/4G    |      |      |
| DC Connection Type                  | MC4                       |      |      |
| AC Connection Type                  | OT terminal               |      |      |

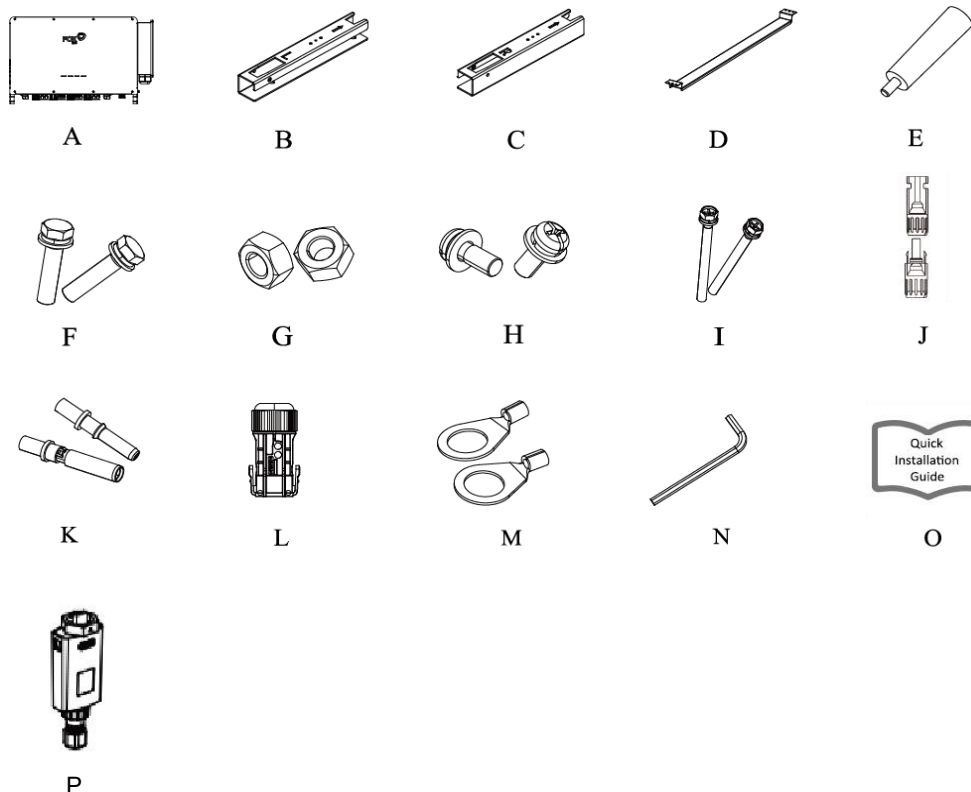
## 5. Installation

### 5.1 Check for Physical Damage

Make sure the inverter has not been damaged during transportation. If there is any visible damage, such as cracks, please contact your dealer immediately.

### 5.2 Packing List

Open the package and take out the product, please check the accessories first. The packing list is as shown as below:



| Object | Quantity | Description                  | Object | Quantity | Description                              |
|--------|----------|------------------------------|--------|----------|--|
| A      | 1        | Inverter                     | I      | 4        | M4*10 Screw                              |
| B      | 1        | Left Hanging Plate           | J      | 36       | DC Connector (Positive*18, Negative*18)* |
| C      | 1        | Right Hanging Plate          | K      | 36       | DC Pin Plug (Positive*18, Negative*18)*  |
| D      | 1        | Hanging Plate Connection Bar | L      | 1        | Communication Connector                  |
| E      | 4        | Screw-in Type Handle         | M      | 2        | Ground Terminal                          |
| F      | 4        | M10*45 Bolt Assembly         | N      | 1        | 5mm Internal Hexagon Wrench              |
| G      | 4        | M10 Hexagon Nut              | O      | 1        | Quick Installation Guide                 |
| H      | 2        | M6*50 Bolt Assembly          | P      | 1        | Smart WiLANII                            |

Note: \* R75 and R100 inverters are provided with DC Connector (Positive\*18, Negative\*18) and DC Pin Plug (Positive\*18, Negative\*18); R110 inverter is provided with DC Connector

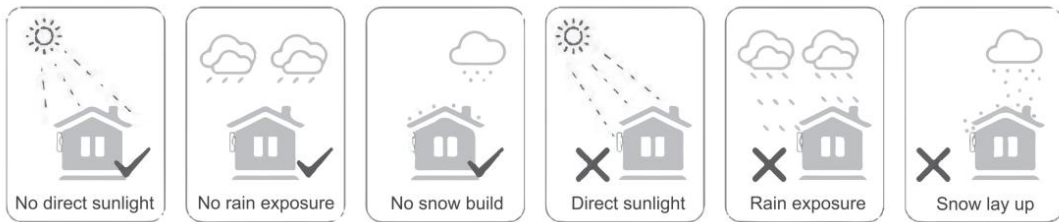
(Positive\*20, Negative\*20) and DC Pin Plug (Positive\*20, Negative\*20).

### 5.3 Mounting

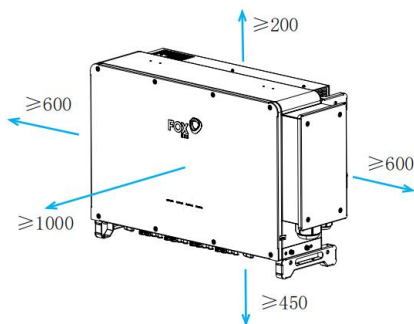
- Installation Precaution

Make sure the installation location complies with the following conditions:

- Not in direct sunlight.
- Not in areas where highly flammable materials are stored.
- Not in potential explosive areas.
- Not in the cool air directly.
- Not near the television antenna or antenna cable.
- Not higher than altitude of about 4000m above sea level.
- Not in environment of precipitation or humidity (>100%).
- Under good ventilation condition.
- The ambient temperature in the range of -30°C to +60°C.
- The slope of the wall should be within  $\pm 5^\circ$ .
- The wall hanging the hybrid inverter should meet conditions below:
  1. Solid brick/concrete, or strength equivalent mounting surface;
  2. Hybrid inverter must be supported or strengthened if the wall's strength isn't enough (such as wooden wall, the wall covered by thick layer of decoration).
- Avoid direct sunlight, rain exposure, snow laying up during installation and operation.



- Space Requirement



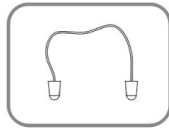
| Position | Min Size |
|----------|----------|
| Left     | 600 mm   |
| Right    | 600 mm   |
| Top      | 200 mm   |
| Bottom   | 450 mm   |
| Front    | 1000 mm  |

- Installation Steps

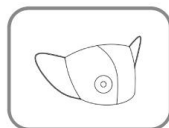
Tools required for installation include, but not limited to, the following recommended tools. If necessary, use other auxiliary tools on the spot.



Safety Goggles



Soundproof Earplugs



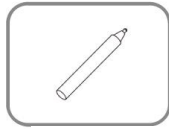
Dust Mask



Insulating Gloves



Insulating Work Shoes



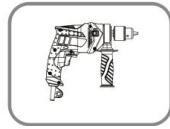
Marker



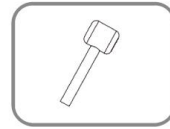
Antistatic Wrist Strap



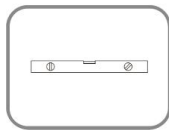
Knife



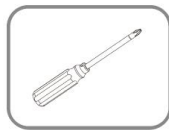
Percussion Drill (φ12)



Rubber Hammer



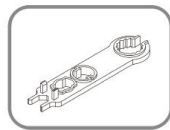
Level



Cross Screwdriver  
M4, M6, M8



Straight Screwdriver  
M2, M3, M6



MC4 Wrench



Wrench  
16mm, 33mm



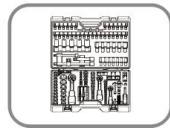
Wire Cutter



Wire Stripper



Hydraulic Clamp



Sleeve Combination  
M4, M8, M12



Heat Gun



Multimeter  
(≥1100V DC)



Electric Drill (φ12)



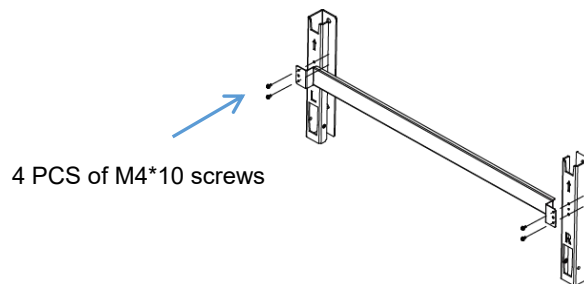
Scissors



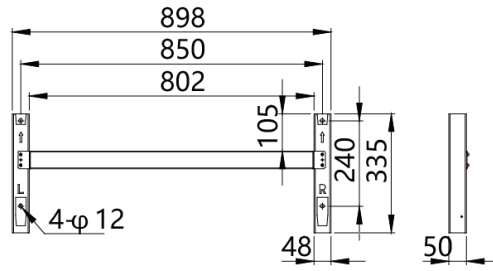
Vacuum Cleaner

### Step 1: Hanging Plate Assembly

Install the Inverter on a bracket or wall by means of the hanging plate. The hanging plate assembly diagram and the size of the assembled hanging plate are shown as below:



Hanging Plate Assembly Diagram

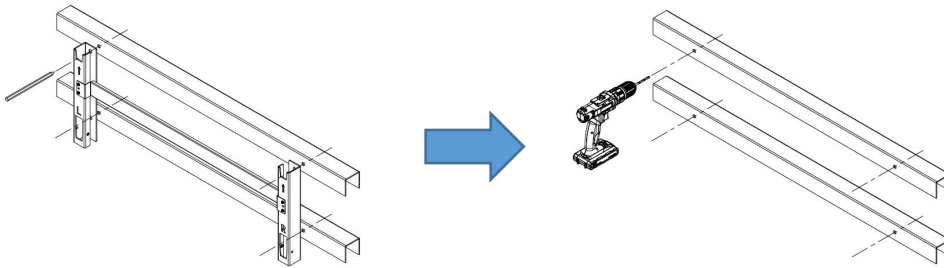


The Size of Hanging Plate

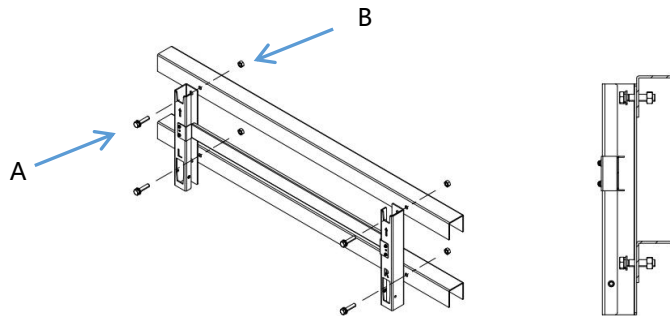
**Step 2: Bracket-mounted Installation or Wall-mounted Installation**

**Mode 1: Bracket-mounted Installation**

1. Place the assembled hanging plate on a PV bracket, adjust the angle with a level, mark drilling positions, and drill holes with an electric drill (with a  $\phi 12$  drill bit).



2. Fix the hanging plate with bolts.

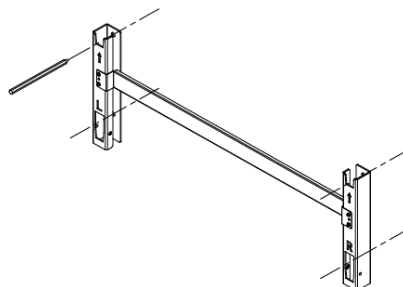


A: 4 PCS of M10\*45 hexagon bolts

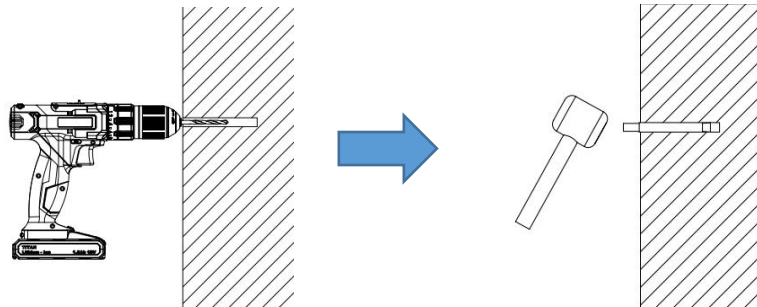
B: 4 PCS of hexagon nuts

**Mode 2: Wall-mounted Installation**

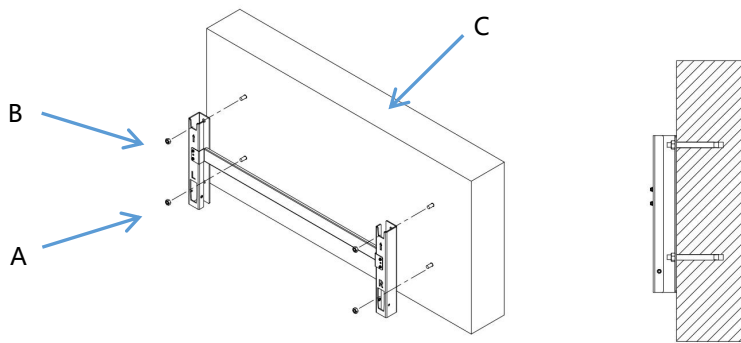
1. Place the assembled hanging plate at the installation site, adjust the angle with a level, and mark drilling positions.



2. Drill holes with a hammer drill (with a  $\phi 12$  drill bit), clear holes, insert 4 PCS of expansion bolts (by client, M10\*95 is recommended) into holes, and fix them with a rubber hammer.



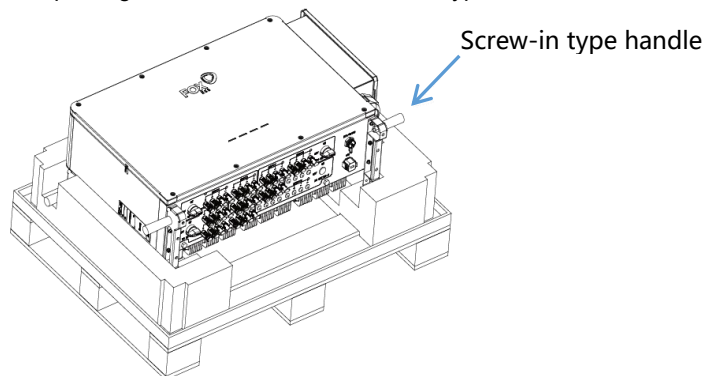
3. Fix the hanging plate with expansion bolts.



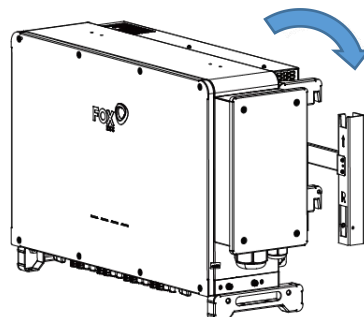
A: 4 PCS of M10 hexagon nuts    B: 4 PCS of expansion bolts (M10)    C: Wall

### Step 3: Inverter Installation

1. Lift the inverter from the package box with 4 PCS of screw-in type handles.

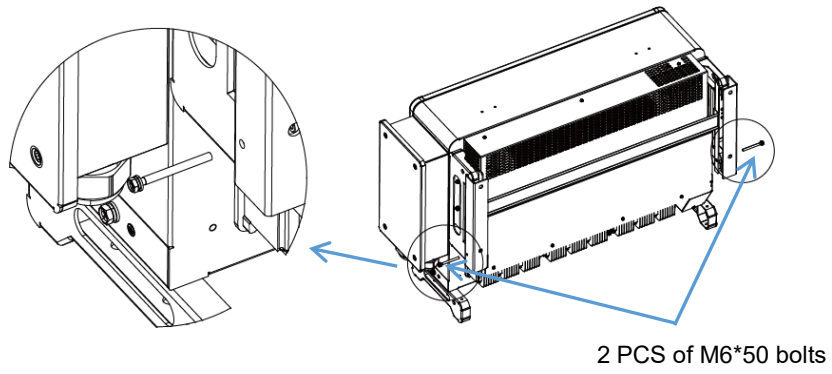


2. Install the inverter on the hanging plate, and ensure that lugs of the inverter are properly matched with slots of the hanging plate.





3. Secure the inverter with bolts.



—End

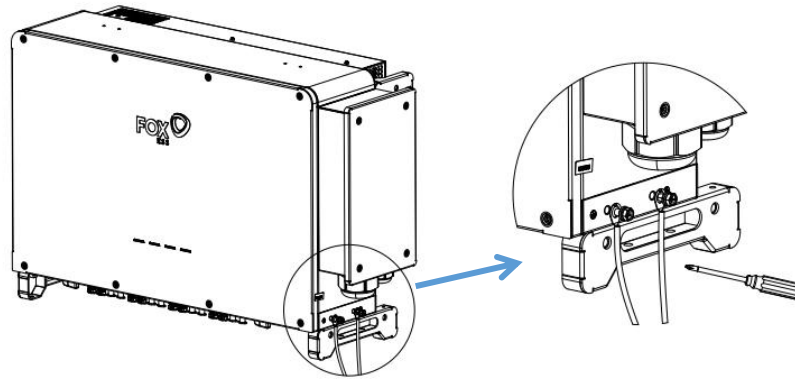
## 6. Electrical Connection

### 6.1 Wiring Steps

#### Step1: Secondary Ground Connection

Lock crimped ground cables to ground holes with screw locks on the inverter case, and paint the ground screws and ground terminals to improve anti-corrosion characteristics.

The conductor sectional area of each ground cable is 0.5~10 mm<sup>2</sup> (4~6 mm<sup>2</sup> is recommended).

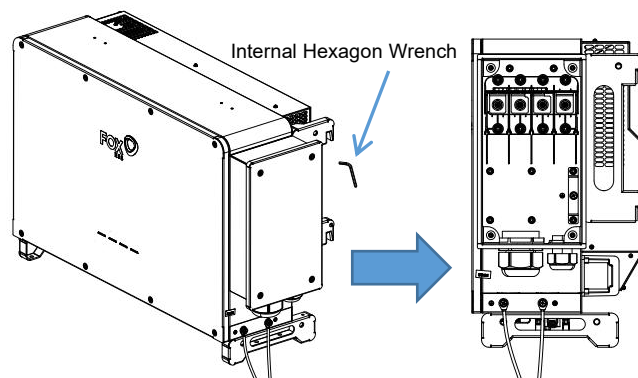


#### Step 2: AC Side Wiring

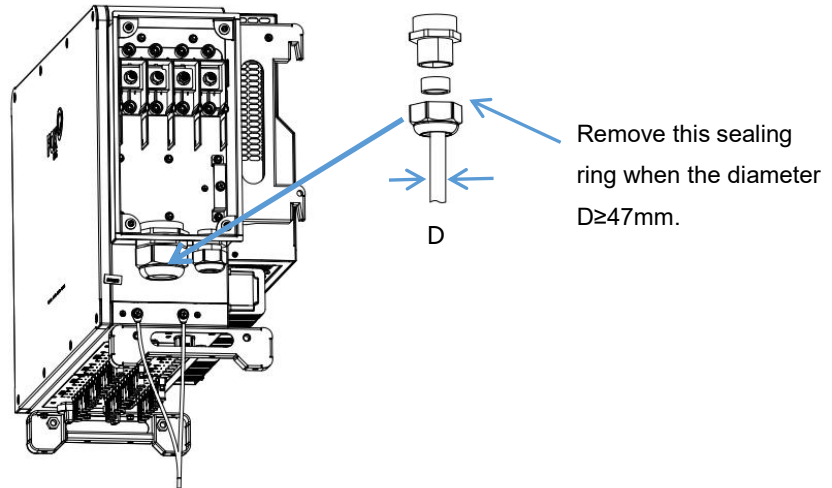
- Check the grid voltage and compare with the permitted voltage range (refer to technical data).
- Disconnect the circuit-breaker of all the phases and secure against re-connection.
- Trim the cables.

| Cable Type | Outer Diameter (mm) | Conductor Sectional Area (mm <sup>2</sup> )                                     |
|------------|---------------------|---|
| AC Cable   | 38~56               | L1,L2,L3, (N) Cables: 70~240; PE: S/2 (S is a sectional area of AC phase cable) |

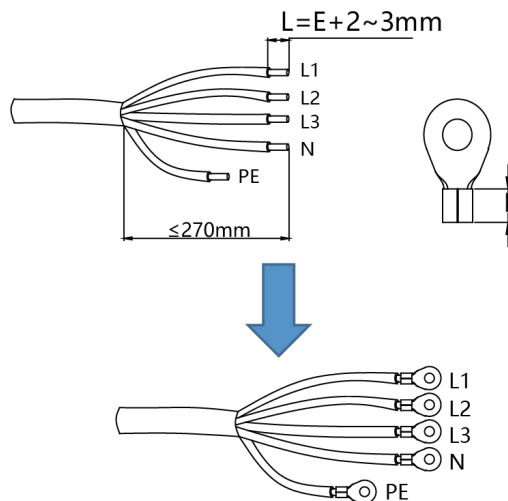
- Open the AC side wiring box with a 5mm internal hexagon wrench. Open the breaker and prevent its accidental reclose.



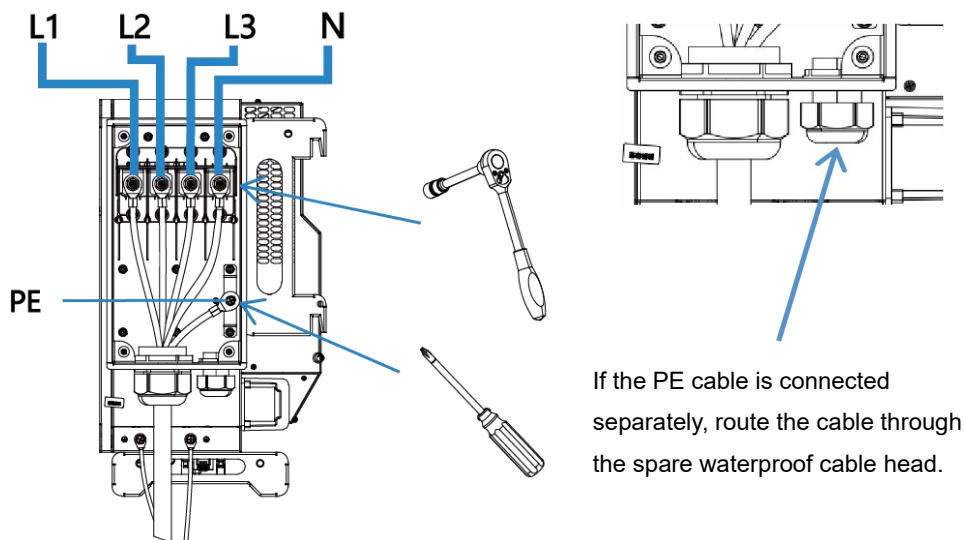
- Unscrew the lock nut of the waterproof connector and take out multilayer sealing rings. Select the sealing ring based on the cable outer diameter. Route the cable through the lock nut and sealing ring.



- Peel off the protective layer and insulation layer of a certain length and crimp the cold-pressed terminals as shown below:







- Secure cables to the corresponding terminals with a hexagon socket wrench and a cross screwdriver, and tighten the waterproof cable heads.



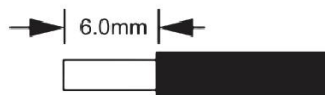
**Step 3: DC Side Connection**

This series inverters can be connected with at most 20 strings of PV modules depending on the inverter type. Please select suitable PV modules with high reliability and quality. Open circuit voltage of the module array connected should be less than 1100V, and operating voltage should be within the MPPT voltage range.

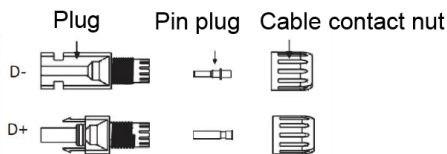
|  |  |
|--|--|
|   | <p><b>Note!</b></p> <p>Please choose a suitable external DC switch if the inverter does not have a built-in DC switch.</p>   |
|   | <p><b>Warning!</b></p> <p>PV module voltage is very high and within a dangerous voltage range, please comply with the electric safety rules when connecting.</p>   |
|   | <p><b>Warning!</b></p> <p>Please do not make PV positive or negative to ground!</p>  |
|  | <p><b>Note!</b></p> <p>PV modules - please ensure they are the same type, have the same output and specifications, are aligned identically, and are tilted to the same angle. In order to save cable and reduce DC loss, we recommend installing the inverter as near to the PV modules as possible.</p> |

**DC Wiring**

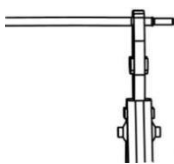
- Turn off the DC switch.
- It is recommended that the DC cable dedicated to photovoltaics (2.5~4 mm<sup>2</sup>) be used to connect the PV module.
- Trim about 6mm of insulation from the cable end.



- Separate the DC connector as below.

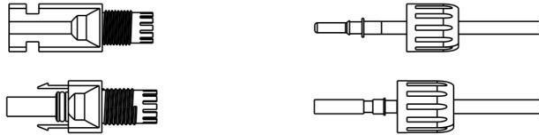


- Insert multiple cables connected to the PV module into the pin plug and ensure all strands are captured in the pin plug.
- Crimp the pin plug with a crimping plier.



- Route the crimped cable through the nut into the plug. When you hear a “click”, the pin plug is

properly clamped in the plug.

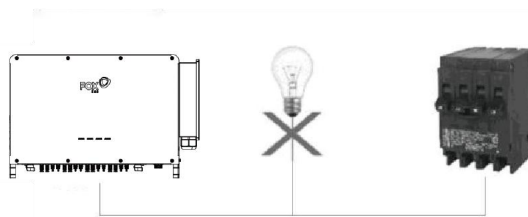


- Unlock the DC connector
- Use the specified wrench tool.
- When separating the DC+ connector, push the tool down from the top.
- When separating the DC- connector, push the tool up from the bottom.
- Separate the connectors by hand.

**Step 4: Grid Connection**

The series of inverters are designed for three-phase grid. Normal operating voltage is 220/230V; frequency is 50/60Hz. Other technical requests should comply with the requirement of the local public grid.

| Model (kW)        | 75                    | 100                   | 110                   |
|-------------------|-----------------------|-----------------------|-----------------------|
| <b>Cable</b>      | 70~240mm <sup>2</sup> | 70~240mm <sup>2</sup> | 70~240mm <sup>2</sup> |
| <b>AC Breaker</b> | 200A                  | 200A                  | 250A                  |



|  |  |
|--|--|
|  | <p><b>WARNING!</b></p> <p>A micro-breaker for max output overcurrent protection device shall be installed between inverter and grid, and the current of the protection device is referred to in the table above, any load <b>SHOULD NOT</b> be connected with the inverter directly.</p> |
|--|--|

**6.2 Communication Device Installation**

This series of inverter is available with multiple communication options such as Smart WiLANII and RS485.

Operating information like output voltage, current, frequency, fault information, etc. can be monitored locally or remotely via these interfaces.

- Smart WiLANII

The inverter has an interface for the Smart WiLANII that allows this device to collect information from inverter, including inverter working status, performance etc., and update that information to monitoring platform.

Connection steps:

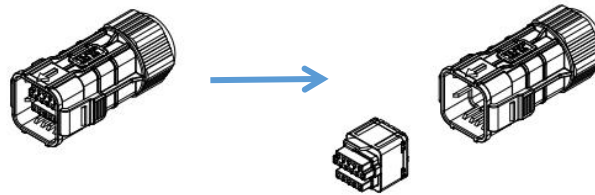
1. Plug the Smart WiLANII into “WiFi/4G/USB” port at the bottom of the inverter.
2. Set up the site account on the Fox ESS monitoring platform (please refer to the monitoring user manual for more details).

- Communication and Monitoring

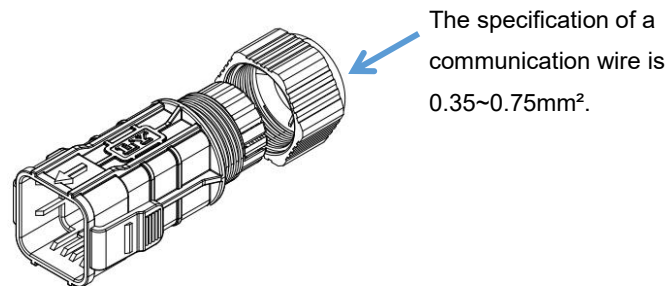
This series of inverters provide an optional 16 Pin communication port.

Installation steps are as below:

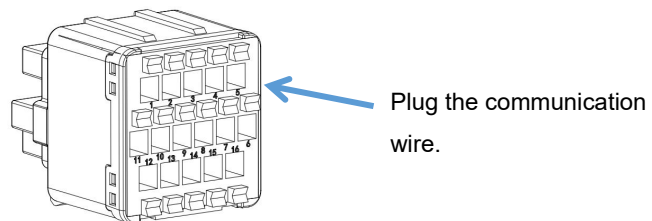
Take out the rubber core:



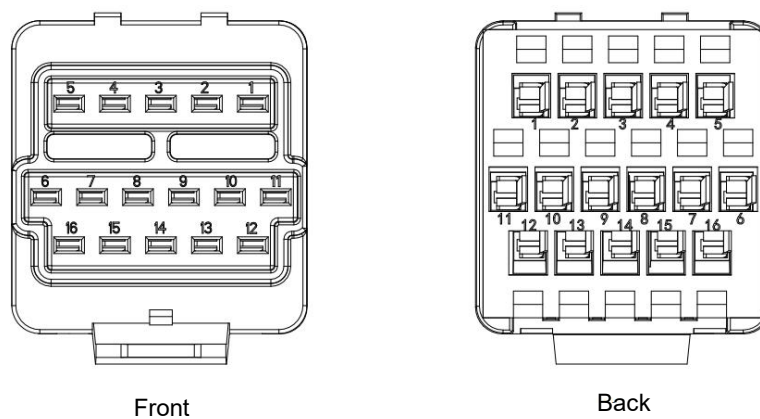
Screw out the sealing cap and route a communication wire through a tail portion of the terminal:



Plug the communication wire into the rubber core:



The wire sequence of the rubber core is shown as below:



| PIN | Name    | Function                 |
|-----|---------|--------------------------|
| 1   | ISO_GND | Signal earth             |
| 2   | RS485A1 | RS485 communication port |
| 3   | RS485B2 |                          |

|      |           |                                   |
|------|-----------|-----------------------------------|
| 4    | RS485A2   | Reserved RS485 communication port |
| 5    | RS485B2   |                                   |
| 6    | Meter485A | Meter communication port          |
| 7    | Meter485B |                                   |
| 8-16 | Undefined | N/A                               |

### 6.3 Inverter Start-Up

Please refer to the following steps to start-up the inverter:


- a) Check if device is fixed well on the wall;
- b) Make sure all DC breakers and AC breakers are disconnected;
- c) Ensure AC cable is connected to the grid correctly;
- d) All PV panels are connected to inverter correctly; DC connectors that are not used should be sealed by cover;
- e) Connect the external DC breakers and AC breakers; and
- f) Turn the DC switch to the "ON" position.

If the LED is not blue, please check the below:

- All the connections are correct.
- All the external disconnect switches are closed.
- The DC switch of the inverter is in the "ON" position.

Note:

- When starting the inverter for the first time, the country code will be set by default to the local settings. Please check if the country code is correct.
- Set the time on the inverter using the APP.

|   |  |
|---|--|
|  | <p><b>Warning!</b></p> <p>Power to the unit must be turned on only after installation work has been completed. All electrical connections must be carried out by qualified personnel in accordance with legislation in force in the country of installation.</p> |
|---|--|

### 6.4 Inverter Switch Off

Please follow the below steps to switch off the inverter:

- Switch off the inverter AC isolation switch.
- Switch off the DC isolation switch and allow 15 minutes for the inverter to power down completely.

## 7. Maintenance

This section contains information and procedures for solving possible problems with the Fox ESS hybrid inverters and provides you with troubleshooting tips to identify and solve most problems that can occur.

### 7.1 Alarm List

| Item | Fault Code | Statement                      | Solution   |
|------|------------|--------------------------------|--|
| 1    | 1030       | AC Overcurrent                 | The inverter will reconnect to the grid after the grid is restored.<br>If the fault recurs, please contact Fox ESS Customer Service for further assistance.  |
| 2    | 1034       | DC Component Current Fault     | Wait for the inverter to return to normal.<br>If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 3    | 1035       | Leakage Overcurrent Fault      | The fault is caused by excessive parasitic capacitance due to poor light or moist air. After the environment improves, the inverter will reconnect to the grid.<br>If the environment is normal, check whether the insulation of the AC and DC cables is good.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 4    | 1036       | Leakage Current Static Fault   |  |
| 5    | 1040       | Grid Voltage Imbalance         | The inverter will reconnect to the grid after the grid is restored.<br>If the fault recurs:<br>1. Check whether the protection parameter settings meet the requirements through the APP.<br>2. Measure the actual grid voltage, confirm that the grid voltage and frequency of each phase do not meet the grid-tied requirements, and contact the local power company for solutions.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance. |
| 6    | 1042       | Grid High Freq                 |  |
| 7    | 1043       | Grid Low Freq                  |  |
| 8    | 1044       | Grid Phase Volt Over-limit     |  |
| 9    | 1045       | Grid Line Volt Over-limit      |  |
| 10   | 1046       | Inverting Current Imbalance    |  |
| 11   | 1049       | Capture PLL Abnormality        |  |
| 12   | 1050       | Inverting Hardware Overcurrent | The inverter will reconnect to the grid after the grid is restored.<br>If the fault recurs, please contact Fox ESS Customer Service for further assistance.  |



| Item | Fault Code | Statement                     | Solution  |
|------|------------|-------------------------------|---|
| 13   | 1051       | Grid Phase Lost Fault         | The inverter will reconnect to the grid after the grid is restored.<br>If the fault recurs:<br>1. Measure the actual grid voltage.<br>2. Check that the grid voltage and frequency of each phase do not meet the grid-tied requirements, and contact the local power company for solutions.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance. |
| 14   | 1057       | Bus Transient Over Volt       | Wait for the inverter to return to normal.  |
| 15   | 1065       | Hardware Overcurrent          | If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 16   | 1066       | DC Input MPPT1 Reverse Fault  | Check whether the positive and negative polarities of the strings corresponding to the fault are reversed.<br>If the polarities are reversed, adjust the string polarities when the string current is low.  |
| 17   | 1067       | DC Input MPPT2 Reverse Fault  | If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 18   | 1070       | BUS Volt Imbalance High Fault | Wait for the inverter to return to normal.  |
| 19   | 1071       | BUS Hardware Over Volt        | If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 20   | 1072       | MPPT Access Fault             | Wait for the inverter to return to normal.<br>If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 21   | 1081       | DC Input MPPT3 Reverse Fault  | Check whether the positive and negative polarities of the strings corresponding to the fault are reversed.<br>If the polarities are reversed, adjust the string polarities when the string current is low.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 22   | 1090       | Hardware Power Module Fault   | Wait for the inverter to return to normal.  |
| 23   | 1096       | Auxiliary Chip Fault          | If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC   |

| Item | Fault Code | Statement                                 | Solution   |
|------|------------|---|--|
| 24   | 1097       | 12V Auxiliary Power Supply Fault          | and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 25   | 1098       | 5V Auxiliary Power Supply Fault           |  |
| 26   | 1099       | Over Temp Protection                      | Check if the inverter is exposed to direct sunlight, please shade the inverter properly.<br>Check and clean the air outlet.<br>Check whether there is a fan alarm through the APP (refer to the solution to the fan alarm).<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 27   | 1102       | Inverting Current DC Component Bias Fault | Wait for the inverter to return to normal.<br>If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 28   | 1103       | Inverting Current Bias Fault              |  |
| 29   | 1106       | Inverting Soft Start Time-out Fault       |  |
| 30   | 1107       | BUS Soft Start Fault                      |  |
| 31   | 1108       | Freq Detection Value Abnormality          | The inverter will reconnect to the grid after the grid is restored.<br>If the fault recurs:<br>1. Check whether the protection parameter settings meet the requirements through the APP.<br>2. Measure the actual grid voltage, confirm that the grid voltage and frequency of each phase do not meet the grid-tied requirements, and contact the local power company for solutions.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance. |
| 32   | 1109       | Leakage CT Self-test Fault                | Wait for the inverter to return to normal.<br>If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 33   | 1110       | CPLD Clock Abnormality                    |  |
| 34   | 1111       | CPLD Program Version Abnormality          |  |
| 35   | 1112       | Internal Control Diagnose Fault           |  |
| 36   | 1116       | Ground Impedance Fault                    | Check if the ground cables are connected properly.<br>Check if the insulation between the ground cable and the live cable is good.<br>If the fault still exists, please contact Fox ESS  |

| Item | Fault Code | Statement                                     | Solution   |
|------|------------|---|--|
|      |            |   | Customer Service for further assistance.   |
| 37   | 1123       | Grid Relay Fault                              | Wait for the inverter to return to normal.<br>If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 38   | 1124       | Insulation Resistance Low Fault               | Wait for the inverter to return to normal.<br>If the fault recurs:<br>1. Check whether the ISO impedance protection value meets the local regulations through the APP.<br>2. Check whether the DC cable and ground contact are good.<br>3. If the cable is normal and the fault occurs on a cloudy or rainy day, check again when the weather gets better.                                 |
| 39   | 1129       | Inverting Open-loop Self-test Fault           | Wait for the inverter to return to normal.<br>If the fault recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.   |
| 40   | 1145       | Arc Fault                                     | 1. Disconnect the DC input, check whether there are damaged cables, loose terminals or fuses, and burn marks on components on the DC side.<br>2. Reconnect the DC input and clear the arc fault through the APP to make the inverter return to normal.<br>3. If the above reasons are excluded and the alarm still exists, please contact Fox ESS Customer Service for further assistance. |
| 41   | 1154       | INV Overcurrent Permanent Fault               | Turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the fault still exists, please contact Fox ESS Customer Service for further assistance.  |
| 42   | 1157       | Relay Permanent Fault                         |  |
| 43   | 1160       | Inverting Open-loop Self-test Permanent Fault |  |
| 44   | 1172       | Auxiliary Power Supply Permanent Fault        |  |
| 45   | 1173       | Internal Control Diagnosis Permanent          |  |

| Item | Fault Code | Statement                                | Solution  |
|------|------------|--|---|
|      |            | Fault                                    |   |
| 46   | 1174       | BUS Hardware Over Volt Permanent Fault   |   |
| 47   | 1175       | CPLD Clock Permanent Fault               |   |
| 48   | 1176       | BST Hardware Overcurrent Permanent Fault |   |
| 49   | 1177       | Static Leakage Current Permanent Fault   |   |
| 50   | 1178       | BUS Over Volt Permanent Fault            |   |
| 51   | 1179       | BUS Volt Imbalance High Permanent Fault  |   |
| 52   | 1188       | AC SPD Abnormality                       | Check the status of the SPD, and contact Fox ESS Customer Service for further assistance.   |
| 53   | 1189       | DC SPD Abnormality                       |   |
| 54   | 1190       | Temp Sensor Alarm                        | If the ambient temperature is within the inverter operating temperature range and the alarm still exists, please contact Fox ESS Customer Service for further assistance.   |
| 55   | 1191       | External Fan Alarm                       | Check whether the fan is blocked by foreign objects and remove the foreign objects. Please contact Fox ESS Customer Service for further assistance.   |
| 56   | 1192       | Internal Fan Alarm                       |   |
| 57   | 1193       | EEPROM Read-write Alarm                  | The internal communication is abnormal. If desired, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter.<br>If the alarm still exists, please contact Fox ESS Customer Service for further assistance.   |
| 58   | 1194       | PID Insulation Resistance Low Alarm      | Check whether the insulation resistance of PV modules to ground is abnormal. If there is no abnormality, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter. If the alarm still exists, please contact Fox ESS Customer Service for further assistance. |
| 59   | 1195       | PID Output Over Volt Alarm               | Wait for the inverter to return to normal. If the alarm recurs, turn off the AC and DC side switches, wait for 10 minutes, and then turn on the AC and DC switches in turn to restart the inverter. If the alarm still exists,  |
| 60   | 1196       | PID Power Supply Overcurrent Alarm       |   |

| Item | Fault Code | Statement                       | Solution  |
|------|------------|---------------------------------|---|
| 61   | 1197       | PID Function Abnormality Alarm  | please contact Fox ESS Customer Service for further assistance.   |
| 62   | 1313       | DC Input MPPT1 Volt High Fault  | Wait for the inverter to return to normal. If the fault still exists, please contact Fox ESS Customer Service for further assistance. |
| 63   | 1314       | DC Input MPPT2 Volt High Fault  |   |
| 64   | 1315       | DC Input MPPT3 Volt High Fault  |   |
| 65   | 1316       | DC Input MPPT4 Volt High Fault  |   |
| 66   | 1317       | DC Input MPPT5 Volt High Fault  |   |
| 67   | 1318       | DC Input MPPT6 Volt High Fault  |   |
| 68   | 1319       | DC Input MPPT7 Volt High Fault  |   |
| 69   | 1320       | DC Input MPPT8 Volt High Fault  |   |
| 70   | 1321       | DC Input MPPT9 Volt High Fault  |   |
| 71   | 1322       | DC Input MPPT10 Volt High Fault |   |
| 72   | 1323       | DC Input MPPT11 Volt High Fault |   |
| 73   | 1324       | DC Input MPPT12 Volt High Fault |   |
| 74   | 1325       | DC Input MPPT4 Reverse Fault    |   |
| 75   | 1326       | DC Input MPPT5 Reverse Fault    |   |
| 76   | 1327       | DC Input MPPT6 Reverse Fault    |   |
| 77   | 1328       | DC Input MPPT7 Reverse Fault    |   |
| 78   | 1329       | DC Input MPPT8 Reverse Fault    |   |
| 79   | 1330       | DC Input MPPT9 Reverse Fault    |   |
| 80   | 1331       | DC Input MPPT10 Reverse Fault   |   |
| 81   | 1332       | DC Input MPPT11 Reverse Fault   |   |

| Item | Fault Code | Statement                     | Solution  |
|------|------------|-------------------------------|---|
| 82   | 1333       | DC Input MPPT12 Reverse Fault |   |
| 83   | 1345       | String1 Warning               | 1. Confirm whether the Xth MPPT is connected reliably. If no connection is required, ignore this alarm message.<br>2. Check whether the Xth MPPT DC fuse is damaged and replace the fuse in time.<br>3. If the above reasons are excluded and the fault still exists, please contact Fox ESS Customer Service for further assistance. |
| 84   | 1346       | String2 Warning               |   |
| 85   | 1347       | String3 Warning               |   |
| 86   | 1348       | String4 Warning               |   |
| 87   | 1349       | String5 Warning               |   |
| 88   | 1350       | String6 Warning               |   |
| 89   | 1351       | String7 Warning               |   |
| 90   | 1352       | String8 Warning               |   |
| 91   | 1353       | String9 Warning               |   |
| 92   | 1354       | String10 Warning              |   |
| 93   | 1355       | String11 Warning              |   |
| 94   | 1356       | String12 Warning              |   |
| 95   | 1357       | String13 Warning              |   |
| 96   | 1358       | String14 Warning              |   |
| 97   | 1359       | String15 Warning              |   |
| 98   | 1360       | String16 Warning              |   |
| 99   | 1361       | String17 Warning              |   |
| 100  | 1362       | String18 Warning              |   |
| 101  | 1363       | String19 Warning              |   |
| 102  | 1364       | String20 Warning              |   |
| 103  | 1365       | String21 Warning              |   |
| 104  | 1366       | String22 Warning              |   |
| 105  | 1367       | String23 Warning              |   |
| 106  | 1368       | String24 Warning              |   |

## 7.2 Troubleshooting

A. Please check the fault code of the inverter on the APP or website. If a message is displayed, record it before doing anything further.

B. Attempt the solution indicated in table above.

C. If the inverter LEDs are not on, check the following to make sure that the current state of the installation allows for proper operation of the unit:

- (1) Is the inverter located in a clean, dry, adequately ventilated place?
- (2) Have the DC input breakers opened?
- (3) Are the cables adequately sized?
- (4) Are the input and output connections and wiring in good condition?
- (5) Are the configurations settings suitable for your particular installation?
- (6) Are the display panel and the communications cable properly connected and undamaged?

Contact Fox ESS Customer Service for further assistance. Please be prepared to describe details of your system installation and provide the model and serial number of the unit.

### 7.3 Routine Maintenance

#### A. Safety Check

A safety check should be performed at least every 12 months by a qualified technician who has adequate training, knowledge and practical experience to perform these tests. The data should be recorded in an equipment log. If the inverter is not functioning properly or fails any of the tests, the inverter has to be repaired. For safety check details, refer to Chapter 2 of this manual.

#### B. Maintenance Checking List

During the process of using the inverter, the responsible person shall examine and maintain the machine regularly. The required actions are as follows:

| Checking List         | Checking Method   | Maintenance Period  |
|-----------------------|---|---|
| System Cleaning       | Check whether there are dust and other blockades at the air outlet and heat sink.<br>If necessary, clean the air outlet and heat sink.                  | Once half a year to a year<br>(Depending on ambient dust content) |
| Fan                   | Check whether the fan makes abnormal noise when it is running and whether the fan blade is cracked.<br>If necessary, change the fan.                    | Once a year   |
| Cable Inlet Holes     | Check whether the cable inlet hole of the device is partially blocked or the gap is large. If yes, perform supplementary sealing.                       | Once a year   |
| Electrical Connection | Check whether cables are loose.<br>Check whether the cable is damaged, especially whether the part of the cable in contact with the metal shell is cut. | Once half a year to a year  |

Note: Only qualified individuals may perform these actions.

#### C. Fan Maintenance

The inverter's built-in fan cools and dissipates heat during its operation. If the fan does not work properly, the inverter cannot be effectively cooled, which will affect the efficiency of the inverter or cause derating operation. Therefore, it is necessary to keep the fan clean and replace the damaged fan in time.

The steps to clean and replace the fan are as follows:

- Before fan maintenance begins, be sure to power down the inverter and disconnect all

power inputs to the inverter.

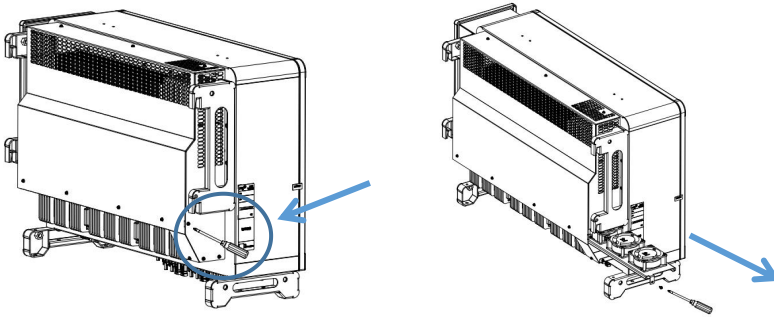
- After the inverter is powered down for 15 minutes, use the detection equipment for check to ensure that there is no voltage and current, and wear protective equipment to operate and maintain the inverter.

- When the inverter is shut down, turn the DC switch to “OFF”, ensuring that the inverter is completely powered off, and wait for at least 15 minutes.

- Loosen the screws on the fan cover of the case.

- Loosen the fan tray retention screws, unplug the connector cable and pull out the fan, use a soft-bristled brush or vacuum cleaner to clean the fan or replace a damaged fan.

- Fan maintenance must be done by professional personnel.





## 8. Decommissioning

### 8.1 Dismantling the Inverter

- Disconnect the inverter from DC Input and AC output. Wait for 15 minutes for the inverter to fully de-energize.
- Disconnect communication and optional connection wirings. Remove the inverter from the bracket.
- Remove the bracket if necessary.

### 8.2 Packaging

If possible, please pack the inverter with the original packaging. If it is no longer available, you can also use an equivalent box that meets the following requirements.

- Suitable for loads more than 90 kg.
- Contains a handle.
- Can be fully closed.

### 8.3 Storage and Transportation

Store the inverter in dry place where ambient temperatures are always between  $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$ . Take care of the inverter during the storage and transportation; keep less than 4 cartons in one stack. When the inverter or other related components need to be disposed, please ensure it is carried out according to local waste handling regulations.

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