

User Manual

Stackable AIO

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

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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:

Stackable AIO-H1-3.7-W-Z Stackable AIO-AC-3.7-W-Z

Stackable AIO-H1-5.0-W-Z Stackable AIO-AC-5.0-W-Z

Stackable AIO-H1-6.0-W-Z Stackable AIO-AC-6.0-W-Z

Stackable AIO-H1-7.0-W-Z Stackable AIO-AC-7.0-W-Z

Stackable AIO-H1-9.0-W-Z Stackable AIO-AC-9.0-W-Z

Stackable AIO-H1-11.0-W-Z Stackable AIO-AC-11.0-W-Z

Note: Please keep this manual where it will be accessible at all times.

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:

	Danger! "Danger" indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	Warning! "Warning" indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	Caution! "Caution" indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	Note! "Note" provides important tips and guidance.

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

	The inverter complies with the requirements of the applicable CE guidelines.
	This mark indicates that this product complies with the requirements of the applicable RoHS guidelines.

	Danger to life due to high voltage. There is residual voltage in the inverter which needs 5 minutes to discharge. Wait 5 minutes before you open the side cover.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Danger of high voltages. Danger to life due to high voltages in the inverter!
	Danger. Risk of electric shock!
	Refer to the operating instructions.
	Product should not be disposed as household waste.

2 Safety

2.1 Appropriate Usage

Stackable AIO is designed and tested in accordance with international safety requirements. However, certain safety precautions must be taken when installing and operating this unit. 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 unit 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 unit 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 or desert 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.
- Liabilities arising from commercial components are delegated to their respective manufacturers.
- Any time the unit 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 unit please ensure surfaces and equipment are under touch safe temperatures and voltage potentials before proceeding.

2.2 PE Connection and Leakage Current

PV System Residual Current Factors

- In every PV installation, several elements contribute to the current leakage to protective earth (PE). These elements can be divided into two main types.
- Capacitive discharge current - Discharge current is generated mainly by the parasitic

capacitance of the PV modules to PE. The module type, the environmental conditions (rain, humidity) and even the distance of the modules from the roof can effect the discharge current. Other factors that may contribute to the parasitic capacitance are the unit's internal capacitance to PE and external protection elements such as lightning protection.

- During operation, the DC bus is connected to the alternating current grid via the unit. Thus, a portion of the alternating voltage amplitude arrives at the DC bus. The fluctuating voltage constantly changes the charge state of the parasitic PV capacitor (i.e. capacitance to PE). This is associated with a displacement current, which is proportional to the capacitance and the applied voltage amplitude.
- Residual current - if there is a fault, such as defective insulation, where an energized cable comes into contact with a grounded person, an additional current flows, known as a residual current.

Residual Current Device (RCD)

- All Fox ESS units incorporate a certified internal RCD (Residual Current Device) to protect against possible electrocution in case of a malfunction of the PV array, cables or unit (DC). The RCD in the Fox ESS unit can detect leakage on the DC side. There are 2 trip thresholds for the RCD as required by the DIN VDE 0126-1-1 standard. 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, and 300mA per unit for lower speed fire safety.

Installation and Selection of an External RCD device

- An external RCD is required in some countries. The installer must check which type of RCD is required by the specific local electric codes. Installation of an RCD must always be conducted in accordance with local codes and standards. Fox ESS recommends the use of a type-A RCD. Unless a lower value is required by the specific local electric codes, Fox ESS suggests an RCD value between 100mA and 300mA.
- In installations where the local electric code requires an RCD with a lower leakage setting, the discharge current might result in nuisance tripping of the external RCD. The following steps are recommended to avoid nuisance tripping of the external RCD:
 1. Selecting the appropriate RCD is important for correct operation of the installation. An RCD with a rating of 30mA may actually trip at a leakage as 15mA (according to IEC 61008). High quality RCDs will typically trip at a value closer to their rating.
 2. Configure the trip current of the unit' internal RCD to a lower value than the trip current of the external RCD. The internal RCD will trip if the current is higher than the allowed current, but because the internal unit RCD automatically resets when the residual currents are low it saves the manual reset.

2.3 Surge Protection Devices (SPDs) for PV Installation

WARNING!

Over-voltage protection with surge arresters should be provided when the PV power system is installed. The storage units are equipped with SPDs on the PV input side as standard, in order to meet the secondary lightning protection requirements.

3 Introduction

3.1 Basic Features

The Stackable AIO is a whole home energy solution for residential users, which can convert solar energy to AC energy and store energy into battery. Users can monitor and operate their storage system remotely via the FoxCloud mobile phone app.

- **System Advantages**

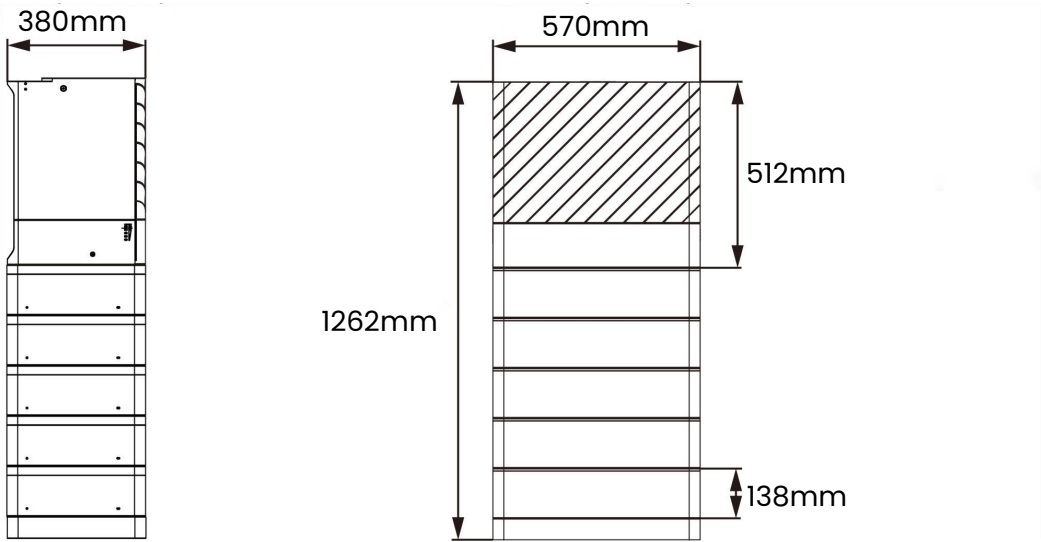
- Easy installation: flexible configuration, plug and play set-up
- High Voltage: compatible with high-voltage batteries for maximum round-trip efficiency.
- IP65 (battery) & IP66 (inverter): engineered to last with maximum flexibility, and suitable for outdoor installation.
- Remote monitoring: monitor your system remotely via smartphone app or web portal.
- High backup power, up to 12.1 kW.
- Fast battery charging, up to 50 A charging and 60 A discharging current.
- GRID Meter inside: a 0.5% accuracy GRID meter is integrated in the Stackable AIO.
- Safety & Reliability: transformerless design with software and hardware protection.
- Arc detection function: capability of detecting up to 35 A arc current. When the PV panel produces arc, the inverter will shut down immediately, disconnect the grid-side relay, turn off the BDC relay, and send instructions to turn off the battery. After the arcing occurs, the Stackable AIO will report the arcing fault immediately and upload it to the cloud.

- **Work Modes**

Work modes	Description
Self-use (with PV Power)	Priority: load>battery>grid The energy produced by the PV system is used to optimize self-consumption. The excess energy is used to charge the batteries, then exported to grid.
Self-use (without PV Power)	When no PV supplied, battery will discharge for local loads firstly, and grid will supply power when the battery capacity is not enough.
Feed in priority	Priority: load>grid>battery In the case of the external generator, the power generated will be used to supply the local loads firstly, then export to the public grid. The redundant power will charge the battery.
EPS mode	When the grid is off, system will supply emergency power from PV or battery to supply the home loads (Battery is necessary in EPS mode).

Note: Charging time is when the battery is charged within the set time range. The setting of charging time can be used in the above three modes.

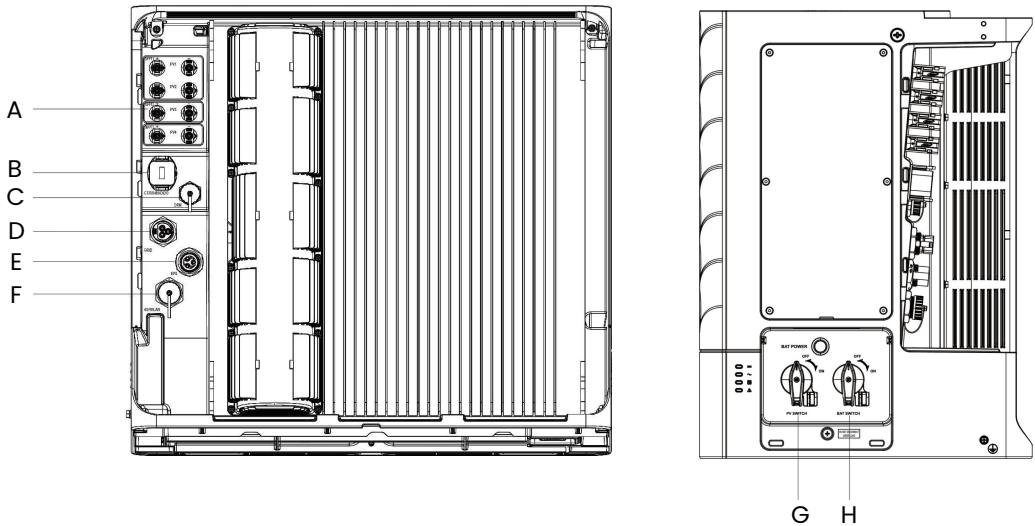
3.2 Dimensions



Note!

Illustrated is an example with 5 battery cells. The PQ inverter is 512mm high, with each battery cell measuring 138mm in height (battery cells from different series slightly differ in height) and the base 60mm high.

3.3 Terminals



Item	Description	Item	Description
A	PV	E	EPS
B	CT/RS485/DIDO/E-STOP	F	4G/WLAN
C	DRM	G	PV Switch
D	GRID	H	BAT Switch

5 Installation

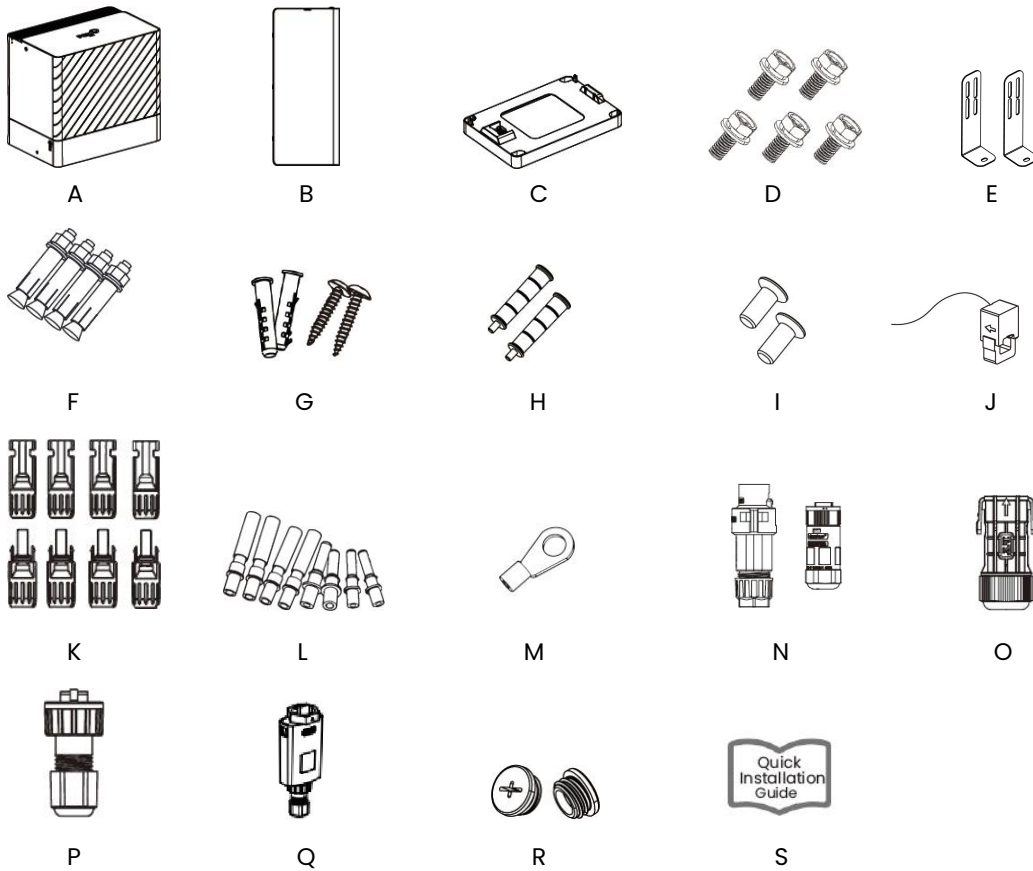
5.1 Check for Physical Damage

Make sure the inverter is intact 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 shown as below.

• PQ Inverter



Object	Quantity	Description	Object	Quantity	Description
A	1	Qube Inverter	K	8	PV Connector (4*positive, 4*negative)
B	1	Side Cover	L	8	Crimp Terminal (4*positive, 4*negative)
C	1	Base	M	1	Earth Terminal
D	5	Set Screw	N	2	AC Connector (1*EPS, 1*Grid)
E	2	Fixing Bracket	O	1	Communication Connector

F	4	Sleeve Expansion Bolt M8*60	P	1	RJ45
G	4	Expansion Tube & Expansion Screw	Q	1	Wlan-WW
H	2	Handle	R	2	Screw Hole Cap
I	2	Flat-head Screw	S	1	Quick Installation Guide
J	1	Current Transformer (100A)			

• Battery



A



B

Object	Quantity	Description	Object	Quantity	Description
A	2-6/7	Battery Cell	B	2	Set Screw

Note: battery cells from different series should not be mixed.

5.3 Installation

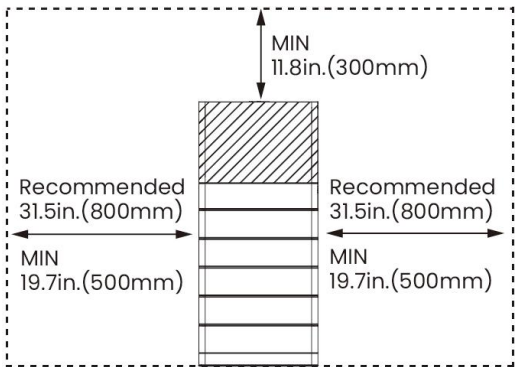
• Precautions

Make sure the installation site meets the following conditions:

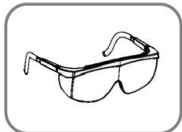
- Not in direct sunlight.
- Not in areas where highly flammable materials are stored.
- Not in potential explosive areas.
- Not in the cool air directly.
- Not near the television antenna or antenna cable.
- Not higher than altitude of about 2000m above sea level.
- Not in environment of precipitation or humidity (> 95%).
- Under good ventilation condition.
- The ambient temperature in the range of 0°C to +55°C.
- The slope of the wall should be within $\pm 5^\circ$.
- The wall installing the inverter should meet conditions below:
 - A. Solid brick/concrete, or strength equivalent mounting surface;
 - B. Stackable AIO 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).

Please avoid direct sunlight, rain exposure, snow laying up during installation and operation.

• **Space Requirement**



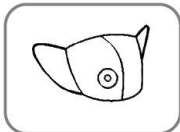
• **Tools**



Safety Goggles



Steel Toe Boots



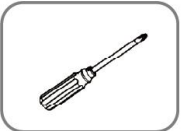
Dust Mask



Helmet



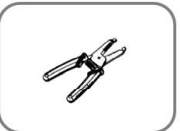
Insulating Gloves



Phillips-Head
Screwdriver



Flat-Head
Screwdriver



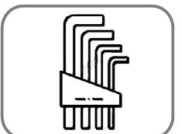
Wire Stripper



Electric Drill



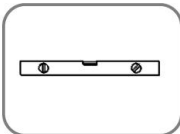
Adjustable
Wrench



Hex Wrench
Set



Hole Punch



Level



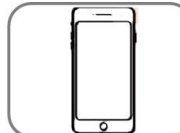
Tape



Sleeve



Multimeter



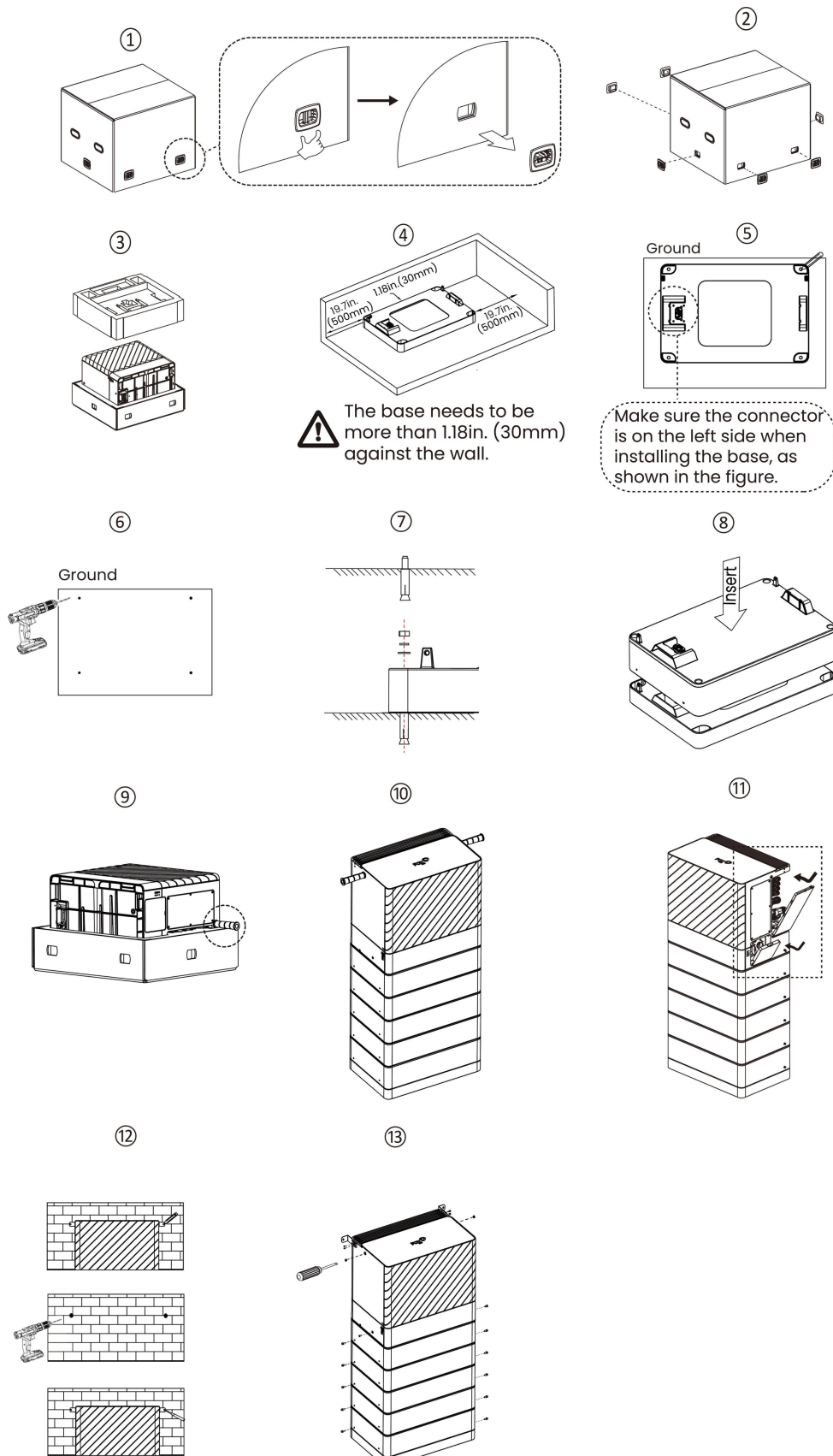
Phone



Crimping Tool

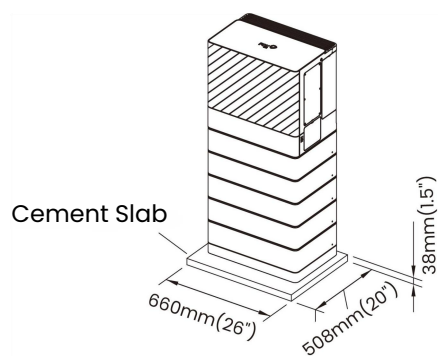
• Installation Steps

Installation on a Solid Ground



Installation on a Solid Ground

- ① Prepare a cement slab with a dimension as shown in the figure below.
- ② Install stackable AIO in the middle of the cement slab to prevent cracking.
- ③ The following steps are the same as those in "Installation on a Solid Ground".



6 Electrical Connection

6.1 PV Connection (For Hybrid Only)

Step 1: PV String Connection

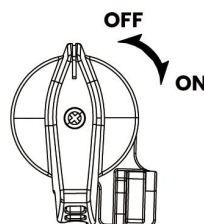
Stackable AIO can be connected with 4 strings of PV modules. Please select suitable PV modules with high reliability and quality. Open circuit voltage of module array connected should be less than 600V, and operating voltage should be within the MPPT voltage range.

	Warning! PV module voltage is very high and within a dangerous voltage range, please comply with the electric safety rules when connecting.
	Warning! Please do not make PV positive or negative to ground!
	Note! 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 Stackable AIO as near to the PV modules as possible.

Step 2: PV Wiring

	Note! (1) If there are ≤ 3 PV strings, connect the PV strings preferentially to the terminals PV1+, PV1-, PV3+, PV3-, PV4+, PV4-. (2) If there are 4 PV strings, the number of PV panels connected to terminals PV1+, PV1- needs to equal the number connected to terminals PV2+, PV2-.
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- (1) Turn off the PV Switch.

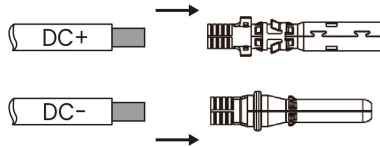


PV SWITCH

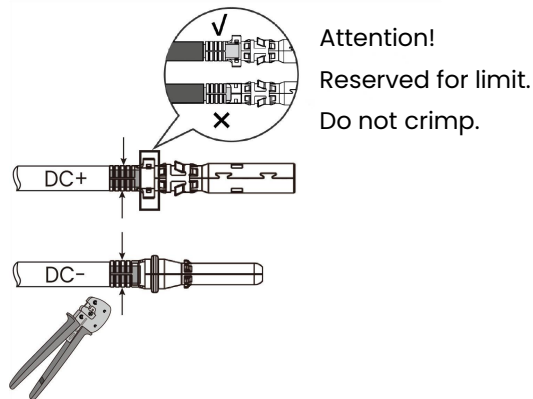
- (2) Trim 6mm of insulation from the end of 12 AWG wires.



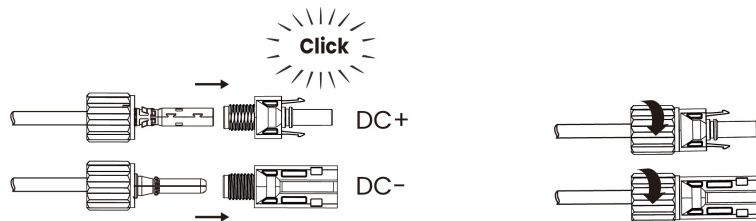
- (3) Insert striped wires into crimp terminals.



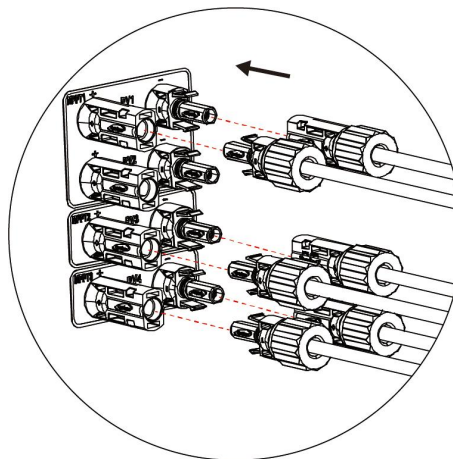
- (4) Crimp the crimp terminals by using a crimping tool. Do not crimp limit lugs.



- (5) Thread the crimped terminals through nuts, insert them into male or female PV connectors, and you will hear a “click”. Rotate the nuts tightly.



- (6) Insert the PV connectors into PV terminals of the Stackable AIO.



Danger!

Make sure that the power cable connected to the inverter is connected vertically and that the vertical length is greater than 30 cm. If the cable is bent close to the terminals, it may cause poor line contact and result in burnt terminals.

6.2 AC Connection

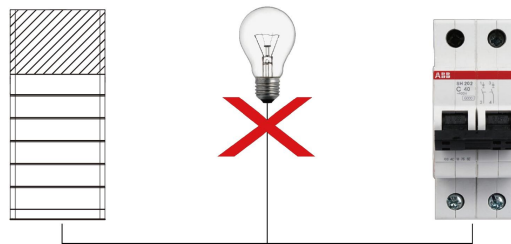
Step 1: AC String Connection

Stackable AIO is designed for single-phase grid. Nominal output voltage is

220/230/240V; frequency is 50/60Hz. Other technical requests should comply with the requirement of the local public grid.

Cable Dimensions

Power (kW)	3.7	5.0	6.0	7.0	9.0	11.0
Cable (GRID)	Conduct Core Section: 10–13mm ²					
Cable (EPS)	Conduct Core Section: 10–13mm ²					
Micro-breaker	80A					



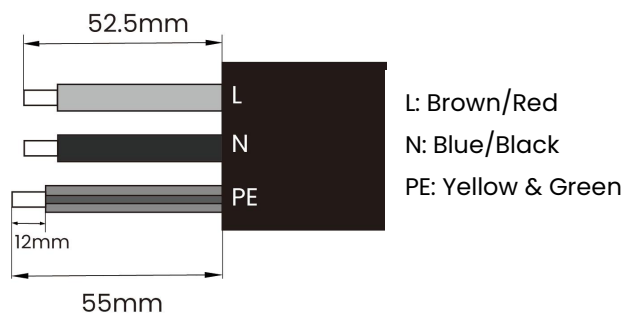
Note!

If you do not use the EPS function or use on-grid power to charge the battery, you can choose 63A micro-breaker.

Step 2: AC Wiring

Preparations

- (1) Check the grid voltage and compare with the permitted voltage range (refer to the technical data).
- (2) Disconnect the circuit breaker from all the phases and secure against re-connection.
- (3) Trim the wires:

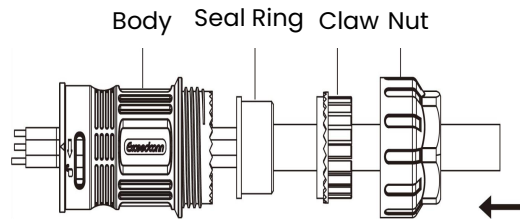


Note!

Please refer to local cable type and color for actual insulation.

A. EPS Wiring (performed prior to Grid Wiring)

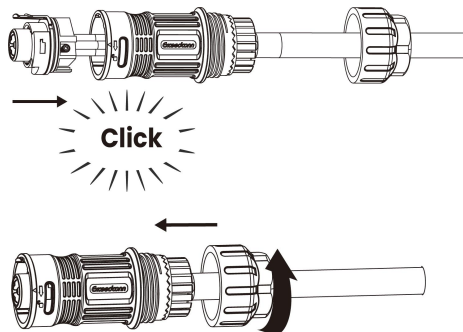
- (1) Separate the EPS connector, and thread the cable through the EPS connector.



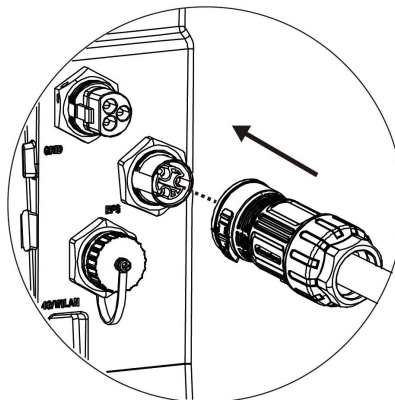
- (2) Insert cables into the housing assembly, and tighten them with a hex wrench.



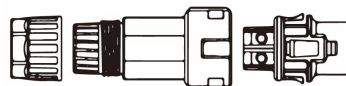
- (3) Insert the housing assembly into the body, you will hear "Click", and tighten the nut.



- (4) Plug the EPS connector into the EPS port of the AIO.

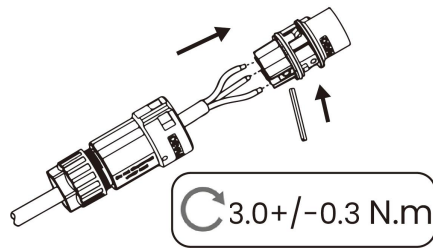
**B. Grid Wiring**

- (1) Separate the AC connector into three parts as below.

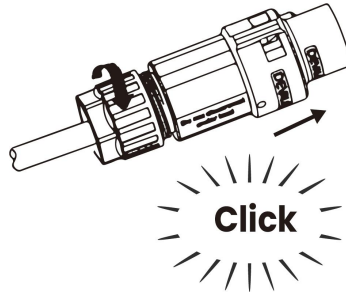


- (2) Thread the cable through the nut and body, insert it into the plug, and tighten it with

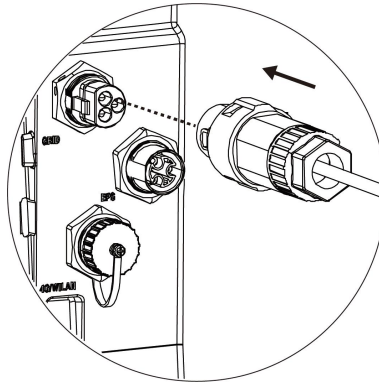
a hex wrench.



- (3) Insert the housing assembly into the body, you will hear “Click”, and tighten the nut.

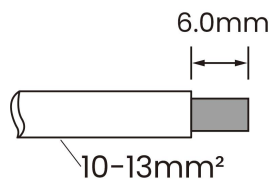


- (4) Plug the Grid connector into the Grid port of the AIO.

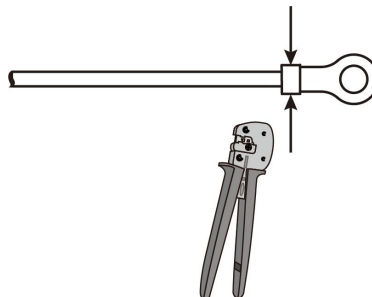


6.3 Ground Connection

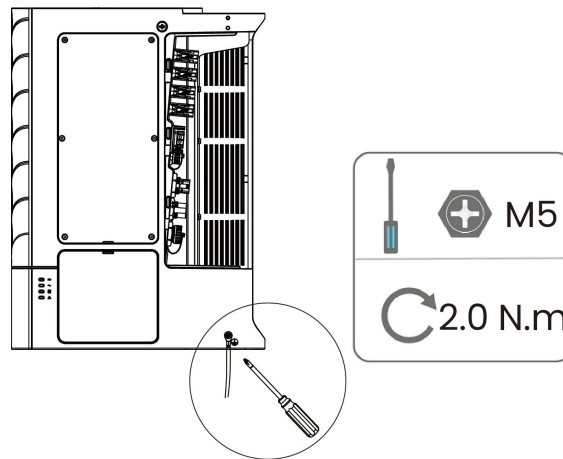
- (1) Trim 6mm of insulation from the end of 10-13mm² wires.



- (2) Crimp the earth terminal with a crimping plier.



- (3) Screw the ground screw with a screwdriver.



6.4 Electrical Connection

Communication Device Installation (Optional)

The Stackable AIO is available with multiple communication options such as WLAN, 4G, RS485 and meters.

Operating information such as output voltage, current, frequency, and fault information can be monitored locally or remotely via these interfaces.

● 4G/WLan (Optional)

The Stackable AIO has an interface for 4G/WLan devices to collect information, including AIO working status, performance etc., and update that information to monitoring platform (the 4G/WLan device is available for purchase from your local supplier).

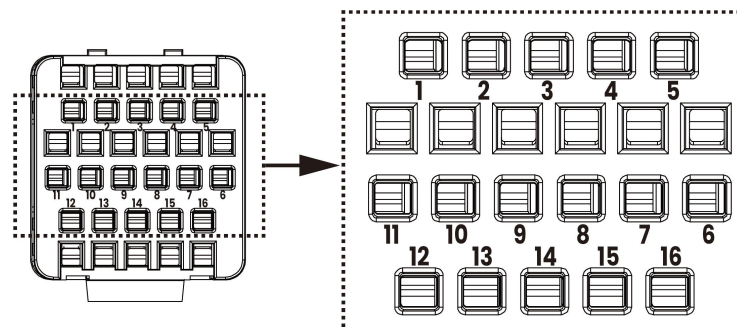
Connection Steps:

- (1) Plug the 4G/WLan device into "4G/WLAN" port of the Stackable AIO.
- (2) For WiFi device: Connect the WiFi with the local router, and complete the WiFi configuration (Please refer to the WiFi product manual for more details).
- (3) Set-up the site account on the Fox ESS monitoring platform (Please refer to the monitoring user manual for more details).

● CT/RS485/DIDO

The Stackable AIO has integrated export limitation functionality. To use this function, a power meter or a CT needs to be installed. The PIN definitions of CT/RS485/DIDO interface are as below.

For Plug Pin Definition:



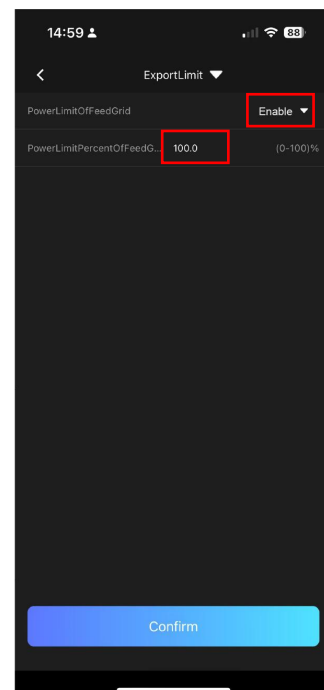
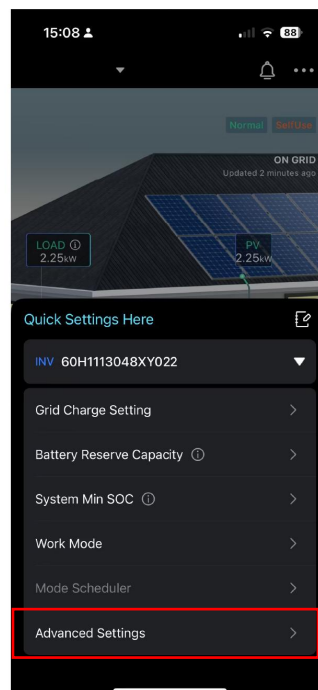
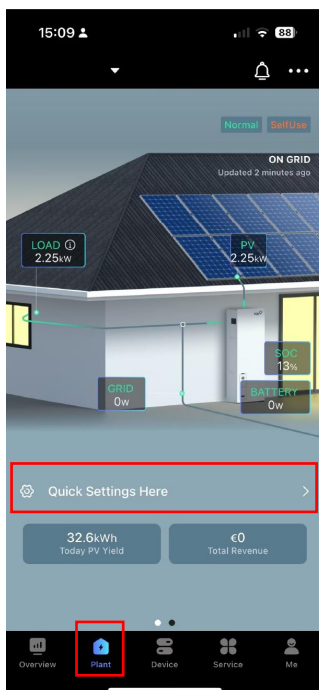
PIN	Definition	PIN	Definition	PIN	Definition
1	E-STOP	7	CT1-	13	K4
2	GND_COM	8	CT1+	14	/
3	485B	9	/	15	DI
4	485A	10	K1	16	COM
5	CT2+	11	K2		
6	CT2-	12	K3		

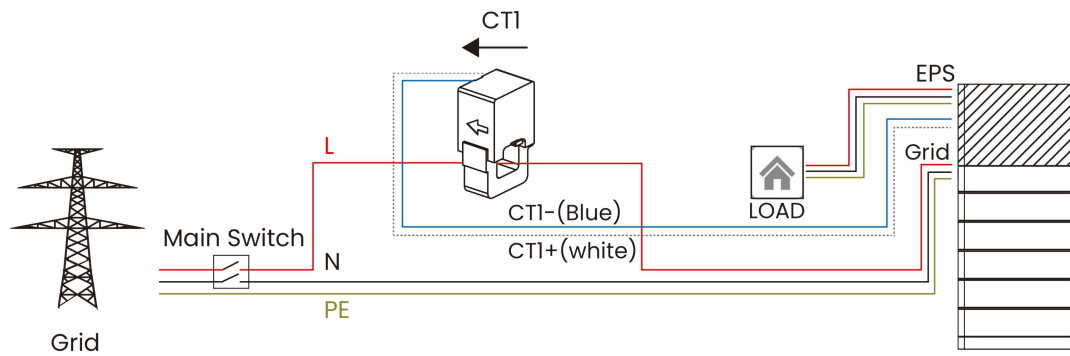
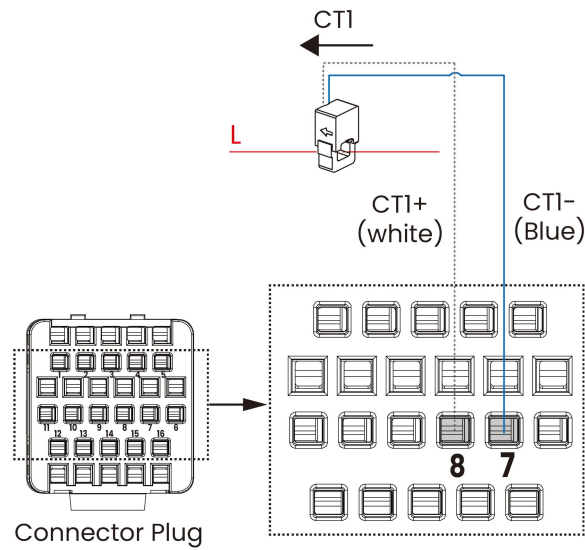
**Note!**

- (1) CT1: For Stackable AIO; CT2: For AC-Couple inverter (if it exists).
- (2) K1/K2, K3/K4 are dry contacts or external heat pump control signals.
- (3) DI/COM is an external input signal.

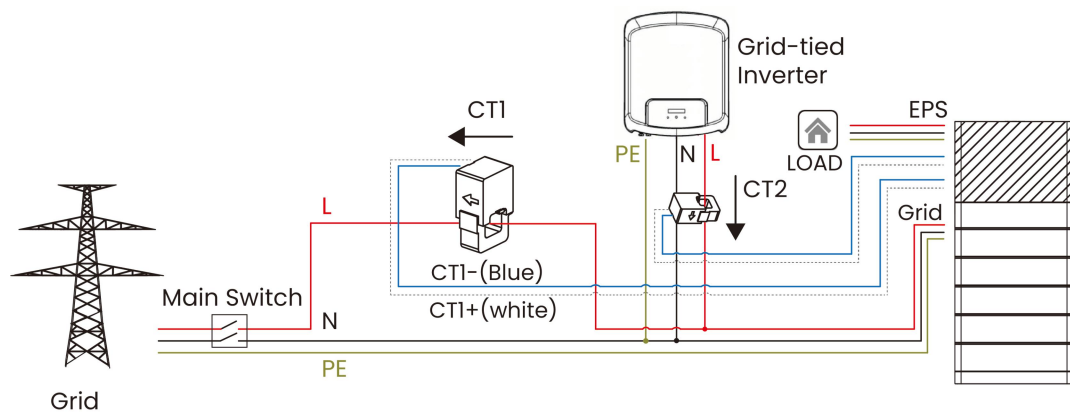
The Stackable AIO has an integrated export management function. To enable this function, a power meter is integrated in the Stackable AIO, and a CT must be installed. The CT should be clamped on the main live line of the grid side. The arrow on the CT should be pointing towards the grid. The white cable connects to CT+, and the blue cable connects to CT-.

To use the export limitation functionality, please set the export limitation parameters on FoxCloud App 2.0 as below.

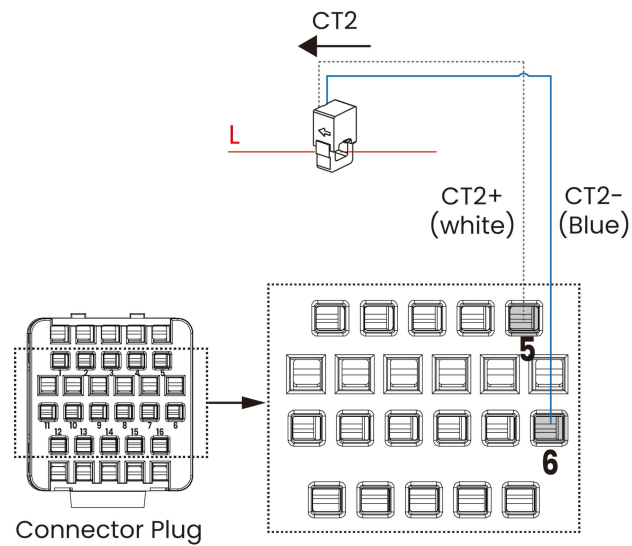


CT Connection:**Connection of CT1 to Connector Plug:**

If there is another generator in the home, CT2 can be used to record the power generated by the generator and transmit the data to the website for monitoring.

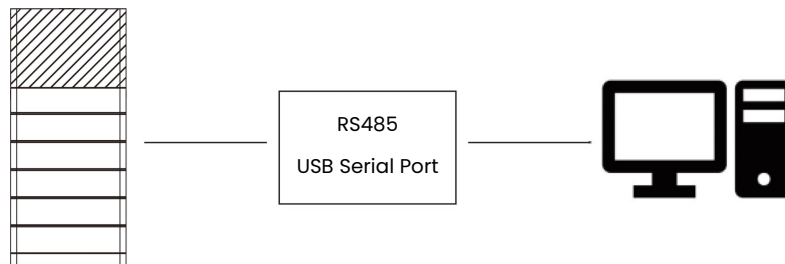


Connection of CT2 to Connector Plug:



● RS485

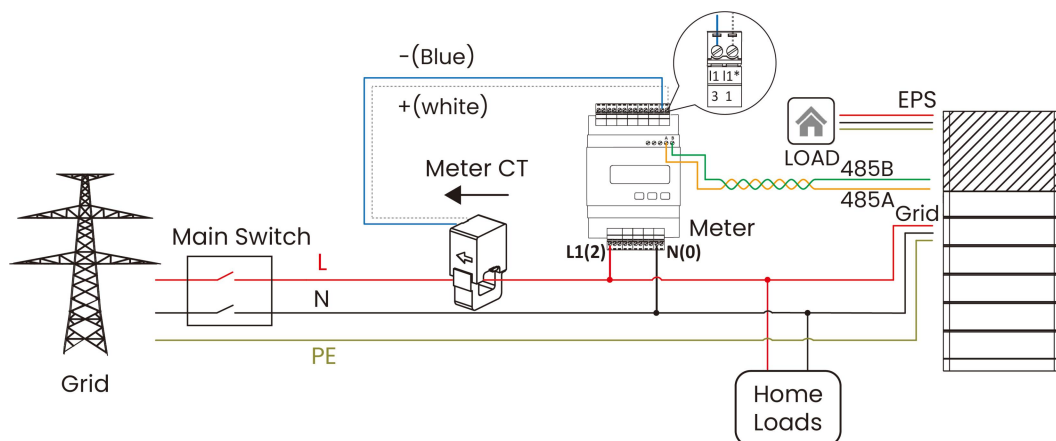
RS485 is a standard communication interface which can transmit the real time data from inverter to PC or other monitoring devices.



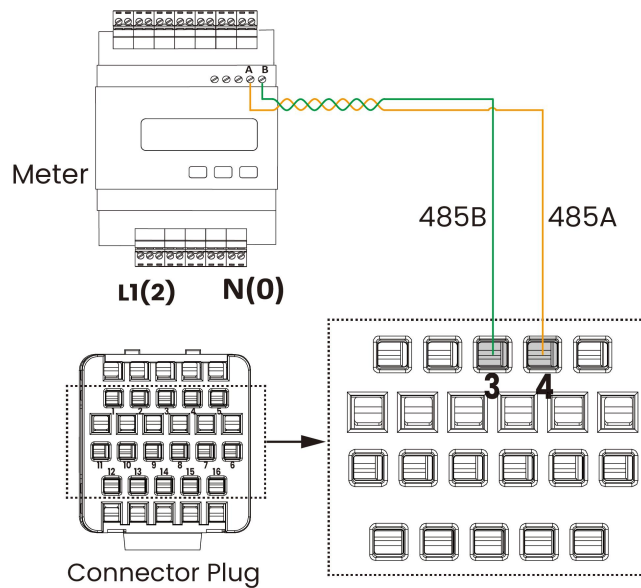
● Meter (Optional)

The Stackable AIO has integrated export limitation functionality. To use this function, a power meter or a CT must be installed. For meter installation, please install it on the grid side.

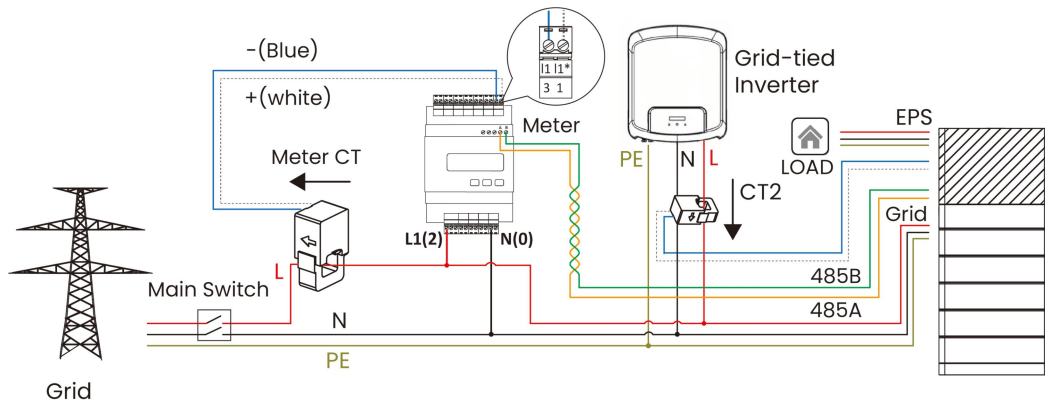
The electricity meter is connected as follows:



Connection of Meter to Connector Plug:



Wiring diagram for solution Meter+CT2:



● DRM

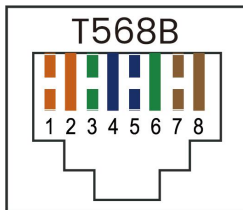
DRM is provided to support several demand response modes by emitting control signals as below:

Mode	Requirement
DRM0	Operate the disconnection device.
DRM1	Do not consume power.
DRM2	Do not consume at more than 50% of rated power.
DRM3	Do not consume at more than 75% of rated power and source reactive power if capable.
DRM4	Increase power consumption (subject to constraints from other active DRMs).
DRM5	Do not generate power.
DRM6	Do not generate at more than 50% of rated power.

DRM7	Do not generate at more than 75% of rated power and sink reactive power if capable.
DRM8	Increase power generation (subject to constraints from other active DRMS).

**Note!**

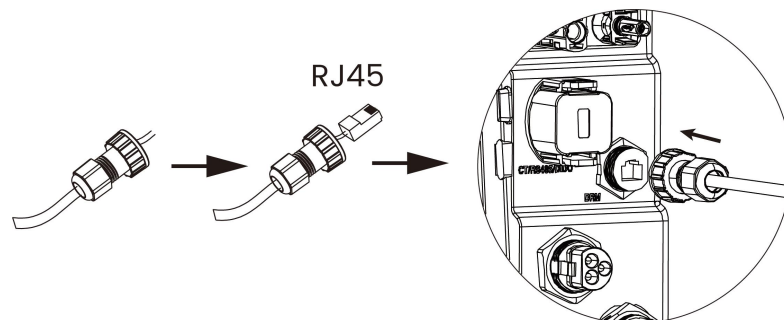
Currently only supports DRM0 function, other functions are under development.

DRM PIN Definition

1: White-Orange	5: White-Blue
2: Orange	6: Green
3: White-Green	7: White-Brown
4: Blue	8: Brown

PIN	1	2	3	4	5	6	7	8
DRM	DRM1	DRM2	DRM3	DRM4	+3.3V	DRM0	GND	GND

Model	Sockets asserted by shorting pins		Function
DRM0	5	6	Operate the disconnection device.

Connection Steps:**Note:**

- **Ground Wire Detection Fault**

The Stackable AIO complies with IEC 62109-2 clause 13.9 for ground wire fault monitoring. If a ground wire fault occurs, the fault code 1047 will be displayed on the FoxCloud App and the RED LED indicator will light up.

- **Reactive Power Regulation for Voltage Variation (Volt-VAr Mode)**

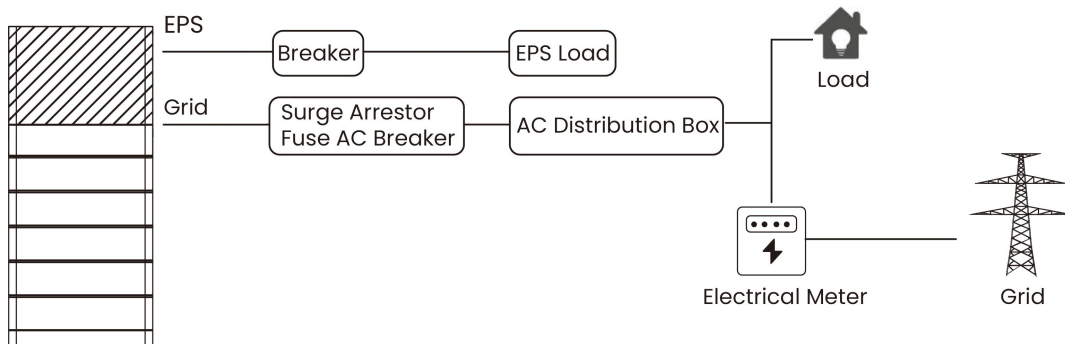
This mode can be enabled via the installer's account on the FoxCloud App.

- **Power Derating for Voltage Variation (Volt-Watt Mode)**

This mode can be enabled via the installer's account on the FoxCloud App.

6.5 EPS Connection

A. EPS Wiring Diagram



Note!

When the grid power is off, ensure that the EPS load power is lower than the AIO's maximum output power.

B. Common Loads Description

In EPS mode, if you need to connect an inductive load to the EPS port, please ensure that the startup power of the load does not exceed the maximum power rating for EPS mode. The table below lists some conventional and reasonable loads for your reference. Please consider your specific loads.

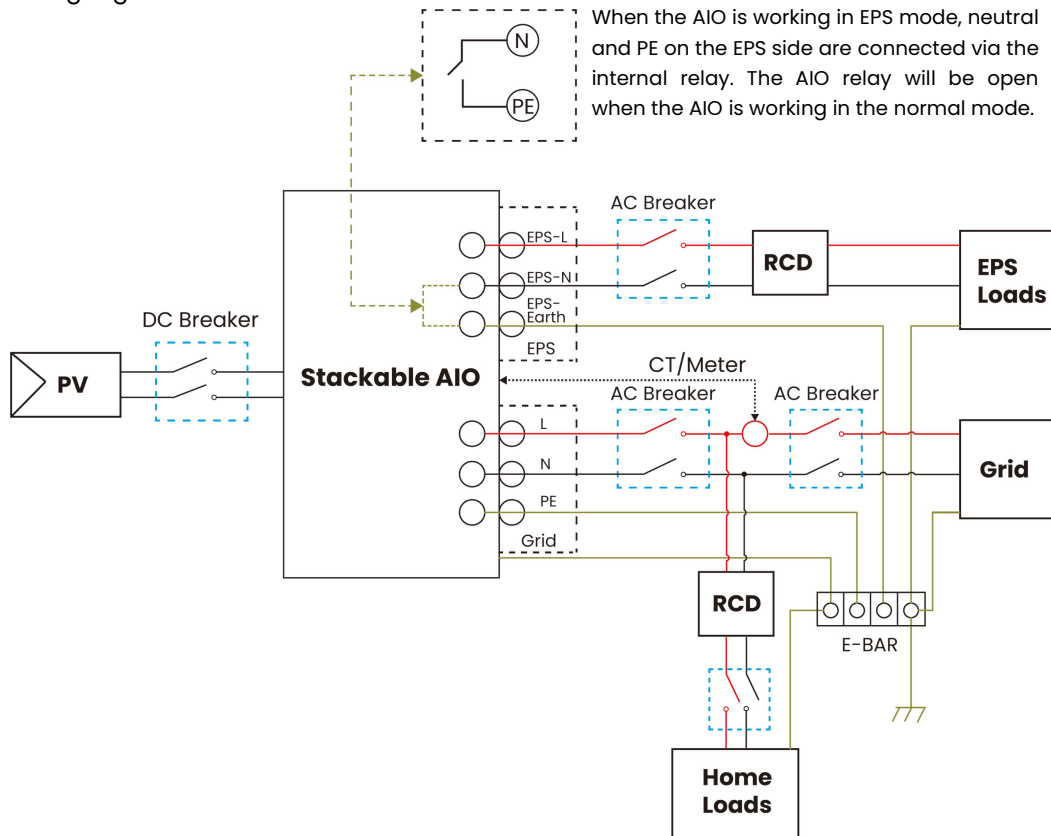
Type	Power		Common Equipment	Example		
	Start	Rated		Equipment	Start	Rated
Resistive Load	X1	X1	  Incandescent Lamp TV	 100W Incandescent Lamp	100VA (W)	100VA (W)
Capacitive Load	X2	X1.5	 Fluorescent Lamp	 40W Fluorescent Lamp	80VA (W)	60VA (W)
Inductive Load	X3~5	X2	  Fan Fridge	 Fridge 150w	450~750 VA (W)	300VA (W)

*Unipolar load is not supported.

6.6 System Connection Diagrams

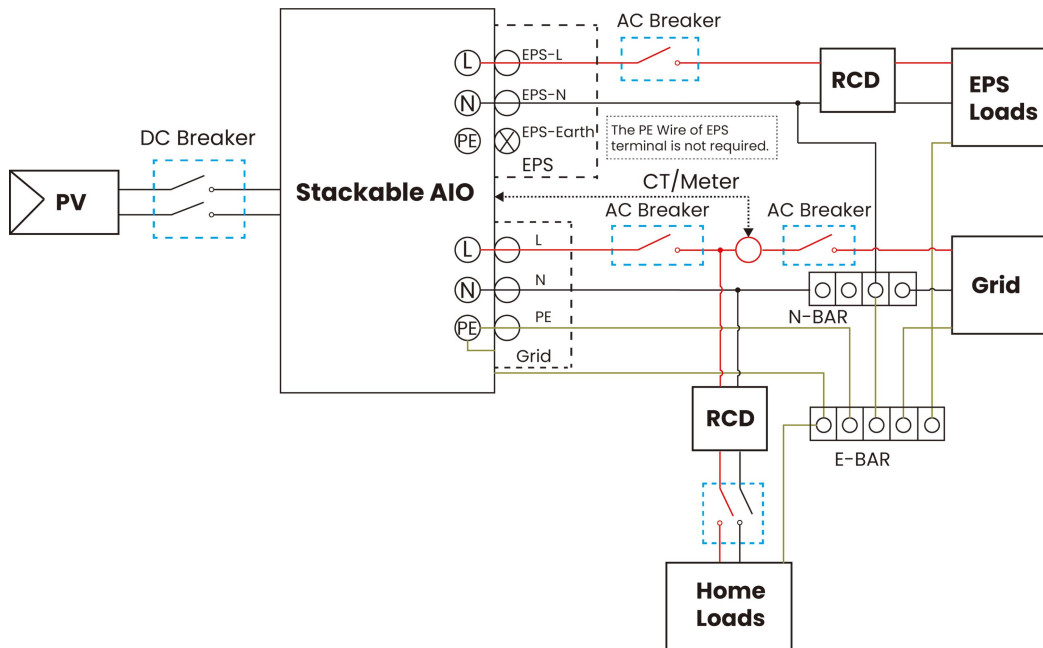
Neutral line of alternative supply needs to be connected after the grid is off.

For countries such as China, Germany, the Czech Republic, Italy, etc, please follow local wiring regulation!



Neutral lines of grid and alternative supply need to be connected together.

For countries such as Australia, New Zealand, South Africa, etc., please follow local wiring regulation!



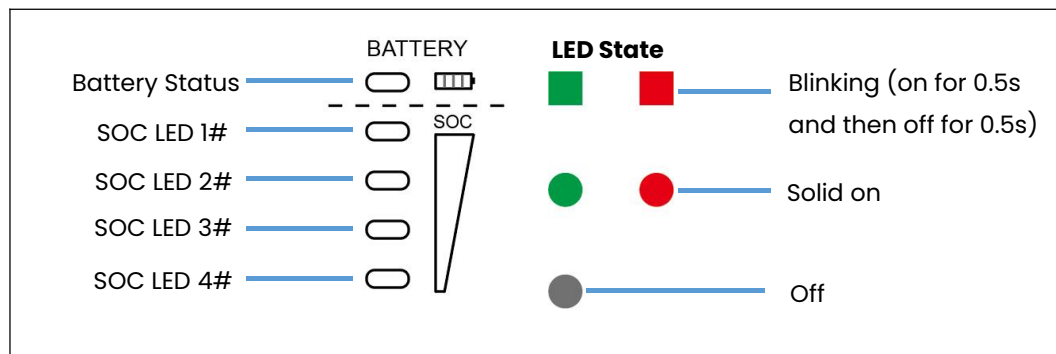
7 Operation

7.1 LED Lightening Description

For PQ Inverter Lightening

DC Status			LED State Blinking (on for 1s and then off for 1s) Solid on Off
AC Status			
Off-grid			
Alarm			

Status				Meaning
				N/A
				The AIO is running in on-grid state and exporting power to the power grid.
				The DC is on and the AC is off in on-grid mode.
			/	The DC is off and the AC is on.
			/	The DC is on, the AC is on, and the PCS is starting up.
				Both the DC and AC are off in on-grid mode.
				The AIO is running in backup state.
			/	The DC is on and the AIO has no output in backup state.
				Both the DC and AC are off in backup state.
				Both the DC and AC are off.

For Battery Lightening

SOC	Battery Status LED	SOC LED 1#	SOC LED 2#	SOC LED 3#	SOC LED 4#
100%>SOC>=75%	Standby	■	●	●	●
75%>SOC>=50%		■	●	●	●
50%>SOC>=25%		■	●	●	●
25%>SOC>=0%		■	●	●	●
100%>SOC>=75%	Discharge	●	●	●	●
75%>SOC>=50%		●	●	●	●
50%>SOC>=25%		●	●	●	●
25%>SOC>=0%		●	●	●	●
100%>SOC>=75%	Charge	●	■	■	■
75%>SOC>=50%		●	●	■	■
50%>SOC>=25%		●	●	■	■
25%>SOC>=0%		●	●	●	■

Fault	Battery Status LED	SOC LED 1#	SOC LED 2#	SOC LED 3#	SOC LED 4#
Under Voltage Fault	■	●	●	●	●
Over Voltage Fault	■	●	●	●	●
Over Temperature Fault	■	●	●	●	●

Fault	Battery Status LED	SOC LED 1#	SOC LED 2#	SOC LED 3#	SOC LED 4#
Under Temperature Fault					
Discharge Over Current					
Charge Over Current					
Discharge Over Power					
Charge Over Power					
Pre-charge Failed					
Short Circuit Protection					
AFE Communication Failed					
Module Addressing Failed					
IVU Communication Failed					
BMU Communication Failed					
PCS Communication Failed					
HVB FUSE Fault					
Module FUSE Fault					
Power Failed					
Internal Total Voltage Sampling Failed					
Temperature Sampling Failed					
Relay Adhesion					
Relay Not Close					
Relay Drive Failed					
Single Cell "0V" Fault					

Fault	Battery Status LED	SOC LED 1#	SOC LED 2#	SOC LED 3#	SOC LED 4#
Temperature High Permanent Failed					
Single Voltage High Permanently					
SOH Low Protection					
AFE Failed (UV/OV/UT/OT)					
Shutdown Failed					
Other Faults					

8 Service and Maintenance

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

8.1 Troubleshooting

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
1	1025	Grid Overvoltage	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage RMS value exceeds the higher threshold specified for HVRT.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. Check whether the grid connection voltage exceeds the upper threshold. If so, contact the local power operator. 3. If you have confirmed that the grid connection voltage exceeds the upper threshold and have obtained the consent of the local power operator, modify the overvoltage protection threshold.
2	1026	Grid Transient Overvoltage	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage peak value exceeds the higher threshold specified for HVRT.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid voltage is within the acceptable range. If not, contact the local power operator. If so, modify the power grid overvoltage protection threshold with the

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
						consent of the local power operator.
3	1027	Grid Undervoltage	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage rms value is below the lower threshold specified for LVRT.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid voltage is within the acceptable range. If not, contact the local power operator. If so, modify the power grid undervoltage protection threshold with the consent of the local power operator. 3. If the fault persists for a long time, check the connection between the AC switch and the output power cable.
4	1028	Grid Voltage Low	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage rms value is below the lower threshold specified for LVRT.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid voltage is within the acceptable range. If not, contact the local power operator. If so, modify the power grid undervoltage protection threshold with the consent of the local power operator. 3. If the fault persists for a

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
						long time, check the connection between the AC switch and the output power cable.
5	1030	AC Overcurrent	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage drops dramatically or the power grid or the output load is short-circuited. As a result, the inverter transient output current exceeds the upper threshold and, which triggers the inverter protection.	1. The inverter monitors its external working conditions in real time. And it can automatically recover after the fault is rectified. 2. If the alarm is triggered frequently and affects the power production of the PV plant, check whether grid or the output is short-circuited. If the fault persists, contact your installer.
6	1031	Grid Overfrequency	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The actual grid frequency is higher than the local power grid standard.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid frequency is within the acceptable range. If not, contact the local power operator. If so, modify the grid overfrequency protection threshold with the consent of the local power operator.
7	1032	Grid Underfrequency	Major	Shutdown, alarm reporting, and	The actual grid frequency is below than lower threshold	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
				automatic recovery after the fault is rectified.	standard.	will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid frequency is within the acceptable range. If not, contact the local power operator. If so, modify the grid underfrequency protection threshold with the consent of the local power operator.
8	1035	High Leakage Current Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The leak current RMS value exceeds the threshold specified for leak current, and the temporary dynamic value exceeds 30mA over 0.3s, or exceeds 60mA 0.15s or 150mA 0.04s.	1. If the alarm is triggered accidentally, it may be due to leak current exceeding the threshold or temporary dynamic value exceeding the threshold. The inverter will automatically recover when the leak current is less than 100mA. 2. If the alarm is triggered frequently and affects the power production of the PV plant, check ground impedance of PV. If the fault persists, contact your installer.
9	1038	Grid Voltage High	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage RMS value exceeds the higher threshold specified for HVRT.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. Check whether the grid connection voltage exceeds the upper threshold. If so, contact the local power operator. 3. If you have confirmed that

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
						the grid connection voltage exceeds the upper threshold and have obtained the consent of the local power operator, modify the overvoltage protection threshold.
10	1039	Hardware Inverter Overcurrent Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage drops dramatically or the power grid or the output load is short-circuited. As a result, the inverter transient output current exceeds the upper threshold and, which triggers the inverter protection.	1. The inverter monitors its external working conditions in real time. And it can automatically recover after the fault is rectified. 2. If the alarm is triggered frequently and affects the power production of the PV plant, check whether grid or the output is overloaded or short-circuited. If the fault persists, contact your installer.
11	1040	Unbalanced Grid Voltage	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The difference between grid phase voltages exceeds the upper threshold.	1. Check that the grid voltage is within the normal range. 2. Check the connection of the AC output power cable. 3. If the cable is connected properly but the alarm is triggered frequently and affects the power production of the PV plant, contact the local power operator.
12	1041	Hardware Inverter Overcurrent Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage drops dramatically or the power grid or the output load is short-circuited. As a result, the inverter	1. The inverter monitors its external working conditions in real time. And it can automatically recover after the fault is rectified. 2. If the alarm is triggered frequently and affects the power production of the PV plant, check whether grid or

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
					transient output current exceeds the upper threshold and, which triggers the inverter protection.	the output is overloaded or short-circuited. If the fault persists, contact your installer.
13	1042	Grid Frequency High	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The actual grid frequency is higher than the local power grid standard.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter inverter will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid frequency is within the acceptable range. If not, contact the local power operator. If so, modify the grid overfrequency protection threshold with the consent of the local power operator.
14	1043	Grid Frequency Low	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The actual grid frequency is below than the local power grid standard.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid has resumed normal functioning. 2. If the alarm is triggered frequently, check whether the grid frequency is within the acceptable range. If not, contact the local power operator. If so, modify the grid underfrequency protection threshold with the consent of the local power operator.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
15	1047	Ground Wire Detection Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	1. The PE cable for the inverter is not connected. 2. The voltage between the inverter neutral wire and ground exceeds the upper threshold.	1. Check whether the PE cable for the inverter is connected properly. 2. Check whether the output is connected to an isolation transformer. If so, set OFF due to abnormal grounding to Disable. 2. If the inverter is connected to the TN power grid, check whether the voltage of the neutral wire to ground is normal.
16	1057	Bus Transient Overvoltage	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	Bus voltage is higher than the value of protection.	1. If the alarm is triggered accidentally, it may be due to temporary abnormalities in the power grid. The inverter will automatically recover after the power grid resumes normal functioning. 2. Check the PV open voltage if higher than 550V. 3. Check the BAT voltage if higher than 460V. 4. If the fault persists, contact your installer.
17	1066	DC Input PV1 Reverse Connection Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The PV1 module output is reversely connected.	Check whether the PV1 module output is reversely connected.
18	1067	DC Input PV2 Reverse Connection Fault	Major	Shutdown, alarm reporting, and automatic recovery after the	The PV2 module output is reversely connected.	Check whether the PV2 module output is reversely connected.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
				fault is rectified.		
19	1081	DC Input PV3 Reverse Connection Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The PV3 module output is reversely connected.	Check whether the PV3 module output is reversely connected.
20	1089	INV IGBT Overtemperature	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The temperature of INV IGBT is higher than the threshold. 1. The inverter is installed in a place with poor ventilation. 2. The ambient temperature exceeds the upper threshold. 3. The inverter is not working properly.	1. Check the ventilation and ambient temperature at the inverter installation position. 2. If the ventilation is poor or the ambient temperature exceeds the upper threshold, improve the ventilation and heat dissipation. 3. If the ventilation and ambient temperature both meet requirements, contact your installer.
21	1095	E-STOP Trigger	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	Emergency Stop Switch triggered.	1. Check the Emergency Stop Switch if it is pushed. 2. Check the Emergency Stop Switch cable if the Emergency Stop Switch is open. 3. Check whether the Emergency Stop Switch cable is connected to the correct connector of the inverter. 4. If the fault persists, contact your installer.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
22	1109	Leak Current CT Self-checking Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	Residual Current CT check failure. The insulation impedance of the input side to PE decreased.	1. If it is triggered accidentally, the external power cable may be abnormal temporarily. The inverter automatically recovers after the fault is rectified. 2. If the alarm is triggered frequently or persists, check that the impedance between the PV string and ground is not below the lower threshold.
23	1122	Ambient Overtemperature	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The inner temperature of inverter is higher than the upper threshold . 1. The inverter is installed in a place with poor ventilation. 2. The ambient temperature exceeds the upper threshold. 3. The inverter is not working properly.	1. Check the ventilation and ambient temperature at the inverter installation position. 2. If the ventilation is poor or the ambient temperature exceeds the upper threshold, improve the ventilation and heat dissipation. 3. If the ventilation and ambient temperature both meet requirements, contact your installer.
24	1124	Low Insulation Impedance Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	Low Insulation Resistance is below than the value of protection. 1. The PV string is shorted to PE. 2. The PV string has been operating in a moist environment for a long time.	1. Check the impedance between the PV array output and PE, and eliminate short circuits and poor insulation points. 2. Check whether the inverter PE cable is properly connected. 3. If you are sure that the impedance is less than the value of protection in a cloudy or rainy environment, reset insulation resistance protection.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
25	1126	Leak Current Sampling Channel Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	Residual Current CT check failure. The insulation impedance of the input side to PE decreased.	1. If it is triggered accidentally, the external power cable may be abnormal temporarily. The inverter automatically recovers after the fault is rectified. 2. If the alarm is triggered frequently or persists, check that the impedance between the PV string and ground is not below the lower threshold.
26	1136	Load Overpower Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The power of the Off-Grid Load is higher than the upper threshold in the Off-Grid Mode.	Check if the power of the Off-Grid Load exceeds the permitted value.
27	1137	INV Low Voltage Fault Under Off-grid	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The output voltage is below the lower threshold in the Off-Grid Mode.	1. Check if the power of the Off-Grid Load exceeds the permitted value. 2. Check if the output is shorted.
28	1144	Arc Self-checking Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The PV string power cable arcs or is in poor contact.	Check whether the string circuit arcs or is in poor contact. After the fault is rectified, manually clear the alarm and then start again.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
29	1145	Arc Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The sampling circuit of the AFCI circuit is not operating correctly.	Check whether the string circuit arcs or is in poor contact. After the fault is rectified, manually clear the alarm and then start again.
30	1154	INV Overcurrent Permanent Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage drops dramatically or the power grid or the output load is short-circuited. As a result, the inverter transient output current exceeds the upper threshold and, which triggers the inverter protection.	1. The inverter monitors its external working conditions in real time. And it can automatically recover after the fault is rectified. 2. If the alarm is triggered frequently and affects the power production of the PV plant, check whether grid or the output is overloaded or short-circuited. If the fault persists, contact your installer.
31	1168	INVL2 Overcurrent Permanent Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The grid voltage drops dramatically or the power grid or the output load is short-circuited. As a result, the inverter transient output current exceeds the upper threshold and, which triggers the inverter protection.	1. The inverter monitors its external working conditions in real time. And it can automatically recover after the fault is rectified. 2. If the alarm is triggered frequently and affects the power production of the PV plant, check whether grid or the output is overloaded or short-circuited. If the fault persists, contact your installer.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
32	1172	Leak Current Permanent Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The insulation impedance of the input side to PE decreases when the inverter is operating	1. If the alarm is triggered accidentally, the external power cable may be abnormal temporarily. The inverter automatically recover after the fault is rectified. 2. If the alarm is triggered frequently or persists, check that the impedance between the PV string and ground is not below the lower threshold.
33	1217	Transient Overcurrent during BDC Charging	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The Battery DC charge current is higher than the upper threshold. 1. The battery is faulty.	1. If the FAULT indicator on the front of the battery pack is ON or flashing, contact your installer. 2. Check that the communications cable and power cable between the inverter and the battery are properly connected. 2. Send a shutdown command on the app. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence after 5 minutes. 3. If the alarm still exists, contact your installer.
34	1218	Transient Overcurrent during BDC Discharging	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The Battery DC discharge current is higher than the upper threshold. 1. The battery is faulty. 2. The battery SOC is too low.	1. If the FAULT indicator on the front of the battery pack is ON or flashing, contact your installer. 2. Check that the communications cable and power cable between the inverter and the battery are properly connected.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
						3. Send a shutdown command on the app. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence after 5 minutes. 4. If the alarm still exists, contact your installer.
35	1229	BDC Overtemperature Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The temperature of battery DC IGBT is higher than the upper threshold. 1. The inverter is installed in a place with poor ventilation. 2. The ambient temperature exceeds the upper threshold. 3. The inverter is not working properly.	1. Check the ventilation and ambient temperature at the inverter installation position. 2. If the ventilation is poor or the ambient temperature exceeds the upper threshold, improve the ventilation and heat dissipation. 3. If the ventilation and ambient temperature both meet requirements, contact your installer.
36	1242	BDC Average Low Voltage Fault (Total battery voltage is below undervoltage value in non-charging mode)	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	1. The battery is faulty.	1. If the FAULT indicator on the front of the battery pack is ON or flashing, contact your installer. 2. Check that the communications cable and power cable between the inverter and the battery are properly connected. 2. Send a shutdown command on the app. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
						output switch, and DC input switch in sequence after 5 minutes. 3. If the alarm still exists, contact your installer.
37	1247	Reversed Battery Polarity Connection Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	The battery output is reversely connected.	Check whether the battery output is reversely connected.
38	1248	BDC Overload Fault	Major	Shutdown, alarm reporting, and automatic recovery after the fault is rectified.	1. The battery is faulty. 2. The battery SOC is too low.	1. Check that the communications cable and power cable between the inverter and the battery are properly connected. 2. Send a shutdown command on the app. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence after 5 minutes. 3. If the alarm still exists, contact your installer.
39	1281	Communication Fault between Communication Board and Main DSP	Minor	Alarm reporting	1. The communication cables are not connected properly. 2. The communication is interfered.	1. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence after 2 minutes. 2. If the fault still exists, contact your installer.

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
40	1283	Communication Fault between Communication Board and BMS	Minor	Alarm reporting	1. The communication cables are not connected well. 2. The communication cables are too long or do not use shielded twisted pair with drain wire.	Shut down the battery and check the communication cables and power cable between the FOX Inverter and the battery are properly connected.
41	1284	Communication Fault between Communication Board and Built-in Meter	Minor	Alarm reporting	The RS485 communication cables of the Built-in Meter are not properly connected.	1. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence after 2 minutes. 2. If the fault still exists, contact your installer.
42	1285	Communication Fault between Communication Board and Grid Meter	Minor	Alarm reporting	The RS485 communication cables of the Grid Meter are not properly connected.	Check that the communications cable and power cable between the inverter and the Meter are properly connected.
43	1286	Communication Board Flash Writing Fault	Minor	Alarm reporting	1. The Flash IC is interfered. 2. Flash IC fails.	1. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence after 2 minutes. 2. If the fault still exists, contact your installer.
44	1287	RTC Read-Write Fault	Minor	Alarm reporting	The RTC communication is interfered.	1. Turn off the AC output switch, DC input switch, and battery switch in order, and then turn on the battery switch, AC output switch, and DC input switch in sequence

Item	Alarm Number	Alarm Name	Alarm Severity	Alarm Action	Possible Cause	Suggestion
						after 2 minutes. 2. If the fault still exists, contact your installer.
45	1289	Solar Meter Communication Fault	Minor	Alarm reporting	The RS485 communication cables of the Solar Meter are not properly connected.	Check the RS485 communication cables of the Solar Meter are properly connected.

8.2 Service and Maintenance

• Service

- Keep the Stackable AIO clear of any leaves or foreign objects, particularly avoiding their presence on top of the unit or between the unit and the back wall.
- Keep the Stackable AIO away from the direct sunlight.
- Keep all the equipment in an environment with acceptable temperature and humidity.
- Clean the equipment surface using a soft cloth. If necessary, lightly dampen the cloth with water (only) and ensure that the equipment is fully powered off before cleaning.
- Do not block the vents.
- Maintain a safe distance between all units and substances that are flammable, explosive, or toxic.
- Keep the equipment operating within the allowed power range and avoid overloading.
- Verify that all cables are securely connected and all connectors are free from stress.
- Maintain a safe distance between the equipment and hazardous areas or potential risks.

• Maintenance

- Please check the running status of your equipment on your mobile app. If any alarm is found, please contact the qualified service group.
- Do not attempt to repair the system by yourself. Contact the professionals qualified by Fox ESS.
- If the problem cannot be solved via the above solution, 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.

9 Decommissioning

9.1 Dismantling the Stackable AIO

- Turn off "PV SWITCH", press and hold "BAT POWER" for 5s, and turn off "BAT SWITCH", AC breakers, and EPS breaker. Wait for 5 minutes for the Stackable AIO to fully de-energize.
- Disconnect communication and optional connection wirings. Remove the Stackable AIO from the ground.

9.2 Packaging

If possible, please pack the equipment 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 the weight specified in Chapter 4 Technical Data.
- Contains a handle.
- Can be fully closed.

9.3 Storage and Transportation

Store the batteries in dry place where ambient temperatures are always between -10 °C - +50 °C and the inverter between -40 °C - +70 °C. Take care of the equipment during the storage and transportation. When the equipment or other related components need to be disposed of, please ensure it is carried out according to local waste handling regulations. Please be sure to deliver the equipment that needs to be disposed from sites that are appropriate for the disposal in accordance with local regulations.

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10-500-10349-01