

User Manual

EP5

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

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1. Introduction

The document describes the installation, commissioning, maintenance and troubleshooting of the following high voltage battery listed below.

- EP5

The battery chemistry of this product is Lithium Iron Phosphate. This manual is designed for qualified personnel only. The tasks described in this document should be performed by authorized and qualified technicians only.

After Installation the Installer must explain the user manual to the end user.

2. Symbols

	<p>Symbol Explanation CE mark. The inverter complies with the requirements of the applicable CE guidelines.</p>
	<p>Caution, risk of electric shock.</p>
	<p>Do not place nor install near flammable or explosive materials.</p>
	<p>Install the product out of reach of children.</p>
	<p>Read the instruction manual before starting installation and operation.</p>
	<p>Do not dispose of the product with household wastes.</p>
	<p>Disconnect the equipment before carrying out maintenance or repair.</p>
	<p>Observe precautions for handling electrostatic discharge sensitive devices.</p>
	<p>PE conductor terminal.</p>
	<p>Caution, risk of electric shock, energy storage timed discharge.</p>

3. Safety

Any work on the Batteries should be handled by authorized technicians and hence it is understood that the technicians should familiarize themselves with the contents of this manual before any maintenance or installation is carried out on the system.

3.1 Handling

- Do not expose battery to open flame.
- Do not place the product under direct sunlight.
- Do not place the product near flammable materials. It may lead to fire or explosion in case of accident.
- Store in a cool and dry place with ample ventilation.
- Do not store the product near water sources.
- Store the product on a flat surface.
- Store the product out of reach of children and animals.
- Do not damage the unit by dropping, deforming, impacting, cutting or penetrating with a sharp object. It may cause leakage of electrolyte or fire.
- Do not touch any liquid spilled from the product. There is a risk of electric shock or damage to skin.
- Always handle the battery wearing the insulated gloves.
- Do not step on the product or place any foreign objects on it. This can result in damage.
- Do not charge or discharge damaged battery.
- Do not store the battery near water sources.

3.2 Installation

- Do not connect the pack to inverter conductors or Photo-Voltaic conductors. This will damage the battery and may result in explosion.
- After unpacking, please check the product for damages and missing parts.
- Make sure that the inverter and battery is completely turned off before commencing installation.
- Do not interchange the positive and negative terminals of the battery.
- Ensure that there is no short circuit of the terminals or with any external device.
- Do not exceed the battery voltage rating of the inverter.
- Do not connect the battery to any incompatible inverter.
- Do not connect different battery types together.
- Please ensure that all the batteries are grounded properly.
- Do not open the battery to repair or disassemble. Only manufacturer is allowed to carry out any such repairs.
- In case of fire, use only dry powder fire extinguisher. Liquid extinguishers should not be used.
- Install the batteries only inside approved manufacturer enclosure. Installing the battery anywhere outside is strictly forbidden.
- Do not install the battery near water sources or places where the battery can get wet.
- Install the battery away from children or pets.
- Do not use battery in high static environment where the protection device might be damaged.
- Do not install with other batteries or cells.
- Please ensure the new batteries mounted on-site comply to the warranty scope or have ever been re-charged within 6 months; on top of that, please make sure the SOC of present battery system onsite is $50\pm 5\%$.

3.3 Response to Emergency Situations

The battery can be used in single or multi in parallel. It is designed to prevent hazards or failures. However, manufacturer cannot guarantee their absolute safety.

Under exposure to the internal materials of the battery the following recommendations should be carried out by the user.

- If there has been inhalation, please leave the contaminated area immediately and seek medical attention.
- If there has been contact with eyes, rinse the eyes with running water for 15 minutes and seek medical attention immediately.
- If there has been contact with the skin, wash the contacted area with soap thoroughly and seek medical attention immediately.
- If there has been ingestion, induce vomiting and seek medical attention.

Fire Situation

In situations where the battery is on fire, if it is safe to do so, disconnect the battery pack by turning of the switch to shut off the power to the system (External, if any). Use FM-200 or Co2 fire extinguisher for the battery and an ABC fire extinguisher for the other parts of the system.

Under any fire situation, please evacuate the people from the building immediately before trying to extinguish it.

Water Situation

The battery modules are not water resistant. Hence care should be taken not to get it wet. If you find the battery completely or partially submerged in water do not try to open. Contact authorized personnel or manufacturer for further instructions.

4. Product Information

EP5 photovoltaic energy storage system is a high-voltage energy storage system based on lithium-ion ferrous phosphate battery. It is equipped with a customized battery management system (BMS), which is designed for energy storage applications of household photovoltaic power generation users. In the daytime, the surplus power of photovoltaic power generation can be stored in the battery. At night or when necessary, the stored energy can be provided to the electrical equipment, it can improve the use efficiency of photovoltaic power generation, peak-load shifting, and provide emergency standby power.

4.1 EP5 Specifications

Specifications for Battery	
Battery module	EP5
Nominal capacity (Ah)	27
Nominal voltage (Vdc)	192
Nominal energy (kWh)	5.18
Battery voltage range (Vdc)	174~219
Max. continuous discharging/charge current (A)	27/27
Recommended charging current (CC-CV) (A)	13.5
Charging cut off current (constant current and constant voltage) (A)	2
Peak charging current (5s) (A)	32.4
Peak discharging current (30s) (A)	65
Cycle life (cycles)	≥4000(60% SOH) @25°C @90%DOD
Storage temperature (°C)	0~35
Operating temperature range (°C)	Charge: 0~55 Discharge: -10~55
Discharge capacity (Ah)	19@1C@-20 ±2°C 27@1C@25 ±2°C
Energy density (Wh / kg)	≥100
Ingress protection	IP65
Communication	CAN
Weight (kg)	50.5±1
Dimensions (L*W*H) (mm)	380*147*625

5. Product Features

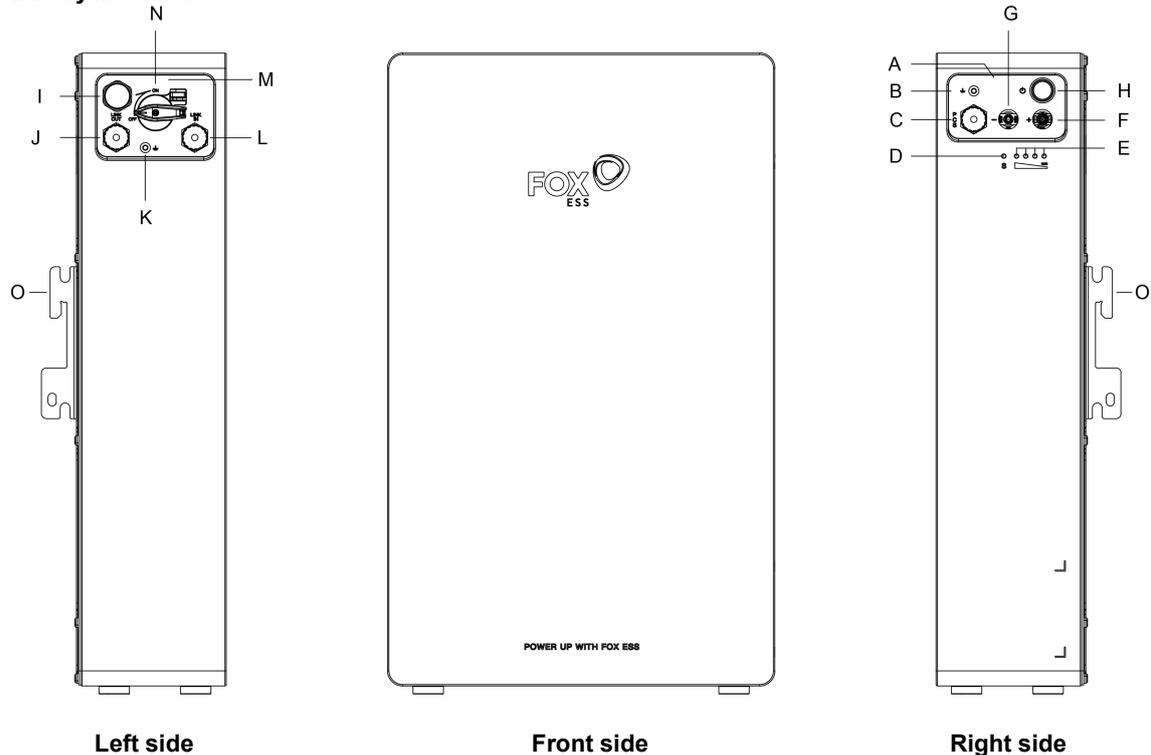
5.1 Battery System Features

The batteries have been fitted with multiple protection systems to ensure the safe operation of the system. Some of the protection system includes:

- Inverter interface protection: over voltage, over current, external short circuit, reverse polarity, ground fault, over temp, in rush current.
- Battery protection: internal short circuit, over voltage, over current, over temp, under voltage.

The battery system contains the following Interface to allow it to connect and operate efficiently.

Battery interface:

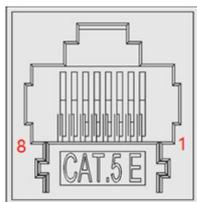


Object	Description	Object	Description	Object	Description
A	Handle	F	DC+	K	Ground Terminal
B	Ground Terminal	G	DC-	L	LINK IN
C	PCS COM	H	Power Switch	M	Handle
D	BMS Status LED	I	Valves	N	DC Switch
E	SOC LED	J	LINK OUT	O	Battery Bracket

Communication parallel interface (LINK IN, LINK OUT) and communication interface to inverter (CAN)

Network interface description: LINK IN is connected to the upper battery module, LINK OUT is connected to the lower battery module. PCS is the communication interface to the inverter.

The interface is defined as follows:



Pin configuration is as follows:

- **LINK IN**

Pin	Function definitions	Function declaration
1	Master_SL	Master_SL
2	RACK_CANL	CANL
3	N/A	N/A
4	N/A	N/A
5	RACK_CANH	CANH
6	ISO_GND	GND
7	Sync_WKEOUT	WakeupIn
8	Encode_IN	Encode_IN

- **LINK OUT**

Pin	Function definitions	Function declaration
1	Last_SL	Last_SL
2	RACK_CANL	CANL
3	N/A	N/A
4	N/A	N/A
5	RACK_CANH	CANH
6	ISO_GND	GND
7	Sync_WKEOUT	WakeupOut
8	Encode_OUT	Encode_OUT

- **PCS**

Pin	Function definitions	Function declaration
1	PCS_Wake+	Wakeup+
2	PCS_Wake-	Wakeup-
3	N/A	N/A
4	PCS_CANL	CANL
5	PCS_CANH	CANH
6	PCS_CANH	CANH
7	PCS_CANL	CANL
8	N/A	N/A

Ground Terminal

This terminal is used to connect the battery to the earth for safety purposes. In parallel mode, this terminal can also be used to connect to parallel battery.

Handle

The handle is used to carry or move the battery.

DC Switch

Power switch, battery charge and discharge circuit switch.

DC+

Connect bat + of inverter.

DC -

Connect bat - of inverter.

Power Switch

System power on switch, press this switch for about 3s, the system starts to work.

BMS Status LED and SOC LED

LED display specific alarm information and battery system power.

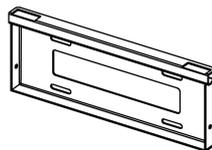
6. Installation

6.1 Items in the package

Please check if following items are including with the package:



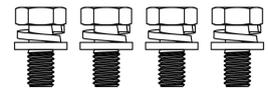
Battery×1(A2)



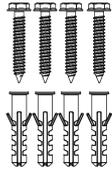
Bracket(wall)×1(B2)



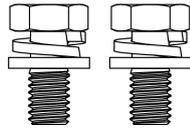
Bracket(battery)×2(C2)



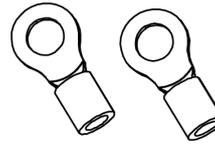
M6*12 Screw×4(D2)



D8 Plastic Expansion Tube × 4(E2)



M5*10 Screws × 2(F2)



OT Terminal × 2(G2)



Parallel Plug × 2(H2)



PCS Communication Cable (3m) × 1(I2)



Ground Cable (3m) × 1(J2)



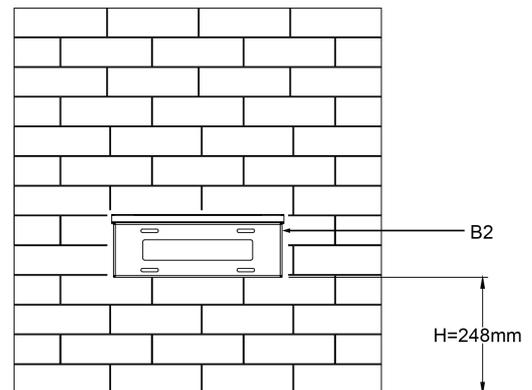
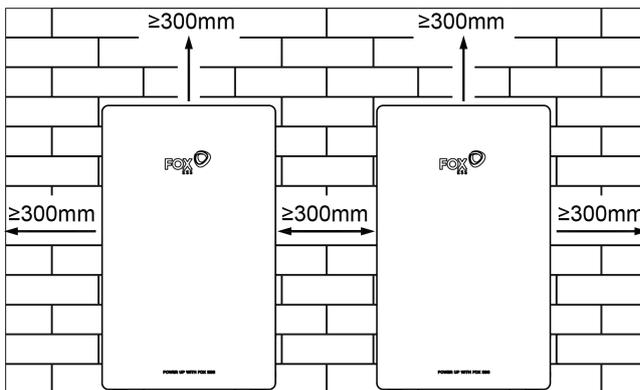
Power Cable (3m) × 1(K2)



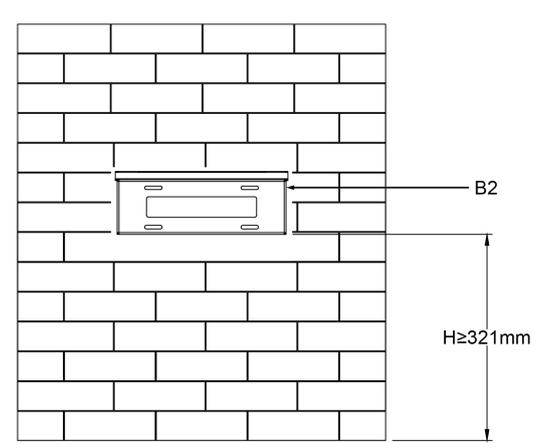
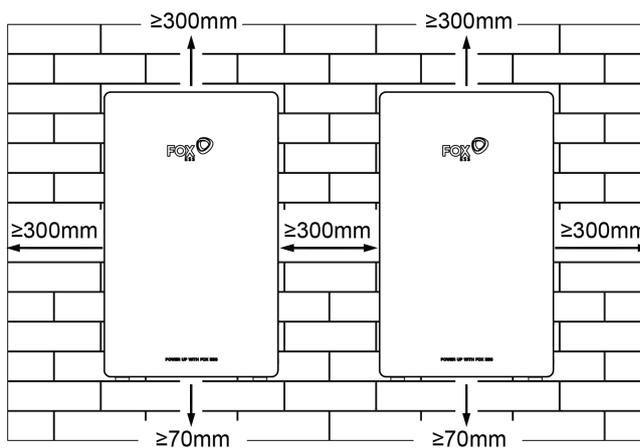
Quick Installation Guide × 1(L2)

6.2 Clearance

Standing mounting:



Wall mounting:



Make sure to leave a space of at least 300 mm. A clearance of at least 300 mm must be left around the battery pack for proper cooling.

Note: Make sure that the battery pack is always exposed to the ambient air. The battery pack is cooled by natural convection. If the battery pack is entirely or partially covered or shielded, it may cause the battery pack to stop operating.

6.3 Tools

The following tools will be required to install the battery.



6mm Magnetic Phillips Screwdriver(A1)



Crimpers(B1)



Safety Shoes(C1)



Safety Gloves(D1)



Safety Glasses(E1)



Rubber Mallet(F1)



Marker(G1)



8mm External Hexagonal Socket(H1)



Cable Ties(I1)



Hammer Drill @ ϕ 8mm(J1)



Spirit Level(K1)

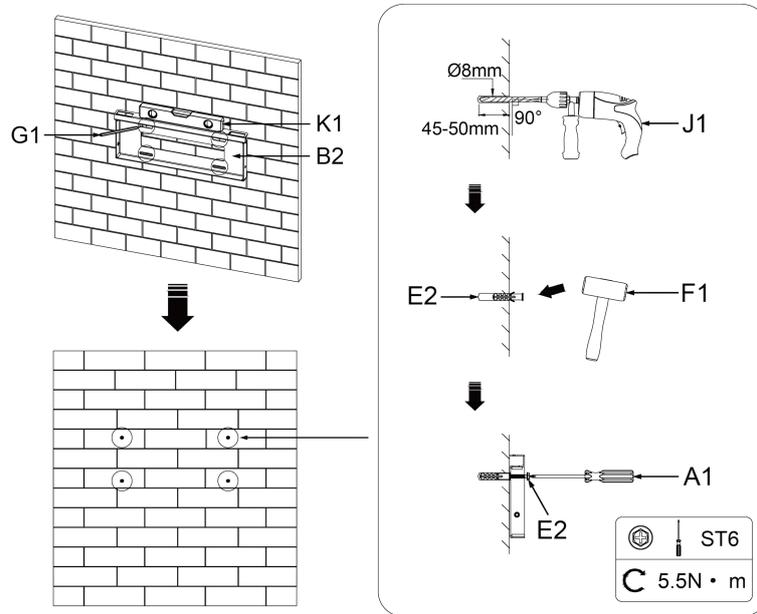


Multimeter (Vdc>500)(L1)

6.4 Installation Steps

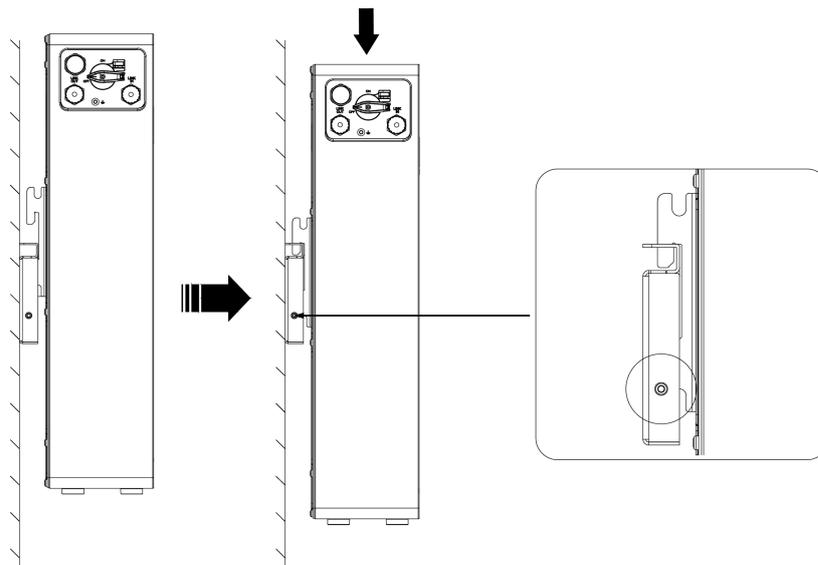
Step 1: The steps for installing the bracket is as follows:

- a. Place the bracket against the wall, adjust the hole position with a level (K1), and mark the positions of the 4 holes.
- b. Remove the bracket, drill the holes with a hammer drill ($\varnothing 8\text{mm}$, depth range 45-50mm), and tighten the expansion bolts to ensure that the bracket is securely installed.
- c. Fix the bracket to the wall with ST6*40 screws (E2), ensuring that the bracket is installed in a horizontal position.

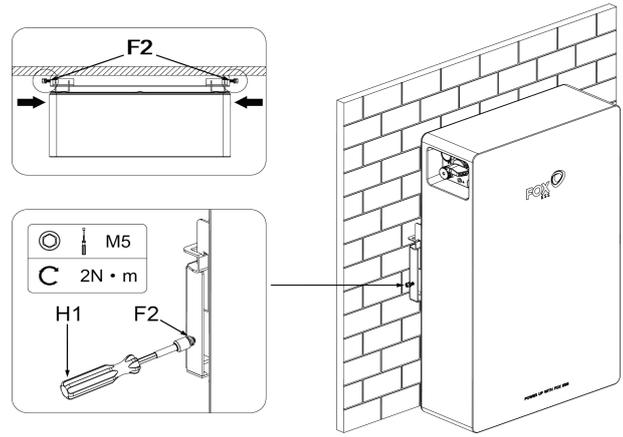


Step 2: The steps for installing the battery on the wall is as follows:

- a. Align the buckle of the battery bracket with the holes of mounting bracket on the wall, then place the battery from top to bottom.
- b. Observe the left and right sides of the bracket to ensure that the holes of the battery bracket and mounting bracket on the wall are aligned.

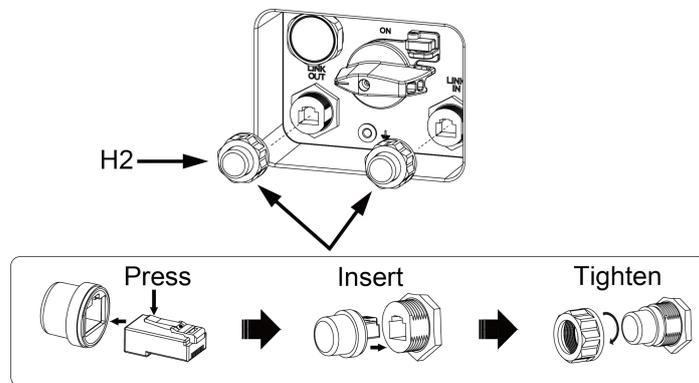


Step 4: Insert 2 pcs of M5*10 screws (F2) into the holes on the left and right sides of the mounting bracket then tighten the screws.

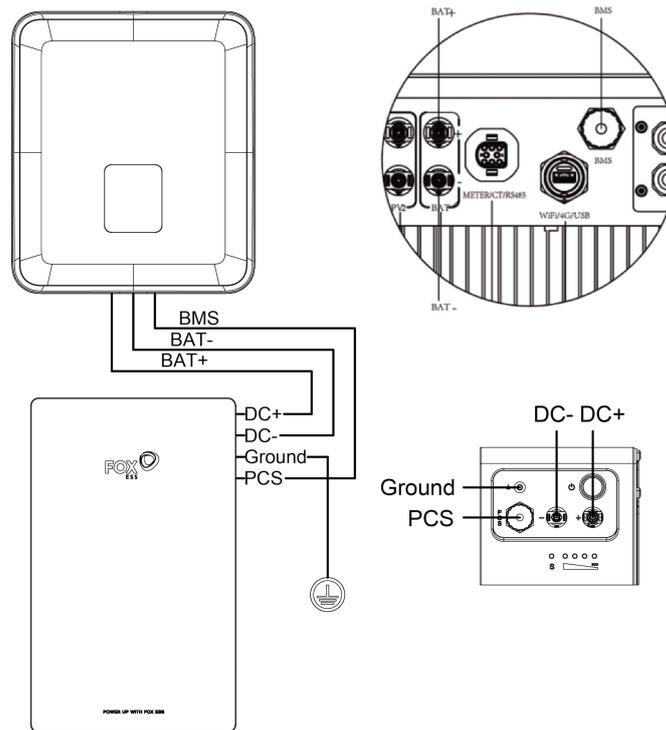


Stand-alone mode:

Step 1: Insert the 2 parallel plugs (H2) into the LINK IN and LINK OUT ports respectively.

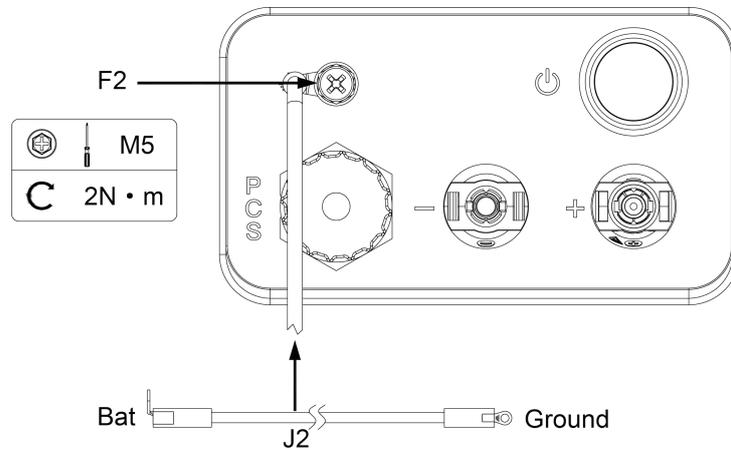


Step 2: Connect the inverter cables:

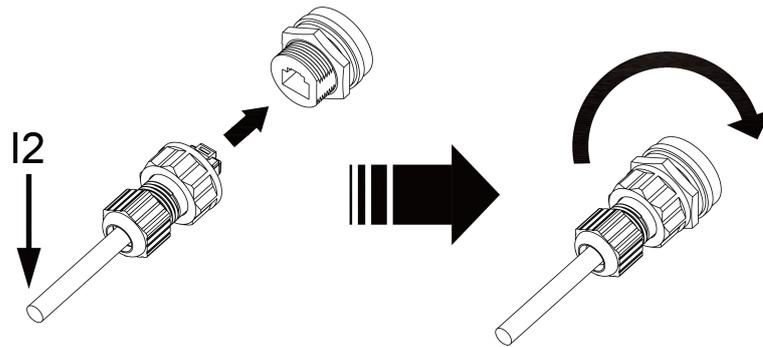


Note: Power cable (K2) must be pulled straight from the battery DC+/- for more than 80mm before bending.

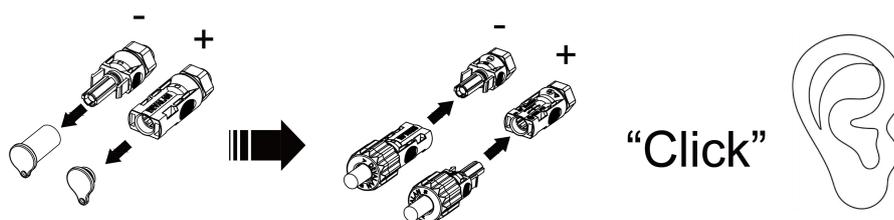
a. Connect the ground cable (J2) to the ground.



b. Connect the PCS communication cable (I2) to the BMS port on the inverter.

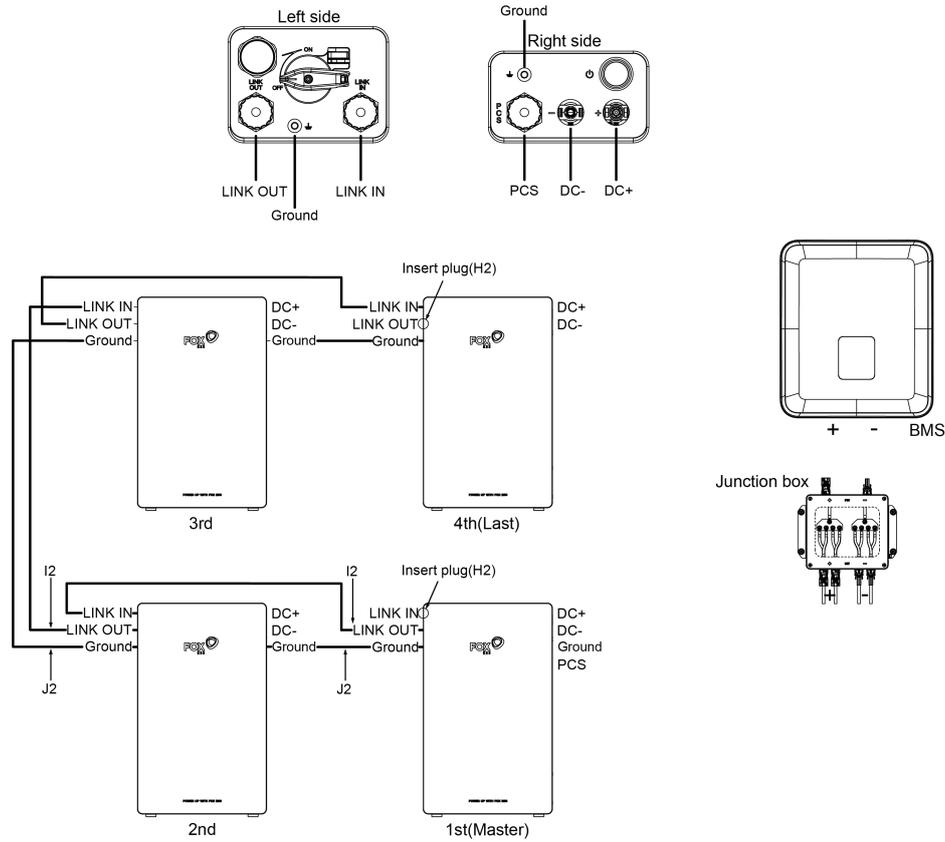


c. Remove the waterproof bridge from DC+ and DC-, then insert the power wire (K2) into DC+ and DC-.



Parallel mode:

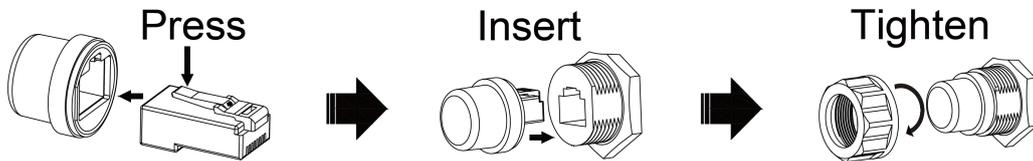
Step 1: Connect the parallel cables:



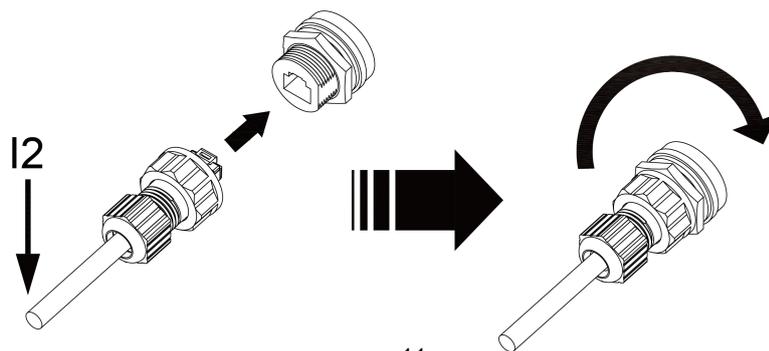
The steps for parallel connection of batteries is as follows:

- Insert the parallel plug (H2) into the LINK IN port, this battery is defined as the **Master** battery (whichever battery can be set as the **Master**).
- Connect the ground cable (J2) from the ground terminal of the **Master** battery (left side of the battery) to the ground terminal of the next battery (right side of the battery), and continue the same connection until the ground terminal of the last battery (left side of the battery).
- Use the communication cable (I2) to cross-connect the LINK OUT of the previous battery with the LINK IN of the next battery. Start from the LINK OUT of the **Master** and continue until reaching the LINK IN port of the last battery.
- Insert the parallel plug (H2) into the LINK OUT port of the last connected battery.

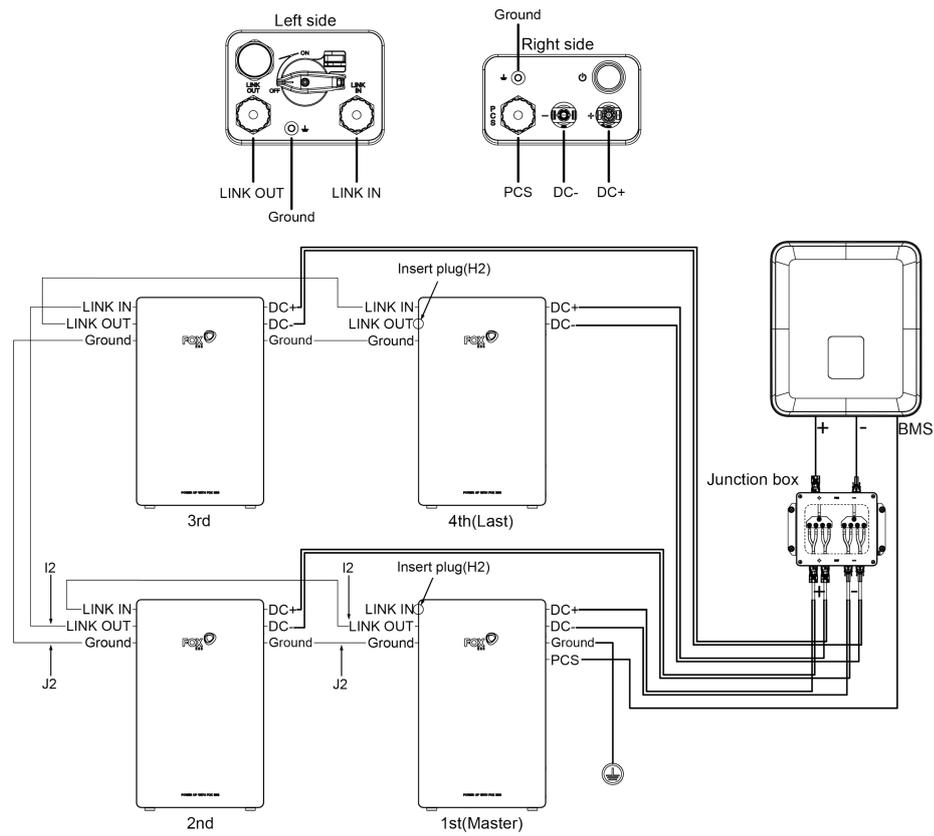
Note 1: The steps of inserting the parallel plug (H2) are as follows:



Note 2: The steps of installing the parallel communication wire are as follows:

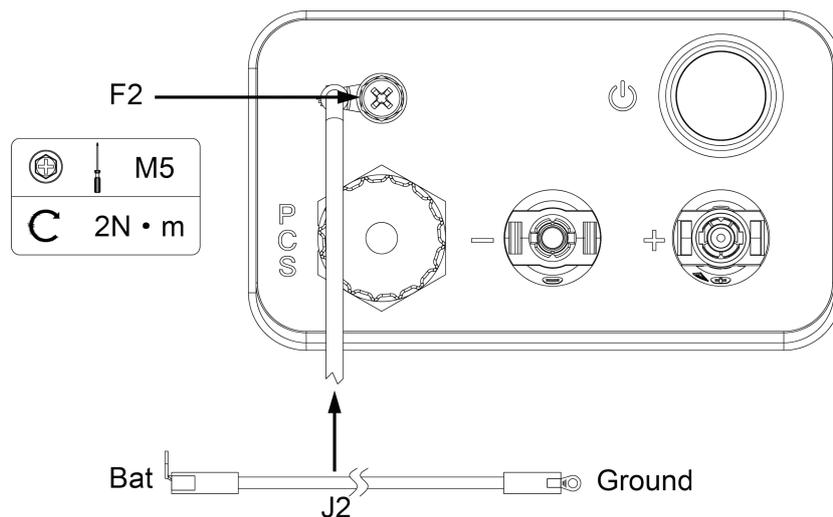


Step 2: Connect the inverter cables:

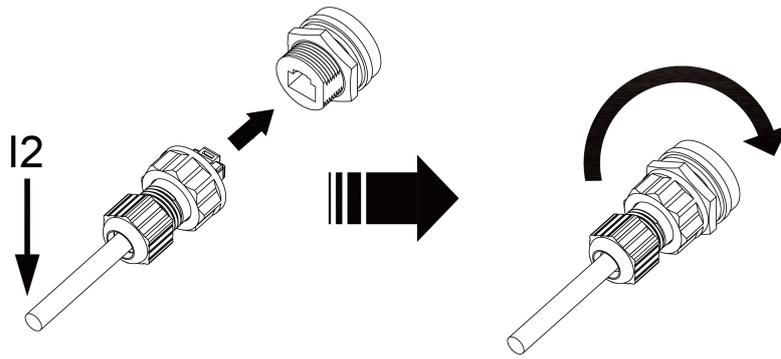


Note: Keep a distance of 300-600mm from the battery to the junction box. Power cable(K2) must be pulled straight from the battery DC+/- for more than 80mm before bending.

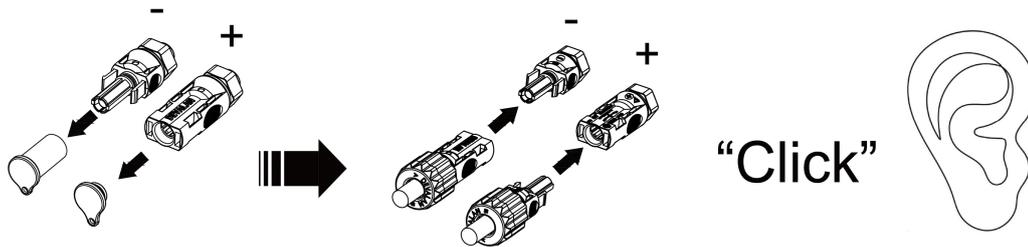
a. Connect the ground cable (J2) of the **Master** battery to the ground.



b. Connect the PCS communication cable (I2) of the **Master** battery to the BMS communication port of the inverter.



c. Connect the power cable (K2) of each battery to the junction box (need to purchase separately). Connect the output power cable of the junction box to the battery port of the inverter.



6.5 System start up preparation

- When connected to the inverter, turn on the battery first to ensure that the battery voltage output is normal, then turn on the inverter.
- All installation and operation must comply with local electrical standards.
- Check all power cables and communication cables carefully.

6.6 System start up

- Rotate the DC Switch of each battery to the “ON” position, then press and hold the Power Switch on the **Master** battery for about 3 seconds, and then release the switch.
- Each battery LED will light up and flash, indicating that the battery is powered on.

6.7 System black start

In special cases, such as when the grid and solar panels are not in use, the battery can be activated through the “Black Start” function. That means that our energy storage inverter and battery can continue to operate. The startup steps for black start is as follows:

- Press the Power Switch on the **Master** battery for 1-3 seconds (can not longer than 5 seconds), then release the switch to activate the Black Start function.
- When at least one battery's LED turns green and remains steady, and the LED of the other batteries does not turn red, it indicates that the batteries have entered normal running state.

6.8 System stop

- If user needs to stop the battery, they can press and hold the Power Switch for more than 5s until all LED flash and release it. When all LED turn off, it indicates that the system has stopped running.

Note: Do not stop the battery during charging and discharging.

7. Commissioning

There are five LED indicators to show its operating status.

Different symbols indicate different flashing modes, and the explanation is as follows:

Symbol	Status
■	LED flash display (on: 0.5S, off: 0.5S)
/	LED off display
•	LED on display

SOC status indicated by indicator:

SOC	Status	S	SOC(LED4-1)				
$100\% \geq \text{SOC} > 75\%$	Standby	■	•	•	•	•	
$75\% \geq \text{SOC} > 50\%$		■	/	•	•	•	
$50\% \geq \text{SOC} > 25\%$		■	/	/	•	•	
$25\% \geq \text{SOC} \geq 0\%$		■	/	/	/	•	
=100%	Charge	•	•	•	•	•	
$100\% > \text{SOC} \geq 75\%$		•	■	■	■	■	
$75\% > \text{SOC} \geq 50\%$		•	/	■	■	■	
$50\% > \text{SOC} \geq 25\%$		•	/	/	■	■	
$25\% > \text{SOC} \geq 0\%$		•	/	/	/	■	
$100\% \geq \text{SOC} > 75\%$	Discharge	•	•	•	•	•	
$75\% \geq \text{SOC} > 50\%$		•	/	•	•	•	
$50\% \geq \text{SOC} > 25\%$		•	/	/	•	•	
$25\% \geq \text{SOC} \geq 0\%$		•	/	/	/	•	

Fault status indicated by indicator:

Fault	S	SOC(LED4-1)			
Under voltage fault	■	/	/	/	●
Over voltage fault	■	/	/	●	/
Over temperature fault	■	/	/	●	●
Under temperature fault	■	/	●	/	/
Discharge over current	■	/	●	/	●
Charge over current	■	/	●	●	/
Reserve	■	/	●	●	●
Parallel addressing failure	■	●	/	/	/
Pre-Charge failed	■	●	/	/	●
Short circuit Protection	■	●	/	●	/
AFE communication failed	■	●	/	●	●
Module addressing failed	■	●	●	/	/
Internal communication failed	■	●	●	/	●
Power parallel failure	■	●	●	●	/
PCS communication failed	■	●	●	●	●
HVB FUSE fault	●	/	/	/	●
Current sampling fault	●	/	/	●	/
Module not match	●	/	/	●	●
Internal total voltage sampling failed	●	/	●	/	/
Temperature sampling failed	●	/	●	/	●
Relay adhesion	●	/	●	●	/
Relay Not Close	●	/	●	●	●
Relay drive failed	●	●	/	/	/
Cell "0V" fault	●	●	/	/	●
Temperature high permanent failed	●	●	/	●	/
The Single voltage high permanently failed	●	●	/	●	●
SOH low protection	●	●	●	/	/
AFE failed (UV/OV/UT/OT)	●	●	●	/	●
Charger overvoltage	●	●	●	●	/
Other fault	●	●	●	●	●

8. Exclusion

The warranty shall not cover the defects caused by normal wear and tear, inadequate maintenance, handling, storage faulty repair, modifications to the battery or pack by a third party other than manufacturer or manufacturer agent, failure to observe the product specification provided herein or improper use or installation, including but not limited to the following.

- Damage during transport or storage.
- Incorrect Installation of battery into pack or maintenance.
- Use of battery pr pack in inappropriate environment.
- Improper, inadequate, or incorrect charge, discharge or production circuit other than stipulated herein.
- Incorrect use or inappropriate use.
- Insufficient ventilation.
- Ignoring applicable safety warnings and instructions.
- Altering or attempted repairs y unauthorized personnel.
- In case of force majeure (ex: lightning, storm, flood, fire, earthquake, etc.).
- There are no warranties-IMPLIED or express-other than those stipulated herein. manufacturer shall not be liable for any consequential or indirect damages arising or in connection with the product specification, battery or pack.

9. Troubleshooting and Maintenance

9.1 Maintenance

- 1) It is recommended that the battery storage time is not more than 6 months.
- 2) Regularly check whether the service environment of the battery meets the requirements, and the installation position should be far away from the heat source.
- 3) The battery module should be stored in an environment with a temperature range between 0 °C -+35 °C , and charged regularly according to the table below with no more than 0.5 C(A C-rate is a measure of the rate at which a battery is discharged relative to its maximum capacity.) to the SOC of 50% after a long time of storage.

Storage environment temperature	Relative humidity of the storage environment	Storage time	SOC
Below 0°C	/	Not allowed	/
0~35°C	45%~85%	≤ 6 months	20%≤SOC≤50%
Above 35°C	/	Not allowed	/

NOTICE

Damage to the system due to under voltages

- Charge the over-discharged system within seven days when the temperature is above 25°C.
- Charge the over-discharged system within seven days when the temperature is below 25°C.

- 4) Every year after installation. The connection of power connector, grounding point, power cable and screw are suggested to be checked. Make sure there is no loose, no broken, no corrosion at connection point. Check the installation environment such as dust, water, insect etc.

9.2 Troubleshooting

When the S LED on the panel is flashing or normally on, it does not mean that the battery is abnormal, it may be just an alarm or protection. Please check the "Fault status indicated by indicator" in chapter 7 for the detailed faulty definition before any trouble-shooting steps. In general, the alarm indication is normal without manual intervention. When the alarm triggering state is removed, the battery will automatically return to normal use.

- Problem determination based on the following points

- 1) Whether the green light on the power switch is on;
- 2) Whether the battery system can be communicated with inverter;
- 3) Whether the battery can be output voltage or not.

- Preliminary determination steps

Battery system cannot work, When the DC Switch is turned on and the Power Switch is pressed, the LED doesn't light up or flash, please consider contact the local distributor.

- 1) The LED display of BMS is normal, but it cannot charge and discharge. Observe the display screen of inverter and there is no SOC. Please check whether the communication between BMS to inverter is well connected. If the connection is good, please replace communication cable. If the SOC is still not visible on the inverter display screen, please contact the local distributor.
- 2) After the battery system is powered on, if you can see the alarm information on the LED and inverter display screen at the same time, please contact the local distributor.

