

Installation and Operational Manual

Product Name : Energy Storage Pack

Product Model : OPAL-48100LV-ES

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Approve	Review	Proofread	Compile

Opal Energy Pte Ltd

Add: 18, Boon Lay Way, #06-107, Trade Hub 21, Singapore 609966

Tel: +65-6515-4780 **Fax:** +65-6515-4758 **Email:** info@opalenergy.com.sg

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1. Summary

1.1. Introduction

OPAL Energy Pte Ltd. (hereinafter referred to as "OPAL") is a green energy enterprise providing customized solutions and products for power lithium battery, energy storage lithium battery and lithium battery power system for global users.

Based on advanced lithium battery applications and solutions, the company has always adhered to independent innovation. With advanced lithium-ion battery module development and design capabilities, good cost control ability and reasonable market positioning, the company has laid the core competitiveness of customized service in lithium battery enterprises.

1.2. Product Commitment

OPAL is committed that its products are free of defects caused by improper materials.

1.3. Company Contact Information

Address: 18, Boon Lay Way, #06-107, Trade Hub 21, Singapore

Postcode: 609966

Tel: +65-6515-4780

Fax: +65-6515-4758

E-mail: info@opalenergy.com.sg

2. Packaging Transportation and Storage

2.1. Items in the Box

The packaging diagram and delivery list of the entire battery pack are shown in Figure 1 and Table 1 respectively.

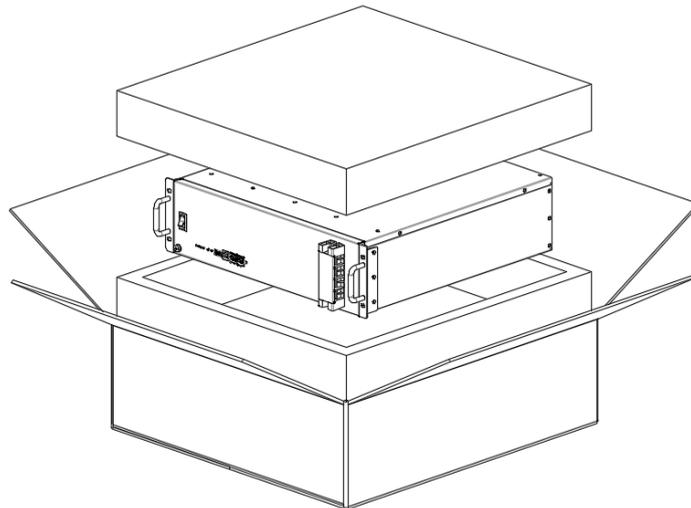


Figure 1. product packaging diagram

Table1.packing list

S.N.	Name	Legend	Specifications	Amount	Standard/Optional
1	Battery pack		OPAL-48100LV-ES	1	Standard

2.2. Transport Requirement

During transportation, the battery packing box must be placed properly and avoid strong vibration, impact and heavy pressure.

2.3. Storage Requirements

Products should be stored in a place free from rain, humidity and sun. During storage, the power of the product shall not be less than 60%.

3. Product Description

3.1. Notes

This product is made of lithium iron phosphate battery, which has the characteristics of good safety, long life, low internal resistance, and high charge and discharge efficiency.

3.1.1. Identification Definition

Table 2. identification definition

	Danger of electric shock
	Ignoring safety warnings or improper operation may result in minor injury or slight or moderate damage to equipment or property
	Do not short-circuit
	Do not disconnect or disassemble by non-professionals
	Do not place near flammable materials
	Do not place the battery near fire
	Please read the product manual before installation and use

	Keep out of reach of children, animals or insects
	Recyclable
	Do not dispose of this product with domestic waste

3.1.2. Operational Safety

For safety reasons, it is the installer's responsibility to be familiar with the contents of this document and all warnings before performing the installation.

- (1) When operating and maintaining this product, please follow the operation regulations of high voltage DC power supply, and take good personal protection measures;
- (2) Keep away from children;
- (3) Avoid touching exposed metal parts before touching the battery;
- (4) In order to prevent the accumulation of static electricity, the maintenance personnel should release the static electricity from the human body before operating the battery;
- (5) Do not place tools or metal parts on the top of the battery;
- (6) Do not step on or sit on the battery;
- (7) Do not short circuit the positive and negative electrodes of the battery directly;
- (8) It is forbidden to change the battery without authorization;
- (9) It is forbidden to cover the battery during charging and discharging;
- (10) It is forbidden to charge or discharge the battery module directly without BMS or other charging and discharging protection measures.

3.1.3. Responding to Emergencies

- (1) Electrolyte Leakage

In case of electrolyte leakage, immediately follow the following instructions;

Inhalation: evacuate the contaminated area and seek medical advice immediately;

Eye contact: Rinse eyes with running water for 15 minutes and seek medical advice immediately;

Skin contact: wash the affected area thoroughly with soap and water and seek medical advice immediately;

Ingestion: cause vomiting and seek medical advice immediately.

- (2) Battery Soaking

If the battery is immersed in water, do not continue to use.

- (3) Battery Damage

If the battery is damaged, please contact us directly.

3.2. Purpose

OPAL-48100LV-ES battery box can be used for communication base station power supply or home energy storage and other similar scenarios.

3.3. Appearance

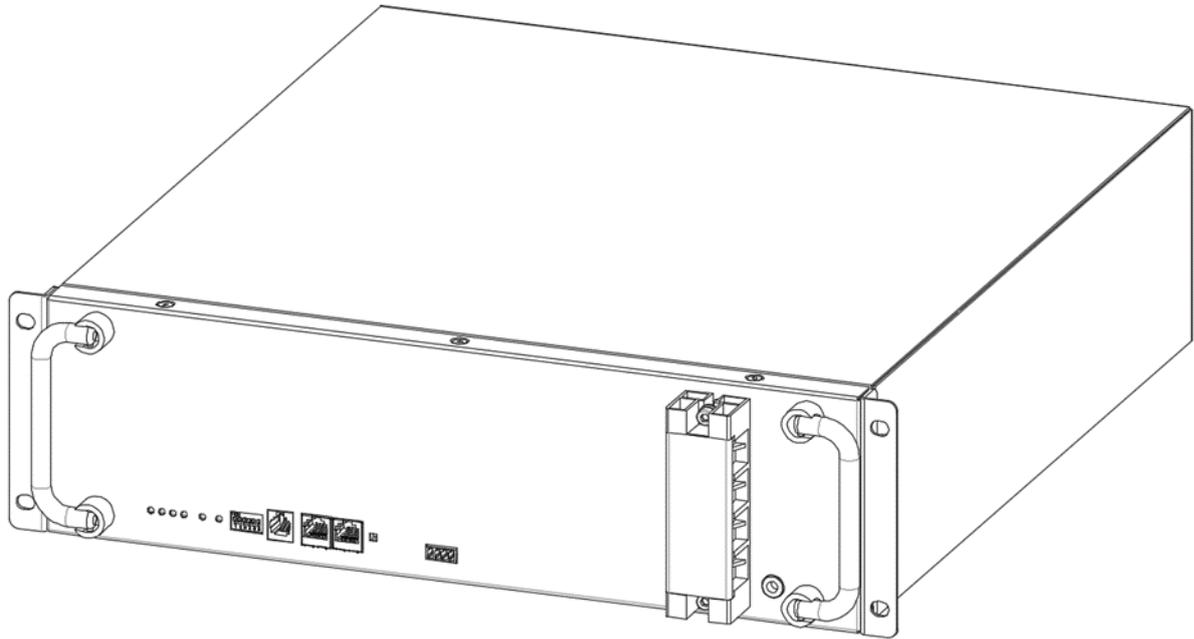


Figure 2. product appearance

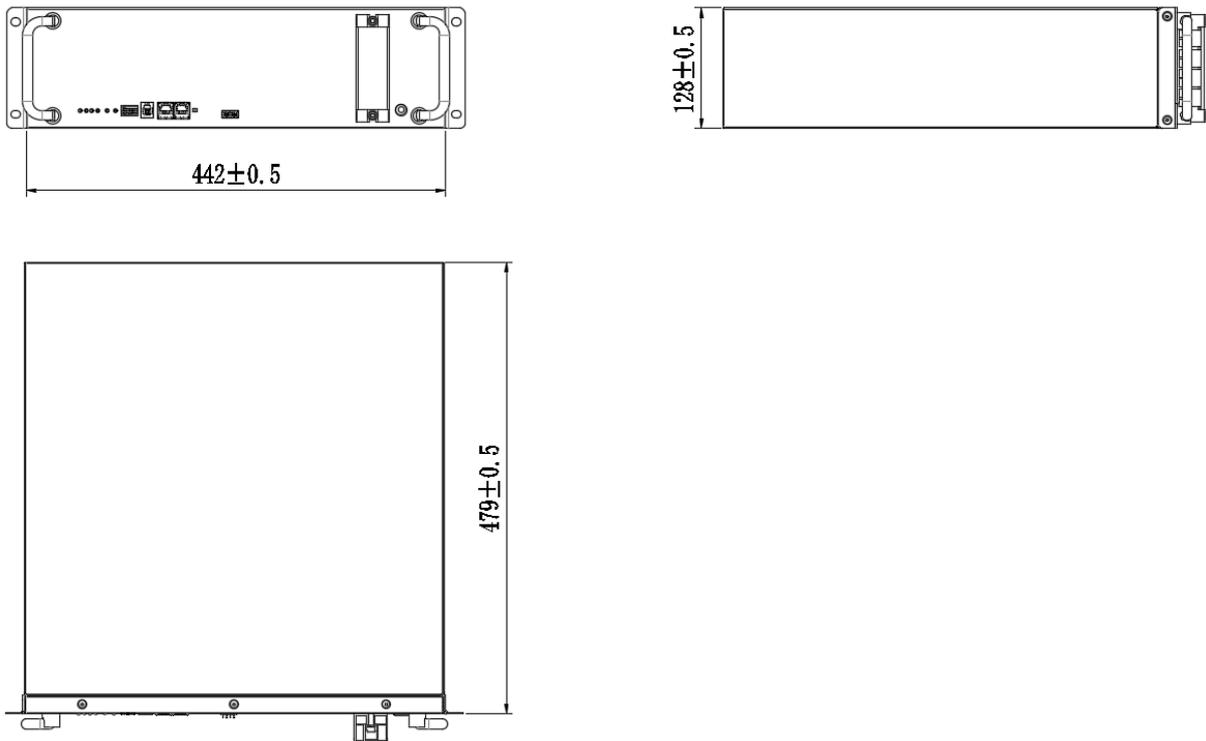


Figure 3. product size

3.4. Structure

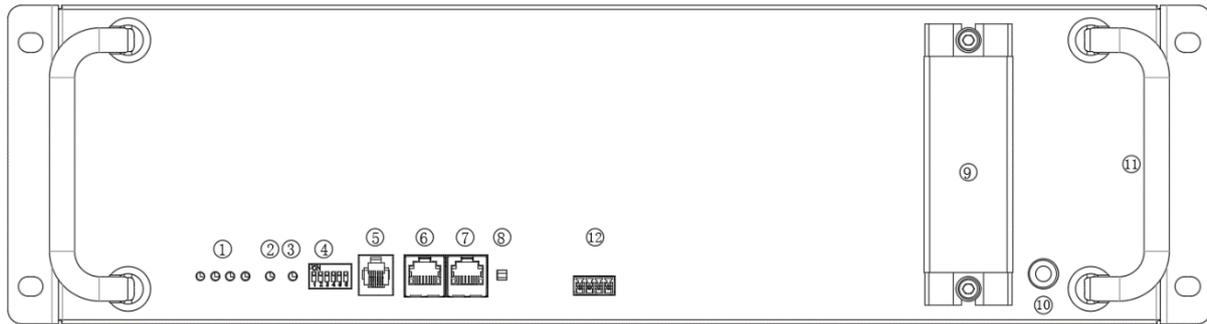


Figure 4. Product panel interface

Table 3. component table

Serial Number	Name	Label	Function Description
1	SOC indicator	/	/
2	Warning indicator	ALM	Alarm in case of battery failure
3	Operation indicator	RUN	Flashing during battery charging and discharging
4	Dial switch	ADD	Address setting for parallel connection of batteries
5	Debugging port	CONSOLE	Connect the computer
6	Communication port	CAN/RS485	CAN: Communication with inverter RS485: Battery pack cascade communication
7	Communication port	CAN/RS485	CAN: Communication with inverter RS485: Battery pack cascade communication
8	Reset switch	RST	BMS reset parameters
9	Positive and negative terminal	+/-	Battery positive and negative output
10	Grounding hole	/	For installation of grounding wire
11	Handle	/	Easy to handle battery box
12	Dry contact	DO1/DO2	Output two control signals

3.5. Electric

See the figure below for the electrical schematic diagram of battery box.

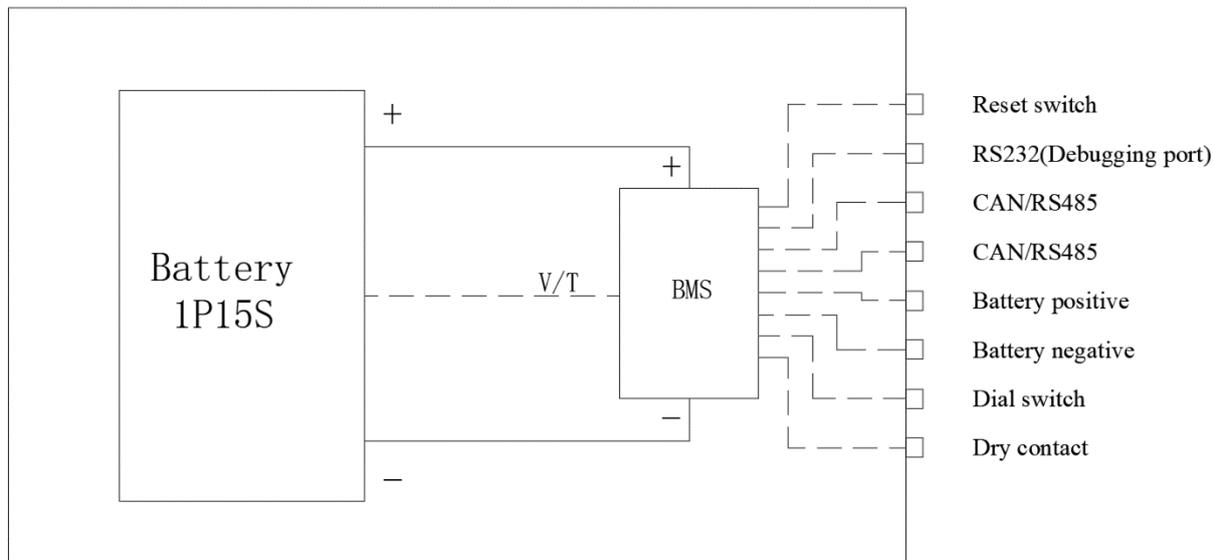


Figure 5. electrical schematic diagram of the product

Please refer to the table below for the electrical performance parameters of residential battery box:

Table 4. product electrical parameters

S.N.	Key items	Specifications
1	Type of battery	LFP
2	Cell Connection	1P15S
3	Rated voltage	48V (25°C±2°C)
4	Rated energy	4.8kWh
5	Standard charging current	50A
6	Maximum continuous charging current	100A
7	Standard discharge current	50A
8	Maximum continuous discharging current	100A
9	Battery self-discharge rate	≤3%/month (25°C, 50%SOC)
10	Cycle life	≥6,000times (0.5C/0.5C, 80%DOD)
11	Maximum Number of Parallel-connected Battery	32
12	Protection & Alarm	Protection or alarm against over over-temperature, over over-current, over over-charge, over over-discharge, short circuit, etc.
13	Network Port	CAN/RS485/2 dry contacts
14	Factory SOC state	30~40%
15	Cooling	Natural Cooling
16	Withstand voltage level	1500V DC
17	Insulation resistance	>100MΩ
18	Ingress protection	IP20

19	Altitude	<2000m
20	Range of working temperature	Charge: 0°C~55°C/ Discharge: -20°C~55°C
21	Storage temperature	-10°C~30°C
22	Relative humidity	5%~95%, RH
23	Weight	About 40kg
24	Dimensions (W*D*H)	442mm* 479mm* 128mm
25	Installation location	Indoor

3.6. Communication Function

- RS232 Communication port

RS232 interface communicate with PC or other intelligent terminals.

PIN	Signal
3	BMS TX
4	BMS RX
5	RS232_GND
1,2,6	NC

- RS485 Communication port

The BMS shall be equipped with RS485 communication interface to communicate with FSU. FSU and BMS communication mode is master-slave. FSU is the master and each BMS is the slave. BMS address 1, 2, 3 ...

The BMS provides two RJ45 communications ports. The two interfaces are physically one serial port, which are connected in BMS board. Each BMS is connected by 8-core direct connection network cable conforming to T568b standard.

PIN	Signal
1,3,6	RS485A
2,7	RS485B
8	GND

- RS485 Communication port

CAN interface communicate with Inverter. Upload battery status and fault information, accept inverter commands.

PIN	Signal
4	CAN-H
5	CAN-L
8	GND

4. Installation

4.1. Tools and Safety Protection Appliance

The following tools are required to install this product.



Wrench



Electric screw driver



Insulated gloves



Goggles



Safety shoes

When installing, moving and placing batteries, always follow the instructions in the manual, otherwise there may be safety hazards.

4.2. Structure installation

OPAL-48100LV-ES telecom battery box supports horizontal stacking, as shown in Figure.

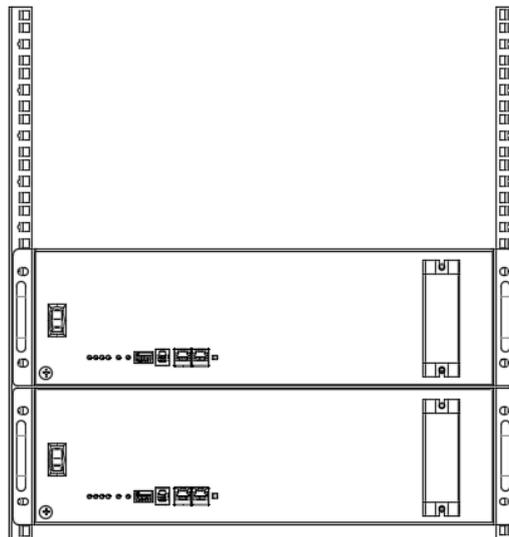


Figure 6. horizontal stacking installation diagram

Figure 7. installation & fix method

When installing, fix the mounting ears on both sides of the front panel of the battery box to the bracket or other box with M6 screws.

4.3. Electrical installation

The OPAL-48100LV-ES telecom battery box can be used alone, or multiple systems can be used in parallel, up to 31 in parallel. When connecting in parallel, the positive poles of the power line are connected in sequence, and the negative poles are connected in sequence. The communication line is connected from the “CAN/RS485” of the first battery to the “CAN/RS485” of the second battery, and the “CAN/RS485” of the second battery is connected to the " CAN/RS485" of the third battery, and so on, can connect up to 31 batteries. The DIP switch on the panel needs to set up DIP configuration address.

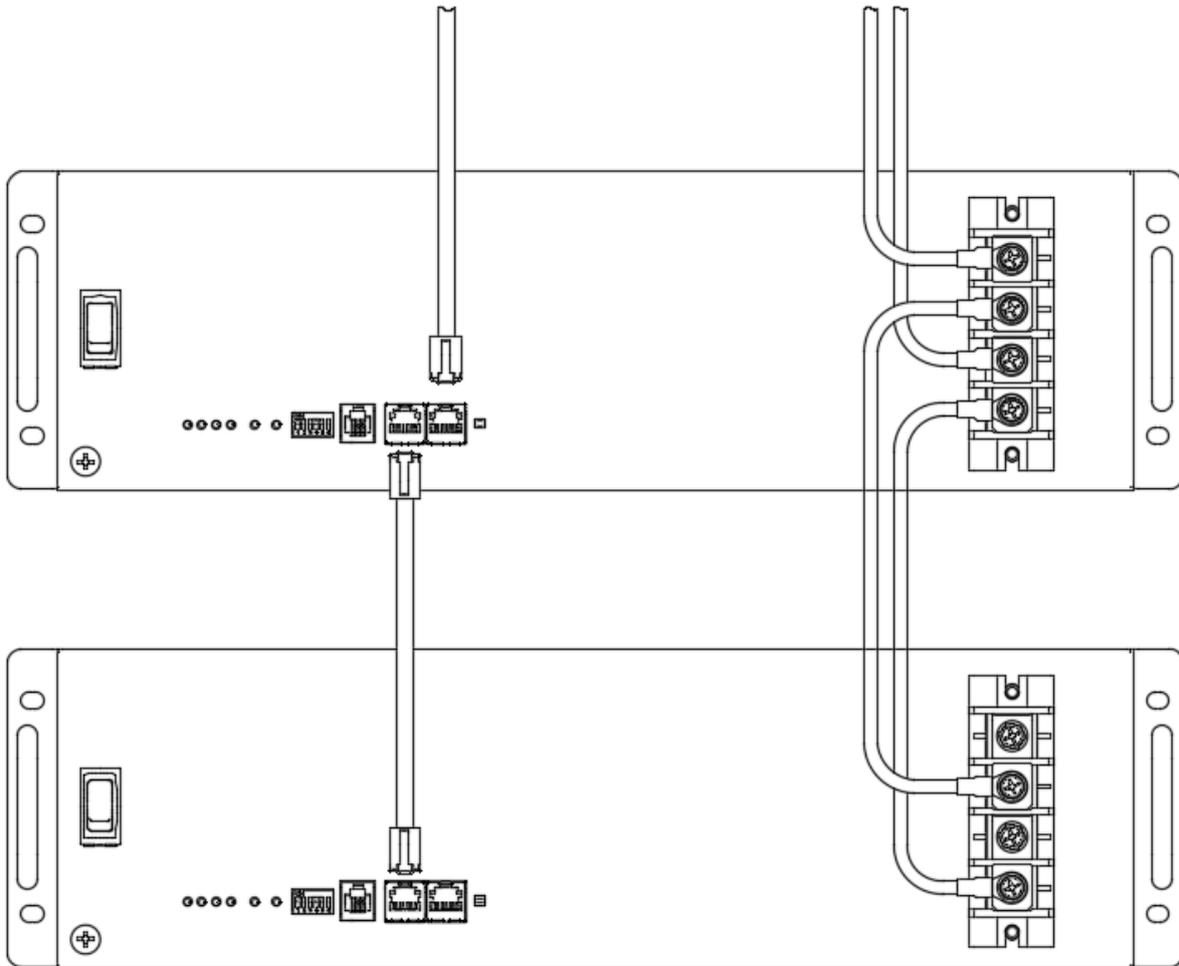


Figure 8. electrical installation diagram

The setting method of the DIP switch is as follows:

No.	Dial switch position					Explain
	1#	2#	3#	4#	5#	
1	ON	OFF	OFF	OFF	OFF	<p style="text-align: center;">31 sets in parallel</p> <p>(The dial switch has 6 bits in total, and bits 1 to 5 are address bits. The sixth bit is the matching resistance. When used in parallel, the first battery pack and the last battery pack need to dial the sixth bit up, and the sixth bit of the other battery boxes does not need to be dialed.)</p>
2	OFF	ON	OFF	OFF	OFF	
3	ON	ON	OFF	OFF	OFF	
4	OFF	OFF	ON	OFF	OFF	
5	ON	OFF	ON	OFF	OFF	
6	OFF	ON	ON	OFF	OFF	
7	ON	ON	ON	OFF	OFF	
8	OFF	OFF	OFF	ON	OFF	
9	ON	OFF	OFF	ON	OFF	
10	OFF	ON	OFF	ON	OFF	
11	ON	ON	OFF	ON	OFF	
12	OFF	OFF	ON	ON	OFF	
13	ON	OFF	ON	ON	OFF	
14	OFF	ON	ON	ON	OFF	
15	ON	ON	ON	ON	OFF	
16	OFF	OFF	OFF	OFF	ON	
17	ON	OFF	OFF	OFF	ON	
18	OFF	ON	OFF	OFF	ON	
19	ON	ON	OFF	OFF	ON	
20	OFF	OFF	ON	OFF	ON	
21	ON	OFF	ON	OFF	ON	
22	OFF	ON	ON	OFF	ON	
23	ON	ON	ON	OFF	ON	
24	OFF	OFF	OFF	ON	ON	
25	ON	OFF	OFF	ON	ON	
26	OFF	ON	OFF	ON	ON	
27	ON	OFF	OFF	OFF	ON	
28	OFF	OFF	ON	ON	ON	
29	ON	OFF	ON	ON	ON	
30	OFF	ON	ON	ON	ON	
31	ON	ON	ON	ON	ON	

The default address 1 is the host. Please set the battery dial switch connected to the load or inverter to 1, and set the other batteries in sequence.

5. Operating

5.1. Power on

Before powering on, make sure that the communication and positive and negative cables are correctly connected, and there are no foreign objects around the battery.

Boot steps:

- Press and hold the system reset switch for 3 seconds, and all indicators on the panel flash once, indicating that the power on is successful.;

5.2. Shutdown

Before disconnecting the cable from the battery, make sure the battery is turned off.

Shutdown steps:

- Press and hold the system reset switch for 3 seconds, and all indicators on the panel flash once and turn off, indicating that the shutdown is successful.;

6. Maintenance

- Battery maintenance must be performed by qualified authorized personnel;
- If the battery has been stored continuously for more than three months, it must be fully charged once;
- Every three months, check whether the connections of battery communication and power cables are loose.

7. Troubleshooting

Table 5. common problems

S.N.	Key items	Specifications
1	Communication failure	Check whether the communication line is loose, and check whether the BMS communication protocol matches the load or inverter.
2	Unable to boot	Use a charging device to charge the battery. If it still cannot be turned on, please contact for maintenance.

8. Interpretation of Abbreviated Words

FPC	Flexible printed circuit
BMS	Battery management system
BMU	Battery management unit
BOL	Begin of life
Bus-bar	Connection bar between cell poles
CAN	Controller area network
EOL	End of life
HV	High voltage
LV	Low voltage
OCV	Open circuit voltage
SOC	State of charge