



User Manual

LifePO4 Battery

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Manual Description

Content Description

Marvel LiFePO₄ Battery Energy Storage System is an external battery system that provides power for the home power supply system. When the mains or photovoltaic power supply is normal, it is converted by the inverter to supply power to the household load and charge the battery; The household load provides uninterrupted power supply to ensure the normal operation of household electricity; when the mains (or photovoltaic) is turned on again, the battery pack is charged while the power supply to the household load is restored.

This manual systematically expounds the working principle, basic structure, operating parameters, operation, installation and maintenance of LiFePO₄ Battery Energy Storage System. The main contents are as follows:

Chapter	Abstract
Chapter 1 Overview	The chapter systematically expounds the background, application and characteristics of LiFePO ₄ Battery Energy Storage System.
Chapter 2 Structure and Principles	This chapter focuses on the structure and working principle of LiFePO ₄ Battery Energy Storage System.
Chapter 3 Product Parameters	This chapter introduces the system parameter design of LiFePO ₄ Battery Energy Storage System
Chapter 4 Installation and Commissioning	This chapter introduces the installation, debugging process and precautions of LiFePO ₄ Battery Energy Storage System.
Chapter 5 Transportation, Use and Maintenance	This chapter mainly introduces the transportation, usage requirements, operating status description and common troubleshooting of LiFePO ₄ Battery Energy Storage System.

Safety Notice

Installation, operation and maintenance of LiFePO₄ Battery Energy Storage System with wall mounted type should only be carried out by trained and qualified professionals. Before installation and use, please read the safety precautions and related operating procedures of this product carefully, otherwise it may cause personal injury or product damage. The precautions mentioned in this manual belong to the precautions under normal circumstances. If you find any special use environment or use conditions, please contact the technical support of Marvel to solve it.

Common Symbols

 Safety Notice	 Do not throw into fire
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RECYCLE



Do not throw away

Precautions



Safety Notice

Please read carefully and install and use the battery in accordance with the following terms. Improper installation and use of the battery may cause personal injury or damage to the product.

1. It is strictly forbidden to immerse the battery in water. When not in use, it should be placed in a cool and dry environment.
2. It is strictly forbidden to put the battery into fire or heat it from outside to avoid explosion or other danger.
3. When charging, please use the special charging and rectifying power supply module for communication iron lithium battery, and follow the correct instructions for use. Do not configure the charger for the battery pack without authorization.
4. It is strictly forbidden to reverse the positive and negative poles of the battery, it is strictly forbidden to connect the battery directly to the power socket, and it is forbidden to short-circuit the positive and negative poles of the battery.
5. Do not mix batteries of different manufacturers or different types and types, as well as old and new batteries.
6. The embedded BMS in the battery is designed for 48V DC, please DO NOT connect the battery in series;
7. Do not charge or discharge hot, swollen, deformed or leaking batteries into the device.
8. It is forbidden to pierce the battery with nails or other sharp objects, and it is forbidden to throw, trample, knock, hit the battery, etc.
9. It is forbidden to disassemble and disassemble the battery and components, but the company will not be responsible for any damage caused by unauthorized disassembly or repair.



Warning

10. The battery has been strictly inspected before leaving the factory. If the customer finds that the purchased battery has symptoms such as heat, swelling or peculiar smell, please do not use it and return it to the factory immediately.
11. When storing for a long time, in order to ensure the best performance of the battery, the battery should be charged and discharged once every three months, and the battery should be stored with 50%~60% of the power.
12. Please use the battery within the temperature range specified in the specification.
13. The product is in a half-charged state when shipped, and users should fully charge it before using it.

1. Overview

1.1. Background and Applications

In recent years, with the rapid development of lithium-ion battery technology, the pace of lithium-ion batteries replacing traditional lead-acid batteries is gradually accelerating in various power fields. Compared with traditional lead-acid batteries, lithium-ion batteries have the advantages of high energy density, small size, light weight, long life, and wide operating temperature range, especially the comprehensive advantages of lithium iron phosphate batteries with lithium iron phosphate as the positive electrode material protrude. At present, the technology of lithium iron phosphate battery is becoming more and more mature, the cost is gradually rationalized, and it is gradually becoming the mainstream high-end home power supply solution.

Marvel closely follows the market demand and is the first to develop a home energy storage lithium-ion battery system. The system includes a high-energy lithium iron phosphate battery and an intelligent management system to achieve high integration and intelligent management, and can match many inverter brands in the market to achieve efficient conversion of electricity.

1.2. Advantages

- ✓ The positive electrode material of the battery is lithium iron phosphate (LiFePO₄) material, which has good safety performance, has a cycle life of more than 6,000 times.
- ✓ The high-performance intelligent management system is adopted to realize comprehensive state control of battery charging, discharging, floating charging and hibernation, and multi-level protection is set for voltage, current, temperature, etc., so that the battery is always in an ideal state.
- ✓ It has a comprehensive monitoring system to monitor the voltage, current, temperature, capacity and working status of the battery.
- ✓ The system adopts an intelligent design method to meet the four remote control standards of the national standard: telemetry, remote signaling, remote control, and remote adjustment.
- ✓ Built-in intelligent balance module to ensure the capacity consistency of the battery pack during long-term use and prolong the service life.
- ✓ The control panel includes status display and alarm devices, which can visually see the working status and alarm information of the battery.
- ✓ The system has its own intelligent thermal management device, which can work in a wide temperature range.

2. Principle and Structure

2.1 Operating Principle

Working principle for Residential Lifepo₄ Battery Energy Storage System: Connect battery pack in parallel to the DC output end of the inverter of the energy storage device. When the mains power supply is normal, the inverter module works normally to supply power to the equipment (the load in the figure) and charge

the battery pack; when the utility power and photovoltaic power are cut off, the battery pack provides uninterrupted power supply to the inverter to ensure the normal operation of household electricity; When power is turned on again, the battery pack is charged while power is restored to the household loads.

2.2 Connection Structure

The connection diagram of residential lifepo4 battery energy storage system is shown in Figure 1 below:

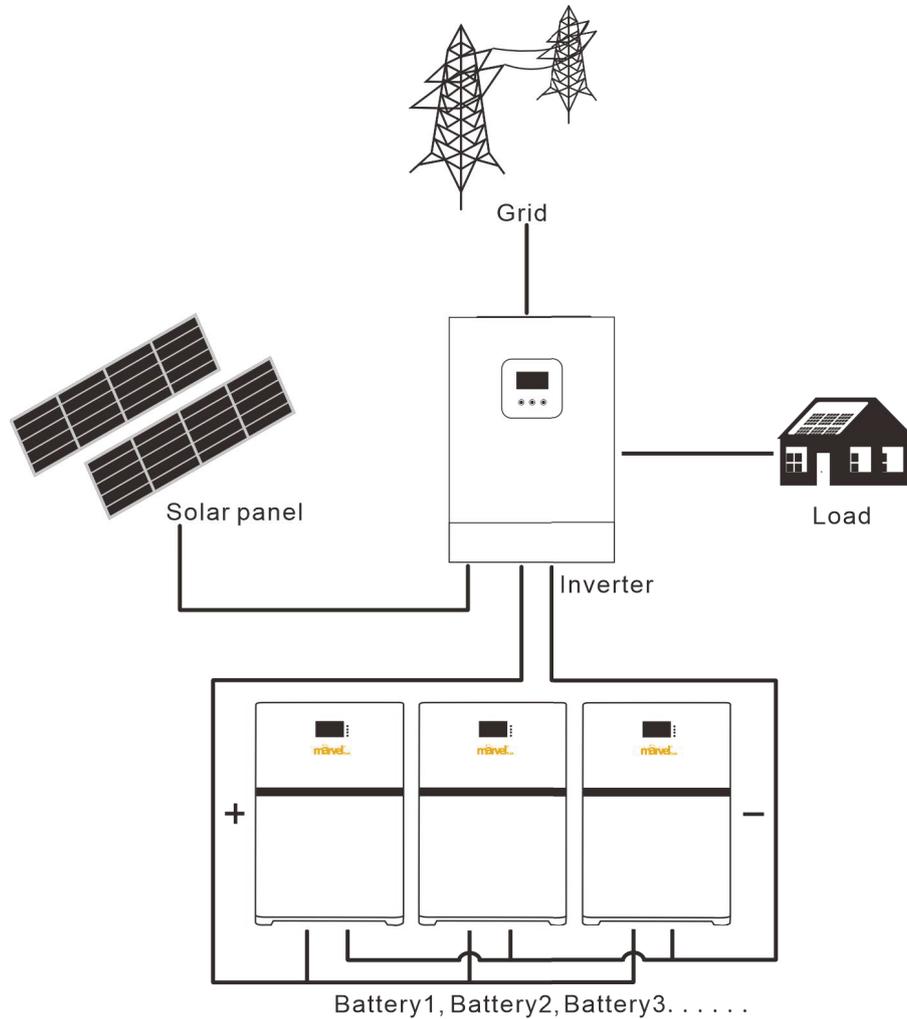


Figure 1 Operation Principle Diagram of Battery System

3. Parameters

3.1. Product Model

The technical parameters of LiFePO4 Battery Energy Storage System are shown in Table 1 below:

Table 1 Product List

Items	25.6V200Ah	48V100Ah	51.2V200Ah
Rated Voltage (V)	25.6	48	51.2
Nominal capacity (Ah)	200	106	200
Energy (kWh)	5.12	5.09	10.24

3.2. Control Panel

LiFePO4 Battery Energy Storage System adopts the same control panel structure as Figure 2,



Figure 2 Control Panel Illustration (Reference Picture)

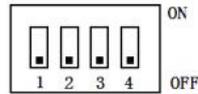
Remark: All LiFePO4 battery energy storage system with wall mounted type, different panel place, LCD display shown in battery pack have same functions.

Table 2 Control Panel Interface

No.	Item	Function	Remark
1	Ground Mat		optional
2	Positive Terminal	Battery external positive output port	
3	Negative Terminal	Battery external negative output port	
4	RST Button	Emergency system reset to ensure system maintainability	Press for 1-3 seconds and release
5	RUN & ALM	Green LED is lighting during normal operation Red LED is lighting during abnormal operation	
6	SOC Display Lighting	Battery capacity display	
7	Dry Contact	Dry contact communication	Dry contact 1-PIN1 to PIN2: normally open, closed in fault protection; Dry contact 2-PIN3 to PIN4: normally open, low battery alarm closed.
8	ADS (or ID)	Address location definition during system expansion application	Refer to Table 3
9	Communication interface	RS485、CAN	B-RS485 to 485 port of the inverter C-CAN to CAN port of the inverter
	RS232	1. Monitor battery and parameter changes 2. Perform software upgrade.	Tools required: 1. 232 computer monitoring software 2. Upgrade software and upgrade program 3. Computer and USB to 232 communication line
10	LCD Display Screen	Battery information display	
11	Function Buttons	ON/OFF, and other buttons	
12	GND	Switch button	It can be turned off when not in use to reduce power consumption

3.3. ADS Dial Definition

Table 3 ADS DIP Address Assignment Instructions

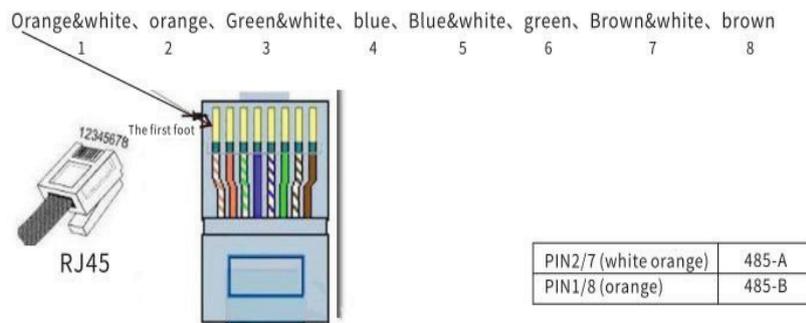


ADS	Dial Switch Position			
	#1	#2	#3	#4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Note: The lithium battery that communicates with the inverter is the master by default, the dial code is 1, and the other parallel batteries are slaves.

3.4. RS485 & CAN Port Definition

3.4.1. Definition of RS485A port (default baud rate 9600bps) for communication between the battery and the inverter.



3.4.2. Definition of CAN port (default baud rate is 500K) for communication between the battery and the inverter.



Note: Instructions for battery and inverter communication: choose one of 485 or CAN.

3.5. Battery Parameters

Table 4 Battery Parameters

NO.	Items	Sub-Items	Parameters			Remark	
			25.6V106Ah	48V106Ah	51.2V106Ah		
1	Voltage	Charging	Single cell charging over-voltage protection	3.7V			Release below 3.5V
2			Battery pack of charging over-voltage protection	29.2V	54.75V	58.4V	52.5V/56V release
3		Discharging	Single cell discharge low voltage protection	2.7V			Release above 3.0V
4			Battery pack of discharge low voltage protection	21.6	40.5V	43.2V	Release above 45V
5	Current	Charging	Alarm value	100-105			Delay 5s protection
6			Over-current Protection 2	>110A			Delay 1s protection
7		Discharging	Over-current Protection 1	110A			1s delay
8			Over-current Protection 2	150A			100ms delay
9			Short circuit protection	Yes			100ms delay
10	Temperature	Cell	Charge and discharge	Charging temperature range: - 5°C~65°C			Delay 1s~3s to confirm

			temperature range	Discharge temperature range: - 20°C~70°C	temperature protection
11	Ambient	Charge and discharge temperature range		Charging temperature range: - 5°C~65°C	
				Discharge temperature range: - 20°C~70°C	
12	PCB	Operating temperature range		Below 85°C	

4. Installation Steps

4.1. Installation Preparation

Safety Regulations

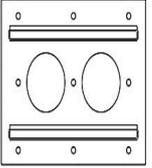
The installation, operation and maintenance of LiFePO4 Battery Energy Storage System should only be carried out by trained and qualified professionals. Before installation and use, please read the safety precautions and related operating procedures of this product carefully. The installation process must strictly abide by the following safety regulations and local safety regulations, otherwise it may cause personal injury or product damage.

- ✓ Please ensure that the inverter connected to the battery is a qualified power system;
- ✓ When installing the battery, please ensure that the power system is turned off and the battery pack is turned off;
- ✓ All power-saving cables must have corresponding insulation measures, and it is strictly forbidden to expose the power cord;
- ✓ Ensure that the battery and the power system are reliably grounded during installation.

4.2. Product & Accessories List

Product and accessories list inspection: after receiving the goods, you need to visually inspect the packaging first. If there is any damage to the external packaging or missing accessories, please contact the supplier in time.

Table 5 List

No.	Picture	Name	Qty.	Remark
1		LiFePO4 Battery	1 pcs	
2		Mounting brackets	1 pcs	
3		Expansion screw bolt	9 pcs	M8*60
4		Power cables	2 pcs	Connect the inverter and the battery
5		RS232 communication cable	1 PCS/wooden box	Monitoring battery and software upgrade
6		Category 6 network cable	1 pcs	Connect the inverter and the battery
7		User Manual	1 pcs	

4.2.1. Installation Environment Requirements

The required environmental conditions are shown in Table 6 below.

Table 6 Use Environment Requirements

Items	Description
Site Choose	1.The installation location must be compatible with the size and weight of the lithium battery. 2.Must be mounted on a solid wall to withstand the weight of the battery
Operating Temperature	1. Recommended best operating temperature: 0°C~+45°C 2. It is forbidden to expose to harsh temperatures,which may affect battery pack performance and lifespan
Storage Temperature	The recommended best storage temperature is 25°C
Relative Humidity	45%~85%, recommended: 45%~60%
Atmospheric Pressure	86kPa~106kPa
Site Requirements	1. There is no conductive dust and corrosive gas, no explosion hazard, no vibration and bumps. 2. Keep away from heat,open flames, the water. 3. There is less dust and dirt in the area

4.2.2.Tools Prepared

The tools may be used are shown in Table 7 below.

Table 7 Tools List

No.	Items	No.	Items
1	Installation and Instruction Manual (User Manual)	7	Diagonal cutting pliers
2	Screwdriver (slotted, cross)	8	Multi-meter
3	Wrench	9	Clamp meter
4	Needle nose pliers	10	Insulation tape
5	Wire stripper	11	Anti-static bracelet
6	Wire pliers	12	Cable ties

4.2.3. Other Requirements

Space Distance Requirements around battery installation

Table 8 Space Distance Requirements

Direction	Mini. Clearance (mm)
Upside	200
Downside	300
Both Sides	200
Front Side	300

4.3. Installation Steps

4.3.1. Cautions

When begin to install the battery system, you should pay attention to the following matters:

- ✓ Installation space and load bearing. Make sure that there are sufficient fixed components to install the battery system, and to ensure that the battery mounting bracket or the cabinet be strong enough to bear the weight.
- ✓ Cable specifications. To ensure that the use of the connection of the power supply line can meet the maximum current requirements of equipment operation.
- ✓ Project layout. Ensure the whole construction process of power equipment, batteries and other reasonable layout.
- ✓ Wiring layout. Ensure that the wiring reasonable, orderly; and consider the moisture-proof, corrosion prevention.
- ✓ The whole installation process should wear anti-static wristband.
- ✓ The installation site should be at least two or more peoples to operate.



CAUTIONS: *Please ensure the installation site safe before installation.*

4.3.2. Installation Steps

The battery installation steps are shown in Table 9 below:

- ✓ Select a suitable solid wall with a thickness greater than 150mm;
- ✓ Refer to the fixing distance of the mounting bracket bolts, and mark the hole position on the wall;
- ✓ Drill 9 holes according to the hole position, the depth is ≥ 80 mm;
- ✓ Mount the M8 expansion bolts in the upper holes and screw on the nuts;
- ✓ Fix the mounting bracket on the wall with expansion bolts;
- ✓ Under the condition of keeping the battery vertical, raise the battery to a position slightly higher than the mounting bracket, and hang the battery on the mounting bracket.

Table 9 Installation Steps

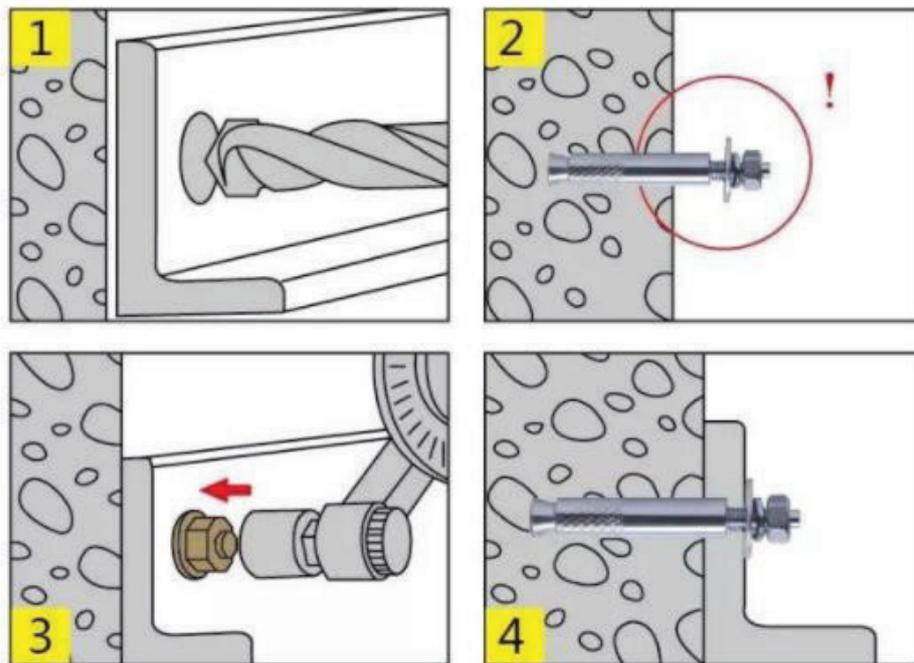
Step No.	Name	Definition
1	Turn off power supply	The system should be powered off, to ensure that there is no electric in installation process
2	Mechanical installation	1. Mounting lugs installation
		2. Battery fixed installation
3	Electrical installation	1. Grounding cable
		2. Power cable installation
		3. Connecting equipment installation
		4. Communication cable installation
4	Electrical commissioning	Power system commissioning

Step 1. Interruption Of Power Supply

Before installation, please ensure the battery is powered off, at the same time, shutdown the equipment which need to connect to the battery.

Step 2. Machinery Installation

1. Installation of the mounting bracket. The device is packaged with an attached mounting wall bracket. Before installing the battery, fix the mounting bracket on the wall to ensure that the installation is tight.
2. Fixed battery installation. Secure the battery module to the mounting bracket to ensure that the battery pack is securely installed.
3. Expansion bolt installation diagram.



Notice:

1. In order to avoid electric shock or other injuries, check whether the existing electronic plumbing installation is compliant before drilling;
2. The battery is heavy, please handle it with care, so as not to damage the product or injure the installer;

Step 3. Electrical Installation

1. Grounding cable. The grounding cable end with screw press-fit fixation in the chassis rear grounding hole, the other end is connected to the frame (or cabinet) grounding copper bar. To ensure the stable connection.
2. Power cord installation. When using a single battery, the terminal of the battery is directly connected to the terminal of the device or switching power supply. If multiple batteries are used in parallel, first use the power cord to connect the batteries in parallel.
3. Communication cable installation. When the battery is used in a single, please skip this step. When a plurality of batteries used in parallel according to Table 3, please dial settings for each battery pack address code (to ensure that no duplicate address code), and then connect the communication interface of RJ45-RS485 one by one(or CAN port). Connect the first or last battery module RS485 interface(or CAN port) to the inverter



CAUTIONS: *If there is any problem during installation, please contact Marvel in time to avoid damage to the equipment or cause safety accidents.*

4. Communication cable installation. When using the battery alone, skip this step. When multiple batteries are used in parallel, please set the address code of each battery according to Table 3 (make sure there is no duplicate address code), and then cascade the RS485 communication interfaces. The cascade sequence is the left side of

the battery pack with the lower address bit The RS485 interface is connected to the interface on the right side of the high address bit, and the RS485 interface on the left side of the highest-order Master battery is connected to the serial port of the computer through a communication adapter cable (RS485 to RS232).

Step 4. Electrical Commissioning

When these steps are completed, turn on switch to start the battery one by one, then boot on the whole power system, complete the installation.

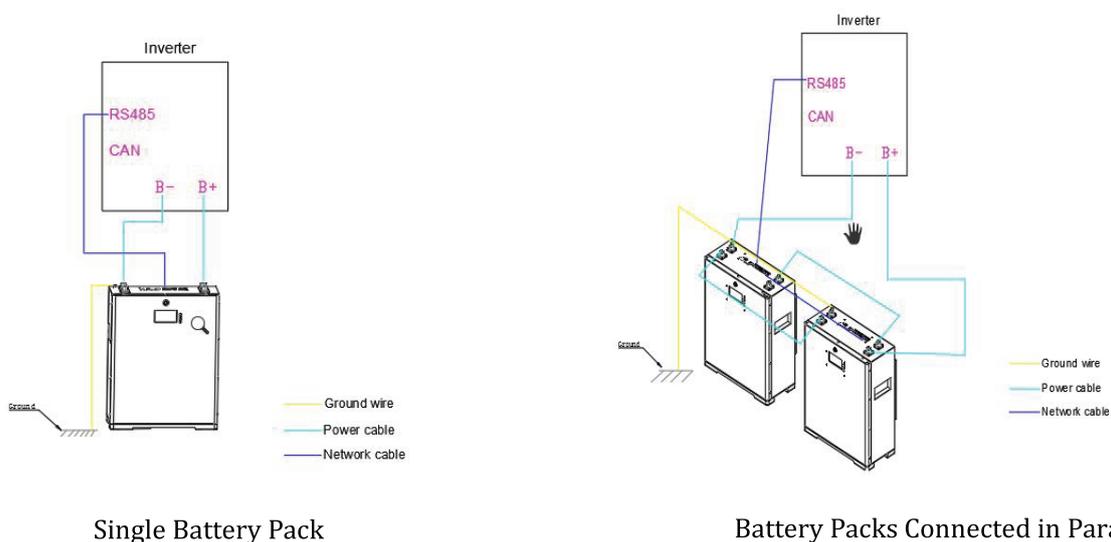


CAUTIONS : *If you have any question about the installation, please stop and contact Marvel technical support immediately. If the battery does not start or control panel ALM lights, please disconnect the power line inspection and reinstall the start, if still cannot solve, please contact Marvel, avoid damage to equipment or cause accidents.*

4.4. Easy & Fast Guideline for Installation Steps

- ✓ Detect whether the installation of the battery, the inverter and the wire slot is firm and safe;
- ✓ Make sure that the installation equipment is powered off and the installers wear appropriate work clothes;
- ✓ Insert one end of the power cable (yellow) into the positive (+) terminal (yellow) of the battery, and connect the other end with the OT terminal to the battery B+ interface of the inverter;
- ✓ Insert one end of the power cable (black) into the negative (-) terminal (black) of the battery, and connect the other end with the OT terminal to the battery B- interface of the inverter;
- ✓ Insert one end of the network cable into the 485A or CAN interface of the battery, and connect the other end to the 485A or CAN interface of the battery corresponding to the inverter;
- ✓ Start the battery switch (ON/OFF) button;
- ✓ Start the inverter switch.

Schematic diagram of battery and inverter connection:



Note:

(1) The communication interface needs to be one-to-one correspondence. For the definition of battery 485 and CAN communication interface, refer to 3.1 and 3.2. For the inverter 485 and CAN communication interface, please refer to the inverter operation manual. If the communication interface is inconsistent, it will cause communication failure;

(2) Wiring for photovoltaic and AC input and load power output should be done in accordance with local safety regulations;

(3) The battery contains a variety of inverter protocols. The default protocol of the battery is Pylon (V3.5) protocol, and other corresponding inverters can be selected through the 232 host computer;

(4) The battery that communicates with the inverter is the master, the ADS dial code is 1, and the others are slave machines, the dial code is 2-15, you need to dial the code before starting the battery.

5. Transportation & Storage& Maintenance

5.1. Transportation and Storage

Transportation

According to the provisions of the product can be used in general means of conveyance, but should avoid throwing, rain fall, strong radiation and corrosion erosion. during transportation, please prevent the collision and strong vibration.

Storage

When the storage equipment is stored indoors, the ambient air temperature can be 0°C to +30°C, the average monthly humidity is not more than 90%, and there is no corrosive, flammable and explosive gas in the surrounding air; the storage warehouse should be ventilated and free of alkali, no strong mechanical vibration, shock, strong electromagnetic field and direct sunlight. The battery is stored at around 50% to 60%, and the battery should be recharged after three months.

5.2. Alarm & Disposal

When the ALM light on the control panel of the battery case is on, it means that the battery has given an alarm or has been protected. Please check the cause of the fault through the computer and take corresponding measures, or go directly to the site to troubleshoot. The following table 10 is the main alarm situation.

Table 10 Alarm and Protection

State	Type	Indicator	Disposal
Charging	Over voltage protection	ALM	Stop charge, check module voltage and charger
	Over current protection	ALM	Stop charge, check the settings and limitation
	Temperature protection	ALM	Stop charge, wait for the temp recovery
Discharging	Low voltage protection	ALM	Stop discharge, turn to charging mode
	Over current protection	ALM	Stop discharge, check if there is an over load
	Temperature protection	ALM	Stop discharge, wait for the temp recovery

5.3. Common faults and Solutions

Common faults and solutions are shown in Table 11.

Table 11 Common Faults and Solutions

No.	Fault Phenomenon	Analysis	Solutions
1	No DC output	Low voltage protection	Charge the battery and try again
2	Power supply time is too short	Battery capacity lack or not full power	Maintenance or replacement
3	Battery can not be charged to full	Power system DC output voltage falls below the minimum charge voltage	Regulating DC output voltage of power supply to battery suitable charging voltage
4	ALM LED always lights	Power line connection short circuit	Disconnect the power cable and check all cables
5	The battery output voltage is unstable	Battery management system do not operate normally	Press the reset button to reset the system, then reboot the system
6	Communication lost or data fault	Communication settings fail	Check the communication settings and correct it



CAUTIONS: *If you have some special technical problems which not mentioned above, please contact Marvel technical staff.*

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