# Rack Mounted Lithium-ion Battery Pack

## Energy Storage Application

# User Manual

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# FOREWORD

## Overview

This manual describes product introduction, installation, use, maintenance, etc. Please read this manual before installing the battery and follow the instructions carefully during installation. If there is any confusion, please get in touch with the vendor immediately for advice and clarification.

## Readers

This document provides technical details regarding the tools and infrastructure used by the following users:

- Sales engineer
- Technical support engineer
- Installation engineer
- Application engineer
- Maintenance engineer

## Manual Lost

If you lose the manual, please contact the vendor’s customer service center for the electronic files.

# Symbol convention

The following symbols may appear in this article, and they are represented as follows:

| Symbol | Indication |
|---|---|
|  Dangerous | Used as warning in an emergency, if not avoided, it will result indeath or serious personal injury. |
|  Warning | Used as a warning of a middle or low potential hazards, if notavoided, it may cause minor or normal injury. |
|  Caution | Used as a warning of potential dangers, if ignore this information,it may result in equipment broken, data lost, equipment performance decrease and other unpredictable result. |
|  INTRO | Represents the supplement information of main text to emphasizeor replenish. |

# General Warning, Dos and Don’ts

a. It is important and necessary to read the user manual carefully (in the accessory pack) before installing or using the battery. Failure to do so or to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death, or can damage the battery, potentially rendering it inoperable.

b. If the battery is stored for a long time, it is required to charge it every six months, and the SOC should be no less than 80%.

c. All the battery terminals must be disconnected for maintenance.

d. Lithium batteries are heavy. To prevent muscle strain or back injuries, always use lifting aids and proper lifting techniques when installing or removing them.

e. In the event of a vehicle accident, lithium batteries can become projectiles. Ensure they are securely mounted and always use appropriate handling equipment during transportation.

f. Handle lithium batteries with care, as they are sensitive to mechanical shock.

g. Exposure to water can severely damage the battery. If this occurs, stop using the battery immediately and seek further guidance.

h. Please contact the supplier within 24 hours if there is something abnormal.

a. Do not attempt to open or disassemble the battery. The electrolyte inside is highly corrosive. Under normal operating conditions, contact with the electrolyte is not possible. However, if the battery casing is damaged, avoid touching any exposed electrolyte or powder, as they are corrosive.

b. Do not expose the cable outside.

c. Do not connect the power terminal reversely.

d. Do not use cleaning solvents to clean the battery.

e. Do not expose the battery to flammable or harsh chemicals or vapors.

f. Do not paint any part of the battery, including any internal or external components.

g. Do not connect the battery with PV solar wiring directly.

h. Do not use a battery that is damaged.

i. Any foreign object is prohibited from being inserted into any part of the battery.

j. Battery needs to be recharged within 12 hours, after fully discharged. Do not install in an environment outside of the operation temperature or humidity range listed in the manual.

# DIRECTORY

## Contents

# 1 OVERVIEW

## 1.1 Product specification

The model of integrated lithium-Ion battery (hereafter referred to as lithium battery or PACK) for Rack-Mounted is shown in figure 1-1-1.

1-1-1 The explanation of the product specification (For example)

**L R – 51.2 100**

① ② ③ ④

① L represents LFP

② R stands for Rack-Mounted

③ The voltage is 51.2 V

④ The capacity is 100Ah

## 1.2 Product profiles

LR series lithium iron phosphate battery is one of new energy storage products developed and produced. It can be used to support reliable power for various types of equipment and systems. Especially suitable for application scene of high power, limited installation space, restricted load-bearing and long cycle life.

LR series lithium iron phosphate battery has built-in BMS battery management system, which can manage and monitor cells information including voltage, current and temperature. What's more, BMS can balance cells charging and discharging to extend cycle life. Multiple batteries can connect in parallel to expand capacity and power in parallel for larger capacity and longer power supporting duration requirements.

# 1.3 Product structure

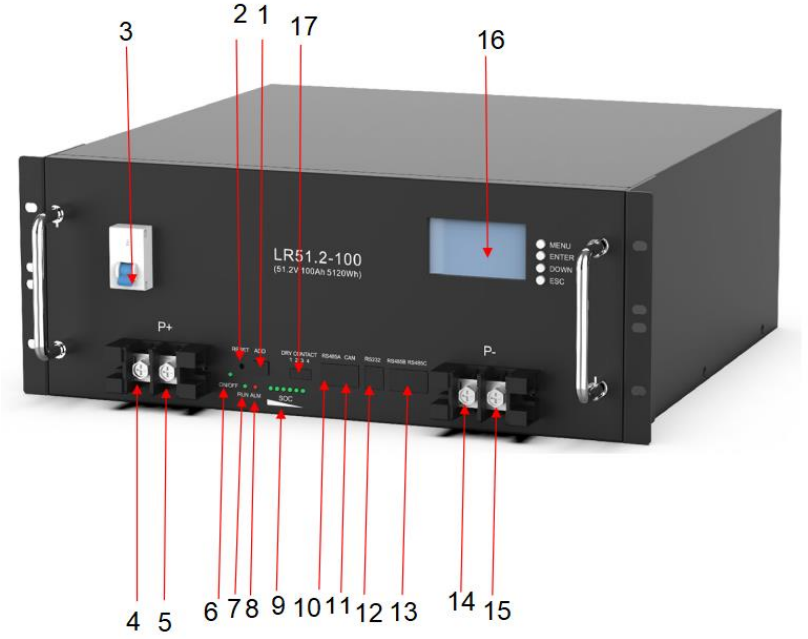
The appearance of the lithium battery pack is shown in figure 1-3-1, for interface description; please refer to the 2-1-1 panel description".

1-3-1 Product picture (The actual object prevails)

# 2 ILLUSTRATIONS

## 2.1 Explanation of the structure

The structure of Lithium-Ion battery pack as shown in figure 2-1-1




| | | | | | |
|---|---|---|---|---|---|
| 1. ADD | 2. RESET | 3.Breaker | 4. P+ | 5. P+ | 6.ON/OFF |
| 7. RUN | 8. ALM | 9. SOC | 10. RS485 | 11. CAN | 12. RS232 |
| 13.PARALLEL | 14. P- | 15. P- | 16. Display | 17.Dry Contact | |

Reminder: There are two DIP switch options, 4DIP and 6DIP, depending on your application.

## 2.2 Panel description

The panel of the module of the lithium battery pack, as shown in figure

2-1-1 Module panel description


## Battery Output

Using 4 pin terminal pins, the front of the terminal from left to right is defined as **Battery+, Battery+, Battery-, Battery-**, which relates to the power transmission line for charging and discharging.

## SOC

The meaning of SOC indication light is shown in table 2-2-1

Table 2-2-2 The relationship between the capacity of the battery and the light

● indicates LED is ON, ○ indicates LED is OFF.

| ● | ● | ● | ● | ● | ● | Capacity |
|---|---|---|---|---|---|---|
| ● | ● | ● | ● | ● | ● | 83.0%-100% |
| ○ | ● | ● | ● | ● | ● | 66.4%-83.0% |
| ○ | ○ | ● | ● | ● | ● | 49.8%-66.4% |
| ○ | ○ | ○ | ● | ● | ● | 33.2%-49.8% |
| ○ | ○ | ○ | ○ | ● | ● | 16.6%-33.2% |
| ○ | ○ | ○ | ○ | ○ | ● | 0%-16.6% |

# ALM

When the battery is at alarm or fault, "ALM" light is red.

# RUN

During charging, the "RUN" light will be flashing.

"RUN" and "ALM" can display the battery status, as shown in table 2-2-2

Table2-2-2 The explanation of “RUN” and “ALM”

| PACK Status | Normal/Alarm/ Protection | RUN | ALM | Remark |
|---|---|---|---|---|
| | | ● | ● | |
| Power Off | Sleep | OFF | OFF | All off |
| Standby | Normal | Flash 1 | OFF | Standby state |
| | Alarm | Flash 1 | Flash 3 | Cell low voltage |
| Charge | Normal | ON | OFF | |
| | Alarm | ON | Flash 3 | |
| | Over Charge Protection | ON | OFF | Stop charge |
| | Temperature. Over-current Fault Protection | OFF | ON | Stop charge |

| | | | | |
|---|---|---|---|---|
| Discharge | Normal | Flash 3 | OFF | |
| | Alarm | Flash 3 | Flash 3 | |
| | Under Discharge Protection | OFF | OFF | Stop discharge |
| | Temperature. Over-current. Short Circuit Fault Protection | OFF | ON | Stop discharge |
| Fault | | OFF | ON | Stop charge Stop discharge |

Note: The flashing instructions, flash1-light 0.25s/off 3.75 seconds; flash2-0.5 slight /0.5s off; flash3-0.5 slight/1.5s off.

# ADD

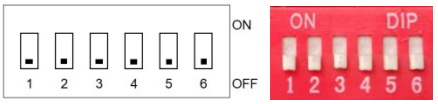
In parallel, band switch uses six dip switches to address the set cell system. The explanation of its dial switch as shown in table 2-2-3.

Table 2-2-3 DIP switch address code

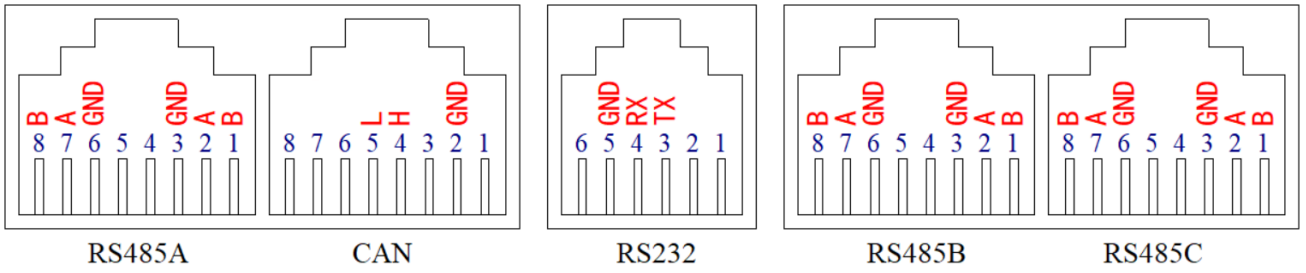
Note, ADD 0, reserved exclusively for engineering diagnostics.

| PACK Definition | ADD | Address Code | | | | | |
|---|---|---|---|---|---|---|---|
| | | #1 | #2 | #3 | #4 | #5 | #6 |
| Reserve | 0 | OFF | OFF | OFF | OFF | OFF | OFF |
| PACK 1 | 1 | ON | OFF | OFF | OFF | OFF | OFF |
| PACK 2 | 2 | OFF | ON | OFF | OFF | OFF | OFF |
| PACK 3 | 3 | ON | ON | OFF | OFF | OFF | OFF |
| PACK 4 | 4 | OFF | OFF | ON | OFF | OFF | OFF |
| PACK 5 | 5 | ON | OFF | ON | OFF | OFF | OFF |
| PACK 6 | 6 | OFF | ON | ON | OFF | OFF | OFF |
| PACK 7 | 7 | ON | ON | ON | OFF | OFF | OFF |
| PACK 8 | 8 | OFF | OFF | OFF | ON | OFF | OFF |
| PACK 9 | 9 | ON | OFF | OFF | ON | OFF | OFF |
| PACK 10 | 10 | OFF | ON | OFF | ON | OFF | OFF |
| PACK 11 | 11 | ON | ON | OFF | ON | OFF | OFF |
| PACK 12 | 12 | OFF | OFF | ON | ON | OFF | OFF |
| PACK 13 | 13 | ON | OFF | ON | ON | OFF | OFF |
| PACK 14 | 14 | OFF | ON | ON | ON | OFF | OFF |
| PACK 15 | 15 | ON | ON | ON | ON | OFF | OFF |
| PACK 16 | 16 | OFF | OFF | OFF | OFF | ON | OFF |
| PACK 17 | 17 | ON | OFF | OFF | OFF | ON | OFF |
| PACK 18 | 18 | OFF | ON | OFF | OFF | ON | OFF |
| PACK 19 | 19 | ON | ON | OFF | OFF | ON | OFF |
| PACK 20 | 20 | OFF | OFF | ON | OFF | ON | OFF |
| PACK 21 | 21 | ON | OFF | ON | OFF | ON | OFF |
| PACK 22 | 22 | OFF | ON | ON | OFF | ON | OFF |
| PACK 23 | 23 | ON | ON | ON | OFF | ON | OFF |
| PACK 24 | 24 | OFF | OFF | OFF | ON | ON | OFF |
| PACK 25 | 25 | ON | OFF | OFF | ON | ON | OFF |
| PACK 26 | 26 | OFF | ON | OFF | ON | ON | OFF |
| PACK 27 | 27 | ON | ON | OFF | ON | ON | OFF |
| PACK 28 | 28 | OFF | OFF | ON | ON | ON | OFF |
| PACK 29 | 29 | ON | OFF | ON | ON | ON | OFF |
| PACK 30 | 30 | OFF | ON | ON | ON | ON | OFF |
| PACK 31 | 31 | ON | ON | ON | ON | ON | OFF |
| PACK 32 | 32 | OFF | OFF | OFF | OFF | OFF | ON |
| PACK 33 | 33 | ON | OFF | OFF | OFF | OFF | ON |
| PACK 34 | 34 | OFF | ON | OFF | OFF | OFF | ON |
| PACK 35 | 35 | ON | ON | OFF | OFF | OFF | ON |
| PACK 36 | 36 | OFF | OFF | ON | OFF | OFF | ON |
| PACK 37 | 37 | ON | OFF | ON | OFF | OFF | ON |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PACK 38 | 38 | OFF | ON | ON | OFF | OFF | ON |
| PACK 39 | 39 | ON | ON | ON | OFF | OFF | ON |
| PACK 40 | 40 | OFF | OFF | OFF | ON | OFF | ON |
| PACK 41 | 41 | ON | OFF | OFF | ON | OFF | ON |
| PACK 42 | 42 | OFF | ON | OFF | ON | OFF | ON |
| PACK 43 | 43 | ON | ON | OFF | ON | OFF | ON |
| PACK 44 | 44 | OFF | OFF | ON | ON | OFF | ON |
| PACK 45 | 45 | ON | OFF | ON | ON | OFF | ON |
| PACK 46 | 46 | OFF | ON | ON | ON | OFF | ON |
| PACK 47 | 47 | ON | ON | ON | ON | OFF | ON |
| PACK 48 | 48 | OFF | OFF | OFF | OFF | ON | ON |
| PACK 49 | 49 | ON | OFF | OFF | OFF | ON | ON |
| PACK 50 | 50 | OFF | ON | OFF | OFF | ON | ON |
| PACK 51 | 51 | ON | ON | OFF | OFF | ON | ON |
| PACK 52 | 52 | OFF | OFF | ON | OFF | ON | ON |
| PACK 53 | 53 | ON | OFF | ON | OFF | ON | ON |
| PACK 54 | 54 | OFF | ON | ON | OFF | ON | ON |
| PACK 55 | 55 | ON | ON | ON | OFF | ON | ON |
| PACK 56 | 56 | OFF | OFF | OFF | ON | ON | ON |
| PACK 57 | 57 | ON | OFF | OFF | ON | ON | ON |
| PACK 58 | 58 | OFF | ON | OFF | ON | ON | ON |
| PACK 59 | 59 | ON | ON | OFF | ON | ON | ON |
| PACK 60 | 60 | OFF | OFF | ON | ON | ON | ON |
| PACK 61 | 61 | ON | OFF | ON | ON | ON | ON |
| PACK 62 | 62 | OFF | ON | ON | ON | ON | ON |
| PACK 63 | 63 | ON | ON | ON | ON | ON | ON |




The number of DIP switches depends on the product received. For 4 DIPS ADD, the max is 15 in parallel, for 6 DIP ADD, the max is 63 in parallel.

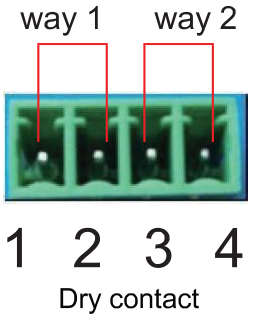



RS485A CAN RS232 RS485B RS485C

| Inverter to Battery | | | | PC to Battery | | Battery to battery Or PC to Battery | |
|---|---|---|---|---|---|---|---|
| RS485A | | CAN | | RS232 | | RS485B, RS485C | |
| PIN | Definition | PIN | Definition | PIN | Definition | PIN | Definition |
| 1 | **RS485-B** | 1 | NC | 1 | NC | 1 | **RS485-B** |
| 2 | **RS485-A** | 2 | GND | 2 | NC | 2 | **RS485-A** |
| 3 | GND | 3 | NC | 3 | **TX** | 3 | GND |
| 4 | NC | 4 | **CAN-H** | 4 | **RX** | 4 | NC |
| 5 | NC | 5 | **CAN-L** | 5 | GND | 5 | NC |
| 6 | GND | 6 | NC | 6 | NC | 6 | GND |
| 7 | **RS485-A** | 7 | NC | | | 7 | **RS485-A** |
| 8 | **RS485-B** | 8 | NC | | | 8 | **RS485-B** |
| NC=No connect | | | | | | | |

# Dry Contact Terminal

Dry Contact Terminal: provided 2 ways input and 2 ways output dry contact signal.




Dry contact

RESET

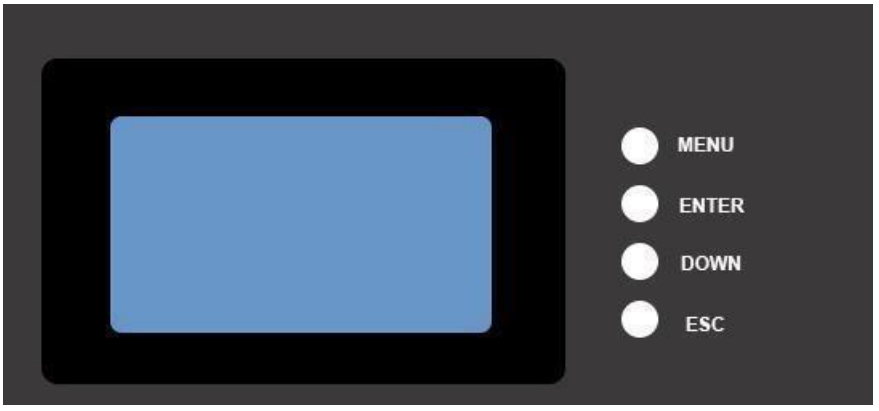
Press RESET key for 3~6 seconds, then start the device, press the RESET key for 3~6 seconds again, then shut down the device. When the system is running, should there be an exception, use this button to reset the system (press / release) to ensure the stability of the system.

## 2.3 LCD operation instructions

The LCD display interface is user-friendly, as shown in figure 2-3-1. The LCD is able to display the alarm information in real time, and provides the historical warning records for the user to query, and provide a reliable basis for fault diagnosis.

Users can easily browse the battery parameters through the LCD interface, and obtain timely access to information on the current state of the battery. The interface displays a total of 4 menu keys, the functions described as follows.

2-3-1 LCD Display




The commonly used button function

The display function of the button as shown in table 2-3-2.

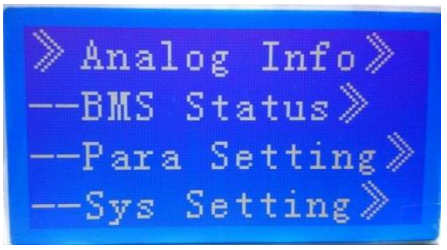
Button function description

| | |
|---|---|
| MENU | Main menu |
| ENTER | Confirm, enter |
| DOWN | Page down |
| ESC | Return |

# Operation procedures

1) Press “MENU” once, the LCD display screen light up, then the welcome interface will be shown.


2) Followed by the prompt and then click once to enter the main menu bar.




3) Scroll page up and page down “DOWN “， Enter the Menu screen, when the arrow  points to the corresponding bar, press Enter “ENTER” to confirm.

4) Go back on the menu bar, click “ESC”.

## 2.4 The working principle

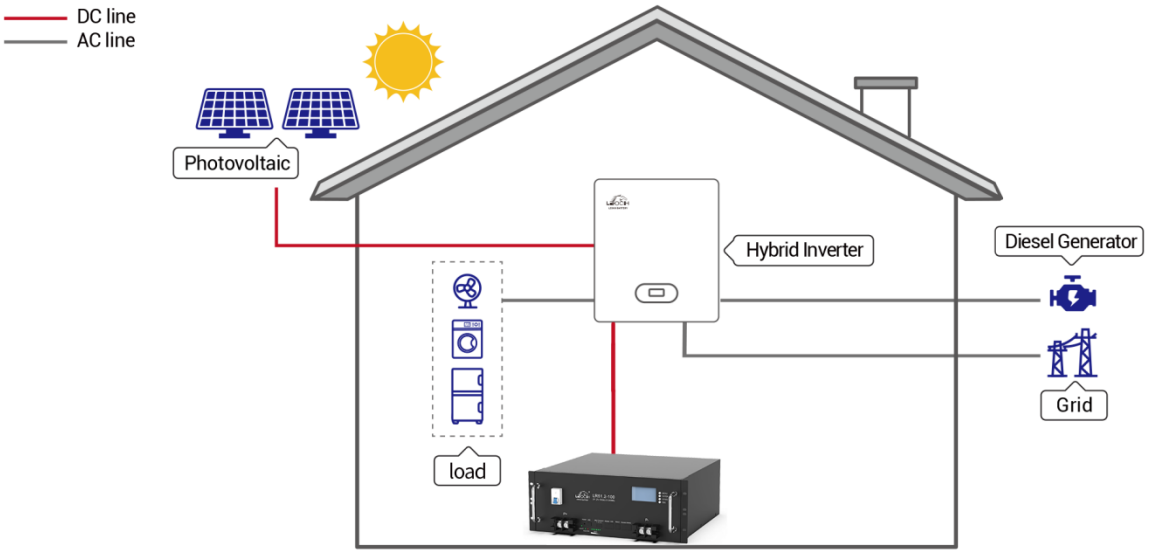
Lithium battery pack is equipped with charging and discharging management module and monitoring module.

Charge and discharge management module protects battery charge and discharge functioning, prevents overcharging, discharge over-current, the charging process by the adapter charger to the DC input form, the discharge process is completed by connecting the load discharge.

The monitoring module has the balance function and power, temperature and SOC. The monitoring module transmits the real-time information collected in the operation of the product through the Telecommute protocol network to the monitoring platform, and the user can observe the operation status of the battery in each group through the display screen.

A single module has a 51.2V (100) Ah, with a large capacity, As shown in figure 2-4-1

2-4-1 the working principal diagram



## 2.5 The product features

Integrated lithium battery pack for Rack-Mounted has the following remarkable characteristics:

- The whole module is non-toxic, non-polluting and environmentally friendly;
- The system can automatically manage charge and discharge state and balance current and voltage of each cell;
- Flexible configuration, multiple battery modules can be in parallel for expanding capacity and power
- Adopted self-cooling mode rapidly reduced system entire noise;
- The module has less self-discharge, up to 6 months without charging on shelf; no memory effect, excellent performance of shallow charge and discharge;
- Operating Conditions for Charging and Discharging

It is essential to adhere to the specified temperature ranges for both charging and discharging the battery. These conditions are as follows:

**Discharging:**

Discharging is only permitted within a temperature range of **-10°C to +55°C**.

**Charging:**

Charging is only allowed within a temperature range of **+0°C to +45°C**.

- Small size and light weight, standard of 19-inch embedded designed module is comfortable for installation and maintenance;

**Recommended charging**

While the battery is capable of handling a higher charging currents up to 100A for a LR51.2-100Ah battery, we recommend using a charging current at a lower rate. For a 100Ah battery that is 50A. This will fully recharge a completely depleted battery in approximately 2-3 hours.

The battery has to be fully charged once a month, until the float charge has been reached, due to cell balancing and SoC calibration purposes. If the batteries are intensively used or frequently deeply discharged, it is recommended to fully charge the batteries once a week.

**Recommended Discharge**

When operating at higher discharge rates, the battery generates more heat compared to lower discharge rates. This necessitates increased ventilation space around the batteries and, depending on the installation, may require hot air extraction or forced air cooling. It is recommended that for a 100Ah battery the continuous current set at 50A .

Additionally, at higher discharge rates, some cells may reach the low voltage threshold faster than others. This can occur due to a combination of elevated cell temperature and battery aging. To ensure optimal performance and longevity, it is advisable to adhere to the recommended discharge current limits.

Although a BMS is in place, there are still certain situations where the battery may be at risk of damage from over-discharge. Please carefully adhere to the following warning.

Avoid allowing the battery to fully discharge under any circumstances. If the system will be left unattended for an extended period, ensure the batteries remain charged during that time. Alternatively, fully charge (or nearly fully charge) the batteries and then disconnect the DC system from the battery.

## INTRO

- Telemetry: voltage, current, temperature, SOC, SOH (optional), etc.

- Tel-signaling state of charge and discharge, overcharge / over-current, under voltage over-current alarm / alarm, environment / battery /PCBA/ battery temperature alarm, low environmental temperature alarm, battery capacity is too low, the battery temperature /voltage / current sensor failure alarm, battery failure alarm (just not cut off the monomer pressure high limit alarm) (optional), battery failure alarm (optional).

- Remote control: charge / discharge (optional), alarm sound off, intelligent intermittent charging mode, current limiting charging mode.

- Optional: Battery charge / discharge management parameters and the output parameters of the switching power supply system.

# 3 INSTALLATION GUIDE

## 3.1 Installation precaution notes

● Comply with local laws and regulations

When operating the equipment, make certain to comply with local laws and regulations.

● Personnel requirements

Technicians who are responsible for installation and maintenance are required to undertake strict training at first. Master the correct methods for operation and safety, only then the installation, operation and maintenance can be carried out.

In order to maximize the efficiency of the equipment, to obtain best possible operating results, and ensure maximum lifespan, please pay careful attention to the correct installation and usage requirements.

● Personal safety

Insulated tools and gloves should be used and worn at all times – During the installation process, watches, bracelets, rings and other metal products should be removed.

Avoid any fall or collision during the installation process.

Do not remove the battery components. The maintenance of the battery should be carried out by a professional engineer.

Should be operated and supervised by engineer who have experience and can take preventive measures for potential hazards of battery.

| Terminal | Recommended torque value |
|---|---|
| M6 | 5.5±0.5N*M |

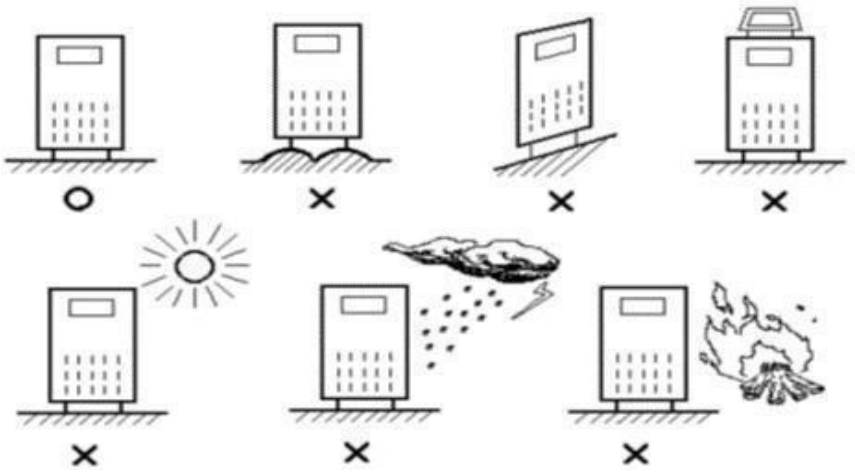
● Field and environment

Site requirements

1) Cleanliness

Lithium battery packs cannot be placed in or near garbage disposals, or accidentally dropped or

placed in smaller disposal units, as their interaction with metals is likely to cause short circuits and



endanger the system and personal safety.

2) Fire protection

The room is prohibited to store flammable, explosive and other dangerous goods, and it should be equipped with effective fire equipment (such as $CO_2$ fire extinguishers).

3) Ventilation and heat dissipation

In order to facilitate the operation and maintenance of equipment for the heat, the equipment should be left around (50~30) cm around at least, left about 50cm for the upper space. The space should be equipped with exhaust fan, to maintain good indoor ventilation.

4) Installation requirements

Installation should be carried out as shown in figure 3-1-1 in order to avoid possible risks.

Put the lithium battery on the ground (to avoid tilt, uneven ground).

Avoid placing in the sunlight, rain or wet surfaces.

3-1-1Requirements for installation scenarios

- Environmental

Requirements Ambient temperature: ( -10~+40) ℃.

Relative humidity level: 5%RH~95%RH, no condensation. Cooling method: air cooling.

Height above sea level: match to the standard requirement of GB3859.2-93. Versatility: no vibration and the vertical inclination does not exceed 5º.

Pollution level: Level 2.

Recommended operating temperature (20~25) ℃, humidity level control within 50%.

Do not install in the working environment with metal conduction type dust.

Do not put anything containing corrosive gases.

Do not put anything in the dust concentrated areas.

Do not place any items on the top of lithium-ion battery pack. People could not sit on the battery.

# Power check

Before installation, please confirm that the load capability of inlet wire meets the requirements of the new equipment. Check to see if the power supply corresponds to the equipment nameplate of the voltage and frequency and if the current capacity has decreased due to the aging of the wire.

If in doubt, please check with your local power supply consultation department.

Ground wire

Earthing terminal is ready; zero voltage required in the room cannot exceed 5V. DC output voltage and load capacity

Lithium-ion battery pack of rated DC output 51.2V.

When installing the lithium-ion battery pack, the user should check the lithium- ion battery pack in advance to make sure that the contacts and connectors are safely in place to avoid an open circuit or short circuit fault.

During installation, do not connect the lithium batteries polarity in reverse or in any way incorrectly, to avoid causing a short circuit.

Please do not connect the terminals with no security or insulation protection, so as to avoid the risk of electric shock.

## 3.2 Installation preparation

### ■ Unpacking and inspection

Lithium batteries and accessories use packaging of cardboard boxes or wooden boxes. When unpacking, be careful when dismantling. Inspect the device and accessories according to the package list, to ensure its complete and make certain nothing was damaged during shipping.

Before clearing the packaging, make sure that all parts are included. If equipment or accessories are damaged in transit, or incomplete or incompatible,

the equipment, accessories and order contracts should be recorded and local branches or offices should be contacted immediately.

The site needs to be tidied and inspected once again to make sure the audit documents are in order for the audit. Before inspection, the site should be clean.

### ■ Installation tools

Potential commonly used tools as shown in table 3-2-1~3-2-4 the field technician will increase or decrease the amount according to the construction.

Table 3-2 -1 General purpose tools

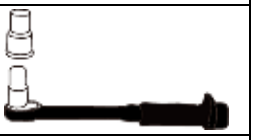
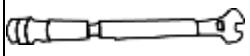
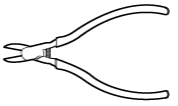
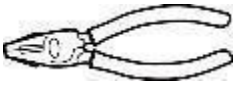
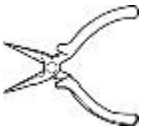
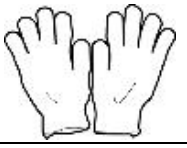
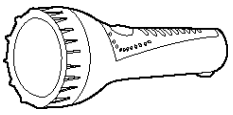
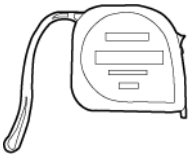
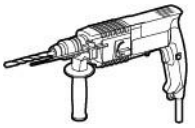
| The appearance of the tools, parameters, and names | | | |
|---|---|---|---|
| Adjustable wrenches | Phillips's screwdriver | Slotted screwdriver | Socket wrench |
|  |  |  |  |
| Torque wrench | Open-end wrenches | Double offset ring spanner | Diagonal cutting pliers |
|  |  |  |  |
| Wire cutters | Needle nosed pliers | Marking pen | Working gloves |
|  |  |  |  |
| Ladder (2m) | Flashlight | Tape measure | Impact drill |
|  |  |  |  |

Table3-2-2 Tools for delivery and unpacking

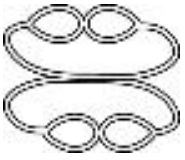
| The appearance of the tools, parameters, and names | | | |
|---|---|---|---|
| Manual forklifts | Electric forklift | Sling weight(≥ 400kg) | Leverage (Weight≥400kg) |
|  |  |  |  |

Table3-2-3 Electrical installation tools

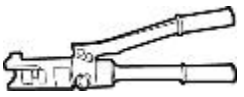
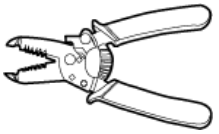
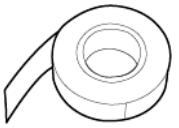
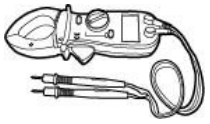
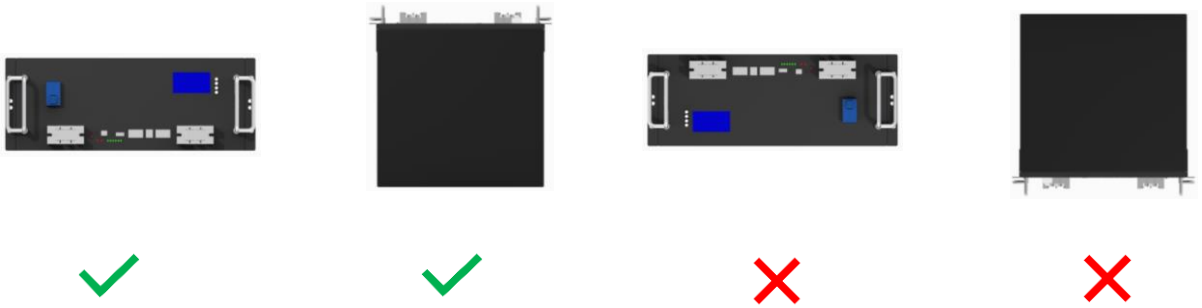
| The appearance of the tools, parameters, and names | | | |
|---|---|---|---|
| Insulated gloves | Power cable crimp mg pier | Wire stripping pliers | Electrical tape |
|  |  |  |  |

Table 3-2-4 Measuring Tools

| The appearance of the tools, parameters, and names | | | |
|---|---|---|---|
| Clamp the flow table | | | - |
|  | | | - |

## 3.3 Mounting the battery

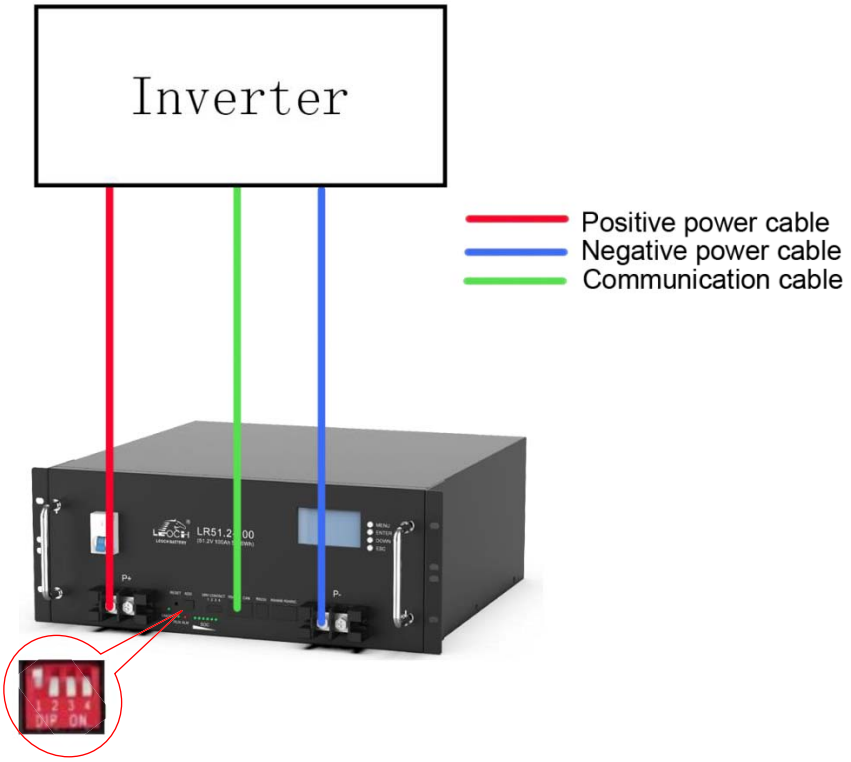
Note the allowable installation modes:



## ■ Single installation

(1)Connect the positive and negative wires of the battery
(2)Connect the communication cable between the battery and the inverter
(3)The DIP switch of the battery is set to 1

Single installation as shown in figure 3-3-1

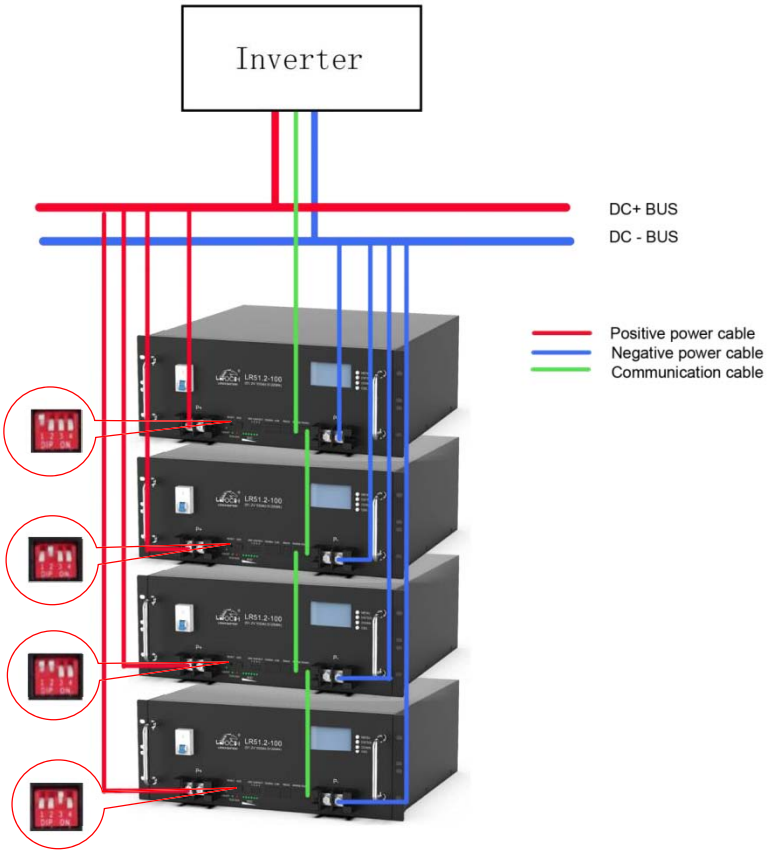


## ■ Multiple sets of parallel installation

(1)The positive and negative battery cables are respectively connected to the BUS
(2)Connect the communication cables between the battery room and the battery and inverter
(3)Connect the positive and negative BUS to the inverter
(4)Set the DIP switch of the battery connected to the inverter to 1, and set the DIP switch of other batteries to 2.3.4.

For parallel sets of batteries, no more than 8 groups, as shown in figure 3-3-2

3-3-2 Sketch map of parallel Installation




1)Before the parallel installation, setting the battery to the limited charging mode is very important. For detailed operations, please refer to Integrated Lithium-ion Battery Pack PC Software User Manual, and it will be provided with this manual.

2)Capacity load (namely in therewith voltage hysteresis current load), to ensure the work, start the power supply module first, then load.

# 4 MAINTENANCES

In order to ensure the lithium-ion battery pack achieves the longest life cycle, the maintenance technician should carry out regular inspections and maintenance care.

The maintenance records should be complete and routine, so that subsequent verification of management parameters of the battery pack can be tracked.

**Warning:**

Lithium batteries are costly and can sustain damage from over-discharge or overcharge.

Over-discharge damage may occur when small loads—such as alarm systems, relays, standby currents from certain devices, back current drain from battery chargers, or charge regulators—gradually drain the battery while the system is inactive.

While the BMS can shut down the system due to low cell voltage to prevent immediate battery damage, this should only be a last resort. To avoid reaching this critical point, it is important to make sure the system is fully switched off when leaving unattended for extended periods. Even better, consider turning off the circuit breaker or disconnecting the battery's positive terminal when the system is not in use. Before doing so, ensure the battery is sufficiently charged to maintain an adequate reserve capacity.

Residual discharge currents pose a significant risk, especially after the system has been fully discharged and a low cell voltage shutdown has been triggered. In such cases, the battery retains a reserve capacity of less than 5Ah per 100Ah of battery capacity. If this remaining reserve is depleted, the battery can be permanently damaged.

If a low cell voltage shutdown occurs, immediate action is required: recharge the battery as soon as possible to prevent irreversible damage.

By following these guidelines, you can ensure safe and efficient battery operation while avoiding potential damage caused by operating outside the recommended temperature ranges.

The maintenance record should be complete and routine, so that subsequent verification of management parameters of the battery pack can be tracked.

## 4.1 Electrical maintenance

Maintenance of the electrical parts may refer to table

Table4-1 -1 Table of contents for maintenance

| Items | The checking points | Methods | Repair conditions | Repair solution |
|---|---|---|---|---|
| Electrical | Check if the output of the voltage is normal | Multi-meter | Battery voltage should be always within the range of 43.2V-58.4V | See the following troubleshooting section |
| Fault inspection | Check if lights are normal | Visual inspection | Alarm | |
| Cable | Insulation, Terminal | Visual inspection | Insulation: Cracks and Aging Exfoliation and Terminal Corrosion | Replace the cable Replace the terminal block |

## 4.2 Battery maintenance

Table 4-2-1 Contents of battery maintenance

| Frequency | Items | Solutions |
|---|---|---|
| Monthly | Operating environment | Keep away from heat sources and avoid direct sunlight. |
| | Visual inspection | If any breakage, leakage, or deformation is detected, isolate the affected battery pack, take a photograph, and replace the battery. Check if the DIP switch settings as well as battery communication cables are correct and make sure no mis-operation that changed the DIP setting/cable connection. |
| Quarterly | Visual inspection | Use a cotton cloth to clean the surface. Exercise caution during cleaning due to the high voltage. |
| | Connection status | 1，Inspect each terminal and check if the bolts are loose; tighten them if necessary but also avoid over-torqued. For M6 use5.5± 0.5N*M torque.<br>2，Investigate the cause if the cable temperature exceeds 40℃. |
| Every 6 months | PBMS reading check | Get a screen shot for PBMS screen reading every half a year to track its status. |

Charge and discharge status at the final stage can through capacity light to display. Please refer to 2-2-2 for the definitio1n of capacity lights.

## 4.3 Trouble shooting steps

① Problem determination based on:

1) Whether the battery can be turned on or not.

2) If the battery is ok to turn on, check the run light is off, flashing or lighting;

3) If the run light is off, check whether the battery is ok to charge/discharge or not.

② Preliminary determination steps:

1) The battery is unresponsive; it cannot turn on, and the indicator lights are neither illuminated nor flashing. If the battery external switch is ON, the RUN light is flashing, and the external power supply voltage is 48V or more, the battery is still unable to turn on, please contact Leoch.

2) The battery can be turned on, but red light is lighting, and cannot charge or discharge. If the red light is lighting, that means system is abnormal, please check the value as follows:

a) Temperature: Above 50℃ or under - 10℃, the battery could not work.

Solution: to move battery to the normal operating temperature range between -10℃ ~ 50℃.

b) High voltage: If charging voltage above 58.4V, battery protection will turn on.

Solution: check whether voltage is too high or not, if yes, to change the settings on power supply side.

LOW Voltage: when the battery discharges to 43.2V or less, battery protection will turn on.

Solution: charge the battery for some time when the red light turns off.

Excluding the three points above, if the faulty still cannot be located, turn off battery and contact Leoch.

③ Battery cannot be charged or discharged

1) Unable to charge

Disconnect the power cables, measure voltage on the terminals, if the voltage is 53~54V, restart the battery, connect the power cable and try again, if it still does not work, turn off battery and contact LEOCH.

2) Unable to discharge:

Disconnect the power cables and measure voltage on the battery side, if it is under 44.5V, please charge the battery if voltage is above 48V and still cannot discharge, turn off battery and contact LEOCH.

| fault phenomenon | possible cause | handling method |
|---|---|---|
| Over voltage alarm | ● Overcharge voltage<br>● There is a problem with cells | ● Check whether the charging voltage setting is reasonable. If not, adjust it according to the actual situation.<br>● If the battery consistency is faulty, contact Leoch. |
| Under voltage alarm | ● The AC power failure time is too long<br>● Cell problems, resulting in low capacity. | ● Charge the battery again. If the charge still fails, contact Leoch.<br>● Contact Leoch for cell fault. |
| The buzzer kept ringing | ● The battery triggered an anti-theft lock | ● Use anti-theft PC software to remove the lock |

| fault phenomenon | possible cause | handling method |
|---|---|---|
| Fail to turn on | ● After the over discharge of the battery cell, the battery voltage is lower than 2V without replenishment for a long time.<br>● The voltage collection cable of the battery cell is loose | ● Contact Leoch. |
| High temperature protection for charging or discharging | ● The ambient temperature is too high.<br>● Heat sources exist around the battery. | ● Check the ambient temperature alarm value (default: 0 ° C). |
| Low temperature protection for charging or discharging | The ambient temperature is too low. | ● Check whether the upper battery temperature alarm value (53 ° C by default) is reasonable. If the alarm value is incorrect, adjust it according to the actual situation.<br>● Check whether the battery cabin temperature control system is faulty. If yes, rectify the fault. This alarm is automatically cleared when the battery temperature returns to normal.<br>● Check whether the BMS temperature sensor is faulty. If yes, replace the BMS temperature sensor. |

# 5 TRANSPORTATION AND STORAGE

## 5.1 transportation requirement

Battery via UN38.3 (UN38.3: Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria) and SN/T 0370.2-2009 "Inspection Procedures for Packaging of Dangerous Goods for Export Part 2 Performance Inspection" certification (This product belongs to Class 9 dangerous goods)

The battery meets the transportation requirements of cars and ships. The transport box must be firm, and the outside of the box should comply with the provisions of the national standard and should be marked "handle with care" and "moisture-proof". Direct rain and snow and mechanical impact should be avoided during transportation.

## 5.2 Storage

### ■ Storage Requirements

1. When storing batteries, place them according to the labels on the packing case. Do not place them upside down or on the side.

2. When packing cases are stacked, they shall comply with the packing requirements.

3. The storage environment requirements are as follows:

- Ambient temperature -20 ° C to 60 ° C. The recommended storage temperature is 0 ° C to 40 ° C.
- Relative humidity ≤95%.
- Storage battery should be at 40% ~ 80% SOC.
- The distance from the heat source (such as the heating device) must be at least 2m.

The warehouse manager should count the battery storage every month, and the batteries that are stored beyond the expiration date must be replenished in time.

- A dry, ventilated, and clean place.

- Avoid contact with corrosive substances or organic solvents (including gas).
- Avoid direct sunlight.

## ■ Expired Storage Criteria

| Storage temperature | Recharge interval | Recharge procedure for the single battery |
|---|---|---|
| ＜30°C | Every 6 months | 1) Discharge with current 0.2C(A) to 0% SOC.<br>2) Charge with current 0.2C(A) per battery for 2~4 hours. |
| 30°C-45°C | Every 3 months | |
| ＞45°C | Every 1 months | |

## ■ Top charge process

Check storage battery appearance, such as expansion, leakage, shell damage, scrap treatment. The positive and negative extremes of the battery are corroded. Sand them clean.

Use the charger to charge the battery with the following parameters.

| Top charge control | Parameter Setting |
|---|---|
| Recommend: charging voltage | 56.32V |
| MAX charging voltage | 57.6V |
| charge current | It is recommended to use 0.2C with a maximum of 0.5C |
| Stop condition | The charging current is less than 0.05C |

After the battery is replenished, mark the last charge time and the next recharge time on the battery packing box.

# 6 ENVIRONMENT PROTECTION

## 6.1 Environmental Label

The product described in this manual does not contain toxic and hazardous substances or elements. It is a green product. It can be recycled after being discarded and should not be discarded at will. The environmental label shown in Table 6-1.

Table6-1-1Environmental label

| Specification | Mark |
|---|---|
| 51.2V | |

## 6.2 Recycle

This mark indicates that the product cannot be classified with other waste. In order to prevent potentially hazardous substances from hazardous waste disposal hazards to the environment and human health, please refer to the classification of waste recycling in order to promote the sustainable use of material resources.


In order to recycle the used equipment, please use the recycling system or contact the manufacturer or seller of the product or the local authority to manage the product.

**Appendix:**

Checklist to determine if the battery has been misused:

1, Is there any mechanical damage to the battery, its terminals? Please note that mechanical damage will void the warranty.

2, Has the battery been stored and installed in its correct orientation? The battery can be mounted either upright or on its side, but it should not be positioned facing downward.

3, Is the battery wet? Keep in mind that the battery is not waterproof and is not designed for outdoor use.

4, Is there any indication that the battery has been fully discharged? Review the screen data or Pbms tool reading. Check the deepest discharge level, minimum battery voltage, and the number of full discharge cycles recorded in the BMS which was counted as UVP. If constant UVP happens, a root cause analysis is suggested to carry out to prevent reoccurrence.

5, How long has it been since the last full charge? It is essential to fully charge the battery at least once a month to maintain its health.

**Product information when submit a warranty claim:**

Product Serial Number:

Installation date:

Fault description:

A, Can the battery turn on by reset?

B, Can the battery be charged?

C, Can the battery be discharged?

D, Running light on?

E, ALM blinking?

F, Access to the battery by PBMS tool?