

ESS Battery Module

User Manual

V4.0



REVISION RECORDS

NO.	Revision	Author	Revision Of Content	Revision Time
1	V1.0		First Release	12-26-2019
2	V2.0		Change the Battery Type	2-8-2021
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4	V4.0		Add communication description	1-4-2022

MANUAL EXPLANATION

► COTENT EXPLANATION

ESS battery is Lithium iron phosphate battery module which designed for energy storage applications. This battery module integrated with intelligent BMS inside, has big advantages on safety, cycle life, energy density, temperature range and environmental protection. This product user manual describes the type, size, structure, battery module and BMS characteristics, module installation details.

Chapters	Contents
1. Overview	Background, Applications and Advantages
2. Structure and principle	Structure and operating principle
3. Parameters	All parameters of battery module
4. Installation	Installation and operation
5. Shipping, Storage, and Disposal	Shipping, Storage, Maintenance And Disposal
6. Symbols and precautions	Symbols and safety instructions

● BEFORE YOU START

Read all the safety information provided in this document prior to installing and/or operating the equipment. Contact Customer Support immediately for a free consultation, if you have any questions about the handling, operation and safe use of the battery.

To handle or operate with battery system:

- You must be qualified for electrical work;
- Before you operate the battery module, you should be better trained and read the manual carefully;
- Remove any possible metallic shorting risk of Jewel, Watches, Pens. Metal bars and frames;
- All tools must be insulated

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1 OVERVIEW

1.1 BACKGROUND AND APPLICATIONS

Lithium-ion batteries are a new generation of green energy batteries. In recent years, with the rapid development of lithium ion battery technology, the pace of lithium ion batteries to replace the traditional lead-acid batteries are also gradually accelerate in various power fields. Compared with the traditional lead-acid batteries, lithium ion batteries boast with high energy density, small volume, light weight, long life, wide applicable temperature range and other advantages, particularly the advantages of lithium iron phosphate (LiFePO_4) battery are comprehensive more prominent. At present, the lithium iron phosphate battery technology is very mature, with the cost is gradually lowered, it is widely used in mainstream and high-end standby power supply solutions.

ESS battery is the standard lithium battery systems for energy storage applications. ESS battery module with intelligent BMS have big advantages in safety, energy density, applicable temperature range, service life and environmental protection, and can be widely applied in various conditions.

1.2 ADVANTAGES

1. Packed with high performance LFP single cell, long life, safety and wide temperature range.
2. High energy density, small size, light weight, no pollution.
3. Built-in BMS, with battery voltage, current, temperature, and health management.
5. LED/LCD indicate the battery SOC and operating status.
6. Intelligent balance module, to ensure that the consistency of battery capacity, to extend the service life.
7. Optional integrated Inverter module, support access to dynamic environment monitoring system
8. Special design structure is adopted to match the inverter device.

2 PRINCIPLE AND STRUCTURE

2.1 OPERATING PRINCIPLE

The principle of work of the ESS battery system . Under normal condition, grid AC power, generator, or solar system supply to the loads (the load of figure showed below) and charge battery pack; When these power sources fail and stop power supply, the battery serves for load equipment, to ensure the equipment runs normally; when these power sources are switched on again, recover power supply and charge the battery pack back.

2.2 CONNECTING STRUCTURE

Battery system working principle of ESS battery is shown in Figure 2.1 .

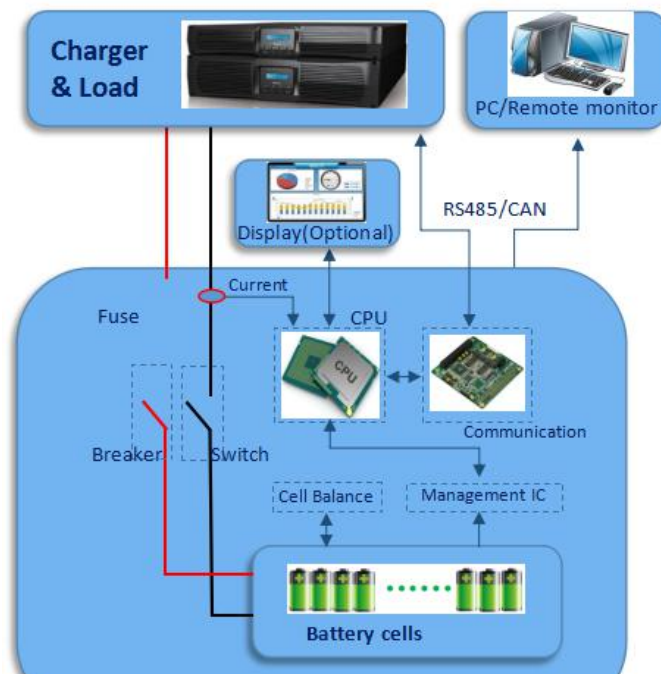


Figure 2.1 Connecting structure of the battery system

3 PARAMETERS

3.1 MODELS

ESS series battery specifications are in Table 3.1

Table 3.1 ESS batteries list

Model Type	Voltage(V)	Capacity	Energy	Length	width	Height	Weight(Kg)
TN-LFP-4860(16S)	51.2	60Ah	3072Wh	442mm	430mm	88mm	30
TN-LFP-48100(16S)	51.2	100Ah	5120Wh	442mm	470mm	154mm	48
TN-LFP-48200(16S)	51.2	200Ah	10240Wh	442mm	820mm	154mm	87

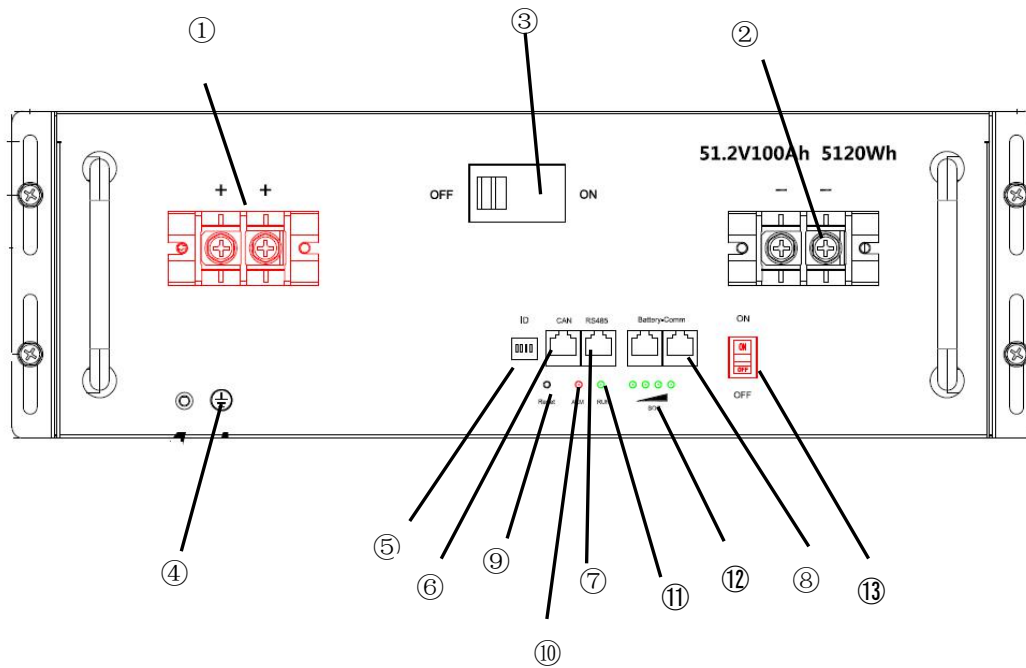
3.2 CONTROL PANEL

ESS battery is shown in figure3.2

Figure 3.2 ESS battery picture



Table 3.3 Descriptions



NO.	Name	Function	Remarks
1	Terminal	Positive Output	
2	Terminal	Negative Output	
3	MCB	Power Switch	
4	GND	Ground	
5	ID	Battery Address	
6	CAN	CAN Port	Pin 4 is CAN-H Pin 5 is CAN-L
7	RS485	RS485 Port	Pin 2,7 is RS485-A Pin 1,8 is RS485-B
8	Battery-Comm	Battery Communication Port	
9	Reset	Reset	
10	ALM	ALM LED	
11	RUN	RUN LED	
12	SOC	Capacity LED	
13	Switch	Battery On/Off	

Tips 1: ID description



If there is one battery , the No.1 address battery directly connect to the inverter. And the RS485 or CAN communication port of battery connected to the corresponding inverter communication port.

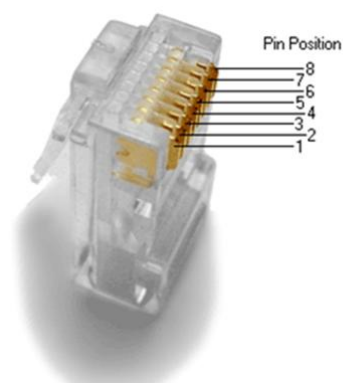
If there are more than two battery modules in parallel, No.1 address battery is master battery, have to connecting to the inverter, include power output and communication port. Others slaves batteries (other battery address) connect to each other by Battery-Comm COM port. Then all batteries and inverter can establish communication.

Please see the Chapter IV, there is the details connection diagram.

Note: Address 1 will not communicate with BMS Tools correctly. To use BMS Tools change to another battery address unique to others in the system.

Tips 2: Communication function description

CAN		RS485	
CAN-H	Pin 4	RS485-A	Pin 2, Pin 7
CAN-L	Pin 5	RS485-B	Pin 1, Pin 8



3.3 BATTERY MANAGEMENT SYSTEM (BMS)

3.3.1 VOLTAGE PROTECTION

● Over Charge Protection

During charging, if the voltage of any cell exceeds the setting for cell protection or total voltage of the system is greater than the setting for the system, the BMS stops charge. And when all voltage of each cell and total voltage of the battery drop to the recovering-set values, the protection removes automatically. The voltage settings are shown in table 3.6.

● Over Discharge Protection

During discharge, if the voltage of any one cell or total voltage of the battery is lower than the protection settings, the BMS stops discharge. And when all cell voltage and total voltage go up to recovering-setting, the protection remove automatically. Parameters in table 3.6.

3.3.2 CURRENT PROTECTION

● Charging Over Current Protection

During charge, if the charging current is bigger than the setting value, the BMS stops charge. Delay specified time or discharge the battery, it will recover. The settings are shown in table 3.6.

● Discharging Over Current Protection

During discharge, if the discharging current is bigger than the setting value, the BMS stops discharge. Delay specified time or charge the battery, it will recover. The settings are shown in table 3.6.

3.3.3 TEMPERATURE PROTECTION

● Cell Temperature Protection

There are several thermal sensors to monitor the cell temperature, if the temperature of any cell is higher than 70°C or lower than -5°C, the BMS will stop charging. If the temperature of

any cell is higher than 75°C or lower than - 20°C , BMS will stop the discharge. The settings are shown in table 3.6.

3.3.4 CELL BALANCE

● Smart Cell Balance

During charging, If all cell voltages are greater than 3.40V and the voltage difference between cells $\Delta U > 40\text{mV}$, BMS will trigger the balancing process, the balance current is designed base on the capacity of battery pack.

$$\Delta U = \text{Max_Cell voltage} - \text{Min_ Cell voltage}$$

Table 3.6 Parameter Settings

NO.	Type		Function	Setting value	Remarks
	Voltage	Charge	Cell Voltage Protection	3.90V Protection	3.45V recovery
			Total Voltage Protection	60.0V protection	
		Discharge	Cell Voltage Protection	2.3V Protection	3.1V recovery
			Total Voltage Protection	43.2V Protection	
2	Current	Charge	Over current protection 1	Please check the specification	
			Over current protection 2	Please check the specification	
		Discharge	Over current protection 1	Please check the specification	
			Over current protection 2	Please check the specification	
3	Temp	Cell	Temperature protection	Charging Range -5°C~70°C Discharging Range -20°C~75°C;	
		PCB		105°C	80°C recovery

4 INSTALLATION AND TESTING

4.1 PREPARE TO INSTALL

- Rules Of Safe

The installation, operation and maintenance of ESS battery system must be performed by trained and qualified professional personnel. Before installation and use, please carefully read the product safety precautions and related operating rules. Strictly abide by the following safety rules and local safety regulations, otherwise may cause personal injury or damage to the product.

1. Make sure that the load equipment to be connected with the battery system is in good condition and free from defects;
2. Before installation, make sure that the power supply system is under shut down state, while the battery system is also under shut down state;
3. All the electricity cables must have corresponding grade of insulation, Please ensure that no exposed cables;
4. Make sure that the battery and power system are reliable grounding.

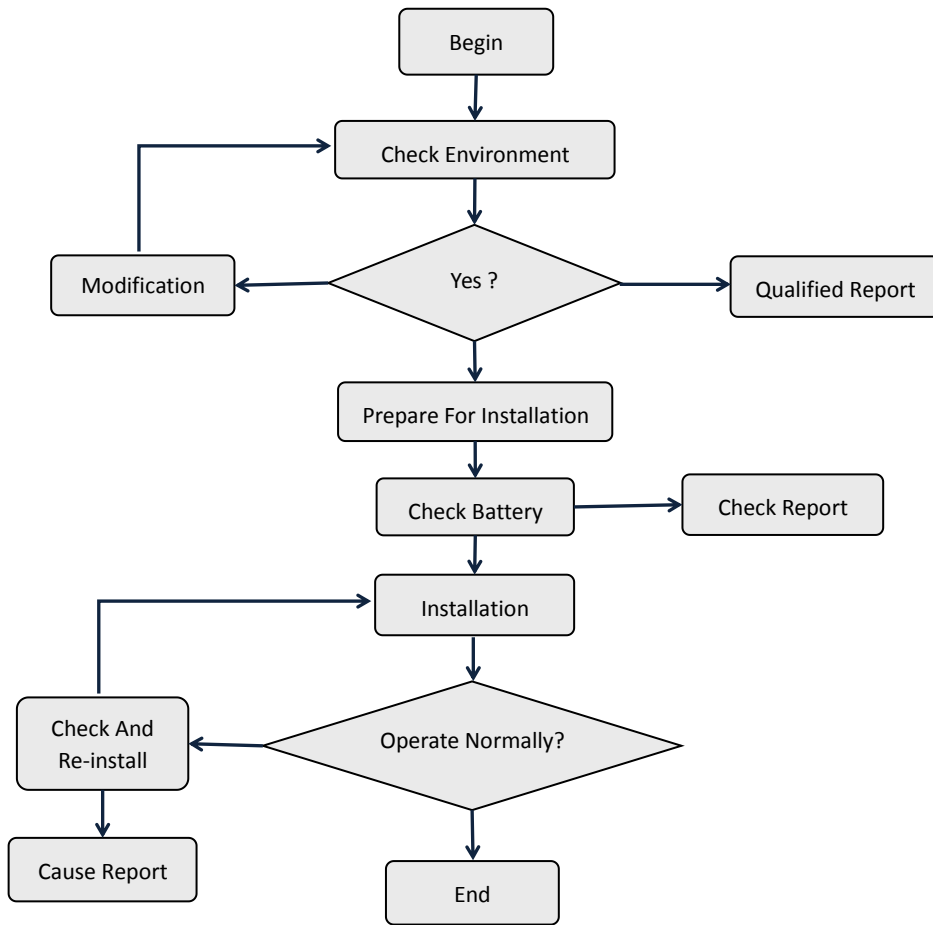
4.1.1 INSTALLATION OF ENVIRONMENT

The requirement of installation environment is shown in table 4.2.

Table 4.2 Requirement Of Environment

Type	Requirement
Working Temperature	Working Range: -20°C ~+60°C
Storage Temperature	-20°C ~+60°C
Relative Humidity	<95%
Atmospheric Pressure	86kPa~106kPa
Site Requirements	No conductive dust and corrosive gas, no vibration. Keep away from heat and flame

Figure 4.1 Process Of Installation



4.1.2 TOOLS ANF MATERIALS

May use the tools and information are shown in table 4.3.

Table 4.3 Tools And Materials

Name	Name
User manual	Oblique mouth clamp
Screw driver	Multimeter
Wrench	Ammeter
Pincers	Insulating tape
Wire stripping pliers	Electrostatic prevention Bracelet
Wristband	Clamp band

4.1.3 SITE SURVEY

● Equipment Inspection

1. Check that the equipment connected with batteries are right and in good conditions.
2. Check the DC interface position of the equipment. Check and confirm the output voltage is in the range showed in table 3.6, charging voltage.
3. Check DC device interface, make sure the maximum output current is matched with the selected battery.
4. Check the maximal working current of devices backed by the battery , make sure that the current is less than the maximum discharge current of the products .

● Ground Check

Check and confirm the electrical grounding position of power system room.

4.1.4 BATTERY CHECK

1. On the installation site, check the battery packaging to make sure it's intact;
2. Check battery box according to the packing list, make sure all the material is complete, if any damaged, please fill in the receipt;
3. Please be careful while handling batteries, avoid any damage.

4.2 INSTALLATION

4.2.1 CAUTIONS

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

1. 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.
2. Cable specifications. To ensure that the use of the connection of the power supply line can match the maximum current requirements of equipment operation.

3. Project layout. Ensure the whole construction process of power equipment, batteries and other reasonable layout.
4. Wiring layout. Ensure that the wiring reasonable, orderly; and consider the moisture-proof, corrosion prevention.
5. The whole installation process should wear anti-static wristband.
6. The installation site should be at least two or more peoples to operate.



CAUTION: Please ensure the installation site safe before installation.

4.2.2 INSTALLATION STEP

Battery installation steps are shown in table 4.4.

Table 4.4 The 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	Battery fixed installation
3	Electrical installation	1. Power cable installation
		2. Connecting equipment installation
		3. 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.

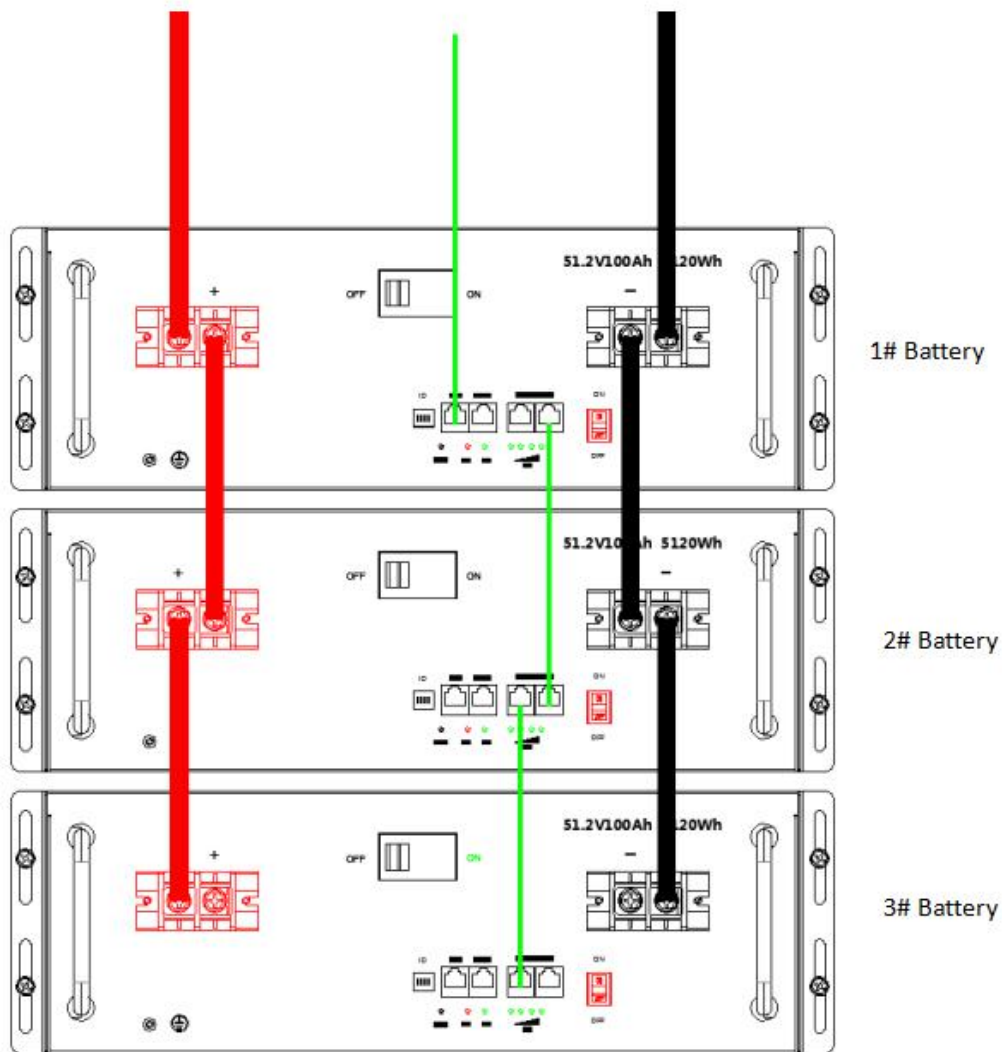
● Step 2. Machinery Installation

1. Mounting lugs installation. Equipment packaging with the chassis mounting lugs, before the installation of equipment, fix the mounting lugs on both sides of the battery box, ensure that the installation strong.

2. Battery installation. Battery module preference mounted in the rack 19 inch (or cabinet), when installed, portable handle arranged in parallel on the frame (or cabinet) supporting plate, push rack (or cabinet), ensure the mounting lugs and frame (or cabinet) edge fixing hole tightly, and then using a screwdriver with screw for fixation screwed into the rack to the mounting holes, to ensure that the battery pack mounted solid.

● 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 line installation. When using a single battery, battery terminals directly connected to the device or switch power supply terminal, if there are multiple batteries in parallel when in use, please connect all batteries to the copper bus-bar with the power cable.
3. Connect the copper bus-bar to charger/load system with power cable, Be careful not to connect the positive and negative poles wrongly.
4. 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 3.4, please dial settings for each cell address code (to ensure that no duplicate address code), and then connect the communication interface of battery-comm one by one. Connect the No.1 battery module RS485/CAN interface to the inverter. As follow below picture.



● Step 4. Electrical Commissioning

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

⚠ Caution: If you have any question about the installation, please stop and contact technical support immediately. If the battery does not start, please disconnect the power line inspection and re-install the start, if still cannot solve please contact technical support, avoid damage to equipment or cause accidents.

5 SHIPPING, STORAGE, AND DISPOSAL

5.1 SHIPPING AND STORAGE

● Shipping

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

Storage device in the indoor storage, the ambient air temperature is 0 °C to + 45°C, the average monthly relative humidity of not more than 90%, the ambient air without corrosive and flammable and explosive gas; storage warehouse should be ventilated, free of alkaline, acidic substances and other corrosive gases, without a strong mechanical vibration, shock, and without strong electromagnetic field and direct sunlight. Capacity was maintained at 50% to 60% stores, and charging the battery every 6 months.

5.2 WARNING AND DISPOSAL

When the ALM lights, battery has been alarmed or protected, please check fault reasons and take corresponding measures. Table 5.1 below is the main alarm condition.

Table 5.1 The main alarm and protection





State	Type	Indicator	Disposal
	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



Caution : If the battery cannot operate normally, please do not disassemble the battery without technical instructions.

6 SAFETY, SYMBOLS AND CAUTIONS

6.1 SHAFETY SYMBOLS

Symbol	Definition
	Important safety information will follow.
	DO NOT dispose of battery in a fire.
	Recycle or dispose of Lithium batteries in accordance with local Laws/regulations.
	DO NOT dispose of battery in the trash.

6.2 PRECATIONS

Please read and comply with the following conditions of installation and use of the battery, incorrect installation using the battery may cause personal injury or damage to the product.

1. DO NOT throw the battery into water. Store batteries in cool and dry environment when not in use.
2. DO NOT put the battery into fire or heat the battery, so as to avoid explosion or other dangerous events.
3. When charge the battery , please choose specialized charging equipment, and follow the correct procedures, do not use unqualified chargers.
4. DO NOT reverse positive and negative terminals, do not connect the battery directly to AC power , avoid battery short circuit.
5. DO NOT using batteries from different manufacturers or different kinds, types together ,and do not mixed use old batteries and new batteries.
6. DO NOT use the battery when it become hot, bulges, deforms or leaks.
7. DO NOT puncture the battery by nail or other sharp objects; Do not throw, stamp on, impact or hit the battery.
8. DO NOT open or try to repair the battery when it is defective. Warranty invalid if the battery repaired or disassembled.
9. Batteries are half charged before shipment, Don't use the battery if it's hot, bulge, or smell abnormal and so on, and report to after-sale dept. immediately.
10. If you need storage the battery for a long time, please charge and discharge the battery every three months to ensure the best performance, and the best state of charge for storage is between 50%~60%.
11. Please use the battery in the temperature range which defined in the manual.
12. The state of charge of batteries is 50% before shipment, please charge the battery before using.



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