

User Manual

Wall-mounted 24V 100Ah Lithium-Iron Phosphate Battery module

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1. Overview

Thank you for purchasing Lithium battery module. This manual describes the installation and product parameter settings etc. Please read this manual before you install the battery. Follow the instruction carefully during the installation process and keep this manual in safety for further information.

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

Conventions and used symbols

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 in death or serious personal injury
●  Warning	● Used as a warning of a middle or low potential hazards, if not avoided, 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 emphasize or replenish

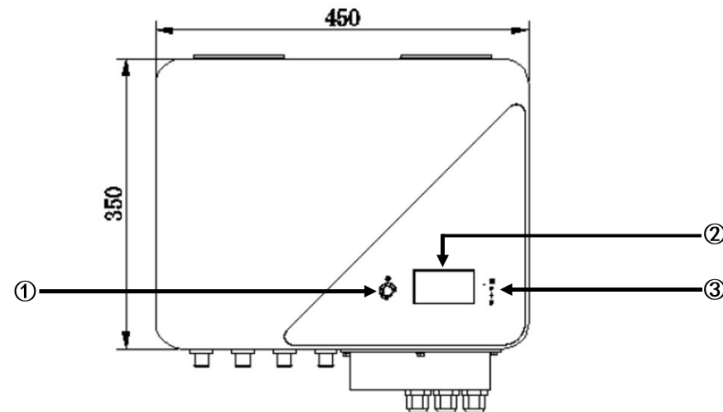
2. Introduction

LIO II-2410E lithium iron phosphate battery is one of new energy storage products. It can be used to support reliable power for various types of equipment and systems. LIO II-2410E is especially suitable for application scene of high power, limited installation space, restricted load-bearing and long cycle life.

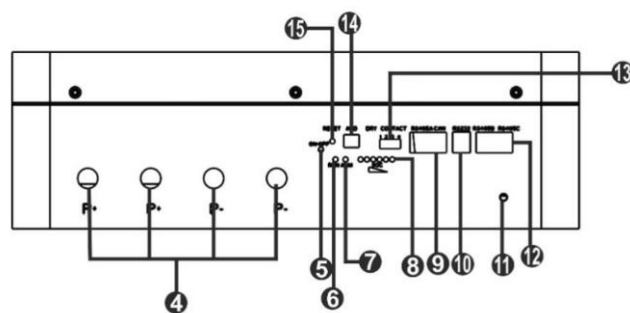
LIO II-2410E has built-in BMS battery management system, which can manage and monitor cells information including voltage, current and temperature. What's more, BMS can balance cells charging and discharging to extend cycle life. Multiple batteries can be connected in parallel to expand capacity and power in parallel for larger capacity and longer power supporting duration requirements.

Certification: UL 1642, UN38.3.

2.1 Product Overview



1. Power on/off button: Power on, wake up or shut off the battery module.
 - If battery module is in sleep-mode, press and hold the button for approximately 3~6 seconds to wake up the module and the all indicators will light up in sequent for 0.5 seconds.
 - If battery module is working, press and hold the button for approximately 3~6 seconds to enter sleep mode.
2. LCD display
3. Operation buttons



Terminal view

4. Battery connectors (including 2 positive poles and 2 negative poles): Using 4-pin terminals, from left to right is defined as battery+, battery+, battery-, battery-, which is connected with the power transmission line for charging and discharging.
5. On/Off indicator
6. RUN LED: During charging, the "RUN" light will be flashing.
7. ALM LED: When the battery is at fault, "ALM" LED is lighting red.

8. SOC LEDs: Six LEDs indicating battery capacity.

Condition		Charging						Discharging					
Capacity indicator		L6	L5	L4	L3	L2	L1	L6	L5	L4	L3	L2	L1
Capacity %	0-17%	Off	Off	Off	Off	Off	Flash 2	Off	Off	Off	Off	Off	On
	18-33%	Off	Off	Off	Off	Flash 2	On	Off	Off	Off	Off	On	On
	34-50%	Off	Off	Off	Flash 2	On	On	Off	Off	Off	On	On	On
	51-66%	Off	Off	Flash 2	On	On	On	Off	Off	On	On	On	On
	67-83%	Off	Flash 2	On	On	On	On	Off	On	On	On	On	On
	84-100%	Flash2	On	On	On	On	On	On	On	On	On	On	On
RUN LED		On						flash 3					

Note: Flash1- light 0.25s/off 3.75 seconds; Flash 2-0.5 slight /0.5s off; Flash 3 -0.5 slight/1.5s off.

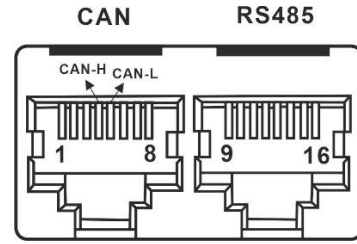
RUN, ALM and SOC LEDs will display battery status as below table.

Condition	Normal/ Alarm/ Protection	RUN	ALM	Capacity LED						Description
				L6	L5	L4	L3	L2	L1	
Shutdown	Sleep mode	Off	Off	Off	Off	Off	Off	Off	Off	All off
Standby	Normal	Flash 1	Off	According to the battery indicator						Standby mode
	Alarm	Flash 1	Flash 3							Low battery
Charging	Normal	On	Off	According to the battery capacity (Check SOC indicator table)						If overcharge occurs, ALM does not flash.
	Alarm	On	Flash 3							
	Overcharge protection	On	Off	On	On	On	On	On	On	If there is no utility power, the indicator is in standby state.
	Over temperature over current, and failure protection	Off	On	Off	Off	Off	Off	Off	Off	Stop charging.
Discharging	Normal	Flash 3	Off	According to the battery capacity						
	Alarm	Flash 3	Flash 3							
	Under voltage protection	Off	Off	Off	Off	Off	Off	Off	Off	Stop discharging.
	Temperature overcurrent short circuit and reverse connection, failure protection	Off	On	Off	Off	Off	Off	Off	Off	Stop discharging.
Failure		Off	On	Off	Off	Off	Off	Off	Off	Stop charging and discharging.

Note: Flash 1- light 0.25s/off 3.75 seconds; Flash 2-0.5 slight /0.5s off; Flash 3 -0.5 slight/1.5s off.

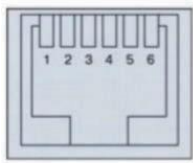
9. CAN & RS485: CAN Communication Terminal:(RJ45port) follow CAN protocol, for output battery information.

CAN Using 8P8C vertical RJ45 socket		RS485 Using 8P8C vertical RJ45 socket	
RJ45 Pin	Definition description	RJ45 Pin	Definition description
1, 3, 6, 7, 8	NC	9, 16	RS485-B1
4	CAN-H	10, 15	RS485-A1
5	CAN-L	11, 14	GND
2	GND	12, 13	NC



10. RS232 port: (RJ11 port) follow RS232 protocol, for manufacturer or professional engineer to debug or service.

RS232 Use 6P6C vertical R11 socket	
RJ11 pin	Definition description
2	NC
3	TX
4	RX
5	GND

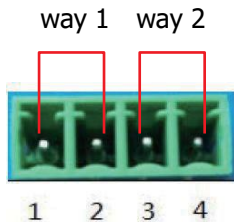


RS232 port

11. Grounding screw

12. Extension ports: BMS signal transmission for battery modules and for battery capacity extension in parallel.

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



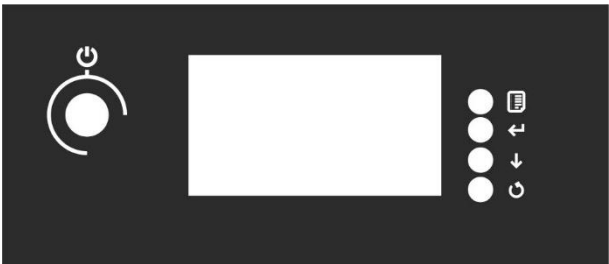
14. ADD: It indicates the unique ADD code for each battery module. It's required to assign a unique ID to each battery module for parallel operation. Maximum 15 battery modules can be operated in parallel. The explanation of its dial switch as shown in below table.

Address Code				ADD	PACK Definition	Address Code				ADD	PACK Definition
1	2	3	4			1	2	3	4		
ON	OFF	OFF	OFF	1	PACK1	ON	OFF	OFF	ON	9	PACK9
OFF	ON	OFF	OFF	2	PACK2	OFF	ON	OFF	ON	10	PACK10
ON	ON	OFF	OFF	3	PACK3	ON	ON	OFF	ON	11	PACK11
OFF	OFF	ON	OFF	4	PACK4	OFF	OFF	ON	ON	12	PACK12
ON	OFF	ON	OFF	5	PACK5	ON	OFF	ON	ON	13	PACK13
OFF	ON	ON	OFF	6	PACK6	OFF	ON	ON	ON	14	PACK14
ON	ON	ON	OFF	7	PACK7	ON	ON	ON	ON	15	PACK15
OFF	OFF	OFF	ON	8	PACK8						

15. Reset: Press RESET key for 5 seconds, then start the device, press the RESET key for 5 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.

2.2 Menu Operation Instruction

The LCD display interface is user-friendly, as shown in below figure. It provides 320 x 240 dot matrix graphic display. 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.

The commonly used button function

	Main menu
	Confirm, enter
	Page down
	Return, launch

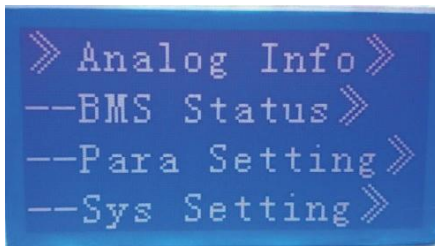
Operation Procedure



1. Press the icon 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, Enter the Menu screen, when the  points to the corresponding bar, press Enter  to confirm.

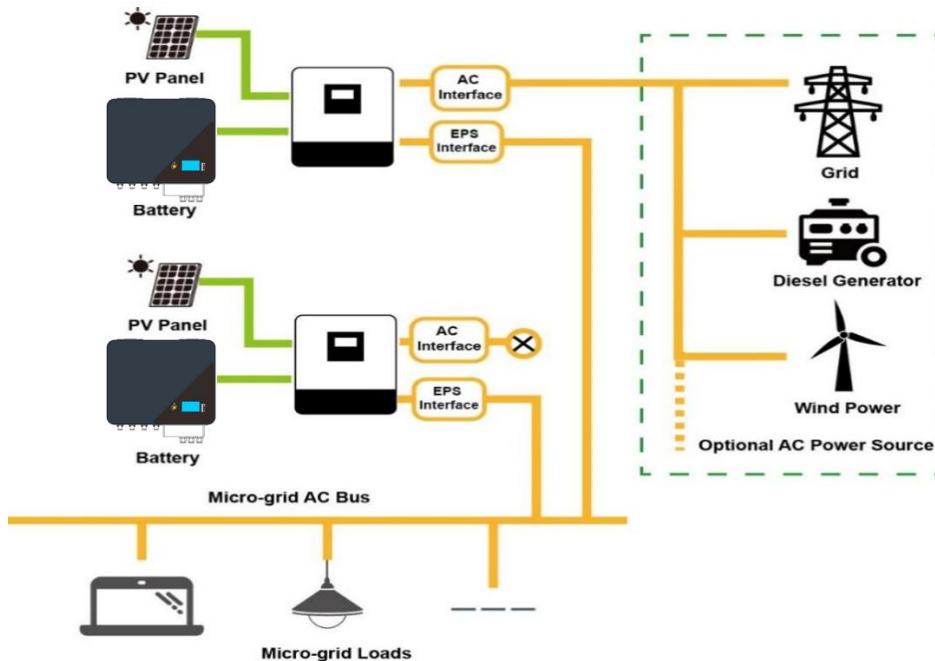
4. Go back on the menu bar, click  button.

2-3. 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 Telecom 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 25.6V 100Ah, with a large capacity, can be used in accordance with user requirements arbitrary combination as shown in below figure.



2-4. Product Features

Integrated lithium battery pack for Wall-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 3 months without charging on shelf ;no memory effect, excellent performance of shallow charge and discharge;
- Working temperature range is from -20°C to 60°C, (Charging 0~60°C; discharging -20~60°C) with excellent discharge performance and cycle life;



INTRO:

1. Telemetry: voltage, current, temperature, SOC, SOH (optional), etc.
2. Tel-signalling 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).
3. Remote control: charge / discharge (optional), alarm sound off, intelligent intermittent charging mode, current limiting charging mode.
4. Optional: Battery charge / discharge management parameters and the output parameters of the switching power supply system.

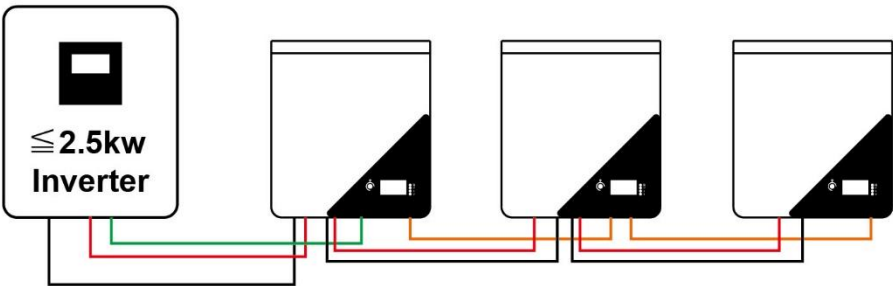
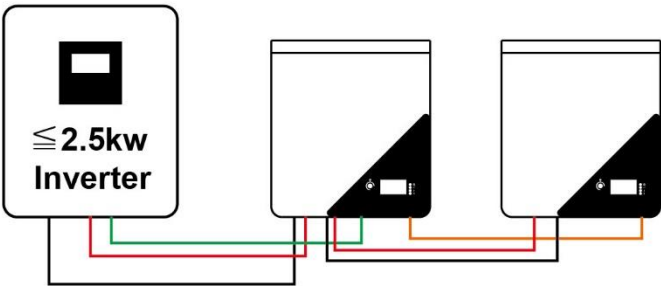
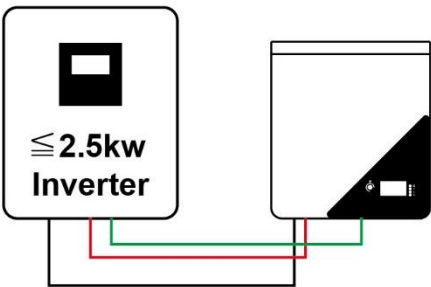
2-5. Multiple Batteries in Parallel

To extend backup time, this battery module is allowed to connect up to 15 pieces in parallel. The recommended minimum battery module number is listed as below.

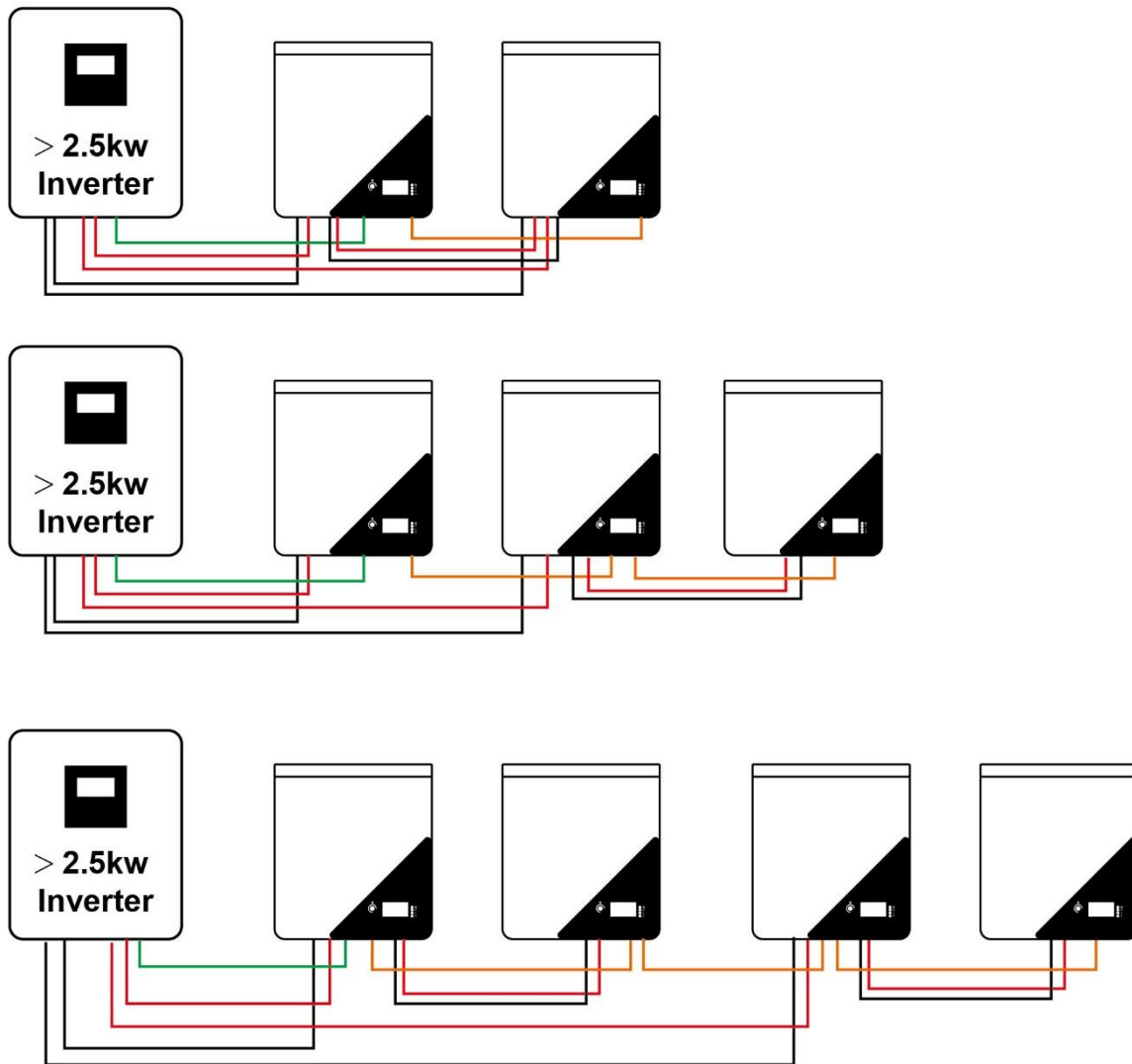
Connected inverter power rating	Connected battery module numbers
$\leq 2.5kw$	1
$> 2.5kw$	2

Parallel connection wiring

1. Wiring diagram for small power rated inverters ($\leq 2.5KW$)



2. Wiring diagram for big power rated inverters (> 2.5KW)



2-6. Battery Active Equalization

Because the battery capacity, internal resistance, voltage and other parameter values are not completely consistent, this difference causes the battery with the smallest capacity to be easily overcharged and discharged during charging, and the smallest battery capacity becomes smaller after damage, entering a vicious cycle. The performance of single battery directly affects the charge and discharge characteristics of the whole battery system and the reduction of battery capacity. BMS without balance function is just a data collector, which is hardly a management system. BMS active equalization function can realize the maximum continuous 1A equalization current, transferring the high-energy single battery to the low-energy single battery, or using the whole group of energy to supplement the lowest single battery. During the implementation process, the energy is redistributed through the energy storage link, so as to ensure the battery consistency to the greatest extent, improve the battery lifecycle and delay the battery aging.

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.

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 CO2 fire extinguishers).

3. Ventilation and heat dissipation

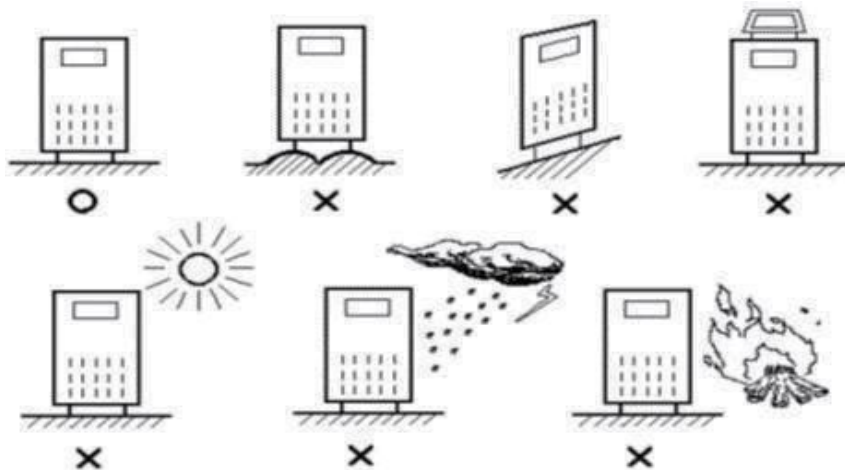
In order to facilitate the operation and maintenance of equipment for the heat, the equipment should be left around (50~30) cm around at least, left about 50cm for the upper space. The space should be equipped with exhaust fan, to maintain good indoor ventilation.

4. Installation requirements

Installation should be carried out as shown in figure 3-1 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.



5. Environmental requirements

Ambient temperature: (-10~+40) °C.

Relative humidity level: 0%RH~95%RH, no condensation.

Cooling method: air cooler.

Height above sea level: match to the standard requirement of GB3859.2-93.

Verticality: no vibration and the vertical inclination does not exceed 5°.

Pollution level: Level II

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

 CAUTION	- Do not install in the working environment with metal conduction typedust. 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.
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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 25.6V.

DC output power

 CAUTION	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.
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3-2. Installation Procedure

3-2-1. 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 it's complete and make certain nothing was damaged during shipping.

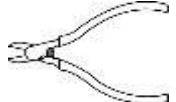
Before clearing the packaging, make sure that all parts are included. If equipment or accessories are damaged in transit, or incomplete or incompatible, the equipment, accessories and order contracts should be recorded and local dealer should be contacted immediately.

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.

3-2-2. Installation Tools

Potential commonly used tools as shown in below tables the field technician will increase or decrease the amount according to the construction.

Table 1: General purpose tools

The appearance of the tools, parameters, and names			
Adjustable wrenches	Phillips 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

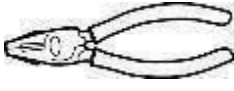
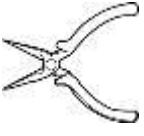
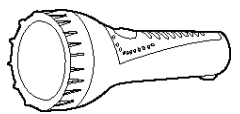
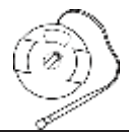
			
Ladder (2m)	Flashlight	Tape measure	Impact drill
			

Table 2: Tools for delivery and unpacking

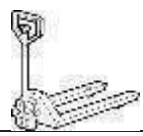
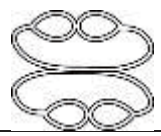
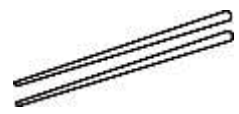
The appearance of the tools, parameters, and names			
Manual forklifts	Electric forklift	Sling (weight $\geq$ 400kg)	Leverage (weight $\geq$ 400kg)
			

Table 3: Electrical installation tools

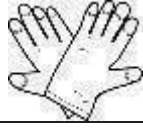
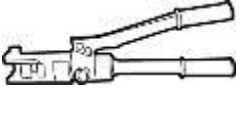
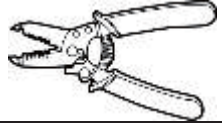
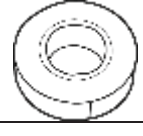
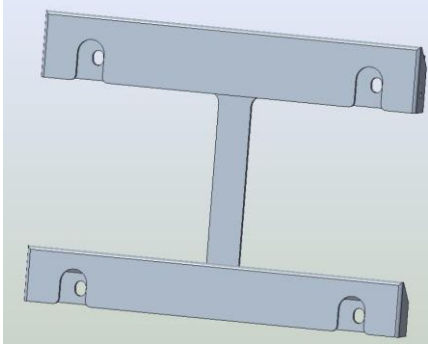
The appearance of the tools, parameters, and names			
Insulated gloves	Power cable crimping plier	Wire stripping pliers	Electrical tape
			

Table 4: Measuring Tools

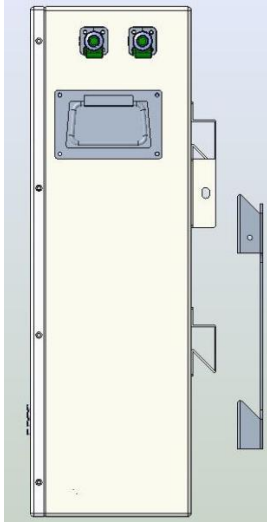
The appearance of the tools, parameters, and names	
Clamp the flow table	
	

3-3. Installation Method

1. Use expansion screws to fix the accessory bracket shown below on the wall.



2. Hang the battery box on the stand. (picture is for reference only)



3. Use M6 screws to secure the case from both sides. (picture is for reference only)



4. Maintenance

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.

4-1. Electrical Maintenance

Maintenance of the electrical parts may refer to table.

Items	The checking Points	Methods	Repair conditions	Repair solution
Electrical	Check if the output voltage is normal.	Multimeter	Battery voltage out of range set.	See the following troubleshooting section
Fault inspection	Check if lights are normal.	Visual inspection	Alarm	
Cable	Insulation, Terminal	Visual inspection	Insulation cracks, aging	Replace the cable.
			Exfoliated, corrosion of the terminals.	Replace the terminal block.

4-2. Battery Maintenance

Frequency	Items	Solutions
Monthly	Operating environment	Stay away from heat source and avoid direct sunlight.
	Visual inspection	If there is any breakage, leakage or deformation, isolate the problematic battery pack, take a photograph and replace the battery
Quarterly	Visual inspection	Use cotton cloth to clean the appearance. Be careful during cleaning because the voltage is high.
	Connection status	● Check each terminal and bolt. If it's loose, tighten it again. ● Check the cause if the cable temperature exceeds 40°C.
Every 6 months	Measure and record the voltage	● At the final stage of charging, record the voltage; make sure the positive and negative voltage of the battery are the same. Otherwise, check and repair the corresponding connection cable. ● Connect the discharge data at least once every six months for the first year. ● In the second year, capacity is determined by every three months. Review history through the RS232, which shows frequent overcharge of a battery in the alarm message, indicating that the batteries have reached the charging and discharging protection point. This may result in time for preparing electricity is not enough and suggest changing the battery immediately.

4-3. Trouble Shooting Steps

① Problem determination based on:

1. Whether the battery can turn on or not;
2. If battery is turned on, check the red light is off, flashing or lighting;
3. If the red light is off, check whether the battery can charge/discharge or not.

② Preliminary determination steps

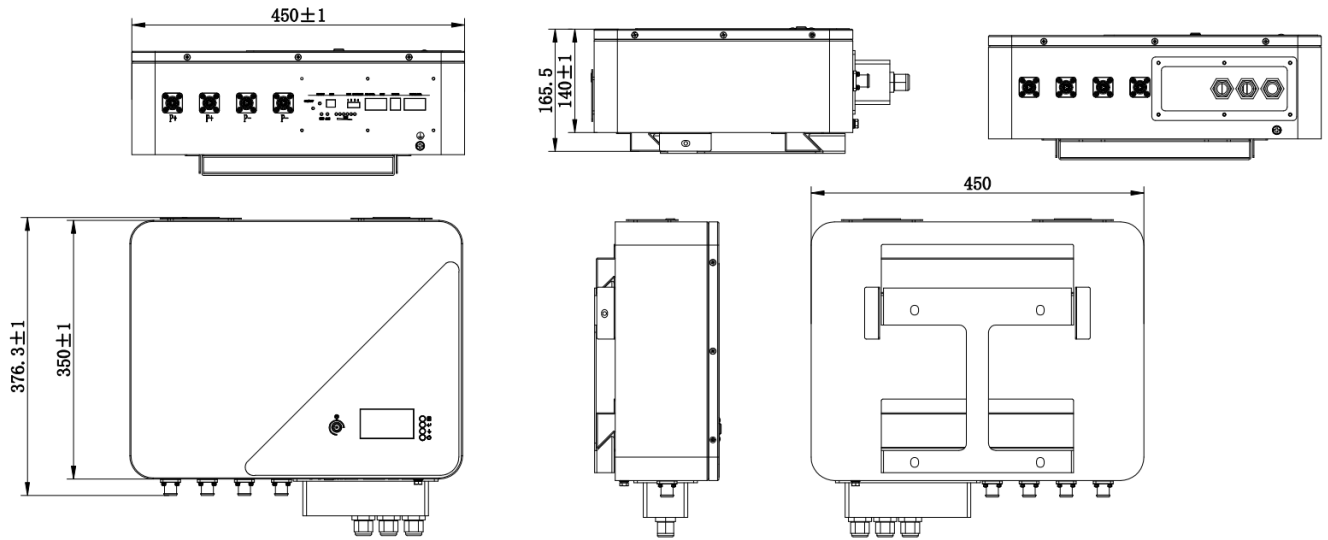
1. Battery cannot turn on, switch on the lights are all no lighting or flashing.
If the battery external switch is ON, the RUN light is flashing, and the external power supply voltage is 25.6V or more, the battery still unable to turn on, please contact local dealer or installer.
2. The battery can be 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 values as following:
 - a. Temperature: Above 50°C or under -10°C, the battery could not work.
Solution: to move battery to the normal operating temperature range between -10°C and 50°C
 - b. Current: If current is greater than 100A, battery protection will turn on.
Solution: Check whether current is too large or not, if it is, to change the settings on power supply side.
 - c. High Voltage: If charging voltage above 29.2V, battery protection will turn on.
Solution: Check whether voltage is too high or not, if it is, to change the settings on power supply side.
 - d. Low Voltage: When the battery discharges to 21.6V or less, battery protection will turn on.
Solution: Charge the battery for some time, the red light turn offExcluding the four points above, if the faulty is still cannot be located, turn off battery and repair.
3. The battery cannot be charged or discharged
 - a. Cannot be charged:
Solution: Disconnect the power cables, measure voltage on power side, if the voltage is 28~29V, restart the battery, connect the power cable and try again, if still not work, turn off battery and contact local dealer or installer.
 - b. Unable to discharge
Solution: Disconnect the power cables and measure voltage on battery side, if it is under 21.6V, please charge the battery; if voltage is above 25.6V and still cannot discharge, turn off battery and contact local dealer or installer.

5. Specification

5-1. Technical Specification

The main physical dimensions for a single module is shown below and refer to below specification table for a single battery module.

Outline of the unit with bracket



Specification of one single module

Rated Capacity (5HR)	100 Ah
Nominal Voltage	25.6 V
Discharge ending voltage	21.6V
Charging limited voltage	29.2V
Max. charging current	50A
Max. continue discharge current	100A
Weight	Approx. 30 kg
Display	With display screen
Protocol	RS485
Parallel connection	Parallel connection is up to 15 pcs (optional)
Dimension (W x D x H) mm	450 x 350 x 140 mm
Design life	More than 15 years
Cycle life	4000 cycles @ 80% DOD
IP class	IP65
Outer package material	White bake lacquer steel case (optional)
Operating temperature	Charging: 0 to +60°C, Discharging: -20 to +60°C Storage: -20 to +60°C

5-2. Main performance index of the battery

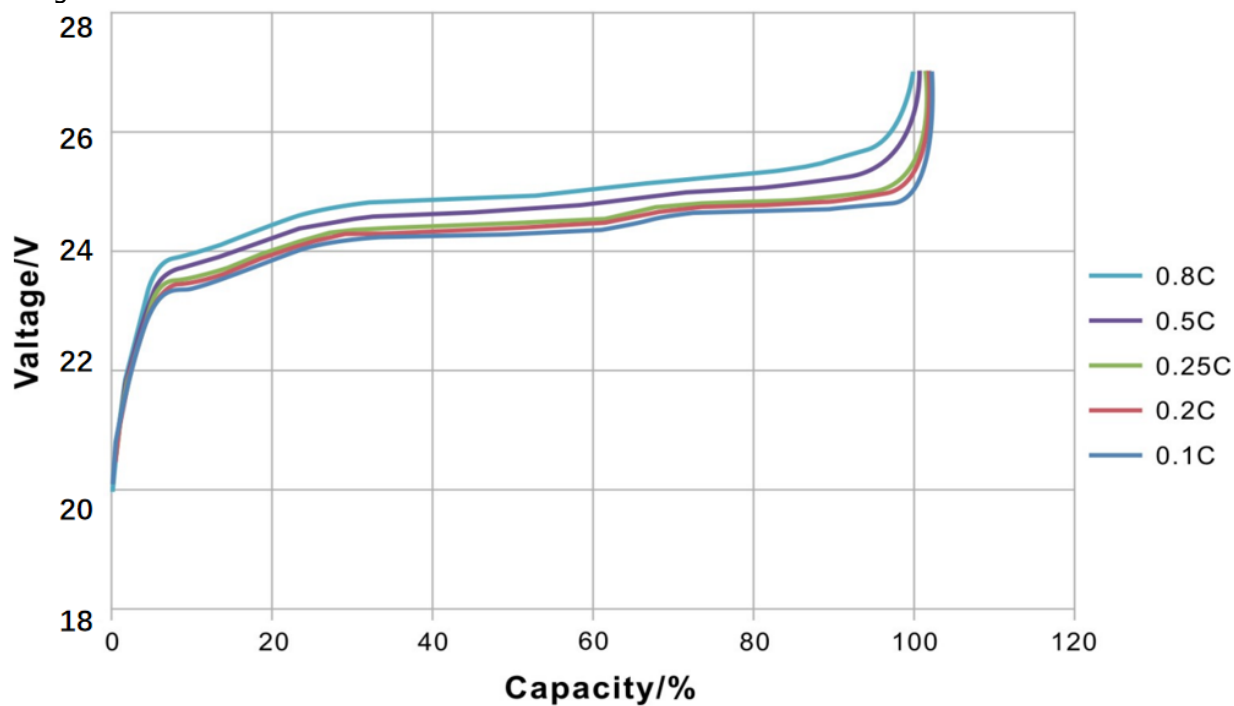
The electrical performance is listed below table.

Items for test	Testing methods	Requirements
0.1C discharge performance	Standard battery charge, within 1h with 0.1C discharge current to 21.6V and record the discharge time.	Discharge time $\geq$ 600min
0.5C discharge performance	Standard battery pack within 1h with 0.5C discharge current to 21.6V and record the discharge time.	Discharge time $\geq$ 115min
High temperature performance	After the battery pack is charged in the standard (60 ± 2) °C high temperature box for 4 hours and the discharged to 21.6V at 0.1C, record the discharge time.	Discharge time $\geq$ 600min
Low temperature performance (-10°C)	After charging, the battery pack is put in the low temperature box of (-10 ± 2) °C for 6 hours, then discharged to 21.6V at 0.2C at this temperature, record the discharge time.	Discharge time $\geq$ 180min
Low temperature performance (-20°C)	After charging, the battery pack is put in the low temperature box of (-20 ± 2) °C for 6 hours, then discharged to 21.6V at 0.2C at this temperature, record the discharge time.	Discharge time $\geq$ 120min

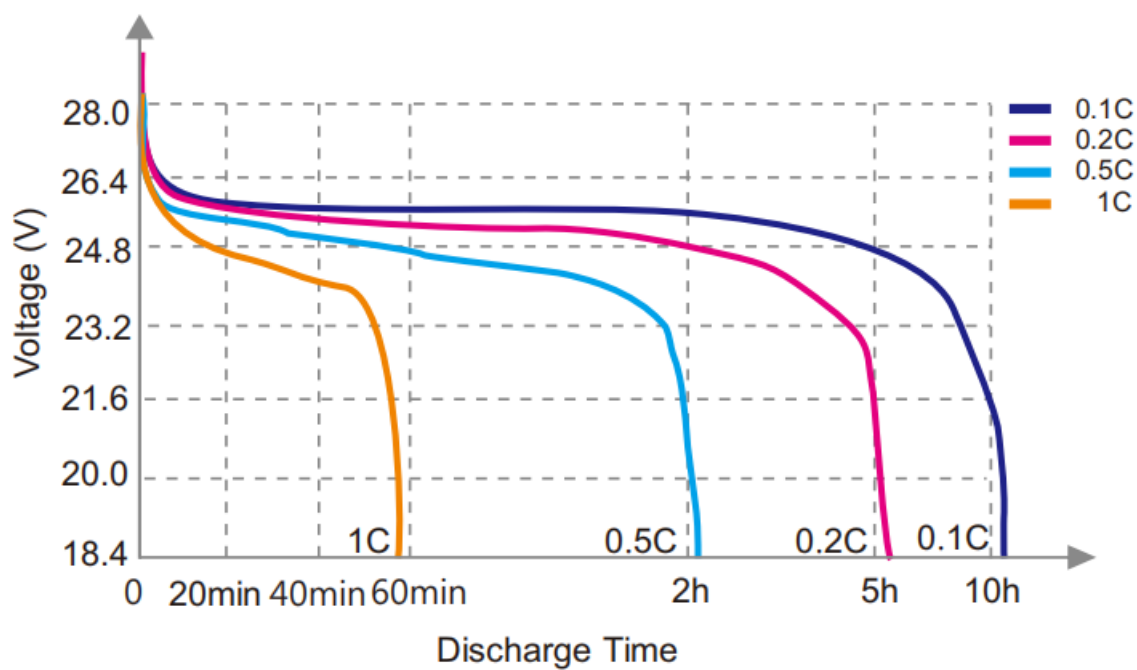
5-3. Battery Characteristics

Charging and discharging graph is listed below.

Charge Curves



Discharge Curves



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 is shown below.

Specification	Mark
25.6V 100Ah	

6-2. Recycle



This mark indicates that the product can not 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.



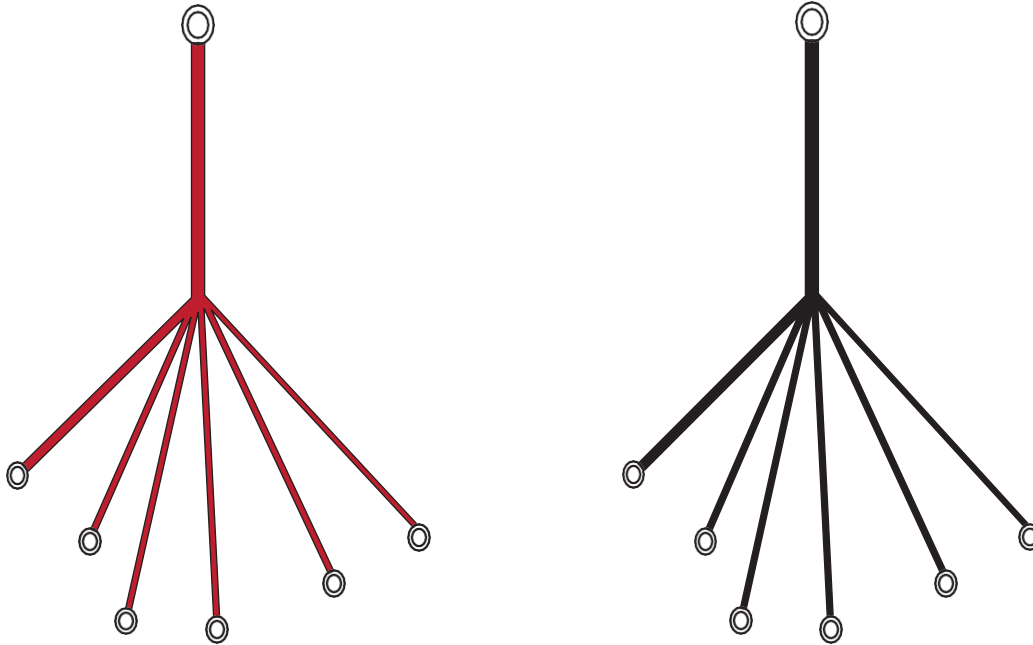
In order to recycle the used equipment, please use the recycling system or contact the manufacturer or seller of the product or the local authority to manage the product.

7. APPENDIX

7-1. Connection Cable

If groups (4~10) of parallel sets of lithium batteries are not supplied by battery supplier, you can choose the customized wiring cables to replace. Relevant technical requirements are the feeder cable number and the number of parallel battery pack inconsistent, and the specifications of each extension cable (length, diameter, and material) are the same.

For example, a customized six parallel wiring cable diagram as shown below.



According to the customer requirements, selecting the appropriate connector, cables, extension cable specifications, refer to relevant cable specifications given in below table.

Corresponds to AWG line number table

AWG	Diameter		cross- sectional area (mm ²)	Resistance (Ω/km)	Rated current (A)	Maximum current (A)
	mm	inches				
0000	11.68	0.4600	107.22	0.17	423.2	482.6
000	10.40	0.4096	85.01	0.21	335.5	382.6
00	9.27	0.3648	67.43	0.26	266.2	303.5
0	8.25	0.3249	53.49	0.33	211.1	240.7
1	7.35	0.2893	42.41	0.42	167.4	190.9
2	6.54	0.2576	33.62	0.53	132.7	151.3
3	5.83	0.2294	26.67	0.66	105.2	120.0
4	5.19	0.2043	21.15	0.84	83.5	95.2
5	4.62	0.1819	16.77	1.06	66.2	75.5
6	4.11	0.1620	13.30	1.33	52.5	59.9
7	3.67	0.1443	10.55	1.68	41.6	47.5
8	3.26	0.1285	8.37	2.11	33.0	37.7
9	2.91	0.1144	6.63	2.67	26.2	29.8
10	2.59	0.1019	5.26	3.36	20.8	23.7
11	2.30	0.0907	4.17	4.24	16.5	18.8
12	2.05	0.0808	3.332	5.31	13.1	14.9
13	1.82	0.0720	2.627	6.69	10.4	11.8
14	1.63	0.0641	2.075	8.45	8.2	9.4