

# Li90-Battery Module

User & Installation Manual

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# 1 Overview

## 1.1 Product Constitution

Li90-BM li-ion battery module is made up of li-ion battery group, power conversion unit, BMS management unit and fire-fighting unit.

- Li-ion battery group: adopt the cell of 50Ah/4C lithium iron phosphate, the capacity of single module is 2.8kWh.
- Power conversion unit: the conversion unit between charge and discharge of li-ion battery, it can output two groups of independent 240Vdc.
- BMS management unit: collect the cell voltage, temperature and current of battery group, control the conversion unit to achieve the conversion between charge and discharge.
- Fire-fighting unit: Nano microcapsule fire extinguishing device.

**NOTE**

The meaning of icon on the nameplate is as follows.

Icon	Meaning
	Please read the instruction
	Non-recyclable

## 1.2 Features

- Electric and physical dual insulated between li-ion battery module and UPS.
- Dual low-voltage design (low-voltage of battery pack, no voltage output while OFF), with higher safety.
- If one battery module is fault, the module will exit automatically, will not affect the system, other modules can work normally.

- Modular fire protection, safe and reliable.
- N+1 parallel project, easily realize the backup redundancy.
- Smart fan speed control to make the service life of fan longer and make the noise smaller.
- The module adopts pluggable connection to achieve minute-level replacement.

## 1.3 Structure

Li90-BM li-ion battery module is mainly made up of handles, indicators, ON/OFF knob, fans, output connector and case. The appearance of Li90-BM li-ion battery module is as shown in Figure1-1.

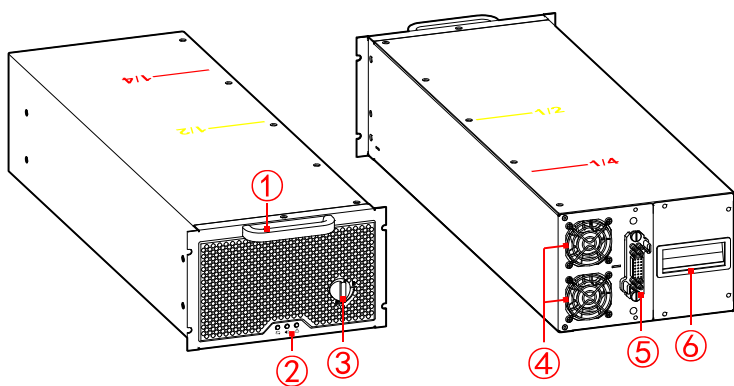


Figure1-1 Appearance

Table1-1 Component illustration



No.	Name	No.	Name
①	Front handle	④	Fan
②	Indicators	⑤	Output connector
③	ON/OFF knob	⑥	Handle



### NOTE

At the top of the li-ion battery module, there are position marks. The yellow “1/2” means half of the module. The red “1/4” means quarter of the module.

### 1.3.1 ON/OFF Knob Illustration

- When the ON/OFF knob stay in  status, the module is OFF and with no output.
- When the ON/OFF knob stays in  status, the module is ON, and output DC voltage.

1.3.2 Indicator Illustration

The indicator of Li90-BM li-ion battery module includes run, alarm and fault. The corresponding indicator illustration and status illustration is as shown in

Table1-2 Indicator illustration

Indicator Status	Run	Alarm	Fault
Charge			
Discharge			
Sleep			
OFF			
Module alarm	-		
Communication abnormal	-		-
Module protect			
Battery abnormal			

NOTE

“\*” means that the indicator stays in any status.

, , means that the corresponding indicator is on.

, , means that the corresponding indicator flickers once every 1 second.

means that the alarm indicator flickers once every 3 seconds.

, , means that the corresponding indicator is off.

Connector illustration

The connector of Li90-BM li-ion battery module is as shown in Figure1-2, corresponding illustration is as shown in Table1-3.

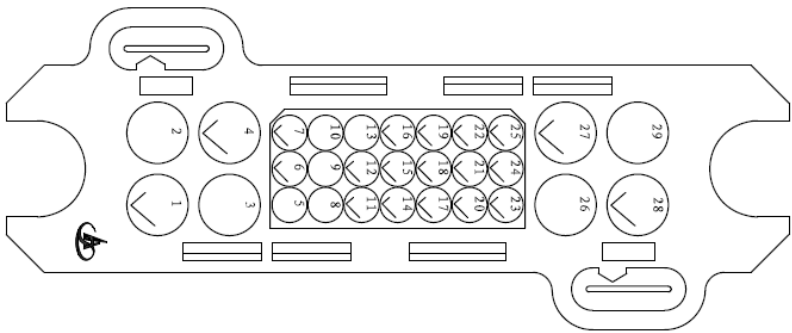


Figure1-2 Communication connector diagram

Table1-3 Illustration of communication connector

Signal name		JDS-29Z-35   socket	Definition illustration
DC output	Output 1+	1	Module's route 1 output +
	Output 1-	4	Module's route 1 output -
	Output 2+	28	Module's route 2 output +
	Output 2-	27	Module's route 2 output -
CAN communication port 1	CAN-L	17	CAN communication between PBMU and SBMU.
	CAN-H	18	
CAN communication port 2	CAN-L	14	CAN communication between PBMU and PBMU.
	CAN-H	15	
RS485-1	RS485-A	19	RS485 communication between PBMU and UPS.
	RS485-B	22	
EPO	EPO+	20	Emergency power off signal, when they are short connected, the module will power off.
	EPO -	23	
RS485-2	RS485-A	11	Cell BMU Transcribe port
	RS485-B	12	
UPS dry contact	S1	6	Reserved
	S2	7	
Parallel address	AD+	24	Distribute the parallel address.
	AD-	25	

## 1.4 Work Principle

### 1.4.1 Work Principle Diagram

The work principle diagram of Li90-BM li-ion battery module is as shown in Figure1-3.

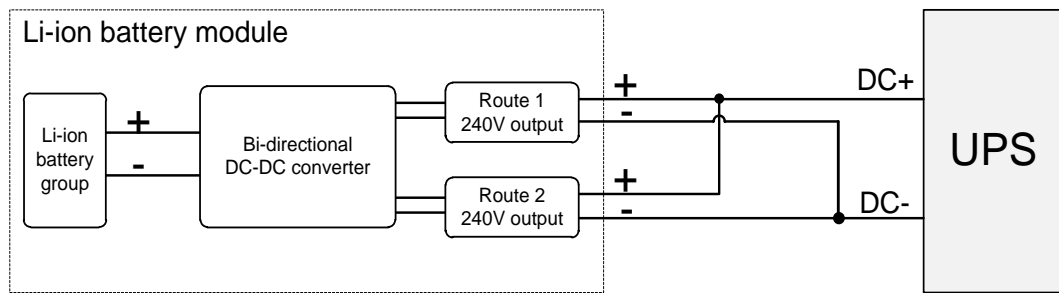


Figure1-3 Work principle diagram

## 1.4.2 Work Mode

Li90-BM li-ion battery module has three work modes: charge mode, sleep mode, discharge mode.

### Charge mode

When the input mains of UPS is normal and the li-ion battery modules need to charge, the UPS step-down the charge voltage of 265VDC by the inner bidirectional DC/DC converter and then charge the inner li-ion battery group in constant current and limited voltage.

### Sleep mode

When the UPS input mains normal and the inner li-ion batteries are fully charged, Li90-BM li-ion battery module turns to sleep mode. At this time, the module does not charge or discharge, until the battery voltage or SOC lower than the setting value, it starts to charge again.

### Discharge mode

When the UPS input mains abnormal, Li90-BM li-ion battery module turns to discharge mode from charge mode or sleep mode. At this time, the inner li-ion battery voltage will be boost to 240VDC by the inner bidirectional DC/DC converter and then supply DC power for the UPS.



## 2 Daily Operation

This chapter mainly introduces the operation procedure and method, including the use announcements, ON/OFF of Li90-BM li-ion battery module.

### 2.1 Use Announcements

- When connecting the li-ion battery module with UPS, a disconnect device must be added on the connection circuit.
- If the disconnect device is equipped between the Li90-BM li-ion battery module and UPS, before power on the UPS, please close the disconnect device to avoid the UPS without output when mains abnormal. While maintaining the UPS, please disconnect the disconnect device to avoid the positive and negative short circuit.
- Before powering on Li90-BM li-ion battery module, please check the load of UPS, and confirm the load capacity is within the allowed range. The load of UPS cannot exceed 90% of the rated output power of Li90-BM li-ion battery module, which is to avoid overload protection of the Li90-BM li-ion battery module.
- When the Li90-BM li-ion battery module is connected with UPS to use, please confirm that the charge voltage of UPS accord with the input voltage of Li90-BM li-ion battery module, or, the charge for Li90-BM li-ion battery module will not be done.

### 2.2 Operation Procedure

The operation procedure of Li90-BM li-ion battery module is as shown in Figure2-1.

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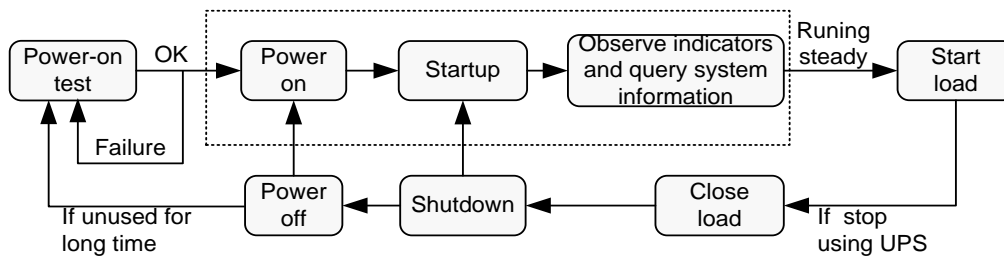



Figure2-1 Operation procedure


## 2.3 Power-on Test

### 2.3.1 Start the Li-ion Battery Module

- Step 1 Ensure that the battery breakers at the output side of Li90-BM li-ion battery module are all OFF.
- Step 2 Start the li-ion battery module: switch the ON/OFF knob on the module panel to  status. The three indicators on the panel all flicker, it means the module start to self-check. About 10s later, the green indicator flicker once, the module will turn to discharge status. Check the module output voltage by multimeter and see if the voltage is  $250\pm 5\text{VDC}$ .

----End


### 2.3.2 Power-on Test for the Connected UPS

- Step 1 Switch the ON/OFF knob on the module panel to  status to shut down the module. 1min later, close the battery breaker at the output side of Li90-BM li-ion battery module, and then start the UPS that connected with Li90-BM li-ion battery module. At this time, the UPS should be able to start through battery clod start and output normal AC voltage.
- Step 2 After the UPS output steadily, close the output load of UPS (the output load should be not greater than the output power of Li90-BM li-ion battery module).
- Step 3 Close the AC input breaker of UPS, the UPS should turn to mains inverter from battery inverter, and the Li90-BM li-ion battery module turns to charge mode from discharge, li-ion battery module should be in charge mode, at this time, the green indicator on the panel of module should be on.

----End

### 2.3.3 Power Down

- Step 1 Before shutting down, please power off the connected UPS and then disconnect the battery breakers connected with UPS and li-ion battery module.

Step 2 Switch the ON/OFF knob on the module panel to  status, all the indicators on the module light off, the li-ion battery module is completely shut down.

----End

---

## 3 Maintenance and Troubleshooting

This chapter mainly introduces the maintenance guide, daily maintenance, battery replacement announcement and troubleshooting, etc. of Li90-BM li-ion battery module.

### 3.1 Maintenance Guide

Proper maintenance is the key to make the Li90-BM li-ion battery system operate in the best status and with a longer service life.

#### 3.1.1 Safety Precautions

To ensure human safety and device safety, observe the following precautions.

- Please keep in mind that there is dangerous voltage inside the Li90-BM li-ion battery module even if it does not operate. Before maintenance, use a multi-meter to check the voltage and make sure that the Li90-BM li-ion battery module is completely shut down and stays in safe status.
- Before connecting the Li90-BM li-ion battery module at any time, use a multi-meter to measure if the voltage of wiring terminals is normal and the polarity is reverse connected. If abnormal, it is strictly forbidden to close the battery breaker.
- Do not wear any conductive metal objects during operating, such as ring, watch.
- Observe safety regulations strictly. If any doubt, please consult professionals who is familiar with the li-ion battery system.

#### 3.1.2 Preventive Maintenance

To improve the reliability and efficiency of Li90-BM li-ion battery module, perform the following maintenance tasks regularly.

- Keep the operating environment clean to avoid dust or chemical pollution to the li-ion battery system.
- Check the wiring terminals on input, output cables every half year and see if the contact is in good status.

- Check the fans work status regularly, avoid sundries blocking the air vents. If a fan is damaged, maintain or replace it in time.
- Check the SOC and SOH of li-ion battery modules regularly, ensure that the li-ion battery modules work in good status.
- Check the work status of Li90-BM li-ion battery module regularly and ensure that any fault can be found in time.

## 3.2 Daily Maintenance of Li-ion Battery Module


- Charge requirement of li-ion battery module
  - When first use, please start the UPS to charge the battery. During charging, Li90-BM li-ion battery module still can be used, but if power outage occurs at the same time, the battery discharge time may less than the standard vale this time.
  - If the Li90-BM li-ion battery module not used for a long time, please charge them regularly to supply power. The charge time of li-ion battery module is as follows.

When  $SOC \leq 10\%$ , please charge it immediately.

When  $10\% \leq SOC < 40\%$ , please charge it every month.


When  $40\% \leq SOC < 80\%$ , please charge it every 3months.

When  $80\% \leq SOC < 100\%$ , please charge it every 6 months.

- Clean the shells of li-ion battery module by cloth. Oil and organic solvents, such as petrol and diluents are prohibited.
- Keep the li-ion battery modules far away from fire sources and devices that easily generate sparks to avoid explosion.
- If the Li90-BM li-ion battery module needs to stop using, please switch off the battery breakers on the Li90-BM li-ion battery system and screw the ON/OFF knob to  status to avoid long discharge, and even cause the li-ion battery damage.

## 3.3 Announcements for Module Replacement

- Do not put the li-ion battery module into fire, which is to avoid explosion.
  - Do not open or disassemble the li-ion battery module, especially for the inner cells, which is to avoid electric shock or burn dangerous.
-

- Dangerous voltage may exist in the output end of the Li90-BM li-ion battery module, before contacting, please check if there is dangerous voltage to avoid endanger human safety.
- Keep the ON/OFF knob of replaced module at  status If the replaced module needs to be transported, it is suggested to pack the module the original package material or contact the local agency or distributor of Kehua Company.

## 3.4 Troubleshooting

### 3.4.1 Common Abnormal Phenomena Diagnosis

If the Li90-BM li-ion battery module cannot work abnormally after start, please refer to Table3-1 to find possible reason. Meanwhile, please check whether the fault is caused by external environment, such as temperature, humidity is not accordance with the requirement or overload.

Table3-1 only includes some simple diagnosis. If the diagnosis is not clear or not sufficient to solve the problem, please contact with local agency or dealer to deal with.

Table3-1 Troubleshooting

No.	Abnormal phenomena	Possible reason
1	Mains normal and the SOC of li-ion battery module is lower than 80%, but the charging for li-ion battery module cannot be done.	<ul style="list-style-type: none"> <li>● The charge voltage of UPS beyond the allowed range and cannot charge the li-ion battery module.</li> <li>● The wiring of battery is not well connected or the polarity of battery is reverse connected.</li> <li>● The battery breaker is not closed.</li> </ul>
2	Once the Li90-BM li-ion battery module switches to discharge status, it starts to protect immediately.	<ul style="list-style-type: none"> <li>● The connected load capacity exceeds the rated output capacity of Li90-BM li-ion battery module. Please lessen the load or add the li-ion battery module quantity.</li> <li>● The battery system is not charged for a long time and cause low SOC or the battery damaged, once discharge, it will turn to protect for low SOC.</li> </ul>

No.	Abnormal phenomena	Possible reason
3	After starting, the Li90-BM li-ion battery module works normally, but some time later, it will shut down automatically.	On battery supply power mode, the system turns to battery low-voltage protection for discharging ending, the system shut down automatically. This phenomenon is normal. When the mains recover, the system will start and charge the battery automatically.
4	The red indicator on the module panel light on.	<ul style="list-style-type: none"><li>● The module protects for low SOC.</li><li>● The operating temperature exceeds the allowed range or the heat dissipation fan is not started.</li><li>● The module fault, please replace it in time.</li></ul>

### 3.4.2 Emergency Dispose for System Fault

When one module fault, it will be insulated with system automatically. Generally, it will not affect the normal operation of system, but it will decrease the redundancy degree of module. At this time, please shut down the fault module and pull it out of the cabinet, and then inform the engineering technician to maintain.

## 4 Package, Transportation and Storage

This chapter mainly introduces the package, transportation and storage of Li90-BM li-ion battery module.

### 4.1 Package

During packing, please pay attention to the place direction requirements. At the side of the package, there is afraid of wet, handle with care, upward, stack layer limit, etc. alarm marks. And also, the device model is pasted on the package.

### 4.2 Transportation

During transporting, pay attention to the alarm marks and avoid severe impact on the device. Place the device according to the marked direction, which is to avoid damage the component. Any inflammable, explosive, corrosive object is not allowed to shipping with the device. While midway transportation, do not put the device in the open air. The device cannot suffer any rain, snow or liquid material or mechanical damage. The capacity of transported li-ion battery module should be within the range of 20-50%.

### 4.3 Storage

While storing, place the device according to the marked direction. The package box should be far away from ground for 200mm, and keep at least 500mm from wall, heat source, cold source, window or air inlet.

Storage temperature:  $-10^{\circ}\text{C}\sim 45^{\circ}\text{C}$  (recommended optimum temperature is  $0^{\circ}\text{C}\sim +35^{\circ}\text{C}$ ). If the device is transported or stored out of the storage temperature, before installation and startup, put it aside and let its temperature recover to normal range for more than 4h. In the warehouse, any inflammable, explosive, corrosive object or harmful gas is not allowed, and also, strong mechanical shake, impact or magnetic field is forbidden. The storage period of above requirements, generally, is 6 months. If stored more than 6 months, it is necessary to check again. If the device is stored for a long time, please charge the li-ion battery module every 3 months.



## 4.4 Recycle

- The recycle of li-ion battery module should meet be accord with the local laws and regulations.
  - Do not dismantle or damage the old li-ion battery at will.
  - Do not burn the old li-ion battery.
  - For the recycle of li-ion battery module, please contact the local dealer to recycle.
-

# A Technical Specifications

Index \ Model		Li90-BM
Electrical specification	Nominal capacity (kWh)	2.8
	Cell max discharge rate	4C
	Cell max charge rate	1C (0.4C factory default)
	Rated output voltage (discharge) (VDC)	240
	Rated output power (discharge) (kW)	10
	Overload capacity (discharge)	For $110\% \leq \text{load} < 120\%$ , it will turn to protect after 30s. For $120\% \leq \text{load} < 150\%$ , it will turn to protect after 1s. For $150\% \leq \text{load}$ , it will turn to protect after 200ms
	Rated input voltage (charge) (VDC)	260
	Rated input current (charge) (A)	$5 \pm 1$
	Battery prestart	Equipped
	Self-start after power recover	Equipped
	EPO function	Equipped
	Fire-fighting function	Equipped with module-level fighting function
	Module SOC detection	SOC accuracy $\geq 90\%$

Index \ Model		Li90-BM
	Module SOH estimate	SOH accuracy≥90%
	Switch time from charge mode to discharge mode	The switch time satisfy the output dynamic index requirement of UPS
	ON/OFF over-shock voltage	≤260
	Protection function	Protect for over-temperature, over-current, short-circuit, battery over-voltage, battery under-voltage, low SOC, etc.
Other features	Communication way	CAN, RS485
	Operation temperature (°C)	0~ + 40
	Storage temperature (°C)	-10~+45
	Relative humidity	5-95% (with no condensation)
	Altitude (m)	<4000, if the module is used above 2000m, it is necessary to derate according to IEC62040-3.
	Noise (dB)	<60
	Protection grade	IP20
	Size (W×D×H) (mm)	223×665×152
	Weight (kg)	36.5±1

- Specifications are subject to change without prior notice.

## 9 Obtaining Service

If the UPS requires Service:

1. Use the TROUBLESHOOTING section in this manual to eliminate obvious causes.
2. Verify there are no circuit breakers tripped.
3. Call your dealer for assistance. If you cannot reach your dealer, or if they cannot resolve the problem, call Xtreme Power Conversion Corp Technical Support at 800.582.4524. Technical support inquiries can also be made at [support@xpcc.com](mailto:support@xpcc.com). Please have the following information available BEFORE calling the Technical Support Department:

- Your name and address.
- The serial number of the unit.
- Where and when the unit was purchased.
- All of the model information about your UPS.
- Any information on the failure, including LED's that may or may not be illuminated.
- A description of the protected equipment, including model numbers if possible.
- A technician will ask you for the above information and, if possible, help solve your problem over the phone. In the event that the unit requires factory service, the technician will issue you a Return Material Authorization number (RMA).

If you are returning the UPS to Xtreme Power for service, please follow these procedures:

1. Pack the UPS in its original packaging. If the original packaging is no longer available, ask the Technical Support Technician about obtaining a replacement set of packaging material. It is important to pack the UPS properly in order to avoid damage in transit. Never use Styrofoam beads for a packing material.
2. Include a letter with your name, address, daytime phone number, RMA number, a copy of your original sales receipt, and a brief description of the problem.
3. Mark the RMA number on the outside of all packages. Xtreme Power cannot accept any package without the RMA number marked on the outside of the boxes.
4. Return the UPS by insured, prepaid carrier to the address provided by the Technician.

5. Refer to the Warranty statements in this manual for additional details on what is covered.

## 10 Xtreme Power Conversion Limited Warranty

Xtreme Power Conversion (XPC) Corporation warrants Xtreme Power Conversion equipment, when properly applied and operated within specified conditions, against faulty materials or workmanship for a period of **five years for Li90-Series products** from the date of purchase. XPC Corporation warrants **internal batteries for a period of five years** from the date of purchase. For equipment sites within the United States and Canada, this warranty covers repair or replacement, at the sole discretion of XPC Corporation. The customer is responsible for the costs of shipping the defective product to XPC Corporation. XPC Corporation will pay for ground shipment of the repaired or replacement product. This warranty applies only to the original purchaser.

If equipment provided by XPC Corporation is found to be **Dead-on-Arrival (DOA)**, the customer must request and received a **Return Material Authorization (RMA)** number. DOA equipment is defined as equipment that does not properly function according to user documentation when initially received and connected in conjunction with proper procedures as shown in the user documentation or via support provided by XPC Corporation personnel or authorized agents.

This warranty shall be void if (a) the equipment is repaired or modified by anyone other than XPC Corporation or a XPC Corporation approved third party; (b) the equipment is damaged by the customer, is improperly used or stored, is subjected to an adverse operating environment, or is operated outside the limits of its electrical specifications; or (c) the equipment has been used or stored in a manner contrary to the equipment's operating manual, intended use or other written instructions. Any technical advice furnished by XPC Corporation or a XPC Corporation authorized representative before or after delivery with regard to the use or application of Xtreme Power Conversion equipment is furnished on the basis that it represents XPC Corporation's best judgment under the situation and circumstances, but it is used at the recipient's sole risk.

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EXCEPT AS STATED ABOVE, IN NO EVENT WILL XPC Corporation BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF Xtreme Power Conversion EQUIPMENT, including but not limited to, any costs, lost profits or revenue, loss of equipment, loss of use of equipment, loss of software, loss of data, cost of substitutes, or claims by third parties. Purchaser's sole and exclusive remedy for breach of any warranty, expressed or implied, concerning Xtreme Power Conversion equipment, and the only obligation of XPC Corporation under this warranty, shall be the repair or replacement of defective equipment, components, or parts; or, at XPC Corporation's sole discretion, refund of the purchase price or substitution of an equivalent replacement product.