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Rechargeable LiFePO4 Battery Pack

LFP12-100MB, LFP12-100MBH and LFP12-230B series

INSTRUCTION MANUAL

Dear Customer,

Thank you very much for choosing our product. This manual contains important information about the installation, operation, and safety of the Photonic Universe LiFePO4 battery. Please read this manual carefully before installing the product. Failure to follow any instructions, warnings, as well as commonly accepted safety principles may result in an electric shock, injury or damage to the battery.

Overview

This lithium iron phosphate (LiFePO4) battery is a high-cycle energy storage product that provides a power source for various equipment and systems. This LiFePO4 battery features a built-in electronic Battery Management System (BMS), which manages the battery charging and discharging processes and monitors the battery voltage, current and temperature, ensuring it operates safely and efficiently.

Due to the BMS, the behaviour of this battery in various conditions may differ from other batteries without a BMS, especially if you are used to operating lead-acid batteries. In particular, the BMS may automatically disconnect the battery from your equipment in critical situations, such as when your equipment is drawing too much power, including at the start or at peak times (for example inverters) or the battery is being discharged too deeply. The range of BMS protection functions which safeguard the battery from potential damage includes: over-charging, over-discharging, over-current and over-temperature.

The battery features a low self-discharge rate, which minimises the power loss when the battery is not in use. This ensures that energy is conserved and available when needed.

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Instructions for use

Recommended tools



Cable cutters **Crimping tool** **Screwdriver**

Use appropriately insulated tools to prevent accidental electric shock or short circuits. If insulated tools are not available, cover all exposed metal on the tool, except the tips, with electrical tape or use insulated gloves.

Recommended safety gear



Insulated gloves **Safety goggles** **Safety shoes**

It is strongly recommended that you use personal safety gear when working with batteries, such as gloves, goggles, appropriate clothing, and safety shoes with toe caps.

Choosing a suitable installation location

Make sure that the installation location meets the following conditions:

- The area is dry and clean.
- The surface is flat and level.
- There are no flammable, explosive or corrosive materials present.
- The ambient temperature is within the operating range.
- The distance from any heat source is more than 2 metres.
- The distance from the air outlet of an inverter is more than 0.5 metres.
- The battery is not installed in direct sunlight.
- Avoid installing the battery in confined areas.

Caution: if the ambient temperature is outside of the operating range, the battery pack will stop operating to protect itself. Frequent exposure to harsh temperatures may deteriorate the performance and shorten the lifetime of the battery pack.

Before connecting the battery

- After unpacking, please check the product first. If you find any damage, please contact your supplier.
- Do not place or mount the battery on any surface with protruding screws, bolts, fixings or other objects which may press against, puncture or otherwise damage the battery casing. This also applies when using a mounting tray or bracket. When installing trays or brackets, always use suitable flat-head or countersunk screws with a rubber pad at the bottom of the tray to cover screws. Ensure that no screw heads, bolts or other components protrude into the area supporting or surrounding the battery.
- Thoroughly check polarity of the cables to ensure you do not accidentally connect the battery with reverse polarity, which may damage your battery.
- Examine the connecting cables to avoid any short circuits. Use a suitable fuse, automatic overcurrent circuit breaker or another current protection device on the connecting cable within 15 cm of the battery terminal.
- Ensure that the electrical parameters of the battery system are compatible with any connected system and equipment. In particular, match the nominal voltage of the battery with the nominal voltage of any charging equipment or loads. Do not connect sources of power like AC or solar panels directly to the battery terminals.
- Keep the battery away from chemicals and sources of heat. Avoid painting the battery or its components or contacts.
- Do not open, repair, or disassemble the battery or insert anything inside the case.
- Do not connect this battery in series or parallel with batteries of a different type, capacity, or chemistry, including lead-acid batteries.

Installation steps

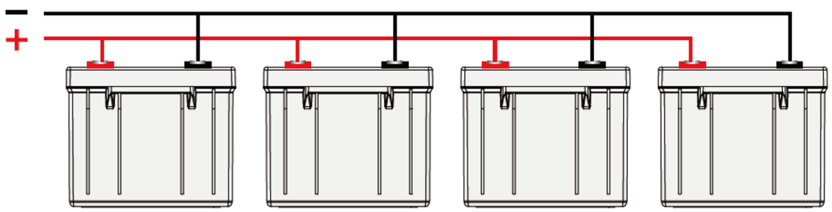
1. Install the battery securely in its intended compartment or mounting position.
2. Connect the positive (+) and negative (-) power cables to the equipment and loads first, before connecting the cables to the battery.
3. Make sure fuses are removed and/or breakers are open, then connect the other ends of the power cables to the battery, making sure to connect the positive (+) terminal first, then negative (-). Ensure all connections are tight, secure and correctly insulated.
4. Check the wiring for shorts, incorrect polarity or loose connections before closing breakers or inserting fuses.
5. Power on and test the connected equipment. Stop immediately if there is unusual heat, smell, noise or other abnormal behaviour.
6. To remove the battery, switch off and isolate the system, then disconnect the negative (-) terminal first, followed by the positive (+) terminal.

Series or parallel battery connection

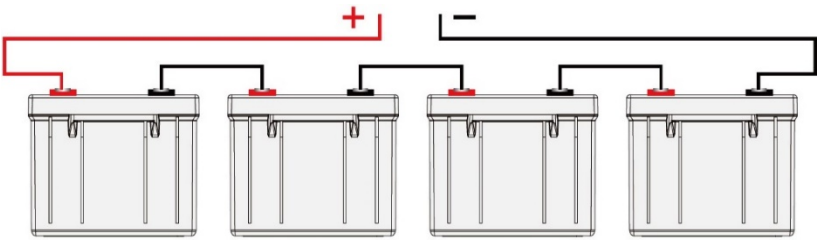
It is generally not recommended to connect the battery in parallel or in series with other batteries. If such connection is required, please ensure it meets the following requirements:

1) Either up to 4 in parallel, or up to 4 in series can be installed.
2) Only identical battery models with the same product code and age can be used. Do not connect different types, brands or sizes of batteries together and do not use old and new batteries in the same bank.
3) The voltage difference between the batteries before connection must be less than 0.2V.

Series and parallel connection in the same bank at the same time **is not allowed**.



Parallel connection



Series connection

When connecting the batteries in parallel, the power cables between the batteries and busbars must all be the same length to ensure the batteries remain balanced during charging and discharging. Once all the batteries are connected in parallel, it is recommended to leave them for at least 1 hour before connecting any loads.

Charging and discharging

Charging

- Charge the battery under suitable conditions and only with sound, correctly functioning charging equipment.
- The charging voltage must not exceed 14.6V for a single 12.8V battery.
- Use the standard charging current shown for the relevant model in the specification table. If a separate maximum charging current is stated on the product label or model-specific documentation, that maximum must not be exceeded.

- For first use, fully charge the battery before placing it into normal service.
- Do not charge continuously for more than 24 hours.
- Never charge with reversed polarity.
- Stop charging immediately if there is unusual odour, abnormal sound, excessive heat, swelling or leakage.

Discharging

- Do not exceed the continuous discharge-current rating of the relevant battery model.
- Peak discharge currents are permitted only for the short durations stated in the specification table.
- Excessive discharge current may cause heating, protective BMS operation and reduced available capacity.
- Avoid prolonged over-discharge. Recharge the battery after deep discharge and do not leave it in a deeply discharged condition for long periods.

BMS protection functions

The battery is fitted with a Battery Management System (BMS), which continuously monitors cell voltage, current and temperature. If an operating limit is exceeded, the BMS will automatically restrict charging or discharging to protect the battery. Normal operation will resume once the fault condition has been removed and the relevant recovery conditions have been met.

High-temperature charging protection

If the internal battery temperature rises to approximately 60°C while charging, the BMS will disable charging.

Charging will resume automatically once the internal battery temperature falls to approximately 52°C.

Low-temperature charging protection

If charging is attempted when the internal battery temperature is approximately 0°C or below, the BMS will prevent normal charging.

Charging will resume automatically once the internal battery temperature reaches approximately 5°C.

For the LFP12-100MBH only, the charger power may be used to operate the internal heating system while normal cell charging is disabled. See the Low-temperature heating function section for further information.

High-temperature discharge protection

If the internal battery temperature rises to approximately 62°C while discharging, the BMS will disable discharge.

Discharging will resume automatically once the internal battery temperature falls to approximately 52°C.

Low-temperature discharge protection

If the internal battery temperature falls to approximately −20°C, the BMS will disable discharge.

Discharging will resume automatically once the internal battery temperature rises to approximately −10°C.

Cell over-voltage protection

If the voltage of any individual cell rises above approximately 3.65V for 2 seconds, the BMS will disable charging to protect the cells from overcharge.

Charging will be enabled again once the affected cell voltage falls to approximately 3.50V.

Cell under-voltage protection

If the voltage of any individual cell falls below approximately 2.50V for 2 seconds, the BMS will disable discharge to protect the cells from excessive discharge.

Discharging will be enabled again once the affected cell voltage has recovered to approximately 2.70V. Connecting a suitable charger can be used to recover the battery from low-voltage protection.

Charging over-current protection

If the charging current exceeds the BMS over-current protection threshold for longer than the permitted delay period, the BMS will disable charging.

Remove or reduce the charging source so that the charging current is within the battery's permitted maximum continuous charging-current rating. The BMS will automatically recover after its programmed recovery delay once the over-current condition has been removed.

Discharge over-current protection

If the discharge current exceeds a programmed BMS over-current threshold, the BMS will disable discharge.

The BMS provides protection against both sustained over-current and higher short-duration over-current conditions. The maximum continuous and peak discharge-current ratings vary by battery model and are shown in the Specifications table.

If over-current protection is activated, switch off or disconnect the excessive load. The BMS will automatically recover after its programmed recovery delay once the overload condition has been removed.

Some inverters can draw a very high inrush current when first connected as their internal capacitors charge. If this repeatedly activates the BMS over-current protection, disconnect the inverter and use a suitable pre-charge arrangement before reconnecting it.

Short-circuit protection

If the BMS detects a sudden high-current event consistent with a short circuit, it will immediately disable discharge.

Disconnect the load and inspect the complete installation for short circuits, damaged cables, incorrect connections or other faults before attempting to use the battery again.

Once the load has been disconnected and the fault has been corrected, the BMS will automatically recover.

<u>Low-temperature heating function</u>

In this series only the LFP12-100MBH model includes built-in heating pads, which allows the battery to be safely charged at ambient temperatures below 0°C.

- When the charger is connected at a battery temperature below 0°C, the BMS does not yet permit normal charging. Instead, the charging current is diverted to the heating pads, which warm the battery.
- Once the battery temperature reaches 5°C, the BMS automatically enables charging. Between 5°C and 15°C, the charger continues to power both the battery and the heating pads at the same time.
- Once the battery temperature reaches 15°C, the heating function switches off.

Bluetooth App

This battery includes a built-in Bluetooth module, allowing you to monitor voltage, current, temperature and other battery data from your smartphone.

Download the monitoring app by scanning the QR code below.

Android App

iOS App

Maintenance and storage

- If you need to move the battery or perform any maintenance on the system, disconnect the battery from your equipment completely.
- The battery cells naturally self-discharge by approximately 1-2% per month, even when no load is connected. Leaving the battery in a fully discharged state for a prolonged period may cause excessive over-discharge, after which the battery may no longer be able to wake up or operate correctly. Damage caused by excessive discharge is not considered a manufacturing defect and is not covered by the warranty. To avoid this outcome:
    - If your battery is in storage or otherwise not in regular use, **charge the battery at least once every 6 months**. When performing this maintenance charge, ensure that the battery is charged to at least 30% state of charge.
    - If your battery is in regular use and is accidentally fully discharged to the point where the BMS cuts off the discharge, **recharge it immediately**, and in any case within 12 hours of the BMS cut-off.
- All terminals, connectors, grounding points, cables and screws must be checked at least once a year. Ensure there are no loose, broken, or corroded connectors or parts. Check the installation environment for dust, water, insects etc.
- When cleaning, wipe down the product's surface using a soft, dry cloth. Do not use harsh or abrasive cleaning chemicals or materials on the product, such as detergent,

as doing so may damage or scratch the finish.

- In case of any abnormal situations with the battery, especially mechanical damage, please contact your supplier within 24 hours.
- The optimal storage temperature range for the battery pack is 0°C to 30°C. Do not store the battery in temperatures above 40°C.

Note: if you are planning to keep the battery in storage without use for a long time, it is best to keep the level of charge of the battery at **approximately 60%**. Storing the battery with full 100% charge for a prolonged period of time may negatively affect its performance and lifetime.

Environmentally friendly disposal

At the end of its useful life the battery must be disposed of at a local authority specialist waste collection centre or at a recycling company providing this service. **Do not put the battery into the general waste** as it contains toxic substances. Recycling is environmentally friendly and enables the materials of the battery to be recovered to obtain significant savings in energy and resources. As a reminder of the need to dispose of this battery properly, the product is marked with a crossed-out wheeled bin.

Troubleshooting

- **Leakage**. In the unlikely event that the battery pack leaks chemical substances, avoid contact with it. If you have accidentally been exposed to the leaked substance, immediately perform the actions described below depending on the type of contact:
    a. In case of inhalation: leave the contaminated area and seek medical attention.
    b. Contact with eyes: rinse eyes with flowing water for 15 minutes and seek medical attention.
    c. Contact with skin: wash the affected area thoroughly with soap and water and seek medical attention.
    d. Ingestion: induce vomiting and seek medical attention.
- **Contact with water**. If the battery pack has come into contact with water or has been submerged, keep people away from it and contact your supplier for technical support. If applicable, also contact emergency services.
- **Damages**. Damaged batteries are dangerous and must be handled with the utmost care. If damaged, the battery must not be used and may pose a danger to people or property. If the battery pack seems damaged, pack it in its original container and contact your supplier.

Frequently asked questions

Can I connect this battery with lead-acid batteries?
No. Do not connect this battery in series or parallel with lead-acid batteries.

Can I connect batteries of different capacities or models together?
No. Only identical batteries with the same model, product code and age should be connected together. Do not mix batteries of different types, brands, capacities or ages within the same battery bank.

Can I charge this battery below 0°C?
Only the LFP12-100MBH model supports charging below 0°C. This model is fitted with an internal heating pad which allows the battery to be heated to a suitable temperature for charging.

What are the recommended charging voltages for the batteries?
A charging voltage of 14.4V is recommended. The charging voltage must not exceed the maximum permitted value of 14.6V.

Can the battery be mounted on its side?
Yes. The battery may be mounted on its side, although upright installation is preferred where possible. Do not install the battery upside down.

Can this battery power my inverter?
Yes, provided that the inverter's current demand remains within the battery's discharge-current ratings. Ensure that the maximum continuous current drawn by the inverter does not exceed the maximum continuous discharge current specified for the battery.

Can I use a charger with a lower charging current than the value shown in the specifications?
Yes. A charger with a lower charging current may be used, provided that the charging voltage is suitable for the battery. A lower charging current will increase the time required to fully charge the battery.

Can I charge the battery from my vehicle alternator?
Yes. The battery may be charged from a vehicle alternator using a suitable DC-DC charger.

Specifications

Model		LFP12-100MB	LFP12-100MBH	LFP12-230B
Nominal voltage		12.8V		
Nominal capacity		100Ah		230Ah
Nominal energy		1280Wh		2944Wh
Life cycles		3500 @ 80% DOD		4000 @ 80% DOD
Operating voltage		10 - 14.6V		
End of discharge voltage		10V		
Recommended charge voltage		14.4V		
Max. charge voltage		14.6V		
Standard continuous current	Charging	20A		45A
	Discharging	20A		45A
Maximum continuous current	Charging	100A		200A
	Discharging	100A		200A
Maximum peak discharge current (3s)		200A		400A
Charging temperature		0 ~ 55°C	-20 ~ 55°C	0 ~ 55°C
Discharging temperature		-20 ~ 60°C		
Storage temperature		-10 ~ 35°C		
Shipment voltage		12V ~ 13.5V		
Dimensions (L x W x H)		229 x 138 x 208 mm		384 x 194 x 255 mm
Weight		10 kg		20 kg
IP Rating		IP65		
Cell Type		Grade A Prismatic		
Case material rating		UL 94 V-0		
Humidity range		10% ~ 90% RH		
Heating function		No	Yes	No



Disclaimer

Working with electricity and batteries can be dangerous. The information provided in this manual is for general guidance only. All work should follow the safety standards and should be carried out by an appropriately qualified person.

Photonic Universe Ltd is not responsible for any damage or injury caused by inappropriate installation or use of the product.

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