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100Ah 51.2V
Rack Mounted LiFePO4 Battery

LFP48-100RS

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 Photonic Universe lithium iron phosphate (LiFePO4) battery offers enhanced safety and an extended lifecycle. The battery features a built-in battery management system (BMS) that manages the battery charging and discharging processes and monitors the battery voltage, current and temperature, ensuring it operates safely and efficiently. The BMS provides comprehensive protection against over-discharge, over-charge, over-current, and extreme temperatures. Automated management of charging, discharging, and cell voltage balancing ensures optimal battery performance at all times.

Multiple batteries can be connected in parallel, expanding capacity and power as needed. In multi-battery setups, the battery automatically configures the address; streamlining the installation process.

Important Safety Precautions

- Do not open, repair, or disassemble the battery. The warranty or QC label or sticker must not be removed, damaged or repositioned.
- Please ensure that the electrical parameters of the battery system are compatible with the related equipment.
- All battery terminals must be disconnected during installation, maintenance, and relocation.
- Do not connect the batteries with reverse polarity and ensure there is no short circuit with any external device.
- Do not connect the battery directly to PV solar panels or AC power. The battery must only be connected through suitable charging equipment or an inverter/charger with appropriate battery charging settings.
- Do not connect the battery in series. The built in BMS (Battery Management System) is designed for a single 48V battery or a 48V battery bank connected in parallel.
- Do not connect the battery with faulty or incompatible products or with different types of batteries, or batteries with the same make and model but different age or condition.
- Do not insert foreign objects, tools, wires, or any other items into the battery casing, ports, terminals, ventilation openings, or connectors.
- Do not paint, coat, cover, or modify any part of the battery, including the casing, terminals, labels, ports, or internal/external components.
- In the event of a fire, only dry powder fire extinguishers suitable for electrical equipment can be used. Liquid fire extinguishers are prohibited.
- In case of any abnormal situations with the battery, including mechanical damage, please contact your supplier within 24 hours.

- The installation, equipment, parts and any work carried out must adhere to all local and national regulations and standards, as well as to commonly accepted safety principles of electrical installations.

Packing List

After unpacking, please check the product and packing list first. Contact your supplier within 7 days after delivery if the product is damaged or if parts are missing.

1 x Lithium Iron Phosphate Battery
1 x User Manual
1 x Set of 1m power cables (1 x positive, 1 x negative)
2 x Communication cable
1 x Wi-Fi antenna
4 x Cable connectors (2 x positive, 2 x negative)

Installation Tools

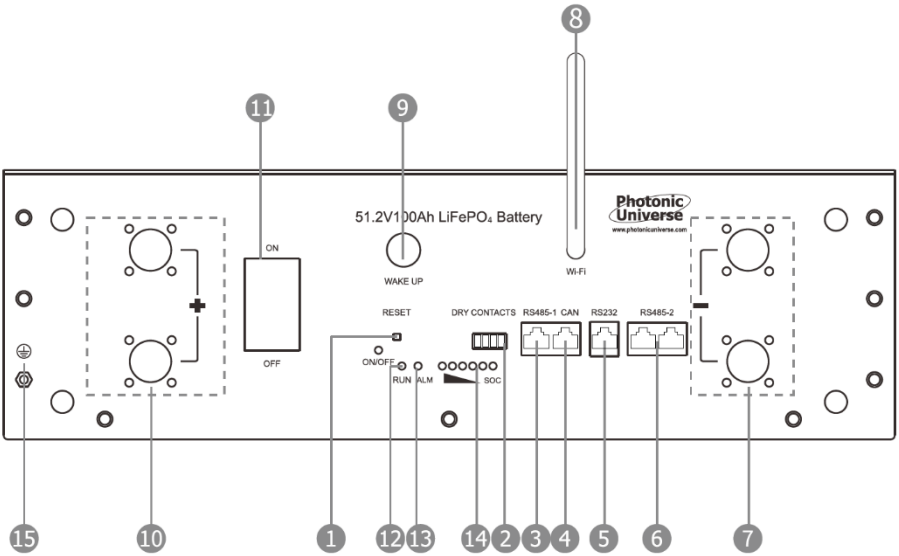


Use appropriately insulated tools to prevent accidental electric shock or short circuits. If insulated tools are not available, cover all exposed metal on the tool, except the tips, with electrical tape or use insulated gloves.



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

Ports and Terminals



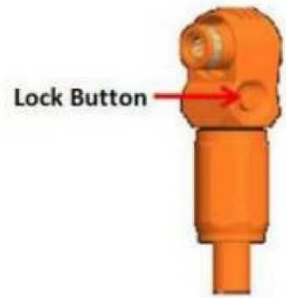
1. Reset button.
2. Dry contact ports.
3. RS485-1 communication port.
4. CAN communication port.
5. RS232 port: used for connecting the battery to a computer so that the battery parameters can be adjusted and viewed.
6. RS485-2 ports (A and B): used for parallel communication.
7. Negative (-) battery terminals.
8. Wi-Fi antenna.
9. Wake up switch.
10. Positive (+) battery terminals.
11. ON/OFF switch.
12. Run indicator: green LED indicates the battery's running status.
13. Alarm indicator: red LED flashing indicates the battery alarm.
14. SOC indicator: six green LEDs indicate the battery's current capacity.
15. Grounding point

Cable Connectors

The battery comes with a set of cable connectors that must be crimped on the supplied or other suitable power cable using an appropriate crimping tool. When attaching the connectors to the battery, ensure they are aligned with the grooves on the terminals of the battery. The connectors can only be secured in place if inserted vertically, or at a 45° angle with the terminal.

Important: the connector should be inserted into the battery terminal and pressed into place in full until an audible click is heard. Connecting without an audible click leaves the terminal insecure and poses a risk of overheating and fire.

When disconnecting the connectors from the battery, the lock button on the connector must be pressed. Any attempt to remove the connector from the battery without pressing the lock button may cause damage.



Important: ensure the battery power switch is turned off before connecting or disconnecting the cables, and the inverters or other devices in the system are off.

Installation

Before installing the battery, ensure the installation location meets the following requirements:

- The area is completely dry, waterproof and clean.
- The floor is flat and level, and firm to support the weight of all batteries.
- There are no flammable or explosive materials.
- There are no chemicals or chemical vapour.
- The ambient temperature is within the range from 0°C to 45°C with non-condensing humidity. Although the battery can operate within the stated temperature range, frequent or prolonged exposure to temperatures close to the operating limits may reduce battery performance and service life.
- 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 meters.
- The installation area is out of direct sunlight.
- Avoid installing the battery in confined areas.
- Do not install the battery outdoors and keep all connectors / contacts indoors.

Important: follow the local and national regulations and standards to ground the metal battery case (as well as the cabinet or brackets if used) to a permanent earthing point. The grounding cable must have a cross-section of at least 6mm^2. Crimp a ring terminal to the end of the cable and attach it to the battery case using the grounding screw. You may need to remove some paint from the battery case under the ring terminal for proper grounding connection and low resistance. Once the grounding cable has been connected, measure the resistance between the case and the grounding point. If it is higher than 0.1Ω, a thicker cable should be used instead.

Grounding screw position:



When mounting the battery(ies) in a cabinet or rack, please follow the steps below, keeping all power switches off:

1. Place the battery into the cabinet or rack.
2. Screw the battery in place using the 4 mounting screws.
3. Connect the grounding point(s).
4. If multiple batteries are used in parallel, connect all grounding points, connect the batteries to each other using appropriately sized linking power cables and data cables.
5. Connect the (master) battery to the inverter or other charging / discharging equipment.

Important: When connecting the power cables, connect the negative cable first and then the positive cable. Do not insert both positive and negative cables into the battery and leave the other ends loose or unconnected, as this may create a short-circuit risk.

DC circuit protection

It is recommended to install a suitable DC-rated disconnection device between the battery system and the inverter or other connected equipment.

The device must be selected according to the system design and must meet the following requirements:

- Rated voltage: the device must be suitable for the battery system voltage and rated for DC use. Do not use an AC-only breaker.
- Rated current: the rated current must be selected according to the maximum DC current on the inverter side, the number and size of power cables, and the overall system design. For example, if only one pair of 25 mm2 power cables is used, the breaker rated current should be 125A or lower.
- Breaker type: if a circuit breaker is used, type C is recommended. Type D may also be used where appropriate.
- Breaking capacity / Icu: the breaker must have a suitable ultimate short-circuit breaking capacity (Icu) for the number of battery modules connected in parallel. For short-circuit calculation, use 2500A as the maximum short-circuit current per battery module. For multiple batteries connected in parallel, the minimum Icu of the breaker should be selected as follows:

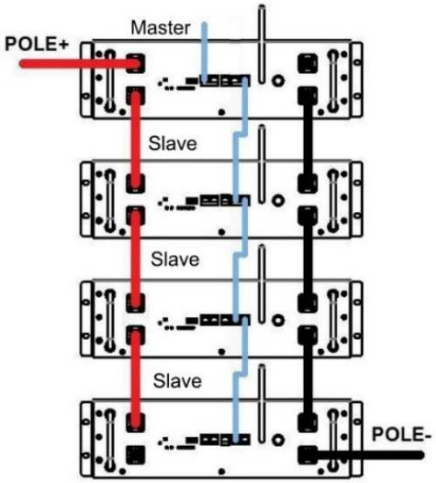
Number of battery modules	Minimum Icu of breaker
1–4 modules	10kA
5–8 modules	20kA

Parallel Connection

To connect the batteries in parallel, keep all power switches off. The batteries must have the same SOC and the voltage difference less than 1.5V.

Connect the RS485-2-B port of the master battery to the RS485-2-A port of the first slave battery using the RJ45 communication cables provided. Then connect the RS485-2-B port of the first slave battery to the RS485-2-A port of the next slave battery etc. For systems where the total charge/discharge current is less than 100A, it is recommended to connect the positive power cable to the inverter to the master battery, and the negative power cable to the inverter to the last slave battery.

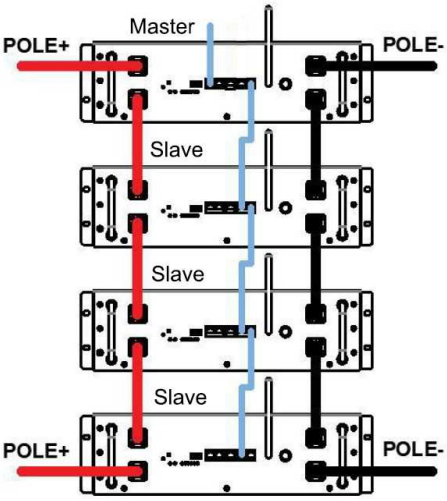
Connect the + and - power terminals in parallel as per the diagram below:



Note: the battery with the empty RS485-2-A port automatically becomes the master battery. In systems with paralleled batteries, only the master battery will communicate with the inverter or your equipment. Communication ports of the slave batteries should not be used.

Note: up to 14 slave batteries can be added (up to a maximum of 15 batteries in parallel in total).

For systems where the total charge/discharge current is between 100A and 200A, it is recommended to use two sets of power cables between the batteries and inverter as shown in the diagram below:



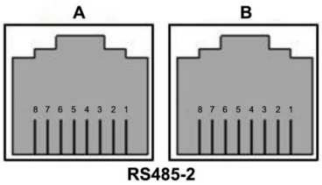
For high-current applications, all pairs of positive and negative power terminals of the paralleled

batteries can be connected to high-current central positive and negative bus bars respectively.

Note: When adding a new battery module to an existing parallel system, configure the new module as the master battery. The new module may have a different SOC because of its higher state of health, but this should not affect parallel system performance once correctly connected.

Parallel ports pin configuration:

Whilst the standard RJ45 communication cables included with the batteries can be used for quick parallel connection, the description of the pins of the *RS485-2* parallel ports is provided below for technical reference.



RS485-2

RS485-2-A		RS485-2-B	
Pin	Definition	Pin	Definition
1 & 8	RS485-B	1 & 8	RS485-B
2 & 7	RS485-A	2 & 7	RS485-A
3 & 6	GND	3 & 6	GND
4	GND	4	GND
5	UP_IN	5	DN_OP+

Power On:

1. Check all power and communication cables and connections, ensure they are correct and tight. Double check the polarity of connection.
2. Turn on the external isolator switch or circuit breaker used between the battery(ies) and your equipment.
3. Press the wake-up button until the LED indicators flicker. If multiple batteries are used in parallel, press the wake-up button of each battery in sequence. The batteries will then assign master and slave addresses according to the RS485-2 wiring arrangement.

Power Off:

1. Press the wake-up button until the LED indicators flicker.
2. Turn off the external isolator switch between the battery(ies) and your equipment.

If you need to add or replace batteries, keep the system powered off for at least 30 minutes and then check the SOC LED lights. A maximum difference of 1 SOC LED light or 1.5V is allowed between the batteries. If your new batteries have larger difference, alight the SOC LEDs and voltage first by bringing all batteries to full charge.

Low-power mode:

If the cell voltage falls below the power-down threshold and there is no charge or discharge current for a period of time, the battery may enter low-power mode to protect itself. To wake the battery, press the wake-up button. If the wake-up button is already pressed, apply a charging voltage above 48V, or release and press the wake-up button again.

Reset button:

When the BMS is dormant, press and hold the button for 3 - 6 seconds and release. The battery will activate and the LED indicators will turn on starting from the "RUN" light for 0.5 seconds.

When the BMS is active, press and hold the button for 3 - 6 seconds and release. The BMS will become dormant and the LED indicators will turn on starting from the lowest power “SOC” light for 0.5 seconds.

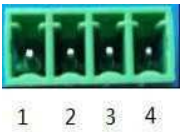
When the BMS is active, press and hold the button for 6 - 10 seconds and release. The BMS will reset, and the LED lights will all light up for 1.5 seconds.

BMS Communication Protocol Settings

The BMS communication protocol of the battery can be selected and changed in the app, by connecting to the battery from your phone or tablet via Wi-Fi or local Bluetooth. There are different options for CAN and RS485 protocols available for the most common inverter brands. Please download the BMS management app from the battery listing or contact your supplier for more information.

Dry Contacts

The dry contact ports on the battery can be used to provide a signal to an inverter or generator in the case of low battery or if the fault protection has been activated.



PIN 1 to PIN 2 will close in the event of a low battery SOC:

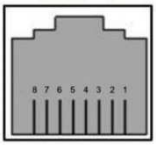
Condition	PIN 1 & PIN 2
Normal	Open
Low Battery SOC	Closed

PIN 3 to PIN 4 will close in the event of the fault protection being activated:

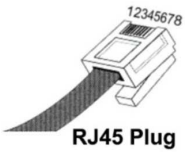
Condition	PIN 3 & PIN 4
Normal	Open
Fault Protection Active	Closed

RS485 and CAN Port Configuration

The RS485-1 and CAN ports are used for communication between the battery and an inverter. Only one inverter communication interface, RS485-1 or CAN, should be used at a time. Do not connect both RS485-1 and CAN to the inverter simultaneously.



RS485/CAN Port



RJ45 Plug

RS485-1 port (9600 bit/s) configuration:

PIN 1	RS485-B
PIN 2	RS485-A
PIN 3	GND
PIN 4	NC (Empty)
PIN 5	NC (Empty)
PIN 6	GND
PIN 7	RS485-A
PIN 8	RS485-B

CAN port (500 kbit/s) configuration:

PIN 1	NC (Empty)
PIN 2	GND
PIN 3	NC (Empty)
PIN 4	CANH
PIN 5	CANL
PIN 6	NC (Empty)
PIN 7	NC (Empty)
PIN 8	NC (Empty)

RS232 Communication Port



RS232

The RS232 port on the battery can be used to connect the battery to a computer which will allow the battery parameters to be viewed and adjusted. The RS232 baud rate is 9600 bit/s. The PIN configuration for this port is shown below:

PIN No	PIN Configuration
PIN 1	NC (Empty)
PIN 2	NC (Empty)
PIN 3	TX BMS sending data (PC receiving data)
PIN 4	RX BMS receiving data (PC Sending data)

PIN 5	GND
PIN 6	NC (Empty)

Note: the RS232 port requires a separate connection tool to operate and is reserved for manufacturing engineers and professionals for testing and firmware updates of the battery.

BMS Functions

The built in BMS will perform several functions to protect the battery and to manage and monitor the battery performance.

Protection and alarm:

- End of charging and discharging
- Charging over voltage
- Discharging under voltage
- Charging and discharging over current
- High/low temperature
- Short circuit

Management and monitoring:

- Cell balancing
- Intelligent charging
- Charging and discharging current limit
- Capacity retention calculations

LED Status

State	Normal / Alarm / Protection	ON/ OFF	RUN	ALM	SOC indication LEDs						Notes
					L6	L5	L4	L3	L2	L1	
Power Off	Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Battery Off
Standby	Normal	ON	Flashes 1 time /4s	OFF	Indication by SOC						Standby
	Alarm	ON	Flashes 1 time /4s	Flashes 1 time /2s							Cell voltage low
Charge	Normal	ON	ON	OFF	Indication by SOC (the next SOC LED is flashing)						ALM does not flash for overcharge warning
	Alarm	ON	ON	Flashes 1 time /2s							
	Overcharge protection	ON	ON	OFF	ON	ON	ON	ON	ON	ON	If there is no charging source, LEDs as Standby
	Temperature. Over-current fault protection	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Stop charging immediately
Discharge	Normal	ON	Flashes 1 time /2s	OFF	Indication by SOC						
	Alarm	ON	Flashes 1 time /2s	Flashes 1 time /2s							
	Under discharge protection	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Stop discharging immediately
	Temperature. Over-current. Short circuit fault protection	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Stop discharging immediately
Fault		OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Stop charging and/or discharging immediately

SOC Status

The SOC indicators will show the real time state of charge when charging and discharging according to the tables below:

Charging:

SOC		L6	L5	L4	L3	L2	L1
SOC %	0-17%	OFF	OFF	OFF	OFF	OFF	Flash
	18-33%	OFF	OFF	OFF	OFF	Flash	ON
	34-50%	OFF	OFF	OFF	Flash	ON	ON
	51-66%	OFF	OFF	Flash	ON	ON	ON
	67-83%	OFF	Flash	ON	ON	ON	ON
	84-100%	Flash	ON	ON	ON	ON	ON
Run Indicator Status		ON					

Discharging:

SOC		L6	L5	L4	L3	L2	L1
SOC %	0-17%	OFF	OFF	OFF	OFF	OFF	ON
	18-33%	OFF	OFF	OFF	OFF	ON	ON
	34-50%	OFF	OFF	OFF	ON	ON	ON
	51-66%	OFF	OFF	ON	ON	ON	ON
	67-83%	OFF	ON	ON	ON	ON	ON
	84-100%	ON	ON	ON	ON	ON	ON
Run Indicator Status		Flash					

Troubleshooting

Before troubleshooting, first check the battery status as follows:

1) Check whether the battery can be switched on.
2) If the battery switches on, check the Alarm indicator. Note whether the red light is off, flashing, or continuously on.
3) If the red Alarm indicator is off but the battery still does not operate normally, check whether the battery can charge and discharge.
4) If the LED display appears normal but the battery cannot communicate with the inverter or other connected equipment, check the communication cable, communication protocol, and master battery connection.

If the battery is not turning on:

Press the wake-up button and verify if any of the LED indicators are flashing.

Use a charger or inverter to charge the battery at 48V-53.5V. If after charging, the battery switches on, then keep the battery charged and use the monitoring tools to check the log.

If the voltage at the battery terminals is < 45V, charge the battery with < 0.5C charging current (< 50A) to ensure the battery health is not affected.

If the voltage at the battery terminals is > 45V, the battery can be charged with current >= 0.5C (>= 50A).

If the battery does not switch on after being charged, turn the battery OFF and contact the supplier.

If the battery is turning on but displaying a fault:

1. Check the temperature of the battery. The battery will not charge if the temperature is above 50°C or below -0°C, or discharge if the temperature is above 50°C or below -20°C. If the battery temperature is outside either of these limits, adjust the temperature or the location of the batteries so that the temperature is between 0°C and 50°C.

2. Check the discharge current. The maximum discharge current for the batteries is 100A. If the discharge current exceeds 100A, the BMS will protect the battery and prevent any charging or discharging. Reset the battery and reduce the current draw by the loads.

3. Check if the battery voltage is too high. If the charging voltage is above 58V, the battery protection will prevent any further charging. Discharge the battery to reduce the voltage and check the charging voltages set.

4. Check if the battery voltage is too low. If the battery voltage drops below 43.2V, the battery protection will prevent any further discharge. Charge the battery with < 0.5C current (< 50A) until the fault light turns off.

If the battery is unable to charge or discharge:

1. Cannot charge: disconnect the power cables and measure the output voltage of the inverter or charging equipment. If the voltage is 56.8 ~ 57.6V, restart the battery, connect the power cables and try again. If it still cannot charge, turn off the unit and contact your supplier.

2. Cannot discharge: disconnect the power cables and measure the voltage on the battery terminals. If the voltage is under 43.2V, charge the battery. If the battery voltage is above 50V and if it still cannot discharge, turn off the battery and contact your supplier.

3. If the LED display appears normal but the battery still cannot charge or discharge after the checks above, the external fuse or circuit breaker may have blown. Check the fuse or circuit breaker to ensure they are in tact and closed.

If the battery is unable to communicate with your equipment:

If the battery cannot communicate with your charging or discharging equipment via the BMS communication port, it can still charge and discharge normally as long as your equipment is setup with the correct current and voltage limits for the battery. However, you should aim to

establish communication between the battery BMS and your equipment whenever possible:

1. Ensure you are using the correct cable and protocol for your inverter.

2. The communication cable may be damaged. Please check or replace it with a new cable.

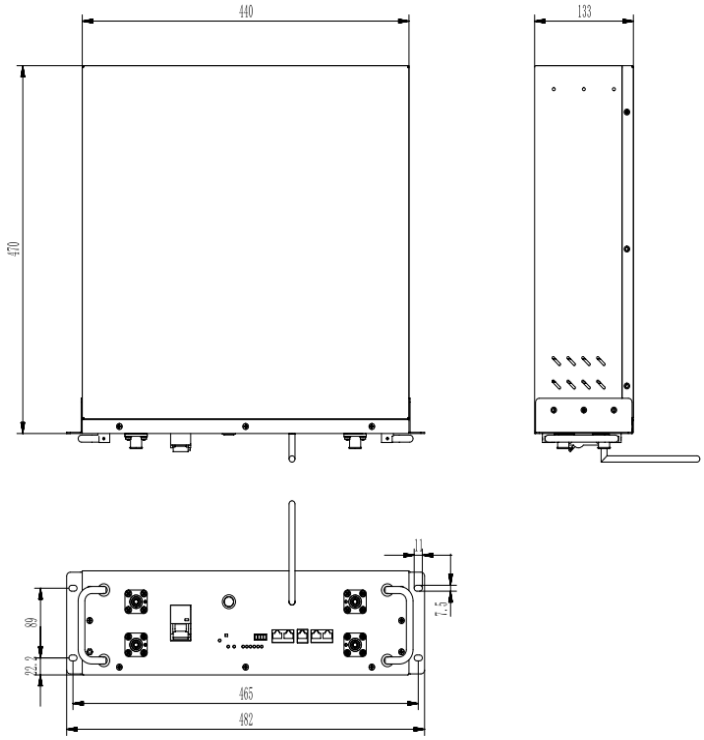
3. If multiple batteries are used in parallel in the same bank, please check if the communication cable is connected to the master battery.

4. Please ensure that the battery terminals and the inverter terminals are not reversed

5. CAN pin issue. Try connecting the CAN-H, L and GND only and do not connect other pins to the inverter.

Specifications

Parameter	Value
Nominal voltage	51.2V
Discharge voltage	43.2-56.8V
Maximum charging voltage	56.8V
Nominal capacity	100Ah
Nominal energy	5.12kWh
Usable energy	5.08kWh
Recommend charging current	0.5C / 50A
Maximum charging current	1C / 100A
Recommended discharging current	0.5C / 50A
Maximum discharging current	1C / 100A
Communication	RS485/RS232/CAN
Maximum depth of discharge	99%
Cycle life	>6000 @ 25°C
Working temperature	0°C ~ 50°C charging -20°C ~ 55°C discharging
Storage temperature	-5°C ~ 35°C
Enclosure IP rating	IP20
Humidity	5~95% (RH) non-condensing
Altitude	< 4000m
Dimensions	440 x 470 x 133 mm
Weight	46 kg
Loading quantity	8 batteries / pallet



Emergency Situations

If the battery is leaking:

If the battery is leaking electrolyte, avoid any physical contact with the liquid or gas. If physical contact is made with the batteries follow the steps below:

- If gas from the battery has been inhaled, leave the area in which the battery is located and seek medical attention.
- If the leaked substance makes contact with the eyes, rinse the eyes with flowing water for 15 minutes and seek medical attention.
- If the leaked substance makes contact with the skin, thoroughly wash the affected area with soap and water and seek medical attention.
- If the leaked substance is ingested, induce vomiting and seek medical attention.

In the event of a fire:

In the event of a fire, **do not use water** to extinguish the fire. Only dry power fire extinguishers should be used.

If it is possible and safe to do so, move the battery pack to a safe area before it catches fire.

If the batteries get wet:

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. Contact emergency services if required.

If the battery is damaged:

Damaged batteries are dangerous and must be handled with the utmost care. They are not fit for use and may pose a danger to people or property. If the battery seems to be damaged, pack it in its original container, and then contact your supplier.

Battery Maintenance

Perform the following maintenance while the battery is in storage or in use:

- If the battery is fully discharged, it must be charged to full capacity within 12 hours.
- The battery must be charged at least once every 6 months up to a SOC of over 60%.
- After the installation and at least once a year, please check the power connectors, grounding point, power cable and screws. Make sure there are no loose, broken or corroded connectors or terminals. Check the installation environment for dust, water, insects etc and ensure the environment is still suitable for an IP20 battery system.

Battery Cleaning

Before cleaning the product, please ensure the product is not hot and has nothing connected to it. When cleaning, please wipe down the product's surface using a soft, dry cloth and do not use harsh or abrasive cleaning chemicals (e.g. detergent or solvent) or materials on the product, as doing so may damage or scratch the finish.

Battery Disposal

At the end of its working 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.

Always follow the local and national regulations when disposing of this battery.

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