

100Ah 51.2V LiFePO4 Battery (Rack Mounted)

LFP48-100R

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.

The battery incorporates a built-in soft start function, which helps reduce the impact of high current draw during inverter startups.

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 in series. The built in BMS (Battery Management system) is designed for single battery voltage.
- 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.
- In the event of a fire, only dry powder fire extinguishers suitable for electrical equipment can be used. Liquid fire extinguishers are prohibited.
- 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.
- 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

- 1 x Lithium Iron Phosphate Battery
- 2 x Communication cables
- 4 x Cable connectors (2 x positive, 2 x negative)
- 1 x Ring terminal for a grounding cable
- 1 x Instruction Manual

Installation Tools



Wire cutter



Crimping modular plier



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.



Insulated gloves



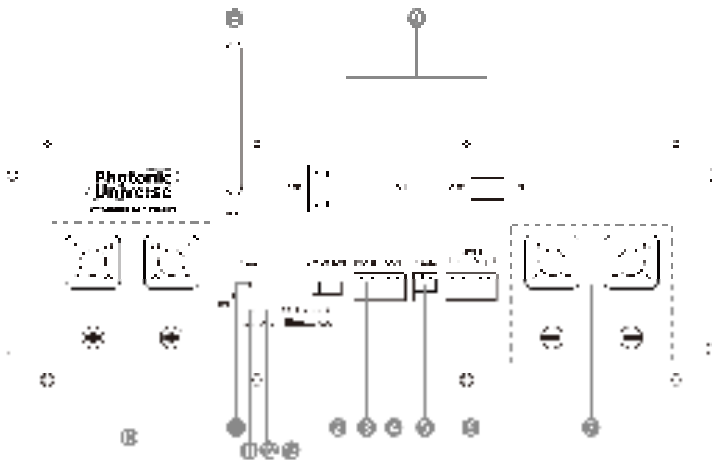
Safety goggles



Safety shoes

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: 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.

2. Dry contact ports.
3. RS485 communication port.
4. CAN communication port.
5. RS232 port: allows the battery to be connected to a computer so that the battery parameters can be adjusted and viewed.
6. Parallel input and output ports.
7. Battery - terminal connector.
8. Wi-Fi antenna.
9. Power switch.
10. Battery + terminal connector.
11. Run indicator: green LED indicates the battery's running status.
12. Alarm indicator: red LED flashing indicates the battery alarm.
13. SOC indicator: six green LEDs indicate the battery's current capacity.

Cable Connectors

The battery comes with a set of cable connectors that must be crimped on the 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.

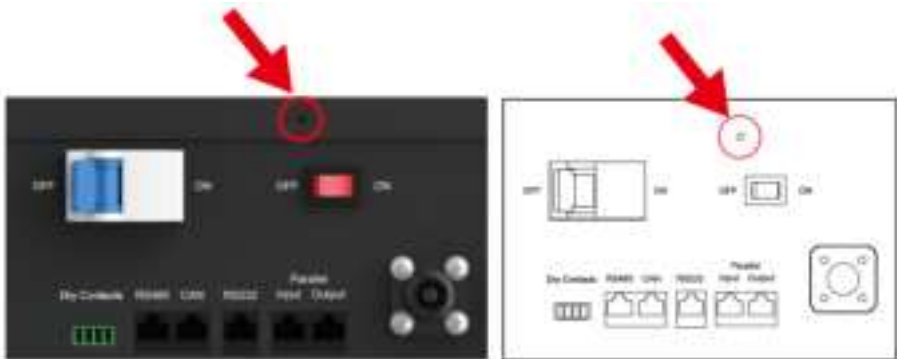
Installation

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.
- 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.
- 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 6mm². Crimp the grounding ring terminal (included with the battery) 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 (batteries) in a cabinet or rack, please follow the steps below, keeping all power switches off:

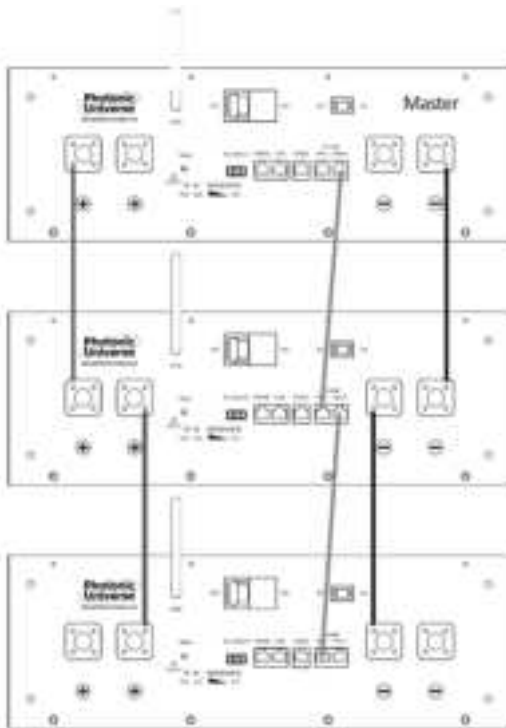
1. Place the battery into the cabinet or rack.
2. Screw the battery in place using the 4 mounting screws.
3. Connect the grounding point(s).
4. If multiple batteries are used in parallel, connect all grounding points, connect the batteries to each other using appropriately sized linking power cables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

A suitable external isolator switch and a fuse must be used between the battery(ies) and any connected equipment, with the current rating chosen depending on the size of the load and power of the charging and discharging equipment connected to the battery(ies). Alternatively, an optional Photonic Universe surface mounted (**CB** series) or recess mounted (**CBR** series) DC circuit breaker with overcurrent protection can be purchased separately. These breakers combine an isolator switch and a thermal overcurrent breaker in one housing. The range includes 50A, 100A, 120A, 150A, 200A, 250A and other current ratings.



Parallel Connection

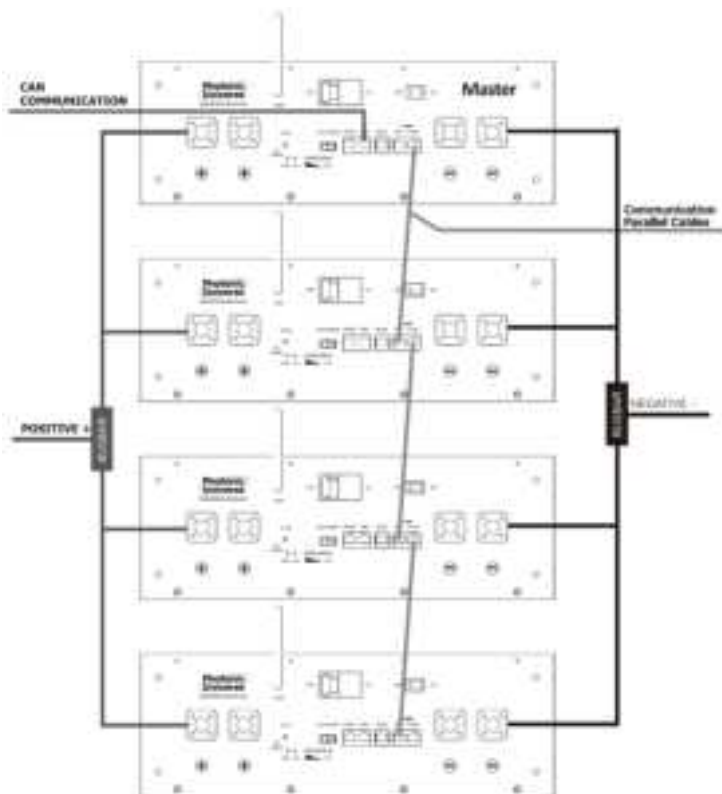
To connect the batteries in parallel, keep all power switches Off. Connect the parallel *Output* port of the master battery to the parallel *Input* of the first slave battery using the RJ45 communication cables provided. Then connect the parallel *Output* of the first slave battery to the parallel *Input* of the next slave battery etc. Connect the + and - power terminals in parallel as per the diagram:



Note: the battery with the empty parallel *Input* 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.

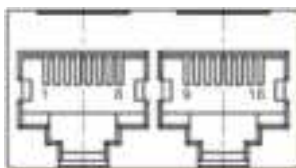
Note: up to 14 slave batteries can be added (up to a maximum of 15 batteries in parallel in total).

For 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:



Parallel ports pin configuration:

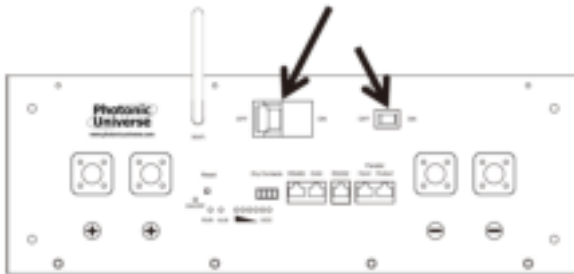
Whilst the standard RJ45 communication cables included with the batteries can be used for quick parallel connection, the description of the pins of the *Input* and *Output* parallel ports is provided below for technical reference.



Parallel Output RJ45		Parallel Input RJ45	
Pin	Clarifying	Pin	Clarifying
1 & 8	RS485-B	9 & 16	RS485-B
2 & 7	RS485-A	10 & 15	RS485-A
3 & 6	GND	11 & 14	GND
4	GND	13	UP_IN
5	DN_OP+	12	GND

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. Turn on the power switch and the red On/Off switch on the battery. If multiple batteries are used in parallel:
 - Turn on the power switches on all batteries first
 - Then turn on the red On/Off switches on the slave batteries
 - Finally turn on the red On/Off switch on the master battery (the battery with the empty *Input* parallel port).



Note: when the battery module is powered on, it activates the soft-start function which takes 3 seconds. After that the battery is ready for full power output.

Power Off:

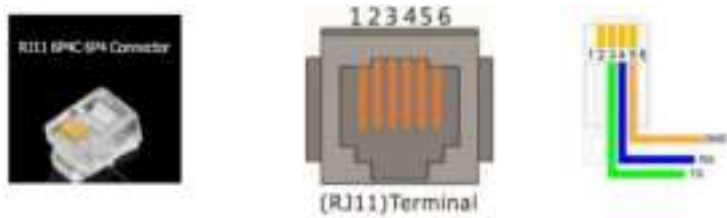
1. Turn off the external isolator switch between the battery(ies) and your equipment.
2. Turn off the red On/Off switch on the battery. If multiple batteries are used in parallel:
 - First turn off the red On/Off switch on the master battery (the battery with the empty *Input* parallel port)
 - Then turn off the red On/Off switches on the slave batteries
3. Turn off the power switch(es) off.

If you need to add or replace batteries, keep the system powered off for at least 15 minutes and then check the SOC LED lights. A maximum difference of 1 SOC LED light is allowed between the batteries. If your new batteries have larger difference, align the SOC LEDs first by bringing all batteries to full charge.

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.

RS232 Communication Port



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 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.

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. Dry contacts are rated up to a maximum of 30V voltage and 1A pass through current.



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

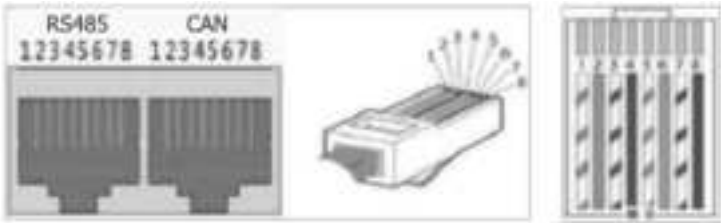
Condition	PIN 1 & PIN 2
Normal	Open
Low Battery SOC ($\leq 10\%$)	Closed

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 and CAN ports are used for communication between the battery and an inverter.



RS485 port 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 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)

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
- Records of operation
- Soft start for an inverter

LED Status

State	Normal / Alarm / Protection	ON/ OFF	RUN	ALM	SOC indication LEDs						Notes
					L6 	L5 	L4 	L3 	L2 	L1 	
Power Off	Sleep	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	
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

Troubleshooting

If the battery is not turning on:

Turn the battery power ON/OFF switch into the ON position. Turn the red ON/OFF switch into the ON position to 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 $\geq 0.5C$ ($\geq 50A$).

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 or discharge if the temperature is above $55^{\circ}C$ or below $-10^{\circ}C$. 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 $0^{\circ}C$ and $55^{\circ}C$.
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 $56.8 \sim 57.6V^*$, restart the battery, connect the power cables and try again. If the battery 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 it still cannot discharge, turn off the battery and contact your supplier.

** Use values divided by 2 for a 24V battery*

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 or restore 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	Specifications	
	LFP24-100R	LFP48-100R
Nominal voltage	25.6V	51.2V
Discharge voltage	21.6-29.2V	43.2-58.4V
Charging voltage	29.2V	58.4V
Capacity	100Ah	
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	
Depth of discharge	95%	
Dry contacts maximum rating	30V 1A	
Working Temperature	0°C ~ 45°C charging	
	-10°C ~ 45°C discharging	
Storage temperature	0°C ~ 35°C	
Enclosure IP rating	IP21	
Humidity	5~95% (RH) non-condensing	
Altitude	< 4000m	

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 or carbon dioxide 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 30%.
- 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 IP21 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 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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