LiFe4851

Installation and Operation Manual

Your complete installation guide
for LiFe4851 batteries

1. INTRODUCTION

The PowerPlus Energy LiFe4851 battery module is both a **managed** and a **self-managed** Lithium Iron Phosphate ($LiFePO_4$) energy storage module designed for Battery Energy Storage System (BESS) applications.

The battery is engineered to operate reliably in demanding residential, commercial, and industrial environments and is suitable for use in grid-connected, off-grid, hybrid, solar, and Uninterruptible Power Supply (UPS) applications.

2. SAFETY

IMPORTANT – Installer Responsibility

Installers and users are responsible for familiarising themselves with this manual and all applicable safety documentation before installing or operating the battery.

IMPORTANT – Installer Qualification

Installation must be carried out by a suitably qualified and experienced person who is competent in the design, installation, and commissioning of Battery Energy Systems. All work must comply with relevant local, state, and national electrical standards and regulations.

WARNING

The PowerPlus Energy LiFe4851 battery stores large amounts of electrical energy and can deliver high fault currents. Incorrect handling, installation, or operation may result in serious injury, equipment damage, or fire.

2.1. GENERAL SAFETY

The following safety precautions must be always observed:

- The battery must not be exposed to temperatures outside the operating limits specified in this manual.
- The battery must not be installed in direct weather, including rain, flooding, or direct sunlight, unless housed in a suitably rated enclosure.
- The battery must not be exposed to strong mechanical impacts, crushing, puncturing, or excessive vibration.
- The battery must not be opened, modified, or disassembled.
- The battery terminals must not be short-circuited or allowed to contact conductive objects.
- The battery must be always kept dry.
- The battery must be kept out of reach of children and animals.
- The battery must not be stepped on or subjected to excessive force.
- The battery is intended to be lifted and installed by two persons or with appropriate lifting equipment.

2.2. TRANSPORTATION

The PowerPlus Energy LiFe4851 battery is classified as **Dangerous Goods – Class 9 (UN3480)** and complies with the requirements of **UN38.3** for lithium battery transport.

- Batteries should be transported in original packaging wherever possible.
- Batteries must be secured during transport to prevent movement or impact.
- Batteries are supplied in a partially charged state in accordance with transport regulations.
- Transport must comply with all applicable international and local Dangerous Goods regulations.

2.2.1. TRANSPORTATION WITHIN A PREASSEMBLED SYSTEM

Where batteries are installed within a preassembled BESS prior to transport:

- Batteries must be securely restrained to prevent movement.
- The system must be transported in a horizontal orientation.
- Shock and vibration must be minimised.
- If adequate restraint cannot be provided, batteries must be removed and transported separately in original packaging.

2.3. HANDLING

- Always handle the battery with care.
- Use correct manual handling techniques or lifting equipment.
- Do not use the battery if it shows signs of damage, deformation, leakage, or abnormal odour.
- Do not use cleaning solvents or sprays on the battery.
- Do not touch exposed DC terminals or data connections.

2.4. STORAGE

- Store the battery in a dry, clean, and well-ventilated environment.
- Recommended long-term storage temperature is close to 25°C, or within ±10°C.
- For extended storage, maintain the battery at **60–80% State of Charge (SoC).**
- Batteries stored for more than **6 months** must undergo a periodic recharged before commissioning.
- Do not stack batteries in a manner that may cause mechanical stress or instability – no more than 6 high.

2.5. LIFE SUPPORT APPLICATIONS

PowerPlus Energy batteries must not be used in critical medical or life-support applications where battery failure could result in injury or loss of life.

2.6. DAMAGED BATTERY

A damaged battery must not be used.

- Isolate the battery from all power sources.
- Avoid contact with any leaking material.
- Contact PowerPlus Energy for guidance.
- Dispose of damaged batteries only through approved recycling facilities.

2.7. FIRE

In the event of fire:

- Evacuate the area immediately.
- Contact emergency services.
- Toxic gases may be released if the battery is involved in a fire.
- Cooling the battery is critical to prevent fire propagation.

2.8. QUALIFIED PERSON (INSTALLER)

Installation and servicing must only be performed by a qualified person who:

- Has a thorough understanding of battery energy storage systems.
- Is aware of the risks associated with DC electrical systems.
- Holds all required licences and certifications for the installation location.
- Follows all safety requirements outlined in this manual.

2.9. WET BATTERY

- Do not attempt to access, energise, or move the battery if it has been wet or submerged.
- Isolate the battery immediately if safe to do so.
- Contact PowerPlus Energy for advice.

IMPORTANT – Installation must be carried out by a suitably qualified person.

- Do not expose the battery to water, fire, or corrosive environments.
- Do not crush, puncture, disassemble or modify the battery.
- Always isolate DC sources before working on the battery.
- Use appropriate PPE including insulated gloves and safety footwear.
- The battery must not be used in life support or critical medical applications.

3. PRODUCT INFORMATION

3.1. INTRODUCTION

The PowerPlus Energy LiFe4851 Battery Pack is a LFP energy storage module designed for use in BESS applications.

While each battery module incorporates an internal Battery Management System (BMS) that allows the battery to operate independently without requiring active communication with external Power Conversion Equipment (PCE), and with a communication link, will operate in managed mode.

When installed and operated in accordance with this manual, the battery provides safe, stable, and predictable performance over its service life.

As this product stores significant electrical energy and can deliver high fault currents, it must be installed and operated with care and in compliance with all applicable electrical standards.

3.2. CHARACTERISTICS

The PowerPlus Energy LiFe4851 Battery Pack has been designed to provide a safe, reliable, and flexible energy storage solution for stationary BESS applications.

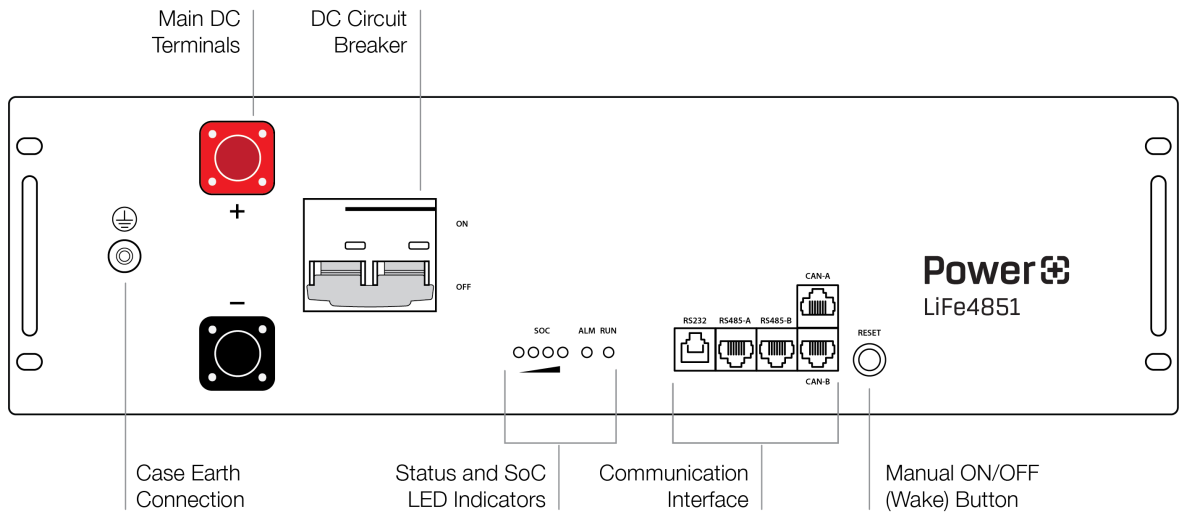
Key characteristics of the battery include:

- **LFP chemistry**, offering excellent thermal stability, long service life, and a high level of intrinsic safety.
- **BMS** that continuously monitors cell-pack voltage, current, and temperature to protect the battery from adverse operating conditions.
- **Self-managed operation**, allowing the battery to function safely without requiring active communication with external PCE.
- **High cycle life performance** when operated within the recommended temperature and charge parameters.
- **Flexible system configuration**, with support for parallel connection to increase total system capacity as required.
- **Integrated DC circuit breaker**, providing over-current protection and a convenient point of isolation for installation and servicing.
- **Natural convection cooling**, eliminating the need for fans or active cooling and reducing maintenance requirements.
- **Compact and modular design**, suitable for rack-mounted or floor-mounted installations in residential, commercial, and industrial environments.

These characteristics allow the PowerPlus Energy LiFe4851 battery module to be easily integrated into a wide range of energy storage applications while delivering predictable and dependable performance over its service life.

3.3. FRONT PANEL OVERVIEW

The front panel of the battery provides key operational interfaces and indicators for installation, operation, and servicing. These interfaces allow installers and service personnel to safely connect, energise, monitor, and isolate the battery as required.



3.4. INCLUSIONS

Packaging materials are recyclable and should be retained for transport or return.

Item Description	Quantity	Picture Reference
Terminating connector link for battery startup	x1	
Communication cables (RJ45) for system integration	x2	

3.5. BATTERY SPECIFICATIONS

LiFe4851 has been designed to deliver high energy density, long cycle life, and reliable performance.

Nominal DC Voltage	51.2V
Operational Voltage Window	48V to 56.0V
Rated DC Power	5.12kW
Nominal Capacity	5120Wh
Useable Capacity	5120Wh
Recommended Useable Capacity	4608Wh
Depth of Discharge	1
Recommended Depth of Discharge	0.9
Continuous Discharge C-Rate	0.5C (Maximum 1.5C, 30s)
Normal Discharge Current	20A
Maximum Continuous Discharge Current	120A
Maximum Discharge Current	150A 30s
Maximum Charge C-Rate	0.5C (Maximum 1.25C, 30s)
Normal Charge Current	20A
Maximum Continuous Charge Current	110A
Maximum Charge Current	125A 30s
Battery Fault Current	1750A
Circuit Breaker	2-Pole 125A C-Curve
Arc Flash Incident Energy	0.07cal/cm^2
Arc Flash Incident Energy Protection Boundary	10.56cm
Personal Protective Equipment Category	0
Lithium Composition	Lithium Ferro Phosphate (LiFePo4
Operating Temperature Range	-20°C to 60°C
Recommended Maximum Ambient Temperature Range	-10°C to 50°C
Operating Humidity	95% Non-Condensing
BMS Under/Over-Volt Module Level Protection	43.2V to 60.8V
BMS Under/Over-Volt Cell Level Protection	2.7V to 3.8V
BMS Over/Under-Temp Cut Off	-20°C to 60°C discharge, 0°C to 60°C charge
Altitude	4000m
Battery Mounting Options	Rack Mount, Side Mount
Terminal Connections	DEGSON ESS-150A-35-B/S
IP Rating	IP20
Efficiency	96%
Cooling	Natural Convection
Parallel Connection	Up to 16

Series Connection	Not Permitted
Alarm Output	CAN/RS485/LED
Communications	CAN/RS485
Module Weight	43.0kg
Battery Dimensions	440mm D x 430mm W x 131mm H
Certifications	UL1973, UN38.3, EMC, RCM, UL9540A, IEC 62619:2017, IEC 61000-6-3:2020, IEC 62368-1:2018
Warranty	10 Years

Specifications correct at time of publication and subject to change. Refer to website for latest information.
1. Voltages are specified at the battery terminals. 2. The usable capacity is measured under specific conditions of 0.5C

Table 1 (Specifications)

3.6. CHARGING AND DISCHARGING

Battery supports controlled charging and discharging within defined voltage, current, and temperature limits.

Charging and discharging performance is managed internally by the BMS, which:

- Prevents over-charge and over-discharge.
- Limits current during abnormal conditions.
- Protects the battery during extreme temperature events.
- Manages cell balancing during charge cycles.

For optimal battery life, PowerPlus Energy recommends operating the battery within the specified temperature range and performing periodic full charge cycles to allow cell balancing.

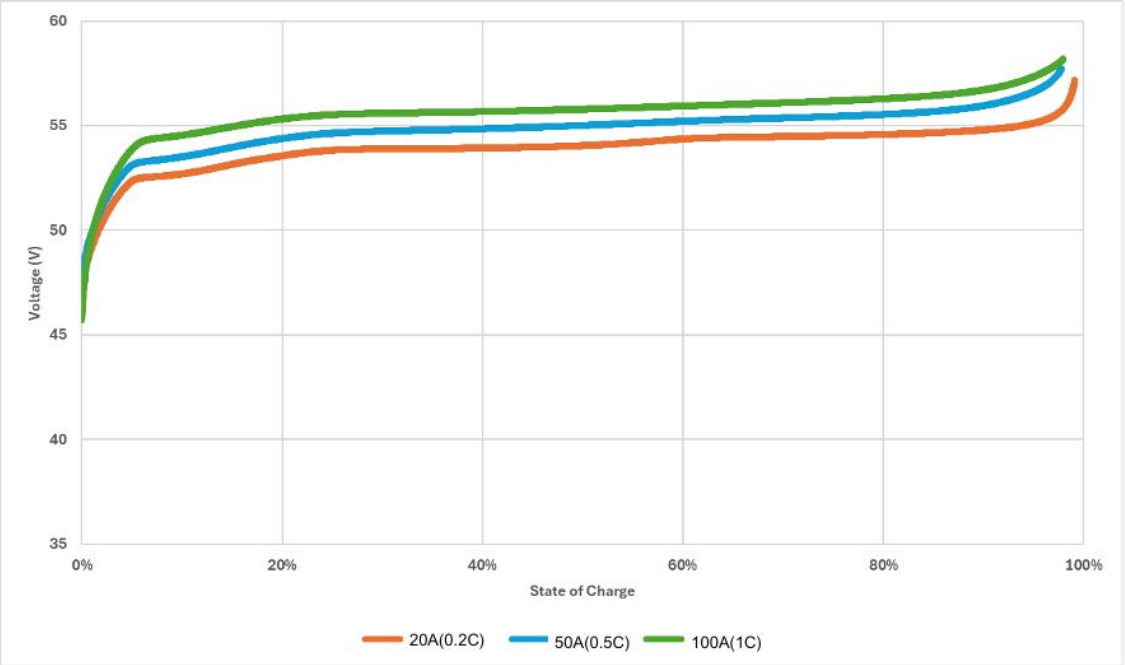
Shutdown DC Voltage	(No Load) 50V
Shutdown DC Voltage	(0.5C) 48V
Recovery / Restart Voltage	52V
Continuous Charge Voltage	56V
Continuous Charge Transition	Battery is considered full after battery is absorbing less than 0.5% of maximum charge current after being held at specified charge voltage for 30 minutes minimum.
Absorption time	2h
Float Voltage Cyclic (Short Term Float) (Example stand-alone solar)	56V
Float Voltage Standby (Long Term Float) (Example UPS Application)	55.7V
Charge Current	50A
Peukert Exponent	1.02
Shutdown SoC Recommended	10%
Calibration to 100%	Every 7 days or more frequent where possible. (Ensures cell balancing is performed and keeps external SoC counter more accurate)

Voltages are specified at the battery terminals. Refer to website for charger settings for specific inverters.

Table 2 (Connected PCE Programming Requirements)

3.6.1. CHARGING CURVES

Figure 1 (Voltage/Current Curve during Charging)



3.6.2. DISCHARGING CURVES

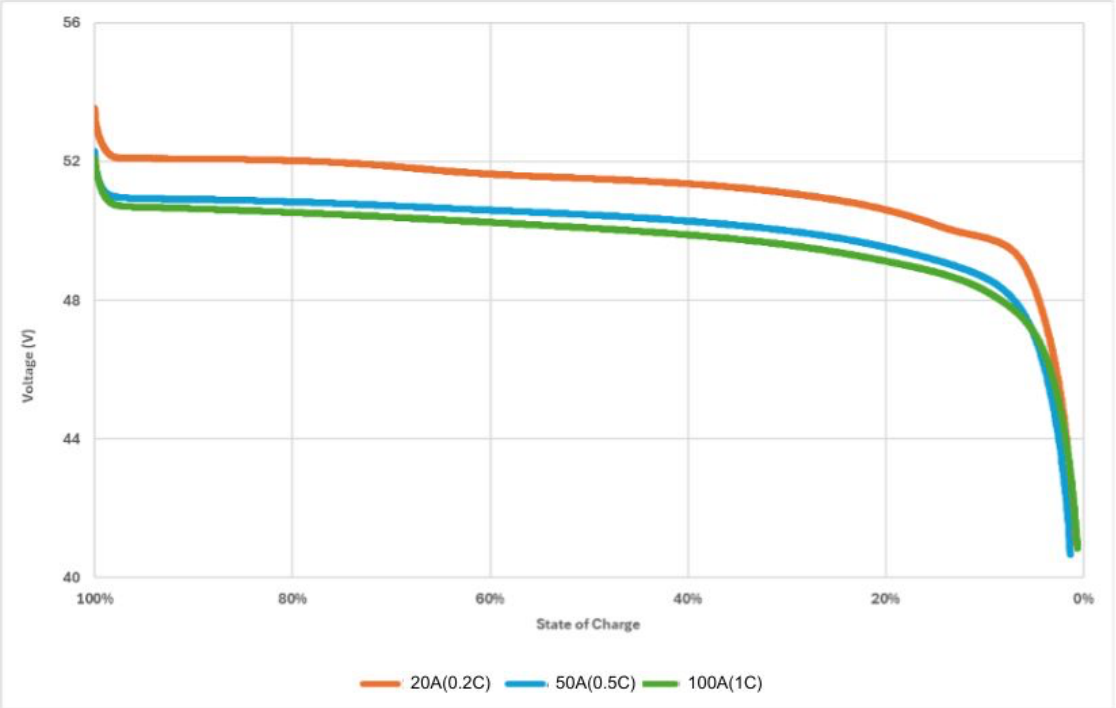


Figure 2 (Voltage/Current Curve during Discharging)

3.6.3. STATE OF CHARGE VS DISCHARGE VOLTAGE

100%	>53V	50%	50.46V
90%	50.91V	40%	50.28V
80%	50.84V	30%	50.00V
70%	50.72V	20%	49.52V
60%	50.59V	10%	48.65V
		0%	48.00V

3.6.4. OVER DISCHARGED BATTERY

In the event the low voltage protection circuit has operated to protect the battery from excessive discharge, it is important that the battery is charged to 100% within 7 days.

> **NOTE**
>
> Leaving the battery in a discharged state can cause irreversible damage to the battery.

3.7. DC CIRCUIT BREAKER

Each battery module is fitted with an integrated DC circuit breaker that serves multiple purposes:

- Acts as the primary ON/OFF switch for the battery.
- Provides over-current and short-circuit protection.
- Allows safe electrical isolation during installation and servicing.

The circuit breaker must be in the OFF position during installation and wiring and should only be switched ON once all connections have been verified.

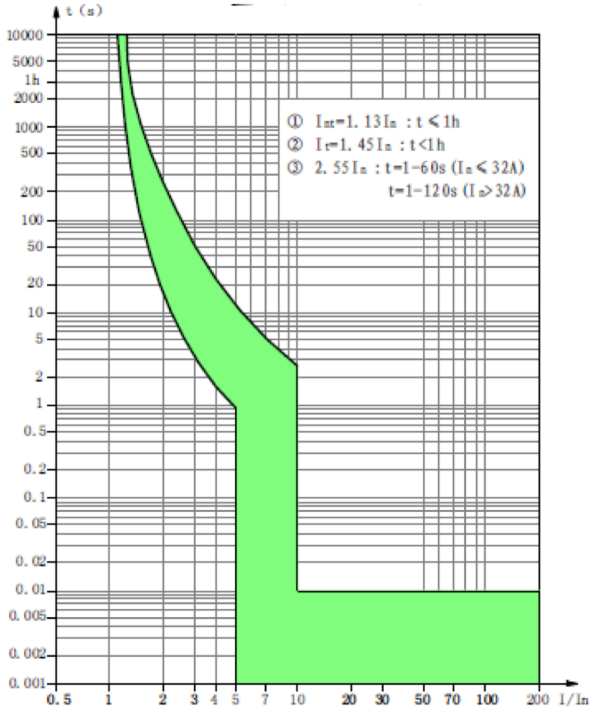


Figure 3 (Characteristic K Graph)

3.8. BATTERY MANAGEMENT SYSTEM (BMS)

The internal BMS continuously monitors the battery to ensure safe operation.

The BMS provides:

- Cell-level voltage monitoring.
- Battery current monitoring.
- Temperature monitoring of cells and internal components.
- Automatic cell balancing.
- Protection against abnormal electrical and environmental conditions.

> **NOTE**
>
> If a fault condition is detected, the BMS will place the battery into a protective state and restrict charge and/or discharge until the condition is resolved.

3.9. COMMUNICATION AND CONTROL INTERFACES

The battery is fitted with communication interfaces to support system integration and diagnostics:

- **CANBus:** Battery-to-battery communication in parallel systems.
- **CANBus:** Battery-to-inverter or Battery-to-EMS communication.

RS485 is for future battery communication development.

Where communication is used:

- Communication cables must be securely connected and routed to avoid mechanical damage.
- Communication ports must not have foreign objects inserted when not in use.

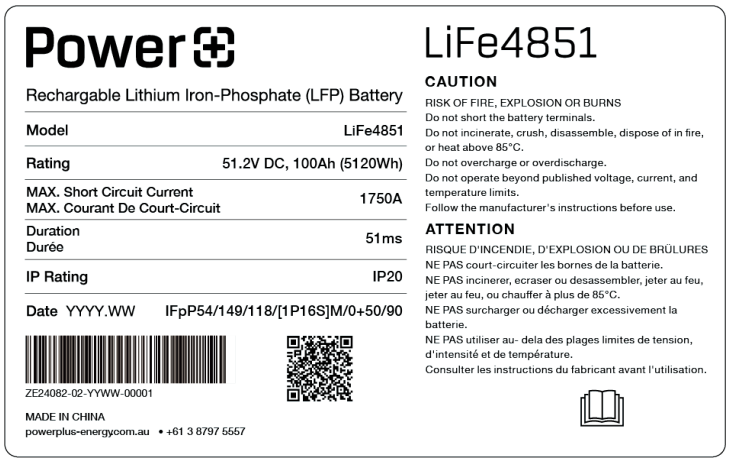
3.10. PARALLEL OPERATION

The PowerPlus Energy LiFe4851 battery supports parallel connection to increase total system capacity.

- Parallel operation is permitted up to the maximum of 16 battery modules as specified in this manual.
- Series connection is **not** permitted.
- All batteries in a parallel system must be of the same model and configuration.
- Interconnecting cables must be of equal length and size to ensure balanced current sharing.

3.11. PRODUCT IDENTIFICATION

Each battery module is fitted with a product identification label containing; model number, serial number, electrical ratings and certification marking. *See sample below.*



NOTE

This information must be recorded during installation and retained for warranty and service purposes.

4. INSTALLATION

This section provides important information and guidance to ensure the safe and correct installation of the PowerPlus Energy LiFe4851.

Installation should be carefully planned and carried out by a suitably qualified person in accordance with this manual, the requirements of the PCE, and all applicable electrical standards and regulations.

WARNING

Incorrect installation may result in reduced performance, shortened service life, or unsafe operating conditions.

4.1. LOCATION AND ENVIRONMENT

The location of the battery must comply with the environmental limits specified in this manual.

The battery is designed for indoor installation, or installation within a suitably rated enclosure when installed outdoors. Where outdoor installation is planned, the enclosure must provide adequate protection against weather, dust, and moisture (minimum IP54 recommended).

The installation location must meet the following conditions:

- The battery is installed on a level and stable surface.
- The area is free from flammable or explosive materials.
- The battery is not exposed to direct sunlight.
- The environment is dry, clean, and well ventilated.
- The battery is protected from salt air, corrosive atmospheres, and excessive dust.
- The temperature and humidity remain as stable as possible.
- The installation area is vermin and insect resistant.

The battery must not be installed in areas subject to flooding or water ingress.

4.2. OPERATING TEMPERATURE AND HUMIDITY

- The battery must be operated within the temperature and humidity limits specified in this manual.
- Operation outside the specified temperature range may cause the BMS to limit or stop operation as a protective measure.
- Frequent exposure to extreme temperatures may reduce battery performance and shorten service life.

4.2.1. EXTREME HUMIDITY CLIMATES

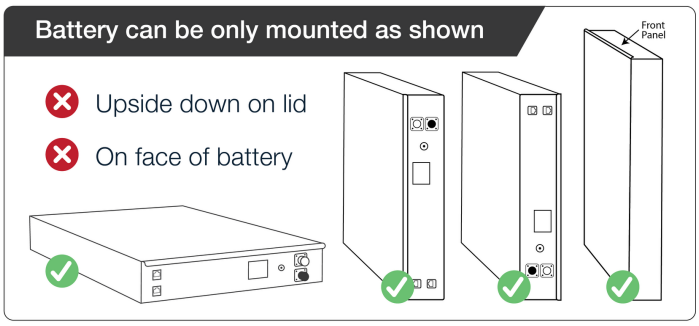
When installing the battery in environments with elevated humidity levels, additional precautions must be taken:

- A humidity control agent (such as a desiccant) may be required inside the enclosure.
- Controlled airflow may be required to expel moist air.
- Installation in a climate-controlled room is recommended where practical.
- The internal temperature of the enclosure must be always maintained above the dew point.

4.3. BATTERY ORIENTATION AND MOUNTING

The PowerPlus Energy LiFe4851 is designed for stationary applications and may be installed in the following orientations:

- Rack mounted (19-inch equipment rack).
- Floor mounted.
- Horizontal or vertical orientation (excluding upside-down or terminal-face-down positions).
- The battery must **not** be installed upside down or resting on its terminals (on the face).



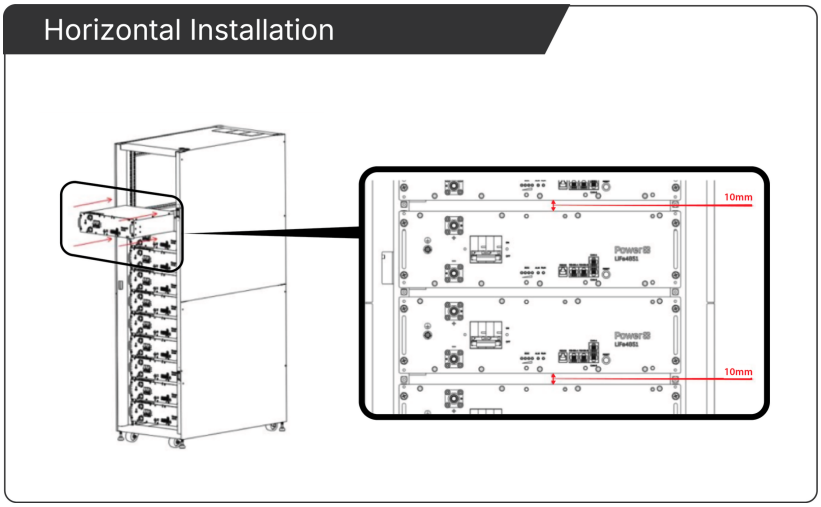
4.3.1. GUIDELINE FOR INSTALLING THE BATTERY HORIZONTALLY

The PowerPlus Energy 51.2V 100Ah Battery Pack may be installed in a horizontal orientation for stationary applications where adequate mechanical support and ventilation are provided.

When installing the battery horizontally, the following guidelines must be observed:

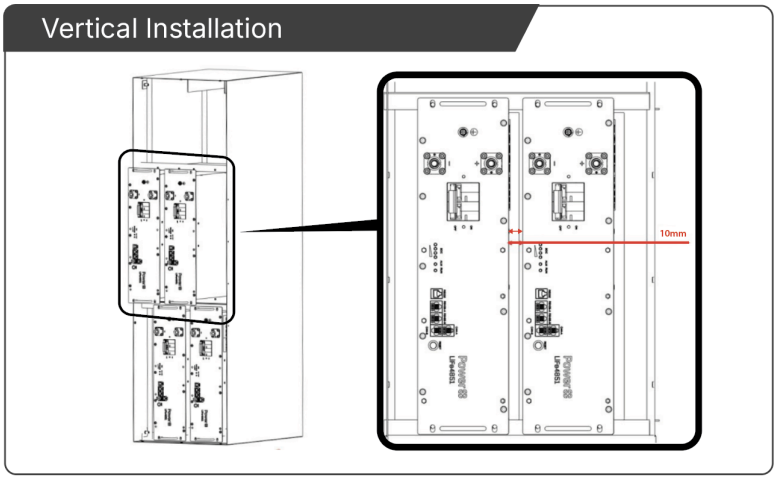
- Ensure the mounting surface, rack, or shelf is **level, rigid, and capable of supporting the battery weight.**
- Lift the battery using appropriate manual handling techniques or lifting equipment and position it onto the mounting rails or support surface.
- Align the battery so that the DC terminals, DC circuit breaker, and communication interfaces remain **accessible from the front.**
- Secure the battery to the rack, cabinet, or mounting structure using appropriate fixings to prevent movement during operation or servicing.
- Where more than one battery is installed, **a minimum separation of 10mm must be maintained between adjacent battery modules** to allow adequate airflow and heat dissipation.
- Ensure sufficient clearance is provided around the battery to allow natural convection cooling and safe access for maintenance.

The battery must not be installed resting on its lid, terminals, or communication ports. Horizontal installation must not restrict airflow or access to safety controls.



4.3.2. GUIDELINE FOR INSTALLING THE BATTERY VERTICALLY

The PowerPlus Energy LiFe4851 may be installed in a vertical orientation for stationary applications, provided the battery is adequately supported and restrained.



When installing the battery vertically, the following guidelines must be observed:

- Ensure the mounting surface or cabinet base is flat, stable, and capable of supporting the battery weight.
- Position the battery in an upright orientation with the front panel facing outward to allow access to indicators, controls, and interfaces.

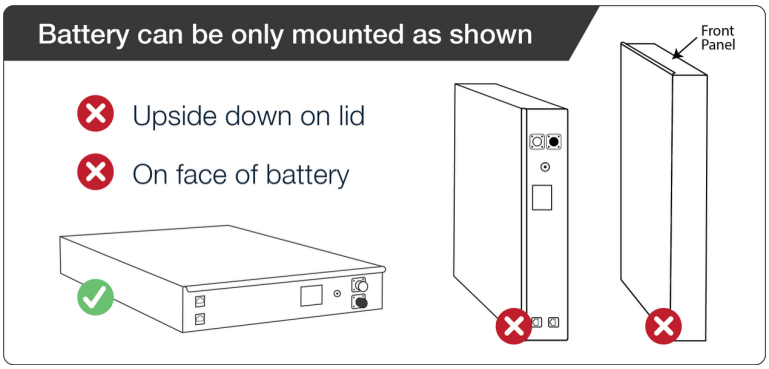
- Secure the battery using mounting brackets, rails, or restraints to prevent tipping or movement.
- Where more than one battery is installed, a minimum separation of 10mm must be maintained between adjacent battery modules to allow adequate airflow and to reduce heat transfer.
- Ensure sufficient clearance is provided around each battery to allow natural convection cooling and safe access for installation and servicing.
- Avoid stacking or arrangements that place excessive mechanical load on lower batteries unless suitable structural support is provided.

IMPORTANT

The battery must not be installed upside down or in any orientation that places mechanical stress on the enclosure, terminals, or internal components.

4.4. BATTERY INSTALLATION IN MOTORHOMES, RV'S TRAILERS, VEHICLES, TRUCKS, BUSES OR SIMILAR

- The battery must be installed horizontally (with the lid upwards) and secured in place to limit movement.
- The battery should be positioned in a non-flammable section and be vented to the outside, easily accessible, and removable from outside of the vehicle.
- A sufficient non-flammable shock mount system (like high density foam or similar) should be installed under each battery.
- The LiFe4851 battery module is certified to IEC62619 and therefore is approved for mobile applications as described in ASN253001.
- Batteries can be stacked no more than four high.



4.5. CUSTOM CABINETS AND ENCLOSURES

Where the battery is installed in a custom cabinet or enclosure, the following requirements must be met:

- Adequate ventilation must be provided for natural convection cooling.
- Batteries must be securely restrained to prevent movement.
- Minimum 10mm Clearance must be provided around the battery to allow heat dissipation minimum 10mm.
- The enclosure IP rating must be appropriate for the installation environment.
- The enclosure must allow safe access for installation, servicing, and isolation.

PowerPlus Energy recommends the use of PowerPlus Energy cabinets where available.

4.6. ELECTRICAL INSTALLATION REQUIREMENTS

WARNING

Electrical installation must only be performed by a suitably qualified person.

Before making any electrical connections:

- Ensure all battery DC circuit breakers are in the **OFF** position.
- Ensure all external DC and AC sources are isolated.
- Verify that the battery voltage is compatible with the connected PCE.
- Confirm correct polarity of all cables.

4.6.1. DC CONNECTIONS

- The battery provides DC positive and negative terminals for charge and discharge.
- Parallel operation is permitted up to the maximum number of 16 battery modules as specified in this manual.
- All parallel interconnecting cables must be of **equal length and size** to ensure balanced current sharing.
- Cable sizing, fusing, and protection must comply with applicable standards and PCE manufacturer requirements.

WARNING

Series connection of batteries is **not permitted.**

4.6.2. CRIMPING BATTERY CONNECTORS TO CABLES

Each Degson connector supplied by PowerPlus Energy can adequately seat 25mm or 35mm battery cable. Crimping of the Degson connector to the stripped end of the cable is performed using a standard 70mm hex crimp tool.

Before connecting the DC cable to the battery, you will need to remove the safety insulating cap on the battery DC connectors and dispose of appropriately.

4.6.3. CONNECTING BATTERY CONNECTORS TO BATTERY TERMINALS

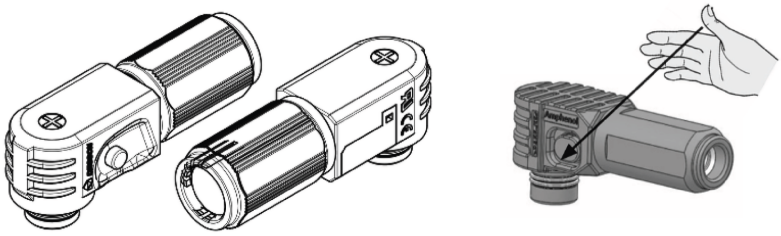
The battery connectors are keyed and colour coded to minimise the event of a reverse polarity connection.

When connecting the Degson plug into the socket, the plug must be first aligned to the key-way then pushed until an audible click is heard. This indicates the plug has locked onto the battery terminal.

To remove the plug, press in the button on the underside of the plug before pulling the plug out. This releases the locking mechanism.

Failure to release the locking mechanism before trying to remove the connector may result in damage to the Degson plug and/or battery.

Battery Connectors



4.6.4. CASE EARTHING

The LiFe4851 battery case is designed to be electrically floating and isolated from all internal battery connections and in most installations will not require earthing. However, should your application require the case to be grounded a M5 bolt should be used and is supplied with the battery.

4.7. BATTERY INSTALLATION METHOD

This section outlines the correct method for installing and connecting the PowerPlus Energy LiFe4851 in both single-battery and parallel-battery configurations.

All installation work must be carried out by a suitably qualified person and in accordance with this manual, the PCE manufacturer's instructions, and applicable electrical standards.

WARNING

Incorrect battery interconnection may result in equipment damage, unsafe operation, or reduced system performance.

4.7.1. STEP-BY-STEP PARALLEL CONNECTION PROCEDURE

Step 1 – Installation

1. Install each battery module in its final location in accordance with Section 4.3.
2. Ensure:
    - Each battery is securely supported and restrained.
    - A **minimum separation of 10mm** is maintained between adjacent battery modules.
    - Adequate clearance is provided for ventilation and servicing.

Step 2 – Communication Between Batteries

1. Using the supplied or approved RJ45 communication cables, connect the CANBus **communication port** of Battery 1 to Battery 2. Use bottom CAN port to connect to top can port.
2. Continue daisy-chaining the CANBus connection between all batteries in the system.
3. Ensure all connections are secure, and cables are routed to avoid mechanical damage.

Step 3 – Install Terminating Link

1. The Terminating link is required in the last battery in the remaining empty CANBus port. In a self-managed system, a terminating link is also required in the first battery empty CAN port.

Step 4 – DC Power Connections

1. Connect the **positive DC terminal** of each battery to a common positive busbar or combiner.
2. Connect the **negative DC terminal** of each battery to a common negative busbar or combiner.
3. Ensure:
    - All DC cables are identical in length and conductor size.
    - Cable ratings are suitable for the maximum system current.
    - All connections are tight and correctly torqued.
4. Connect the output of the busbar or combiner to the inverter or PCE, confirming correct polarity.

NOTE

A busbar or combiner arrangement is strongly recommended to ensure balanced current sharing.

Step 5 – Battery to Inverter / EMS Communication (if required)

5. Where communication with the inverter or Energy Management System (EMS) is required, connect **only one battery** (typically the top battery module) to the inverter or EMS using **CANBus**.
6. Ensure communication settings and addressing are configured in accordance with the PCE manufacturer's requirements.

Step 6 – Final Checks and Power-Up

1. Verify all mechanical fixings, DC connections, and communication cables are secure.
2. Confirm correct polarity on all DC connections.
3. Turn ON the DC circuit breaker of each battery **one at a time.**
4. Verify that battery status indicators illuminate normally.
5. Proceed with system commissioning in accordance with Section 5 (Battery Operation) and the PCE startup procedure.

IMPORTANT INSTALLATION NOTES

- All batteries in a parallel system must be installed and commissioned as a single system.
- Unequal cable lengths or poor connections may result in uneven current sharing.
- Communication ports must not be left exposed when not in use.
- If abnormal behaviour or fault indications occur, isolate the system and investigate before proceeding.

IMPORTANT

Commissioning should be performed in conjunction with the PCE manufacturer's instructions and the operating procedures outlined in this manual.

NOTE

The battery is intended for indoor installation or within a weatherproof enclosure.
Recommended minimum enclosure rating for outdoor installations is IP54.

5. BATTERY OPERATION

5.1. BATTERY STARTUP

The battery is supplied in a shutdown (shipment) mode.

5.1.1. STARTUP PROCEDURE

Confirm that all DC and AC sources are isolated.

1. Ensure all mechanical and electrical installation steps have been completed.
2. Turn the DC circuit breaker to the ON position.
3. Wake the battery pressing the manual ON/OFF button for approximately 1 second.
4. Confirm that the status LEDs illuminate, indicating the battery is active.

5.2. BATTERY SHUTDOWN

The battery may enter shutdown mode manually or automatically under defined conditions.

5.2.1. MANUAL SHUTDOWN

- Press and hold the manual ON/OFF button for approximately 3 seconds.
- Turn the DC circuit breaker to the **OFF** position to fully isolate the battery.

5.2.2. AUTOMATIC SHUTDOWN CONDITIONS

The battery will automatically enter shutdown mode if:

- The battery is removed from the system and remains idle for an extended period.
- The termination link is removed, or communication cable is damaged.
- Cell voltage falls below minimum thresholds for a sustained period.
- The battery remains idle without charge or discharge for a defined duration.

NOTE

Automatic shutdown protects the battery during transport, storage, or abnormal conditions.

5.3. CHARGING AND DISCHARGING OPERATION

Charging and discharging are managed by the internal BMS to ensure safe operation.

- Charging is permitted only within the specified voltage, current, and temperature limits.
- Discharging is restricted if voltage, current, or temperature limits are exceeded.
- The battery must not be connected directly to photovoltaic, wind, hydro-electric or any other unregulated systems without an approved charger.

For optimal performance and service life:

- Operate the battery within the recommended temperature range.
- Avoid prolonged operation at extreme SoC levels.
- Perform periodic full charge cycles to support cell balancing.

5.4. STATUS INDICATORS

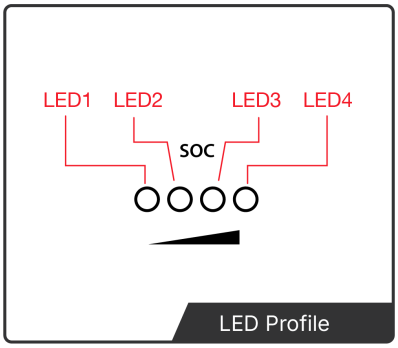
The battery is fitted with LED indicators to display operating status and SoC.

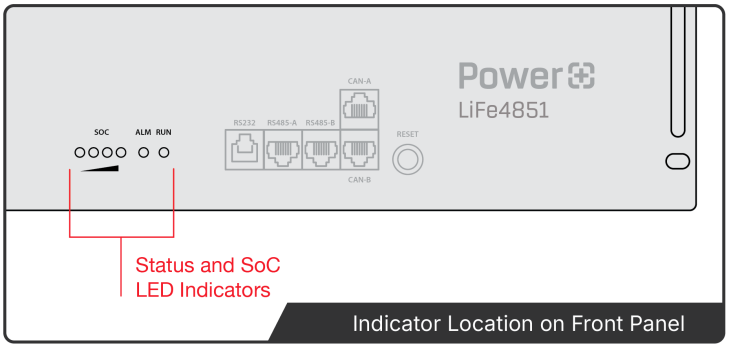
5.4.1. STATUS LEDS

Colour	Status Meaning
RUN (Green)	Indicates the battery is active and operating normally
ALARM (Red)	Indicates a fault or protection state

5.4.2. STATE OF CHARGE (SOC) DISPLAY

Multiple LEDs are used to indicate approximate battery SoC. The number of illuminated LEDs corresponds to the remaining capacity. Flashing LED patterns may indicate charging, discharging, or protection states.





Capacity Status	LED Display			
	●	●	●	●
	LED1	LED2	LED3	LED4
0%	Off	Off	Off	Off
0%~10%	**3 Flashes**	Off	Off	Off
10%~25%	**On**	Off	Off	Off
25%~50%	**On**	**On**	Off	Off
50%~75%	**On**	**On**	**On**	Off
75%~100%	**On**	**On**	**On**	**On**

Note 3 Flashes for soc of 0-10% = the Green LED turning on for 1 sec and then off for 1 sec 3 times, before a brief break and then repeating.

5.5. CALIBRATION

5.5.1. STATE OF CHARGE (SOC) CALIBRATION

SoC calibration is achieved through a full charge cycle.

PowerPlus Energy recommends:

- Fully charging the battery to 100% at least once a week.
- Maintaining the battery at full charge for a short duration to allow cell balancing.
- Performing calibration within the recommended operating temperature range.

5.5.2. FULL CHARGE CAPACITY (FCC) CALIBRATION

FCC calibration is used to accurately determine the usable capacity of the battery and to update SoH calculations within the BMS.

FCC calibration involves a controlled full discharge followed by a full charge cycle and must only be performed by a suitably qualified person. If an FCC calibration is required, contact PowerPlus Energy support.

IMPORTANT

FCC calibration should be carried out only when required and within the recommended operating temperature range of 15°C to 35°C.

5.6. COMMUNICATION

5.6.1. BATTERY-TO-BATTERY COMMUNICATION

CANBus communication is used between parallel-connected batteries to:

- Share operating data.
- Coordinate protection functions.
- Support balanced operation.

5.6.2. BATTERY-TO-SYSTEM COMMUNICATION

CANbus communication may be used between the battery and inverter or EMS where supported.

In self-manged mode, communication between batteries is still required, however a terminating link must be put into the top battery in the empty CANBus port, as well as the bottom battery.

5.6.3. MONITORING

To monitor the battery please use inverter monitoring

5.7. STATE OF HEALTH (SOH) AND CYCLE COUNT

SoH is calculated based on available capacity relative to the original design capacity. Cycle count is accumulated based on discharged energy rather than the number of charge events.

- One cycle is one full discharge of greater than 90% followed by a recharge to 100% SoC, or
- A series of partial discharges and recharges that together total 100% of the battery's usable capacity.

For example, four separate discharge events of 25%, each followed by a recharge, collectively equal one full battery cycle.

5.8. STORAGE AND RECHARGE REQUIREMENTS

If the battery is stored for an extended period:

- Maintain SoC between 60–80%.
- After 6 months of storage the battery will need a periodic recharge.
- Perform a full charge cycle prior to returning the battery to service.

5.8.1. PERIODIC RECHARGE

Periodic recharging is required to maintain battery health, support accurate SoC calculation, and ensure long-term performance of the PowerPlus Energy LiFe4851.

Where the battery is not regularly cycled, or where extended periods of low SoC occur, a periodic recharge must be performed.

Recharge Requirements

The battery must be recharged using an approved charger or inverter that meets the following requirements. The charger or inverter must be compatible with LFP batteries and must not exceed the specified voltage, current, or temperature limits.

1. **Charge Voltage:** Charge voltage of 56V DC.
2. **Charge Current:** Typical charge current up to 0.5C is recommended. Maximum charge current must not exceed the limits specified in this manual.
3. **Charge Method:** Constant Current (CC) followed by Constant Voltage (CV).

Periodic Recharge Procedure

Perform a periodic recharge under the following conditions:

- The battery has been stored or idle for an extended period.
- The battery SoC has fallen below approximately 30%.
- The battery has been in storage for 6 months or more.

The recommended procedure is as follows:

1. Ensure the battery is correctly installed and the DC circuit breaker is in the ON position.
2. Connect an approved charger or inverter configured with the correct voltage and current limits.
3. Charge the battery until 100% SoC is reached.
4. Maintain the battery at full charge for 30 minutes to 1 hour to allow internal cell balancing.
5. Return the battery to normal operation.

Important Notes

- Periodic recharge should be performed within the recommended operating temperature range of 15°C to 35°C.
- Failure to periodically recharge the battery may result in reduced performance or inaccurate SoC indication.
- If the battery has been deeply discharged, recharge should be performed as soon as practicable.
- Do not attempt to recharge the battery using uncontrolled or incompatible charging equipment.

6. TROUBLESHOOTING

If the battery enters a protection state or does not operate as expected, refer to the table below before contacting PowerPlus Energy technical support.

> **IMPORTANT**
>
> Always isolate the system and follow safe work practices before inspecting or servicing the battery.

6.1. TROUBLESHOOTING TABLE

Symptom	Possible Cause	Battery Response	Corrective Action
Battery does not power ON	DC circuit breaker OFF	No output, LEDs OFF	Turn DC circuit breaker ON
Battery does not wake from shipment mode	Battery in shutdown mode	LEDs OFF	Press ON/OFF button for ~1 second or apply charge voltage
No charge or discharge	Terminating link not installed	Output disabled	Install terminating link
ALARM LED ON (Red)	Battery in protection state	Charge and/or discharge inhibited	Identify protection cause and rectify before restarting
RUN LED OFF, breaker ON	BMS protection active	Output disabled	Refer to fault type below and recover accordingly
Battery not charging	Charge voltage too low or too high	Charging inhibited	Verify charger voltage set to 56 V DC
Battery not discharging	Inverter undervoltage or configuration issue	Discharge inhibited	Verify inverter settings and DC cabling
Battery shuts down during discharge	Low battery voltage	Discharge stopped	Recharge battery to recover
Battery shuts down during charge	Over-voltage protection	Charge stopped	Reduce charge voltage and restart
Battery shuts down during operation	Over-current protection	Output disabled	Check load current and cabling
Battery shuts down at high temperature	Over-temperature protection	Charge/discharge stopped	Allow battery to cool, improve ventilation
Battery will not charge in cold conditions	Temperature below charge limit	Charging inhibited	Warm battery above minimum charge temperature
Uneven performance in parallel system	Unequal cable lengths or connections	Imbalanced current sharing	Ensure identical cable lengths and secure connections
Communication fault between batteries	CANBus cable disconnected	Reduced coordination	Check and reseat CANBus connections
Inverter not detecting battery	CanBus not connected or configured	No comms	Verify CANBus wiring and inverter settings

6.2. PROTECTION STATES AND RECOVERY

The BMS will automatically place the battery into a protection state if abnormal conditions are detected. Most protection states are **self-resetting** once the fault condition is removed. Some conditions may require manual restart using the DC circuit breaker or ON/OFF button.

Protection Type	Trigger Condition	Recovery Method
Over-voltage	Charge voltage exceeds limit	Reduce charge voltage and restart battery
Under-voltage	Battery discharged below limit	Recharge battery to recover
Over-current	Load or charge current too high	Reduce current and restart
Short-circuit	External fault detected	Remove fault, wait, then restart
Over-temperature	Battery temperature exceeds limit	Allow battery to cool
Under-temperature (charge)	Temperature below charge limit	Warm battery before charging

6.3. WHEN TO CONTACT POWERPLUS ENERGY

Contact PowerPlus Energy technical support if:

- The battery repeatedly enters protection mode.
- LEDs indicate abnormal behaviour after recovery steps.
- Physical damage, swelling, leakage, or abnormal odour is observed.
- Communication faults persist after cabling and configuration checks.

Do not continue operating the battery if unsafe conditions are suspected.

PowerPlus Energy Technical Support Contact Details:

- support@powerplus-energy.com
- (03) 8797 5557

7. MAINTENANCE

The PowerPlus Energy LiFe4851 is designed to operate with minimal maintenance when installed and operated in accordance with this manual.

Routine inspection and preventative maintenance are essential to ensure safe operation, optimal performance, and long service life.

All maintenance work must be carried out by a suitably qualified person and in accordance with safe work practices and applicable electrical standards.

7.1. GENERAL MAINTENANCE REQUIREMENTS

- The battery contains no user-serviceable internal components.
- The battery enclosure must not be opened or modified.
- Maintenance is limited to inspection, verification, and functional checks.
- Any signs of abnormal operation must be investigated before returning the system to service.

⚠ WARNING

Always isolate all DC and AC sources before performing any maintenance activities.

7.2. INSPECTION SCHEDULE

PowerPlus Energy recommends the following inspection intervals:

- **Initial inspection:** After installation and commissioning.
- **Routine inspection:** Every 6–12 months, or as required by site conditions.
- **Event-based inspection:** After abnormal operation, fault events, or environmental exposure.

7.2.1. MAINTENANCE SCHEDULE

NOTE

The table below outlines the recommended maintenance activities for the PowerPlus Energy LiFe4851. All maintenance activities must be performed by a suitably qualified person.

Maintenance Notes

- The battery contains no user-serviceable internal components.
- Any abnormalities identified during maintenance must be investigated before returning the system to service.
- Maintenance frequency may need to be increased in harsh or high-use environments.
- Records of maintenance activities should be retained for warranty and system history purposes.

Maintenance Item	Inspection / Action	Recommended Frequency
Battery enclosure	Inspect for damage, deformation, corrosion, or signs of overheating	Every 6–12 months
Mounting and restraints	Confirm battery is securely mounted and mechanically stable	Every 6–12 months
DC terminals and connectors	Inspect for looseness, discoloration, overheating, or contamination	Every 6–12 months
DC circuit breaker	Verify correct operation and physical condition	Every 6–12 months
DC cabling	Check insulation, routing, strain relief, and signs of wear	Every 6–12 months
Communication cables	Inspect CANBus / RS485 cables for secure connection and damage	Every 6–12 months
Ventilation and airflow	Ensure ventilation paths are unobstructed and free of dust or debris	Every 6–12 months
Environmental conditions	Verify temperature, humidity, and enclosure conditions remain within limits	Every 6–12 months
Status and alarm LEDs	Confirm LEDs operate normally during charge, discharge, and idle states	Every 6–12 months
Battery operation	Confirm normal charging and discharging behaviour	Every 6–12 months
Parallel battery systems	Verify equal cable lengths and balanced connections	On installation or as required
Periodic recharge	Perform full recharge if battery has been idle or lightly cycled	As required (see Section 5.8.1)
Calibration (SoC / FCC)	Perform calibration only if required	As required
Post-fault inspection	Inspect system following any fault, shutdown, or abnormal event	After any event

7.3. VISUAL INSPECTION

During each inspection, perform a visual check of the following:

- Battery enclosure for signs of damage, deformation, corrosion, or overheating.
- DC terminals and connectors for discoloration, looseness, or contamination.
- Communication cables for damage, strain, or loose connections.
- Ventilation paths to ensure they are clear of dust, debris, or obstructions.
- Mounting hardware to confirm the battery remains securely restrained.

NOTE

If any physical damage or abnormal condition is observed, the battery must be isolated and assessed before continued operation.

7.4. ELECTRICAL INSPECTION

Verify the following electrical conditions:

- DC circuit breaker operates correctly.
- All DC connections are tight and correctly torqued.
- No signs of arcing, overheating, or insulation damage on cables.
- Polarity of all connections remains correct.
- Busbars or combiners (where used) show no signs of overheating or corrosion.

WARNING

Do not re-energise the system if electrical defects are identified.

7.5. OPERATIONAL CHECKS

During routine maintenance, confirm:

- Battery starts and shuts down correctly.
- Status and alarm LEDs operate as expected.
- The battery charges and discharges normally within specified limits.
- No recurring fault or protection states are present.
- Communication with the inverter or EMS (if used) is functioning correctly.

NOTE

If the battery has been idle for an extended period, perform a periodic recharge as outlined in Section 5.8.1.

7.6. ENVIRONMENTAL CONDITIONS

Confirm the installation environment remains within the specified limits:

- Ambient temperature within the recommended operating range.
- No water ingress or condensation present.
- Enclosure ventilation is adequate.
- No exposure to corrosive atmospheres, salt air, or excessive dust.

NOTE

Changes to environmental conditions may require corrective action to prevent long-term degradation.

7.7. CLEANING

- Clean the exterior of the battery using a **dry or lightly damp cloth only.**
- Do not use solvents, sprays, or chemical cleaners.
- Ensure the battery is isolated before cleaning.

NOTE

Cleaning must not introduce moisture into the battery enclosure.

7.8. FIRMWARE AND CONFIGURATION

Where applicable:

- Firmware updates, if available, must only be performed by authorised personnel.
- Incorrect firmware or configuration changes may affect performance or warranty.

7.9. RECORD KEEPING

It is recommended that maintenance records be kept, including:

- Installation date.
- Inspection dates.
- Observed issues and corrective actions.
- Any fault or protection events.
- Recharge or calibration activities.

NOTE

These records assist with troubleshooting, warranty assessment, and long-term system management.

7.10. CONDITIONS REQUIRING IMMEDIATE ACTION

Immediately isolate the battery and contact PowerPlus Energy technical support if any of the following occur:

- Persistent fault or alarm conditions.
- Visible swelling, leakage, or abnormal odour.
- Excessive heating or noise.
- Damage due to impact, flooding, or fire exposure.
- Repeated unexpected shutdowns.

NOTE

- Do not attempt to continue operating a battery under unsafe conditions.

8. UPGRADING CAPACITY

Additional batteries can be added to an existing LiFe4851 installation later. It is not possible to mix different battery types and capacities to an existing battery rack.

Therefore, all batteries in a rack must be of the same type, part number, and specification – unless advised by PowerPlus Energy.

Before adding one or more new batteries to the rack, this new battery voltage and the existing battery rack voltage must be within 0.2VDC of each other.

This may be achieved by using one of the following methods:

- By charging both the new battery and the existing battery to fully charged separately before combining them into the same battery system.
- Insert the new battery to a partially discharged battery bank ensuring the new battery and the battery bank are within 0.2V of each other. Charge banks up and maintain our recommended continuous charge voltage for up to 6 hours before floating or allowing load to be applied.

NOTE

Remember to update all PCE charging current and battery capacities to reflect the new increased battery storage system capacity.

9. END OF LIFE (EOL)

EOL is reached when the battery no longer delivers acceptable performance or has reached the end of its operational life. LFP batteries contain valuable materials and must be managed responsibly to ensure safety and environmental compliance. When a battery is removed from service, it must not be disposed of with general or household waste. Instead, it can be returned to PowerPlus Energy for recycling through approved facilities.

Due to the stability and longevity of prismatic cells, returned batteries are assessed and, if suitable, refurbished for repurposing in low-power applications such as community, education, or charity projects. Batteries that cannot be repurposed are sent to licensed recycling facilities, where ferrous and nonferrous metals are separated and forwarded to recycling partners, ensuring responsible material recovery.

9.1. IDENTIFICATION OF END OF LIFE

A battery may be considered to have reached EOL when one or more of the following conditions occur:

- SoH has fallen below the acceptable level for the application.
- Battery capacity is insufficient to meet system requirements.
- Repeated or persistent fault or protection states occur.
- Physical damage, deformation, or deterioration is observed.
- The battery has reached the end of its intended service life.

EOL determination should be made by a suitably qualified person.

9.2. PREPARATION FOR DECOMMISSIONING

Before removing the battery from service:

- Isolate all AC and DC power sources connected to the system.
- Turn the battery DC circuit breaker to the OFF position.
- Confirm that the battery is in a shutdown state and LEDs are OFF.
- Disconnect all communication and power cables.
- Ensure the battery is electrically isolated before handling.

WARNING

Do not attempt to open, disassemble, or modify the battery under any circumstances.

9.3. SAFE HANDLING OF EOL BATTERIES

When handling batteries at or near EOL:

- Use appropriate personal protective equipment (PPE).
- Handle the battery with care and avoid impact or mechanical stress.
- Do not stack batteries in a manner that may cause instability.
- Do not expose the battery to heat, water, or corrosive substances.
- Do not transport damaged batteries without appropriate containment.

NOTE

If the battery shows signs of swelling, leakage, or abnormal odour, isolate the battery and seek professional advice immediately.

9.4. TRANSPORTATION OF EOL BATTERIES

End of Life batteries remain classified as Dangerous Goods (UN3480 – Class 9).

Transportation must comply with all applicable Dangerous Goods regulations, including:

- Proper packaging (able to prevent short-circuits, damage and accidental activation) and labelling.
- Secure restraint during transport.
- Use of approved transport providers where required.

Refer to Technical Note on our website for Transport of Damaged or Defective Lithium Battery Modules

NOTE

Batteries should be transported in original packaging where possible.

9.5. RECYCLING AND DISPOSAL

The PowerPlus Energy LiFe4851 must be recycled through a licensed lithium battery recycling facility.

Recycling ensures:

- Recovery of valuable materials.
- Safe treatment of battery components.
- Compliance with environmental and safety regulations.

PowerPlus Energy can provide guidance on suitable recycling options where required.

9.6. ENVIRONMENTAL CONSIDERATIONS

Lithium Iron Phosphate batteries do not contain heavy metals such as lead or cadmium; however, improper disposal can still pose environmental risks.

Responsible recycling:

- Minimises environmental impact.
- Supports sustainable material recovery.
- Complies with environmental protection legislation.

9.7. RECORDS AND REPORTING

It is recommended that records be maintained for batteries taken out of service, including:

- Serial number.
- Installation and removal dates.
- Reason for decommissioning.
- Recycling or disposal method used.

These records support asset management, warranty assessment, and regulatory compliance.

10. WARRANTY

PowerPlus Energy will protect this product under warranty when it is installed as written in this manual and used as set out in the warranty documents. Any product not being used or installed as outlined will be in violation of the terms and will render the product void of any warranty. Refer to the warranty document for more information. Found at www.powerplus.energy.com.au

PowerPlus Energy does not cover warranty or any liability for damages or defects caused or from the following:

- Incorrect storage or transportation.
- Incorrect installation and wiring.
- Installed not according to this manual.
- Incorrect operation.
- Inappropriate environmental conditions when operating the battery.
- Failure to follow safety requirements.
- Tampering of or opening the battery.
- Unauthorised repairs or modifications.
- External influences such as physical damage, over charging or electrical damage.
- Used outside of warranty terms and conditions.

11. GLOSSARY

Ah	Ampere-hour	A unit of electric charge representing battery capacity.
ALARM LED	Alarm Indicator Light	Red LED indicating a fault or protection state.
BESS	Battery Energy Storage System	A system comprising batteries, inverters, protection devices, and controls for storing and supplying electrical energy.
BMS	Battery Management System	Internal system that monitors and protects the battery by controlling voltage, current, temperature, balancing, and safety functions.
CAN / CANBus	Controller Area Network	A communication protocol used for battery-to-battery communication in parallel systems.
CC	Constant Current	Charging mode where current is held constant.
CV	Constant Voltage	A charging mode. Voltage is held constant during the final stage of charging.
DC	Direct Current	Electrical current flowing in one direction, used by battery systems.
DG	Dangerous Goods	Classification for hazardous materials during transport (e.g. UN3480).
DoD	Depth of Discharge	The percentage of battery capacity that has been used.
EOL	End of Life	The point at which the battery reaches the end of its usable service life.
EMS	Energy Management System	A higher-level control system that manages energy flow between batteries, inverters, loads, and the grid.
FCC	Full Charge Capacity	Max. charge battery can hold at a given time, used for SOH calculation.
IP	Ingress Protection	Rating system defining resistance to dust and water (e.g. IP20, IP40).
LED	Light Emitting Diode	Indicator lights displaying battery status, alarms, and state of charge.
LFP	Lithium Iron Phosphate ($LiFePO_4$)	Battery chemistry known for safety, longevity, and thermal stability.
PCE	Power Conversion Equipment	Inverters, chargers, or hybrid systems connected to the battery.
RS485	Recommended Standard 485	Serial communication interface used for battery-to-inverter or EMS communication.
SOC	State of Charge (SoC)	The current available energy in the battery, expressed as a percentage.
SOH	State of Health (SoH)	Measure of battery condition relative to its original capacity.
UPS	Uninterruptible Power Supply	System providing backup power during grid outages.
UN38.3	United Nations Transport Test Standard	Transport safety testing requirements for lithium batteries.
VDC	Volts Direct Current	Unit of DC voltage.