

# Eco P Series Lithium Battery



# Installation and Operation Manual



Residential



Commercial



Industrial



Utilities and  
Telecom

# Introduction

The Eco P Series Lithium Ferro Phosphate (LFP) battery by PowerPlus Energy is designed and manufactured in Australia for the worlds harshest conditions to be a simple, flexible and reliable energy storage solution. As a result, the Eco Series batteries can be easily installed with most Inverter and charger combinations, UPS, rectifiers, DC or AC coupled charging devices, on-grid and off-grid in single, dual or three phase applications. There is almost no limitations in applications and suitable devices that can charge or discharge the Eco P Series battery. Currently the Eco P Series battery is available in a 48V version.

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# Safety

Installers and users are responsible for familiarising themselves with this manual.

The Eco P Series batteries use a high grade cylindrical Lithium Ferro Phosphate (LFP) cells which are robust and reliable in higher ambient temperatures, have a long service life and with no heavy metals and are fully recyclable.

Each Eco P Series battery has an internal Battery Management System (BMS) that provides protection against Over and Under Voltage, Over Current, Over Temperature and Short Circuit as well extended service life through managing cell string balancing.

Each battery has a 2 pole non polarised circuit breaker, status indicator light, volt free alarm contact and high quality Amphenol SurLok DC connections for safe and easy installation.

Installation should be by qualified and experienced installers who can specify the correct cables and DC bus arrangement, external circuit protection, polarity checking and suitability of the design for the installation.

## Transportation

Lithium Ferro Phosphate batteries are classed as Dangerous Goods (DG) Class 9 UN3480. They are safe for road transport. The batteries are shipped in a partially discharged state with terminal protection and the circuit breaker off.

## Basic Safety

The following precautions should be observed:

- Battery should not be exposed to temperatures above or below the ambient temperature rating specified within in this manual.
- Battery should not be installed in direct sunlight.
- Battery should not be exposed to strong impacts.
- Battery should not be crushed or punctured.
- Battery connectors should not touch conductive surfaces unless intended to do so.
- Battery should not be disassembled unless qualified to do so.
- Battery should not be touched if wet.
- Battery should be kept dry at all times.
- Battery should be kept away from animals and children.
- Battery pack should not be exposed to pressure or have objects stood on top of them.
- Battery pack is intended to be a 2 person lift when installing.

## Handling

- Use battery only as directed.
- The battery is non user serviceable and should not be opened for repair.
- Do not use the battery if it appears damaged or broken.
- Handle battery with care when installing or transporting.
- Do not use chemicals to clean the battery.

## Damaged Battery

A damaged battery should not be used and should be returned to the PowerPlus Energy or disposed of via a recycling facility. Leaking electrolyte can cause skin irritation and chemical burns so contact should be avoided.

Eye Contact: Rinse gently with running water and seek medical attention if irritation develops.

Skin Contact: Rinse gently with running water and seek medical attention if irritation develops.

Ingestion: If ingested, do not induce vomiting and contact your local poisons information centre or doctor.

Inhalation: Evacuate area and seek professional medical attention immediately, however an inhalation is not expected due to product form and nature of use.

## Fire

Should the battery pack catch on fire a dry agent fire extinguisher should be readily available and used. DO NOT use water. Evacuate the area and call emergency services. Toxic gas may be produced if the battery catches fire.

Note: Refer MSDS document for more details which is available from PowerPlus Energy's web page or upon request.

## Qualified Person (Installer)

This manual and task sets within regarding installation should be carried out by a suitable qualified and skilled person.

The installer needs to be a person with adequate skills, qualifications and experience.

They should:

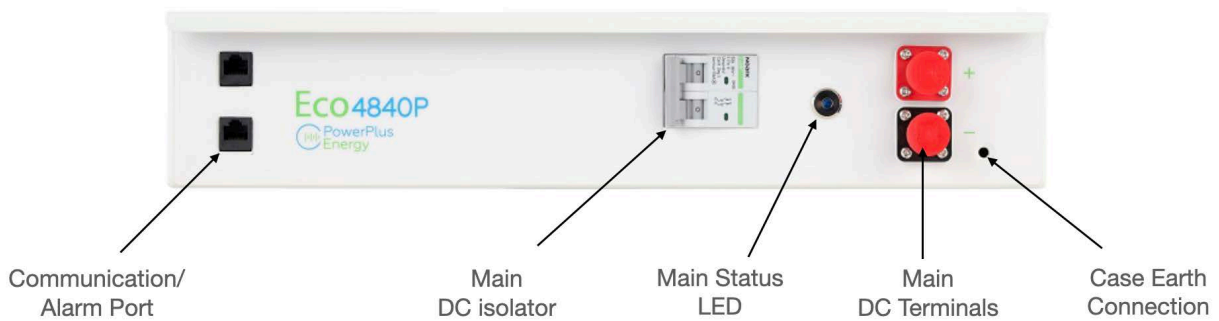
- Have a thorough understanding of operations, design and installation principles of on and off-grid electrical systems.
- Have a thorough understanding of all dangers associated with installing and using electrical devices as well as all risks.
- Hold all local, state and country based qualifications to carry out such work.
- Adhere to all safety and installation requirements within this manual.

# Product Information

The technical information presented here within outlines the physical and electrical characteristics of the battery and what environment they should be installed in.

## Weight and Dimensions

	Eco4840P
Depth	635mm
Width	434mm
Height	88mm
Weight	43kg



# Specifications

Eco4840P	
Nominal Capacity DC Voltage	51.2V
Nominal Capacity	4.0kWh (3.994) / 78Ah
Continuous Charge / Discharge C-Rate	0.5C (C2)
Continuous Charge / Discharge Current	39A (Refer to Eco 2RU Warranty Statement)
Maximum Current	63A (Limited by circuit breaker)
Battery Fault Current (1ms)	250A
Arc Flash Incident Energy IEm in Cal/cm (45cm)	0.36
Arc Flash Incident Energy AFB in cm <sup>2</sup>	24.45
Charge/Discharge Cycles approx.	2700@100% DoD / 5000@75% DoD / 10,000@50% DoD @25°C op. temp.
Operating Temperature Range	Charge: 0° to 55°C / Discharge -20° to 55°C
Operating Humidity (Non condensating)	85%
Altitude	Below 2000m
Battery Dimensions	635mm D x 434mm W x 88mm H
Battery Mounting Options	Standard 19" Rack Mounting / Horizontal or Vertical
Terminal Connections	Amphenol Surlok 100A Non Keyed
Module Weight	43kg
Operational Voltage Window	40V to 58.4V
BMS Over-Volt Cell Level Protection	3.9V/Cell
BMS Under-Volt Cell Level Protection	2.0V/Cell
BMS Over-Temp Cut Off	65°C
Max Trip Current	200A
Circuit Breaker	2-Pole 63A 360VDC (K Curve)
Self Discharge	14% Per Annum
Lithium Composition	Lithium Ferro Phosphate (LiFeP04 or LFP)
IP Rating	IP40
Round Trip Efficiency	>96%
Expected Life @25oC	Greater than 10 years when used as per warranty terms
Cooling	Natural convection
Parallel Stacking	Unlimited - Refer Manufacturer
Serial Stacking	N/A
Alarm Output	Normally closed, volt free, 1A maximum
Certifications	Pending IEC:62619:2017, UN38.3, EMC

# Charging and Discharging

The battery should be charged and discharged within the operating temperature windows as outlined within the specifications and as indicated in the Charge Discharge table below. All currents are maximum for each battery, and should be taken into consideration when multiple devices are charging the battery.

A **Primary charging source** should be identified in the system and programmed to charge the batteries as outlined in the table below. A primary charging source, is the charging device that will be used to charge the battery for 75% of the time (or higher).

**Secondary charging sources** can also be used, the preference is to also have these devices programmed to the charging settings in the table below. However if this is not possible, they can be used as long as the output voltage does not exceed the upper voltage of the Operational Voltage Window of the battery, does not exceed the Continuous Charge Current, and does not account for more than 25% of the charging of the battery.

Example

**Primary Charging Source** = Solar PV will be used to perform 75% of charging and will be programmed as per below table.

**Secondary Charging Source** = Wind Turbine will be used to supply approximately 25% of the charging, however can not have the voltage adjusted as per the specific charging voltages as specified the table, however will not exceed the Operational Voltage Window or Continuous Charge Current of the battery (as outlined in the table below).

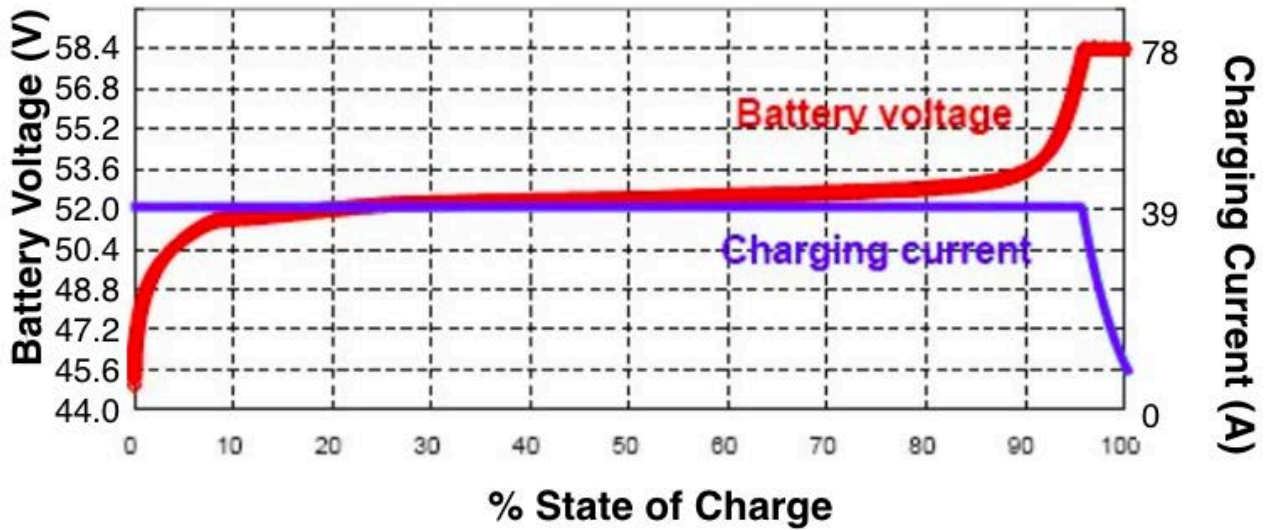
SoC control should be used when maintaining charging and discharging of the battery.

Connected PCE Programming Requirements	
Eco4840P	
Shut Down SoC (Recommended)	20%
DC Volts Shut Down 0% Load	48.0V
DC Volts Shut Down 100% Load	46.0V
Recovery / Restart Voltage	52V
Continuous Charge Voltage (Per Warranty)	57.6V
Float Voltage Cyclic (Short Term Float) (Example Solar Application)	57.6V
Float Voltage Standby (Long Term Float) (Example UPS Application)	54.4V to 56V
Peukert Exponent	1.02
100% recharge (Recommended)	7 to 14 days to keep External SoC counter accurate
Operational Voltage Window	40V to 58.4V
Continuous Discharge Current	39A
Continuous Charge Current	39A
Cable Size	Refer relevant manual or cable sizing standard
Warranty	Refer Warranty document for warranty duration, installation, usage and maintenance requirements
Note	In our efforts towards constant product enhancement this specification is subject to change at anytime without notice



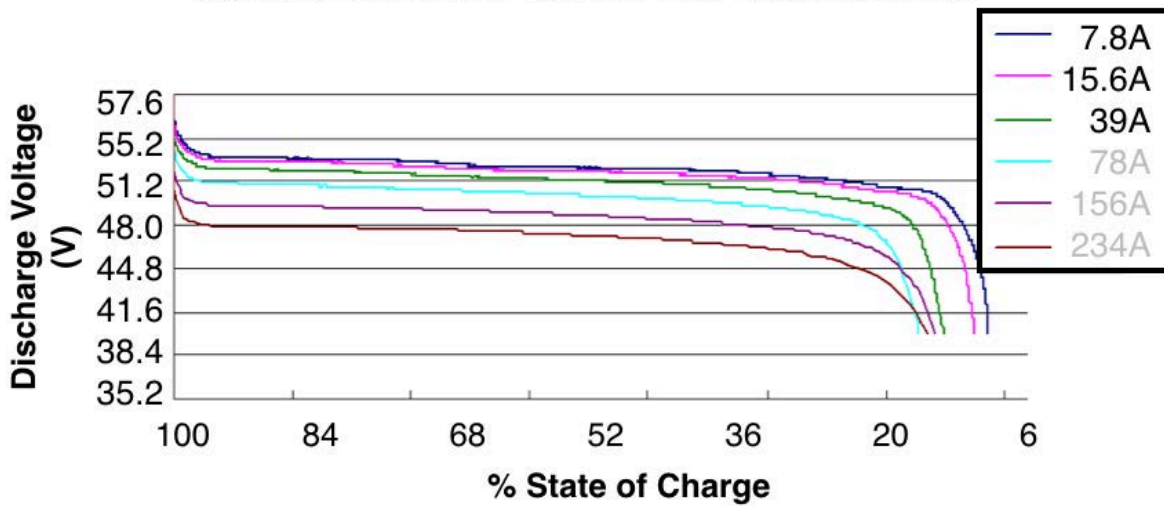
## Charging Curves Eco 4840P

### VOLTAGE/CURRENT CURVE FOR CHARGING



## Discharging Curves Eco 4840P

### VOLTAGE/CURRENT CURVE FOR DISCHARGING



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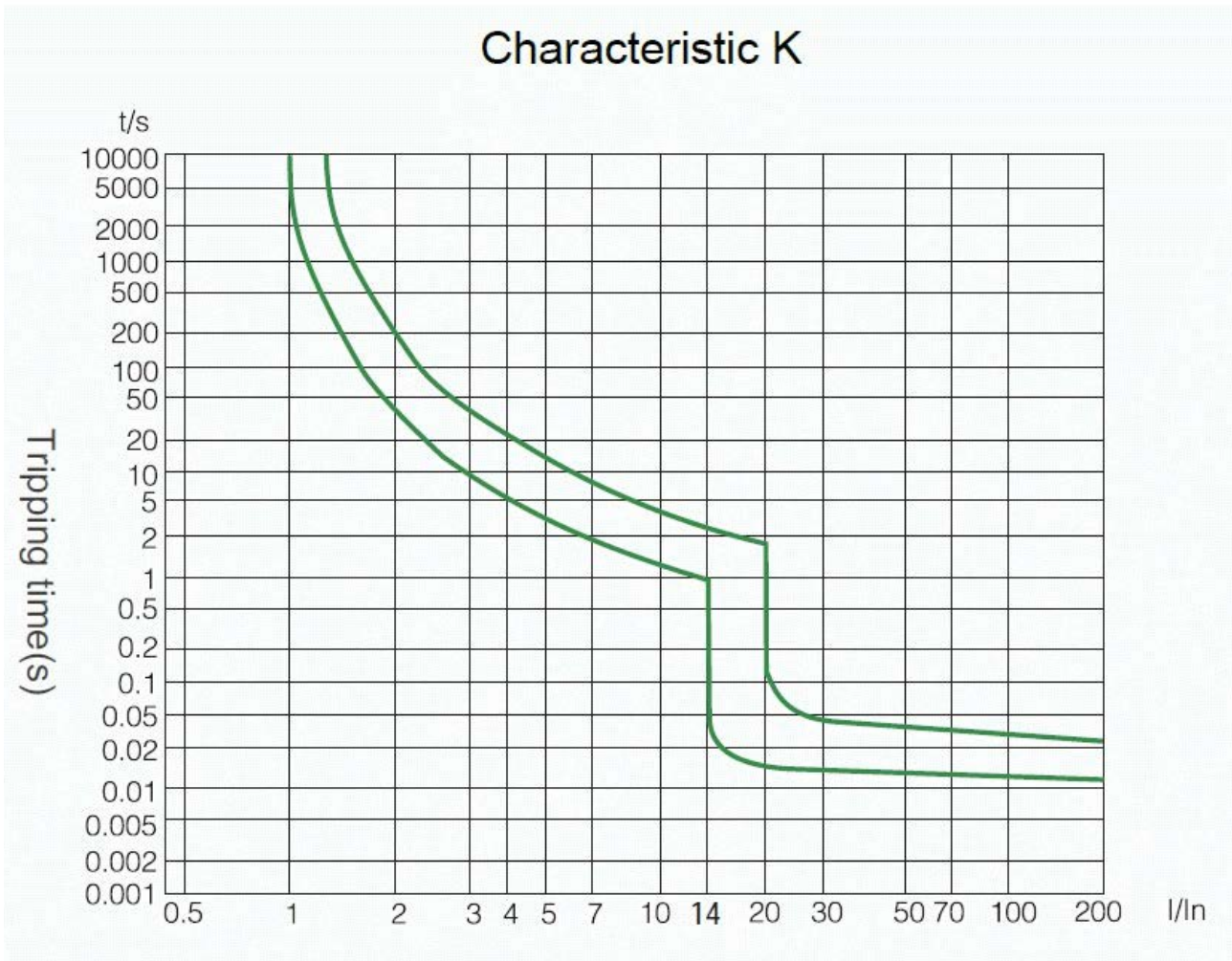
## State of Charge Vs Voltage

The below table can be used a guide for referencing voltage against energy in the battery.  
The below figures are taken at 25°C and with a 0.5C load applied.

SoC	Eco4840P
100%	>53.00
99%	52.50
98%	52.00
97%	51.75
96%	51.72
90%	51.70
80%	51.65
70%	51.50
60%	51.32
50%	51.15
40%	51.00
40%	50.75
30%	50.50
20%	50.20
10%	49.50
0	48.00

# Circuit Breaker Characteristic

The integrated double pole DC is dual pole and a K curve type. The table below outlines the trip times based on current.



# Installation

Installation should be carefully considered and all aspects of the specifications should be understood to determine a suitable location and way of installing the battery.

## Location and Environment

The location of the battery should be in accordance with the IP rating and operating temperature range specified in the Specification section of this manual. Even though the batteries operate at a low temperature, it is preferred that adequate airflow around the batteries is provided.

The location of the batteries should meet the below conditions:

- The location is far way from the ocean/sea. If unavoidable, appropriate air filtration is used to prevent or limit salt air contacting the battery, and the battery installation should be indoors.
- The floor is level and free from obstructions.
- There are no explosive or flammable materials nearby.
- The optimal ambient temperature is between 0 and 45°C (battery is OK to operate outside this range however, not for sustained periods).
- Operation of charge and discharge outside of the optimal ambient temperature should be limited to C5 and still remain between the max and min operation temperature range as specified in this manual.
- The temperature and humidity remains as constant as possible.
- The area is of a clean environment with minimal dust.
- The area or enclosure is vermin proof to suit your environmental locations.
- The batteries and battery cabinets/housings are not exposed to direct sunlight.

The Eco battery is designed to be installed in a 19 inch data rack assembly or an electrical enclosure of your choice. If the battery is to be installed outdoors a suitable IP54 or above enclosure shall be used.

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## Extreme Humidity Climates

When our batteries are being installed in climates of extreme humidity, extra precaution should be taken.

- A humidity control agent (ie chemical which absorbs humidity) is required inside the enclosure, with controlled airflow to expel moist air.
- And or, the battery system to be installed in a moisture and climate controlled room (example, reverse cycle cooled).
- The temperature of the cabinet should be held at a temperature above dew point at all times.

# Battery Installation

The battery has been designed to fit into a standard 800mm deep 9 inch rack enclosure. The enclosure should be fitted with PowerPlus Energy's battery rails or similar to ensure stability and correct installation. Battery rails can be sourced from you normal PowerPlus Energy place of purchase.

- If the battery is installed in to enclosures without rails, please ensure that they are securely seated to prevent accidental damage or tampering.
- If a custom enclosure or mounting method is used please ensure the batteries are not stacked more than 6 high unless battery support rails are used to disperse weight.

Description	Part Number
Rack Mount battery rails Rack M (pair)	PIR Shelf



# Battery Connections

Each battery has a positive and negative Amphenol SurLok non keyed male connector for easy snap on connection. A range of cable and mating connectors are available from your normal PowerPlus Energy place of purchase.

If multiple batteries are being used in parallel, the battery cables shall all be of the same length to retain equal impedance of each battery and cable set.

## Main DC Connections

The battery comes fitted with Amphenol Surlok connectors (non keyed) male connectors. The table below outlines the battery connections and the mating cable connectors required. Before connecting the DC cable you will need to remove the safety insulating cap on the connectors and dispose of appropriately.

Each Amphenol SurLok connector supplied by PowerPlusEnergy can adequately seat 25mm single insulated or 16mm dual insulated battery cables. A 16mm reducing sleeve is provided. Crimping of SurLok to the stripped end of the cable cables is using a standard 25mm hex crimp tool.

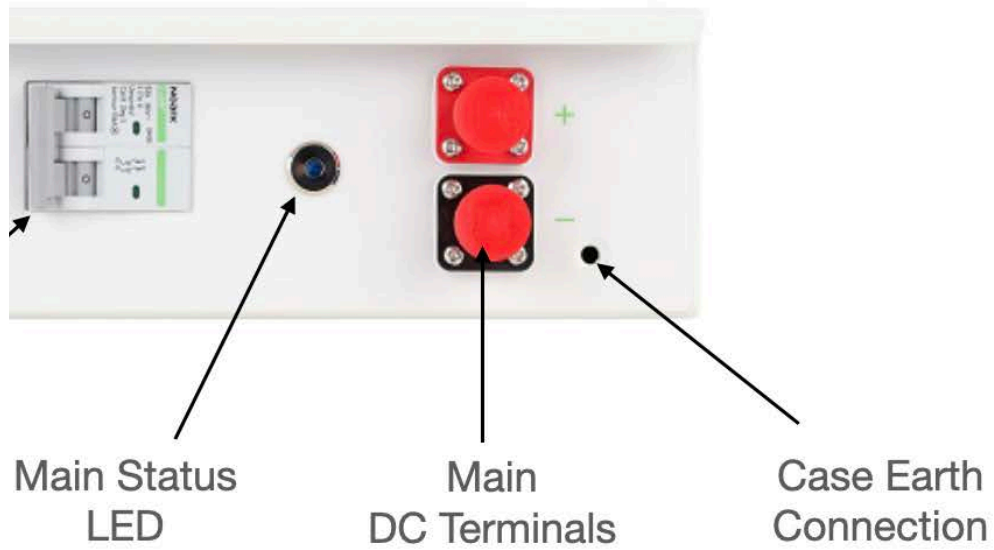


	Battery	Cable
Positive connection	SLPRATPSR	SLPPA16BSR
Negative Connection	SLPRATPSB	SLPPA16BSB



# Case Earthing

The Eco battery has an M6 nut-set to allow case earthing should your application require grounding of case to the same potential across the application. A 5mm M6 bolts should be used.





# Battery Alarm and Communication Installation

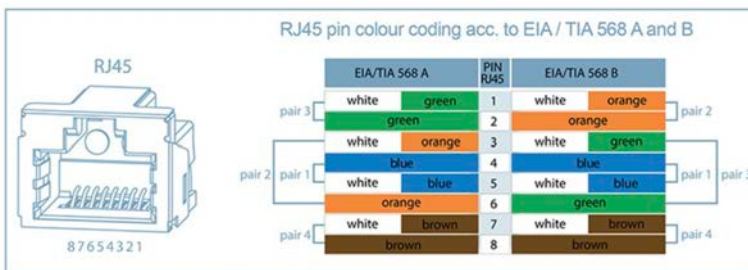
The battery provides the ability to alarm the system manager or user that there has been a loss of power to a battery or batteries. Loss of power to the battery or batteries could be either a circuit breaker or BMS trip. BMS trip will self rest, however a battery circuit breaker will need manual intervention.

The alarm contacts can be daisy chained to produce one alarm output or can be wired individually.

The connectors are an RJ45 style female connector. The alarm output uses pin 5 and 6 and provide and Volt free contact.

The alarm output is normally closed when energised by the battery (battery is ON and LED illuminated). When or if the battery turns OFF (circuit breaker or BMS trip and LED off) the contact will open.

The alarm outputs are designed to be daisy chained connecting the top RJ45 from one battery to the bottom RJ45 of the next and so on. The battery at the beginning of the chain will need to have pins 5 and 6 bridged on the bottom RJ45 terminals, and battery at the end of the chain can be connected to an appropriate alarming circuit.



A range of cables to connect the battery alarm contacts are available for purchase.

	CABLE
Battery daisy chain connector lead (30cm)	COM0030A
Battery Bridge connector	COMLBA
Battery Comms Cable (2Metre)	COM020A
Battery Comms Cable (5Metre)	COM050A
Battery Comms Cable (10Metre)	COM100A
Battery Comms Cable (15Metre)	COM150A



# PowerPlus Energy Battery Enclosures

PowerPlus Energy provides a range of mounting options to make your installation simple and easy. They have been design to suit indoor and outdoor applications and to secure a rage of different battery capacities.

## Rack Series Enclosures

The Rack Series enclosure for domestic, commercial and utility installations, allows quick and easy visualisation of battery operation.

The cabinets come pre configured with all interconnecting battery cables and DC busbar (accessible via the rear door) for a speedy and easy indoor installation of our batteries.

### Rack Series Specification

	PIR8C	PIR10C	PIR12C	PIR18C	PIR20C
Dimensions (H x W x D)mm	990 x 600 x 800	1166 x 600 x 800	1400 x 600 x 800	1800 x 600 x 800	1950 x 600 x 800
Colour	Black with glass front door (powder coated)				
Mounting	Floor				
Securing	4 x Caster rollers for positioning and 4 x locking feet.				
Feet	Adjustable				
Number of Battery Slots	8	10	12	18	20
Battery Connection Main Isolator	Busbar with M8 Stud 1000A Continuous rated (M8 Nut, bolting and washer not supplied)				
Battery Interconnection	Amphenol Surlok connector, 16mm double insulated cable (supplied and installed in cabinet for easy plug and play assembly)				
DC Circuit Breaker	None				
Cable Entry	Top or bottom entry				
IP Rating	IP21				
Weight Kg	95	110	132	174	187
Note	In our efforts towards constant product enhancement this specification is subject to change at anytime without notice				



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## Rack Series Enclosure Installation

- Move cabinet into position.
- Choose cable entry position to suit your application. Multiple cable entry trays are positioned on and around the enclosure.
- Ensure suitable glands or similar are used to protect the cables after forming cable entry hole. Glands are not supplied and should be of the same or higher IP rating of the cabinet.
- Ensure all filings from forming holes are removed from cabinet.
- Connect main DC cable from main DC isolator to the PIR enclosure DC bus bar with M8 nut, washer and locking washer and tighten.
- Close rear door and move cabinet into final position.
- Secure locking feet and wind down until firm against the ground, transferring the cabinet weight from the caster wheels.
- Using a 2 person lift, slide the batteries into the cabinet starting from the bottom and working your way to the top.
- Connect corresponding Amphenol cables to batteries.

Note: The Caster wheels are not designed to take the weight of the cabinet and batteries. The locking feet supplied must be used.

Note: Batteries should be loaded from the bottom of the cabinet working your way to the top. This ensures the cabinet remains stable.

Note: The cabinets have fans installed for cooling. These fans are 240V powered and are always on when powered. If your installation requires to the use fans (not compulsory) for cooling, an ambient temperature controlled switch may be required to turn the on and off as necessary. These are available from you normal PowerPlus Energy place of purchase.

Note: When paralleling multiple battery cabinets, battery cables from each cabinet must be the same length and cable size to ensure cabinet impedances remain the same. The use of an external busbar is highly recommended.



# SlimLine Series Enclosures

PowerPlus Energy SlimLine series battery enclosures are designed to provide low profile options for mounting the LiFe and Eco batteries. Each style is available at 300 to 400mm deep making them suitable for installation in walkways, sides of buildings and alongside industrial equipment.

The cabinets come pre configured with all interconnecting battery cables and DC busbar for a speedy and easy indoor or outdoor installation of our LiFe and Eco batteries.

## SlimLine Series Specification

	PEW3	PEW4	PEF6W - B250	PEF9W - 250
Dimensions (H x W x D)	800 x 600 x 300mm	800 x 600 x 400mm	2002 x 802 x 304mm	1477 x 849 x 300mm
Mounting	Wall		Floor	
Feet	N/A		Adjustable	
Number of Battery Slots	3	4	6	9
Battery Connection	Busbar with M8 Stud			
Cooling	Natural convection		Temperature controlled (adjustable) fan forced	Natural convection
DC Circuit Breaker	N/A		2Pole Non Polarised 250A 1000VDC	
IP Rating	IP66		IP54	
Weight	33kg	37kg	95kg	72kg
Note	In our efforts towards constant product enhancement this specification is subject to change at any time without notice			



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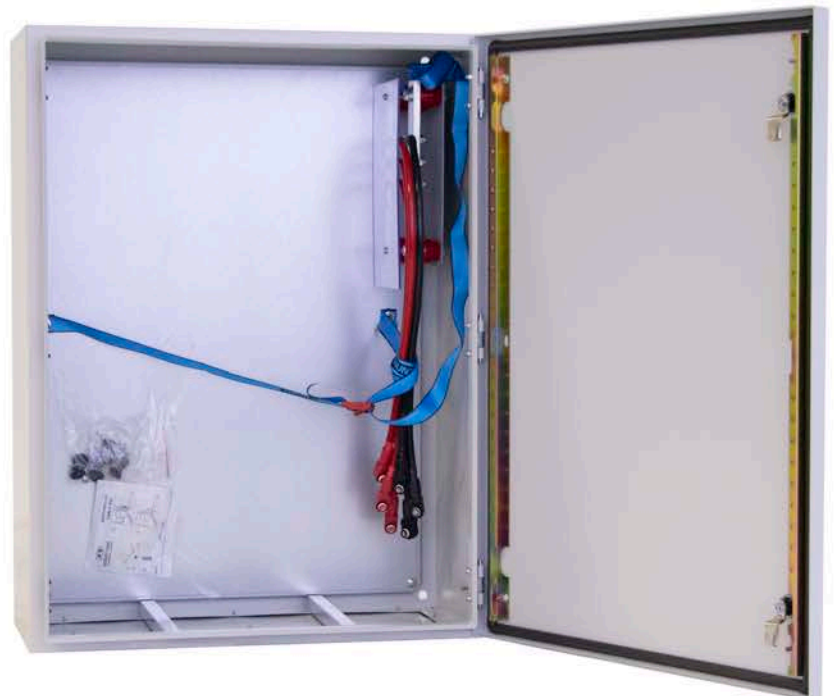
## PEW3 & PEW4 Installation

The PEW3 and PEW4 are a small wall mount battery enclosure for use in smaller storage solutions. The cabinets are suitable to be installed indoor or outdoor.

- Securely mount the battery enclosure to the wall using appropriate fastening. Your fastening types will vary depending on wall surface and sub-straat.
- The wall should be rated to carry all equipment, including up to 210kg for a PEW4 with 4 batteries installed.
- Choose cable entry position to suit your application.
- Ensure suitable glands or similar are used to protect the cables after forming cable entry hole. Glands are not supplied and should be of the same or higher IP rating of the cabinet.
- Ensure all filings from forming holes are removed from cabinet.
- Connect main DC cable from main DC isolator to enclosure DC busbar with M8 nut, washer and locking washer.
- Using a 2 person lift, Insert batteries into cabinet standing them up vertically with battery terminals facing upwards.
- Securely fasten batteries in places using provided strap. Ensure strap is tight and and secure.
- Connect corresponding Amphenol cables to batteries.

Note: Batteries should be loaded from the rear of the cabinet working your way to the front. This ensures the cabinet remains stable and weight is distributed closet to the wall.

Note: When paralleling multiple battery cabinets, battery cables from each cabinet must be the same length and cable size to ensure cabinet impedances remain the same. The use of an external busbar is highly recommended.



## PEF6W-250B Installation

The PEF6W-250B is a BESS (Battery Energy Storage System) cabinets designed to house the PowerPlus Energy batteries and connected PCE's for charge and discharge. The cabinets are suitable to be installed indoor or outdoor.

- The cabinet should be installed on level, solid surface. The surface should be concrete, brick, masonite or similar.
- Securely mount the battery enclosure to the wall using appropriate fastening. Your fastening types will vary depending on wall surface and sub-straat.
- The wall should be rated to support all equipment, including up to 342kg plus the weight of other PCE's and balance of system installed.
- The feet can be adjusted to level and stabilise the cabinet.
- Choose cable entry position to suit your application. Cable entry can be positioned anywhere around the cabinet to suit the application
- Ensure suitable glands or similar are used to protect the cables after forming cable entry hole. Glands are not supplied and should be of the same or higher IP rating of the cabinet.
- Ensure all filings from forming holes are removed from cabinet
- A gear plate is provided for the mounting of PCE's and balance of system equipment.
- DC isolator, main DC busbar and all interconnecting battery cables are provided and should installed to suit your layout inside the cabinet.
- Up to 6 Eco4840P batteries can be installed on the lower shelves.
- Using a 2 person lift, slide the batteries into the cabinet starting from the bottom shelf at the rear and working your way to the front and the repeat on upper shelf.
- Connect corresponding Amphenol cables to batteries.
- The supplied fan assembly can have the fan removed and rotated to allow air to either be drawn into or out of the cabinet. It can be positioned in either of the cabinet vent holes.
- The fans are 240V powered and come supplied with a temperature controlled thermostat that can be adjusted and positioned to suit your installation.

Note: Batteries should be loaded from the rear of the cabinet working your way to the front. This ensures the cabinet remains stable and weight is distributed closet to the wall.



Supplied with PEF6.

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## PEF9W-250 Installation

The PEF9W-250B wall/floor mount battery enclosure to securely house our batteries in an outdoor environment. The cabinets are suitable to be installed indoor or outdoor.

- The cabinet should be installed on level, solid surface. The surface should be concrete, brick, masonite or similar (man made).
- Securely mount the battery enclosure to the wall using appropriate fastening. Your fastening types will vary depending on wall surface and sub-straits
- The wall should be rated to support all equipment, including up to 342kg plus the weight of other PCE's and balance of system installed
- The feet can be adjusted to level and stabilise the cabinet.
- Choose cable entry position to suit your application. Cable entry can be positioned anywhere around the cabinet to suit the application
- Ensure suitable glands or similar are used to protect the cables after forming cable entry hole and maintaining IP rating of cabinet. Glands are not supplied. Ensure all fillings from forming holes are removed from cabinet
- The busbar assembly (including DC isolator) can be removed for ease of battery installation.
- Batteries can be slid into place on their side with their battery terminals face outwards.
- Using a 2 person lift, slide the batteries into the cabinet starting from the bottom shelf at the rear and working your way to the front and then repeat on next shelf and finally the upper shelf.
- Secure the busbar assembly back in to place.
- Connect corresponding Amphenol cables to batteries.



# Battery Operation and Commissioning

Now that you have installed the batteries you are almost ready to turn the battery on. First you should check your installations to ensure the below:

- Check polarity of all battery connection to be correct.
- Check that there is no damage to cables.
- Check that all system breakers are in the off position.
- Check for adequate air flow.
- Check for local installation compliance.

Starting up the battery system should be done in conjunction with the inverter manufactures recommendations as well as this manual and any local or government, or safety requirements.

Each battery in the system is powered up separately by turning the double pole breaker to the ON position. Once powered up voltage will be present at the DC terminals and the main LED status light will glow blue.

## Main Status LED

The Main LED Status Indicator is used to understand the operation of the battery and the state of the BMS.

Status	Operational State
ON	Battery is ON and allowing charge and Discharge
OFF	Battery Circuit Breaker is in the OFF position
OFF	Battery BMS is in Low Voltage protection mode - Charge will still be accepted, however Discharge will not
OFF	Battery is in High Voltage protection mode - Charge will not be accepted, however discharge will
OFF	Battery is in Temperature protection mode, the BMS has detected cell temperature outside of our operation window of MAX 65°C. No Charge or discharge will be allowed

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## Full Recharge Upon First Installation

Our batteries are delivered and shipped in a partial state of charge. Prior to discharging the battery it should be fully charged to the float stage.

This first initial charge will allow the battery BMS to perform a cell balance process and ensure all cells are at the same state before regular cycling.



# Trouble Shooting

The Eco P Series battery is designed as a lead acid replacement energy storage solution to work with most systems. Due to the higher energy density of Lithium batteries compared to lead acid batteries, as well as utilising the settings and protections built into the ancillary equipment, the Lithium batteries have a built in BMS.

The BMS only activates when the operation of the battery is outside of the limits of the battery to safely operate.

During normal operation there will be a voltage across the terminals of the batteries. If the BMS activates its protection circuit, once the fault is cleared the battery should restart with out external assistance. The scenario where this may not occur is on low volt disconnect

In this instance the battery circuit breaker will need to be turned off and on again to wake the BMS.

In rare circumstances where the voltage will not recover, an external power source will need to be applied to the battery output terminals to allow the battery charge up above the BMS low voltage cut off. Once the voltage rises above this point the BMS will return the battery to normal operation.

## Maintenance

The Battery does not require maintenance itself, however as part of your overall system maintenance, some checks can be carried out.

- Check for any obstruction placed around the battery.
- Check for animals, insects or creatures nesting in or around the battery solution.
- Check for build up of any foreign objects in or around the cabinet.
- Check battery connections and cables for secure fitting or damage.
- Check breakers by turning them off and on again.
- Check LED indicators.

## Upgrading Battery Capacity

It is possible to add additional batteries to an existing Eco P Series installation at a later date. If you are to add extra capacity the battery must be of the same type, part number, and specification.

You may wish to do a capacity test on the original bank first so that you can adjust the setting in the connected PCE to the new actually tested capacity. Each battery should be tested individually.

Before adding the new battery the original battery bank and the new battery must be brought up to the same voltage.

This is achieved by one of the below:

- Fully discharging and recharging both the new battery and the existing battery separately before combining them into the same battery system.
- Insert the new battery to a partially discharged battery bank. Charge bank up and maintain our recommended continuous charge voltage for 6hours before floating or allowing load to be applied.



# Capacity Testing Battery

The battery capacity can be measured and verified by following the below test procedure. This should be performed using calibrated test equipment and performed by a suitably qualified person.

To determine the battery capacity, the below process should be conducted by a suitably qualified professional and performed at an ambient temperature of 25°C:

- Discharge the battery at 0.5C until the low voltage cut-off is reached this will be determined by the BMS going open circuit.
- Charge the battery at the recommended continuous charge voltage and 0.5C rate and hold at that voltage for 6 hours.
- Discharge the battery with a constant load at 0.5C until the low voltage cut-off is reached. This will be determined by the BMS going open circuit.
- Record the number of hours it takes to reach low voltage cut-off point.
- Charge the battery at the recommended continuous charge voltage and 0.5C rate for 6 hours.

The State of Health of the rated capacity can now be calculated as below and as a % of original capacity

$$(((Ah*0.5)*Discharge\ hrs)/Ah)*100 =$$

Ah = Amp Hour Capacity

0.5 = 0.5C constant load discharge

100 = Conversion to %

Example:

Eco4840P Ah Capacity = 78Ah

Battery time to discharge under test = 1.85hrs

$$= (((78*0.5)*1.85)/78)*100$$

$$= 92.5\%$$

## End of Life

When a PowerPlus Energy battery is removed from service it can be returned to PowerPlus Energy for recycling.

Due to the stability and longevity of LFP cylindrical cells, returned batteries will be refurbished and checked so they can be repurposed for low power applications and made available for community, education and charity projects.

Any Lithium cells not suitable for repurposing will be sent to a licensed recycling facility, where all ferrous and non ferrous metals are separated and then forwarded to our metals recycling partner.

# Warranty

PowerPlus Energy will protect this product under warranty when it is installed as written in this manual and used in the manner 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.

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 with the battery.
- Unauthorised repairs or modifications.
- External influences such as physical damage, over charging or electrical damage.
- Used outside of warranty terms and conditions.