PolarMax 12V 100Ah Li-ion Battery

User's Guide

Ended User Documentation

XPL12-100

Xplorer

Xplorer PolarMax 12V 100Ah Li-ion battery is intended as a replacement for common lead acid batteries for a wide range of applications

The new generation PolarMax battery adopts advanced modern features such as a removable enclosure and modular design with Bluetooth and self heating

The battery adopts Iron Phosphate (LiFePO4) REPT Grade A cells and unique Ritar BMS to provide safety, high current and prominent long life performance, with 20 times longer cyclic life than SLA battery to save cost and energy & up to 70% lighter than SLA batteries
Diverse internal features which include Bluetooth modules, heater components, LED display units and communication ports.

This document is intended for use by anyone required to install and operate PolarMax 12V 100Ah Li-ion batteries. Be sure to review this manual carefully to identify any potential safety risks before proceeding. The owner must be familiar with all the features of this product before proceeding. Failure to install or use this product as instructed can result in damage to the product that may not be covered under the limited warranty.

Manufactured by Hengyang Ritar Power Co. A global leading and established Battery manufacturer

WARNING:

Explosion, Electrocution, Or Fire Hazard

- A battery can present a risk of electric shock, burns from high short circuit current, fi re, or explosion. Observe proper precautions. Ensure the cables are properly sized.
- Ensure clearance requirements are strictly enforced around the batteries. Ensure the
- area around the batteries is well ventilated and clean of debris. Ensure no heat source
- near the battery. Ensure the battery terminal screws are tightened, (M8 screw torque:
- 18 N.m). Always use insulated tools. Avoid dropping tools onto batteries or other
- electrical parts.
- Never charge a frozen battery unless optional heater parts inside. If a battery must be removed, always remove the grounded terminal from the battery first. Make sure all devices are disconnected.
  Never leave on permanent charge
  Never store the battery at full capacity or over discharged

IMPORTANT

- When installing batteries, leave adequate clearance between batteries. When replacing
- batteries, use the same number and type of batteries. Avoid any fall or collision during
- the installation process. Do not remove the battery components. The maintenance of the
- battery should be carried out by a professional engineer. Do not expose the Li-ion battery to heat in excess of 58°C during operation, 60°C in storage. Do not incinerate or expose to
- open ames. Do not connect over 4 sets Li-ion batteries in series or paralell. Wrong operation will damage the BMS. Before series connection, it's better to make sure fully
- charge or discharge single battery. The different SOC between batteries may cause the
- whole group to fail to charge and discharge normally (Reduce the usable capacity of the battery group. Before parallel connection, it's better to make sure the voltage difference
- less than 0.1V to avoid large current impact . Do not connect in series at the same time connect in parallel.
  Be sure to have satisfied yourself that your charging system supports Lithium Batteries
- safely or optimised to do so

- Direct alternator charging is prohibited unless an adequate DC/DC charger is installed optimised for Lithium Charging

Product Design

1. Battery enclosure - ABS+PC
2. Prismatic Grade A REPT LiFePO4 Cell
3. Ritar BMS- 4S100A Aluminub Bar -
4. AL1060
5. Communication Port (RS485, CAN, Victron)
6. Built-in Blutooth module
7. Battery cover- ABS+PC
8. ON/OFF & Battery Health Display
9. Fixing screws, M3*25, Battery Positive,
10. Positive Terminal Nickle plated brass M8 internal thread
11. Battery Negative, Nickel plated brass M8 internal thread
12. EVA foam
13. Heater Part

Specification

Model		XPL12-100	
Cell and Connection		CB56-104Ah, 1P4S	
Nominal Voltage [V]		12.8	
Nominal Capacity [Ah]		100	
Total Energy [Wh]		1280	
Max. Charging Current [A]		100	
Recommended Charging Current [A]		10A Min - 50A Max	
Charging Voltage [V]		14.2~14.6	
Max. Discharging Current [A]		100	
End of Dicharge Voltage [V]		11.2	
Operating Temperature Range		Charge/Discharge -20~+55°C	
Protection	Over charge， Over discharge, Over temperature, Low Temperature, Over Current, Short circuit		
Cycle Life		3000 cycles	
Designed Calendar Life		10 Years	
Communication Port		RS485; CAN, Victron	
LED Indicator and Button		SOC, ALM, RUN, ON/OFF	
Dimension (L*W*H, mm)		330*172*214	
Weight [Kg]		10.5	
Operation Humidity		0~95% RH	
IP Class		IP30	
Parallel Support		Yes, Max, 4Sets	
Series Support		Yes, Max. 4 Sets	
Certifi cation-Cell		UN38.3; ROHS; IEC62619; UL1973; UL9540A	
Certification		UN38.3; MSDS; CE	

First use & Storage

Your battery will require charging before use to both activate and fully charge your battery before installing. We would recommend doing this via your mains powered Battery charger of at least 10A of charge current.
The XPL12-100 Li-ion battery can be stored in an environment with temperatures between -20°C and +55°C and between 10% and 90% relative humidity, non-condensing. For long storage periods at 25°C, charge the battery every 2 months . For temperatures above 40°C, charge the battery quarterly. Do not store the Li-ion battery at temperatures above 60°C.
We strongly recommend that your battery is stored at between 30 - 50% capacity at room temperature when not in use. Never leave on permanent charge

Relationship Between Charge Limits and Temperature

Due to the chemistry of Lithium Ion cells, the cells cannot accept as much charge current at lower temperatures without risking permanent loss of capacity. As the cells' temperature rises during the charging process, they can gradually accept higher currents. To maintain optimum performance and durability of Li-ion battery, the following charge limits based on ambient temperature is recommended. Please refer to the heating aspect of the battery page further down in this manual

Temperature (°C)	Max Charge Current
-20	Prohibit charging
-10	Prohibit charging
0	0.1C
10	Recommended charge current
20	Max continuous charge current
35	Recommended charge current
45	0.2C
>55	Prohibit charging

Table 1 Charge rate by temperature

Series Strings

The batteries can be combined together in series strings to achieve higher operating voltages by connecting the positive terminal of one battery to the negative terminal of the next battery. The maximum number of 12.8V Li-ion battery that you can connect in a series is four (4). Below figure 2 illustrates four 12.8V Li-ion batteries connected in series, for a 4S1P confi guration.

4pcs 12.8v100ah in series

Figure 2. Connecting Batteries in Series (4S1P Confi guration)

Two batteries in series: 2 x 12.8V = 25.6V (nominal) for 24V applications
Three batteries in series: 3 x 12.8V = 38.4V (nominal) for 36V applications
Four batteries in series: 4 x 12.8V = 51.2V (nominal) for 48V applications

CAUTION

- Failure to follow the following safety instructions may result in personal injuries or damage to the equipment! Do not connect more than four batteries in series. Connecting more than
- four batteries in series exceeds the voltage limit of the BMS. Do not short circuit the Li-ion battery Do not connect different batches, different types, old and new batteries in series.
- Ensure the batteries consistency before connecting in series. For series connection, if one
- of batteries is charged fully (100% SOC), the other batteries will not be charged anymore,
- this may casue some batteris SOC won't show 100%, it doesn’t effect the performance of
- battery.

Parallel Strings

You can combine batteries together in parallel strings to achieve higher operating energy by connecting like-polarity terminals of adjacent batteries. To combine batteries in parallel strings, connect all like-polarity wires on adjacent batteries to an appropriately sized terminal block for your application. Refer to Figure 3 for an example of four 12.8V Li-ion batteries connected together in a 4P confi guration. The maximum number of 12V series strings that you can connect in parallel is four. It is important to use the data cable between batteries to ensure even discharge and recharge. Bus Bar connectivity recommended

4pcs x 12.8v100ah in Parallel

Figure 3 Example of a 4S2P Confi guration

CAUTION

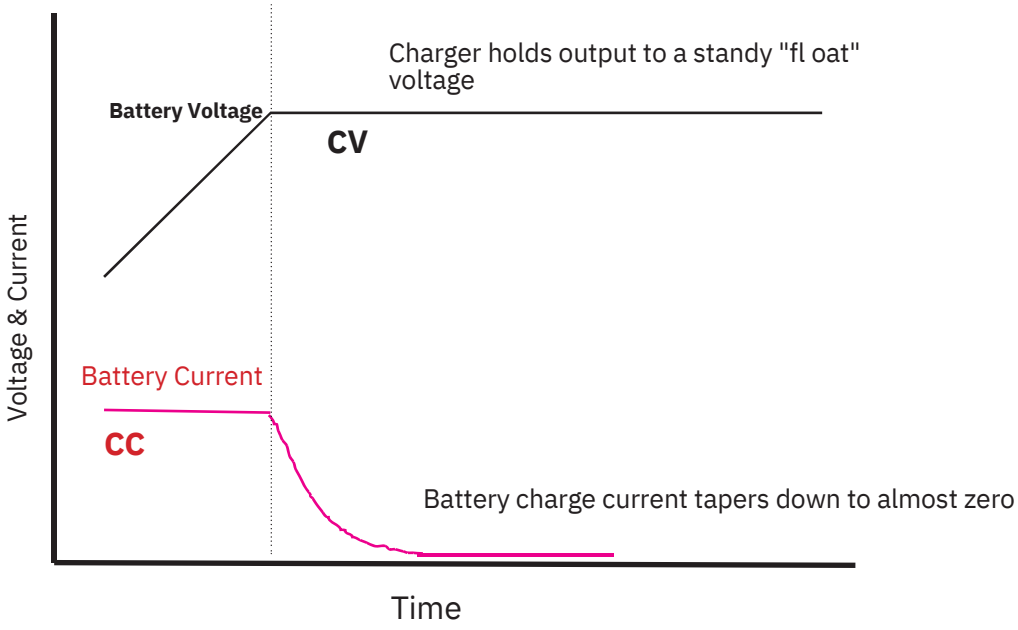
- Do not connect different batches, different types, old and new batteries in parallel. Ensure the
- battery voltage difference is below 100mV before parallel connection to avoid high pulse current. Ensure every battery have 3A charge/discharge current.
- **The parallel application can only extend the capacity and runtime, and cannot increase**
- **the charging or discharging current. The max discharge current remains 100A & 50A Charge current**

Charging Batteries

The 12.8V Li-ion is compatible with common 12V Lead-acid battery chargers. We advise using GEL or AGM charge profiles if Lithium mode not present.

Do not recharge using standard split relay or direct alternator charging unless a Lithium optimised DC/DC charger is installed

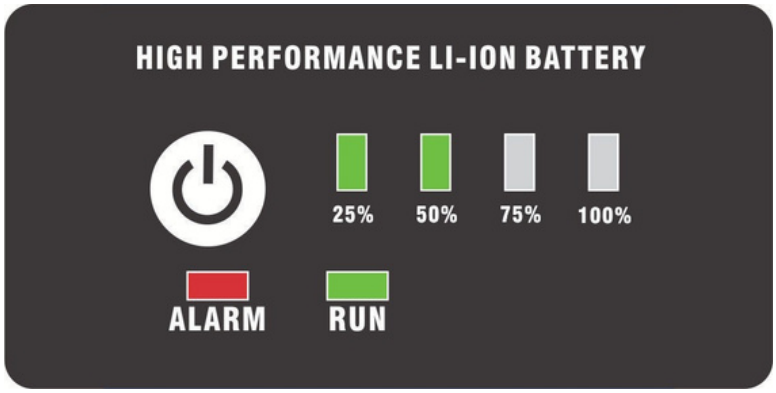
Chargers that require the detection of voltage at the battery terminals to charge may fail to wake the Li-ion battery from a state of under-voltage protection. Constant Voltage (CV) chargers may result in an inrush of current due to the low impedance of the cells, interrupting the charge. Reset the charger and continue charging normally if the charger trips. The constant current (CC) chargers is recommended strongly. To charge a single 12.8V battery, the maximum charge voltage is 14.6V and the maximum charge current is refer to Table 1. Any inrush current may cause over current or short circuit protection. Once you reach end-of-charge voltage, apply a constant voltage hold at this voltage until the current decays to almost zero. This charges the cells to 100% state of charge (SOC). Refer to below fi gure for an illustration.



Battery voltage and current during recharge

Wake up or Switch Off

For 12.8V100Ah Li-ion battery, if there are no charge or discharge for 24 hours, the battery will enter into sleep mode to save energy and it can still be measured a OCV (>10V), any charge or discharge operation will active the battery. If the battery was over-dicharged protection, the BMS will enter into sleep mode after 5 min. there are no OCV at this status. only charge operation can active the battery. Press ON/OFF button 6 seconds to active or switch off a battery.



LED Indicator for G2 & G3

		●	●	●	●	●	●	

Bluetooth battery APP introduction

Harness the power of Bluetooth and open up a world of information reagrding your battery. We have made the App as simple as possible whilst providing the core and vital information regarding your battery
To use, please scan the QR code above for either Google Play or App Store (iphone) or search Bluetooth Li in your App store and download

Connecting

Once installed you will need to make sure your battery is awake. Do this by pressing the on switch or charging/discharging the battery
Ensure Bluetooth and location is enabled on your phone/device
Open the Bluetooth Li App and search via Bluetooth
Locate your battery on the device list. Your battery name is the serial number also printed on the battery lid
Tap the found battery device in the App and it will auto connect

Multiple Batteries

The app is designed to monitor one battery at a time by default
You can monitor up to four batteries in realtime by connecting the batteries together using the communication ports. Contact our customer service team if you need further assistance

State of charge

Battery Voltage

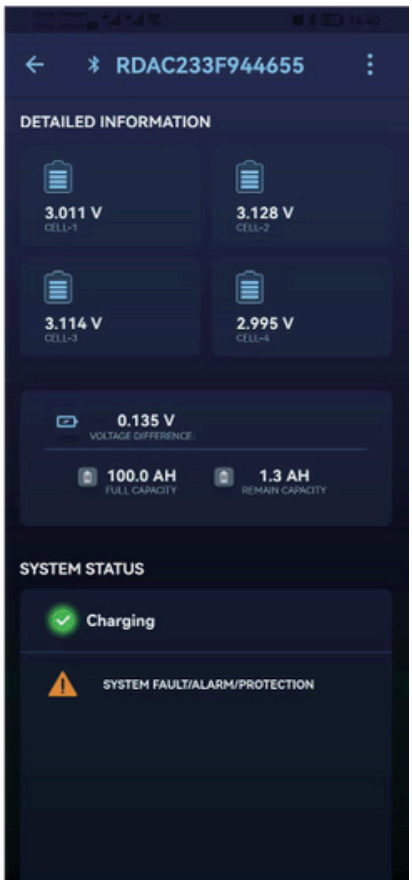
Battery Current

Charge is positive,
Discharge is negative

Battery Rated Capacity

Battery Temperature

Cycle times



BATTERY HEATING

The PolarMax has LiFePO4 chemistry, this allows it to be discharged in temperatures as low as -20°C without any adverse effects due to the built in internal heating pad.
Without this, the charging process can pose problems as charging a LiFePO4 battery below freezing Temperatures can cause irreversible damage, leading to a shorter lifespan.
To combat this issue, we've incorporated heating pads into the battery to maintain optimal charging temperatures.

To avoid charging the battery under freezing conditions, the battery management system will disable charging and Activate the protective state (LTC) when a temperature of 0°C is detected. This action initiates the activation of the heat pads. The BMS will utilize the incoming charge current to energize the 36W heating pads until the temperature reaches 5°C. After achieving 5°C, the protective state will be terminated, and the charging process will resume.

For optimal heating, the heating pads necessitate an incoming charge current of no less than 0.5A

victron energy

The PolarMax Lithium range is designed to work directly with Victron systems. This neagtes the need to use extra shunts or BMS's when using a Victron system. Our Batteries have been designed to plug into the Victron communication hub known as the Cerbo GX

The PolarMax BMS once succesfully connected to the Victron Cerbo will display the following information

Cell Voltages
Temp
Voltage, State of charge & Current
Current Limit
Charging Voltage Limit
Alarms for over voltage, high voltage and cell imbalance

Connect

Using the cable supplied. Connect lead end labelled Battery to the down Com port on the battery and then the lead end labelled Inverter directly to the BMS CAN input on the Cerbo. You must also use the the spare jumper (grey) and place this in the spare BMS CAN input

Please contact our customer service team if you need assistance
sales@alpha-batteries.co.uk Tel: 01706356356

Troubleshooting

The PolarMax Li-ion batteries are extremely reliable batteries that provide greater useful life than comparable 12V lead-acid batteries. Despite the high reliability of the 12.8V Li-ion batteries, you may encounter situations where the battery does not operate as expected. These situations are typically the result of misuse, abuse or a non-optimal charging or storage environment. This part details potential issues you may encounter with the PolarMax batteries and the appropriate troubleshooting procedures.

Charger Trips using Constant Voltage

Problem: Charger trips when charging the batteries. This is due to the low impedance of the battery creating a current inrush.
Solution: Reset the charger and try again.

Terminal Voltage Absent or Low

Problem: Using a multimeter to check terminal voltage shows the terminal voltage is low (<10V). Possible causes for this problem are: The voltage of a cell within the battery dropped below 2.5 V, causing the microprocessor to enable low-voltage protection. The battery's SOC dropped below 5% from either an extended idle period or heavy use, enabling under-voltage protection. The battery overheated (>60°C), causing the microprocessor to enable over-temperature protection.
Solution: To resolve situations where terminal voltage is absent or low: 1.Allow the battery to cool and then recheck terminal voltage. 2.Connect the battery to a charger to wake the battery and recover terminal voltage. (<=30V PV panel can be used to active a deep discharge battery.) (A 12V VRLA battery can also be used to active a deep discharge battery.) 3.If the cells pack voltage is below 7V, the BMS will not be actived anymore. So it needs to be charged in time after deep discharge.

Battery Current Disappears when Charging

Problem:

Battery current disappears when charging. Possible causes for this problem are:
The battery overheated, enabling over-temperature protection.
Charger voltage is too high.

Solution:

To resolve situations where current disappears when charging:
1.Allow the battery to cool.
2.Reduce charger voltage to 14.2~.14.6 V.

We’re here to help.

Our UK based dedicated support team are available to assist
Contact us at sales@alpha-batteries.co.uk Tel: 01706356356

What are the ideal charge settings for my PolarMax?
Bulk Charge: 14.2 - 14.6v
Float Charge: 13.6v

What size thread/Terminal type do the PolarMax Batteries have?
8mm nut and bolt connection supplied. 8mm to SAE round post adapters can be fitted. We supply them here

Can I connect multiple PolarMax batteries?
Yes you can! You can connect up to four PolarMax Batteries in Series or Paralell
You must only connect batteries together of the same type, manufacturer and age!

Can I side mount my PolarMax Battery?
You can indeed! The range is designed to be orientated in any position. Please ensure the terminals are protected to avoid short circuit

What Inverter size can I use on this Model?
The PolarMax 100ah has a Ritar 100A Max discharge BMS built inside. This equates to 1280W
We recommend an Inverter no larger than 1200w. For larger Inverters you will need our 200ah, 300ah or 400ah version

What Charger shall I use?
We recommend 10a minimum and 50A Max. Failure to do so will result in either under or overcharge resulting in battery failure
We strongly recommend the use of modern Victron chargers for mains and alternator charging
Existing chargers can be used but must have a dedicated Lithium charge profile or GEL/AGM setting at least.