



ROYER BATTERIES MICRO BATTERY MANUAL



Lightest | Smallest Footprint | Bluetooth | Automatic Heating | Built in Canada 🍁

Thank You For Learning More About Our Products!

- Page 1** - Intro/Contact
- Page 2** - Quick Feature/Installation/Troubleshooting
- Page 3** - Safety/Equipment/Chemistry
- Page 4** - Installation/Storage/Discharge
- Page 5** - Battery Charge/BMS/Recycling
- Page 6** - App Features
- Page 7** - Warranty

This user manual was created by Royer Batteries Corp. and contains important information relating to the proper care and maintenance of your lithium battery. This manual only applies to Royer Batteries lithium battery products. It does not apply to other lithium batteries or chemistries. Please read through the guide in detail before installing and using your new lithium battery. Reading this guide in its entirety will help you achieve high performance and long life from your lithium battery investment. We are here to help you anytime! Should you have any questions concerning safety precautions, installation or the use of your lithium battery, please contact us:

Email: info@royerbatteries.com
Phone: +1 (604) 724-3248

View our website at www.RoyerBatteries.com

Quick Feature & Installation Overview

Get the App

For Android (Google Play Store) and for Apple (App Store) search "XiaoXiangElectric". The app on/off switches are independent to the physical switch. See Page 6 for App Info.

Physical Switch

The switch controls discharge of the battery only (not charging). The switch will light up if pressed in or external power like a charging device or paralleled "ON" battery is connected.

Heating

The internal automatic built-in heating will turn on when a charge is applied and the battery temperature is below 0°C (32°F). The heater will turn off once the release value of 5°C (41°F) is met.

Series/Parallel

Please do not exceed the specification sheet allowable series/parallel connections. For parallel connections please ensure correct wiring with mains on opposing batteries.

Comm. Port

There is a comm. port on some of our batteries. This port can only be used with our approved devices. The comm port is for RS485 communication and uses a RJ45 female port.

Installation

When installing the batteries please use the phone/tablet app to turn off the charge and discharge of each battery as well as turn the physical switch to off (flush, not pressed in, not lit). This will completely turn off the battery and will ensure safer installation. Although the battery will be completely inert in this state, it is always best practice to treat the battery as if it was "on". Once the installation is completed you may first turn the physical switch on for all the batteries, then turn the charge and discharge on through the phone/tablet app. If putting batteries in parallel, you should have them at very close state of charge. If putting into series, both batteries should be the exact same state of charge and age. Note: When in series or parallel, the power consumption/charge shown in the app (measured in watts) will need to be multiplied by the number of batteries to find actual total power.

Troubleshooting

If you suspect an issue with a battery, record screen shots of the battery app. The app is the best tool to troubleshoot, and please send us the related screenshots. If you have no power, ensure each battery has the physical power switch pressed in (not flush), the app shows that discharge and charge are in the on position, and check the battery with a multimeter. When troubleshooting don't hesitate to call or email for help.

Detailed Manual

Safety

Lithium Iron Phosphate (LiFePO₄) batteries are safe to use indoors and outdoors. However, as with any electronics, safety measures must always be taken. Please follow the instructions within this user manual for safe handling and operation of your Royer Battery lithium batteries.

- Always wear protective gear when handling batteries
- Use a wrench with a rubber coated handle
- Do not place any objects on top of batteries
- Do not place batteries on a metallic surface
- Check that all cables are in good condition
- Make sure all cable connections are properly tightened
- Install and remove batteries using the lifting handles provided
- Keep sparks, flames and metal objects away from batteries
- Have a fire extinguisher of the following type: a foam extinguisher, CO₂, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate) on the premises

Equipment

The following equipment may be required to install your battery:

- Protective Gear; gloves and eye protection
- Wrench with insulated/rubber coated handle
- Multimeter

LiFePO₄ Battery Basics

Royer Batteries LiFePO₄ batteries include two main components:

- (1) Individual prismatic cells assembled inside a steel case
- (2) An internal BMS (Battery Management System) to protect the battery from mismanagement. LiFePO₄ is a 3.2V nominal, 3.65V max chemistry per cell. 4 cells in series are used to create a "12V" battery or 8 cells in series are used to create a "24V" battery

Battery Installation

To maximize battery performance and ensure safe operation of your battery, use the appropriate cable size and tighten connections using the proper torque value. It is recommended to use a washer. Place the washer between the cable lug and nut, not between the cable lug and battery terminal surface. Royer Batteries lithium batteries come with free bolts and washers included. Refer to the data sheet for your particular battery's torque value and the size of the included bolts. Royer Batteries LiFePO₄ batteries can be installed upright or on their sides. Please ensure the battery is fastened if installed in a moving vehicle, such as in an RV or a boat.

When connecting batteries in series or parallel, please follow these guidelines:

- (1) Make sure each battery is within 5% state of charge (SOC) before putting them in service. This will minimize the chance of imbalance between batteries. If your batteries get out of balance, you should charge each battery individually to rebalance. Royer Batteries 12V LiFePO₄ batteries support series connections up to 4 units. Higher voltage batteries will have a specified maximum number of series connections, usually limited to max of 48V (ie. 2 x 24V in series). Please refer to specification sheet for maximum series or parallel connections.
- (2) Size batteries in parallel accordingly: The capacity of batteries (rated in Ah) when connected in parallel is increased by the multiple of the batteries connected (2x, 3x, 4x, etc). You may connect batteries of different capacities in parallel only. For series connections, batteries should be bought together. You cannot series batteries of different capacities or ages.

Battery Storage

It is highly recommended to store lithium batteries indoors during the off season. It is recommended to store LiFePO₄ batteries at about a 50%-75% SOC. Do not store batteries that are discharged. LiFePO₄ chemistry can lose up to 3% from storage so please take this into account for storage SOC. You may turn the battery completely off through the app while in storage and leave connected to your system.

Recommended storage temperature: -5 to +35°C (23 to 95 °F)

Storage up to 1 month: -20 to +60°C (4 to 140 °F)

Storage up to 3 month: -10 to +35°C (14 to 95 °F)

Extended storage time: +15 to +35°C (59 to 95 °F)

Battery Discharge

LiFePO₄ batteries generate a fraction of the heat of other lithium chemistries when discharging, making them very safe. All Royer Batteries LiFePO₄ batteries come with a Bluetooth BMS that protects the battery from low temperatures, high temperatures, and contains a heater which ensures safe charging in any climate. LiFePO₄ batteries can be discharged up to 100% of their capacity. However, to optimize the performance of your LiFePO₄ battery and to avoid the BMS disconnecting the battery due to low voltage, we recommend limiting the discharge to 80%. This will also maximize your life cycles for a longer lifetime of the battery. Please refer to your battery specification sheet for the maximum rate of discharge, min/max voltage, temperature for your specific battery model.

Battery Charging

If LiFePO4 batteries are not fully discharged, they do not need to be charged after each use as they do not require to be constantly topped up. LiFePO4 batteries do not get damaged when left in a partial state of charge (PSOC). You can charge your LiFePO4 batteries after each use or when they have been discharged up to 80% (20% SOC). Our batteries have a built-in heating system which activates when the temperature reaches the freezing point. It works by warming up the lithium cells to above freezing and only then the BMS would allow the charging current to flow in. LiFePO4 batteries do not require temperature compensation for voltage when charging at hot or cold temperatures.

Most lead-acid battery chargers can be used with LiFePO4 batteries as long as they are within the appropriate voltage parameters. The voltage for flooded battery charging algorithms are often higher than LiFePO4 requirements, which will result in the BMS disconnecting the battery at the end of the charge cycle and may result in the charger displaying an error code. If this happens, it is generally good practice to replace your charger. Since the BMS protects the battery, using lead-acid chargers will not damage the battery. It is however always recommended to use a charger designed for LiFePO4 batteries.

Battery Management System

All Royer Batteries LiFePO4 batteries come with a built-in Bluetooth BMS, which protects against:

OVP - Over voltage protection (Charging)

LVP - Low voltage protection (discharging)

OTP - Over temperature protection (charging/discharging)

OAP - Over Amperage protection (short/overload)

If the BMS disconnects the battery due to voltage or current limits, you may see the reasoning under protection in the app. If either charge or discharge are turned off in the app, a protection parameter may have been met and turned off automatically by the BMS. Alternatively the physical switch is off, or the app switches have been turned off manually.

Battery Life & Recycling

If your battery stops working and is out of warranty, please contact us and we can try to repair the battery to extend its life. The best practice is to get the most amount of energy out of a battery over its lifetime to justify the expense and resources put into creating it. The most sustainable usage of lithium batteries is to reach a state of natural lithium degradation over time in which you have too little capacity to be relevant in any application. Finding second life usages for the batteries will ultimately optimize the life of a battery. One example could be when you don't have enough capacity to run your cabin, rather than recycling, find a lower capacity usage like trolling motor, RV, or camper etc.

Dispose of our LiFePO4 batteries at an authorized lithium recycling facility or send it back to us. Please contact us to find the best recycling option for you.

Bluetooth App (XiaoXiangElectric)

Our Bluetooth BMS is made by Jiabaida (JBD). The app our BMS uses to connect to and view our batteries is open source. There are many other apps that can connect to our batteries. The XiaoXiangElectric app is the most simple app to use with our batteries. Please never change battery settings without full knowledge of the implications. We can confirm any changing of settings. Warranty is void with unapproved changes causing damage.

Log In

To quick connect you can press "Log in later" or choose to create an account. You are not required to create an account at anytime.

Connecting

Click all checkboxes for the batteries you'd like to view. When checked, press "Connect" on any of the checked batteries to load up.

Real Time (RT)

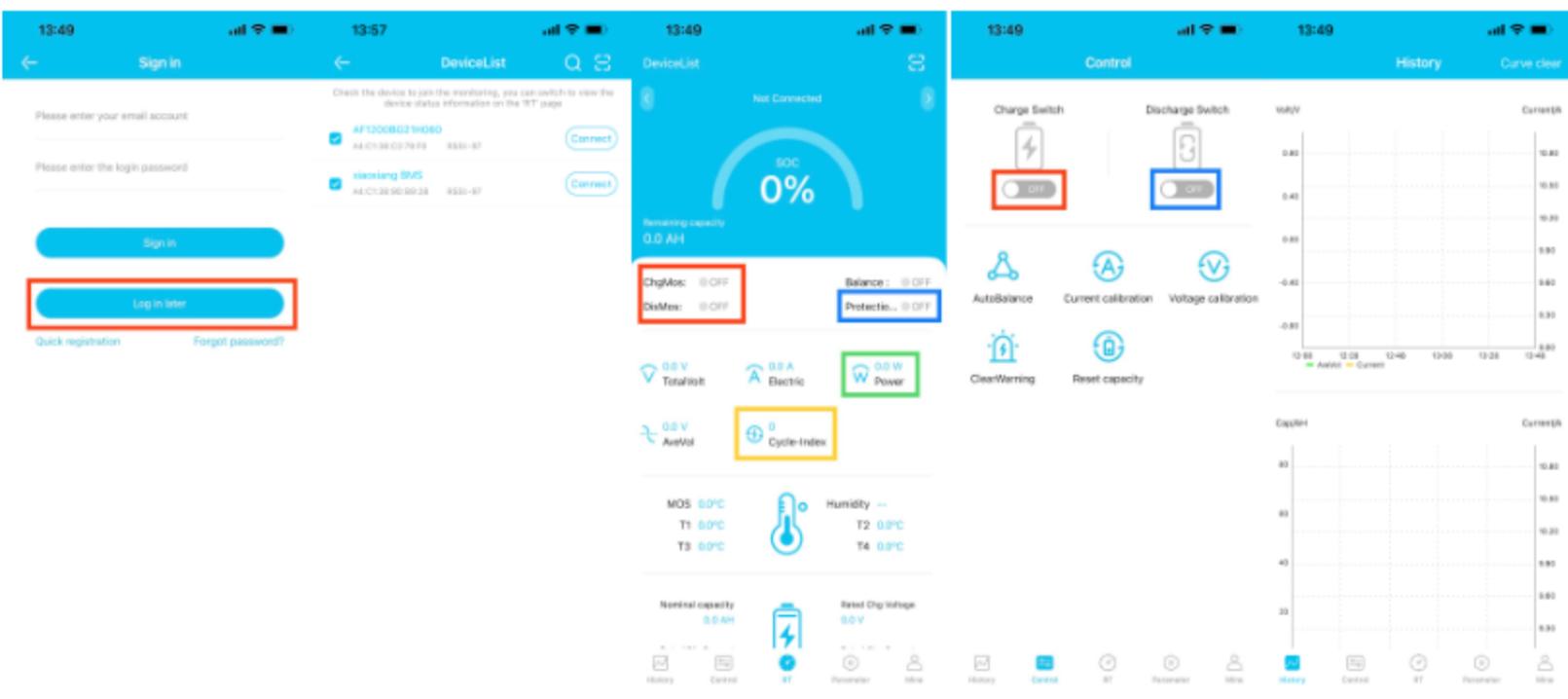
Charge and discharge on/off indication
 Protections indication
 Real time power usage
 How many full cycles
 < or > swap to the next battery

Controls

Charge switch will turn on/off charging
 Discharge switch will turn on/off discharge
 "Soft Lock" shows in protections if switched off

History

While the app is open, the history is recorded of battery usage. The amperage and voltage are logged and graphed.



Other Compatible Apps for Android/Apple

There are many apps that can work with our BMS. Here is a list of other apps which can be downloaded from the App Store and/or Google Play. Overkill Solar is in our opinion is the best advanced app for single battery applications and XiaoXiangElectric is better for multi-battery applications.

- Overkill Solar
- Lynac
- SmartBMSUtility
- XiaoXiangBMS
- BMSTool

Solar Battery Warranty

Our warranty policy is intended to provide customers with protection against any defects causing the battery not to provide power. We want all customers to be assured that our products will not only be outputting power for just the 10-year warranty but also, they easily far exceed it. With the LiFePO4 prismatic cell chemistry we use in our batteries, the cycle life is rated for up to 3000 – 5000 cycles (minimum to ideal usage) until 80% capacity is left. Therefore, you can expect using a full cycle everyday will result in around 80% capacity left after 8-13 years. If you use half a cycle per day this can double to 16-26 years before you see around 20% capacity loss. It doesn't seem possible but these results are extrapolated from torture testing as well as what laboratory specifications indicate. These batteries with proper storage, use, and care can last up to 25 years while still having very relevant energy capacities. If you buy a battery with more capacity than required, this can be further increased through efficiencies and lower capacities requirements.

10-Year Warranty

In the rare case that our battery does stop working for you through normal use then we will repair, rebuild, or replace your current battery within the 10-year warranty period. If there is an issue with your battery at any time, please email us at info@royerbatteries.com to get help. If after diagnostics and troubleshooting the battery still does not work, you can ship or drop off to our Canadian warehouse for repair. We require the battery to be prepaid shipped and we will pay to ship back to you if the battery is deemed faulty. For a battery to be considered not working, the main terminals will not provide power/take charge. This 10-year warranty covers the lithium cells, BMS and main terminals only. All other items and parts are covered under our 1-year warranty policy. Reasons for warranty to be denied include but are not limited to: physical damage, water damage, setting incorrect BMS parameters, not following specified limitations, dead shorting, opening the battery, and/or attempting repair or modification. If it is determined that the battery was sent back for warranty in which the battery was misused in any way which caused a defect, the customer will be subject to a \$150 an hour repair charge plus parts and return shipping costs. We will always try to replace and repair with the same parts/products but if we cannot, we will provide an equivalent or better battery. After 5 years, if an equivalent or better battery is not available, a 30% discount off retail can be granted towards the purchase of a brand new Royer Batteries product. Warranty is provided to original owner with proof of purchase and is non-transferable.

1-Year Warranty

The 10-year warranty does not extend to all auxiliary items on our solar batteries including but not limited to: USB ports, heating pads, 12v port, Anderson ports, sine wave inverter, MPPT/DC to DC converters, display screen, communication ports. All items on a battery that fall outside the 10-year warranty come with a one-year warranty free of defect. We do stand behind our products and if we can help we will. Reach out for help, parts or issues during or after warranty. The 10-year warranty can only apply to our solar batteries and does not include any other our other products or services. Our services and other products are guaranteed for 1 year defect free as well as all other products sold unless otherwise stated.