



RELi³ON[®]

**LEGACY SERIES
USER MANUAL**



Thank You

FOR CHOOSING

RELi³ON[®]





YOUR PURCHASE SUPPORTS OUR PLANET

As 1% for the Planet members, we donate 1% of our revenue each year to non-profits solving the most pressing environmental challenges of our time.

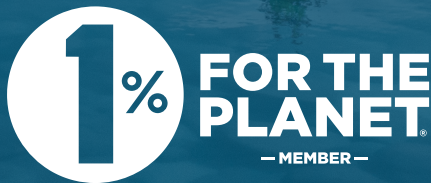


TABLE OF CONTENTS

Safety	6
Equipment	7
LiFePO ₄ Battery Basics (vs. Lead-Acid)	7
Battery Installation	8
Battery Storage	10
Battery Discharging	10
Battery Charging	11
BMS Operation	12
Battery Recycling	13
Warranty Registration	13

RELiON BATTERY USER MANUAL

This User Manual was created by RELiON's engineering team and contains important information regarding the proper care and maintenance of your lithium battery. This manual only applies to RELiON Lithium Batteries. It does not apply to other lithium batteries or chemistries. Please read through the guide in detail before installing and using your new battery. Reading this guide in its entirety will help you achieve high performance and long life from your lithium battery investment. Should you have any questions concerning safety precautions, installation or use of your lithium battery, please contact us at RELiON-Technical@OneASG.com or call 855-931-2466 (toll-free) or +1 (803) 547-7288 (international).

This manual only applies to RELiON Lithium Batteries. It does not apply to other lithium batteries or chemistries.



1. SAFETY

Lithium Iron Phosphate (LiFePO₄) batteries are an inherently safe chemistry. Please reference RELiON's Lithium Iron Phosphate Safety Document (available at reliombattery.com) for more details. However, as with any electronics, safety measures should always be taken. Please adhere to the instructions within this manual for safe handling and operation.

- 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 RELiON's SDS on the premises
- Have an ABC extinguisher of the following type: a foam extinguisher, CO₂, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate) on the premises
- Do not install batteries in a zero-clearance compartment, overheating may result. Always leave at least 4" of space around all sides and top of battery
- Keep any flammable/combustible material (e.g., paper, cloth, plastic, etc.) that may be ignited by heat, sparks, or flames at a minimum distance of two feet away from the batteries
- Battery compartment and any material within two feet should be noncombustible



2. EQUIPMENT

The following equipment may be required to install your battery:

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



3. LiFePO₄ BATTERY BASICS (VS. LEAD-ACID)

3.1. Basic Construction

RELiON LiFePO₄ battery packs include two main components:

1. Individual cells assembled inside a plastic or steel case
2. An internal BMS (Battery Management System) to protect the battery from abusive operation

3.2. Cell and Battery Pack Voltages

Lithium Iron Phosphate (LiFePO ₄) Nominal Voltage	Lead-Acid Equivalent Nominal Voltage
Cell = 3.2V	Cell = 2.0V
12.8V – 4 cells in series	12V
25.6V – 8 cells in series	24V
38.4V – 12 cells in series	36V
51.2V – 16 cells in series	48V





4. BATTERY INSTALLATION

4.1. Battery Connections

To maximize the performance and to ensure safe operation of your battery, use the appropriate cable size and tighten connections using the proper torque value. Refer to the data sheet for your particular battery's 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.

4.2. Cable Size

Choose the appropriate cable size based on the expected load of your system. See the table below – ENEC 310.15 (B)(16) – Allowable Ampacities for copper cables rated at 167°F (75°C) operating at an ambient temperature of 86°F (30°C).

Wire Gauge (AWG) – Copper Conductors	Ampacity (Amps)
14	25
12	30
10	40
8	55
6	75
4	95
2	130
1	150
1/0	170
2/0	195
4/0	260

4.3. Torque Values

Terminal connections should adhere to the appropriate torque values for the specified terminal type to provide optimum electrical conductivity. Refer to the data sheet for your particular battery's torque value. Over- or under- tightening the connections can result in terminal breakage, over-heating and/or terminal melting. Use a rubber handled or insulated wrench when making terminal connections to avoid an external short circuit.

4.4. Terminal Protection

Battery terminals may be covered with a plastic cap to prevent an external short circuit. Terminals must be covered with a protective cap or non-conductive tape prior to battery disposal to a lithium recycler.

4.5. Battery Orientation

- Lithium batteries can be placed upright or on their sides.
- Do not install batteries in a zero-clearance compartment, overheating may result. Always leave at least 4" of space around all sides and top of battery.
- Keep any flammable/combustible material (e.g., paper, cloth, plastic, etc.) that may be ignited by heat, sparks, or flames at a minimum distance of two feet away from the batteries.
- Battery compartment and any material within two feet should be noncombustible.

4.6. Series or Parallel Connections

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

(1) Make sure each battery is within 50mV (0.05V) of each other before putting them in service. This will minimize the chance of imbalance between batteries. If your batteries get out of balance, the voltage of any battery is $>50\text{mV}$ (0.05V) from another battery in the set, you should charge each battery individually to rebalance.

(2) Size batteries in parallel accordingly: The capacity of batteries (rated in amphotours) when connected in parallel is increased by the multiple of the batteries connected (2x, 3x, 4x, etc). However, the current ratings (discharge and charge) for parallel batteries is only increased by 75% of the multiple of the batteries connected (1.5x, 2.25x, 3x, etc).

(3) Batteries connected in series are best charged as individual batteries. charging as a series bank can lead to imbalances and reduced runtime, requiring an occasional individual balancing charge.

(4) Please reference RELiON's LiFePO4 Charging Instructions document (available on our website at reliombattery.com) for series and parallel charging.

Specifications for Batteries in Parallel

Battery Quantity	v	2	3	4
Voltage	12.8	12.8	12.8	12.8
Capacity (Ah)	100	200	300	400
Max Continuous Discharge Current	100	150	225	300
Peak Discharge Current	200	300	450	600
Rec'd Charge Current	50	75	113	150
Max Charge Current	100	150	225	300



5. BATTERY STORAGE

5.1. Storage Temperature

LiFePO₄ can be stored between 23°F to 95°F (-5°C to 35°C). For storage longer than 3 months, the recommended temperature range is 32°F to 77°F (0°C to 25°C).

5.2. Storage Conditions

It is recommended to store LiFePO₄ batteries at 50% state of charge (SOC). If batteries are stored for long periods of time, cycle the batteries at least every 6 months.



6. BATTERY DISCHARGING

6.1. Discharge Temperature

Lithium Iron Phosphate batteries generate a fraction of the heat of other lithium chemistries making them very safe. LiFePO₄ batteries can safely operate between -4°F to 140°F (-20°C to 60°C). All RELiON LiFePO₄ come with a BMS that protects the battery from over-temperature. If the BMS disconnects due to high temperature, wait until the temperature reduces and the BMS reconnects the battery before using or charging the battery. Please refer to your battery data sheet for BMS high temperature cut-off value.

6.2. Discharging your LiFePO₄ Battery

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, we recommend limiting the discharge to 80%. Please refer to your battery data sheet for the continuous and peak rates of discharge for your specific battery model.



7. BATTERY CHARGING

7.1. When to Charge your LiFePO4 Battery

If LiFePO4 batteries are not fully discharged, they do not need to be charged after each use. 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). If the BMS disconnects the battery due to low voltage, at 100% depth of discharge, remove the load to reconnect the battery circuit and charge immediately. Please note that we recommend storing batteries at 50% state of charge (SOC).

7.2. Charging Temperature

Lithium Iron Phosphate batteries generate a fraction of the heat of other lithium chemistries making them very safe. LiFePO4 batteries can safely charge between -4°F to 131°F (-20°C to 55°C). However, at temperatures below 32°F (0°C) the charge current must be reduced as follows:

1. 32°F to 14°F (0°C to -10°C) charge at 0.1C (10% of the battery capacity)
2. 14°F to -4°F (-10°C to -20°C) charge at 0.05C (5% of the battery capacity)

LiFePO4 batteries do not require temperature compensation for voltage when charging at hot or cold temperatures. All RELiON LiFePO4 come with a BMS that protects the battery from over-temperature. If the BMS disconnects due to high temperature, wait until the temperature reduces and the BMS reconnects the battery circuit before using or charging the battery. Please refer to your battery data sheet for BMS high temperature cut-off value.

7.3. Charging with Lead-Acid Chargers

Lithium battery owners should use a charger that has a lithium specific charge profile for LiFePO₄ batteries. Although many existing lead-acid chargers will still charge lithium batteries, it is generally discouraged to do this. The risk is the lead-acid chargers may wind up in fault code condition at some point, despite the lithium battery probably having received a full recharge. The conditions incurred during the fault codes can also cause issues and/or damage to other system electronics, and even the charger itself. Therefore we strongly recommend you use a lithium battery charger. Please refer to RELiON's Lithium Charging Instruction document (available on our website at reliionbattery.com) for complete charging instructions and parameters.



8. BMS OPERATION

All RELiON LiFePO₄ batteries come with an internal BMS. The BMS protects against:

1. Under-Voltage – during discharge
2. Over-Voltage – during charge or regen conditions
3. Over-Current – during discharge
4. Over-Temperature – during discharge
5. Short-Circuit Protection – protects battery cells from damage

Refer to the data sheet for your battery's specific discharge criteria. If the BMS disconnects the battery due to voltage or current limits, you must remove the load to reconnect the battery. If the BMS disconnects the battery due to temperature limits, you must wait for the temperature to reduce to reconnect the battery. If your equipment has parasitic loads, it may require a physical disconnect of the terminals to reconnect the battery circuit. Please note, that while short-circuit protection protects the battery's cells, it still may produce a spark and damage your cable or bolt, so it is best to avoid short circuit conditions.



9. BATTERY RECYCLING

Terminals must be covered with a protective cap or non-conductive tape prior to battery disposal to lithium recycler. Dispose of LiFePO4 batteries at an authorized lithium recycling facility.



10. WARRANTY REGISTRATION

We recommend you protect your investment and register your warranty at reliombattery.com/warranty-registration.



TECHNICAL SUPPORT

If you have technical questions about your battery, please contact RELiON Battery directly:



RELiON-TechnicalSupport@OneASG.com



855-931-2466 or +1 (803) 547-7288



Reliombattery.com

For warranty claims, do not return to place of purchase, contact RELiON directly.



Challenge Your **Li³**imits[®]

relionbattery.com

CALL TOLL FREE: (855) 931-2466 • ALL INTERNATIONAL CALLS: +1 (803) 547-7288



ISO 9001:2015

Quality Management System

ISO/TS 16949:2009

Quality Management System

ISO 14001:2004

Environmental Management System

OHSAS 18001:2007

Occupational Health and Safety Management System

Certifications Applicable to the Design and Manufacture of Lithium Iron Phosphate Batteries

UN38.3

RELiON Battery provides our customers with the highest quality and safest lithium products, in compliance with all regulatory standards.

©2022 RELiON Battery, LLC. All rights reserved. RELiON is not liable for damages that may result from any information provided in or omitted from this publication, under any circumstances. RELiON reserves the right to make adjustments to this publication at any time, without notice or obligation.

To view this manual in other languages, visit relionbattery.com.



INSTALL MANUAL
09.28.22