



# **STANDARD PRODUCTS USER MANUAL**

# Thank You

FOR CHOOSING

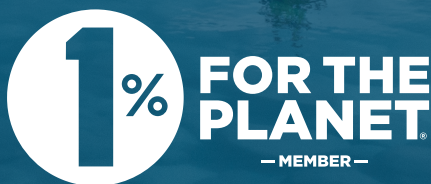
# RELi<sup>3</sup>ON<sup>®</sup>





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# 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 [powerpros@relionbattery.com](mailto:powerpros@relionbattery.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.**

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## 1. SAFETY

Lithium Iron Phosphate (LiFePO<sub>4</sub>) batteries are an inherently safe chemistry. Please reference RELiON's Lithium Iron Phosphate Safety Document (available at [reliionbattery.com](http://reliionbattery.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, CO<sub>2</sub>, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate) on the premises



## 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. LiFePO<sub>4</sub> BATTERY BASICS (VS. LEAD-ACID)

### 3.1. Basic Construction

RELiON LiFePO<sub>4</sub> 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 <sub>4</sub> ) 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.

## 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 >50mV (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 LiFePO<sub>4</sub> Charging Instructions document (available on our website at [reliionbattery.com](http://reliionbattery.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

LiFePO<sub>4</sub> can be stored between 23 to 95°F (-5 to 35°C). For storage longer than 3 months, the recommended temperature range is from 32 to 77°F (25 to 40°C).

### 5.2. Storage Conditions

It is recommended to store LiFePO<sub>4</sub> 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. LiFePO<sub>4</sub> batteries can safely operate between -4°F to 140°F (-20°C to 60°C). All RELiON LiFePO<sub>4</sub> 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 LiFePO<sub>4</sub> Battery

LiFePO<sub>4</sub> batteries can be discharged up to 100% of their capacity. However, to optimize the performance of your LiFePO<sub>4</sub> 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 LiFePO<sub>4</sub> Battery

If LiFePO<sub>4</sub> batteries are not fully discharged, they do not need to be charged after each use. LiFePO<sub>4</sub> batteries do not get damaged when left in a partial state of charge (PSOC). You can charge your LiFePO<sub>4</sub> 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. LiFePO<sub>4</sub> 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)

LiFePO<sub>4</sub> batteries do not require temperature compensation for voltage when charging at hot or cold temperatures. All RELiON LiFePO<sub>4</sub> 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

Most lead-acid battery chargers can be used with LiFePO<sub>4</sub> batteries as long as they are within the appropriate voltage guidelines. AGM and Gel algorithms typically fall within the LiFePO<sub>4</sub> voltage requirements. The voltage for flooded battery charging algorithms are often higher than LiFePO<sub>4</sub> 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 a good practice to replace your charger. Since the BMS protects the battery, using lead-acid chargers will not damage the battery. Please refer to RELiON's Lithium Charging Instruction document (available on our website at [reliionbattery.com](http://reliionbattery.com)) for complete charging instructions and parameters.



## 8. BMS OPERATION

All RELiON LiFePO<sub>4</sub> 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 LiFePO<sub>4</sub> batteries at an authorized lithium recycling facility.



## TECHNICAL SUPPORT

If you have technical questions about your RELiON battery, please contact the original place of purchase or RELiON Battery directly:



[powerpros@relionbattery.com](mailto:powerpros@relionbattery.com)



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



[Relionbattery.com](http://Relionbattery.com)

## NOTES

[illegible]

[illegible]

# Challenge Your **Li<sup>3</sup>**imits<sup>®</sup>

## Share Your Adventures

Share a photo of your new RELiON battery in action!  
Tag @relionbattery and use #ChallengeYourLimits



*@relionbattery*

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.

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INSTALL MANUAL  
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