



**ECO-WORTHY**

# LIFEPO4

## LITHIUM IRON PHOSPHATE

User Manual



# CATALOG

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## Disclaimer

The manufacturer accepts no liability for any damage caused by:

Force majeure including fire, typhoon, flood, earthquake, war, and terrorism.

Intentional or accidental misuse, abuse, neglect or improper maintenance, and use under abnormal conditions.

Improper installation, improper operation, and malfunction of a peripheral device.

Contamination with hazardous substances, diseases, vermin, or radiation.

Alterations to the product without express written consent from the manufacturer.

## Safety Instructions

Please keep the battery away from water, heat sources, sparks, and hazardous chemicals.

Please keep the battery out of the reach of young children.

Please wear proper protective equipment when working on the battery.

Please make sure any battery charger or charge controller has been disconnected before working on the battery.

Please use insulated tools when working on the battery. Please use recycling

·DO NOT puncture, drop, crush, burn, penetrate, shake, or strike the battery.

·DO NOT open, dismantle, or modify the battery.

·DO NOT touch any terminals or connectors.

·DO NOT connect or disconnect terminals from the battery without first disconnecting loads.

·DO NOT place tools on top of the battery.

·DO NOT wear jewelry or other metal objects when working on or around the battery.

·DO NOT dispose of the battery as household waste.

·DO NOT touch the exposed electrolyte or powder if the battery casing is damaged.

# Specifications

## Battery parameters

Battery Capacity	20Ah
Battery Power	256Wh
Battery Voltage	12.8V
Maximum Charge/ Discharge Current	20A
Charge Temperature Range	32°F~131°F / 0°C~55°C
Discharge Temperature Range	-4°F~131°F / -20°C~55°C
Maximum Charge Voltage	14.5V
Discharge Cut-Off Voltage	10V
Screw size	M5
DC output/input size	5.5*2.1mm
Battery Size	7.8*4.1*4.3inch(22.0*10.5*11.0cm)
Battery Weight	4.85lb(2.3kg)

## Battery Management System(BMS)

### Warning and Protection

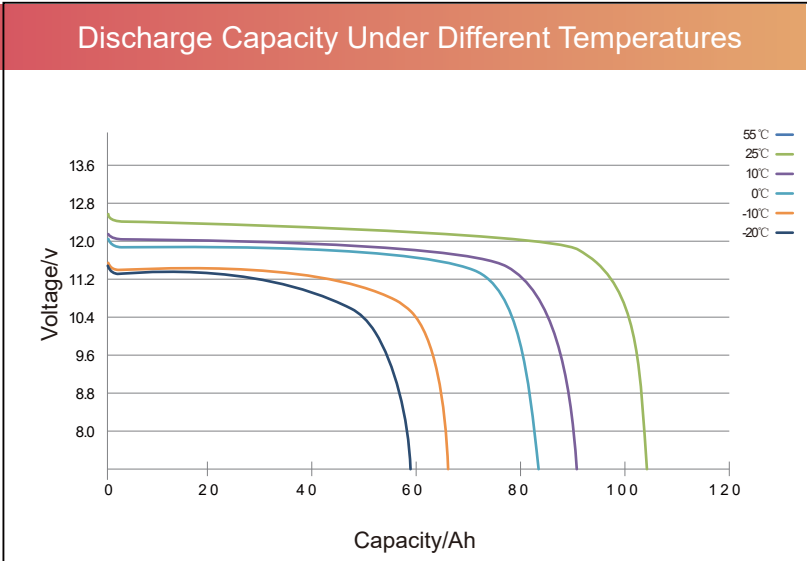
The battery contains a battery management system (BMS) that warns you and protects the battery from over-voltage, under-voltage, short circuit. Please refer to the following table for the triggering and recovery condition of each warning and protection.

Protections	Condition (12V/24V/48V)	
Over-voltage	Triggering	14.5~14.6V/ 28.9~29.6V/ 57.7~59.2V
	Recovery	13.9~14.2V/ 27.7~28.4V/ 55.3~56.8V
Under-voltage	Triggering	9.2~9.5V/ 18.4~19.1V/ 36.8~38.3V
	Recovery	10.5~10.8V/ 20.9~21.6V/ 41.7~43.2V
Short Circuit	Triggering	Discharge Current≥500A
	Recovery	Remove Short Circuits

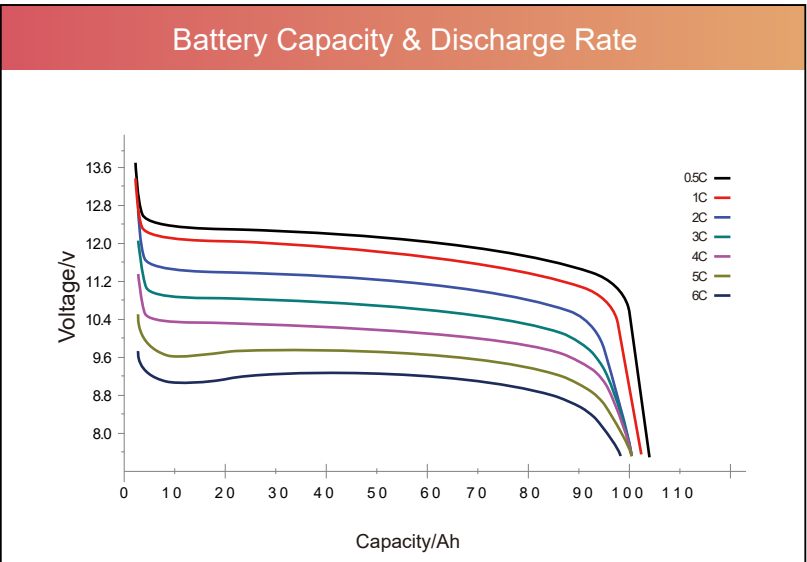
# Battery Performance Relations

Sample: 12V 100Ah battery

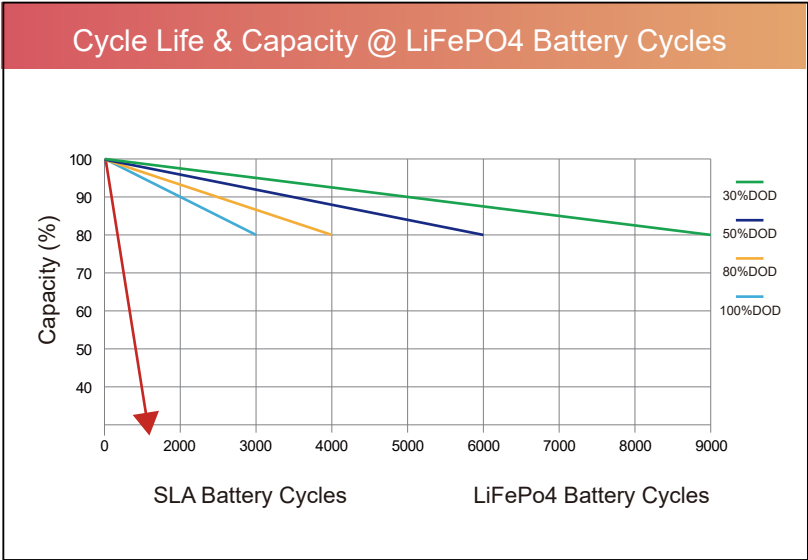
environmental conditions required for all tests:  $25 \pm 5 \text{ }^\circ\text{C} / 77^\circ\text{F} \pm 9^\circ\text{F}$



1.4.1.1



1.4.1.2



1.4.1.3

## General Installation Guide

### ***Installation Environment***

The battery should be installed in a clean, cool, and dry place, keeping water, oil, and dirt away from the battery. The accumulation of these materials on the battery can cause current leakage, resulting in self-discharge and a possible short-circuit. Sufficient air flow must be provided to prevent excessive heat build-up and to minimize temperature variation between the batteries.

### ***Preparation***

Before the installation and operation of the battery, it is recommended to have the following equipment or tools available:

- Proper Protective Equipment Insulated Tool(s)
- Multimeter Battery Cable
- Battery Charger / Charge Controller

## ***Inspection***

Please check for visible damage including cracks, dents, deformation, and other visible abnormalities. The top of the battery and terminal connections should be clean, free of dirt and corrosion, and dry. If any problems are detected with the battery, please contact us for assistance.

DO NOT short-circuit the battery terminals. Doing so can cause current bursts and lead to irreversible damage to the system and the battery.

Please verify the polarity before connecting wiring. Reversing polarity can and will destroy the battery.

Please use circuit breakers, fuses, or disconnects appropriately sized by a certified electrician, licensed installers, or regional code authorities to protect all electrical equipment.

## ***Cable Sizing***

Battery cables should be appropriately sized to handle the expected load.

Please refer to the following table for the ampacities of copper cables with different gauge sizes.

Copper Cable Gauge Size(AWG/MM <sup>2</sup> )	Ampacity(A)
14(20.8)	20
12(3.31)	25
10(5.25)	35
8(8.36)	50
6(13.3)	65
4(21.1)	85
2(33.6)	115
1(42.4)	130
1/0(53.5)	150
2/0(67.4)	175
4/0(107)	230

## **Batteries Connection**

DO NOT string batteries with different chemistry, brands, models, rated capacities, or nominal voltages in parallel.

Please avoid too high a voltage difference between paralleled batteries, despite the auto-balancing function, to avoid triggering the over-voltage protection.

In parallel battery banks, the cables between each battery should be of equal length to ensure that all batteries in the system can work equally together.

It is not recommended to connect more than 4 batteries in parallel to ensure the normal functioning of auto balance.

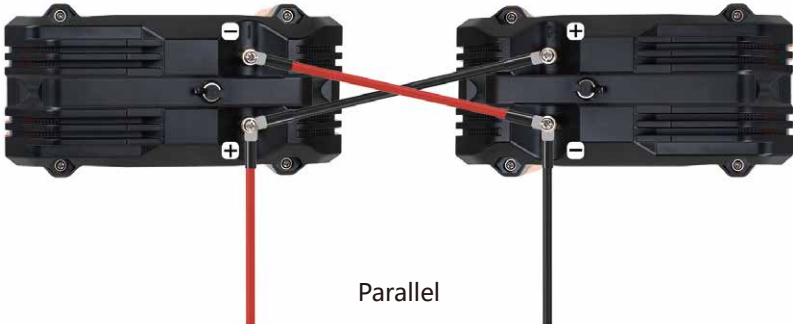
The series connection means that the negative electrode of the first lithium battery is connected to the positive electrode of the second lithium battery, and the negative electrode of the second lithium battery is connected to the positive electrode of the third battery, and so on, until the required voltage is reached.

The voltage of this connection method is all The total voltage of the cells connected together, and the string current rating keeps as single one battery.



The parallel mode means that the positive pole of the first lithium battery is connected to the positive pole of the second cell, and the negative pole is connected to the negative pole, and so on. The string voltage be as a single battery, and the total discharge current be as the sum of all batteries current.





### ***Securing Cable Connections***

Please use an insulated Philips screwdriver to tighten the cable connections.

Please secure all cable connections to the proper specification in order to ensure good contact between the cable lugs and the terminals.

Over-tightening cable connections can cause terminal breakage and loose cable connections can cause terminal meltdown or fire.

To ensure good contact between the cable lugs and the terminals, please use the appropriate number of washers to allow for as much thread engagement as possible without bottoming out the terminal bolt. The correct number of washers can be determined by hand-tightening the terminal bolt with just the cable lug in place and observing the gap that is present. Use the number of washers needed so that the washer stack is slightly larger than the observed gap.

It is important to ensure that the cable lug and the top surface of the terminal are in contact. The washer(s) must be placed on top of the lug. Do not place the washer(s) between the battery terminal and the cable lug as this can cause high resistance and excessive heating

# Charging Method

You can charge your lithium iron phosphate batteries whenever you want just like your cellphone. Unlike lead-acid batteries, lithium iron phosphate batteries do not get damaged if they are left in a partial state of charge, so you don't have to stress about getting them charged immediately after use. They also don't have a memory effect, so you don't have to drain them completely before charging.

## ***Battery charger(mains power)***

The most ideal way to charge a LiFePO<sub>4</sub> battery is with a lithium iron phosphate battery charger, as it will be programmed with the appropriate voltage limits. Most lead-acid battery chargers will do the job just fine.

A 12V lithium battery at 20% capacity will hold voltage around 13V, its lead acid will be approx 11.8v at the same capacity. So if you use lead acid charger to charge your lithium battery, it may not be fully charged.

***To select a proper charger for your battery, you should choose one that capable to charge the ECO-WORTHY battery to full, its rated output/charging voltage should match the LiFePO<sub>4</sub> battery's standard charge voltage, which varies in different battery types, refer to the above parameter table for detailed data.***

## ***Solar panel (DC power)***

You can also use solar panel to charge your ECO-WORTHY LiFePO<sub>4</sub> battery, but please make sure to choose a proper controller, it should contain the LiFePO<sub>4</sub> battery mode, or Li-ion battery mode. Both PWM controller and MPPT controller are okay.

If you don't have a controller, you can connect the battery to the solar panel directly, too. The BMS inside will protect the battery in most time. But if there is a defect on the battery BMS, the battery will be damaged.

## Battery Voltage & Actual Capacity

13.6V	100%
13.4V	99%
13.3V	90%
13.2V	70%
13.1V	40%
13.0V	30%
12.9V	20%
12.8V	17%
12.5V	14%
12.0V	9%
10.0V	0%

## Troubleshooting

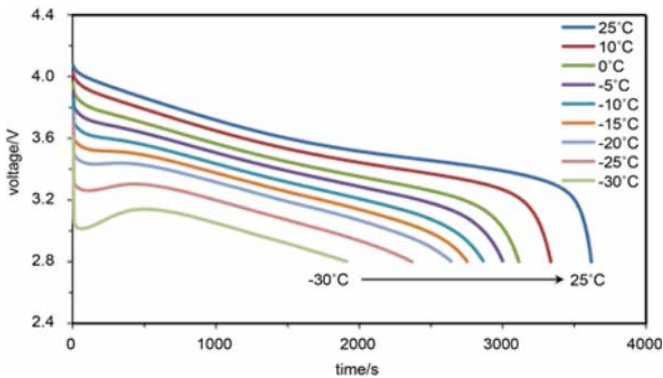
·If you found the battery can not be fully charged to its full voltage rating(14.6V/29V/58V), the charge tools may not compatible with it, you could check if the charger/controller contains the proper output voltage for LiFePO4 battery.

·If the charger is suitable, but the battery still can not be fully charged, it's may due to the fault in BMS. With glove and some tools, you could open the top cap of the battery, take out the BMS board, and directly connect the cells wire to the terminals, then try to charge it without BMS, it'll be safe if you have a charger/controller with protections.

·If the connected batteries could not reach the rated capacity, it may because that the unbalancing charging process causes voltage difference among those individual batteries You could disconnect them first, and try to charge them one by one, to see if each battery is in good condition.

· If the battery is over discharged and triggers the over-discharge protection, please remove the load or inverter, keep the charge process until it recovers. If it's still can not be re-charged, try to remove the controller, use a solar panel or something else with voltage higher than 15V to directly boot it.

## Frequently Asked Questions



### **Can I charge lithium batteries in the cold?**

Lithium batteries rely on chemical reactions to work, and the cold can slow and even stop those reactions from occurring. Unfortunately, charging them in low temperatures is not as effective as doing so under normal weather conditions because the ions that provide the charge do not move properly in cold weather.

There's one hard and fast rule: to prevent irreversible damage to the battery, don't charge them when the temperature falls below freezing ( $0^{\circ}\text{C}$  or  $32^{\circ}\text{F}$ ) without reducing the charge current. Because the lithium batteries suffer from a phenomenon of lithium metal plating on the anode if charged at high rates in cold temperatures. This could cause an internal short of the battery and a failure.

### **Can I leave ECO-WORTHY lithium battery on charging all the time?**

For a lithium battery with a low maintenance charging procedure and battery management system, it's perfectly fine and better than leaving them discharged for a long period. Regardless of whether it is a dedicated charger or a general charger, under normal conditions, it has a charging cut-off voltage, which means that it will stop charging at a certain volt. The same is true for the solar panel controller, and the controller can also be configured like this. The solar panel is directly connected for charging. If there is a problem with the BMS, it may be overcharged.

### ***Can I recharge my lithium battery from my vehicle alternator?***

Yes, but not necessarily to full charge, due to the fact that most Alternators are adjusted for the lower voltage requirements of the vehicle Lead/Acid Battery (approximately 13.9v). Lithium Batteries require 14.4 to 14.6Volts to fully charge. That being said, you can get up to approximately a 70% charge, depending on the depth of discharge and distance driven while recharging from your vehicle alternator.

## **Maintenance**

To prevent possible leakage, heat generation, and explosion of the battery, please pay attention to the following precautions:

It is strictly forbidden to immerse the battery in seawater or water. When it is not in use, it should be placed in a cool and dry environment.

It is forbidden to use and leave the battery near a hot and high temperature source, such as fire, heater, etc.

It is strictly forbidden to directly plug the positive and negative ends of the battery into a power socket.

Do not throw the battery into a fire or heater.

It is forbidden to use metal to directly connect the positive and negative electrodes of the battery to short-circuit.

It is forbidden to transport or store the battery with conductive materials such as metal and carbon powder.

Do not knock or throw, step on the battery, etc.

It is forbidden to weld the battery directly and pierce the battery with nails or other sharp objects.

# Support

If you met technical problems and cannot find a solution in this manual, please contact ECO-WORTHY for further assistance

**Contact number:**

**US 1-866-939-8222**

**UK +44 20 7570 0328**

**Email: [customer.service@eco-worthy.com](mailto:customer.service@eco-worthy.com)**

ECO-WORTHY reserves the right to change the contents of this manual without notice