ROCKSOLAR®

Lithium iron phosphate battery

user manual

Contents

Features of LiFePO4 Battery

- **Longer Cycle Life:** Offers up to 20 times longer cycle life and five times longer float/calendar life than lead acid battery, helping to minimize replacement cost and reduce total cost of owner.
- **Lighter Weight:** About 40% of the weight of a comparable lead acid battery. A 'drop in' replacement for lead acid batteries.
- **Higher Power:** Delivers twice power of lead acid battery, even high discharge rate, while maintaining high energy capacity.
- **Wider Temperature Range:** -20℃~+60℃.
- **Superior Safety:** Automatic protection with internal battery management system. Lithium Iron Phosphate chemistry eliminates the risk of explosion or combustion due to high impact, overcharging or short circuit situation.
- **Increased Flexibility:** Modular design enables deployment of up to four batteries in series and up to ten batteries in parallel.

Application

RV,Electric vehicles,Boat ; Solar/wind energy storage system; UPS, backup power ; Telecommunication; Medical equipment; Lighting.

Warranty

Limited Warranty

ROCKSOLAR LLC, provides a non-transferable warranty to the purchaser of ROCKSOLAR product purchased from an authorized ROCKSOLAR reseller. ROCKSOLAR LLC. warrants to the original consumer purchaser that the ROCKSOLAR product wil be free from defects in workmanship and material under normal consumer use during the applicable warranty period identified in the 'Warranty Period' section below, subject to the exclusions set forth below. This warranty statement sets forth ROCKSOLAR's total and exclusive warranty obligation. We will not assume, nor authorize any person to assume for us, any other liability in connection with the sale of our products.

Warranty Period

The warranty period for portable power stations is 12 months, while the warranty period for LiFePO4 batteries is 11 years. In each case, the warranty period is measured starting on the date of purchase by the original consumer purchaser. The sales receipt from the first consumer purchase, or other reasonable documentary proof, is required in order to establish the start date of the warranty period.

Remedy

ROCKSOLAR's entire liability and your exclusive remedy for any ROCKSOLAR product that is not operating in accordance with its published technical specifications are at ROCKSOLAR's discretion: replace the product at ROCKSOLAR's expense. This warranty obligation is conditioned upon the hardware being returned to the original place of purchase, or another place as directed by ROCKSOLAR, with the original sales receipt attached. You may be required to pay shipping and handling charges, as well as any applicable tariffs, duties, taxes, or other fees. ROCKSOLAR may, at its discretion, provide new or refurbished products.

Limited to Original Consumer Buyer

The warranty on ROCKSOLAR's product is limited to the original consumer purchaser and to any subsequent owner.

LIMITATION OF LIABILITY

ROCKSOLAR shall not be liable for any special, incidental, indirect, or consequential damages whatsoever, including, but not limited to loss of profits, revenue, or data (whether direct or indirect) or commercial loss for breach of any express or implied warranty on your product even if ROCKSOLAR has been advised previously of the possibility of such damages. Some local laws do not allow the exclusion or limitation of special, indirect, incidental, or consequential damages, so this limitation or exclusion may not apply in your jurisdiction.

Exclusions

The warranty does not cover failures resulting from incorrect handling, product modifications, installation, conversion or additions, supplements, operation, natural elements (weather), excessive or deficient energy supply, chemicals, the effect of solid bodies, or deliberate damage. If the Warrantor determines that the problem with the ROCKSOLAR product(s) is not due to a manufacturing defect in the Warrantor's workmanship or materials, or otherwise does not qualify for warranty repair, then the Purchaser will be responsible for all costs incurred by the Warrantor necessary to repair, replace and transport the ROCKSOLAR product(s). ROCKSOLAR's warranty does not apply to the battery cell unless the battery cell is fully charged by you within seven days after you purchase the product and at least every 3 months thereafter.

How to Receive Service

To obtain warranty service, contact our customer service team at support@rocksolars.com.

Battery Specification

MODEL	LP 12-20	LP 12-36	LP 12-50	LP 12-100	LP 12-200	LP 12-300
Nominal Voltage	12.8V					
Nominal Capacity	20Ah	36Ah	50Ah	100Ah	200Ah	300Ah
Nominal Energy	256 Wh	460.8 Wh	640 Wh	1280 Wh	2560 Wh	3840 Wh
Standard Charge Voltage	14.4V(14.6V Max.)					
Discharge Cut-off Voltage	9.6~10.8V					
Standard Charge Current	5A	6A	10A	20A	40A	60A
Allowed Max. Charge Current	20A	36A	50A	100A	160A	200A
Max.Discharge Current	30A	40A	50A	100A	160A	200A
Peak Discharge Current @1S	60A	80A	100A	200A	260A	400A
Terminal	F13 M5	F11 M6	F11 M6	F12 M6	F12 M6	F12 M6
Temperature	Charge temperature:0℃~+45℃ / Discharge temperature -20℃~+60℃					
Cycle Life	>2000 cycles @1C 100%DOD / >4000 cycles @0.5C 50%DOD					

Battery Dimensions

LP12-20	LxWxH=7.12x3.03x6.58 in	TH: 6.58in
LP12-36	LxWxH=7.80x5.11x6.16 in	TH: 6.62in
LP12-50	LxWxH=9.01x5.43x8.26 in	TH: 8.58in
LP12-100	LxWxH=13.0x6.77x8.46 in	TH: 8.66in
LP12-200	LxWxH=20.6x9.37x8.58 in	TH: 8.82in
LP12-300	LxWxH=20.6x9.37x8.58 in	TH: 8.82in

BMS - Battery Management System

Protection		Protection Condition		Recovery
Current	Charging	<1.0C	Temperature Protection	a. Cut Charging 15±5S or b. Discharge >2A or c. <+50°C and >0°C or d. Charge Current<0.5C
		1.0~1.5C	Delay 3~10S	
		1.5~3.0C	Delay 1~3S	
		>3.0C	Delay 50~150mS	
	Discharging	<1.0C	Temperature Protection	a. Cut Discharge 15±5S or b. Charge >2A or c. <+65°C and >-20°C or d. Discharge Current<0.5C
		<2.0C	Temperature Protection	
		3.0~4.0C	Delay 50~150mS	
		4.0~10C	Delay 5~15mS	
		>10C	Delay 300~800uS	
Voltage	Charging	Battery	≥14.6V,Delay 1~2S	a. ≤14.0V or b. Discharge>2A
		Single Cell	≥3.65V,Delay 1~2S	a. ≤3.5V or b. Discharge>2A
	Discharging	Battery	≤9.6V,Delay 1~2S	a. ≥11.4V or b. Charge>2A
		Single Cell	≤2.3V,Delay 1~2S	a. ≥2.7V or b. Charge>2A
temp-erature	Battery	Charging	≤0°C or ≥+50°C	≥+5°C or ≤+45°C
		Discharging	≤-20°C or ≥+70°C	≥-10°C or ≤+60°C
	BMS	≥+90°C		≤+80°C
Balance for single cell		Voltage	≥3.55V,Delay 1~10S	a. Cut Charging or b. Voltage≤3.5V
		Current	35±10mA	

Explain: "C" represents the Battery Nominal Capacity.

Charging Tips

About Charging Voltage

Based on the characteristics of Lithium Iron Phosphate(LiFePO4) batteries, the voltage measured by all LiFePO4 batteries during charging is not the real voltage of the battery. Therefore, after charging and disconnecting the battery from the power source, the voltage of the battery will gradually drop to its real voltage. If you need to test the real voltage of the battery, please charge and disconnect the power supply and test its voltage after putting it aside for over 15 mins.

Charging Methods

Use 14.6V lithium battery charger to maximize the capacity.

Recommend Charging Voltage:Between 14.2V to 14.6V

Recommend Charging Current:

0.2C The battery will be fully charged in around 5hrs to 100% capacity.

0.5C The battery will be fully charged in around 2hrs to around 97% capacity.

Inverter/Controller

·Select"12V(14.6V)LI(LiFePO4) Mode" or

·Select "User Mode" to enter values according to below parameters:

CHARGING	Charging Limit Voltage	14.6V
	Over Voltage Disconnect Voltage	15.0V
	Over Voltage Reconnect Voltage	14.2V
	Equalizer Charging Voltage	14.0V
	Float Charging Voltage	13.8V
	Boost Charging Voltage	13.8V
	Boost Reconnect Charging Voltage	13.2V
DISCHARGING	Low Voltage Disconnect Voltage	10.8V
	Low Voltage Reconnect Voltage	12.4V
	Under Voltage Warning Voltage	11.6V
	Under Voltage Warning Reconnect Voltage	12.0V
	Discharging Limit Voltage	10.4V
	Over Discharge Disconnect Voltage	10.4V
	Over Discharge Reconnect Voltage	11.6V
	Over-Discharge Delay Time	0.8S
OTHERS	Equalize Duration	120min
	Boost Interva	Not Suitable for Lithium Batteries
	Boost Duration	120min

State of Charge(SOC)

The battery capacity could be roughly estimated by its voltage.As there are subtle differences in the voltage of each battery,below parameters are for reference only. The voltage needs to be tested at rest(with zero current) after 15 mins of disconnecting from charger &loads.

Capacity	Voltage
100%	13.50V
99%	13.40V
90%	13.30V
80%	13.25V
70%	13.20V
60%	13.17V
50%	13.14V
40%	13.10V
30%	13.00V
20%	12.90V
10%	12.80V
1%	10.80V (recommend low voltage disconnect voltage)
0%	9.5V

Long-Term Storage

·The battery can be operated in temperature of -20°C to +60°C,and a temperature between +10°C to +35°C is ideal fr long-term storage.Store in a fireproof container and away from children.

·For a longer-lasting product, it is best to store your battery at 100% charge level and recharge every three months if it is not going to be used for a long period of time.

Connection Tips

Premise of Connection: To connect in series or /and in parallel, batteries should meet below conditions:

a. the same battery capacity(Ah);

b. from same brand (as lithium battery from different brands has their special BMS);

c. purchased in near time(within one month).

Two Necessary Steps Before Connecting:

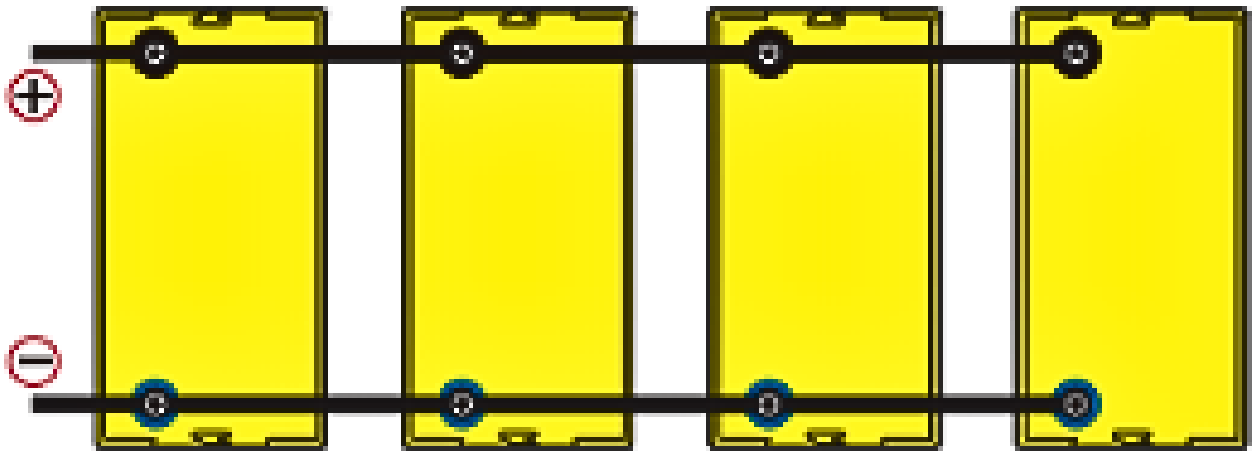
These two steps are necessary in order to reduce the voltage difference between batteries,and through these,the battery system can perform the best of it in series or/and in parallel.

Step 1: Fully charge your batteries separately.

Step 2: Connect your batteries one by one inparallel, and leave them together for 12-24hrs.

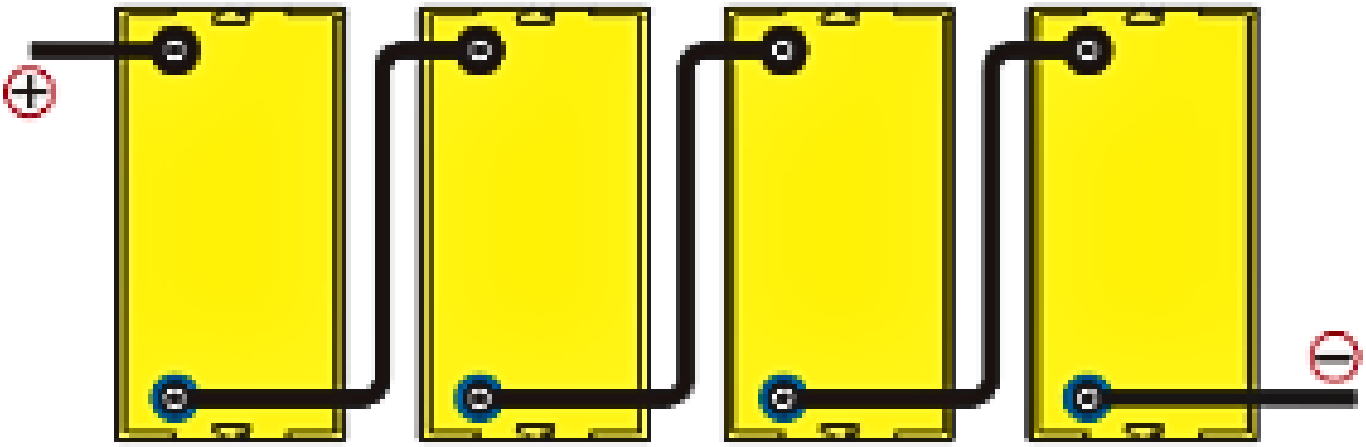
And then, you can connect your batteries in series or/and in parallel.

Parallel connection of batteries



Capacity of parallel battery	Battery Numbers	Limited Charge Voltage	Discharge Cut-off voltage
12.8V/Capacity*1	1PCS	14.6V	10.8V
12.8V/Capacity*2	2PCS	14.6V	10.8V
12.8V/Capacity*3	3PCS	14.6V	10.8V
12.8V/Capacity*n	n≤10PCS	14.6V	10.8V

Battery in series



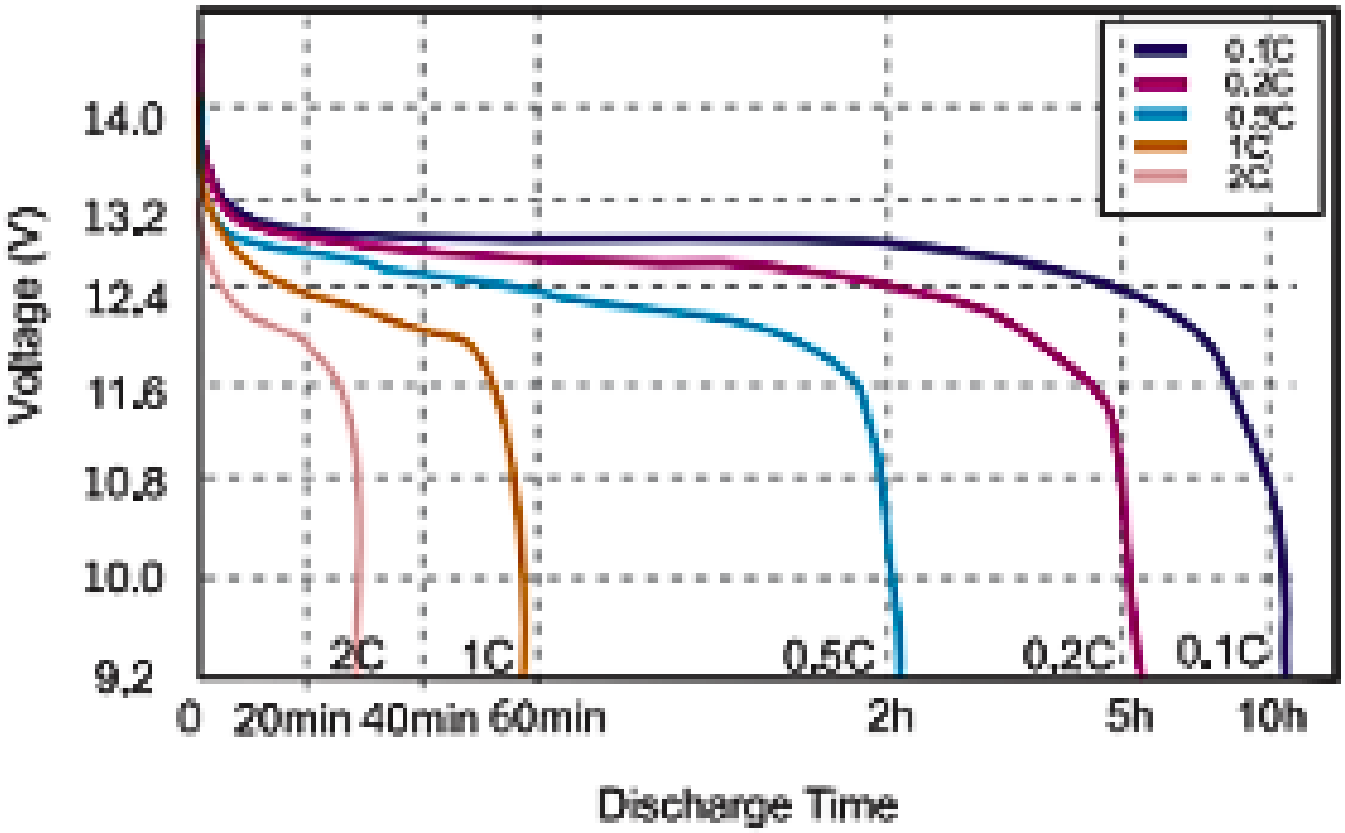
Inverter/ Charger Type	Battery Numbers	Limited Charge Voltage	Discharge Cut-off voltage
12V	1PCS	14.6V	10.8V
24V	2PCS	29.2V	21.6V
36V	3PCS	43.8V	32.4V
48V	4PCS	58.4V	43.2V

Notes for series and parallel connection:

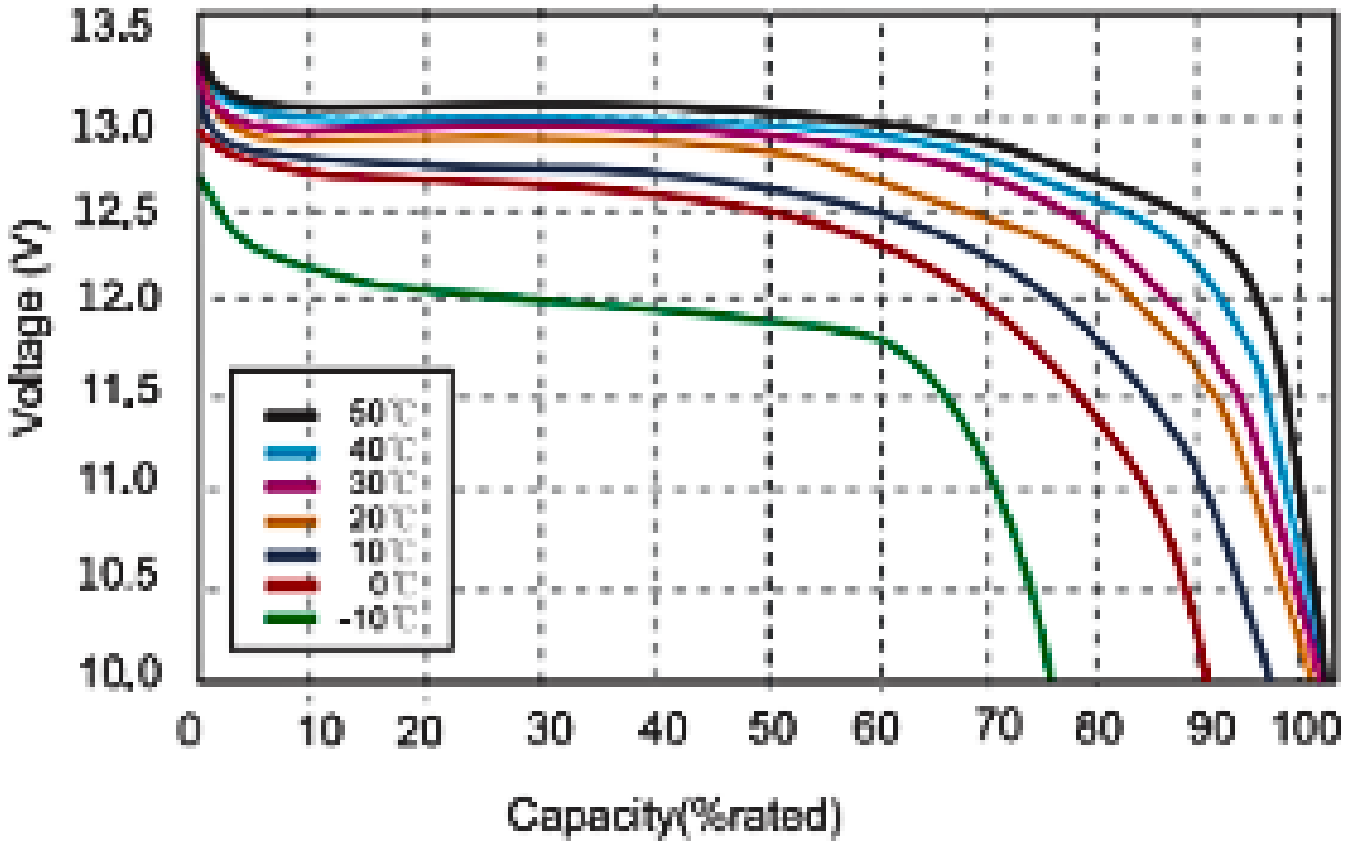
- Fully charge all the battery firstly, then connect them in series or parallel.
- The number of batteries in series is ≤4PCS, and the number of batteries in parallel is ≤10PCS.
- Do not mix in series or parallel with lead-acid batteries or different types of lithium batteries;Only use batteries with the same type and same capacities.
- Battery series and parallel connections need to be charged according to the standard charging voltage in the above table, and a special charger for lithium batteries is recommended;(Follow note as above when selecting proper chargers)

Characteristics of LiFePO4 Battery

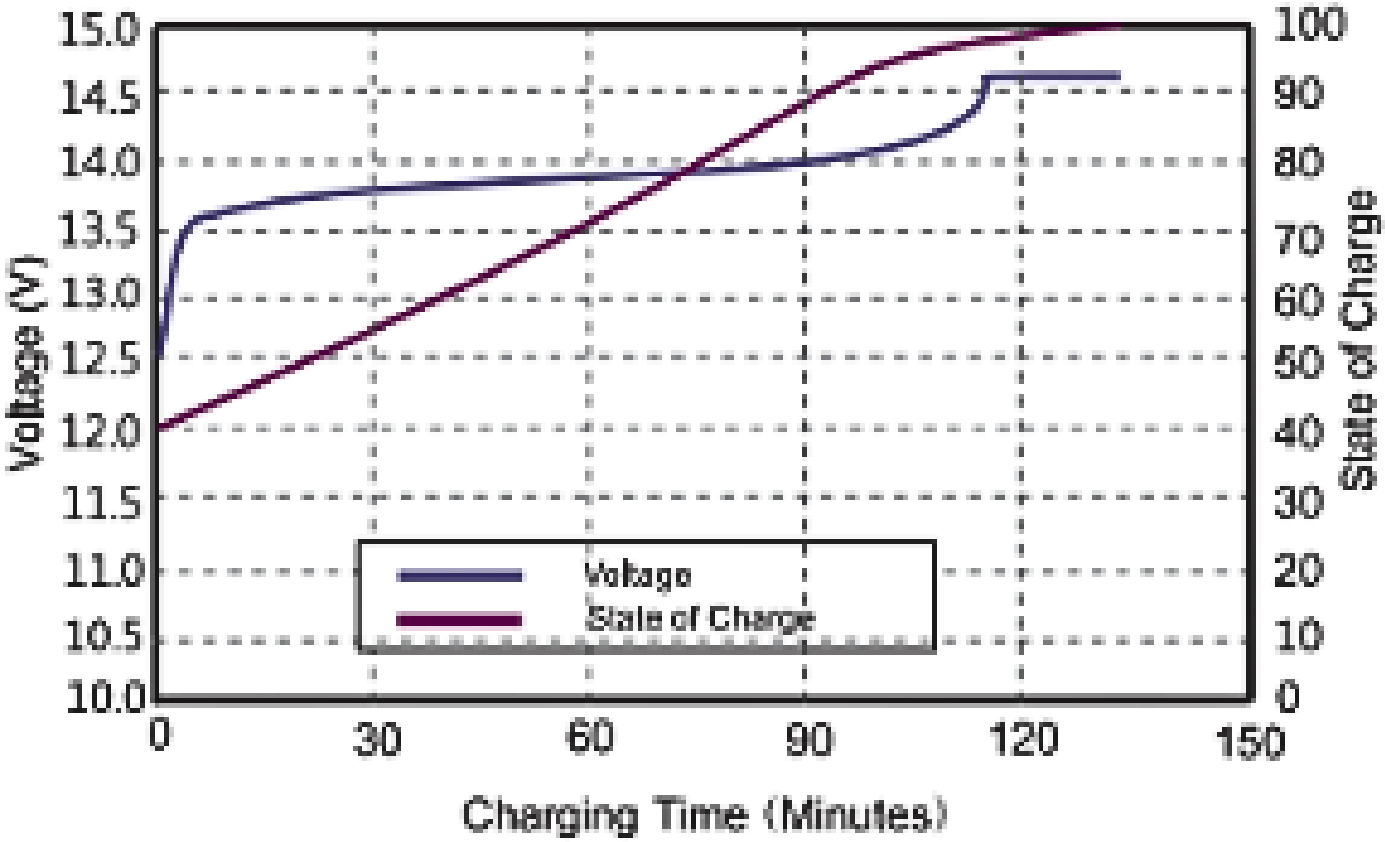
Different Rate Discharge Curve @25°C



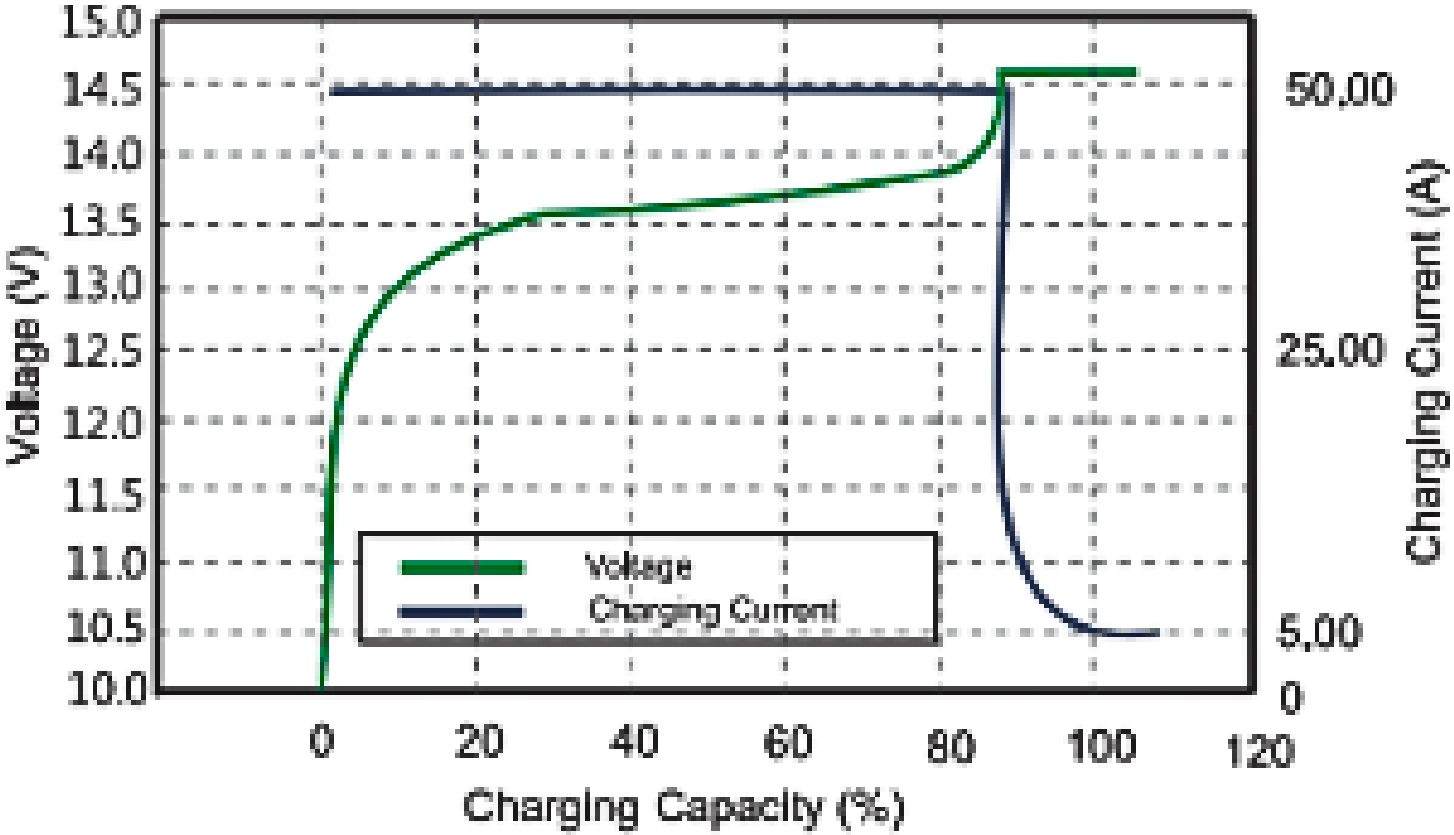
Different Temperature Discharge Curve @0.5C



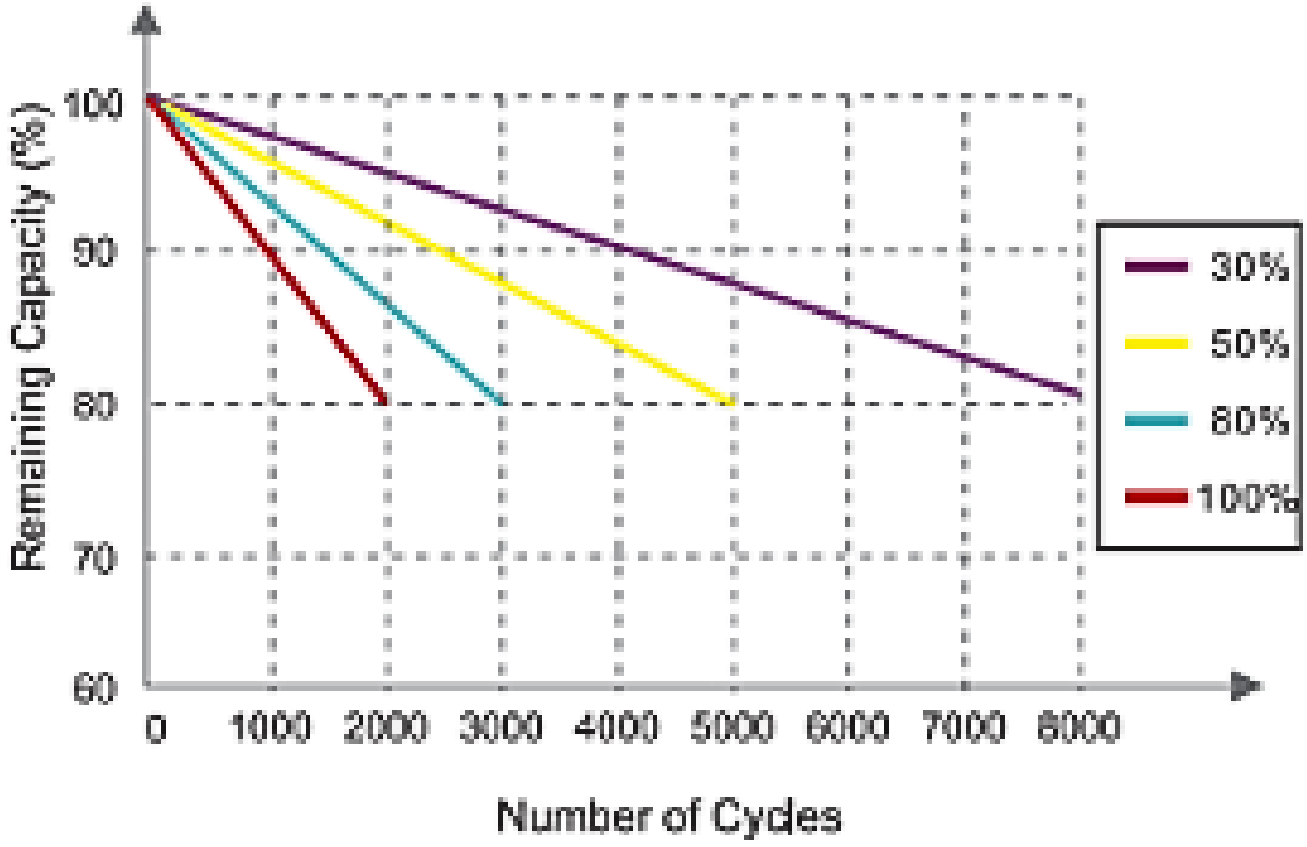
State Charge Curve @0.5C 25°C



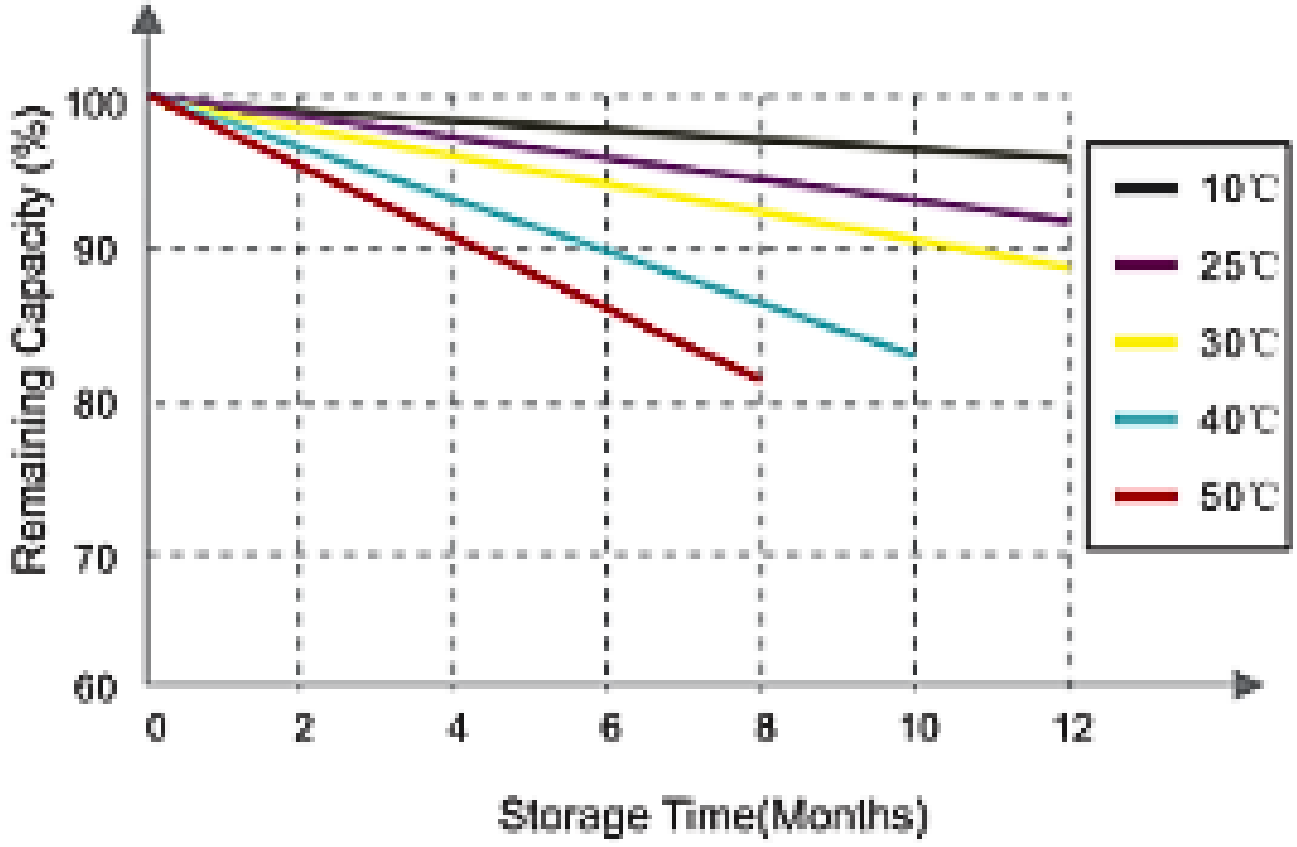
Charging Characteristics @0.5C 25°C



Different DOD Discharge Cycle Life Curve @1C



Different Temperature Self Discharge Curve



Troubleshooting

Solutions to general failures of lithium iron phosphate batteries:

Problem	Solution
The battery pack cannot be discharged properly	1.Check whether the battery connection is loose or not
	2.Make Sure the battery terminal posts were connected correctly and firmly
	3.Switch off the load and switch on again after 3 seconds
The battery pack cannot be charged properly	1.Use chargers with compatible output;
	2.Only connect to electric appliances with compatible input;
The battery heats up when using	1. Make sure the appliance connected are compatible and not overloaded
	2.Connect the battery packs correctly and firmly
The battery ouput: "0V"	Use the charger with 0V charging function (it can charge the battery starting from 0V) to charge the battery. After fully charged,the battery can be used normally.

Warning & Tips.

1. Disassemble or modify the battery is forbidden.
2. Do not reversely connect or short-circuit the positive and negative poles of the battery; do not mix the battery with metal objects avoid short circuit from metal objects touch the positive and negative electrodes of the battery, damaging the battery or even causing danger.
3. It is strictly forbidden to immerse the battery in sea water or throw it into fire.
4. It is strictly prohibited to use chargers that do not meet the requirements for charging.
5. Avoid frequent overcharging. Overcharging will cause the internal temperature rise and harmful to the lithium-ion battery and charger.

HOW TO ACTIVATE THE BATTERY

If the BMS has cut-off the battery for protection, you need to cut off the load of the battery and put the battery aside for 30mins. Then the battery will automatically recover itself to normal voltage and can be used after fully charged.

If the battery is unable to recover itself and its voltage is too low to hold a charge, you can activate it in below two ways:

1. Use the charger with 0V charging function (it can charge the battery starting from 0V) to charge the battery. After fully charged , the battery can be used normally.

2. Use another 12V lithium battery to connect in parallel with the battery for a minute to activate the battery (lead-acid battery with voltage more than/equal to 12V and less than/equal to 14.6V will also work). After that, fully charge the battery and it can be used normally.