USER MANUAL OF

SLA Replacement Lithium Battery

A01

OUR ENERGY WORKS FOR YOU

Zhongrui Green Energy Technology (Shenzhen) Co., Ltd.

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ZRGP is a national high-tech enterprise with a global vision. With independent research and development capabilities and focus on ESS solutions, ZRGP is becoming a world leading supplier of BMS, ESS, modules and monitoring systems. Our business scope integrates R&D, design, production and sales.

Headquartered in China, with multiple sales offices, product centers, factories, and wholly-owned subsidiaries around the world, ZRGP is committed to providing you with safe, lightweight and long-life green energy products.

ZRGP's industrial park boasts comprehensive facilities, including automated intelligent production lines, testing and aging sections, warehouse areas, office spaces, employee dormitories, cafeteria etc. A majority of the production and testing equipment possessed by the company is imported from Germany, whose advanced level and automation level are on the cutting edge of the industry.

21000m²
Factory Area

3GWh
Per Year

90+
Countries We Export To

Company Advantages

- Years of research and development experience
- Sales and after-sales outlets all over the world
- Highly information-based automated factory
- Scientific production process control ability

To produce world-class energy storage products
To serve the consumers in the global market

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1. Safety Precautions

Observe these instructions and keep them located near the Li-ion Battery for future reference.

For more information about this product, please visit the official website:http://www.zruipower.com

Work on a Li-ion Battery should be carried out by qualified personnel only.

1.1. General warnings

While working on the Li-ion Battery wear protective eyeglasses and clothing.

Any uncovered battery material such as electrolyte or powder on the skin or in the eyes must be flushed with plenty of clean water immediately. Then seek medical assistance. Spillages on clothing should be rinsed out with water.

Explosion and fire hazard. Terminals of the Li-ion Battery are always alive; therefore, do not place items or tools on the Li-ion Battery. Avoid short circuits, too deep discharges and too high charge currents. Use insulated tools. Do not wear any metallic items such as watches, bracelets, etc. In case of fire; you must use a typeD, foam or CO2 fire extinguisher.

Do not open or dismantle the battery. Electrolyte is very corrosive. In normal working conditions contact with the electrolyte is impossible. If the battery casing is damaged do not touch the exposed electrolyte or powder because it is corrosive.

Li-ion batteries are heavy. If involved in an accident they can become a projectile! Ensure adequate and secure mounting and always use suitable handling equipment for transportation.

Handle with care because a li-ion battery is sensitive to mechanical shock.

Do not use a damaged battery.

Do not wet the battery.

1.2. Charge and discharge warnings

If the battery is stored for long time, it is required to charge them every six months, and theSOC should be no less than 90%.

The temperature range over which the battery can be charged is 0°C to 45°C. Charging the battery at temperatures outside this range may cause severe damage to the battery or reduce battery life expectancy.

The temperature range over which the battery can be discharged is -10°C to 60°C. Discharging the battery at temperatures outside this range may cause severe damage to the battery or reduce battery life expectancy.

If charged after the Lithium Battery was discharged below the “Discharge cut-off voltage”, or when the Lithium Battery is damaged or overcharged, the Lithium Battery can release a harmful mixture of gasses such as phosphate.

Use only with a ZRGP approved BMS.

1.3. Transportation warnings

If the battery system needs to be moved or repaired, the power must be cut off and the battery is completely shut down; The battery must be transported in its original or equivalent package and in an upright position. If the battery is in its package, use soft slings to avoid damage.

Do not stand below a battery when it is hoisted.

Never lift the battery at the terminals or the BMS communication cables, only lift the battery at the handles.

NOTE：

- ***Batteries are tested according to UN Handbook of Tests and Criteria, part III, sub section 38.3 (ST/SG/AC.10/11/Rev.5).***
- ***For transport the batteries belong to the category UN3480, Class 9, Packaging Group II and have to be transported according to this regulation. This means that for land and sea transport (ADR, RID & IMDG) they have to be packed according to packaging instruction P903 and for air transport (IATA) according to packaging instruction P965. The original packaging complies with these instructions.***

1.4. Disposal of lithium batteries

Batteries must not be mixed with domestic or industrial waste.

Do not throw a battery into fire.

Batteries marked with the recycling symbol must be processed via a recognized recycling agency. By agreement, they may be returned to the manufacturer.

2. Introduction

2.1. Lithium iron phosphate battery

The lithium iron phosphate battery (LiFePO4 or LFP) is the safest of the mainstream lithium battery types. A single LFP cell has a nominal voltage of 3.2V. A 12.8V LFP battery consists of 4 cells connected in series.

LFP is the chemistry of choice for very demanding applications. Some of its features are:

◆Rugged - It can operate in deficit mode during long periods of time.

◆High roundtrip efficiency.

◆High energy density - More capacity with less weight and volume.

◆High charge and discharge currents - Fast charge and discharges are possible.

◆Flexible charge voltages.

The lithium iron phosphate battery is therefore the chemistry of choice for a range of very demanding applications.

2.2. Smartlithium battery models

The Lithium Smart Battery is available in a variety of capacities, namely 12.8V. These are all available battery models:

- Smart LiFePO4 Battery 12.8V/100Ah
- Smart LiFePO4 Battery 12.8V/150Ah
- Smart LiFePO4 Battery 12.8V/200Ah
- Smart LiFePO4 Battery 12.8V/300Ah

For more information, please visit our website: http://www.zruipower.com.

2.3. Battery management system

The battery cells in the Smart Lithium batteries are protected against over-charge, under-charge, charging at too low temperatures as well as charging at too high temperatures.

As part of the protection the battery has an integrated Balancing, Temperature and Voltage control system, the BMS, the BMS connects to each single cell. If customers need applications on higher voltage platforms, they can connect the battery packs in series to reach the required voltage. Our battery management system supports up to 4 battery packs in series.

The BMS monitors each individual battery cell; it balances the cell voltages and in case of high or low cell voltage or in case of high or low cell temperature, it will turn off loads or chargers.

The BMS has a built-in Bluetooth communication module, and users can communicate with it through APP to obtain battery parameters. Users can also set various battery protection parameters online.

2.4. ZRGP battery supervisor

The battery is equipped with Bluetooth and uses this to communicate with the ZRGP Battery Supervisor app. The ZRGP Battery Supervisor is used for reading out battery information, for making or changing battery settings, and receiving alarms.

2.5. Battery pack features& benefits

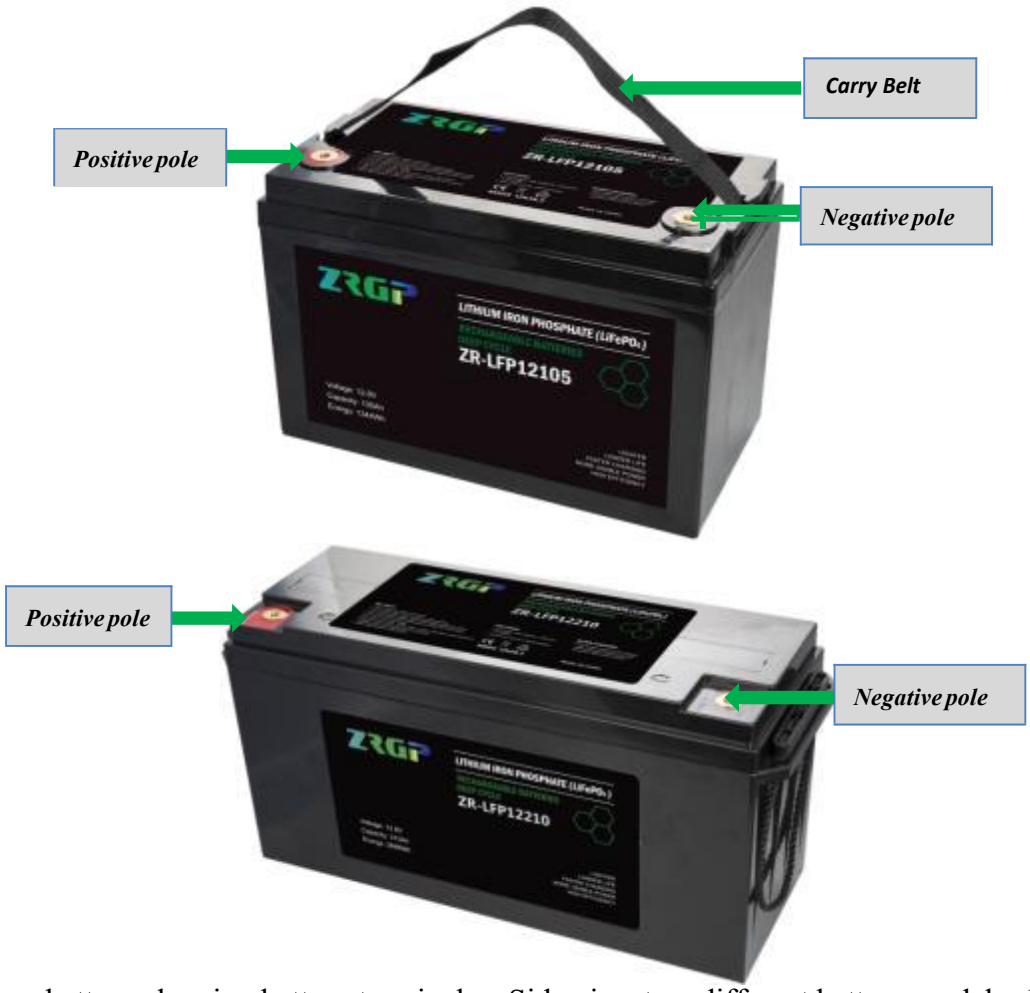
- ◆Consist of LiFePO4 battery cells with advantages of high safety, good reliability, long cycle life, good high/low temperature performance.
- ◆With high automation ensures excellent welding quality, high energy efficiency, and stable & reliable quality.
- ◆Built-in intelligent BMS protects battery from over-charge, over-discharge, charge/discharge over-current, short circuit, high/low temperature, delay protection, etc.
- ◆Wireless communication between the battery and Smartphone via Bluetooth helps obtaining the operating status and provides the graded alarms.
- ◆Supports maximum of 4 batteries in parallel or 4 in series connection.

3. Installation

3.1. What's in the box

Take care when unpacking the battery. Batteries are heavy. Do not lift it by its poles. The battery has two carry handles or belt on either side of the battery. The weight of the battery can be found in the "Technical data" chapter.

Familiarize yourself with the battery. The battery poles are located on top of the battery. The polarity of the battery poles is indicated at the top of the battery. The positive pole is indicated by a "+" symbol and the negative poleis indicated by a "-" symbol.



Top view battery showing battery terminals - Side view two different battery models showing carry belt.

3.2. Download and install the ZRGP battery supervisor

The ZRGP battery supervisor App is needed to communicate with the battery. The app can run on an Android, iOS or macOS device.

◆Where to Download?

The app is available in three app stores: Apple App Store, Google App Store and Huawei App Store

◆How to Download?

Users can search for “ZRGP battery supervisor” in the app store to download it or scan the QR code below to download the app.

Apple APP StoreDownload

Huawei APP StoreDownload

ZRGP battery supervisor communicates with the battery via Bluetooth, for more information, please visit our website: http://www.zruipower.com.

3.3. How to connect the APP with battery

3.3.1 Note before connection

◆Make sure your phone's Bluetooth is on and not connected to any other devices.

◆Make sure the battery pack has A charge or discharge current greater than 1.5A. The Bluetooth communication conditions can be found in the ““Technical data” chapter”.

◆The phone or tablet should communicate with the battery pack no more than 5 meters away, and there should be no barriers between them.

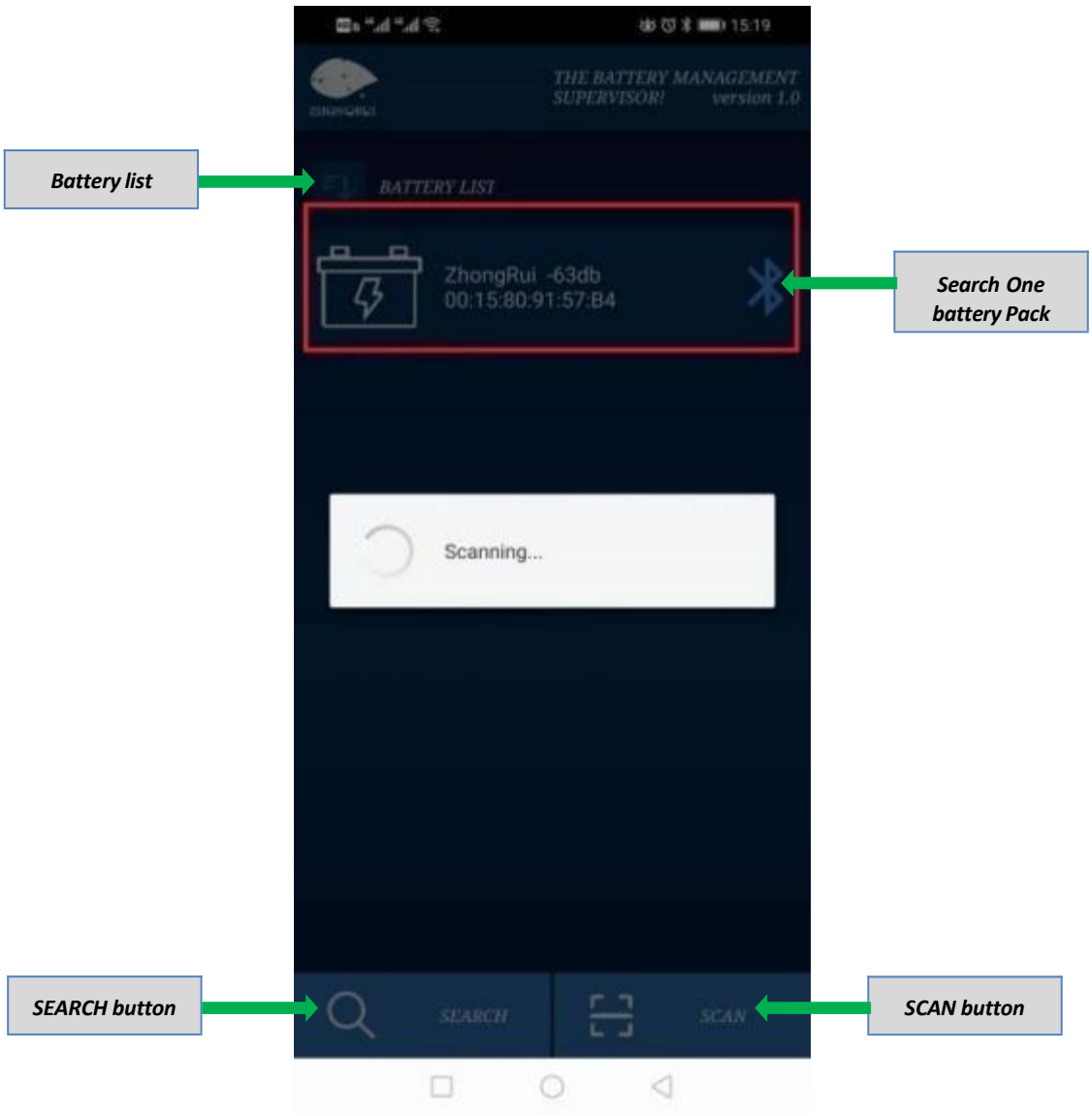
◆One mobile phone only can connect with one battery every time.

◆If you want to connect this battery with another mobile phone, please exit this program.

◆Some phones (tablet) cannot connect with any BLE devices since its hardware does not support BLE, irrelevant to the system version.

3.3.2 Connection battery

◆Open the software, click the "Search" button, and the APP will automatically Search for nearby battery packs and display them in the battery list. Users can click on the one to enter the monitoring page of that battery.



◆If the specified Bluetooth device has been found in the search process, the user can click the other area outside the searchbox to cancel the search process.

◆If no device is available after the search, click the search button at the bottom left of the phone to search the device again.

◆If no device is available after the search, click the search button at the bottom left of the phone to search the device again.

◆If you encounter a battery with a QR code, click the scan button at the bottom right of the phone to scan the QR code on the battery and enter the search device.

◆Click on the device name, and after a few seconds, if prompted "Socket Connect Success!", the connection will be successful, if prompted "Socket connect failed!", the connection will fail. After successfully connecting the device, it will directly enter the battery information page.

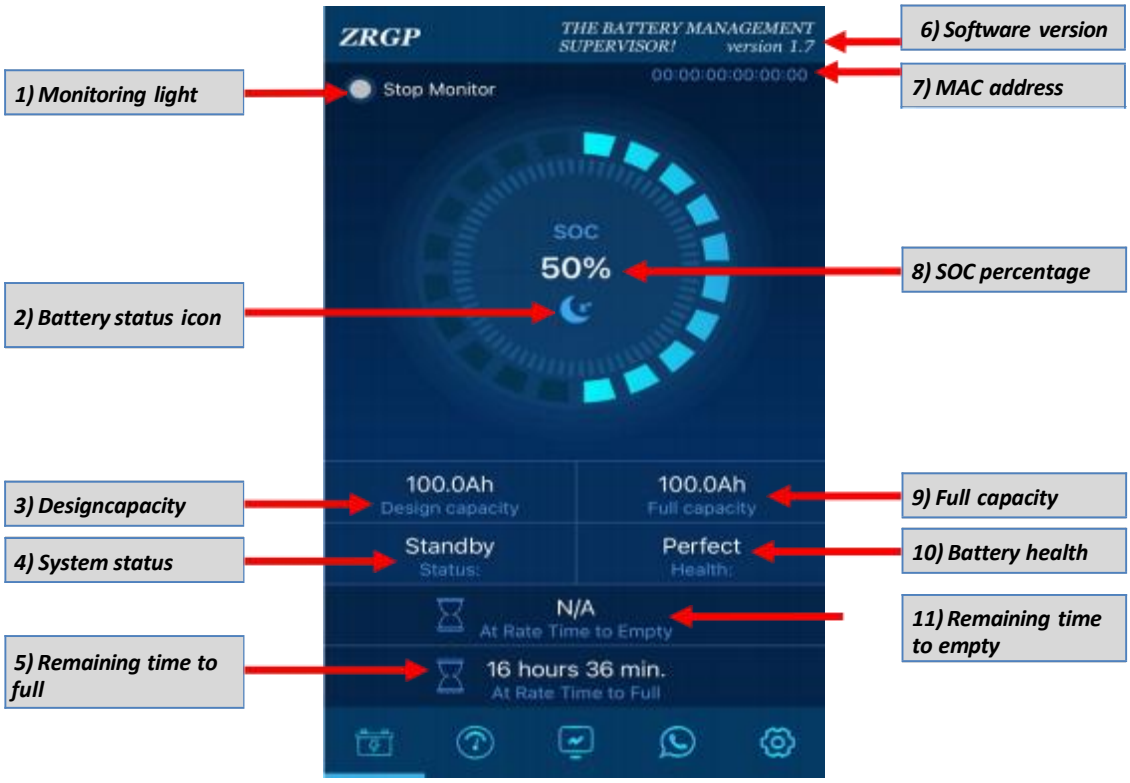
NOTE：

●Our factory Bluetooth battery has the name of "Zhong Rui", please connect the above name Bluetooth device while connection.

●Make sure your phone's Bluetooth is turned on before you search.

3.3.3 Monitoring interface

◆Battery Information Page



1) Monitoring light: When APP communicates with the battery, the monitoring light flashes; if APP disconnects with the battery, the light goes off.
2) Battery status icon: This icon " " is displayed when the battery is in the static state; this icon " " is displayed when the battery is in discharge state; this icon " " is displayed when the battery is in charge state;
3) Design capacity: Display the initial design capacity of the battery when it leaves the factory.
4) System status: Standby or Charging or Discharging.
5) Remaining time to full: When charging, tell the user the remaining time of charging, the calculation is based on the current full capacity minus the remaining capacity, and then divided by the current charging power.
6) Software version: The current version of the software.
7) MAC address: The MAC address of each Bluetooth is unique and is also the unique ID of the battery.
8) SOC percentage: Current remaining battery capacity divided by full charge capacity, when SOC < 15%, the energy bar is red; when 15%≤SOC < 60%, the energy bar is golden; when SOC≥60%, the energy bar is grass green.
9) Full capacity: The capacity of a battery that can be charged from empty to overcharge protection.
10) Battery health: Assess the health status of the battery: SOH < 20%, indicating Dying, indicating that the battery is about to be scrapped and needs to be replaced; 20%≤SOH < 75%, indicating Good, indicating Good; SOH≥75%, indicating Perfect, indicating Perfect.
11) Remaining time to empty: When discharging, tell the user the remaining time of discharging. The calculation is based on the current remaining charge of the battery divided by the discharge power.

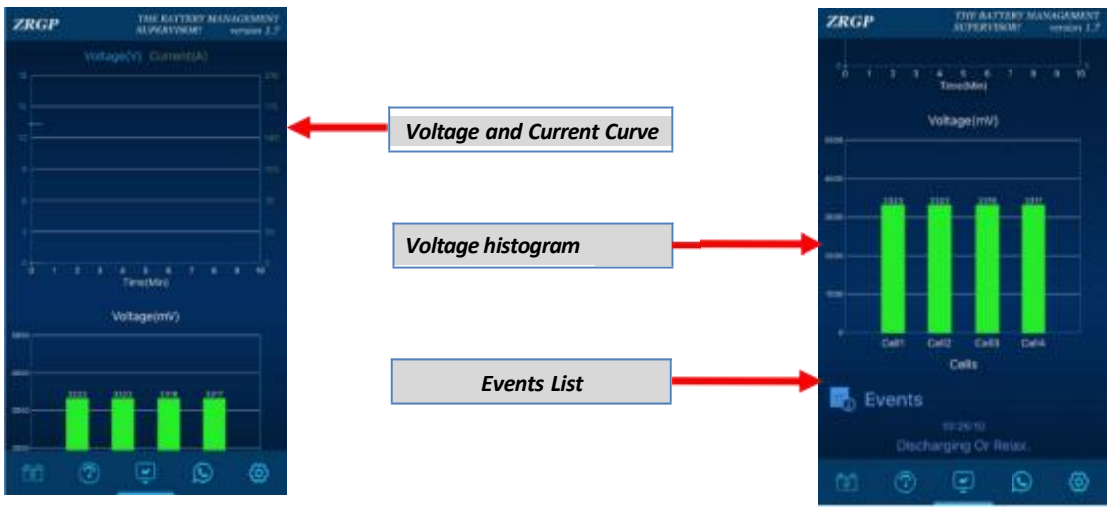
◆Dashboard Interface

Through the horizontal slide screen to achieve each Tab page switch. The full range of voltage instrument panel is 50V, and the full range of current instrument panel is 210A.No matter charging or discharging, the current dashboard pointer deflects clockwise to indicate the size of the charging or discharging current. The digital display of the current is positive to indicate the charging current and negative to indicate the discharging current. The temperature range is -20~75℃, and the number of cycles is 0~3000 times.

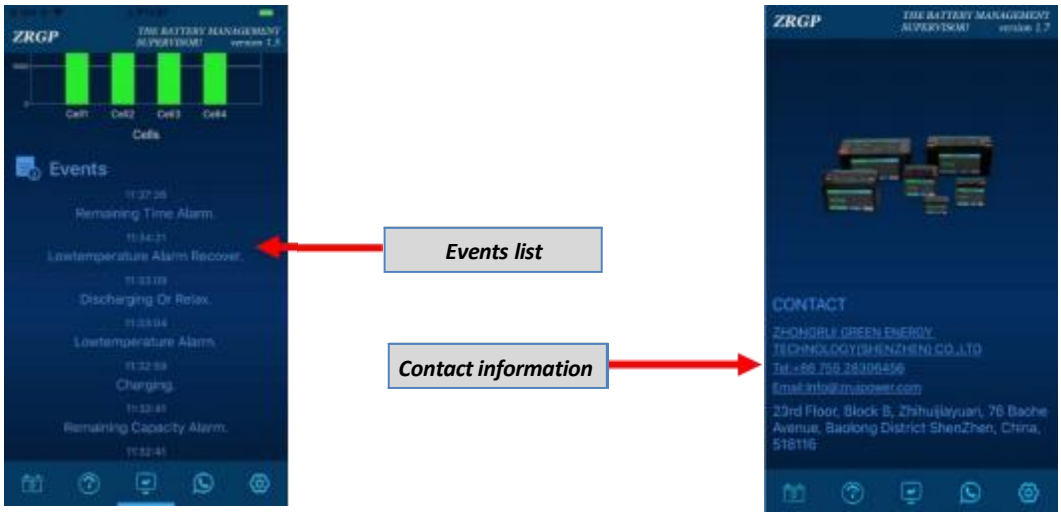
1) Total Voltage: The total voltage of the battery pack, refers to the voltage of four single cells in series.
2) Battery Temperature: Refers to the acquisition of the temperature of the cell surface.
3) Current: The charge or discharge current of a battery pack, charging current is shown as positive and discharging current as negative.
4) Cycle life: When the SOC is below 10% and the battery is recharged more than 90%, the cycle number is increased once.

◆Data Curve and Events

Dynamic drawing of voltage, current and time relationship curve, reflect the change of voltage, current state. At the same time, it has the function of operation recording. The range of the vertical axis of the voltage curve diagram is 0 ~ 50V, and the unit scale is 1MV.Vertical axis range of current curve: 0 ~ 210A, unit scale is 1A.



The APP can record a list of events that the battery pack is currently running, as shown below：



3.3.4 Contact Us

This interface has the company's address, telephone, email and other contact information.

3.3.5 Parameter Configuration

After entering this interface, it will automatically read the parameters once. In this interface, you can modify the system operating parameters and read the operating parameters. You need to enter a password to change the parameters. Please contact the manufacturer for the password.

3.4. Charge batteries before use

If multiple batteries are going to be connected in series or in series/parallel, each individual battery needs to be charged before all batteries are interconnected.

Background: batteries are approximately 50% charged when shipped from the factory. This is because of transportation safety requirements. Due to differences in transportation routes and warehousing the batteries do not all have the same state of charge by the time they are installed.

And as the system is only able to correct small differences in state of charge from one battery to another, a large imbal nce with newly installed batteries will not be corrected. Note that this type of imbalance, different state of charge between batteries, is different from imbalance of cells within a battery.

Charger or inverter/charger settings for initial charge with a BMS (same settings as for normal operation):

Recommended charger settings					
Battery model	Max. chargecurrent	ChargeProfile	Absorptionvoltage	Absorption time	Floatvoltage
12.8 V100Ah	100A	Lithium, fixed	14.4 V	2H	13.5 V
12 8V150Ah~12.8V300Ah	150A	Lithium, fixed	14.4 V	2H	13.5 V

3.5. Mounting

The battery needs to be mounted in an upright position. The battery needs to be located in a dry location.

Batteries are heavy. When moving the battery into its destined location, use suitable handling equipment for transportation.

Ensure adequate and secure mounting as the battery can become a projectile if involved in an accident.

Batteries produce a certain amount of heat when they are charged or discharged. Keep a 20mm space on each side of the battery for ventilation purposes.

3.6. Connect the battery poles

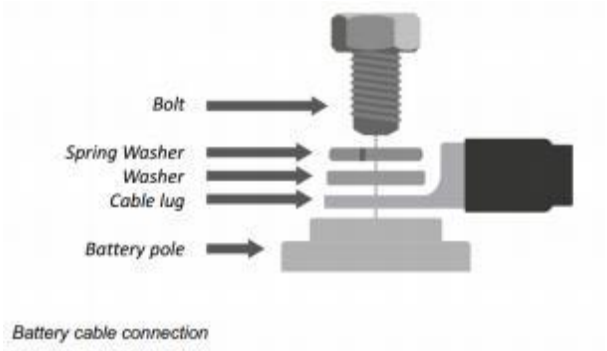
The positive pole is indicated by a "+" symbol and the negative pole is indicated by a "-"symbol.

Observe the battery polarity when connecting the battery poles to a DC system or to other batteries. Take care not to short circuit the battery poles.

Connect the cables; place the cable's cable lug on the battery pole, place the washer, place the spring washer and then insert and tighten the bolt.

When tightening the bolt, use the correct torque and use insulated tools that match the batteries spanner size.

Battery pole connections		
Battery model	Nut size	Torque moment
12.8 V100Ah	M8	10Nm
12.8V150Ah~12.8V300Ah	M8	14Nm



Battery cable connection

3.6.1 Cable cross sectional area

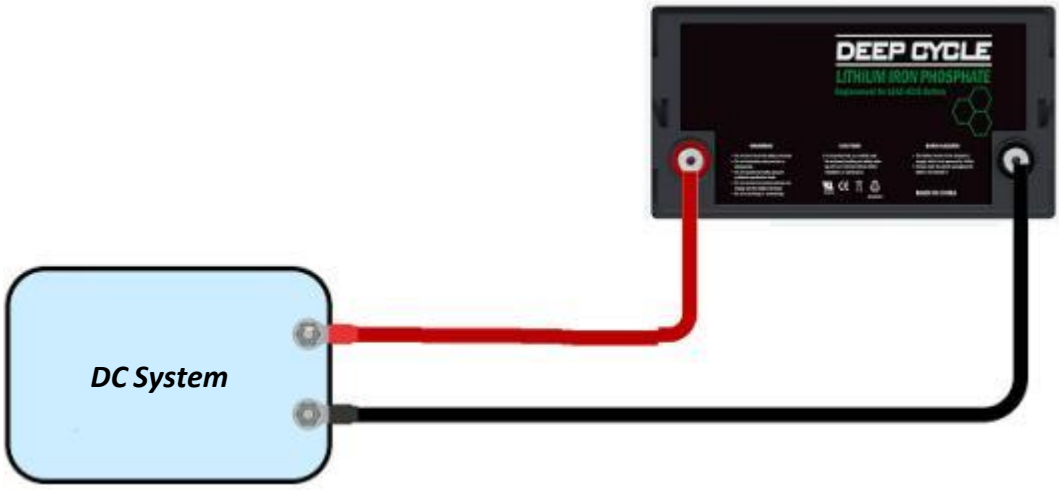
Use battery cables with a cross sectional area that matches the currents that can be expected in the battery system.

The battery maximum discharge rating is indicated in below table. The system current should not exceed this current rating.

Maximum current rating Smart Lithium batteries	
Battery model	Maximum current rating
12.8 V100Ah	100A
12.8V150Ah~12.8V300Ah	150A

3.6.2 Connecting a single battery

◆Single battery Connect the battery to the DC system.



3.6.3 Connecting multiple batteries in series

◆All batteries need to be the same model and age.

◆Each battery needs to have been fully charged individually.

◆Connect a maximum of four 12.8V batteries in series.

◆Connect the negative to the positive of the next battery.

◆Connect the battery bank to the system.

NOTE：

●If the batteries that need to be connected in series are notfully charged separately, the capacity of the battery after the series is equal to the capacity of the least of thefour batterypacks.

3.6.4 Connecting multiple batteries in parallel

◆All batteries need to be the same model and age.

◆Each battery needs to have been fully charged individually.

◆Connect a maximum of 4 batteries.

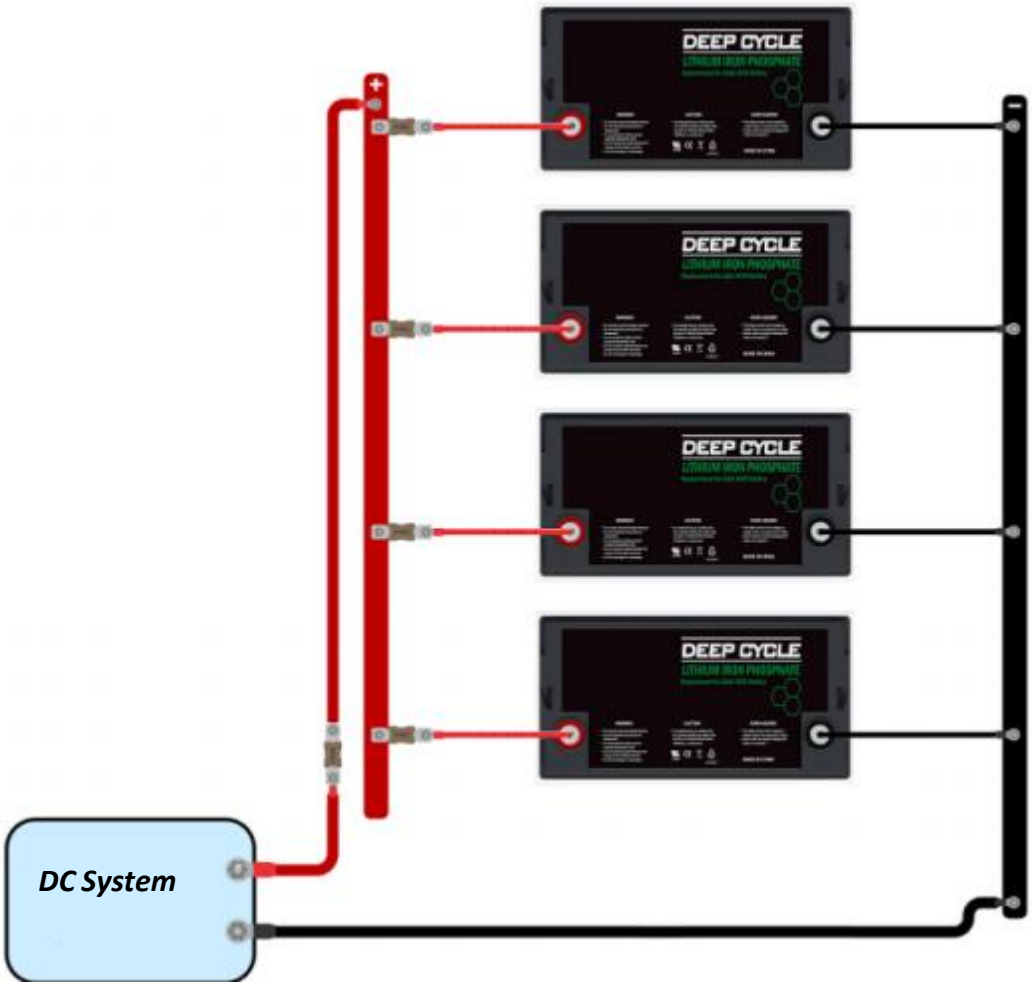
◆Connect the system cables diagonally to ensure an equal current path through each battery.

◆Take care that cross-sectional area of the system cable is equal to the cross-sectional area of the string cable times the number of strings.

◆Multiple batteries in parallel Connect the battery bank to the system.

NOTE：

●If the batteries that need to be connected in parallel are not fully charged separately, sparks can be generated in parallel and damage the BMS inside the battery pack.



4. Commissioning and Operation

4.1. Commissioning

Once all connections have been made, the system wiring needs to be checked, the system needs to be powered up. This is how to do this:

- Check polarity of all battery cables.
- Check cross sectional area of all battery cables.
- Check if all battery cable lugs have been crimped correctly.
- Check if all battery cable connections are tight (don't exceed maximum torque).
- Tug slightly on each battery cable and see if the connections are tight.
- Connect with ZRGP battery supervisor to each battery.
- Check if each battery has the same settings.
- Connect the system positive and negative DC cable to the battery (or battery bank).
- Check the string fuse(s) rating (if applicable).
- Place the string fuse(s) (if applicable).
- Check the main fuse rating (if applicable).
- Place the main fuse (if applicable).
- Check if all battery charge sources have been set to the correct charge settings.
- Turn on all battery chargers and all loads.

4.2. Operation

Once in operation, it is important to take proper care of the battery to maximize its lifetime. These are the basic guidelines:

- Prevent total battery discharge at all times.

◆If the BMS has disabled the loads, make sure that the batteries are recharged as soon as possible. Minimize the time the batteries spend in a far discharged state as much as possible.

◆The batteries need to spend at least 2 hours in absorption charge mode each month to ensure sufficient time in balancing mode.

◆When leaving the system unattended for some time, make sure to either keep the batteries charged during that time, or make sure the batteries are almost full and then disconnect the DC system from the battery.

5. Battery charging and discharging

This chapter describes the charging, discharging and cell balancing process in more detail for those who are interested in the technical background.

5.1. Charging

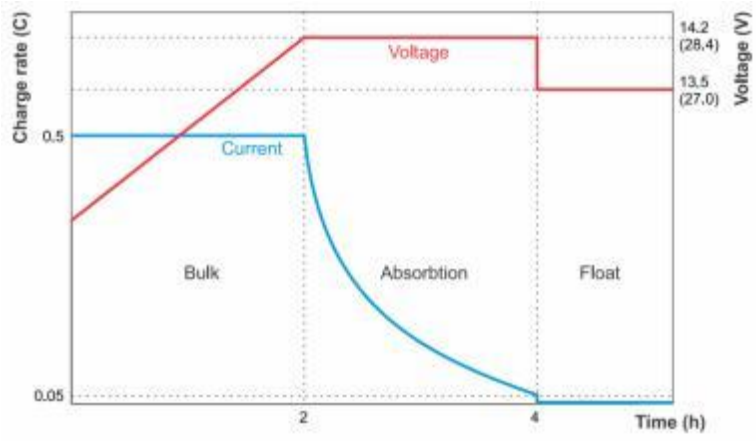
Lithium batteries are easier to charge than lead-acid batteries. The charge voltage may vary anywhere from 12.8V to 15.2V for a12.8V lithium battery, as long as no cell is subjected to more than 3.9V. Lithium batteries will become permanent damaged if they are over-charged. Should a cell reach 3.9V, impossible on a properly installed system, all charge into that cell will be dissipated as heat. We advise to keep the absorption charge voltage between 14V and 14.4V and the float voltage at 13.5V.

Because of the flexibility in charge voltages, up to 4 batteries can be connected in parallel without much problems. No damage will occur if there are small differences in individual battery voltages because of varying cable resistances or internal battery resistances.

Once the absorption stage has been finalized, the battery charger goes into float. We recommend setting the float voltage at13.5V.

The storage stage is not per se needed for a lithium battery, but if the charger has a storage mode, set the storage voltage at the same value as the float voltage.

We recommend a charge current of 0.5C. This means that if the battery is completely empty, it will take 2 hours to charge the battery. A charge rate of 0.5C for a 100Ah battery is 50A charge current. The maximum charge current is 1C,for a 100Ah battery this is 100A. This will charge the battery in one hour. But be aware that the batteries will produce more heat when high charge currents are used. More ventilation space is needed around the batteries and depending on the installation, hot air extraction or forced air cooling might be needed.



Lithium battery charge graph

The BMS will turn off all charge sources as soon as a battery cell voltage reaches 3.65V or if the battery temperature drops below 0°C or increases above 45°C.

5.2. Discharging

Nearly the whole available battery capacity can be used, with exception of the approximate last 3% of remaining capacity. Lithium batteries will become permanently damaged if they are discharged too deeply.

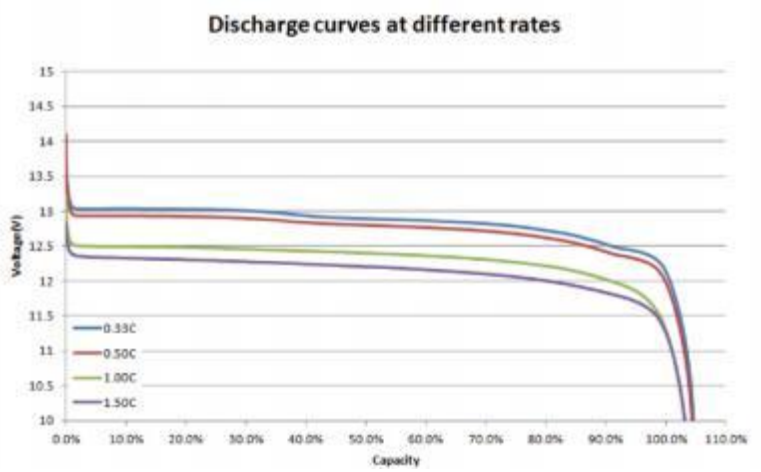
Lithium batteries can be discharged with high currents. The maximum discharge of the lithium battery is 1C. For a 100Ah battery this means a 100A discharge current. This current will discharge the battery in one hour. For a 100Ah battery this is a discharge current of 100A.

When using a higher discharge rate, the battery will produce more heat than when a low discharge rate is used. More ventilation space is needed around the batteries and depending on the installation, hot air extraction or forced

air cooling might be needed. Also, some cells might reach the low voltage threshold quicker than the other cells. This can be because of a combination of heat and ageing.

To be able to tell if a battery is too deeply discharged you will need to look at the individual cell voltages. As the battery is being discharged, the cell voltage drops. This is indicated in below discharge graph. When the battery is almost empty, the voltage will drop faster. This is the sign that the battery is almost empty. This happens at around a cell voltage of 2.0V to 3.3V. Further discharge needs to be prevented; otherwise the battery will get damaged. So as soon as one of the cells has reached this voltage the BMS will disable all DC loads.

The under-voltage shutdown threshold is configurable, if it is set to a higher voltage the reserve capacity is greater than if it is set at a lower voltage. It is set by default at 2.5V and the range is 2.0V to 3.3V.



Discharge graph showing cell voltage at various depths of discharge for different discharge rates.

The BMS will turn off all loads as soon as a battery cell voltage drops below the low voltage threshold.

6. Troubleshooting, storage, support and warranty

Consult this chapter in case of unexpected battery behavior or if you suspect a battery fault.

The troubleshooting and support process is to first consult the common battery issues as described in this chapter. Should this fail to resolve the issue, follow the advice in the technical support paragraph.

6.1. ZRGP battery supervisor issues

Cannot connect with the ZRGP battery supervisor App

It is highly unlikely that the Bluetooth interface in the battery is faulty. These are some pointers to try before seeking support:

◆Is the battery a Smart Lithium battery? The older non-Smart Lithium batteries do not support Bluetooth.

◆Is the battery voltage still high enough? The batteries Bluetooth module is turned off as a precaution as soon as one of the cells drop below undervoltage protection value of single cell (Factory default2.5V). When the charging current is greater than 1.5A, the Bluetooth module will be immediately awakened.

◆Is the battery rest for more than an hour after charging or discharging? If the battery is left standing for up to an hour, the BMS will force the Bluetooth module to shutdown and enter low-power mode. At this point, the user only needs to discharge or charge the battery more than 1.5A, which can wake up the Bluetooth module, and then connect with the APP.

◆Is there already another phone or tablet connected to the battery? Only one phone or tablet can be connected to the battery at any given time. Make sure no other devices are connected and try again.

◆Are you close enough to the battery? In open space the maximum distance is about 5 meters.

◆Does ZRGP battery supervisor App has an issue? Try to connect to another ZRGP product, does this work? If that also does not work, then there probably is an issue with the phone or tablet.

6.2. Battery issues

6.2.1 Cells out of balance

Imbalance between the cells reduces the usable capacity of a battery. It does not cause permanent battery life reduction. There are a number of reasons that can cause cell imbalance:

◆The battery is old and near its maximum cycle life.

◆The battery has been too far discharged and one or more cells in the battery have been damaged. This is not covered by warranty and also be aware that this might not be recoverable.

6.2.2 Less capacity than expected

If the battery capacity is less than its rated capacity these are the possible reasons for that:

◆The battery has a cell imbalance, causing premature low voltage alarms, which in turn cause the BMS to turn loads off. Please refer to paragraph “Charge battery before use”.

◆The battery is old and is near its maximum cycle life. Check how long the system has been in operation, check how many cycles the battery has gone through and to what average depth of discharge the battery has been discharged?

◆The battery bas been too far discharged and one or more cells in the battery are permanently

damaged. These bad cells will have a low cell voltage faster than the other cells and this will cause the BMS to turn loads of prematurely. Has the battery perhaps been through a very deep discharge event?

6.2.3 Battery very low terminal voltage

If the battery has been discharged too far, the voltage will fall well below 12V. If the battery has a voltage of less than 8V or if one of the battery cells has a cell voltage below 2V, the battery will have permanent damage. This will invalidate the warranty. The lower the battery or cell voltage is, the bigger the damage to the battery will be.

You can try to recover the battery by using the below low voltage recharge procedure. Be aware that this is not a guaranteed process, recovery might be unsuccessful and there is a realistic chance that the battery has permanent cell damage resulting in a moderate to severe capacity loss after the battery has been recovered.

Charge procedure for recovery after low voltage event:

This recovery charge procedure is performed on an individual battery. If the system contains multiple batteries, repeat this procedure for each individual battery.

This process can be risky. A supervisor must be present at all times.

◆Set a charger or power supply to 13.8V (27.6V).

◆In case any of the cell voltages is below 2.0V, charge the battery with 0.1A until the voltage of the lowest cell increases to 2.5V. A supervisor must monitor the battery and stop the charger as soon as the battery is getting hot or is bulging. If this is the case the battery is unrecoverable damaged.

◆Once the voltage of the lowest cell has increased above 2.5V, increase the charge current to 0.1C. For a 100Ah battery this is a charge current of 10A.

◆ Make note of the initial battery terminal voltage and battery cell voltages.

◆ Start the charger.

◆Make note of the voltages at regular intervals.

◆The cell voltages should increase during the first part of the charge process. If the voltage of any of the cells does not increase in the first half hour, consider the battery as unrecoverable and abort the charge procedure.

◆Check the battery temperature at regular intervals. If you see a sharp increase of temperature, consider the battery as unrecoverable and abort the charge procedure.

◆Once the battery has reached 13.8V increase the charge voltage to 14.2V and increase the charge current to 0.5C. For a 100Ah battery this is a charge current of 50A.

◆The cell voltages will increase more slowly, this is normal during the middle part of the charge process.

◆Leave the charger connected for 6 hours.

◆Check the cell voltages, they should all be within 0.1V of each other. If one or more cells has a much bigger voltage difference, consider the battery as damaged.

◆Let the battery rest for a few hours.

◆Check the voltage of the battery. It should comfortably sit above 12.8V like 13.2V or higher. And the cell voltages should still be within 0.1V of each other.

◆Let the battery rest for 24 hours.

◆Measure the voltages again. If the battery voltage is below 12.8V (25.6V) or if there is a noticeable cell imbalance, the battery is unrecoverable damaged.

6.2.4 Battery is close to end of cycle life

It is hard to tell what has happened to the battery. But there are a few ways to get around this. You can check the battery settings in ZRGP battery supervisor and check if the BMS is functional.

To check if the battery is close to its cycle life:

◆Find out how many charge-discharge cycles the battery has been subjected to? Battery lifetime is correlated to the number of cycles.

◆How deep has the battery been discharged on average? The battery will last for less cycles if deeply discharged, compared to more cycles if discharged less deep.

◆For more info on the life cycle see chapter: Technical data".

To check if the battery has been misused:

◆Is there mechanical damage to the battery, its terminals or the cables. Mechanical damage voids the warranty.

◆Has the battery been mounted upright? The battery can only be used in an upright position.

◆Check the "allowed to charge minimum temperature" setting in ZRGP battery supervisor? Also check if the battery temperature offset has not been set to an unrealistic value. Charging the battery below 0°C voids the warranty.

◆Is there an indication that the battery bas been totally discharged? Look at the battery monitor settings. Inspect the deepest discharge, minimum battery voltage and number of full discharges in the battery monitor. Total and very deep discharge voids the warranty.

◆Is there an indication the battery has been charged with too high voltage? Check the maximum battery voltage and the high voltage protection in the battery monitor.

6.3. Storage

◆ Batteries should be stored in the cool, dry, ventilated place, with about 30%-50% of capacity.

◆It is recommended to recharge the batteries once every six months to prevent over-discharge.

◆ Long periods of storage can deteriorate battery performance because of lack of use.

6.4. Technical support

For technical support contact the point of purchase. If the point of purchase is unknown, refer to the ZRGP Support web page: http://www.zruipower.com.

6.5. Warranty

This product has a 2-year limited warranty. This limited warranty covers defects in materials and workmanship in this product and lasts for two years from the date of original purchase of this product. To claim warranty the customer must return the product together with the receipt of purchase to the point of purchase.

This limited warranty does not cover damage, deterioration or malfunction resulting from alteration, modification, improper or unreasonable use or misuse, neglect, exposure to excess moisture, fire, improper packing, lightning, power surges, or other acts of nature.

This limited warranty does not cover damage, deterioration or malfunction resulting from repairs attempted by anyone unauthorized by ZRGP to make such repairs.

Non-compliance with the instructions in this manual will render the warranty void.

ZRGP is not liable for any consequential damages arising from the use of this product. The maximum liability of ZRGP under this limited warranty shall not exceed the actual purchase price of the product.

7. Technical data

Item		LFP 12007	LFP 12010	LFP 12020	LFP 12050	LFP 12100	LFP 12150	LFP 12200	LFP 12300	LFP 24100
Basic Parameter										
Cell Type		LiFePO4								
Combination Mode		/	/	/	1P4S	1P4S	/	2P4S	/	/
Nominal Capacity(Ah)		6.6	9.9	19.8	50	100	150	200	300	100
Discharge capacity		/	/	/	>65% nominal capacity	>65% nominal capacity	/	>65% nominal capacity	/	/
Rated Energy(Wh)		85	127	253	640	1280	1920	2560	3840	2560
Initial Internal Resistance(mΩ)		/	/	/	<75	<75	/	<75	/	/
Rated Voltage(V)		12.8								25.6
Charge Voltage(V)		14.2	14.2	14.2	14.4	14.4	14.2	14.4	14.2	28.4(Max.29.2)
Discharge Cut-off Voltage(V)		10	10	10	10.8	9.2	10	9.2	10	20
Open Circuit Voltage(V)		/	/	/	12.8~13.6	12.8~13.6	/	12.8~13.6	/	/
Standard Charge Current(A)		1.32	1.98	3.96	10	20	30	40	60	20
Max. Charge Current(A)		≤6.6	≤9.9	≤19.8	≤50	≤100	≤150	≤200	≤150	≤100
Standard Discharge Current(A)		6.6	4.8	9.6	25	50	75	100	100	50
Max. Discharge Current(A)		9.6	14.4	≤20	≤50	≤100	≤150	≤200	≤150	≤100
Charge Over Current Protection(A)		/	/	/	60	180±15	/	120±15	/	/
Discharge Over Current Protection_1(A)		/	/	/	60	110	/	210	/	/
Operating Temperature	Charge	0~55℃								
	Discharge	-20~55℃								
Operating Voltage(V)		10.0-14.6								20.0-29.2
Weight(kg)		0.8	1.1	3.5	8	13	18	25	33	23
Cycle Life(Times DOD>80%)		≥3500								
Physical Dimensions (mm)(L*W*H)		150*65 *94	150*65 *94	180*76 *168	223*134 *177	333*175.5 *223.7	483*170 *240	483.4*169. 9 *239.5	522*240 *218	483*170*240
Charger or inverter/charge settings										
Max.Charge Current(A)		≤6.6	≤9.9	≤19.8	≤50	≤100	≤150	≤150	≤150	≤100
Charge Profile		Lithium, fixed								
Absorption Voltage(V)		14.2								28.4
Absorption Time(h)		12								
Float Voltage(V)		13.5								27
Storage Voltage(V)		13.5								27

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