

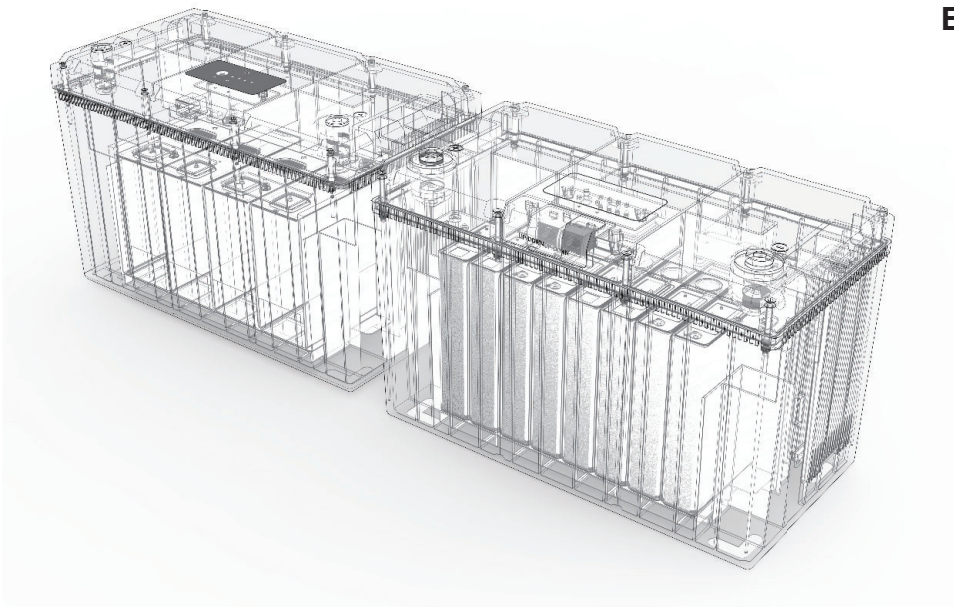
New Generation 12.8V Li-ionnBattery

User's Guide

Ended User Documentation

Rev 1.0

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WARNING:

Explosion, Electrocution, Or Fire Hazard

- A battery can present a risk of electric shock, burns from high short circuit current, fire, or explosion. Observe proper precautions.
- Ensure the cables are properly sized.
- Ensure clearance requirements are strictly enforced around the batteries.
- Ensure the area around the batteries is well ventilated and clean of debris.
- Ensure no heat source near the battery.
- Ensure the battery terminal screws are tightened, (M8 screw torque: 18 N.m).
- Always use insulated tools. Avoid dropping tools onto batteries or other electrical parts.
- Never charge a frozen battery unless optional heater parts inside.
- If a battery must be removed, always remove the grounded terminal from the battery first. Make sure all devices are disconnected.



IMPORTANT

- When installing batteries, leave adequate clearance between batteries.
- When replacing batteries, use the same number and type of batteries.
- Avoid any fall or collision during the installation process.
- Do not remove the battery components. The maintenance of the battery should be carried out by a professional engineer.
- Do not expose the Li-ion battery to heat in excess of 58°C during operation, 60°C in storage.
- Do not incinerate or expose to open flames.
- Do not connect over 4 sets Li-ion batteries in series. Wrong operation will damage the BMS.
- Before series connection, it's better to make sure fully charge or discharge single battery. The different SOC between batteries may cause the whole group to fail to charge and discharge normally (Reduce the usable capacity of the battery group).
- Before parallel connection, it's better to make sure the voltage difference less than 0.1V to avoid large current impact .
- Do not connect in series at the same time connect in parallel.

Ritar new generation 12.8V100Ah Li-ion battery is intended as a replacement for the common 12V100Ah lead acid battery and traditional case Li-ion battery. The new generation 12.8V100Ah Li-ion battery adopt removable enclosure and modular design which support to assembly in local.

The new generation 12.8V100Ah Li-ion battery adopt Iron Phosphate (LiFePO₄) cells and unique BMS to provide safety, high current and prominent long life performance, with 20 times longer cyclic life than SLA battery to save cost and energy, up to 70% lighter than SLA battery to save logistic cost. Diverse accessories which include Bluetooth modules, heater components, LED display units and communication ports.

This document is intended for use by anyone required to install and operate new generation 12.8V100Ah Li-ion batteries. Be sure to review this manual carefully to identify any potential safety risks before proceeding.

The owner must be familiar with all the features of this product before proceeding.

Failure to install or use this product as instructed can result in damage to the product that may not be covered under the limited warranty.

Ritar new generation 12.8V100Ah Li-ion battery include 3 different type:

R-LFP12.8V100Ah G1: IP65 waterproof,

- Optional parts: Built-in Bluetooth module.

R-LFP12.8V100Ah G2: IP65 waterproof, LED indicator (SOC, RUN, ALARM) and ON/OFF button.

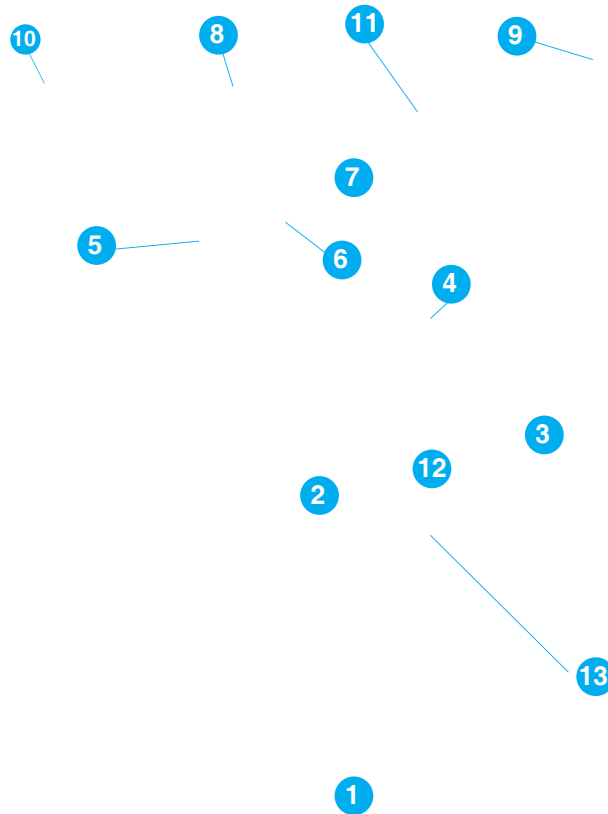
- Optional parts: Built-in Bluetooth module, Heater,

R-LFP12.8V100Ah G3: LED indicator (SOC, RUN, ALARM) and ON/OFF button. Communication port (RS485, CAN).

- Optional parts: Built-in Bluetooth module, Heater, External bluetooth module(RS485), External display module (RS485)



Explode Diagram



- | | |
|--|---|
| 1 Battery enclosure - ABS+PC | 8 Film -PC ,
No silkscreen for G1
SOC/RUN/ALM and ON/OFF for G2, G3 |
| 2 Prismatic LiFePO4 Cell
4000 cycles-3.2V104Ah, 1P4S | 9 Fixing screws, M3*25, |
| 3 BMS- 4S100A | 10 Battery Positive, Nickel plated brass
M8 internal thread |
| 4 Aluminub Bar -AL1060 | 11 Battery Negative, Nickel plated brass
M8 internal thread |
| 5 Communication Port (RS485, CAN),
Only for G3 | 12 EVA foam |
| 6 LED display board for G2, G3
Optional Built-in Bluetooth module for G1
G2,G3 | 13 Optional Heater Part for G2, G3 |
| 7 Battery cover- ABS+PC | |

Specification

Model	LFP12.8V100AH G1	LFP12.8V100AH G2	LFP12.8V100AH G3
Cell and Connection	CB56-104Ah, 1P4S		
Nominal Voltage [V]	12.8		
Nominal Capacity [Ah]	100		
Total Energy [Wh]	1280		
Max. Charging Current [A]	100		
Recommended Charging Current [A]	50		
Charging Voltage [V]	14.2~14.6		
Max. Discharging Current [A]	100		
End of Discharge Voltage [V]	11.2		
Operating Temperature Range	Charge: 0 ~ +50°C; Discharge: -20 ~ +55°C	Charge: 0 ~ +50°C; Discharge: -20 ~ +55°C With Heater: Charge/Discharge -20~+55°C	
Protection	Over charge, Over discharge, Over temperature, Low Temperature, Over Current, Short circuit		
Cycle Life	>3000 cycles		
Designed Calendar Life	10 Years		
Communication Port	/		RS485; CAN
LED Indicator and Button	/、	SOC, ALM, RUN, ON/OFF	
Dimension (W*D*H, mm)	330*172*214		
Weight [Kg]	10.5		
Operation Humidity	0~95% RH (No condensing)		
IP Class	IP65	IP30	
Parallel Support	Yes, Max, 4Sets		
Series Support	Yes, Max. 4 Sets		
Certification-Cell	UN38.3; ROHS; IEC62619; UL1973; UL9540A		
Certification-Battery	UN38.3; MSDS; CE		
Optional Parts	Internal Bluetooth Module		Internal Bluetooth Module
		Internal Bluetooth Module	Heater
			External Bluetooth Module
		Heater	External Display Module
			RS485-USB Device

BMS Information

Model	LFP12.8V100AH G1	LFP12.8V100AH G2	LFP12.8V100AH G3
Over-Charge Alarm & Protection /Over-Discharge Alarm & Protection			
Over-Charge Alarm	3.55V (For cell) 14.0V (For pack)		
Over-Charge Protection	3.7V (For cell) 14.8V (For pack)		
Over-Charge Protection Delay	1000 ms		
Over-Charge Release	3.45V (For cell) 13.8V (For pack)		
Over-Discharge Alarm	2.8V (For cell) 11.2V (For pack)		
Over-Discharge Protection	2.5V (For cell) 10V (For pack)		
Over-Discharge Protection Delay	1000 ms		
Over-Discharge Release	2.8V (For cell) 11.2V (For pack)		
Over Current Alarm & Protection			
Charge Over Current Alarm	60A		
Charge Over Current Protection	110A		
Charge Over-Current Protection Delay	15S		
Charge Over Current Protection Release	Automatic release after 1min and up to 3 times or Discharge		
Discharge Over Current Alarm	110A		
Discharge Over Current Protection-1	115A		
Discharge Over Current Protection-1 Delay	15S		
Discharge Over Current Protection-2	120A		
Discharge Over Current Protection-2 Delay	200ms		
Discharge Over Current Protection Release	Automatic release after 1min and up to 3 times or Charge		
Over Temperature Alarm & Protection			
Charge Low Temperature Alarm	7°C		
Charge Low Temperature Protection	0°C		
Charge Low Temperature Protection Release	5°C		
Charge High Temperature Alarm	50°C		
Charge High Temperature Protection	55°C		
Charge High Temperature ProtectionRelease	45°C		
Discharge Low Temperature Alarm	-10°C		
Discharge Low Temperature Protection	-20°C		
Discharge Low Temperature Protection Release	-17°C		
Discharge High Temperature Alarm	55°C		
Discharge High Temperature Protection	60°C		
Discharge High Temperature Protection Release	50°C		
Short Circuit Protection			
Short Current Protection Delay Time	1500 uS		
Short Current Release Method	Release load		
Heater Control (Optional)			
Heater ON	/	Cell temperature < 0°C and charger	
Heater OFF	/	Cell temperature >10°C	

Storage

The 12.8V100Ah Li-ion battery can be stored in an environment with temperatures between -20°C and +55°C and between 10% and 90% relative humidity, non-condensing.

For long storage periods at 25°C, charge the battery every half years.

For temperatures above 40°C, charge the battery quarterly.

Do not store the Li-ion battery at temperatures above 60°C.

Relationship Between Charge Limits and Temperature

Due to the chemistry of Lithium Ion cells, the cells cannot accept as much charge current at lower temperatures without risking permanent loss of capacity. As the cells' temperature rises during the charging process, they can gradually accept higher currents.

To maintain optimum performance and durability of Li-ion battery, the following charge limits based on ambient temperature is recommended.

Temperature (°C)	Max Charge Current
-20	Prohibit charging
-10	Prohibit charging
0	0.1C
10	Recommended charge current
20	Max continuous charge current
35	Recommended charge current
45	0.2C
>55	Prohibit charging

Table 1 Charge rate by temperature

Series Strings

The batteries can be combined together in series strings to achieve higher operating voltages by connecting the positive terminal of one battery to the negative terminal of the next battery. The maximum number of 12.8V Li-ion battery that you can connect in a series is four (4). Below figure 2 illustrates four 12.8V Li-ion batteries connected in series, for a 4S1P configuration.



4pcs 12.8v100ah in series

Figure 2. Connecting Batteries in Series (4S1P Configuration)

Two batteries in series: $2 \times 12.8\text{V} = 25.6\text{V}$ (nominal) for 24V applications

Three batteries in series: $3 \times 12.8\text{V} = 38.4\text{V}$ (nominal) for 36V applications

Four batteries in series: $4 \times 12.8\text{V} = 51.2\text{V}$ (nominal) for 48V applications



CAUTION

- Failure to follow the following safety instructions may result in personal injuries or damage to the equipment!
- Do not connect more than four batteries in series. Connecting more than four batteries in series exceeds the voltage limit of the BMS.
- Do not short circuit the Li-ion battery
- Do not connect different batches, different types, old and new batteries in series.
- Ensure the batteries consistency before connecting in series.
- For series connection, if one of batteries is charged fully (100% SOC), the other batteries will not be charged anymore, this may casue some batteris SOC won't show 100%, it don't effect the performance of battery.

Parallel Strings

You can combine batteries together in parallel strings to achieve higher operating energy by connecting like-polarity terminals of adjacent batteries. To combine batteries in parallel strings, connect all like-polarity wires on adjacent batteries to an appropriately sized terminal block for your application.

Refer to Figure 3 for an example of four 12.8V Li-ion batteries connected together in a 4P configuration. The maximum number of 12V series strings that you can connect in parallel is four.



4pcs x 12.8v100ah in Parallel

Figure 3 Example of a 4S2P Configuration



CAUTION

- Do not connect different batches, different types, old and new batteries in parallel.
- Ensure the battery voltage difference is below 100mV before parallel connection to avoid high pulse current.
- Ensure every battery have 3A charge/discharge current.
- **The parallel application can only extend the working time, and cannot increase the charging or discharging current.**

Charging Batteries

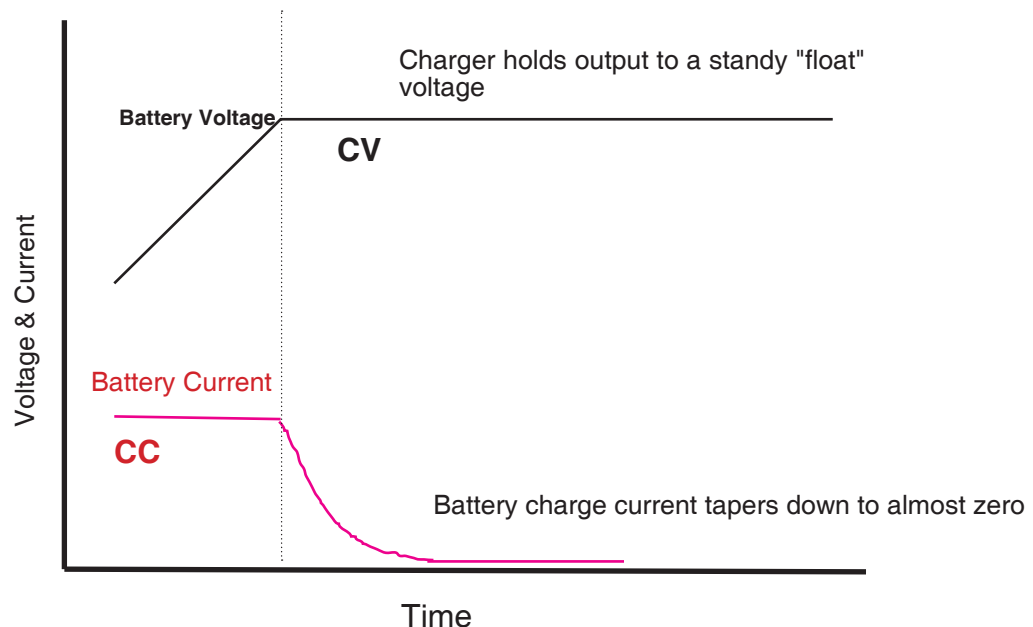
The 12.8V Li-ion is compatible with common 12V Lead-acid battery chargers.

Chargers that require the detection of voltage at the battery terminals to charge may fail to wake the Li-ion battery from a state of under-voltage protection. Constant Voltage (CV) chargers may result in an inrush of current due to the low impedance of the cells, interrupting the charge. Reset the charger and continue charging normally if the charger trips.

The constant current (CC) chargers is recommended strongly.

To charge a single 12.8V battery, the maximum charge voltage is 14.6V and the maximum charge current is refer to Table 1. Any inrush current may cause over current or short circuit protection.

Once you reach end-of-charge voltage, apply a constant voltage hold at this voltage until the current decays to almost zero. This charges the cells to 100% state of charge (SOC). Refer to below figure for an illustration.



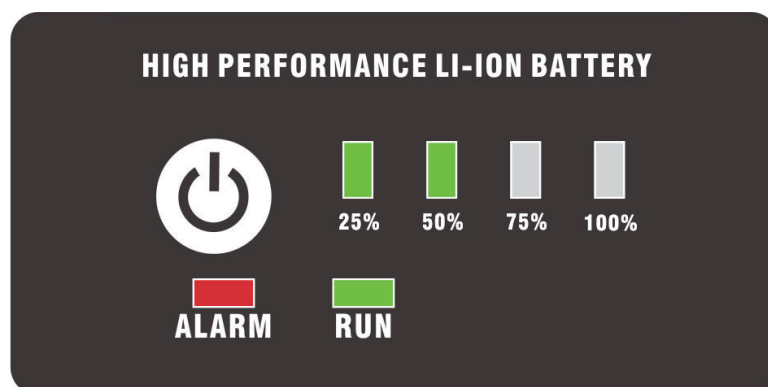
Battery voltage and current during recharge

Week up or Switch Off

For 12.8V100Ah Li-ion battery, if there are no charge or discharge for 24 hours, the battery will enter into sleep mode to save energy and it can still be measured a OCV ($>10V$), any charge or discharge operation will active the battery.

If the battery was over-dicharged protection, the BMS will enter into sleep mode after 5 min. there are no OCV at this status. only charge operation can active the battery.

For G2 and G3 series. it can also support to press ON/OFF button 6 seconds to active or switch off a battery.



LED Indicator for G2 & G3

Status	Nominal Warning Protection	RUN 	ALM 	SOC    				Description
Shut down	Dormancy	OFF	OFF	OFF	OFF	OFF	OFF	
Standby	Nominal	Flash 1	OFF	Follow module capacity				Standby
	Warning	Flash 1	Flash 3					Module at low voltage
Charge	Nominal	ON	OFF	Follow module capacity				
	Warning	ON	Flash 3					
	Over-charge Protection	ON	OFF	ON	ON	ON	ON	LED turn to standby if no power supply
	Temperature, over-current, Failure protection	OFF	OFF	OFF	OFF	OFF	OFF	Stop charging
Discharge	Nominal	ON	OFF	Follow module capacity				
	Warning	ON	Flash 3					
	Under voltage Protection	OFF	OFF	OFF	OFF	OFF	OFF	Stop discharging
	Temperature, over-current, short circuit, failure protection	OFF	ON	OFF	OFF	OFF	OFF	Stop discharging
Failure		OFF	ON	OFF	OFF	OFF	OFF	Stop charging and discharging

Note:

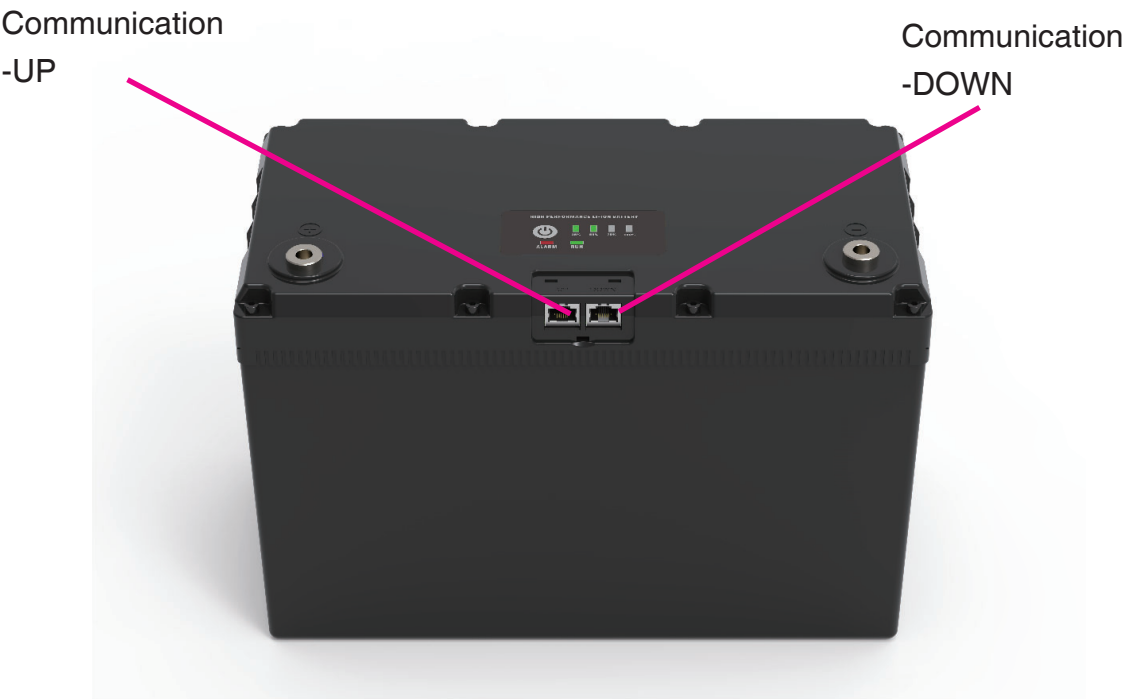
Flash 1: light 0.25s/off 3.75s

Flash 2: light 0.5s/ off 0.5s

Flash 3: light 0.5s / off 1.5s

Communication for G3

This chapter mainly introduce the communication function for R-LFP12.8V100Ah G3.



UP	
PIN	Description
1	LED -
2	O/F/LED+
3	O/F
4	CAN H
5	CAN L
6	COMG
7	RS485-A
8	RS485-B

DOWN	
PIN	Description
1	/
2	SWB
3	SWA
4	CAN H
5	CAN L
6	COMG
7	RS485-A
8	RS485-B

the battery BMS default ADD is 0, if there are 2 or more batteries connect in series or parallel.

It needs change BMS ADD by following steps:

Step 1: Ensure all batteries are on sleep mode. Measure every battery open circuit voltage ($>10V$).

Step 2: Connect power cable for series or parallel.

Step 3: Connect communication cable between batteries.

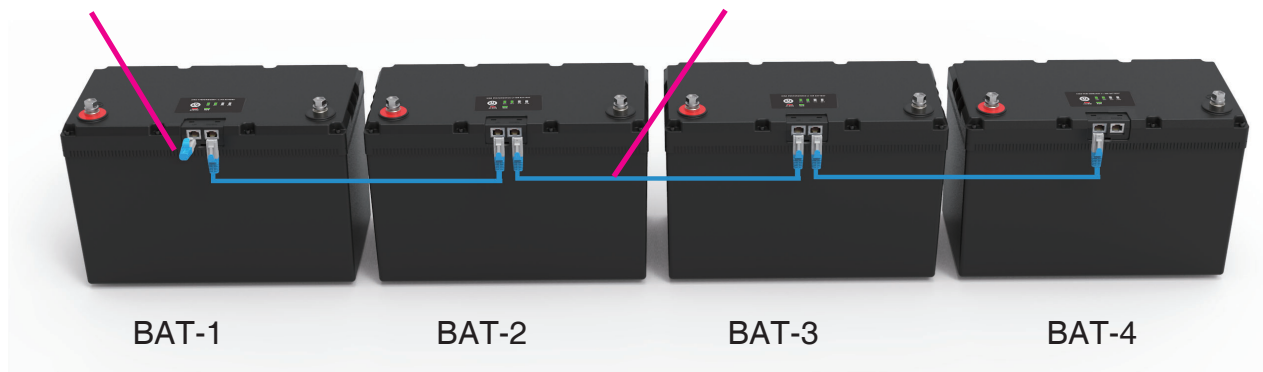
Step 4: Active all batteries by press ON/OFF button 6s, the battery SOC indicator will on.

Step 5: Insert BMS coding accessories to BAT-1 UP port. the BAT-1 RUN & ALARM LED will start to flash, and then BAT-1 and BAT-2 RUN & ALARM LED will flash, finally, all LED indicator will become normal which means the BMS ADD coding process is complete.

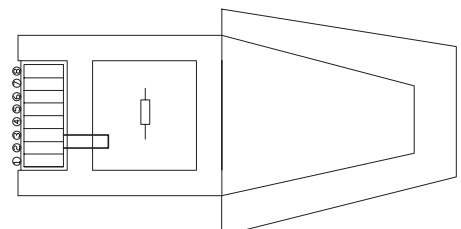
Step 6: Remove BMS coding accessories and connect RS485-USB cable to PC, it can monitor every battery information by BMS PC software.

BMS coding accessories

Communication cable between batteries



BMS coding accessories



Communication cable

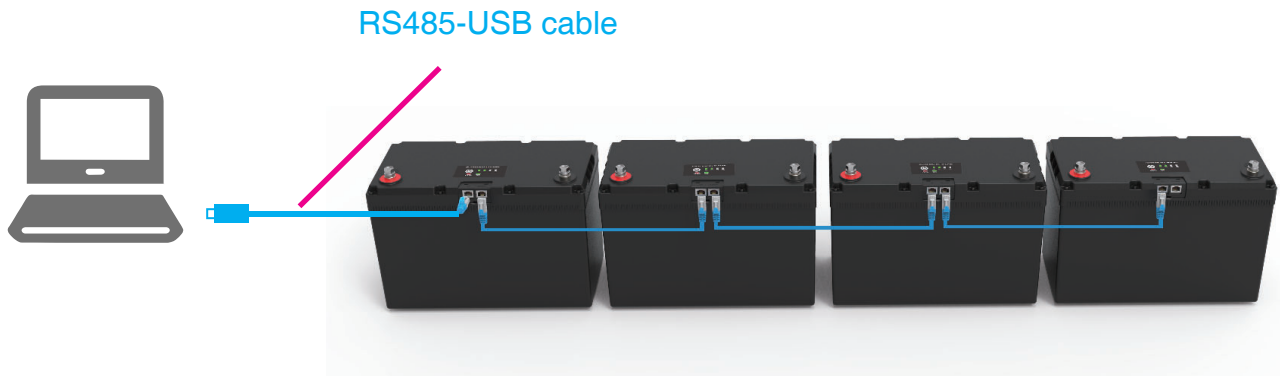
The communication cable between Battery and Victron inverter is Customization required,

Cannot be used standard network cable.

BMS PC software operation

This chapter mainly introduce the BMS PC software operation for R-LFP12.8V100Ah G3.

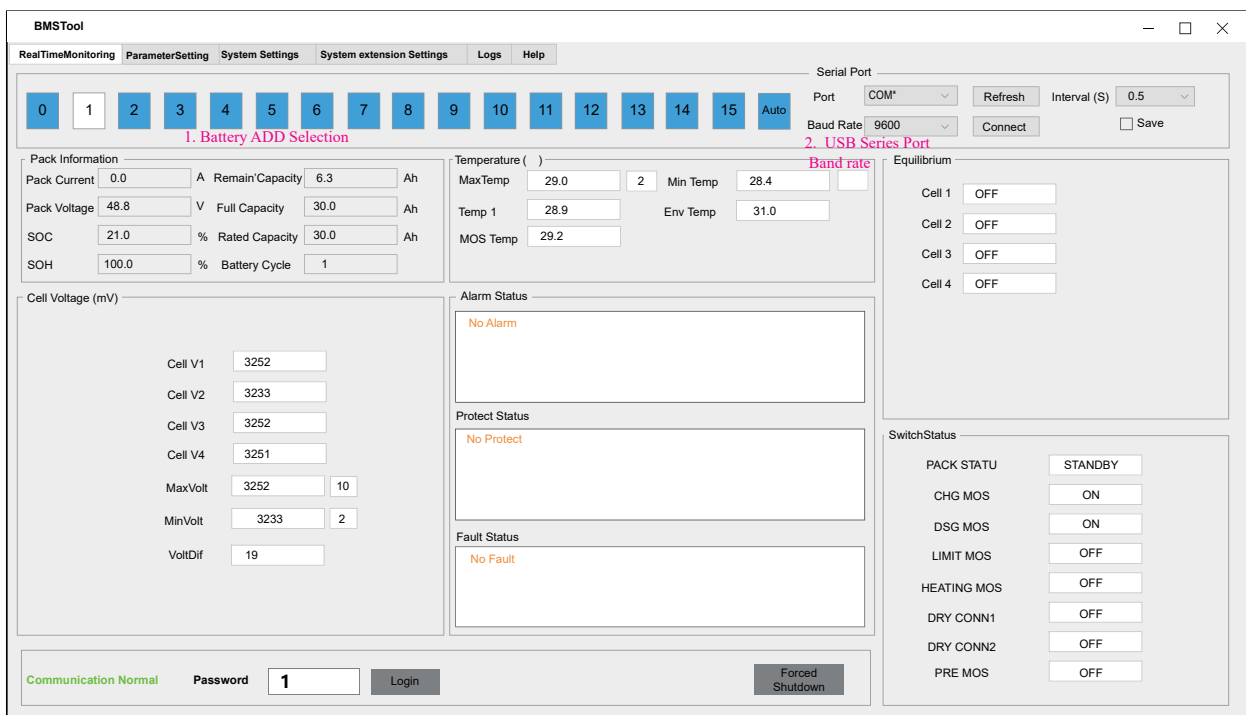
BMS PC software download: http://120.27.63.138:8181/attach_files/new_vrla_replacement/5



Double click BMSTools.exe to open the software.

Check the battery ADD, USB series Port and band rate-9600, click “connect”.

If the communication is normal, the battery realtime information will be listed.



Click “ Read”, the BMS default parameter will be list. any modify about BMS parameters should be carried out by a professional engineer.

Wrong parameters setting will cause the damage about BMS or battery.

The screenshot displays the BMSTool software interface, which is used for configuring BMS parameters. The interface includes a menu bar with options: RealTimeMonitoring, ParameterSetting, System Settings, System extension Settings, Logs, and Help. Below the menu bar, there are several buttons: Clear, Deselect All, Write, Stop, Read, Clear, and Restore. The main area is divided into multiple sections, each containing a set of parameters with checkboxes and input fields. The sections are: Pack OV Alarm Protect, Cell OV Alarm Protect, Pack UV Alarm Protect, Cell UV Alarm Protect, CHG OC Alarm Protect, CHG OT Alarm Protect, DSG OT Alarm Protect, CHG UT Alarm Protect, DSG OC Alarm Protect, DHG UT Alarm Protect, MOS OT Alarm Protect, ENV OT Alarm Protect, ENV UT Alarm Protect, Balance Threshold (mV), Sleep Vcell (V), Delay Time (s), SCP Delay Time (uS), and SOC Low Alarm (%). The status bar at the bottom shows the date and time: 2021-12-22 09:09:10.

Section	Parameter	Value
Pack OV Alarm Protect	Pack OV Alarm (V)	
	Pack OV Protect (V)	
	Pack OVP Release (V)	
	Pack OVP Delay Time (mS)	
Cell OV Alarm Protect	Cell OV Alarm (V)	
	Cell OV Protect (V)	
	Cell OVP Release (V)	
	Cell OVP Delay Time (mS)	
Pack UV Alarm Protect	Pack UV Alarm (V)	
	Pack UV Protect (V)	
	Pack UVP Release (V)	
	Pack UVP Delay Time (mS)	
Cell UV Alarm Protect	Cell UV Alarm (V)	
	Cell UV Protect (V)	
	Cell UVP Release (V)	
	Cell UVP Delay Time (mS)	
CHG OC Alarm Protect	CHG OC Alarm (A)	
	CHG OC Protect (A)	
	CHG OC Delay Time (mS)	
CHG OT Alarm Protect	CHG OT Alarm ()	
	CHG OT Protect ()	
	CHG OTP Release ()	
DSG OT Alarm Protect	DSG OT Alarm ()	
	DSG OT Protect ()	
	DSG OTP Release ()	
CHG UT Alarm Protect	CHG UT Alarm ()	
	CHG UT Protect ()	
	CHG UTP Release ()	
DSG OC Alarm Protect	DSG OC Alarm (A)	
	DSG OC 1 Protect (A)	
	DSG OC 1 Delay Time (mS)	
	DSG OC 2 Protect (A)	
DHG UT Alarm Protect	DHG UT Alarm ()	
	DHG UT Protect ()	
	DHG UTP Release ()	
	MOS OT Alarm Protect	MOS OT Alarm ()
MOS OT Protect ()		
MOS OTP Release ()		
ENV OT Alarm Protect	ENV OT Alarm ()	
	ENV OT Protect ()	
	ENV OTP Release ()	
ENV UT Alarm Protect	ENV UT Alarm ()	
	ENV UT Protect ()	
	ENV UTP Release ()	
Balance Threshold (mV)	Balance Threshold (mV)	
	Balance ΔVcell (mV)	
Sleep Vcell (V)	Sleep Vcell (V)	
	Delay Time (s)	
	SCP Delay Time (uS)	
	SOC Low Alarm (%)	

Bluetooth battery APP introduction

This chapter manily introduce the bluetooth battery APP.

The end user can download APP by searching " Bluetooth Li"

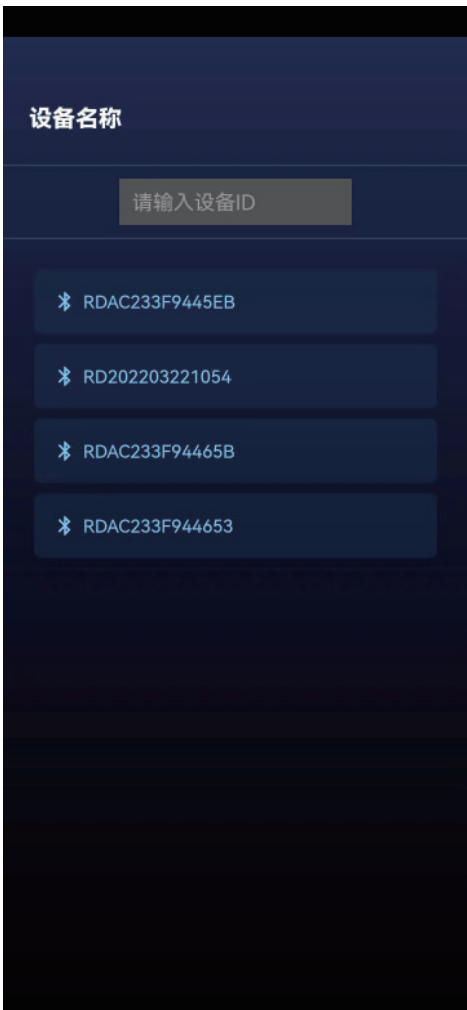
the download link refer to below:



IOS App Store Link



Google Play Link



Bluetooth ID

State of charge

Battery Voltage

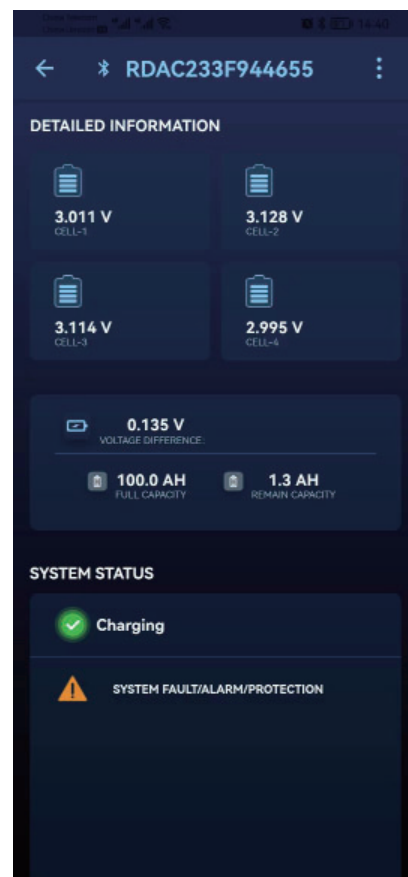
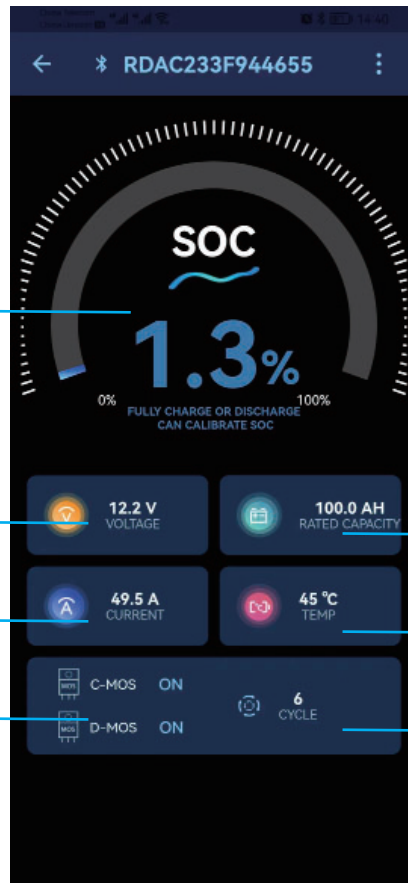
Battery Current

Charge is positive,
Discharge is negative

Battery Rated
Capacity

Battery
Temperature

Cycle times



Troubleshooting

The 12.8V Li-ion batteries are extremely reliable batteries that provide greater useful life than comparable 12V lead-acid batteries. Despite the high reliability of the 12.8V Li-ion batteries, you may encounter situations where the battery does not operate as expected. These situations are typically the result of misuse, abuse or a non-optimal operating or storage environment. This part details potential issues you may encounter with the 12.8V Li-ion batteries and the appropriate troubleshooting procedures.

Charger Trips using Constant Voltage

Problem:

CV charger trips when charging the batteries. This is due to the low impedance of the battery creating a current inrush.

Solution:

Reset the charger and try again.

Terminal Voltage Absent or Low

Problem:

Using a multimeter to check terminal voltage shows the terminal voltage is low ($<10V$).

Possible causes for this problem are:

The voltage of a cell within the battery dropped below 2.5 V, causing the microprocessor to enable low-voltage protection.

The battery's SOC dropped below 5% from either an extended idle period or heavy use, enabling under-voltage protection.

The battery overheated ($>60^{\circ}C$), causing the microprocessor to enable over-temperature protection.

Solution:

To resolve situations where terminal voltage is absent or low:

1. Allow the battery to cool and then recheck terminal voltage.
2. Connect the battery to a charger to wake the battery and recover terminal voltage.
($\leq 30V$ PV panel can be used to active a deep discharge battery.)
(A 12V VRLA battery can also be used to active a deep discharge battery.)
3. If the cells pack voltage is below 7V, the BMS will not be activated anymore. So it needs to be charged in time after deep discharge.

Battery Current Disappears when Charging

Problem:

Battery current disappears when charging. Possible causes for this problem are:

The battery overheated, enabling over-temperature protection.

Charger voltage is too high.

Solution:

To resolve situations where current disappears when charging:

1.Allow the battery to cool.

2.Reduce charger voltage to 14.2~.14.6 V.