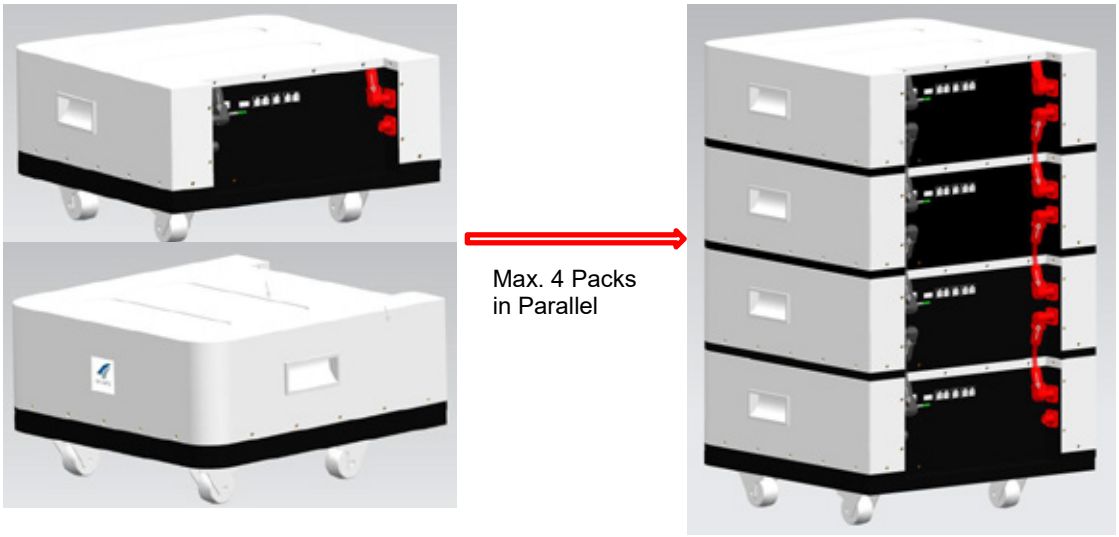
Stackable Battery Pack Storage for Home Use

G51100ST

User Manual



Abstracts of documents being modified				
Date	**Version**	**Description of the modifying**	**Drafted by**	**Approved by**
2023.1.5	1.0	First version		

Legal Notice

-Please keep this manual for future reference;

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-This document complies with related environmental protection and safety design requirements;

-The products described in this document should be used in accordance with the product manuals, contracts, laws and regulations;

-Products are subject to technical update without prior notice.

Safety Statement

Please read all instructions and precautions in the manual carefully before installation and use.

 *Warning*

- Please do not put the battery into water or fire, in case of explosion or any other situation that might endanger your life;
- Please connect wires properly while installing the battery, do not reverse connect. To avoid short circuit, please do not connect positive and negative poles with conductor;
- Please do not stab, hit, trample or strike the battery in any other way;
- Please disconnect air switch before installation or termination of the lithium-ion battery pack;
- Please use dry powder extinguisher to put out the flame when encountering a fire hazard, liquid extinguisher could result in the risk of secondary disaster;
- For your safety, please do not arbitrarily dismantle any component in any circumstances unless a specialist or an authorized one from our company, device breakdown due to improper operation will not be covered under warranty;
- Any conditions without our consent, lithium-ion battery pack failure caused by improper operation is not in the scope of the warranty.

 *Caution*

- We have strict inspection to ensure the quality when products are released from our factory, however, please contact us if case bulging or another abnormal phenomenon;
- For your safety, device shall be ground connected properly before normal use;
- Please do not mixed-use batteries from different manufacturers, different types and models, as well as old and new together;
- Ambient and storage temperature could impact the life span and product reliability, please consider the operation environment abundantly to make sure device works in proper condition;
- For lithium-ion battery storage term of more than 6 months, a standard charge & discharge shall be made once every three months, and the amount of electric charge shall be about 60% of rated capacity.

Contents

1. Overview

1.1 Brief Intro

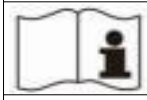
The G51100ST lithium battery pack is a standard battery system unit. Customers can select a certain number of G51100ST lithium battery packs based on their requirements and connect them in parallel to form larger battery storage capacity to meet their long-term power supply requirements. The product is suitable for high operating temperature, limited installation space, long backup time, and long service life.

1.2 Features

The G51100ST energy storage system is made of lithium iron phosphate batteries which are effectively managed by BMS.

Its good performance and features are as following:

- Comply with IEC62619 and UN38.3, employ non-toxic, non-pollution environment-friendly lithium battery;
- Cathode materials are lithium iron phosphate ($LiFePO_4$), safer with longer life span;
- With battery management system for better performance, possesses protection function like over-discharge, over-charge, over-current, abnormal temperature;
- Self-management on charging-discharging by passive balancing function;
- Intelligent design configures integrated inspection module, with 2 remote functions (remote-measuring & remote-communicating);
- Flexible configurations allow parallel of Max. 4 batteries for longer standby time;
- Natural cooling, low noise;
- Less battery self-discharge, support continuous storage for up to 6 months;
- No memory effect so that battery can be charged and discharged shallowly;
- With wide range of temperature for working environment, -10℃ ~ +55 ℃, circulation span and discharging performance are well under high temperature;
- Small volume in light weight.

	Battery voltage is higher than safe voltage. Do not touch the + and - terminals at the same time to avoid a risk of electric shock
	Beware of the danger of lithium batteries
	Read the Manual carefully before use
	The scrapped battery cannot be put into the garbage can and must be professionally recycled
	Discarded lithium batteries can be recycled after evaluation by professional companies
	In line with European standards for use
	A dangerous label is affixed to the battery surface

2 Specification

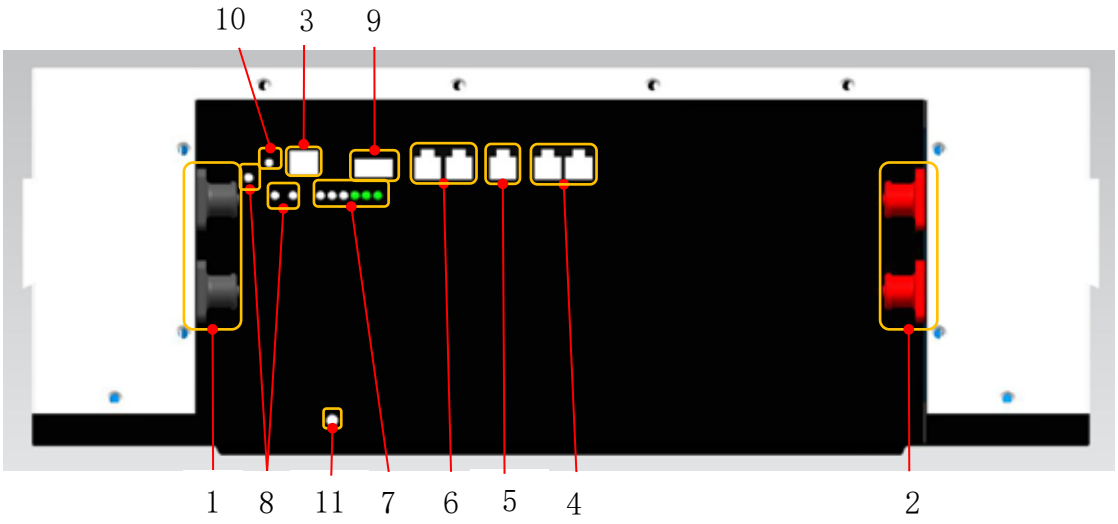
2.1 Dimension & Weight

Product	Rated Voltage	Rated Capacity	Dimension	Weight
G51100ST	DC51.2V	100Ah	460*460*165mm	＜50kg

2.2 Performance

Items	G51100ST
Rated Voltage(V)	51.2
Operation Voltage(V)	45～58.4
Rated Capacity (Ah)	100
Rated Energy(kWh)	5.12
Rated Power (kW)	5.12
Max. Power (kW)	5.12
Recommended Max. charge current(A)	≤100
Recommended Max. discharge current(A)	≤100

2.3 Panel View

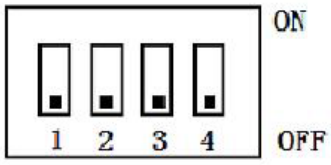


G51100ST Port Definition

No.	Ports	Definition
1	Negative Pole	Battery negative output
2	Positive Pole	Battery positive output
3	Dial Switch	Set up pack parallel address, refer to 2.3.1
4	RS485 in parallel	For pack in parallel communication, refer to 2.3.2
5	RS232	For pack updating, refer to 2.3.2
6	CAN/RS485	For communication between packs and inverter, refer to 2.3.2
7	SOC Status	Current electric Qty， refer to 2.3.3
8	Operation Status	Current battery operation status, refer to 2.3.3
9	Dry Contacts	Dry Contact 1： PIN1 to PIN2: Normally open, closed when low power; Dry Contact 2： PIN3 to PIN4: Normally open, closed when fault protection.
10	Reset	Sleep/Restart battery pack, refer to 2.3.4
11	Grounding	Pack shell grounding

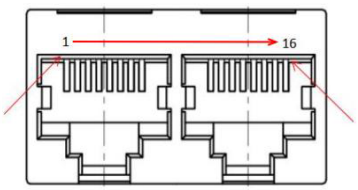
2.3.1 Definition & Description of Dial Switch

When packs are used in parallel, the dial switch of the BMS can be used to distinguish different packs by setting them different addresses. The switch can be defined as per below table.

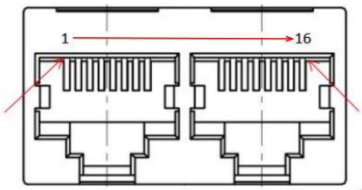


Address	Dial Switch				Remark
	#1	#2	#3	#4	
0	OFF	OFF	OFF	OFF	Slave Pack0
1	ON	OFF	OFF	OFF	Slave Pack1
2	OFF	ON	OFF	OFF	Slave Pack2
3	ON	ON	OFF	OFF	Slave Pack3
4	OFF	OFF	ON	OFF	Slave Pack4
...	...	...	...	...	...
...	...	...	...	...	...
14	OFF	ON	ON	ON	Slave Pack14
15	ON	ON	ON	ON	Slave Pack15

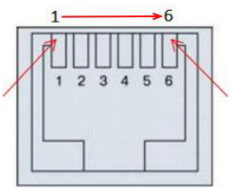
2.3.2 Port View & Definition



CAN/RS485



RS485 in parallel



RS232

CAN **8P8C vertical RJ45 socket is adopted**		**RS485** **8P8C vertical RJ45 socket is adopted**	
RJ45 Pin	**Definition**	**RJ45 Pin**	**Definition**
1, 2, 3, 6, 8	NC	9, 16	RS485 B
4	CAN H	10, 15	RS485 A
5	CAN L	11, 14	GND
7	GND	12, 13	NC
RS485 in parallel **8P8C vertical RJ45 socket is adopted**		**RS232** **6P6C vertical RJ11 socket is adopted**	
RJ45 Pin	**Definition**	**RJ45 Pin**	**Definition**
1, 8, 9, 16	RS485 B	2	NC
2, 7, 10, 15	RS485 A	3	TX
3, 6, 11, 14	GND	4	RX
4, 5, 12, 13	NC	5	GND

2.3.3 LED Indicators

Operation Status Indication

PACK status	Normal/Alarm/ Protection	ON/ OFF	RUN	ALM	SOC Indication LEDs						Remark
		●	●	●	●	●	●	●	●	●	
Power Off	Sleep	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	All off
Standby	Normal	ON	Flash 1	OFF	Indication by SOC						Standby state
	Alarm	ON	Flash 1	Flash 3							Cell low voltgae
Charge	Normal	ON	ON	OFF	Indication by SOC (The top SOC Led Flash 2)						ALM led on when cell over -charge voltage Alarm
	Alarm	ON	ON	Flash 3							
	Over Charge Protection	ON	ON	OFF	ON	ON	ON	ON	ON	ON	If no grid supply, LED is turned to standby mode
	Temperature/Over Current/ Fault Protection	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Turn off charge
Discharge	Normal	ON	Flash 3	OFF	Indication by SOC						
	Alarm	ON	Flash 3	Flash 3							
	Under Discharge Protection	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Turn off charge
	Temperature/Over Current/Short Circuit/ Fault Protection	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Turn off charge
Fault		OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Turn off charge & discharge

SOC Indication

PACK status		Charge						Discharge					
Capacity indication led		L6	L5	L4	L3	L2	L1	L6	L5	L4	L3	L2	L1
		●	●	●	●	●	●	●	●	●	●	●	●
SOC indication	0-16.6%	OFF	OFF	OFF	OFF	OFF	Flash2	OFF	OFF	OFF	OFF	OFF	ON
	16.6-33.2%	OFF	OFF	OFF	OFF	Flash2	ON	OFF	OFF	OFF	OFF	ON	ON
	33.2-49.8%	OFF	OFF	OFF	Flash2	ON	ON	OFF	OFF	OFF	ON	ON	ON
	49.8-66.4%	OFF	OFF	Flash2	ON	ON	ON	OFF	OFF	ON	ON	ON	ON
	66.4-83.0%	OFF	Flash2	ON	ON	ON	ON	OFF	ON	ON	ON	ON	ON
	83.0-100%	Flash2	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

LED Flash Illustration

Way of Flashing	ON	OFF
Flash 1	0.25S	3.75S
Flash 2	0.5S	0.5S
Flash 3	0.5S	1.5S

Remarks:

LED indicator alarm can be enabled or disabled through the host computer. The factory default is enabled.

2.3.4

Sleep

When any of the following conditions are met, the system enters the low-power mode:

1）The monomer or overall over-discharge protection has not been released within 60S;

2）Press the button for 3-6 seconds and release the button;

3）The lowest cell voltage is lower than the sleep voltage, and the duration reaches the sleep delay time (while satisfying no communication, no protection, no equalization, no current);

4）Standby time exceeds 24 hours (no communication, no charge and discharge, no main power);

5）Force shutdown by the host computer software.

Before entering sleep status, make sure that no charger is connected, otherwise you will not be able to enter low power mode.

Wake Up

When the system is in low power mode and any of the following conditions are met, the system will exit the low power mode and enter the normal operation mode:

1）Connect the charger, the output voltage of the charger should be greater than 48V;

2）Press the button for 3-6 seconds and release the button;

3）Communication is activated.

Remarks： After single or overall over-discharge protection enter the low-power mode, wake up every 4 hours, and turn on the charge and discharge MOS. If it can be charged, it will exit the sleep state and enter the normal charge; if it cannot be charged after 10 consecutive wake-ups, it will not wake up automatically.

When the system is defined as charging, after the standby 2 days / 48h (standby time set value), the recovery voltage has not been reached, and the charging is forced to resume until the end of recharging.

3 Installation & Configuration

3.1 Preparation before Installation

Security Requirements

This system can only be installed by personnel who have been trained in the power supply system and have a full understanding of the power system;

The following safety regulations and local safety regulations should always be observed during installation;

If operating in the power system cabinet, please ensure that the power system is not powered on, and the lithium battery pack circuit breaker/air switch should be closed;

Distribution cables should be properly routed and protected to avoid contact with these cables when operating electrical equipment;

When installing the battery system, the following protective equipment must be worn:



Protective gloves Goggles Shielding shoes

3.1.1Environmental Requirements

- The charging temperature range: 0℃～+45℃;
- The discharging temperature range: -10℃～+55℃;
- The best ambient temperature: 15℃～30℃;
- Storage temperature: -10℃～+35℃;
- Relative humidity: 5%～85%RH without condensed water;
- The altitude not exceed 2000m;
- Install indoors, avoid sunlight, no conductive dust and corrosive gases indoors;
- The installation location being far away from the sea, avoiding brine and high humidity environment;
- No flammable and explosive materials near the installation site;
- Keep away from dusty and messy areas.

3.1.2 Tools

Items	
Phillips Screwdriver	Multimeter
Torque Wrench	Clamp Meter

Needle Nose Pliers	Insulation Tape
Wire Dtrippers	Thermometer
Electric Drill	Static Bracelet

3.1.3 Inspection

Electrical Interface Inspection

- The device connected directly to the battery could be an inverter or other power source;
- Confirm whether the user's inverter or other power supply has a DC output interface, and measure whether the DC output voltage meets the voltage range requirements in Table 2-2;
- Confirm that the maximum discharge current capability of the user's inverter or other DC power supply interface should not be greater than the maximum charge current of the products used in Table 2-2.

Security Inspection

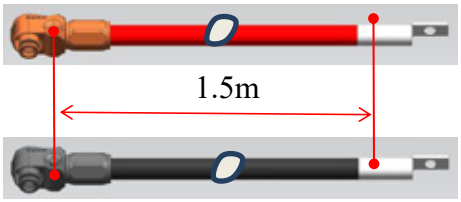
- Fire-fighting equipment should be provided near the equipment, such as portable dry powder fire extinguishers, etc. If necessary, an automatic fire-fighting system should be installed, and flammable, explosive and other dangerous items should not be placed next to the battery.

3.1.4 Out of Box Audit

- When the lithium battery pack arrives at the installation site, it should be disassembled according to the rules and regulations to prevent it from being exposed to the sun and rain;
- Before unpacking, the actual product quantity should be checked against the list;
- The checklist is attached to each packing box, and the packing box should be checked whether it is in good condition;
- During the unpacking process, handle with care to protect the surface coating of the item;
- When opening the packing box, the installer should read the technical documents, checklist, according to the configuration table and packing list, to make sure the items completed in good condition. If the internal product is damaged, it should be checked and recorded in detail.

The packing list as follows：

Items	Specification	Qty	Picture	Mark
G51100ST	51.2V100Ah 460*460*165mm	1		

Positive Pole - Inverter Wire	Red /16mm² /Length 1.5m without connector	1		
Negative Pole - Inverter Wire	Black /16mm²/Length 1.5m without connector	1		
Communication Line	1m, RJ45 interface at both ends	1		

3.1.5 Caution：

The following items should be noted before installation:

- **Power Cord Specifications**

The power cord specification should meet the maximum charge and discharge current requirements of each product.

- **Installation Space and Carrying Capacity**

Make sure that the battery has enough installation space, the ground is flat and the wall has enough bearing capacity.

- **Line**

Make sure that the power and ground wires are reasonable and not prone to short circuit, water ingress and corrosion.

3.2 Installation Process

Step 1	System Self-testing	1.Hold down the reset button to activate the battery pack
		2.Check the system output voltage and LED status light display
		3.Hold down the reset button to hibernate the battery pack
Step 2	Battery Stacking	1.Place the first set of lithium batteries on the pallet truck
		2.Stack the second group to the fourth group (if any) in sequence
Step 3	Electrical Installation	1.Install ground wire
		2.The positive and negative poles of the lithium battery pack are installed in parallel (if any)
		3.Install lithium battery pack communication line cascade
Step 4	Inverter Connecting	1. Connect the positive pole of the lithium battery pack - the inverter line to the positive pole of the inverter battery
		2. Connect the lithium battery pack negative pole-inverter line to the inverter battery negative
		3. Connect the communication line of the lithium battery pack to the communication network port of the inverter

3.2.1 Preparations Before Installation

- Prepare the equipment and tools needed to install the lithium battery pack.
- Confirm that the lithium battery pack is in a dormant state and avoid live operation.

3.2.2 Lithium Battery Pack System Self-test

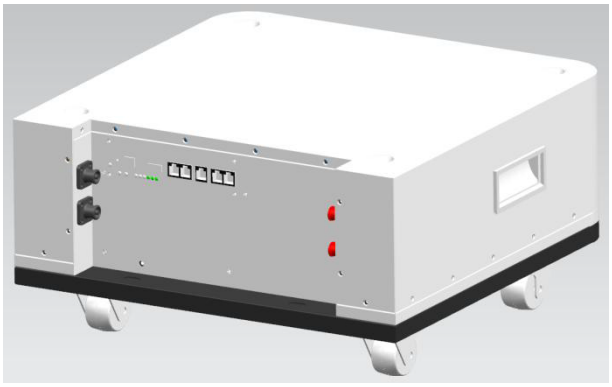
- After the self-test of the lithium battery pack system is completed, the LED running light shows green, the power indicator shows about 2-4 grids of green, and there is no alarm indication.

3.2.3 Battery Stacking

Installation method: stacking installation method (the following pictures are for reference only)

- Place the first set of lithium batteries on the pallet truck;

Caution：Pallet truck brake wheels should be locked

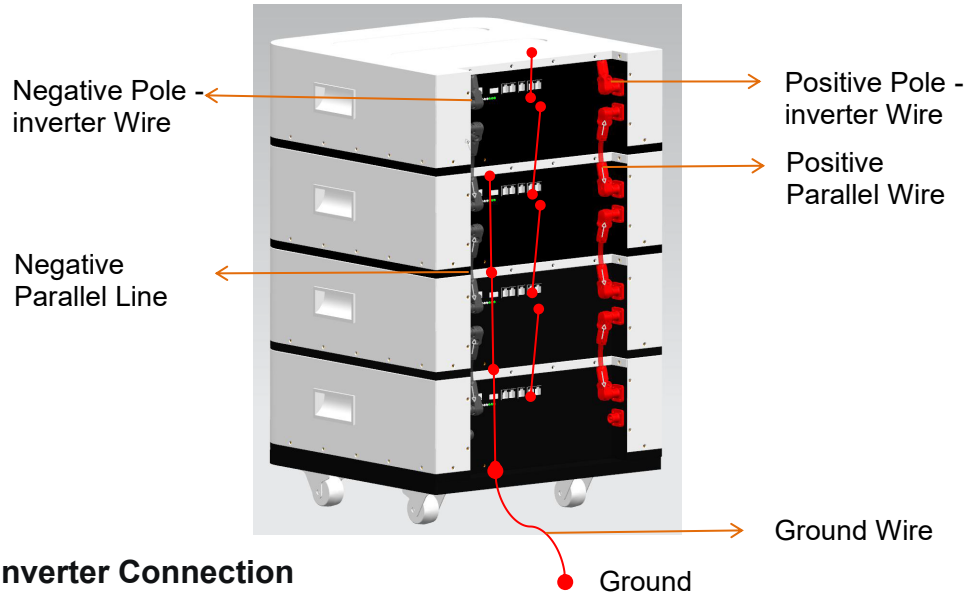


- Stack the second group to the fourth group (if any) in sequence;

3.2.4 Electrical installation

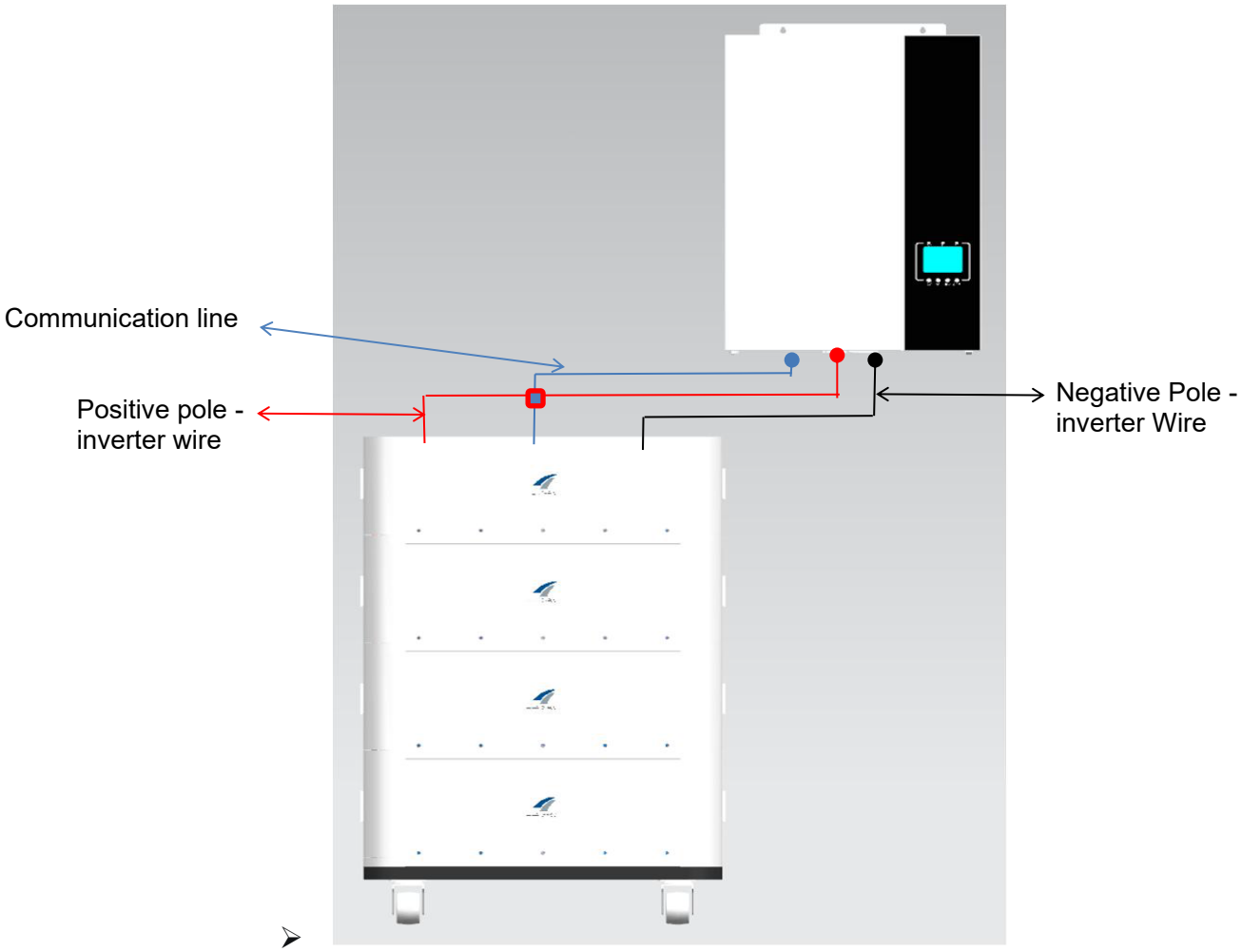
Before installing electrical parts, use a multimeter to measure the continuity of the positive and negative wires and ground wires;

- Select the multimeter conduction range and measure the metal terminals at both ends of the same wire. If the buzzer sounds, it means the cable conduction performance is qualified;
- Install ground wire;
- The positive and negative poles of the lithium battery pack are installed in parallel (if any);
- Install lithium battery pack communication line cascade.



3.2.5 Inverter Connection

- Connect the total positive cable/total negative cable of the lithium battery pack to the input positive/input negative of the lithium battery in the inverter respectively;
- Connect the battery-inverter communication cable to the corresponding communication interface in the inverter.



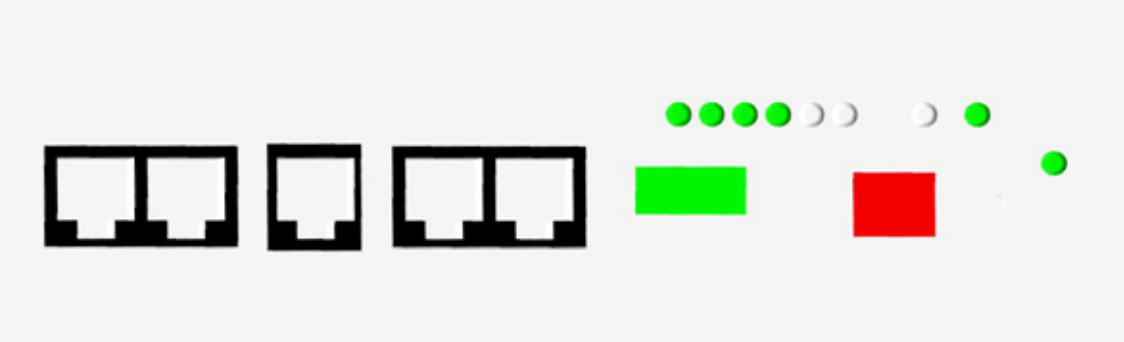
4 Use, Maintenance & Faults

4.1 Intro of Use & Operation

After the lithium battery pack is installed, follow the steps below to start the lithium battery system.

4.1.1 Before starting the lithium battery pack, dial the code according to the definition of the dial switch in 2.3.1, and finally press and hold the RST button for more than 6 seconds.

After the self-test of the lithium battery pack system is completed, the LED running light will display green, and the power indicator will display about 2-4 grids of green.



Caution： If the battery status light turns red after pressing the RST button for a long time, please operate according to 4.2 alarm indication and treatment. If the fault cannot be resolved, please contact our relevant personnel.

4.1.2 Turn on the inverter (refer to the inverter manual for details)

4.1.3 Check whether the status of the inverter indicator light is normal, if not, please contact the inverter supplier.

Inverter power configuration: Inverter output power≤5000W.

Lithium Battery Pack Use	Charge	G51100ST battery pack long-term maximum continuous charging current ≤0.5C; If the battery pack is empty, please charge it within 48 hours.
	Discharge	G51100ST battery pack long-term maximum continuous discharging current ≤0.5C; The maximum discharge depth of the lithium battery pack is ≤90%.

4.2 Alarm & Handling

When the lithium battery pack system is protected or faulty, alarm signal will be sent through the LED working status indicator, and the alarm category can be queried through the BMS fault status on the display.

For example, when the output is affected by abnormalities such as single cell overvoltage, charging overcurrent, undervoltage protection, and high temperature protection, please follow 4.3.

Status	Alarm Category	Alarm Indication	Processing Method
Charging	Overvoltage	●	Stop charging
	Overcurrent	●	Stop charging and find out the cause of the problem
	High Temperature	●	Stop charging
Discharging	Overcurrent	●	Stop discharging and find out the cause of the problem
	High Temperature	●	Stop discharging
	Overall Low voltage	●	Start charging
	Cell Low Voltage	●	Start charging

4.3 Common Faults & Troubleshoot

NO.	Symptom	Cause Analysis	Solution
1	The indicator light without response after power on	Power supply without output voltage	Checking power output
2	Short backup time	Battery capacity damping	Replacing the lithium battery pack
3	Unable to fully charge	Too low charging voltage	Adjusting the charging voltage to 56V
4	The power cord with sparks once connected and the status indicator light showing red	Short circuit	Connecting the battery to the inverter and checking the cause of the short circuit

If you have any technical problems or seek for help, please contact the corresponding market personnel without hesitation.

5 Guideline for transportation and storage

5.1 Temperature

0-35°C for long term storage and transportation (more than 3 months).

-20-45°C for medium term storage and transportation (1-3 months).

-40-55°C for short term storage and transportation (less than 1 month).

5.2 Humidity

60%±25% relative humidity without water condensation.

5.3 SOC

60-80% SOC for long term storage and transportation (more than 6 months).
40-60% SOC for medium term storage and transportation (3-6 months).a
30-40% SOC for short term storage and transportation (0-3 months).

5.4 Others

According to the IATA Dangerous Goods Regulations 59th Edition, lithium ion battery is Class 9 danger goods. It should be transported and stored according to that standard. Headway is not responsible for the incidents caused by not appropriate handling of the goods. Besides, the battery should be handled as to following standards.
Keep the battery away from fire, grid power cables, loads and other heater source.
Keep the battery away from sunlight, rain, thunder, and water.
Keep the battery away from faulty battery, battery for maintenance.
Keep the battery away from flammable and explosive goods such as foam, rubber, cables, cartons and so on.
Keep the battery away from conductive dust and corrosive gas.
Storage location should be away from the sea to avoid brine and high humidity environment.
The ground for storage should be flat and horizontal.
There is no flammable explosive near to the storage places.
Keep the storage house away from dust and messy zones.
It is not allowed for lithium battery to be placed upside down or lying down, and avoid mechanical shock or heavy pressure for the battery.
The battery might be damaged during shipping by shock or vibration. If any abnormal features of the batteries are found such as damages in the carton or wooden box, battery, wooden box or carton caught in the rain, deformation of the battery package, smelling of electrolyte, electrolyte leakage and others, the batteries shall never be used any more in case of fire or explosion.
Patrol officers shall conduct regular inspection of the batteries in the warehouse. They shall be trained and take action immediately when fire or explosion happens.
The warehouse should be designed according to international standards and stored country's government standards for the danger goods.
The storage daily management of lithium ion batteries should be in accordance with international standards and stored country's government standards for the danger cargo.

5.5 Maintenance

Customer shall check the battery status every 3 months after receiving the batteries. If customer finds any cell voltage less than 3.1V, they shall charge the battery as soon as possible. We recommend to charge the battery with 0.1C-0.2C for 1-2h.