

HB-5K

5kWh Residential Lithium-ion Battery System

User Manual



FENG Rui

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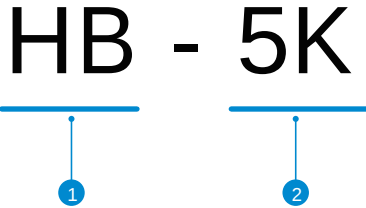
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Scope of application

This manual is an integral part of HB-5K. It describes the transportation, storage, installation, electrical connection, debugging, maintenance, and troubleshooting of the product. Please read carefully before operation.



1	high pressure	High Voltage Lithiun Battery
2	Single module electrical energy	5kWh

Target Audience

Installation and maintenance can only be carried out by qualified professionals who should:

- Hold a license and/or meet the requirements of national and local jurisdictional regulations;
- Familiar with this manual and other related documents

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1. Safety

1.1 General Safety

Before transport/storage/use, read manual & labels. Follow safety rules. Supplements local laws.

Comply with manual safety precautions & signs. Follow relevant laws & industry rules during transport/storage/install/O&M. FENGRUI not liable for losses due to improper op or violation of safety standards.

FENGRUI not liable for repair of faults/damages, nor for losses due to non-compliant installation.

This device has been carefully designed and tested to comply with all applicable national and international safety standards. However, like all electrical and electronic equipment, safety precautions must be followed and adhered to during the installation process to reduce the risk of personal injury and ensure safe installation.

If any of the following situations occur (including but not limited to), FENGRUI will not be held responsible:

- Equipment damage caused by force majeure events such as earthquakes, floods, thunderstorms, lightning strikes, fires, volcanic eruptions, wars, typhoons, tornadoes, etc.
- Equipment damage caused by human factors.
- Using or operating equipment in violation of local policies or regulations.
- Not following the operating instructions and safety precautions in the product and this document.
- Install and use under inappropriate environmental or electrical conditions.
- Unauthorized modification of products or software.
- Equipment damage caused by customers or third parties during transportation.
- Battery damage caused by strong external vibrations before, during, and after installation.
- The storage conditions do not meet the requirements specified in this document.
- Use incompatible inverters or devices.
- Installation and commissioning shall be carried out by unauthorized, unlicensed, and/or non compliant personnel in accordance with national and local jurisdiction regulations.

1.2 Battery Safety

Danger

- Do not short-circuit pos/neg terminals. Risks: overcurrent, leakage, thermal runaway, fire/explosion. Cut power before maintenance.
- Overheating risk: leakage/thermal runaway/fire. Ventilate & avoid high temp. No physical damage: disassembly/drop/squeeze/pierce.
- Do not mix batteries of different types or brands. Otherwise, it may lead to leakage or rupture, causing personal injury or property damage.
- Electrolyte: Toxic/volatile; avoid leak/odor. PPE required before power-off. Abuse (burn/pierce/squeeze/overcharge) may cause thermal runaway/leakage/gas. Vent gas safely to prevent fire/corrosion.
- Do not use damaged batteries.

Warning

- Please read this document carefully before installation, operation, and maintenance.
- When installing and debugging equipment, it is necessary to configure fire-fighting equipment in advance according to local laws, regulations, and standards.
- Before/after unpacking & during storage/transport: Ensure packaging intact. Stack/place per label instructions to prevent damage/scrap from compression/falling.
- Tighten cable/busbar screws to specified torque. Inspect regularly; clear rust/corrosion/debris. Loose screws cause voltage drop, overheat, and battery damage.

Warning

- After discharge, the battery should be charged promptly to prevent damage due to excessive discharge. If the battery pack is stored for a long time, please charge it regularly according to the storage requirements specified in the document to prevent damage.
- Please charge the battery within a specific temperature range, as low temperatures may cause short circuits. Therefore, do not charge when the temperature is below the lower limit of the operating temperature.
- If the battery casing is found to have bulges or dents, do not use the battery and contact the installer or professional maintenance personnel for disassembly and replacement. Damaged batteries must be kept away from other devices and flammable and explosive materials. Non professionals are not allowed to come into contact with them.
- Before operation, please ensure that there is no irritating or burning odor around the battery.
- Do not weld or polish near the battery. Because electric sparks or arcs may cause fires.
- Do not step on, guide, stand or sit on the battery.

Be Careful

- The IP20 protection level requires equipment to be installed indoors. Do not expose to direct sunlight or rainwater.

NOTE

Requirements for battery transportation:

- Freight forwarders engaged in such business must obtain relevant qualifications for dangerous goods transportation and strictly comply with local regulations on dangerous goods transportation.
- Please check the battery before transportation. If the battery leaks, has an odor, or is damaged, please refuse transportation.
- Please handle the batteries with care during loading, unloading, transportation, and movement to prevent collisions, and take effective moisture-proof measures to prevent personal injury and battery damage.
- Unless otherwise specified, do not transport batteries classified as dangerous goods with food, drugs, or other additives on the same transport vehicle.

NOTE

If the battery leaks electrolyte or any other chemical material, electrolyte leakage may cause toxic gases. Therefore, please always avoid contact with them. In case of accidental contact, please follow the steps below:

- If inhaled: immediately leave the contaminated area and seek medical attention immediately;
- If in contact with eyes: Rinse eyes with running water for at least 15 minutes and seek medical attention;;
- If in contact with the skin: thoroughly wash the contact area with soap and seek medical attention;
- If ingested: induce vomiting and seek medical attention.

If a fire occurs at the battery installation location, please follow the steps below:

- If the battery is charging when a fire occurs, press the emergency stop button and unplug the power cord, provided it is safe;
- If the battery has not yet caught fire, use a water-based fire extinguisher or a carbon dioxide fire extinguisher to extinguish the fire;
- If the battery catches fire, do not attempt to extinguish it, evacuate immediately;

Recycling of damaged or scrapped batteries:

- Dispose of damaged or scrapped batteries in accordance with local laws and regulations, rather than placing them in household waste or roadside recycling bins. Otherwise, it may lead to environmental pollution or explosions.
- Ensure that damaged or scrapped batteries are not exposed to high temperatures, high humidity, direct sunlight, or corrosive environments.
- Contact a battery recycling company to handle leaked electrolyte, damaged or expired batteries.
- Before moving the battery, please take protective measures to prevent the battery from short circuiting.
- When transporting and storing damaged batteries, please stay away from flammable material storage areas, residential areas, and other densely populated areas.

1.3 Electrical Safety

Danger

- Before electrical connection, please ensure that the equipment is not damaged in any way.
- Do not modify, alter, or disassemble the equipment.
- Please do not change the power on and off sequence and installation program written in the file, and operate correctly and without error.
- Do not power on the device during installation. Otherwise, it may lead to fire, personal injury, or equipment damage.
- Earrings, rings, bracelets, watches, and any other metal jewelry must be removed before operation to avoid electric shock, burns, or even death.
- During operation, special insulation tools must be used to avoid electric shock or short circuit faults. The rated voltage of insulation tools must exceed the rated voltage of the system.

Warning

- When carrying out electrical wiring, please wear personal protective equipment such as protective clothing, insulated shoes, goggles, safety helmets, insulated gloves, etc.
- Please check if the outer packaging is damaged before unpacking. If damaged, do not use and immediately contact the carrier and manufacturer.
- Do not place installation tools, metal parts, and other debris on the battery during installation. After installation, it is necessary to promptly clean the items above and around it.
- Do not install batteries in rainy, snowy, foggy or other weather conditions to avoid battery damage.
- If the battery is damaged or accidentally soaked in water, do not install or use it. Please transport it to a safe isolation point and contact the local fire department or professional technical personnel for handling.
- If the battery cable is immersed in water, do not approach, touch or use it.
- Ensure that the positive and negative terminals of the battery are not accidentally grounded. If accidental grounding occurs, immediately disconnect the battery terminals from the ground.
- Do not touch the power supply equipment directly or through conductors or damp objects.
- Do not touch equipment components with warning signs to avoid personal injury or equipment damage.

Be Careful

- Do not power on the equipment until it has been installed and confirmed by professionals.
- In case of a fire, evacuate immediately and call the local fire department.

NOTE

Short circuit protection:

- When installing and maintaining batteries, please use electrical tape to wrap exposed conductor cables to prevent short circuits.
- Prevent any objects from entering the interior of the battery to avoid short circuits.
- Regularly check the screws or copper bars on the equipment to ensure they are fully tightened.

NOTE

General requirements:

- Please operate according to the safety regulations of the power station.
- Before connecting and disconnecting the power cord, please ensure that the device and its related switches are turned off.
- After installation, please check if the protective casing and insulation sleeve of the electrical components are correctly installed to avoid electric shock.
- When maintaining electrical terminal equipment and distribution equipment, the output switch of the power supply equipment must be turned off.
- If it is necessary to turn off the device power during troubleshooting and diagnosis, please follow the steps below: power off>power check>connect PE line>hang warning signs and set up guardrails.
- Before maintenance is completed, a "Do Not Close" warning sign must be hung on the relevant switch or circuit breaker to prevent power from being turned on. Do not close the circuit until the fault is resolved.
- Do not use water, alcohol, oil, or other solvents when cleaning electrical components inside and outside the equipment.

Grounding requirements:

- The grounding impedance of the equipment should comply with the requirements of local electrical safety standards.
- The equipment should be permanently connected to the grounding wire within the building's electrical system. Please check if the equipment is reliably grounded before operation. When disassembling and maintaining equipment, the PE line should be removed last.
- If the device is not equipped with a grounding conductor, do not start the device.
- Prohibit any behavior that violates the grounding conductor.
- If the device is equipped with a three hole socket, please ensure that the grounding pin is reliably grounded.
- For equipment that may generate large contact currents, please ensure that the grounding terminal on the casing is grounded before powering on to avoid electric shock.

Cable requirements:

- When determining the wire diameter and connecting or wiring, please follow local laws, regulations, and specifications to ensure safety.
- Before connecting the power cord, please ensure that the cable label is correctly labeled and the cable terminals are well insulated.
- When conducting electrical wiring, do not loop or twist the cables. If the length of the power cord is insufficient, please replace the cable instead of splicing or welding. Ensure that all correct types and specifications of cables are fully connected and well insulated, and that the edges of cable trays and conduit holes are smooth.
- Cables should be kept away from heaters or other heat sources, as high temperature environments may cause aging and damage to the insulation layer of the cables.

2. Product Overview

2.1 Product Introduction

HB-5K is a rack mounted energy storage battery system that features easy installation, high reliability, high safety, intelligent management, and flexible configuration. It consists of a high-voltage box, battery pack, and battery rack:

- High voltage box: Plays the role of the brain in the entire battery system. Intelligent management of battery packs by monitoring their status.
- Battery pack: stores or provides electrical energy according to the instructions of the high-voltage box.
- Battery rack: supports high-voltage box and battery pack.

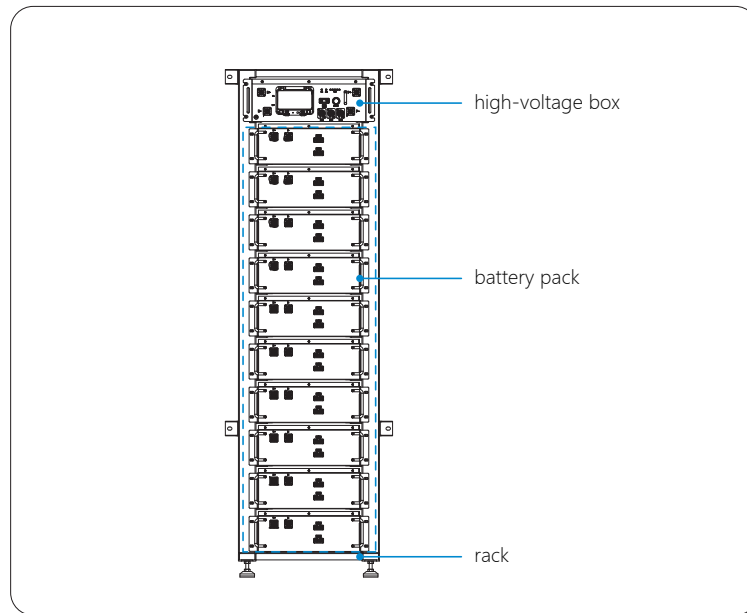


Figure2-1 HB-5K

2.2 Product Appearance

2.2.1 Dimensions and Weight

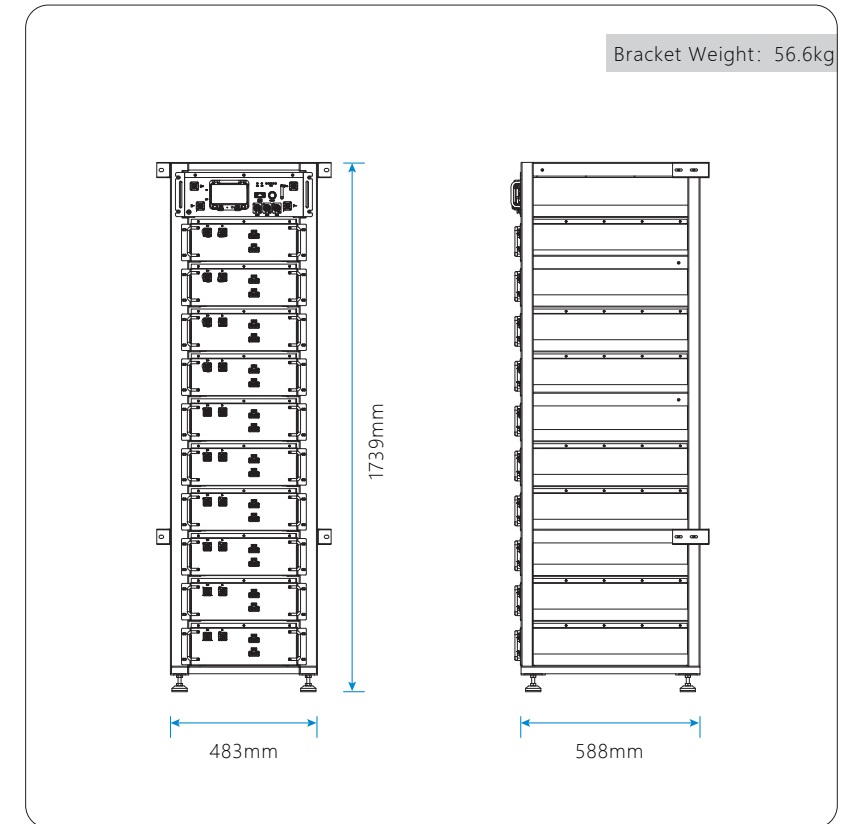


Figure2-2 HB-5K

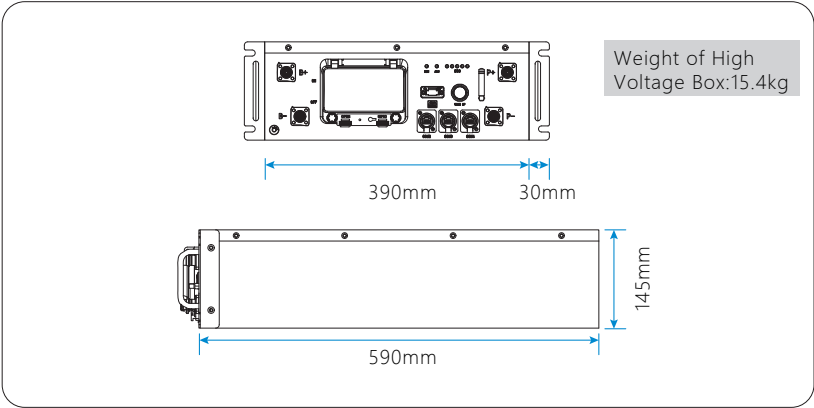


Figure2-3 high-voltage box

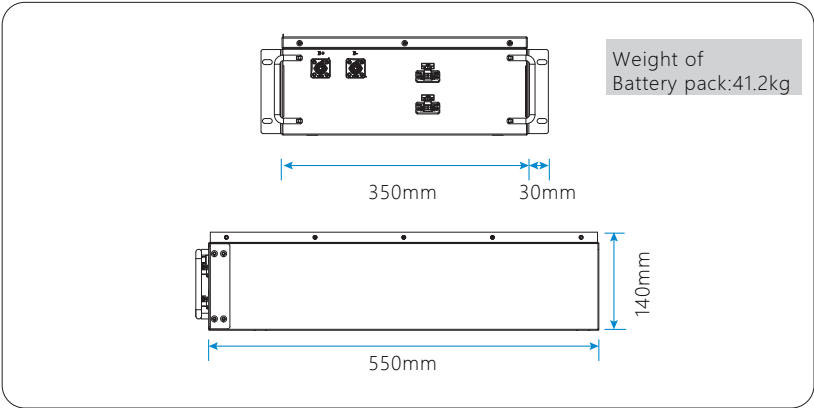


Figure2-4 battery pack

2.2.2 Component Introduction

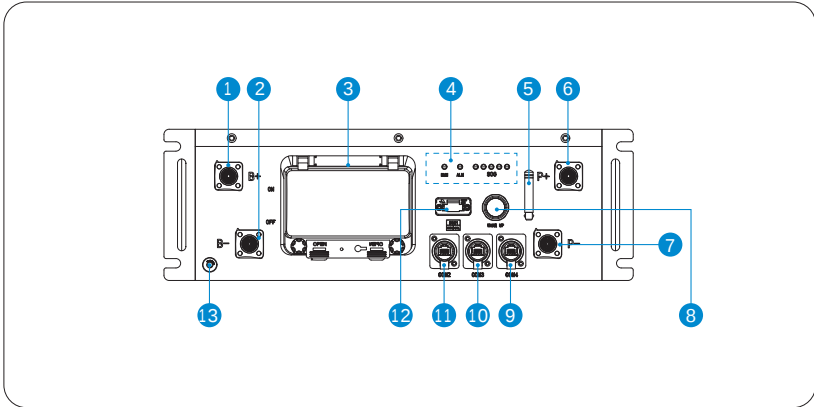


Figure2-5 high-voltage box

1	Battery cluster input positive pole	Used to connect battery pack port B+
2	Battery cluster input negative electrode	Used to connect battery pack port B-
3	DC switch	Used to turn on/off the battery system
4	Indicator light	Fault alarm
5	WIFI	WIFI antenna
6	PCS Input positive pole	Port BAT for connecting inverters+
7	PCS Input negative pole	Port BAT for connecting inverters-
8	Switch	High voltage box power supply switch
9	COM4	Parallel communication
10	COM3	Parallel communication
11	COM2	Communicate with PCS
12	COM1	Communication between high-voltage box and battery
13	PE	Grounding

Table2-1 High voltage box description

Lighting Action	Action Description
0	Not bright
1	Chang Liang
Flash 1	Light up for 0.5S, turn off for 2.0S, cycle
Flash 2	Turn on for 1.0S, turn off for 1.0S, cycle
Flash 3	Illuminate for 2.0S, extinguish for 2.0S, cycle
SOC	Use SOC display as SOC display
Lamp board Schematic Diagram	

Table2-2 Lighting instructions

Status	LED bead	RUN	ALM
Power off state		0	0
No faults on power-on		1	0
No charging/discharging inhibit faults.		1	0
Only Chg Inhibit, No Relay Disconn.		1	0
Only Dischg Inhibit, No Relay Disconn.		1	闪3
Both Chg & Dischg Inhibit, No Relay Disconn.		1	1
Only Chg Inhibit, With Relay Disconn.		0	闪2
Only Dischg Inhibit, With Relay Disconn.		0	闪3
Both Chg & Dischg Inhibit, With Relay Disconn.		0	1

Table2-3 Operation and fault indicator lights

SOC \ LED	LED5	LED4	LED3	LED2	LED1
(90% , 100%]	1	1	1	1	1
(80% , 90%]	闪2	1	1	1	1
(70% , 80%]	0	1	1	1	1
(60% , 70%]	0	闪2	1	1	1
(50% , 60%]	0	0	1	1	1
(40% , 50%]	0	0	闪2	1	1
(30% , 40%]	0	0	0	1	1
(20% , 30%]	0	0	0	闪2	1
(10% , 20%]	0	0	0	0	1

Table2-4 Power SOC indicator light

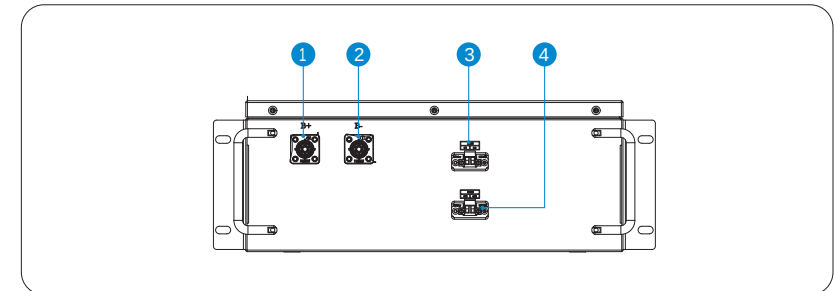


Figure2-6 battery pack

1	port B+	Port B+ for HV Box/Battery Pack via Power Line
2	port B-	Port B- for HV Box/Battery Pack via Power Line
3	COM1	Connect to HV Box/Battery Pack via Comm. Line
4	COM2	Connect to Battery Pack/Terminal Resistor via Comm. Line

Table2-5 Battery Pack Instructions

2.3 Label

Performance labels and manufacturing labels should be affixed to battery packs and high-voltage boxes. The system performance labels are as follows:

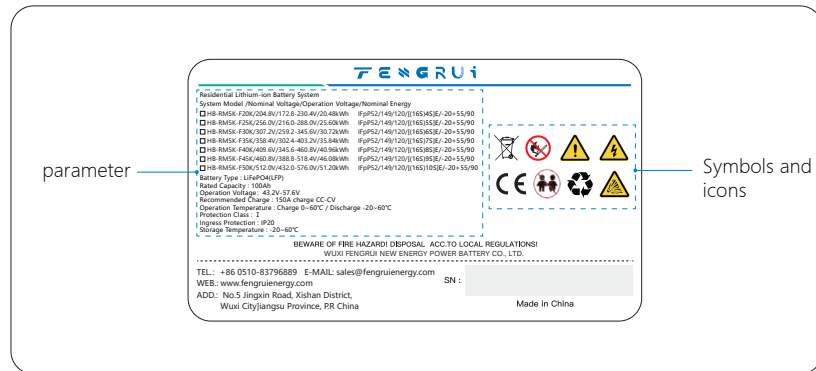


Figure 2-7 System Performance Label

2.4 Symbol and Icon Description

The meanings of symbols and icons on the label are as follows:

CE	CE conformity mark
	Explosion & heat risk. Do not touch during operation.
	Shock risk. Do not touch device when powered on.
	Danger, do not touch the device after it is powered on.
	Keep away from fire/ignition sources.
	Do not dispose of with household waste.
	Keep the device away from children.
	Dispose at proper recycling facilities.

Table 2-6 Symbol and Icon Description

3. Transportation and Storage

3.1 Transportation Requirements

Danger

- Be careful to avoid physical collisions during transportation. Do not invert the device and do not expose it to water, as it may cause damage, fire, or explosion.

Warning

- The high-voltage box, battery pack, and battery rack must be transported in their original packaging. Airo is not responsible for any damage to the high-voltage box, battery pack, and battery rack caused by improper transportation or transportation after installation.
- Please strictly comply with the transportation requirements of warning signs on packaging and equipment.
- Freight forwarders engaged in such business must obtain relevant qualifications for dangerous goods transportation and strictly comply with local regulations on dangerous goods transportation. Please check the battery before transportation. If the battery leaks, has an odor, or is damaged, please refuse transportation.

NOTE

- Please choose a suitable transportation method based on the site conditions and equipment weight.
- Please wear personal protective equipment (such as protective gloves, shoes, belts, etc.) and lift the equipment in the correct posture to prevent personal injury and equipment damage.
- When moving devices, please arrange the number of personnel reasonably, match them correctly, and move them in the correct location to achieve weight distribution and load balancing.
- Please hold the handle or bottom of the device when moving to avoid damage to the device.
- Please pay attention to the surrounding environment, such as obstacles and slippery ground, when moving to avoid personal injury and equipment damage.

3.2 Storage Requirements

Danger

The battery must be stored indoors and meet the following requirements:

- Avoid direct sunlight or exposure to rain.
- Keep dry and well ventilated.
- Stay away from heat sources, fire sources, radiation, chemicals, dust, or metal conductive dust.
- Equipped with fire-fighting facilities.
- The battery must be stored according to the warning signs and other information requirements on the packaging.
- Do not store together with any other electronic devices, chemicals, or other items that may cause interference or danger.
- Pay attention to the height when stacking batteries to avoid deformation or damage.

NOTE

- Store the device according to the label on the packaging.
- Avoid long-term storage. Charge regularly if unavoidable.
- If stored >1 year, pro inspection & test required before use.
- The relative humidity should be between 5% and 85%.
- It is recommended to store the battery within a temperature range of 0 ° C to +35 ° C.

Storage temperature	Charging frequency
+50°C to +60°C	Once every 3 months
+35°C to +50°C	Once every 6 months
-20°C to +35°C	Once every 12 months

Table3-1 Storage temperature and charging frequency

4. Pre-installation Preparation

4.1 Installation Location Selection

NOTE

- Install at proper ambient temp to ensure battery life.
- The working environment temperature of the battery is between -20 ° C and +55 ° C.

Installation location: critical for safety, life & performance.

- Installation must comply with local laws, regulations & industry standards.
- Fire extinguishers required per local fire codes.
- The battery adopts an IP20 casing and can only be used indoors;
- **Installation site: convenient for wiring, operation & maintenance.**
- Plan adequate space for capacity expansion & other uses.
- Convenient transportation at the installation site;
- No installation on ground with deformation/settlement.
- Avoid salt/sand/polluted areas to prevent corrosion.

4.2 Installation Environment Requirements

Ensure that the installation site meets the following conditions:

- Ambient temperature: -20°C ~ +55°C;
- relative humidity: 5~85% RH
- Altitude: Below 3000 meters;
- Maintain good ventilation;
- Keep away from combustibles, flammables/explosives, antennas & corrosives.

4.3 Installation Carrier Requirements

Ensure that the installation carrier meets the following conditions:

- Material: Non-combustible (solid/concrete). Wood prohibited.
- Load capacity: $\geq 4 \times$ battery system weight (See Figs 2-2~4).
- Other: The ground must be level. The wall thickness must not be less than 150 millimeters.

4.4 Installation Gap Requirements

Space requirements: For heat dissipation & disassembly.

- Clearance: ≥ 850 mm for installation & maintenance.
- Wall-to-rack clearance: 20-35 mm.

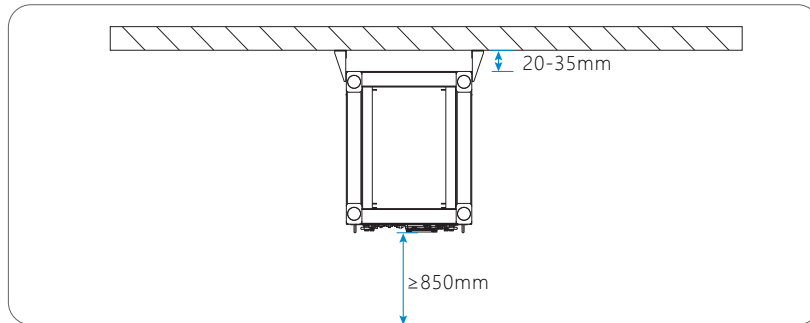


Figure4-1 Wiring diagram for single rack battery system

4.5 Tool Requirements

Installation tools: Not limited to below list. Use suitable on-site tools as needed.



Figure4-2 Installation tools

5. Wiring of Single Battery System

NOTE

- Before electrical connection, check whether all cables are delivered intact or ready.

Battery-inverter cables: See figure below:

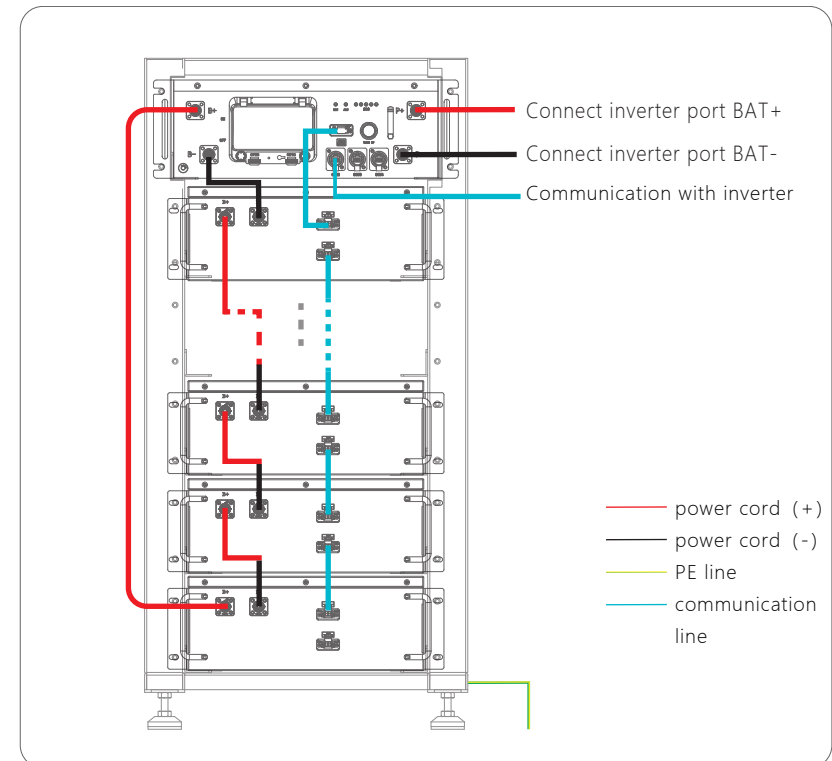


Figure5-1 Wiring diagram for single rack battery system

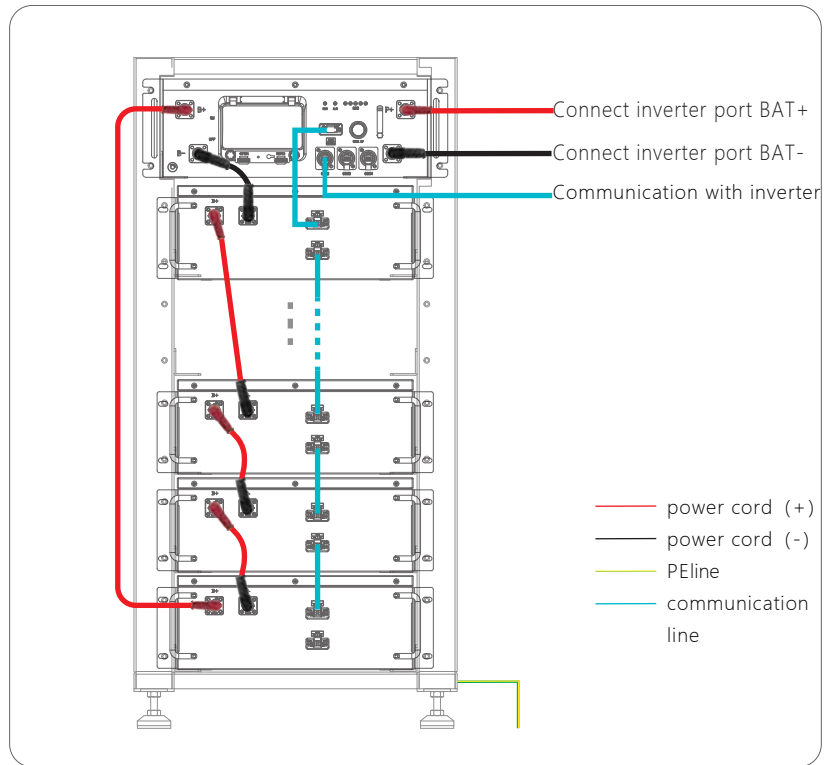


Figure5-2 Quick plug connection diagram

6. Capacity Expansion

Connect two battery clusters in parallel to the inverter.

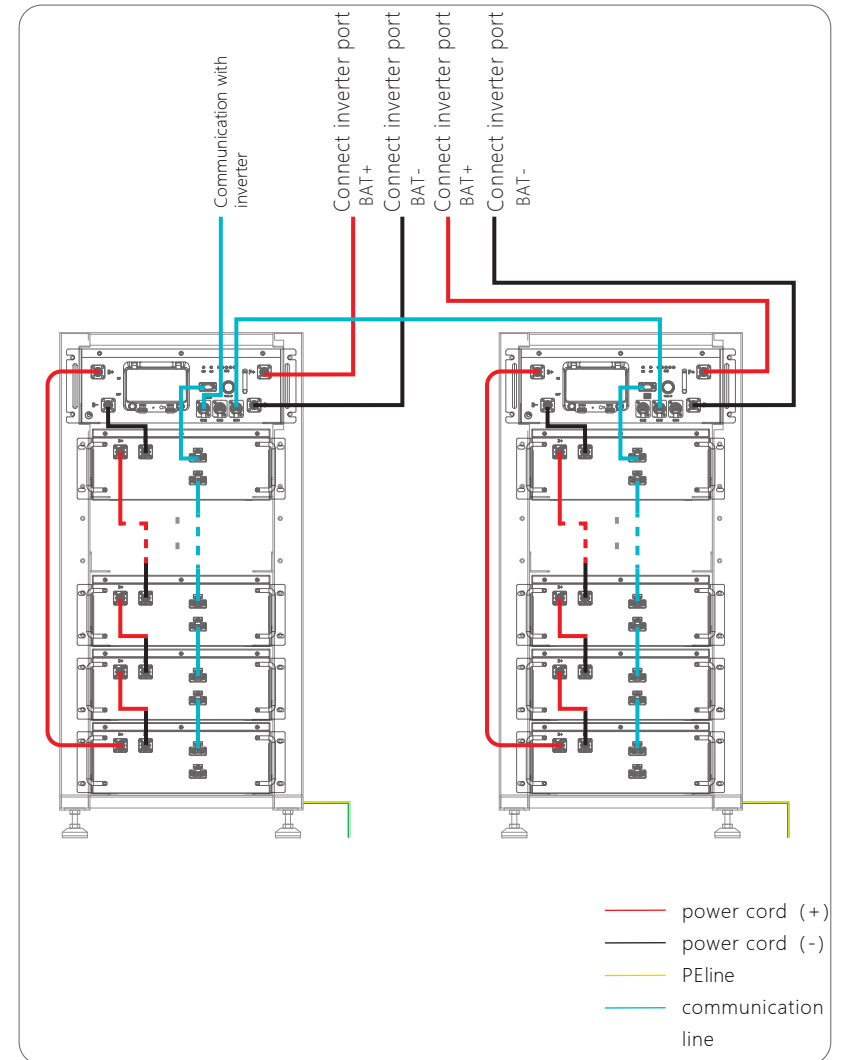


Figure6-1 Wiring diagram of parallel single rack battery system

7. System Debugging

Danger

- Wear PPE & use insulated tools to avoid shock/short.

7.1 Pre-power Check

- Check if the equipment is installed correctly and securely;
- Ensure that the circuit breaker is closed;
- All cables are correctly and securely connected;
- Space: suitable; Environment: clean.

7.2 Power On

Battery system startup:

Step 1: Open the waterproof cover and turn on the DC switch.

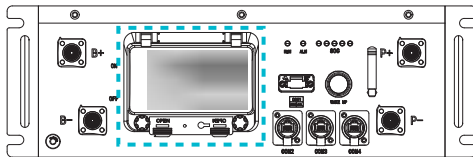


Figure7-1 Direct current (DC) switch

Step 2: Turn on the wake-up switch.

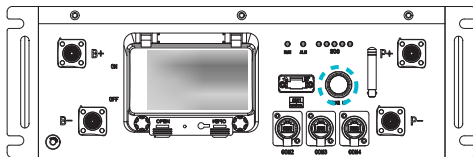


Figure7-2 Wake up switch

Startup/pack change: Restart DC & power switch. Auto-addr assign; RUN LED ON when normal. See Tab 2-2/2-3.

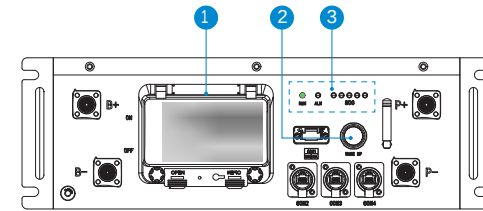


Figure7-3 power-up sequence

7.3 Power Outage

Warning

- Wait 5 min after shutdown before touching. To avoid shock/injury.

Shutdown sequence: Inverter OFF -> ② OFF -> Wait LED OFF -> ① OFF.

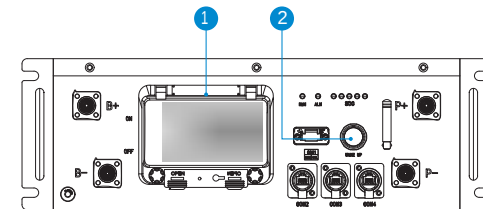


Figure7-4 Power outage sequence

8. Distribution Network

✕ Post-install: Contact Fengrui for APP pairing manual.

Storage APP: Enables remote global monitoring of battery status.

9. Technical Data

Battery Module

Cell Chemistry	LFP 100Ah
Rated Energy (kWh)	51.2
Rated Voltage (V)	512
Cycle Life	6000
Dimensions (W×H×D) (mm)	553×503×2230
Weight (kg)	484

General Parameters

IP Rating	IP20
Operating Temperature (°C)	Charge: 0 - 55°C/ Discharge: -20 ~ 60°C
Relative Humidity	0 ~ 95%, Non-condensing
Altitude (m)	4000m (Derating above 2000m)
BMS Communication	CAN
Installation Method	Stationary/ with Wheels

Configuration List

NO.	Model	High-voltage box	Battery pack
1	RM5K-20K	P72×1	HB-5K×4
2	RM5K-25K	P72×1	HB-5K×5
3	RM5K-30K	P72×1	HB-5K×6
4	RM5K-35K	P72×1	HB-5K×7
5	RM5K-40K	P72×1	HB-5K×8
6	RM5K-45K	P72×1	HB-5K×9
7	RM5K-50K	P72×1	HB-5K×10

Battery System

HB-5K				
Model	RM5K-20K	RM5K-25K	RM5K-30K	RM5K-35K
Number of modules	4	5	6	7
Rated energy (kWh)	20.48	25.60	30.72	35.84
Rated voltage (V)	204.8	256	307.2	358.4
Operating voltage range (V)	179.2-230.4	224-288	268.8-345.6	313.6-403.2
Max charge/discharge current (A)	60			
Depth of Discharge (%)	90%			

HB-5K			
Model	RM5K-40K	RM5K-45K	RM5K-50K
Number of modules	8	9	10
Rated energy (kWh)	40.96	46.08	51.20
Rated voltage (V)	409.6	460.8	512
Operating voltage range (V)	358.4-460.8	403.2-518.4	448-576
Max charge/discharge current (A)	60		
Depth of Discharge (%)	90%		

10. Maintain

Regular maintenance required. See O&M table for details. Higher freq. in harsh env. Keep records.

Warning

- Only qualified personnel can maintain the equipment.
- Please wear personal protective equipment before maintenance.

Be Careful

- Power OFF required before maintenance (e.g., cleaning, electrical conn., PE cable insp.).

Inspection items	Description	Cycle
System operating status	• Check for damage/deformation. • Check for abnormal noise from the system.	Every 6 months
Electrical connection inspection	• Check if the cables are securely fixed. • Check for any damage to the cables.	First maintenance: within 6 months post-debug; then every 6-12 months.
PE line inspection	• Check if the PE wire is securely connected.	First maintenance: within 6 months post-debug; then every 6-12 months.

Table10-1 Maintenance Checklist