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User Manual

LFP BATTERY

FES-5K-LVC

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Cautions

- Customers must rigorously follow the applicable safety rules when installing, maintaining, and using this product, as well as the operating specifications: It is forbidden to store or use the battery at high temperatures, and it must be kept away from heat
- sources. The environments above the safe temperature range will significantly decrease this product's
- performance, life and even cause serious consequences such as burning and explosion.
- It is forbidden to store and use in an environment with high static electricity or electromagnetic radiation.
- Otherwise, the electronic components in this product will be damaged, which may cause safety hazards. Do not get wet or even immerse in water. Otherwise, it may cause an internal short circuit, function loss, or
- abnormal chemical reaction of the product and cause fire, smoke, explosion, etc.
- If you find smoke, heat, discoloration, deformation, or any abnormal phenomenon during use, storage,
- transportation, and service. In that case, you should immediately contact the professional department to
- observe further and control the risk.
- Do not dispose of discarded products in fires or hot stoves. Waste batteries should be recovered and
- recycled by professional institutions or organizations. Professional technicians must operate the installation and maintenance of the battery system, and the
- user must strictly abide by the relevant safety regulations. It is strictly forbidden for non-professionals to
- install or repair the battery system and abuse it beyond the range.

Abbreviation

BMS	Battery Management System
BOL	Begin of Life
CAN	Controller Area Network
EOL	End of Life
HV	High Voltage
LV	Low Voltage
OCV	Open Circuit Voltage
SOC	State of Charge

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Definition

Battery Cell	The minimum energy storage unit, a basic electrochemical energy storage device, consists of a positive electrode, a negative electrode, an electrolyte, a separator, and a casing, also known as a battery cell.
Battery Module (Battery PACK)	A power supply system composed of several battery modules, circuit equipment (protection circuit, cell management system, electrical and communication interfaces), thermal management devices, etc., is used to provide energy for electrical devices.
Nominal Voltage	Indicates or identifies the appropriate voltage approximation for the cell or pack.
Capacity	The amount of electricity that can be provided by a battery cell that is fully charged under specified conditions. Usually expressed in Ah.
Energy Capacity	The energy can be provided by a fully charged battery cell or pack under specified conditions. Usually expressed in Wh or kWh.
Nominal Capacity	At the beginning of life (BOL), the minimum capacity that a fully charged cell can be provided under specified conditions is when it is discharged at a rate of 1C (C-rate).
Unit	“V” (Volt): Electrical current unit. “A” (Ampere): Electrical current unit. “Ah” (Ampere-Hour): Electrical charge unit. “Wh” (Watt-Hour): Electrical energy unit. “Ω” (Ohm): Resistance unit. “°C” (Celsius degree): Temperature unit. “mm” (millimetre): Length unit. “s” (second): Time unit. “kg” (kilogram): Weight unit. “Hz” (Hertz): Frequency unit.

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1.General Instruction

1.1 Scope and Purpose

- This product user manual only applies to the 51.2V100Ah rechargeable lithium-ion battery
- The user manual aims to introduce the 51.2V100Ah product information, installation, operation, and maintenance guidelines. Includes the battery pack, BMS specifications, internal, external structure,
- LED indication, battery system diagram, and other cautions. The manual cannot include complete
- information about the BESS system.

1.2 Brief Introduction

- 51.2V100Ahis designed according to the market requirements to meet application needs. In operation with the hybrid or off-grid inverter, can charge the battery when PV or grid power is available, and discharge the battery when backup power is needed.
- The battery can be paralleled to build a high-capacity hybrid system to satisfy the long-time energy storage demand.

1.3 Product Properties

- 51.2V100Ah products cathode materials are lithium iron phosphate, and battery cells are managed effectively by BMS with better performance, the system features are as follows:

1. Cathode material is lithium iron phosphate (LiFePO4), safer with a longer life span.
2. Flexible configurations allow parallel multi-battery for longer standby time.
3. Self-ventilation with lower system noise.
4. With a wide range of temperatures for the working environment, 0°C~+50°C, circulation span, and
5. discharging performance are well under high temperatures.
6. Carries battery management system with better performance and possesses protection functions like over discharge, over-charge, over-current, and abnormal temperature.
7. Includes self-management of charging/discharging and single-core balancing function.
8. Support the most mainstream CAN and RS485 protocol.

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1.4 Product standard configuration

I tem s	Quantity	Specification	Pictures
Battery Pack	1	ST51.2V100Ah	
Power Cable	1	1.5m 25Sq mm red wire with M6*25 lug 1.5m 25Sq mm black wire with M6*25 lug	
Power Cable	1	300mm 25sq mm red wire with M6*25 lug 300mm 25sq mm black wire with M6*25 lug	
Communication Cable	1	1.5m cable to connect battery to Inverter; CAN or RS485 communicate	
Communication Cable	1	300mm Communication cable for battery to battery	
Mounting Brackets,	4	Stack the battery parallelly one upon the other	
Wall mount bracket	2	Used for mounting the battery to a wall	

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2. Technical Specification

2.1 Battery Specification

Sl.no	Item	Specification	Remarks
1	Battery cell Model	LFP-100Ah	Lithium Iron Phosphate
2	Battery Module Model	16S1P-100Ah	-
3	Nominal Capacity	100Ah	-
4	Nominal Voltage	51.2V	Single cell – 3.2V
5	Operating Voltage Range	40V-58.4	-
6	Nominal Energy	5.12kWh	-
7	Operating Temperature	Charge Temperature： 0°C~55°C Discharge Temperature： -20°C~55°C.	-
8	Storage Temperature	-25-45°C.	At 50% SOC
9	Working Humidity	20~80%RH	
10	Standard Charge Current	0.5C	
11	Maximum Continuous charge Current	1C	
12	Standard Discharge Current	0.5C	
13	Maximum Continuous Discharge Current	1C	(1C，25±2°C)
14	Pack Weight	About 47Kg	
15	Dimension	Length: 595mm Width: 482 mm Height: 145 mm	

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2.2 BMS Specification

BMS Protection Parameter		
Function	Item	Protection Parameter
Cell Over Voltage Alarm	Overvoltage alarm	3.6±0.025V
	Overvoltage recovery	3.5±0.025V
	Undervoltage alarm	2.7±0.025
	Undervoltage recovery	V 3.0±0.025V
Cell Over Voltage Protection	Overvoltage protection	3.65±0.025V
	Overvoltage recovery	3.6±0.025V
	Undervoltage protection	2.5±0.025V
	Undervoltage delay	3000ms
	Undervoltage recovery	2.7±0.025V
Pack Over Voltage Alarm	Overvoltage alarm	57.6±0.3V
	Overvoltage delay	3000ms
	Overvoltage recovery	56±0.3V
	Undervoltage alarm	43.2±0.3V
	Undervoltage delay	3000ms
	Undervoltage recovery	46.4±0.35V

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Pack Over Voltage & Under Voltage Protection	Overvoltage protection	58.4±0.3V
	Overvoltage delay	3000ms
	Overvoltage recovery	57.6±0.3V
	Undervoltage protection	40±0.3V
	Undervoltage delay	3000ms
	Undervoltage recovery	43.2±0.3V

Charge overcurrent alarm	Charge overcurrent alarm	100±2A
	Charge overcurrent alarm recovery	95±2A
Charge overcurrent protection	Charge overcurrent protection	105±2A
	Charge overcurrent protection recovery	98±2A
Discharge overcurrent alarm	Discharge overcurrent alarm	100±2A
	Discharge overcurrent alarm recovery	95±2A
Discharge overcurrent protection	Discharge overcurrent protection	105±2A
	Discharge overcurrent protection recovery	98±2A
	Discharge secondary overcurrent protection	110±2A
	Discharge overcurrent protection recovery	103±2A

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3. General Instruction

3.1 Scope and Purpose

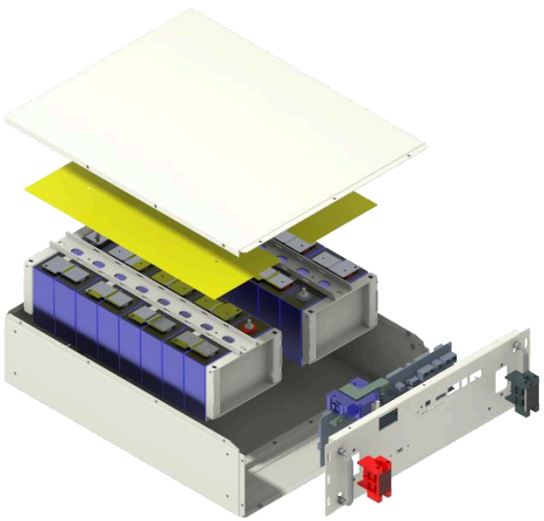

Fig. 3-1FES-5K-LVC PACK

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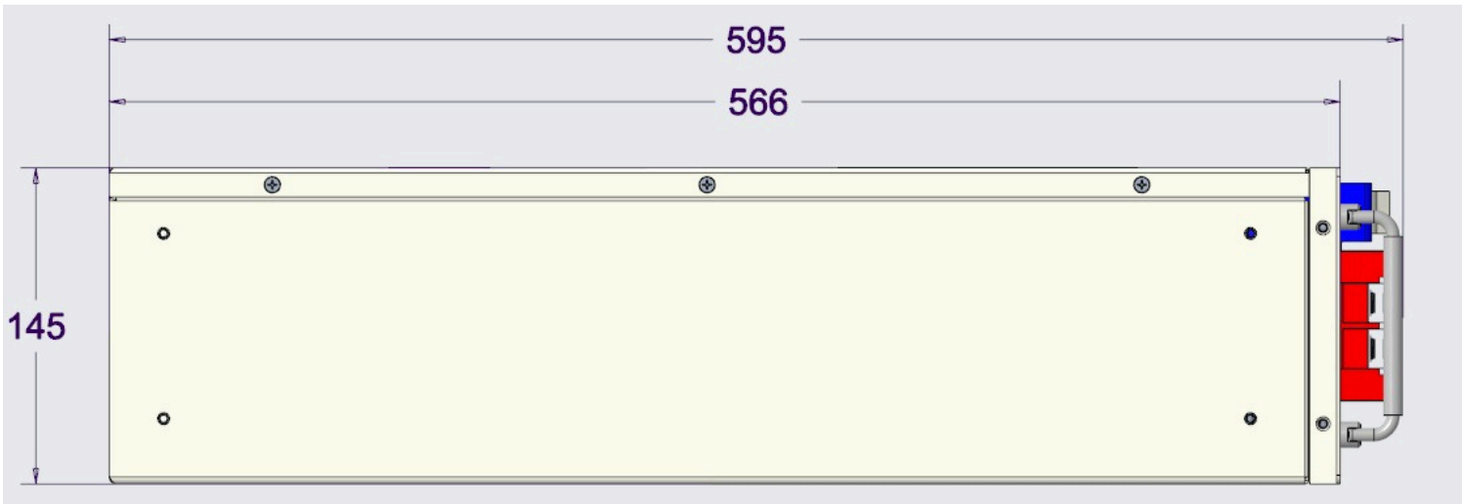
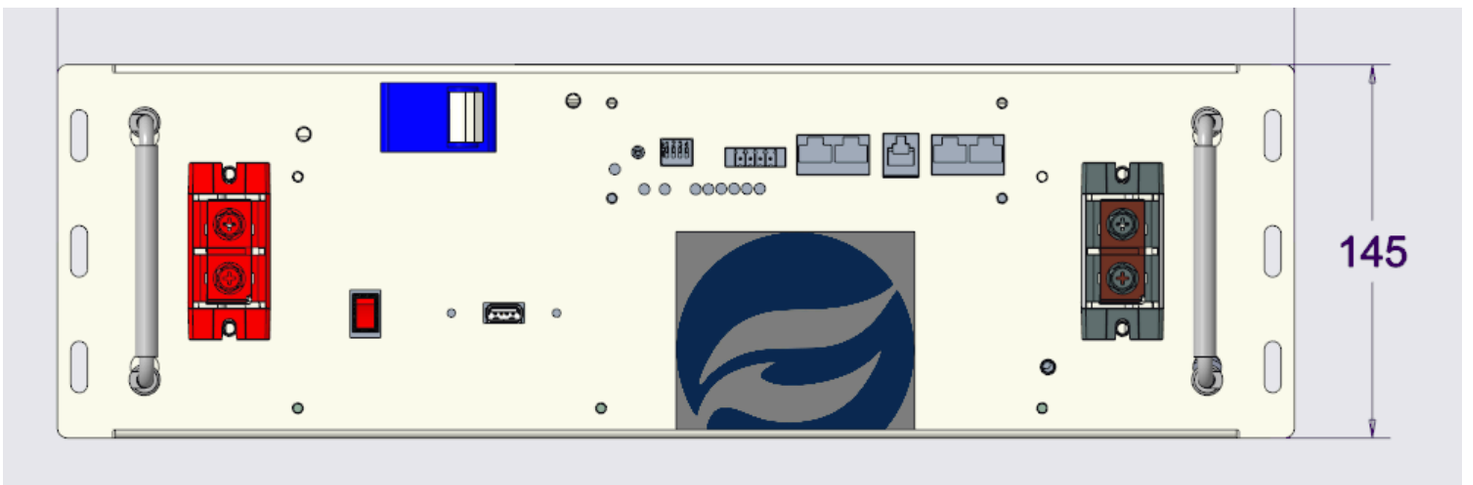
3.2 Dimensional Overview





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3.3 Interface Definition

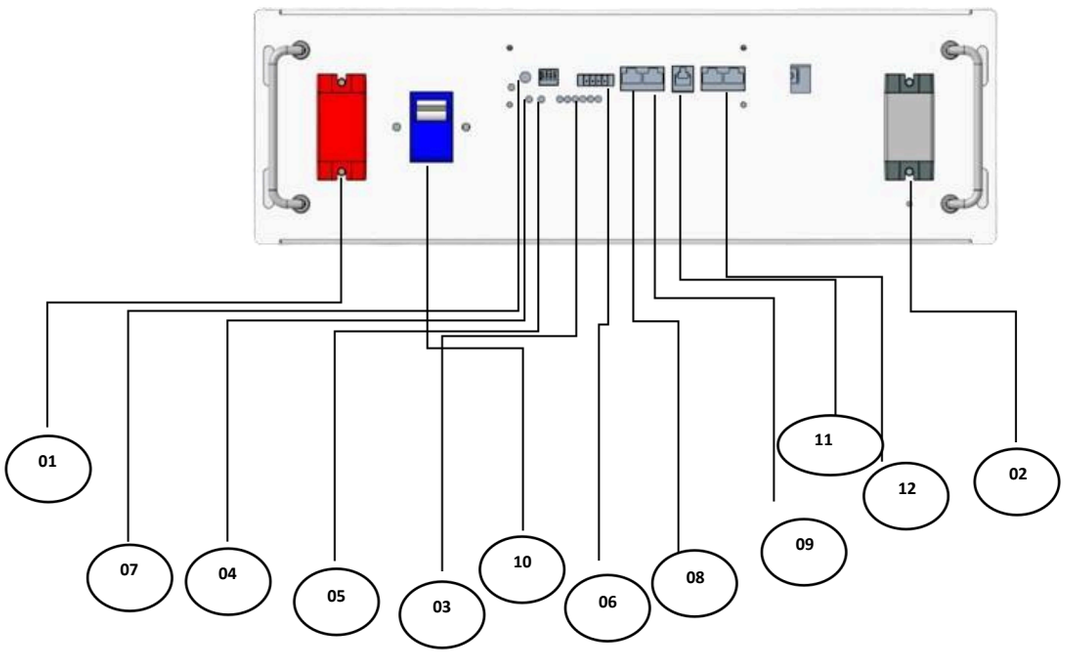

Fig. 3-3 ST51.2V100Ah PACK interface

Sl. No.	Interface	Rating	Description	Remark
1	Battery power +	100A	Positive Pole	-
2	Battery power -	100A	Negative Pole	-
3	Capacity LED	/	Please check clause 3.6	-
4	Alarm LED	/	Please check clause 3.5	-
5	Running LED	/	Please check clause 3.5	-

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6	Dipswitch	/	Please check clause 3.8	Setting the battery address and BMS communication protocols.

7	Reset button	/	After the battery reaches the limit protection, it needs tobe restarted by the Reset button.	
8	RS485 communication port	RJ45	Inverter RS485-Port PIN 1, 8: 485B PIN 2, 7: 485A PIN 3, 6: AGND3 PIN 4,5:NC	The network cable adopts Category 5 double-shielded twisted pair cable, shielded crystal head RJ45 (8P8C), and the actual product shall prevail.
9	CAN BMS communication port	RJ45	CAN2: PIN 1,3,6,7,8: NC PIN 2: AGND3 PIN 4: CAN-H PIN 5: CAN-L	The network cable adopts Category 5 double-shielded twisted pair cable, shielded crystal head RJ45 (8P8C), and the actual product shall prevail.
10	MCB	/	ON/OFF	
11	RS232 BMS communication port	RJ11	RS232: PIN 1,2,6: NC PIN 3: RS232-Tx PIN 4: RS232-Rx PIN 5: AGND2	The network cable adopts Category 5 double-shielded twisted pair cable, shielded crystal head RJ45 (8P8C), and the actual product shall prevail.
12	Parallel port (RS485A1, RS485A2)	RJ45	RS485A1 & RS485A2 PIN 1, 8: 485B PIN 2, 7: 485A PIN 4: CAN-H PIN 5: CAN-L PIN 3,6: AGND2	The network cable adopts Category 5 double-shielded twisted pair cable, shielded crystal head RJ45 (8P8C), and the actual product shall prevail.

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3.4 State LED Indication

System State	Running State	ON/OFF	RUN ●	ALM ●	Capacity LED ●	Remark ● ● ●
Battery Off	Sleep	OFF	OFF	OFF	According to the 2 capacity condition	
Battery Standby	Normal	ON	Flashing mode 1	OFF		Holding state Low SOC and temperature
	Alerting	ON	Flashing mode 1	OFF		alarm ALM is in flashing mode 3
Charge	Normal	ON	ON	OFF		The corresponding capability indicator is in flashing mode 2
	Alerting	ON	Flashing mode 2	OFF		Low SOC and temperature alarm ALM is in flashing mode 3. The corresponding capability indicator is in flashing mode 2
	Over charge protection	ON	ON	OFF		Overcharge protection ALM is off
	Over current protection	ON	Flashing mode 1	OFF		
	Over temperature, Under temperature overcurrent, short circuit and reverse polarity	ON	OFF	ON		Capacity indicator is off
	Charge current limiting	ON	ON	OFF		The corresponding capability indicator is in flashing mode
Discharge	Normal	ON	Flashing mode 3	OFF		
	Alarm	ON	Flashing mode 3	Flashing mode 3		
	Over discharge protection	ON	Flashing mode 1	OFF		Overdischarge protection ALM is off
	Over temperature, Under temperature overcurrent, short circuit and reverse polarity	ON	OFF	ON		Capacity indicator is on

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Failure	Faults	ON	OFF	ON	OFF	Faults refer to hardware failures like damage of BMS voltage sampling device, charging MOS and disconnection of temperature sensor

3.5 Capacity LED Indicators

State	Charge						Discharge					
Capacity LED	L1●	L2●	L3●	L4●	L5●	L6●	L1●	L2●	L3●	L4●	L5●	L6●
0~16.6%	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
16.6%~33.2%	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	ON
33.2%~49.8%	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF	ON	ON	ON
49.8%~66.4%	OFF	OFF	ON	ON	ON	ON	OFF	OFF	ON	ON	ON	ON
66.4%~83%	OFF	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON	ON
83%~100%	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

3.6 LED Flash Mode

Flashing Mode	ON	OFF
Flashing 1	0.25S	3.75S
Flashing 2	0.5S	0.5S
Flashing 3	0.5S	1.5S

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3.7 Dip Switch

Address Parallel number	DIP DIG IT STATE			
	#1	#2	#3	#4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

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4. Installation & Configuration

4.1 Preparation for Installation

- This systemcanonlybeinstalled by personnel who have been trained in the power supply system and have sufficient knowledge of the power system. The local safety regulations listed below should always be followed during the installation:

1. If operating within the power system cabinet, make sure the power system is not charged.
2. Battery devices should also be switched off.
3. Distribution cable wiring should be reasonable and has protective measures to avoid
4. touching these cables during the operation of power equipment.
5. When installing the battery system, must wear the following protective equipment:

The isolation gloves

Safety goggles

Safety shoes

4.1.1 Environmental Requirements

1. Working temperature: 0°C~+50°C
   a. Charging temperature range is 0°C - +55°C.
   b. Discharging temperature range is -20°C -+55°C.
2. Relative humidity: 90%RH
3. Operating environment: Indoor installation, sites that avoid sunlight and wind, with no conductive dust or corrosive gases. And the following conditions are met:
   Installation location should be away from the sea to avoid brine and high humidity environment.
   The ground is flat and level.
   There is no flammable explosive near to the installation places.
   The optimal ambient temperature is 25°C ~ 45°C;
   Keep away from dust and messy zones.

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4. Installation & Configuration

4.1.2 Tools

The following tools and meters that may be used for installation

Screwdriver

Inclined pliers

Wrench

Nose plier

Wire stripper

Clamp meter

Insulation tape

Multimeter

4.1.3 Technical Preparation

- Devices connected directly to the battery can be user equipment, power supplies, or other power supplies.
- Confirm whether the user equipment, the PV equipment or other power supply equipment has the DC standby interface, and measure whether the output voltage of the standby interface meets the requirements of the voltage range.
- Verify that the maximum discharge current capacity of the user equipment, the PV equipment or other power supplies, the DC standby interface, and the maximum discharge current shall be greater than the maximum charging current of the products.
- If the user equipment DC prepared interface maximum discharge capacity is less than the maximum charging current product, the user interface should have the power equipment of DC limiting function, prioritizing the normal work of user equipment.
- Firefighting equipment, such as portable dry powder fire extinguishers, should be provided near the equipment.
- An automatic fire fighting system shall be provided for the case where necessary. No flammable, explosive or other dangerous articles are placed beside the battery.

4.1.4 Pack Inspection

- When the equipment arrives at the installation site, loading and unloading should be carried out according to the rules and regulations, to prevent from being exposed to sun and rain.
- Before unpacking, the total number of packages shall be indicated according to the shipping list attached to each package, and the case shall be checked for good condition.
- In the process of unpacking, handle with care and protect the surface coating of the object.
- Open the package, the professional installation person should read the technical documents, verify the list, according to the configuration table and packing list, and ensure objects are complete and intact. If the internal packaging is damaged, it must be inspected and recorded in detail.

4. 2 Installation

4.2.1 Installation Personnel

- Onlyqualified professionals or trained personnel are allowed to install the equipment.
- Professionals: Personnel who are familiar with the working principles and structure of the equipment, trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation. Trained personnel: Personnel who are trained in technology and safety have required experience are aware of possible hazards on themselves in certain operations and are able to take protective measures to minimize the hazards on themselves and other people.
- Personnel who plan to install the equipment must receive all necessary safety precautions and local relevant standards.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment.
- Knowledge of electronic, electrical wiring and mechanical expertise, and be familiar with electrical and mechanical schematics.
- Understanding and complying with this document and other applicable documents.

4.2.2 Installation Environment

- Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.
- Do not store any flammable or explosive materials in equipment area. Do not cover or wrap the battery.
- Do not place the equipment near heat sources or fire sources, such as smoke, candles,heaters, or other heating devices. Overheat may damage the equipment or cause a fire.
- Install the equipment in an area far away liquids. Do not install it under areas prone to condensation, such as underwater pipe and air exhaust vent, or area prone to water leakage, such as air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that no liquid enters the equipment to prevent faults or short circuits.
- To prevent damage or fire due to high temperature, ensure that the ventilation vents or heat dissipation systems are not obstructed or covered by other objects while the equipment is running.
- The installation and usage environment must meet relevant international, the local laws and regulations. The user is obliged to protect the equipment against fire or other hazards.
- Keep the equipment out of the reach of children and away from daily working or living area, including but not limited to the following areas: studio, bedroom, lounge, living room, music room, kitchen, game room, sunroom, toilet, bathroom, laundry, and attic. Do not install the equipment in places that are enclosed, poorly-ventilated without proper firefighting facilities, or difficult for firefighters to access.
- Do not install the equipment on a moving object, such as ship, train, or car.
- Ensure that the equipment is installed in a clean, dry and well-ventilated area with proper temperature, humidity and altitude range. Check for more data in the “Technical Specifications” section.

- Do not install the equipmentinan environment with magnetic dust, volatile or corrosive gases, infrared and other radiations,organic solvents, conductive metal, or salty air.
- Do not install the equipmentinan area conducive to growth of microorganism such as fungus or mildew.
- Do not install the equipmentinan area with strong vibration, noise, or electromagnetic interference.
- Do not install the equipmentina position that may be submerged in water.
- Keep away from the air outletof PCS to prevent personal injury.
- The floor and walls are completely water proof.
- The wall and floor are flat andlevel.
- Before installing and poweringup the system, dust and iron filings must be removed to keep the environment clean. The systemcannot be installed in desert areas without a shell to protect against sand.
- The equipment is designed forindoor use. Please avoid direct sunlight, rain exposure, snow laying up during installation and operation.

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5. Electrical Connections

- It is noted to distinguish the positive and negative ends of cables. Be careful to avoid misuse oflinesusedforcommunication between PCS and battery, battery and battery.
- Before connecting the cable with the PCS,theworker must confirm the PCS output switch is turned off to prevent fire or electric shock.
- Exercise extreme caution to prevent the terminals from contacting anything except their intended mounting points.
- When tightening the screws,make sure they are at a straight angle from the battery module terminals to avoid damage to the nuts inside.
- The power terminals, suchas“+,””-,”of the module are covered with the protecting cover to guard against a short circuit.
- You must remove the insulation cover prior to connecting and reattach the insulation cover immediately after connecting.

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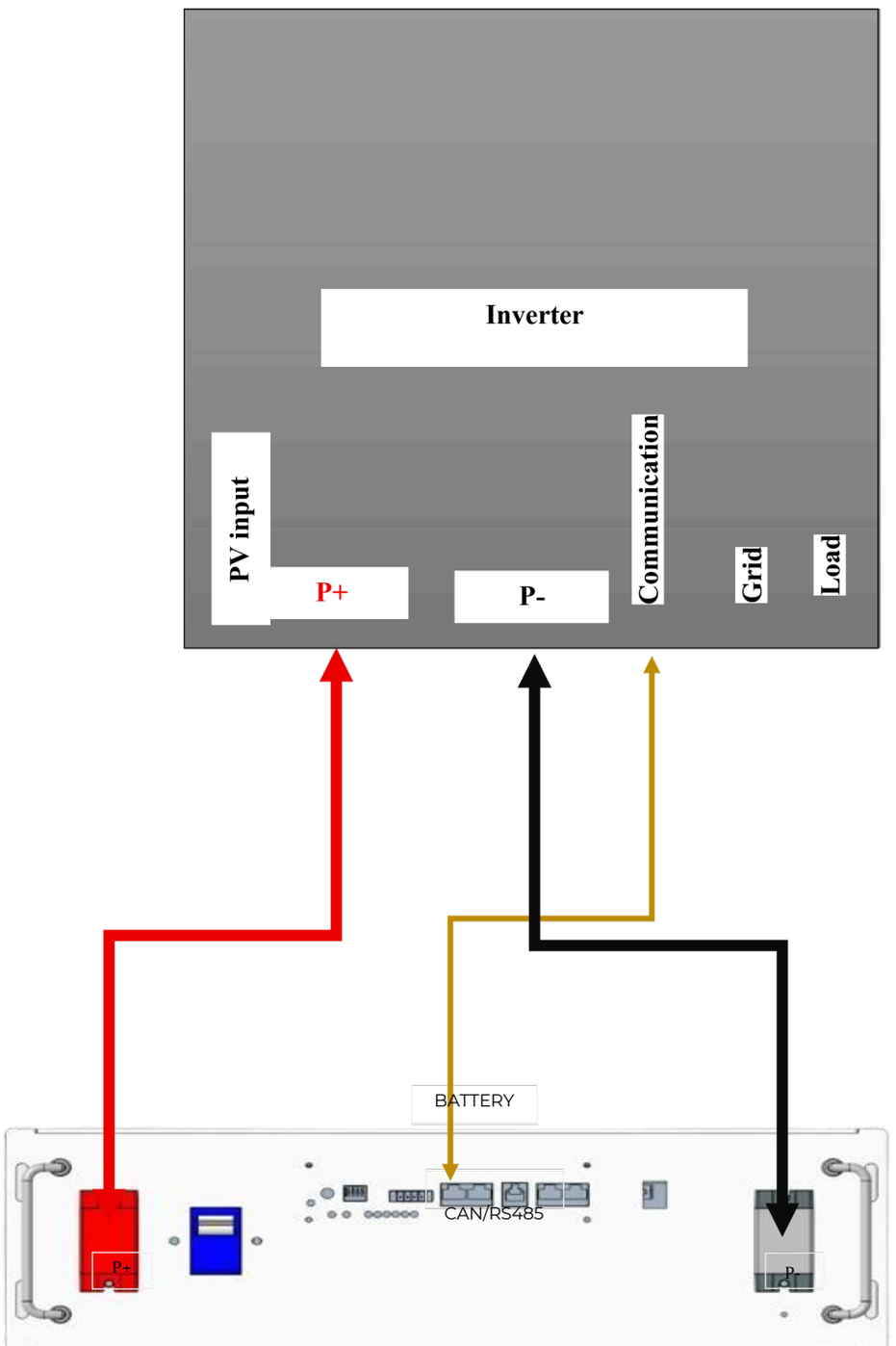
5.1 Single Mode



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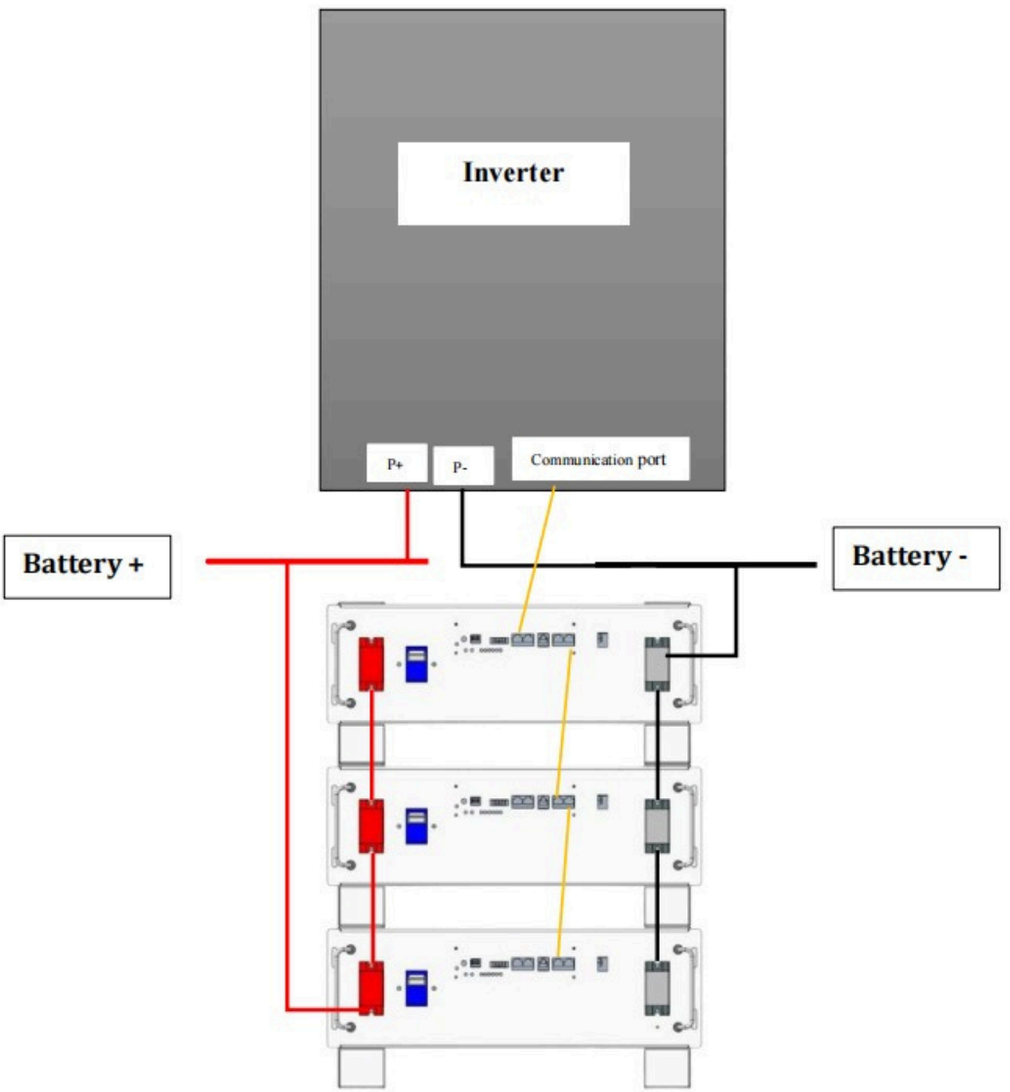
5.2 Parallel Mode

- When batteries need to be used together in parallel, you can select different parallel modes to meet your demands.
- It should be noted that the maximum current of single battery system is 100A. Exceeding 100A
- will cause heating of the connectors and cable, and in severe cases, it will cause a fire accident. As
- for cables, the recommended cross section of them should be at least 4AWG or 25mm².

Schematic diagram of connection of single battery system:



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6. Transportation & Storage

6.1 Transportation

During transportation, it should be protected from violent vibration, shock, sun exposure, and rain and must not be inverted to ensure that no short circuit occurs. In the process of loading and unloading, it should be handled with care to prevent falling, rolling, heavy pressure, and inversion.

6.2 Storage

Product storage requirements are as follows:

- Whenthe batteryPACK islong timestored, the battery should be charged to 50% SOC.
- Electrical box products should be stored in a dry and ventilated environment with a temperature not exceeding 50°C and relative humidity less than 80%. For inflammable and explosive items, avoid places with a lot of dust and metal powder, and avoid contact with acid or other corrosive gases; The storage location of electric box products should be protected from rain, moisture, and sun protection.
- Storage temperature: The storage temperature range is 25°C~45°C. If it is expected to be stored for more than 1 month and not more than 6 months, you should do a charge and discharge in advance and adjust the SOC to 20% to 50%. Sieger Technologies will not be responsible for the loss of capacity or other losses if the storage SOC exceeds the range of 20-50% or the storage for morethan 6 months without charge and discharge maintenance.

7. Troubleshooting

- Regarding the settings in the inverter's user interface, verify that you have selected the correct lithium battery type. crucial settings to check include the charging voltage, battery low cut-off voltage, and charging current, ensuring they align with the battery manufacturer's specifications.
- If any inconsistent performance of the battery occurs, check all cable connections between the inverter and battery, including the power and communication lines. Ensure terminals are secure, and cables are not damaged.
- In communication wiring, verify that CAN High and CAN Low lines are not reversed.
- To reduce overheating, ensure the inverter and batteries are installed in a well-ventilated, shaded, and dry area, away from direct sunlight.

- Recovering the battery pack from fault status.

Error message	Description	Solution
Cell/battery over voltage fault	1.cell/battery reaches over voltage cut-off after fully charged state	1.Trigger discharge If current >15A it will take 15 seconds to recover, if current is >30A the fault immediately recovers 2.Automatically recovers after 30 minutes after reaching the recovery voltage
Battery under voltage fault	1.battery reaches under voltage cutoff after fully discharged state	1.Trigger charge If current >15A it will take 15 seconds to recover, if current is >30A the fault immediately recovers 2.Automatically recovers after 30 minutes after reaching the recovery voltage
Cell under voltage fault	Cell reaches under voltage set value	1.Automatically recovers if it reaches recovery value 2.The BMS in charging state and current>3A
Over current fault	When over current in charge or discharge is triggered	1.Automatic recovery after self-checking for every 30 minutes. After checking 10 times the time will be adjusted to 2 hours 2.Manually restart the BMS
Over temperature fault	When the BMS reaches over temperature or under temperature	1.Automatically recovers when it reaches the recovery value
Sleep mode	The BMS goes to sleep mode after reaching the set value of sleep voltage after 30 minutes	1.Open and close the weak switch 2.Press the reset button for 10 seconds 3.Trigger charging
Short circuit protection	Triggered when current >300A	Automatically recovers

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