Operation manual

Intelligent lithium battery energy storage system

100kW/215kWh

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BEIJING HUA XIN LIU HE INVESTMENT (AUSTRALIA) PTY LTD

Preface

Overview

This document mainly introduces the site requirements, precautions, installation preparation, installation and connection of equipment and cables, inspection before power-on, methods and skills of power-on and system operation of intelligent lithium battery energy storage system Z10SYS768-100K (hereinafter referred to as energy storage system), and provides installation guidance and technical support for on-site installers and technical support engineers.

Applicable Readers

This document mainly applies to the following people objects:

- Hardware installation engineer
- Site installation personnel
- Technical Support Engineer
- Testing engineer
- Maintenance engineer
- User

Symbol Stipulations

The following signs may appear in this article,and they represent the following meanings.

Symbol	Define	Explain
	Dangerous	Hazards with a high risk of causing death or serious injury if not avoided.
	Warning	Hazards of moderate risk that, if not avoided, may result in death or serious injury.
	Attention	Hazards with low risk that may result in mild or moderate injury if not avoided.

NOTE	Instructions	Supplementary statements to the main information in the text. “Instruction”: Not a security warning message

Revision History

The modification record accumulates a description of each document update. The latest version of the document contains updates from all previous versions of the document.

Document Version 01 (2023-01-01)

The document is officially published for the first time.

Catalog

1 Instruction for use

This chapter explains the installation guide for users' convenience.

This document focuses on the installation method, power-on operation, instruction and precautions of the energy storage system. Please refer to the specific project data for the drawings and specific parameters used in the operation process.

Before using this document, you must be familiar with the actual configuration of the energy storage system, so as to quickly complete the installation and power-on.

The relevant precautions in this document are only a supplement to the laws and regulations of the place where the energy storage system is located.

The figures in this document only indicate the method of wiring installation, and the quantity and appearance of the specific products shall be subject to the on-site physical objects.

Safety helmets, gloves and other protective equipment must be worn when entering the construction site.

Before using this document, please collect the data of each component for later use.

2 Safety instructions

2.1 General safety

- The equipment should be used in an environment that meets the requirements of design specifications, otherwise it may cause equipment failure, and the resulting abnormal function of the equipment or component damage, personal safety accidents and property losses are not within the scope of equipment quality assurance. The installation, operation and maintenance of equipment shall comply with local laws, regulations and codes. Safety precautions in the manual are only used as a supplement to local laws, regulations and codes. When any of the following situations occurs, the Company will not be liable.
- And the installation and use environment are beyond the provisions of relevant international, national and regional standards.
- Do not operate under the conditions of use described in this manual.
- Disassemble, change products or modify software codes without authorization.
- Failure to follow the operating instructions and safety warnings in the products and documents.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood and debris flow, etc.).
- Damage caused by customer's failure to comply with transportation and installation requirements.
- Damage caused by storage conditions not meeting the requirements of product documentation.
- Damage to the hardware or data of the equipment due to customer's negligence, improper operation or intentional damage.
- System damage caused by third parties or customers, including the relocation and installation of systems that do not meet the requirements of this manual, and the damage

caused by the adjustment, change or removal of identification marks that do not meet the requirements of this manual.

- Defects, failures or damages caused by acts, events, negligence or accidents beyond the Seller's reasonable control, including power failure or electrical failure, theft, war, riots, civil strife, terrorism, intentional or malicious damages, etc.

There is a high voltage in the equipment, and irregular operation may cause electric shock or fire, resulting in death, serious personal injury or serious property loss. Please observe the operation sequence and safety precautions given in this manual and other related documents, and standardize the operation:

- Please check the cable connection fastening of the pre-installed equipment. Check whether the equipment is damaged, such as holes, dents or other signs of possible internal damage. Check that the components inside the equipment are not displaced, and it is forbidden to change the structure and installation sequence of the equipment without authorization.
- It is forbidden to clean the electrical parts inside the equipment with water. When liquid is found to enter the equipment, please immediately press the emergency stop switch and notify the site management personnel.
- Installation, wiring, maintenance, replacement, etc. are prohibited. Before touching any conductor surface or terminal, measure the voltage at the contact point, and confirm that the protective ground wire of the equipment or the parts to be overhauled has been reliably grounded, and there is no danger of electric shock.
- Please keep away from the equipment except those who operate it. Do not power on the equipment until it has been installed or confirmed by professionals. At least two people must be at the scene when the main circuit is powered on for the first time or the main circuit is powered on.
- Users' operating behaviors and tools in the process of transportation, handling, installation, wiring and maintenance must meet the requirements of laws, regulations and relevant standards of the country and region where they are located.

- During installation, operation and maintenance, the accumulated water, ice and snow or other sundries at the top of the cabinet should be cleaned first, and then the cabinet door should be opened to prevent sundries from falling into the cabinet.
- It is forbidden to reverse engineer, decompile, disassemble, adapt, implant or other derivative operations on the equipment software. It is not allowed to study the internal implementation of the equipment, obtain the source code of the equipment software, steal intellectual property rights, etc. in any way, and it is not allowed to disclose the performance test results of any equipment software.

2.2 Electrical safety

2.2.1 Wiring requirements

- Please select cables that meet the requirements of local laws and regulations. Cables of the same kind should be tied together, and cables of different kinds should be laid separately. It is forbidden to intertwine or cross each other.
- When wiring is completed or left for a short time during wiring, it is necessary to immediately block the cable opening and close the cabinet door to prevent small animals from entering.
- Cables used in the energy storage system must be firmly connected, well insulated and meet the requirements. The position where the cable passes through the pipe or through the hole must be protected to avoid the cable being damaged by sharp edges and burrs.
- After the cable connection is completed, it is necessary to use the cable bracket and the cable clamp for reliable fixation. The cables in the backfill soil area should be closely attached to the ground to prevent the cables from being deformed or damaged due to stress when back filling soil.

- Use of cable in high temperature environment may cause aging and damage of insulation layer, and the distance between cable and the periphery of heating device or heat source area is at least 30mm.
- To ensure the construction safety, all cables should be laid and installed above 0℃. When handling cables, especially in low-temperature environment, they should be handled with care.

2.2.2 Grounding requirements

- Do not damage the grounding conductor. The grounding body of the equipment shall be permanently connected to the protective grounding grid. Before operating the equipment, check the electrical connection of the equipment to ensure that it is reliably grounded.
- Do not operate the equipment when the grounding conductor is not installed. When installing the equipment that needs grounding, the protective ground wire must be installed first; When dismantling the equipment, the protective ground wire must be finally dismantled.

2.2.3 Inspection requirements

- Before connecting or removing cables, disconnect the protection switch of the corresponding circuit.
- Use the multi-meter with the corresponding voltage level to check whether it is electrified and ensure that the equipment has been completely powered off.
- If there is a charged body nearby, please cover or wrap it with insulation board or tape.
- Use grounding wire to reliably connect the circuit to be repaired with the grounding circuit, and then carry out operation and maintenance.
- Before connecting cables, make sure that the line labels are correct before connecting them.

- If the equipment has multiple inputs, all inputs of the equipment should be disconnected, and the equipment can be operated only after the equipment is completely powered off.
- After the overhaul, remove the grounding wire between the overhaul circuit and the grounding circuit.

2.2.4 Mechanical Safety

- When transporting without wooden box fork, the bottom apron must be removed. Take off and land with care to avoid shock or vibration.
- During transportation, the center of gravity of the box should fall in the middle of two forks of the forklift. Long-distance transportation, inversion and tilting are prohibited.
- When transporting the equipment, the large size of the equipment may obscure the operator's sight, so it is necessary to arrange auxiliary personnel to assist in the completion.
- In order to ensure the safety of drilling outside the equipment body, an appropriate position should be selected before drilling to ensure that it will not cause short circuit and other influences. In the process of drilling, the equipment should be shielded to prevent debris from falling into the equipment, and the debris should be cleaned in time after drilling.
- When handling the equipment by hand, be prepared to bear the load, and wear protective gloves, anti-smashing shoes and other safety protection appliances.
- During equipment handling, the equipment should be carefully moved to avoid impact or drop. Avoid scratching the equipment surface, damaging components or cables.

2.2.5 Battery Safety

The company will not be responsible for the damage to the battery provided by the company due to the following reasons:

- Due to the customer's failure to charge and accept the battery in time, the battery is stored beyond the time limit, capacity loss or irreversible damage, etc.
- Drop mechanical damage, liquid leakage, rupture, etc. caused by improper operation or failure to connect the battery as required.
- Or the customer's third party will change the battery usage scenario without knowing our company. Including, but not limited to: connecting extra load to the battery, mixing with other brands of batteries, and mixing with batteries with different rated capacities, etc.
- Direct damage to the battery caused by the fact that the operating environment or external power parameters of the field equipment can't meet the environmental requirements of normal operation. Including the actual operating temperature of the battery is too high or too low, the power grid is in bad condition, frequent power outages, etc.
- The customer's incorrect setting of battery operation management parameters or improper maintenance results in frequent battery over-discharge, on-site capacity expansion or long-term inability to fully charge, etc.
- The customer fails to properly maintain the battery according to the operation manual of the supporting equipment, including but not limited to: not regularly checking whether the battery terminal screws are tightened, etc.
- The battery was stolen and lost.
- Batteries beyond the warranty period.

- Do not expose the battery to the high temperature environment or the surroundings of heating equipment, such as sunshine, fire source, transformer, heater, etc. Battery overheating may cause fire and explosion.
- It is forbidden to disassemble, modify or destroy the battery (such as inserting foreign objects, immersing in water or other liquids, etc.) so as to avoid liquid leakage, overheating, fire or explosion of the battery.

- When the battery is out of control, combustible gas and harmful gases such as CO and HF will be produced. Combustible gas accumulated after the battery is out of control has the risk of deflagration and explosion, which may cause personal injury and property loss.
- When installing and maintaining the battery, it is necessary to wrap the exposed cable terminals on the battery with insulating tape. At the same time, avoid foreign matters (such as conductive objects, screws, liquid, etc.) from entering the battery to cause short circuit.

- Batteries must be stored in a separate warehouse, and in the outer packaging. Avoid mixing with other materials, outdoor storage, and excessive stacking of batteries. The site must be equipped with fire-fighting facilities that meet the requirements, such as fire sand and fire extinguishers.
- Batteries should be protected from impact. When handling the battery, it should be handled in the direction required by the battery, and it is forbidden to turn upside down or tilt.
- Please use the battery within the temperature range specified in this manual. When the ambient temperature of the battery is lower than the lower limit of the working temperature, it is forbidden to charge, so as to avoid the internal short circuit of the battery caused by crystallization during low-temperature charging.
- Please dispose of used batteries according to local laws and regulations, and do not treat batteries as domestic garbage.
- If the last charging time of the battery exceeds 8 months, it is necessary to recharge the battery. If the battery is not recharged as required, it may affect the performance and service life of the battery.
- Treatment measures for battery abnormality
- In case of electrolyte leakage or abnormal smell, contact with leaked liquid or gas should be avoided. Please keep away from non-professionals and contact professionals immediately.

- Electrolyte is corrosive, and contact may cause skin irritation and chemical burns. If you come into contact with battery electrolyte, you need to immediately wash the contact area with plenty of water and soap, and seek medical help immediately.
- After the battery drops (with or without wrapping material), it is forbidden to continue using it. If the appearance is not obviously deformed or damaged, and there is no obvious odor, smoke or fire, on the premise of ensuring safety, transport the battery to an open and safe place to stand for 1h for post-treatment, and contact our service engineer.
- When the battery has obvious odor, damage, smoke or fire after falling, evacuate the personnel immediately and call the police in time. Under the condition of ensuring safety, professionals should use fire-fighting facilities to extinguish the fire.

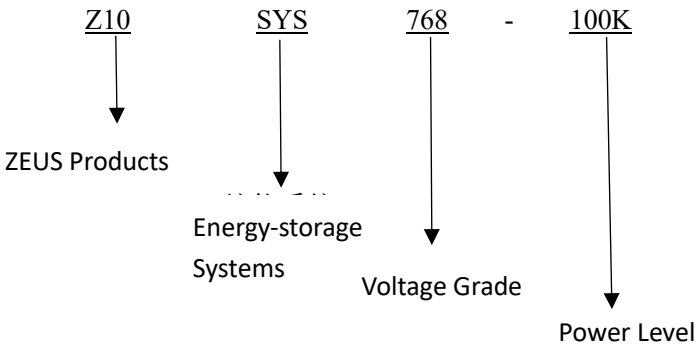
2.2.6 Maintenance and replacement

- It is forbidden to open cabinet doors in rain, snow, thunder, dust, fog and other weather.
- Before taking the components out of the cabinet, please make sure that other components on the cabinet are not loose.
- During equipment maintenance, the nearby live parts should be covered with insulating materials.
- Before the fan is powered off and stopped running, it is forbidden for any articles to touch the running fan (such as fingers, parts, screws, etc.).
- Do not power on the equipment before troubleshooting.
- During live inspection of the system, attention should be paid to the danger warning signs on the equipment, and avoid standing at the cabinet door.
- Wait 15 minutes after the equipment except the battery pack is powered off to ensure that the equipment is powered off before operating it.
- After the replacement of energy storage power components or wiring changes of the system, manual wiring inspection is required to avoid abnormal operation of the system.

- After completion of maintenance and replacement, the cabinet door should be locked in time, and the key should be properly kept

3 Product introduction

3.1 Model description



The power of the product, accessories (such as isolation transformer, ATS, STS, DCDC) and other related parameters are not reflected in the naming, which is determined by the early technical communication. This product is the standard scheme.

3.2 Product functions

Outdoor energy storage cabinet of ZEUSAPPOLLO SOLAR integrates energy storage battery, modular PCS, energy management monitoring system, power distribution system, environmental control system and fire control system. Modular PCS is adopted, which is convenient for maintenance and capacity expansion. Outdoor cabinets adopt front maintenance, which can reduce the floor space and maintenance channels. It has the features of safety, reliability, rapid deployment, low cost, high energy efficiency and intelligent management.

In common application scenarios, the operation strategy of the energy storage system is as follows:

Peak cutting and valley filling: When the time-of-use electricity price is in the valley section:

the energy storage cabinet is automatically charged, and stands by after being full; When the time-of-use electricity price is at the peak, the energy storage cabinet will automatically discharge, realizing arbitrage of electricity price difference and improving the economic benefit of the optical storage and charging system.

Combination of photovoltaic and energy storage: Real-time local load power is obtained, photovoltaic power generation is given priority to spontaneous self-use, and surplus electricity is stored; If the photovoltaic power is insufficient to provide the local load, the battery is preferred to store electricity.

3.3 Electrical primary diagram

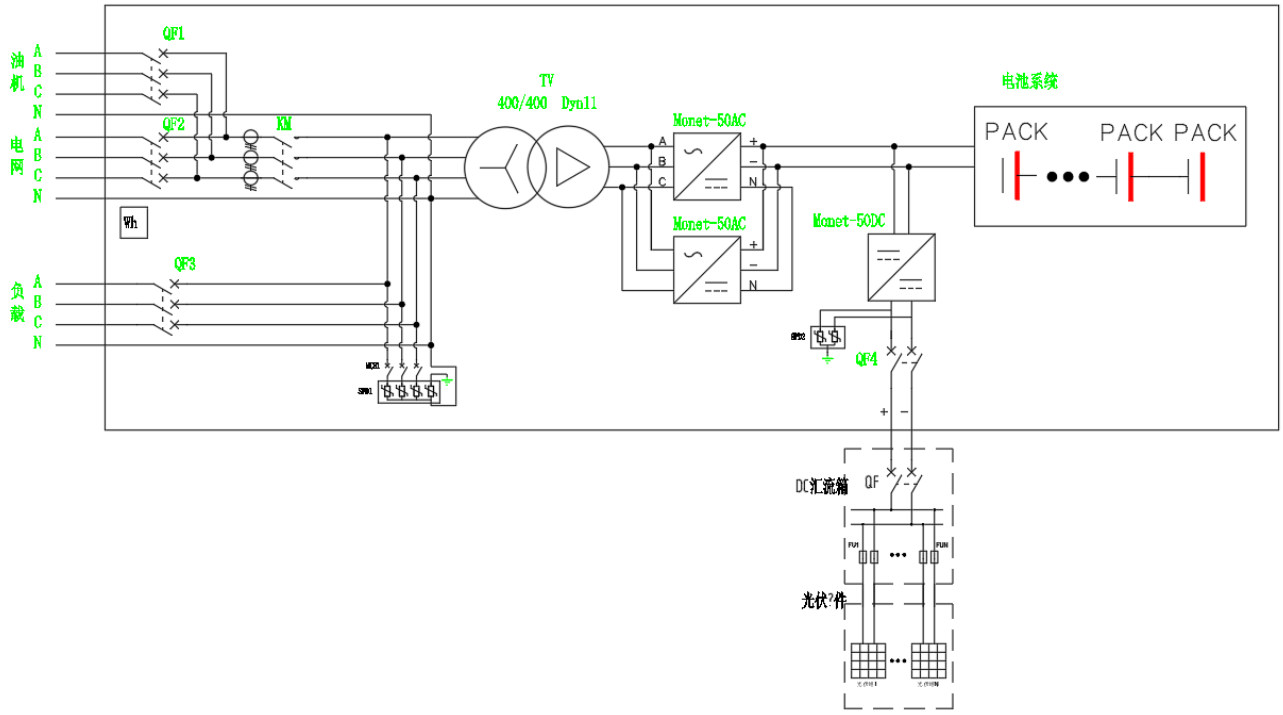


Figure 1 Electrical primary diagram of energy storage system cabinet

Figure 1 shows the system scheme with grid-connected and off-grid, isolation transformer and photovoltaic input. Different projects have different configurations and slightly different lines. Actually, the shipping drawings shall prevail.

3.4 Product features

- Systematization, integration of energy storage battery, PCS, energy management monitoring system, power distribution system, environmental control system and fire control system, etc., to fully control the running status and risks of the system;
- Equipped with rack-mounted modular PCS, it supports multi-machine parallel connection and has good expansibility; The number of PCS modules and the total battery capacity can be selected according to the system capacity requirements of microgrid and other scenarios. The typical configuration is: 100kW/215kWh.
- Protection grade IP54, which can perfectly cope with all kinds of outdoor weather;
- The door-mounted embedded integrated air conditioning is adopted, which does not occupy the cabinet space, improves the available space of outdoor cabinets, has better top structural integrity and good waterproof effect;
- The local control panel can realize diversified functions such as system operation monitoring, energy management strategy formulation, and equipment remote upgrade.

3.5 Product parameters

The following are the typical configuration parameters of outdoor cabinet energy storage system, and the actual supply is subject to the technical agreement.

Table 1 The description of related parameters of energy storage system

Number	Item	Parameters	Z10SYS768-100K
1	Battery	System energy	215.04kWh
2		nominal capacity	280Ah
3		nominal voltage	768V
4		Operating voltage range of battery	672V~835V
5		Maximum charge and discharge current	140A DC
6		rated power	100kW（Max 110kW）

7	AC side	PCS output voltage	400V AC
8		Rated AC current	114A
9		Voltage range of AC side	250~900V DC
10		Maximum current of DC side	140A
11		Input/output frequency	50~60Hz
12		Ac wiring	3W＋N+PE／3W＋PE
13		Overload capacity	100% Operate normally
14			120% 1min
15			150% 10s
16		Standby switching time	30mS
17		Peak efficiency	97.3%
18	DC side of PV	rated power	50~100kW（Max: 55～110kW）
19		Voltage range of PV side	200~1000V（500～900V full load）
20		Maximum current of PV side	110A
21		Voltage range of battery side	312~850V
22		Input channels of battery	2 Channels
23		Maximum current of battery	80A*2（50kW）
24	System parameters	Cooling mode	Through air-cooled air conditioner or heat ex-changer
25		noise	＜70dB
26		The protection grades	IP54

27		Operating temperature	-20℃~60℃
28		Operating humidity	0~95%
29		Dimension	W1800*D1200*H2200（mm）
30		weight	≈2800kg
31	Fire fighting	Environmental testing	Smoke sensor, entrance guard sensor, water immersion sensor
32		Aerosol fire extinguisher	Capacity: 2.5kg
33	Others	Communication	RS485, CAN, Ethernet, dry contact
34		Isolation	Non-isolated (transformer is optional)

Actual parameters have been set before delivery according to customer requirements.

3.6 Introduction of components

3.6.1 Battery system

- Design of 64V/280Ah module: The battery module is composed of 20 *3.2V batteries connected in series, 24S BMU acquisition board developed by ZEUSAPPOLLO SOLAR is loaded inside, and the collected cell data is reported to the secondary controller BCU through CAN communication for summary.
- Pack battery weighs 130kg, and its structural dimensions are as follows:

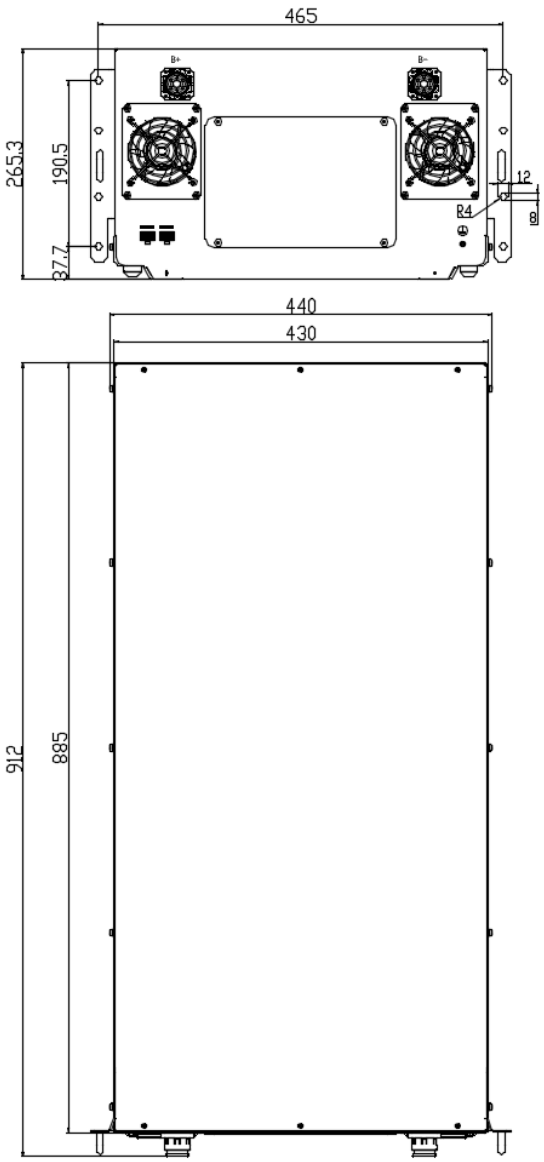


Fig. 2 battery Pack size diagram (unit: mm)

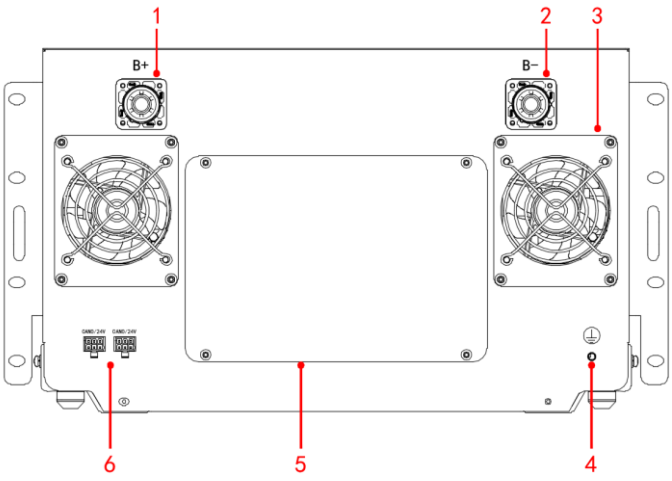
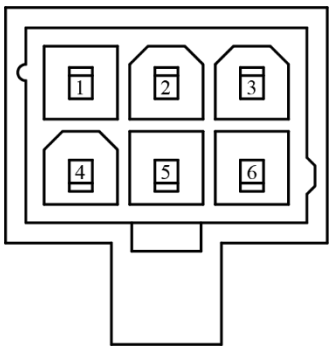


Figure 3 Front panel definition of battery pack

Table 2 Introduction of Pack Panel Functions

Number	Name	Function definition	Notes
1	B+	Pack positive electrode	
2	B-	Pack negative electrode	
3	fan	Pack heat dissipation	
4	Ground point	Pack grounding point	M5 thread
5	BMU	Pack management module	
6	CAN communication	Pack inter-battery communication port	

Table 3 Definition of Battery Pack Communication Port

Pin position diagram	Pin position	Description
	1	24V+
	2	24V-
	3	CAN0_H
	4	CAN0_L
	5	
	6	CAN0_S

- The high voltage box is the control part of the whole battery cluster, which is used to control and protect the DC connection or disconnection of the battery cluster.

- The high-voltage box has built-in BCU is developed by ZEUSAPPOLLO SOLAR , and the cell data and battery cluster status collected in each Pack are reported through CAN communication.

The high-pressure box weighs 16kg, and its structural dimensions are as follows:

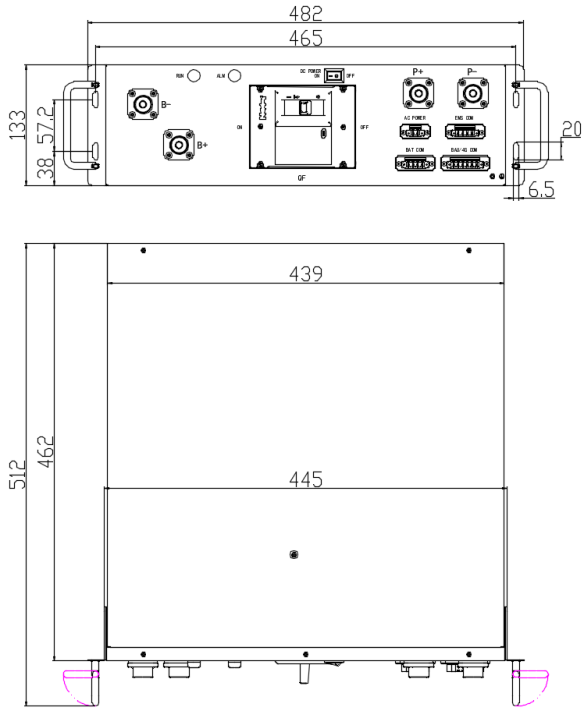


Figure 4 Dimensions of high-voltage box (unit: mm)

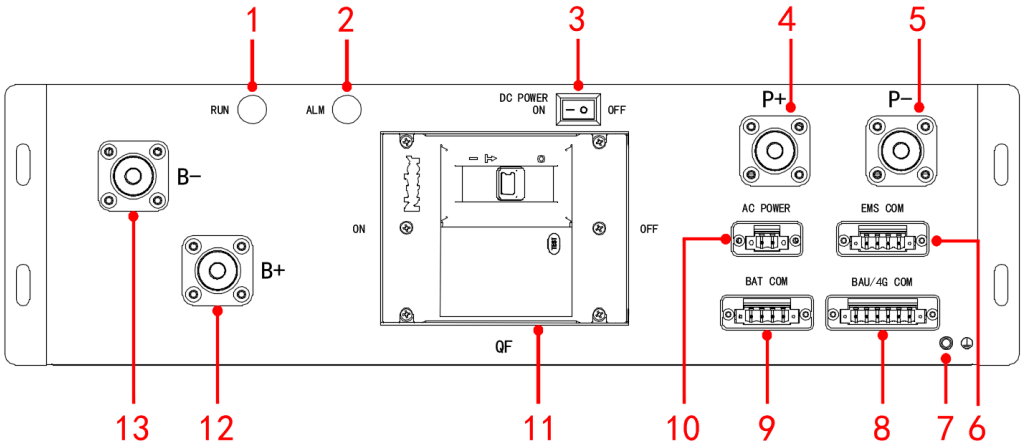


Figure 5 Definition of front panel of high-voltage box

Table 4 Definition of panel function of high-pressure box

Number	Name	Function definition	Note

1	RUN	Running indicator light	
2	ALM	Malfunction indicator light	
3	DC POWER	Auxiliary power switch	
4	P+	Positive output of high voltage box	M8 Screw thread
5	P-	Negative electrode of high voltage box output	M8 Screw thread
6	EMS COM	Communication port between high voltage box and EMS	
7	Ground point	Grounding point of high voltage box	M5 Screw thread
8	BAU/4G COM	Communication port of display screen	Reserve
9	BAT COM	Communication port of battery pack	
10	AC POWER	Input port of AC	Reserve
11	QF	Cluster master switch	
12	B+	Positive electrode of high voltage box anode	M8 Screw thread
13	B-	Negative electrode of high voltage box anode	M8 Screw thread

- **Each port is defined as follows:**

Table 5 Pin Definition of AC POWER Port of High Voltage Box

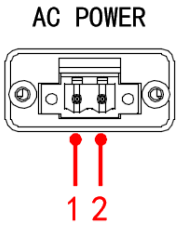
Pin position diagram	Pin position	Description
	1	AC L/220V
	2	AC N/220V

Table 6 Definition of pins of EMS COM port of high-voltage box

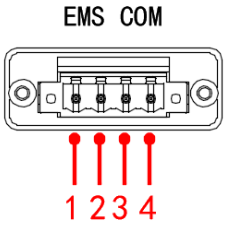
Pin position diagram	Pin position	Description
	1	CAN1-H
	2	CAN1-L
	3	24V+
	4	24V-

Table 7 Pin Definition of BAT COM Port of High Voltage Box

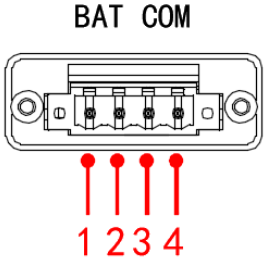
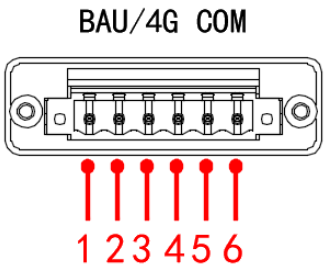
Pin position diagram	Pin position	Description
	1	CAN0-H
	2	CAN0-L
	3	24V+
	4	24V-

Table 8 Pin definition of BAU/4G COM port of high voltage box

Pin position diagram	Pin position	Description
	1	RS485-A2
	2	RS485-B2
	3	RS485-A1

	4	RS485-B1
	5	24V+
	6	24V-

3.6.2 Electrical system

Outdoor cabinet energy storage system adopts modular scheme, and users can configure different numbers of power modules according to project requirements. Parameters of energy storage power module of converter are as follows:

Table 9 Parameters of converter module

Model	Monet-50AC
Rated power	50kW
Maximum power	55kW
DC working voltage range	500V~1000V
Full load voltage range of DC side	500V~1000V
Maximum DC current	110A
Rated AC voltage	400Vac，3W+N+PE/3W+PE
Rated frequency	50/60Hz，（±5Hz）
Rated AC current	72A
overload capacity	110%, normal operation; 120%, 1 minute; 150%, 10 seconds
Current distortion	＜3%（Rated power）
Adjustment range of power factor	-1 lead ~+1 lag

With unbalanced load capacity	100%
Adapted battery	Lithium/lead-acid/photovoltaic module
Charging mode	According to BMS instruction/three-stage /MPPT
Working mode	Constant current, constant power, MPPT, AC voltage source, DC voltage source, VSG
Maximum efficiency	98.2%
Dimensions (W*D*H)	83 (excluding mounting lug 444)*600*150mm
Weight (approx)	25kg
Isolation mode	Non-isolation
The protection grades	IP21
Working temperature	-25℃ ~+60℃ (> 45℃ derating)
relative humidity	0~95% (no condensation)
Cooling mode	Intelligent air cooling
Noise	＜70dB
Altitude	300m (> 3000m derated)
communication interface	RS485/CAN (optional)

Optical storage system for islands, mountainous areas, border posts and other remote areas or areas with unstable power supply, or new zero-carbon science and technology parks. Users can configure DC converter power module according to project requirements, and realize the power supply system integrating photovoltaic and energy storage. Parameters of DC converter power module are as follows:

Table 10 Parameters of DC Converter Module

Module	**Monet-50DC**
Rated DC power	50kW
Maximum DC power	55kW

DC working voltage range	200V~1000V
Low-voltage side full-load voltage range	312V~850V
Maximum current at low voltage side	80A*2
Low voltage side input channels	2 (2 channels can be independent, and 1 channel can be connected in parallel)
High-voltage side full-load voltage range	500V~900V
Maximum DC current at high voltage side	110A
High-voltage side input channels	one
Adapted battery	Lithium/lead-acid/photovoltaic module
work pattern	Constant voltage, constant current, constant power, MPPT
Maximum conversion efficiency	98.8%
Dimensions (W*D*H)	83 (excluding mounting lug 444)*600*150mm
Weight (approx)	25kg
Isolation mode	Non-isolation
The protection grades	IP21
Working temperature	-25℃ ~+60℃ (> 45℃ derating)
Relative humidity	0~95% (no condensation)
Cooling mode	air blast cooling
Noise	＜70dB
Altitude	300m (> 3000m derated)
Communication interface	RS485/CAN (optional)

3.6.3 Environmental control system

The energy storage system is equipped with smoke detector, water immersion sensor, door magnetic sensor, fire control and other environmental control units, which can fully control the running state of the system. Schematic diagram of environmental control system:

Figure 6 Internal structure diagram of cabinet

3.6.4 Parameters of precision air conditioning

Table 11 Parameters of precision air conditioning

Module	AC3000
Electrical parameters	
Rated operational voltage	220Vac

Rated refrigeration current	6.4A
Maximum operating current	10A
Rated working frequency	50Hz
Dimensions (H*W*D)	1350×550×250mm
weight	40kg
The protection grades	IP54
Refrigeration capacity	3000W
Heating capacity	3000W
Air quantity	850m³/h
Cooling	
Cooling point	15℃~50℃ (settable)
return difference	7℃ by default (settable)
Heating	
Heating point	-15℃~25℃ (settable)
Return difference	10℃by default (settable)
dehumidify	
Dehumidification point	40%~90% (settable)
return difference	1%~30%(settable)
Alarm function	
High temperature alarm in cabinet	25℃~80℃(settable)
Low temperature alarm in cabinet	-20℃~15℃(settable)
High humidity alarm in cabinet	0%~100%(settable)
Note: The actual parameters are set before delivery according to customer requirements.	

3.6.5 Parameters of environment and fire safety equipment

- Water immersion detection device: detects whether the energy storage system leaks.

Table 12 Parameters of water immersion sensor

name	parameter
Operating voltage	DC12V (allowable range 10V~15V)
Operational current	≤0.1A
Detection channel	1, 2-core leaky cable
Response time	＜2s
Relay output	Open, contact capacity 1A 30VDC
Operational environment	Temperature: -10℃~+65℃ and relative humidity < ＜95% RH (no condensation)

- Smoke detector: used to detect the smoke concentration in the current environment.

Table 13 Parameters of Smoke Detector

Name	parameter
operating voltage	DC12/24V (allowable range 9V~30V)
operational current	Monitoring status: ＜1mA@DC12V
relay output	Fire alarm: ＜30mA@DC12V
Work instructions	Open, contact capacity 1A 30VDC
operational environment	The monitoring red light flashes once every 6s.

- Fire protection system: The aerosol fire extinguishing device is a new type of environmental protection fire protection product with the world advanced level. Working principle: When the ambient temperature reaches the starting temperature of the thermosensitive wire or comes into contact with an open flame, the thermosensitive wire spontaneously ignites

and is transmitted to aerosol series fire extinguishing devices. After the aerosol fire extinguishing device receives the starting signal, the internal fire extinguishing agent is activated, and the nano aerosol fire extinguishing agent is rapidly generated and ejected, thus realizing rapid fire extinguishing.

Table 14 Fire fighting aerosol parameters

Model	**QRR250**
Technical parameter	
Medicine weight	250g
Equipment weight	2600g
Dimension	ø127*145mm
Fire extinguishing time	≤30s
Nozzle temperature	≤200℃
Actual fire extinguishing efficiency	≤100g/m³
Operating environment temperature range	-40℃~+70℃
Relative humidity	≤95%
TH (thermal line) startup mode parameters	
Starting temperature	175℃
Validity of use	5years

3.6.6 Local Energy Management and Scheduling System

Micro-grid management system ZEUSAPPOLLO SOLAR Technology is an intelligent energy management and dispatching system developed by micro-grid system, which is mainly used in applications of energy storage power stations with various capacities and integrated power stations with optical storage and charging.

It integrates the functions of HMI, port control and communication, system parameters and

operation strategy setting to realize the monitoring and management of energy storage system.

Product hardware resources and parameters are as follows:

Table 15 Local Energy Management and Scheduling System

Product model	Lotus - ESS
Power input	DC 24V
Output control	3-way isolated output switch value
Input control	6-way isolation input switch value
Serial communication	2-way isolation RS232 and 4-way isolation RS485
Field bus	2-way CAN bus interface
Ethernet port	1 10/100M Ethernet port (RJ45)
Extended storage	1 u socket, 1 SD socket
Sound alarm	1 controllable buzzer
Program representation	1 running indicator, 1 status indicator and 1 alarm indicator.
Abnormal representation	1 hardware watchdog timer
real-time clock	1 group RTC real-time clock

3.6.7 Configuration List

To sum up, the overall configuration list of energy storage system under typical configuration is as follows:

Table 16 Overall Configuration List of 100 kW/215 kWh Outdoor Cabinet Energy Storage System

Name	Module	unit	Number	Notes
Battery system	280Ah, 215kWh	set	1	With high voltage control box
Energy storage	Monet-50AC	platform	2	modularize

converter				
Photovoltaic converter	Monet-50DC	platform	1-2	modularize
Isolation transformer	TV 400/400 Dyn11	platform	1	Optional
air-conditioning system	AC3000 220±15%VAC~50Hz	set	1	precision air conditioner
fire extinguisher system	QRRO.25GW/S-THF	set	1	Heat-sensitive starting type
supporting system	Access control, water-immersion, smoke, etc.	set	1	Auxiliary equipment
management system	Lotus-ESS	set	1	It consists of BMS and EMS
Distribution system	Circuit breakers, meters and related power distribution equipment	set	1	ATS by default, optional STS
System cabinet	Energy storage cabinet	set	1	IP54

4 Preparation for transportation and installation

4.1 Transportation and handling

4.1.1 Product transportation

- In order to keep the equipment in a better protection state, it is recommended to transport it with packaging;

- The equipment shall be transported according to the marking requirements on the package to prevent personal injury and equipment damage.
- Battery storage is not recommended for railway transportation or air transportation. Shipping requirements: SOC state 50 ~ 70%; Land speed limit requirements: 80km/h on flat roads and 60km/h on rugged roads. In case of any conflict, the local traffic regulations shall prevail.

4.1.2 Product transportation

- Ensure that the forklift truck has sufficient load when moving, and pay attention to the fact that the center of gravity of the equipment should fall between the legs of the forklift truck to prevent personal injury and equipment damage;
- With battery transfer, the load-bearing capacity of forklift truck needs to be ⩾ 3t; Without battery transfer, the load-bearing capacity of forklift truck needs to be ⩾ 1.5t;
- It is recommended that the length ⩾1.5m, width ⩾ 80cm~160cm and thickness ⩾ 25cm~70cm.

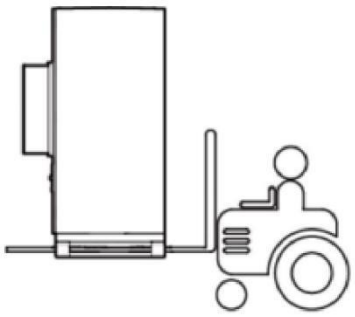


Figure7 Transportation diagram

4.2 Packaging and storage

4.2.1 Product packaging

In order to keep the products in a better protective state during transportation, special wooden cases are used for packaging. The package has the following basic parameters (including but not limited to), which need to be carefully checked according to the project requirements:

Table 17 Packing parameter

Parameter	Description
Model	Product model
Dimension	Package size of product
weight	Total weight of product after packaging
Sign	Heads up, handle with care, center of gravity, etc.

4.2.2 Product storage

If the product is not immediately transported or installed for use, it must be stored indoors and in a storage place and meet the following conditions:

Table 18 Requirements for product storage conditions

Parameter	Requirements
Storage temperature (excluding battery)	-25℃~+60℃
Battery	20℃～30℃
Storage relative humidity	< 95% (no condensation)
Altitude	＜3000m

It is not recommended to store the battery for a long time. If necessary, the battery should be stored in a clean and dry ventilated room with a state of charge of 40%~50%. The temperature should be 0℃~40℃, the relative humidity should be no more than 75%, and it should be fire-proof and heat-proof to avoid contact with corrosive elements. The battery should be charged every 3~6

months during storage. Please perform regular maintenance on the battery system according to the following table:

Table 19 Storage and regular maintenance methods of battery system

Storage temperature	Charging interval	Recharge procedure
20℃~30℃	Every six months	1) Charge to 100% SOC at 0.2C 2) Discharge to 0% SOC at 0.2C 3) Charge to 40%~50% SOC at 0.2C
0℃~20℃ or 30℃~40℃	Every three months	

4.3 Installation environment requirements

The energy storage system installation layout must meet the fire distance or firewall requirements specified by local standards, including but not limited to 《Code for Design of Electrochemical Energy Storage Power Station (GB 51048-2014)》and 《NFPA 855 Standard for the installation of static energy storage systems. The energy storage system》is only suitable for outdoor scenes, and it needs outdoor layout, but does not support indoor layout. General site selection requirements are as follows:

- The installation position level should be higher than the highest water level in this area. The distance from the airport, buried garbage disposal site, river bank or dam should be ⩾ 2km.
- Choose a place with good ventilation. When the equipment is running, do not block the vent and heat dissipation system to prevent high-temperature fire. The installation space is enough to ensure that the surrounding equipment will not be affected by the heat generated by the product; The installation position ensures that there is enough space for external wiring. It has convenient transportation conditions and reliable fire suppression system equipment.
- The installation location is far away from the fire source. Do not place flammable and explosive materials around the equipment. If the equipment is installed in a place with lush

vegetation, in addition to routine weeding, the ground below the equipment should be hardened to prevent overgrown weeds.

- Do not install the energy storage system outdoors in salt-damaged areas to prevent the equipment from being corroded and causing fire. Salt-damaged areas refer to areas within 2km from the coast or affected by sea breeze.
- The energy storage system must be provided with fences, fences and other protective measures, and safety warning signs should be erected for isolation, so as to prevent unauthorized personnel from entering the equipment during operation, resulting in personal injury or property loss.
- The equipment should be installed in the area far away from liquid, and should not be installed under the water pipes, air outlets and other places where condensed water is easily produced; It should not be installed in the air-conditioning openings, air vents, outlet windows of machine rooms and other places that are prone to water leakage, so as to prevent liquid from entering the interior and causing short circuit of equipment.

When the safe spacing of site selection cannot meet the requirements of relevant national standards, it is recommended to relocate the site. Site selection should avoid scenes not recommended by industry standards and regulations, including but not limited to the following lots, regions and places:

- Strong vibration, strong noise source and strong electromagnetic field interference area.
- Or places with dust, oil fume, harmful gas, corrosive gas, etc.
- Or places where corrosive, flammable and explosive materials are produced and stored. Within the scope of blasting danger.
- Places with existing underground facilities. Crowded places, high-rise buildings and underground buildings.
- There are unfavorable geological conditions such as rubber soil and soft soil layer, and the ground that is easy to accumulate water and sink.

- Within the boundary of mining subsidence (dislocation) area. Or areas that may be submerged after the dam breaks.
- Earthquakes and seismic areas with fortification intensity higher than 9 degrees. Areas with direct hazards such as debris flow, landslide, quicksand and karst caves.
- An important water supply source health protection area.
- Historical and cultural relics protection areas.
- If there is no more suitable site selection, it is recommended to install a fire-resistant firewall of not less than 3h for safety protection, and consider the space requirements of equipment transportation, installation and maintenance. It is recommended to refer to T/CEC 373-2020: the length and height of the firewall should exceed the outline of the energy storage cabinet by 1m respectively.

4.4 Preparation before installation and preparation of tools

4.4.1 Preparation before installation

- Check whether the product is in good condition before installation. If any damage is found, please keep the evidence and contact ZEUSAPPOLLO SOLAR.
- If there is no abnormality in the product, please check according to the delivery list to see if the accessories are complete.

Table 20 Delivery List

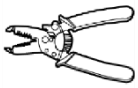
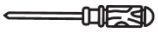
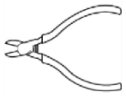
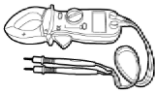
Number	Name	Number	Remarks
1	Outdoor cabinet energy storage system	1	Including cabinet door key
2	user manual/guide/handbook	1	remarks
3	certificate	1	
4	Factory inspection report	1	

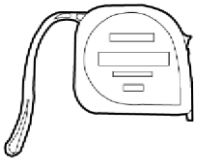
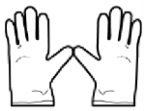
4.4.2 Preparation of tools

Use insulating tools to avoid electric shock. If tools without insulation protection are used, the exposed metal parts need to be wrapped and insulated with insulation tape.

The following table describes the tools and instruments that need to be prepared before the installation operation.

Table 21 Prepare tools and instruments

Manual forklift	Electric forklift	hammer drill	Electric screwdriver
			
Denggao ladder	wire stripper	Cross screwdriver	A screwdriver
			
Torque Wrench	Diagonal pliers	Torque spanner	Torque spanner
			
Pliers flow table	multimeter	socket spanner	levelling instrument
			
tape measure	Safety helmet	Goggles	Protective gloves

			
Multi-meter	Insulated shoes	ribbon	Insulating tape
			

5 Installation of energy storage system

5.1 Mechanical installation

Background information

- The installation site meets the site requirements.
- The weight of the energy storage cabinet is about 2800 kg (refer to the specifications of selected products for details).
- Before installing the energy storage cabinet, the installation position and orientation should be determined according to the site.
- It is recommended to hoist the energy storage cabinet in sunny and windless weather.

Points for attention

- Please select the forklift according to the weight of the energy storage cabinet. The tonnage of the forklift is larger than the weight of the energy storage cabinet, and it should be evaluated by professionals on the spot.
- Confirm that the tonnage and lifting height of the forklift meet the requirements of bearing and use before installation.
- The installation of energy storage cabinets should be operated and directed by professionals.

  When lifting heavy objects, it is forbidden for irrelevant personnel to enter the operation area, and it is forbidden to stand under the fork teeth of the forklift and around the traveling direction.

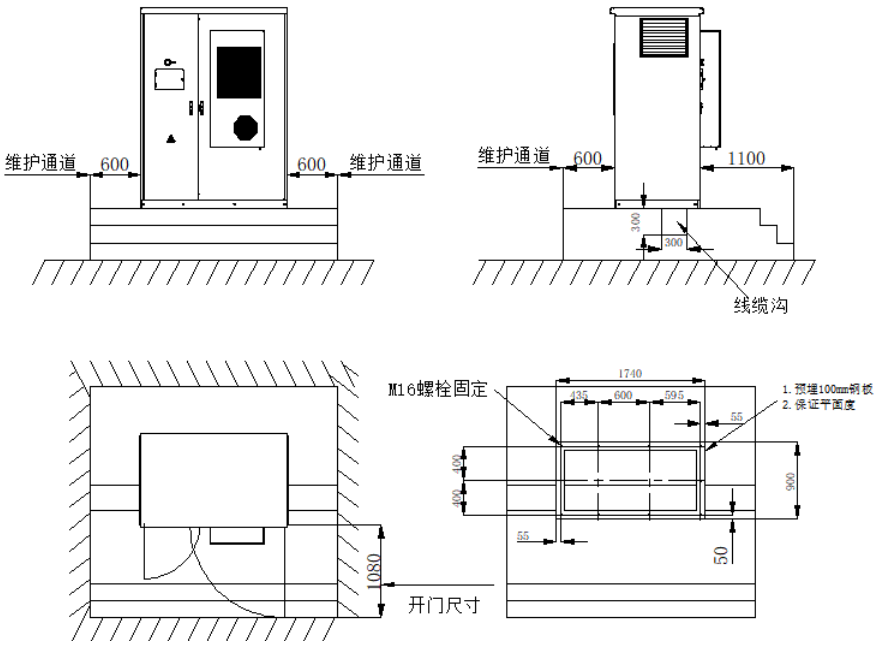


Figure 8 Basic reference diagram (the actual dimensions of the equipment are subject to shipment)

Operation preparation

Tools: forklift, level gauge, level gauge, climbing ladder, impact drill, claw hammer and open-ended wrench.

Material: M16 combination bolt

Operating procedure

1 After dismantling the packing wooden box, first dismantle the enclosure at the bottom of the equipment, adjust the direction of the energy storage cabinet to be consistent with the installation direction, lift the system cabinet with a forklift, and fork the energy storage cabinet onto the reinforced concrete platform.

- Put away the removed coaming and screws, and put them back after the equipment is in place.
- Lift the energy storage cabinet gently, lift it slowly, and drop it slowly and smoothly to avoid impact on internal equipment.
- The lifting process is stable.
- When the energy storage cabinet is in contact with the reinforced concrete platform, remove the forklift after the four supporting stress surfaces are relatively uniform.

Fig.9 Schematic diagram of equipment bottom enclosure

2 Place the equipment on the foundation with a forklift, align the fixing holes of the equipment with the embedded nuts of the foundation, and fasten them with M16X40 bolts.

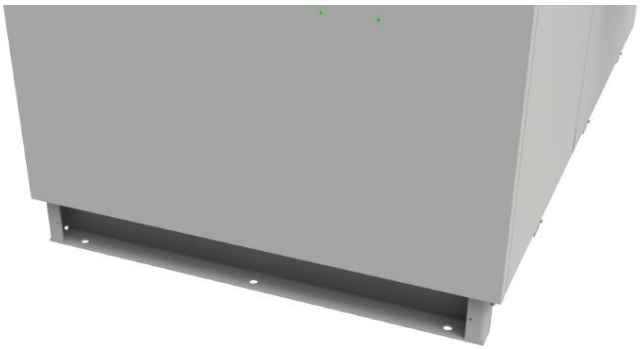


Figure 10 Schematic diagram of bolt fastening at the bottom of equipment

5.2 Installation of electrical cables outside the cabinet

This product adopts the all-in-one structure, and the wiring inside the DC side has been completed. On site, only the electrical cables of the AC side and external communication need to be installed. Hangzhou Weimu provides the following wiring reference according to product power and cable specifications. The selection of cable diameter shall conform to local cable standards. Factors

affecting cable selection include rated current, cable type, laying mode, ambient temperature and maximum acceptable line loss.

Table22 Comparison Table of Cable Diameter

Capacity	AC cables	Earth line	Ground line	Positive and negative DC inputs (per stage)
50kW	≥3*35mm²	≥35mm²	≥25mm²	Single module ≥70mm2
100kW	≥3*70mm²	≥70mm²	≥50mm²	Single module ≥70mm2
150kW	≥3*150mm²	≥150mm²	≥95mm²	Single module ≥70mm2

For electrical installation, please refer to the following suggestions:

(1) Before wiring, check that all switches in the equipment are in off state to ensure that the equipment is not electrified;

(2) Disconnect the power grid switch before wiring to ensure that the cable is not charged;

(3) Make sure the cable phase sequence is correct, and you can add different colors of insulation sheath or logo to distinguish it, so as to prevent the phase sequence from being wrong;

(4) The joint between the cable terminal and the copper bar should be pressed tightly, and the length of the screw should be moderate, so as not to affect the insulation and fastening;

(5) The communication line and power cable shall be laid separately as far as possible, and the insulation layer of the cable shall not be damaged during the laying process;

(6) The grounding cable must be reliably connected with the grounding copper bar, and the cross-sectional area of the cable must meet the design requirements;

(7) All AC cables shall enter the equipment through the access hole at the bottom of the equipment and then be connected to the corresponding phase sequence;

(8) After the wiring is finished, use fireproof mud to seal the leakage of wiring to prevent external insects and rats from entering and damaging equipment or cables.

In order to prevent the contact resistance from increasing and heating due to poor contact caused by the loosening of the terminal, it is necessary to ensure that the bolts fastening the terminal meet the torque requirements listed in the following table:

Table 23 Requirements for wiring torque

Screw size	M4	M5	M6	M8	M10	M12	M14	M16
Torque (N*m)	1.8~2.4	4~4.8	7~8	22~29	44~58	76~102	121~162	189~252

The incoming and outgoing lines of the energy storage system are in and out from the bottom. After the switch baffle is removed, as shown in Figure 3.5, the A/B/C/N copper bar at the lower end of the switch is reserved with Φ11mm and Φ13mm holes for customer wiring, or the holes are opened according to customer requirements. The protective ground wire is connected to PE copper bus, and the grounding impedance of the equipment meets the requirements of GB 50054 and local electrical standards.

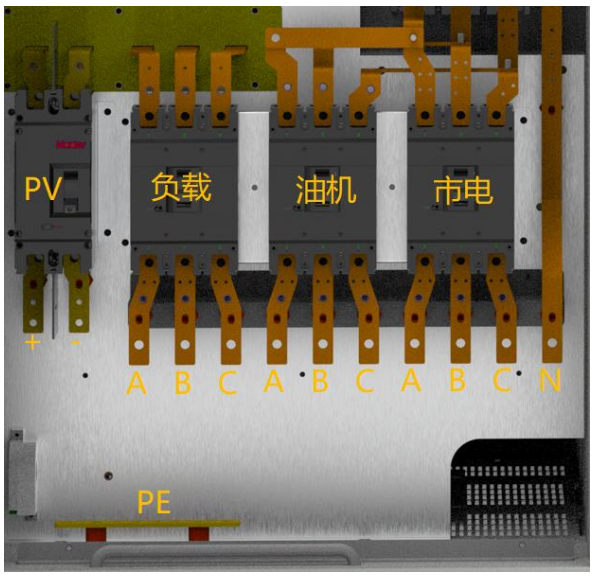
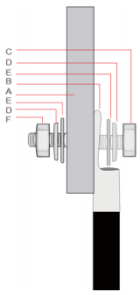


Fig. 11 Schematic diagram of wiring terminal

The installation schematic diagram of terminals and fixing screws used for system power cable wiring is as follows:



Serial number	Name
A	Bronze Medal
B	Terminals
C	Screw
D	Shrapnel
E	Big Gasket
F	Screw Nut

Fig. 12 Installation schematic of fixing screws

- When using copper-core cable or copper-clad aluminum cable, please use copper tip.
- When using aluminum alloy cable, please use copper-aluminum transition terminal or aluminum terminal with copper-aluminum transition gasket.

5.3 Installation of EMS external communication cable

When installing the external communication line, pay attention to laying it separately from the power cable. It is recommended that the distance between communication lines and power cables should not be less than 300mm when laid in parallel. When the communication line must pass through the power cable, try to ensure that the included angle between the two cables is 90, so as to reduce the electromagnetic interference caused by the power cable to the communication line. Communication lines should be as close as possible to the ground support lines, such as conductor grooves, metal guide rails, etc. If there is no support, they can be basically fixed with cable ties.

RS485 or Ethernet can be used for the background communication of the system, and Modbus RTU or TCP； is used as the system communication protocol. Use double-foot shielded cable or

network cable to access the position shown below.

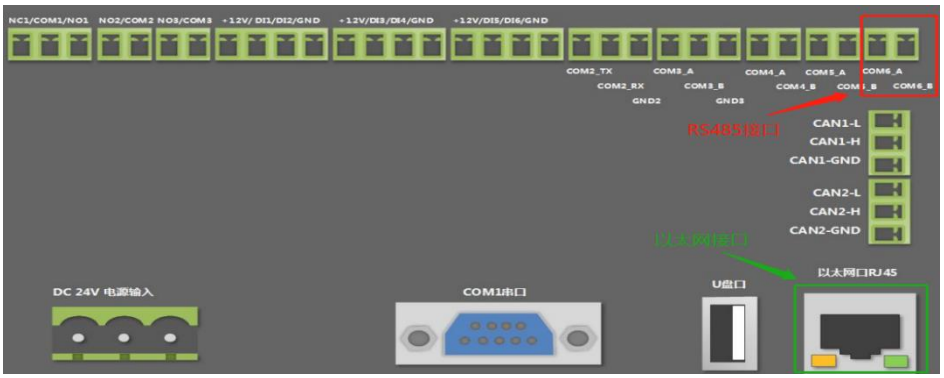


Figure 13 Wiring position diagram of external communication line

6 Battery system installation

This section only introduces the installation of battery system and the connection of internal cables in the energy storage system.

- Safety protection articles must be worn to prevent electric shock injury.
- Use insulating tools to avoid electric shock.
- Before installation, it should be confirmed that each high-voltage box circuit breaker is in an off state.
- Before installation, it should be confirmed that all distribution switches in the central control room of transformer cabin are off.
- Before installation, make sure that the PCS DC switch and AC switch are in the off state.
- When connecting power cable connectors, plug them according to the colors of connectors and terminals. The docking principle is: red to red and black to black. Please do not butt connectors violently.
- When laying cables on site, please pay attention to neat and beautiful cables for subsequent maintenance.
- Signal lines and power lines shall be laid separately.

6.1 Battery Pack installation

Background information

- The battery module installation method is the same. Here, a battery module is introduced as an example.
- The BMU inside the battery module has an address, so please install it strictly according to the layout. See《Pack Layout》for the layout of specific solutions.

Points for attention

- In the process of handling and installing the battery Pack, it is forbidden to short-circuit both ends of the battery Pack.
- Pack batteries are heavy, so at least 4 people should be prepared during handling and installation. If possible, please use forklift tools to assist in handling.

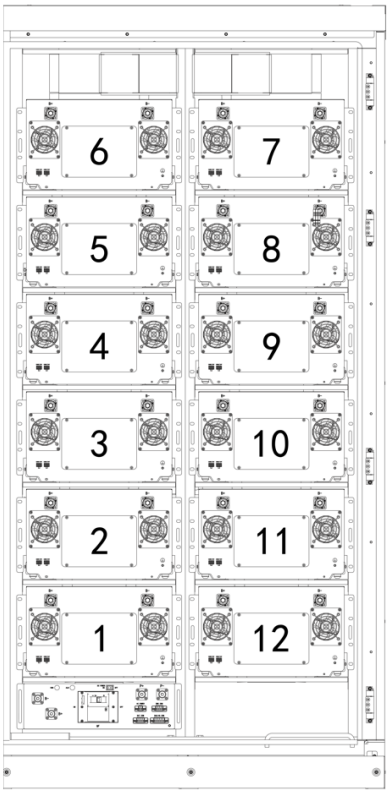


Figure 14 Pack layout

Operation preparation

Tools: Forklift, insulated torque wrench, ladder, Phillips screwdriver, claw hammer.

Materials: battery Pack, M6 bolts

Operating procedure

1 Use forklift to transport the wooden box with battery Pack near the cabinet door of energy storage cabinet.

2 Open the transport wooden box with a claw hammer and lift the battery Pack out.

3 Lift the battery Pack with a forklift (see the following figure for the bottom bearing position of the battery Pack:

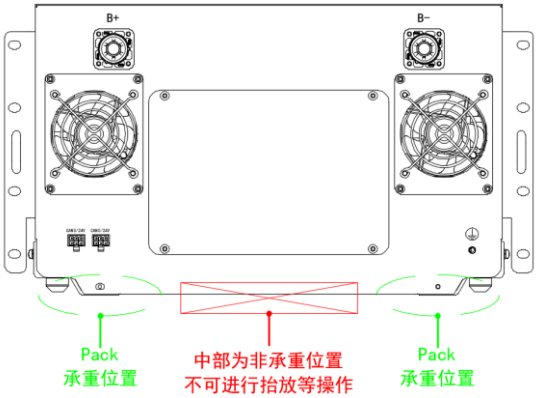


Fig. 15 Description of load-bearing position at the bottom of Pack

4 Push the battery Pack into the guide rail at the installation position from top to bottom according to the battery Pack layout.

- The battery Pack of the same battery rack should be installed from top to bottom.
- Pay attention to the fact that fork teeth of forklift cannot be directly inserted into the bottom of battery Pack during lifting to prevent battery Pack from being damaged.

5 Use 4 *M6 bolts to fix the battery Pack on the rack.

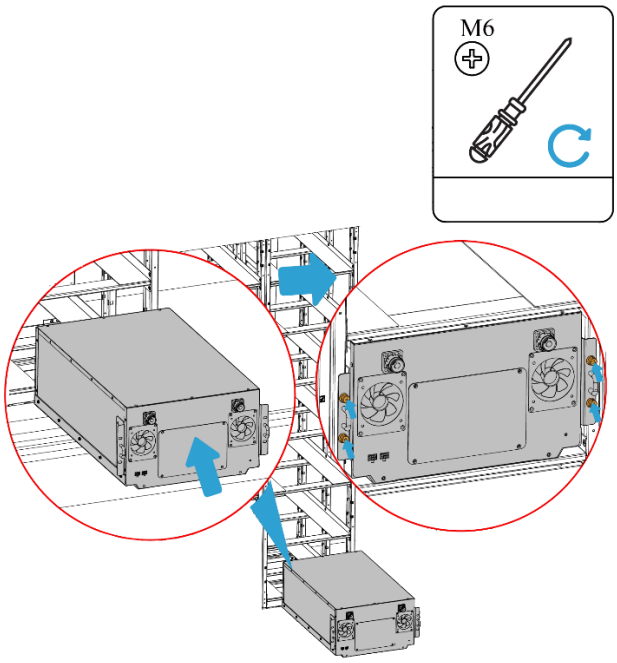


Figure 16 Installing the Battery Pack

6 Take out the grounding wire, one end of which is connected to the grounding point of the battery Pack, and the other end of which is connected to the grounding point of the rack, and fix it with M5 cross head screw

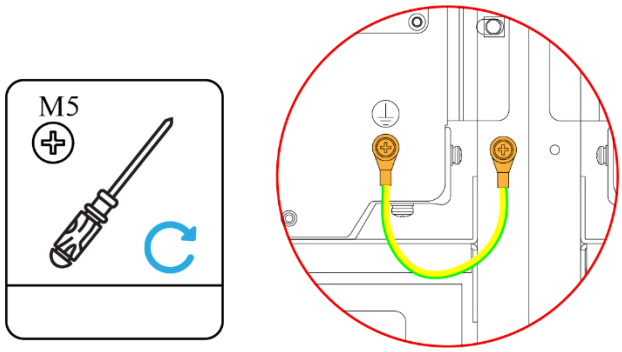


Fig. 17 battery Pack grounding

7 Install the remaining battery Pack in turn.

6.2 Installation of high-voltage box

Background information

- For the convenience of installation, please install the high-voltage box after the battery Pack is installed.

Points for attention

The weight of the high-pressure box is heavy, so at least 2 people should be prepared during handling and installation. If possible, please use tools to assist in handling.

Operation preparation

Tools: Forklift, claw hammer, insulated torque wrench, cross screwdriver.

Materials: high-pressure box, M6 bolts

Operating procedure

1 Use forklift to transport the wooden box with high-pressure box to the door of the energy storage cabinet.

2 With the help of claw hammer, open the transport wooden box and lift the high-pressure box out.

3 Push the high-pressure box into the guide rail at the installation position.

4 Use four M6 bolts to fix the high-voltage box on the rack.

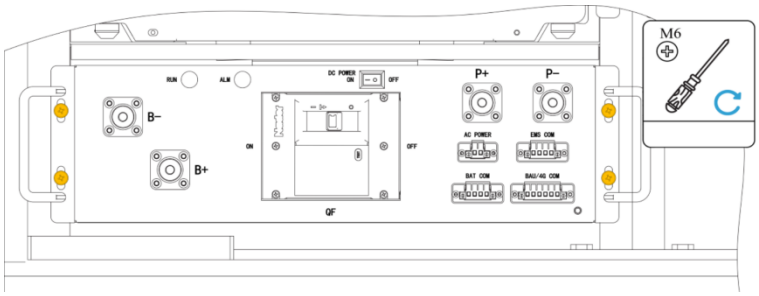


Fig. 18 Installation of high-pressure box

5 Take out the grounding wire, one end of which is connected to the grounding point of the high-voltage box, and the other end of which is connected to the grounding point of the rack, and fix it with M5 cross head screws.

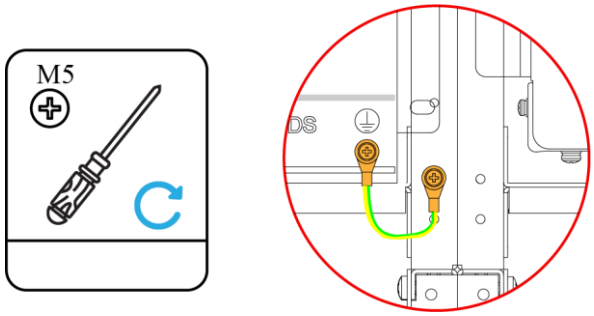


Figure 19 Grounding of high voltage box

6.3 Connection of signal cable

Background information

The batteries are connected and communicated in cascade, and the first Pack is connected and communicated with the high-voltage box

Operation preparation

Tools: protective gloves, torque wrench, diagonal pliers and cross screwdriver.

Materials: cable ties

Preparation of drawings: wiring of signal lines between battery modules in high-voltage box

Operating procedure

1 Connect the signal lines between battery modules.

- Tie the signal wire with the metal handle or frame on the left side of the battery Pack with a cable tie.

Figure 20 Connecting signal lines between battery Pack

2 Connect the signal line between the battery Pack and the high-voltage box.

- The cable with excess length of signal wire should be tied on the cable slot with cable tie.

3 Install shielding resistance at the end of battery Pack.

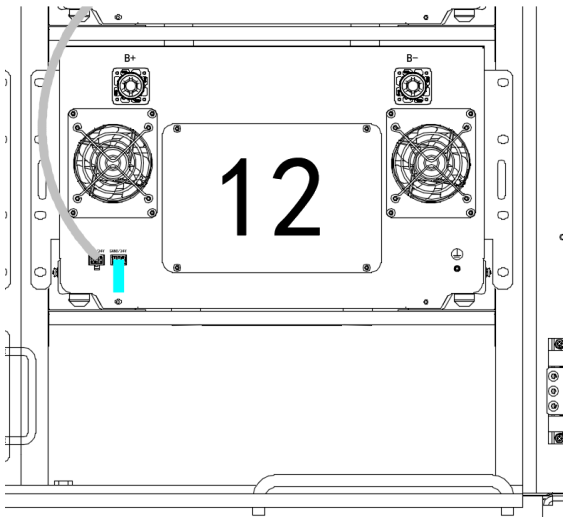


Figure 21 Installation position of shielding resistor

4 Connecting the high voltage box side to EMS signal line.

- The wiring of EMS side has been pre-installed in the factory, so it is only necessary to connect the communication terminal to the high-voltage box on site.

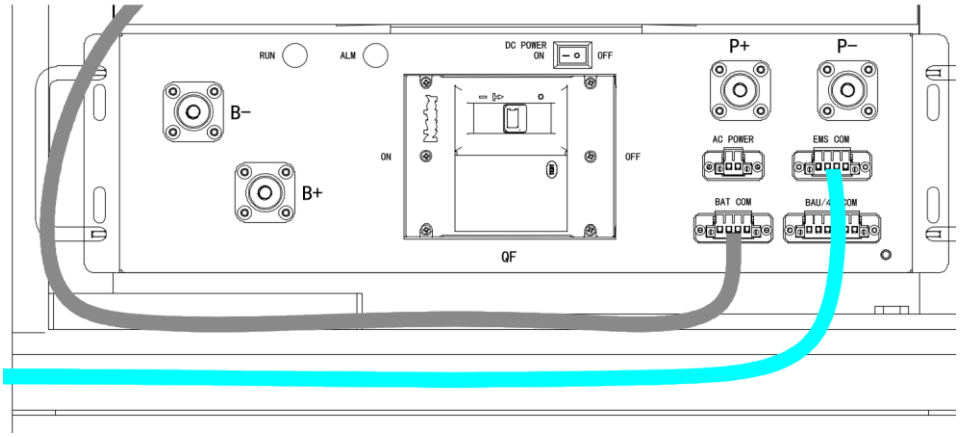


Figure 22 Connect the high voltage box to the EMS side signal line.

6.4 Connection of power cable

Background information

Self-locking connector is used for power cable connection between batteries and between high-voltage box and battery Pack.

Self-locking connector description is as follows:

- The red and black self-locking connectors are mutually foolproof, as shown in the following figure.

Figure 23 Key position angle of self-locking connector

- The steps of butting the self-locking connector are as follows:

A Adjust the direction of the plug so that the plug and socket are aligned.

B Gently rotate the plug, and it will automatically suck in.

C After the plug is automatically sucked in, push it in slightly, and after hearing the "click" sound, the plug and socket are plugged into place.

When you need to pull out the self-locking connector, you need to simultaneously press the button on the self-locking connector.

Figure 24 Self-locking connector button

Operation preparation

Tools: protective gloves, torque wrench and diagonal pliers.

Materials: cable ties

operating procedure

1 Connect the power cord between battery modules.

- Use a cable tie to tie the cross-rack power cord with the rack.

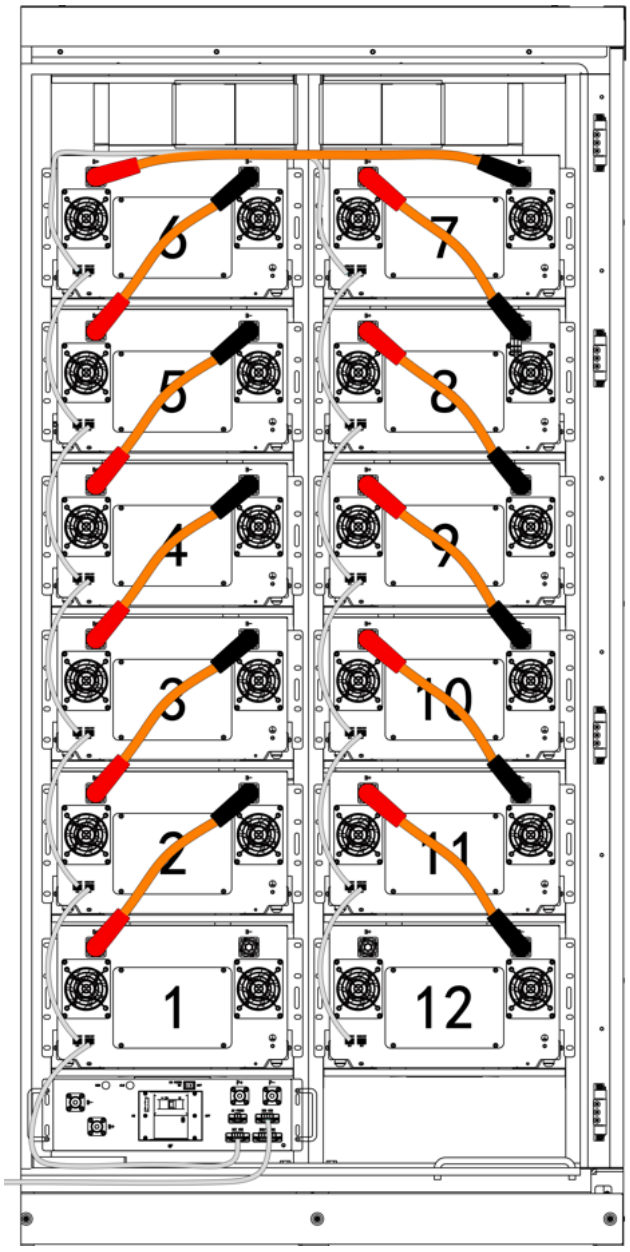


Fig. 25 Connecting the power cord between battery modules

2 Use M8*16 bolts to connect the power cord between the high-voltage box and the battery Pack. The reference torque is 10N.m .

- Note: the copper nose at the B+/B- end of the high-voltage box should be sheathed with PVC insulation sleeve to prevent electric shock injury.
- The power cord between the high-voltage box and the battery Pack should be connected to the B or B terminal of the high-voltage box, and should not be confused with the P or P terminal of the high-voltage box.

- Use a cable tie to tie the cross-rack power cord with the rack.

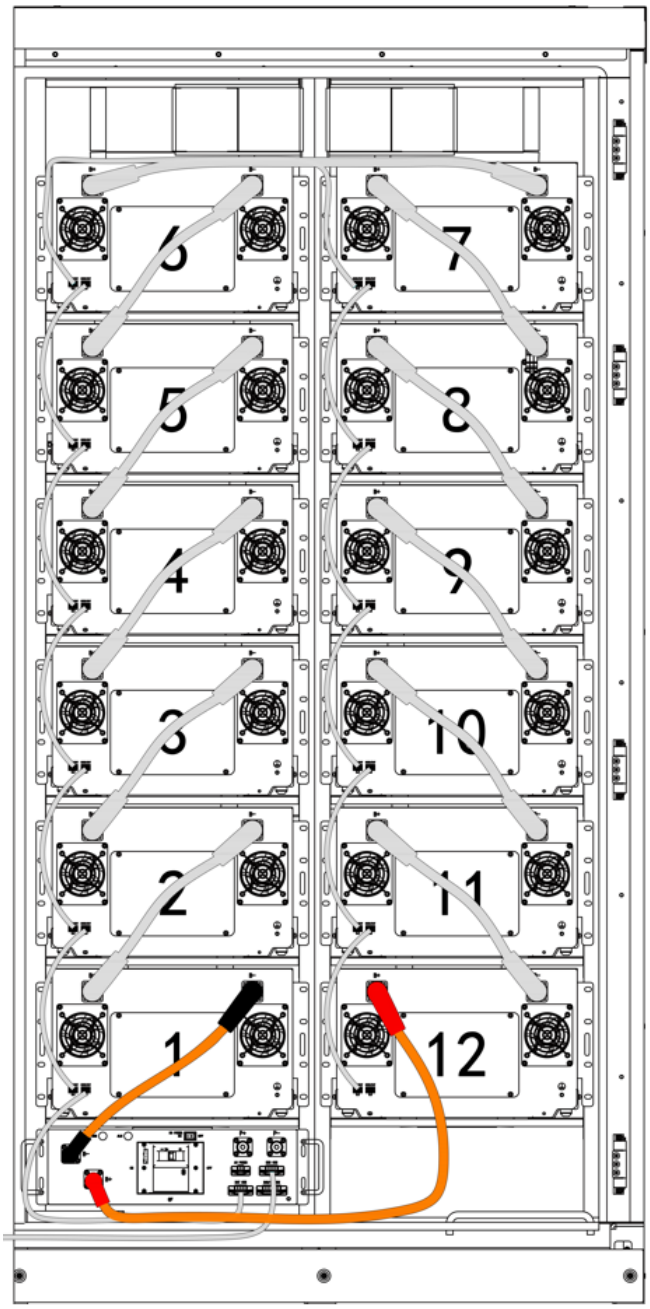


Figure 26 Connecting the power cord between the high-voltage box and the battery module

3 Use M8*16 bolts to connect the power cable from the high voltage box to PCS. The reference torque is 10N.m ..

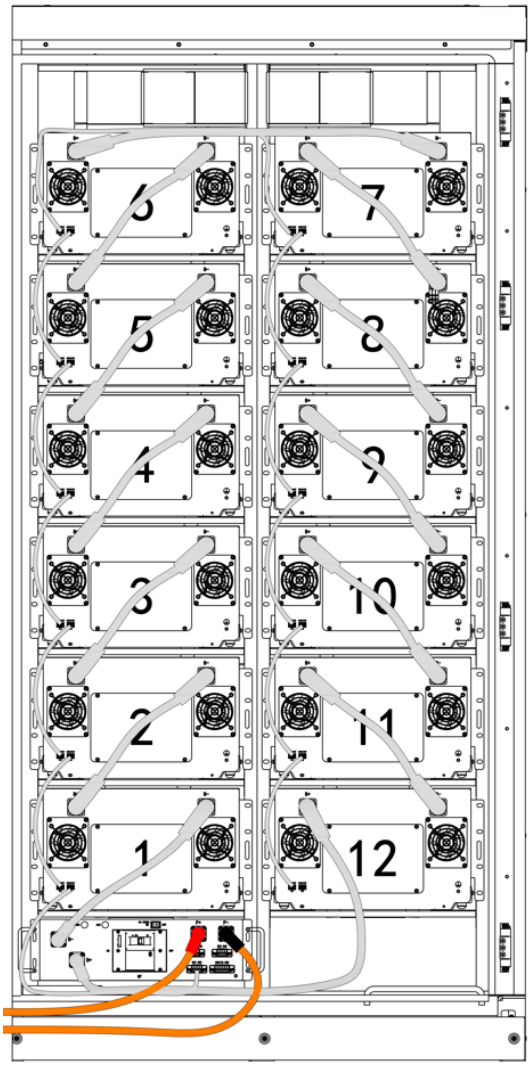


Figure 27 The wiring of the power cord at the high-voltage box side

7 Power on the energy storage system

7.1 The precautions before powering on the system

- Power on the system must be carried out after the installation of the energy storage system has been completed and passed the installation acceptance.
- Power on the system must be guided or operated by qualified engineers.
- It is forbidden to power on the system in thunderstorm weather.
- Some parameters of the energy storage system shall be set according to the use environment, and these parameters shall be provided and configured by the on-site technical support engineer.
- The parameters of the energy storage system are very important to the stable operation of the system. Improper changes of the parameters will cause the system to fail to work normally and even damage the system seriously.
- Some parameters of the energy storage system have been configured at the factory. If you want to modify the parameters, please refer to the component information and consult the on-site technical support engineer.

7.2 Check before power on

Before powering on, check the operation of the product, please ensure that the product has been installed according to the specifications, and make a comprehensive and meticulous inspection of the machine to ensure that all indicators meet the requirements before starting the machine.

1 Check the appearance.

- The equipment is in good appearance, free from damage, corrosion and paint dropping. If paint falls off, please touch up the paint;
- The label of the equipment is clearly visible, and the damaged label should be replaced in time.

2 Check the battery compartment.

- Confirm that the installation position of the high-voltage box and battery module is consistent with the layout.
- Make sure that the cables of the high-voltage box and the battery module are connected correctly, and the wiring terminals are clamped in place.

- Make sure that the high-voltage box circuit breaker is OFF.
- Confirm that the grounding wires of the high-voltage box and the battery module are installed in place.

3 Check the power distribution.

- Make sure that the cable is connected correctly, the cable protective layer is wrapped in good condition without obvious damage, and the terminal blocks are clamped in place.
- Make sure EPO emergency stop button is in high position and not pressed.
- Make sure that there is no obvious crack or deformation in the copper bar, the screws at the lap joint are fastened, the marking marks are not misplaced, and there are no sundries on the copper bar.
- Refer to the figure below, and make sure that all power distribution switches are open and circuit breakers are off.

Figure 28 Location diagram of distribution switch

7.3 The system is powered on and running.

The product startup operation process is as follows:

1) Use multi-meter to confirm that the grid voltage is within the predetermined range (400v ±10%);

2) referring to fig. 4.1, close the system auxiliary power switches MCB0-6 and battery auxiliary power switches QF1-2;

3) Wait for the touch screen to start (about 30 seconds), confirm that the display is normal and there is no fault alarm;

4) close the DC load switch of the battery high voltage control box;

5) Press and hold the battery power button for 5~8s and release it. The battery power button is always on, and the warning light is not on;

6) Close the main AC circuit breaker;

7) After all modules are enabled on the "Switch" page of the touch screen, click "System on" to complete the boot.

7.4 Commissioning

After all the electrical structures of the equipment are installed and the startup conditions are met, in order to ensure the reliable and stable operation of the energy storage system, professional electrical engineers and technicians must power on the first operation and set the operation mode and related parameters according to the project requirements:

1) Set the equipment control mode to "manual mode" and set the active power to 5%;

2) Turn on the air conditioner in Data-> Environmental Monitoring, turn on the battery in Data-> Battery Data, and the red light of the battery operation indicator lights up. After all modules are enabled in the "switch" interface, click "System on";

3) Observe the parameters of PCS, battery and air conditioner on the screen during operation, and stop in time for detection if there is any abnormality;

4) Run for 0.5 hours;

5) Set the active power to -5%. At this time, the battery is charged at 5% of the rated power of the system.

6) Observe the parameters of PCS, battery and air conditioner on the screen during operation, and stop in time for detection if there is any abnormality;

7) Run for 0.5 hours;

8) After the 1-hour trial run is completed without any abnormality, turn off the system on the "switch" interface, and manually turn off the battery and air conditioner on the touch screen;

9) According to the background and requirements of the project, you can choose the local manual power control mode or the automatic peak cutting and valley filling mode to officially put into operation, and just click "System on" in the system interface.

7.5 System shutdown operation

When the product needs daily maintenance, it needs to be shut down. Normal operation of the product is as follows:

1) Click on the touch screen switch interface and click "System Shutdown", wait for the system to stop running, and turn off the battery in "Data"-> "Battery Data". The red light of the battery running indicator goes off and the system is shut down;

2) Press the blue button for battery power supply for 5~8 seconds and then release it. The battery power supply is turned off, and the battery auxiliary power indicator green light goes out;

3) Refer to Figure 4.1, the auxiliary power switches MCB0-6 and battery auxiliary power QF1-2 of the breaking system;

4) Break the main AC circuit breaker;

5) Break the DC load switch of the battery high voltage control box;

6) Wait for the bus discharge to end, the touch screen goes out, and the equipment is shut down.

7.6 Emergency shut down

When the product fails or needs emergency shutdown in an emergency situation, the following emergency shutdown operations can be performed:

1) press the emergency shutdown button "EPO";

2) Refer to Figure 4.1, the auxiliary power switches MCB0-6 and battery auxiliary power QF1-2 of the breaking system;

3) Reset the EPO button after it is determined that the fault or danger is removed and needs to be operated.

After pressing "EPO" for emergency shutdown, you need to wait 10min before starting up!

8 Operation instruction

This chapter mainly introduces the LCD touch screen display interface and the corresponding operation control through man-machine interface. Users can execute various operation commands through the LCD display interface, conveniently browse the parameters and data related to DC, AC and system operation, and obtain the current equipment status and real-time alarm information in time, thus providing reliable basis for fault diagnosis. In addition, the LCD touch screen can also display the version information of system software and upgrade the software of each component through USB flash drive.

8.1 The introduction of human-machine interface

After the system is powered on, the LCD touch screen enters the startup interface. After 30s, the startup interface disappears and the system enters the "Home" interface. As shown in the figure below, the homepage interface displays the real-time power, voltage, current, power generation, operation mode, working status and other information of the system.

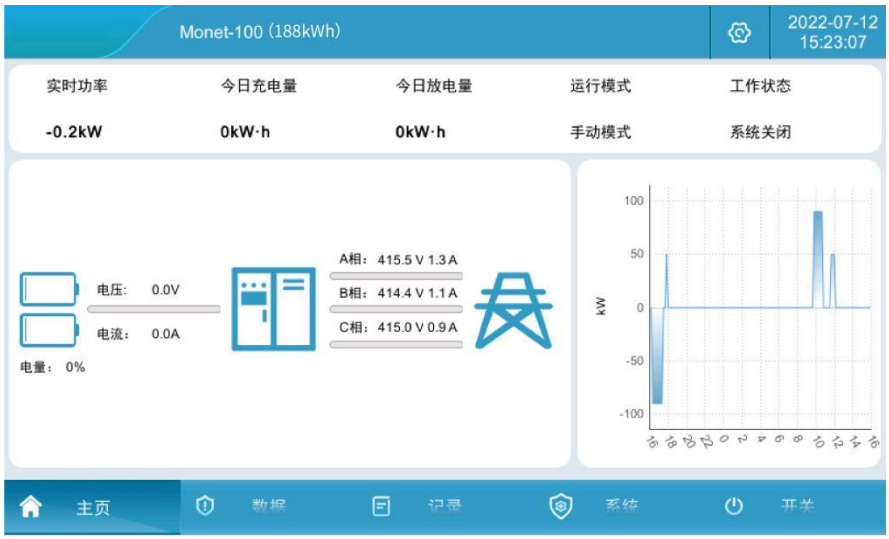


Figure 29 EMS main page

Expansion items of each menu:

Table 24 EMS Page Menu List

Number	Name	Item	Parameter function
1	home page	without	Display the running status of the system and the current charging and discharging curve.

2	data	Real time data	All analog data display of converter
		Real-time status	Display of converter working status and switch status
		Real-time alarm	Current system alarm information
		Battery data	Battery data display and battery on-off settings
		Environmental monitoring	Dynamic monitoring display and air conditioning parameter setting
3	record	Historical alarm	Show historical alarm records.
		Operation log	Show operation log
		Data report	Export history
4	system	System information	Display system information
		Operational mode	System operation mode setting
		Parameter setting	Converter and battery parameter setting
		Manufacturer settings	Equipment manufacturer settings
		System upgrade	System software upgrade
		Communication settings	Make communication settings.
5	switch	System switch	System startup and shutdown

8.2 Switch on and off operation

1） System start-up: first check the power-on condition of the whole machine, refer to Tu Tu 4.1, turn off the auxiliary source MCB0~6 switch and battery auxiliary source switch QF1~2, and observe the trouble-free alarm on the touch screen (it takes about 30 seconds to start the screen);

2) Manually close the DC load switch of the battery high voltage control box; Press and hold the battery power button for 5~8 seconds and then release it. The blue light of the battery

power button is always on, the yellow warning light is off, and the green light of the battery high-voltage box LV is on. Check that there is no problem with the fault warning machine.

3) Close the main AC circuit breaker and wait for the PCS to establish communication with the touch screen, and the screen shows that the mains voltage is normal;

4) Click "Switch" to enter the current on-off interface, and select all modules to make

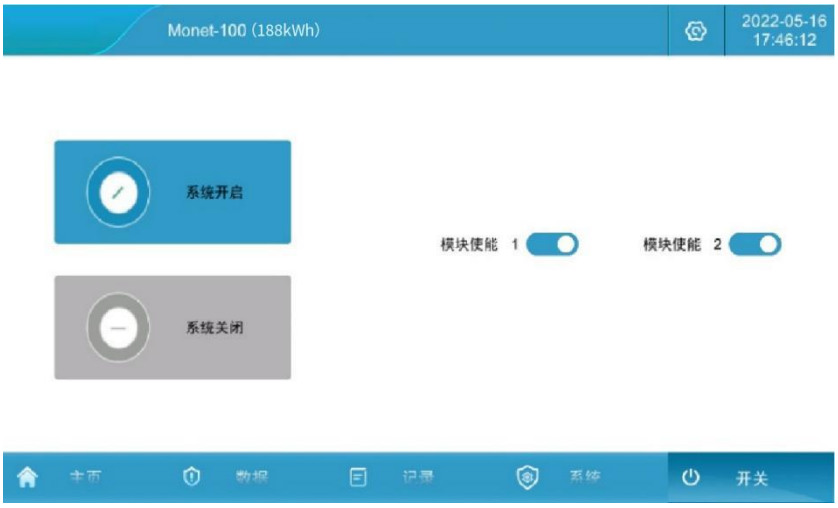


Figure 30 Switch-on interface

5）After clicking the "system on" button, if the temperature waiting appears in the upper right corner of the "switch" interface, the environment does not meet the system on condition, and the air conditioner will continue to work until the system on condition is met, then the "temperature waiting" disappears and the system continues to be turned on.

Figure 31 Environment Waiting Interface

6） If the startup is not successful, the startup failure prompt interface will pop up, and the

cause of the failure will be queried according to the failure; Failure: "System failure" and "PCS failure" (query in the failure list); "Non-dischargeable" (battery capacity reaches the lower limit of SOC) and "non-rechargeable" (battery capacity reaches the upper limit of SOC).

Figure 32 System startup failure interface

7） Turn off the system: when the system is running, click "Turn off the system" and turn off the battery in Data-> Battery Data. The battery running indicator will turn off and the system will turn off, then the whole system will stop running. If the temperature and humidity of the system environment is too high (too low), the air conditioner will stop working until the temperature and humidity return to the normal range (5~35℃).

Figure 33 Battery Shutdown Interface

8) break the auxiliary power switch MCB0~6 of the system and the auxiliary power supply QF1 ~ 2 of the battery;

9) Break the DC load switch of the battery high voltage control box;

10) Break the main AC circuit breaker.

8.3 Communication Settings

Communication settings refer to the communication protocol settings between LCD touch screen and battery BMS, and between LCD touch screen and EMS background.

1) check that the battery BMS communication line has been connected to the terminals CAN2_H and CAN2_L on the back of the touch screen;

2) Check that the background EMS communication line has been connected to the terminals COM6_A and COM6_B on the back of the touch screen or connected to the network port;

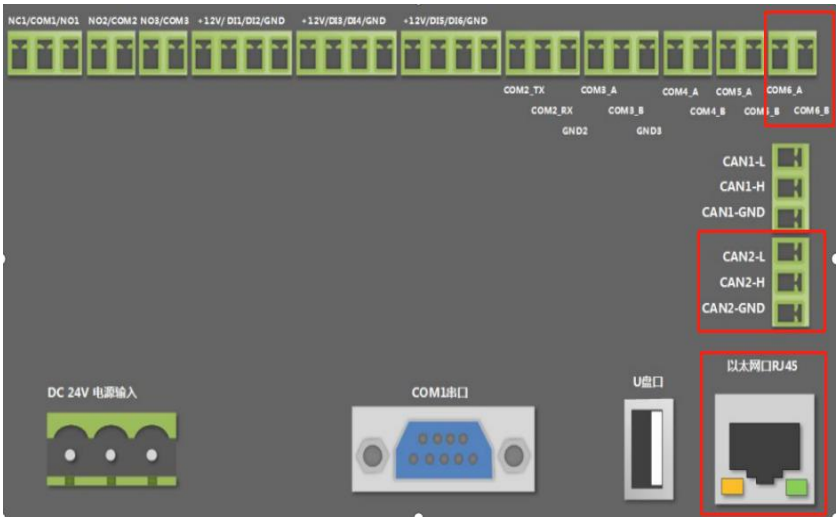


Figure 34 Inspection of communication wiring

3） Click "system"-> "communication settings" on the LCD touch screen to enter the communication settings interface.

Figure 35 Communication Settings Interface

4) Battery BMS communication settings: set the CAN baud rate to 250kbps;

5) Background EMS communication setting 1: If RS485 communication is adopted, set the local address corresponding to the communication panel to 1. If multiple energy storage systems are connected to the background, the slave addresses cannot be duplicated;

6) Background EMS communication setting 2: If Ethernet communication is adopted, the local energy storage system will be used as the server, and the default address of the host will be 192.168.1.100, and the local address corresponding to the communication panel will be set to 1, and the server port will be set to 502. If the background IP addresses of multiple energy storage systems cannot be duplicated, click the Set button to configure the IP addresses after modifying

the IP addresses.

Figure36 IP address configuration interface

8.4 Operation mode setting

8.4.1 Introduction of Mode

The operation modes of energy storage system can be divided into three types: manual mode, automatic mode and off-grid mode.

- Grid-connected manual mode: the energy storage system runs in grid-connected mode, but the user must manually operate the LCD touch screen when the system starts or stops. The charging and discharging active power, reactive power and power factor of the energy storage system can be set in "Parameter Settings".
- Grid-connected automatic mode: for the peak shaving and valley filling application scenario, the energy storage system will be automatically connected to the grid according to the preset time-sharing charging and discharging power.
- Off-grid mode: the energy storage system operates in off-grid mode, and the system can output a stable 400V/50Hz three-phase AC voltage, but the user must manually operate the LCD touch screen to start or stop the energy storage system.

8.4.2 Grid-connected manual mode

1） Click "System"-> "Operation Mode" to enter the page shown below.

Figure37 Grid-connected manual mode setting

2） Set the control mode to "manual mode", set the corresponding active power, power factor and reactive power on the "parameter setting" page, and the machine will run according to the setting values. The power setting interface is shown below.

Figure 38 Power Setting Interface

8.4.3 The grid-connected automatic mode

1) click "system"-> "operation mode" and click "peak cutting and valley filling" button to enter the setting page;

Figure 39 Peak shaving and valley filling operation setting interface

2） Click "Modify" to set peak shaving and valley filling operation time and power: set the start and end time, charging and discharging power and whether it is enabled or not in time period 1; Click

next to enter time slot 2 setting, and save and exit after all time slot settings are completed;

Fig. 40 peak clipping and valley filling charging and discharging time setting interface

3） Automatically jump to the following interface and click the finish button;

Figure 41 Peak clipping and valley filling charging and discharging time setting interface

4） The "control mode" is changed to "peak cutting and valley filling";

Figure 42 Peak shaving and valley filling control mode

5） This is the automatic mode: pause, click "Switch"-> "System on" to complete the setting of local automatic control mode.

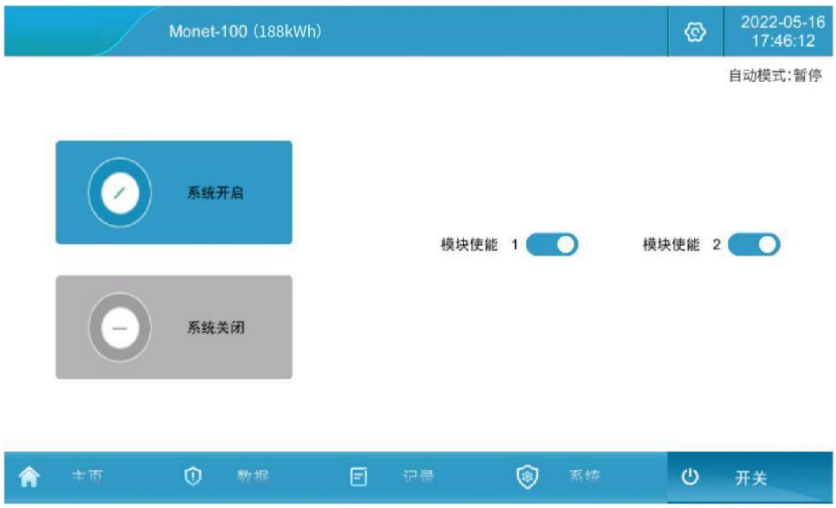


Figure 43 The local control operation mode is turned on

8.4.4 Off-grid mode

When it is hoped that the energy storage system can only supply power to local important loads, the public power grid or diesel engine can be cut off, and the energy storage system can be selected to supply off-grid power to important loads. The specific setting method is as follows:

1） Manual off-grid mode: when running in the grid-connected state, the power grid loses power and PCS islanding protection stops. At this time, the mains switch is manually turned off. When

the energy storage system needs to be set to off-grid mode, click "System"-> "Operation Mode" to enter the current page. Then select "Off-grid Mode" in "Control Mode".

Figure 45 Off-grid mode setting interface

2） Enter the "Switch" page to "enable" the power modules as required (it is recommended to enable all of them). Finally, click "System on" and confirm , then the system will run off-grid and output a stable 400V/50Hz AC voltage.

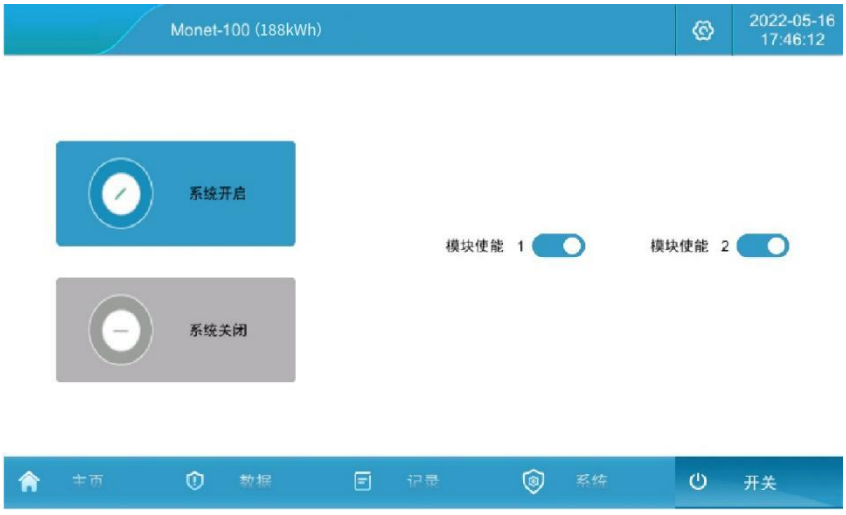


Figure 46 Off-grid mode setting interface

8.4.5 Battery parameter setting

1） Click "System"-> "Parameter Settings" to enter the current page; Set SOC upper and lower limits according to customers' needs; It is recommended that the upper limit setting of SOC should

not be higher than 98% and the lower limit setting should not be lower than 5%.

Figure 47 Battery charging and discharging setting interface

2） According to the parameters of battery configuration, set the upper and lower limits of battery charging and discharging voltage and current.

Parameters of the battery have been set before the energy storage system leaves the factory, so it is not recommended to modify them by yourself

8.4.6 Data Export and View

1） Click on "Record"-> "Data Report" to enter the current page.

Figure 48 Data Report Interface

2) Check the current day, month, year and total charge and discharge amount.

3) Insert the USB flash drive, wait for the USB flash drive to connect, click data export, and wait for the export to complete.

Figure 49 Data export interface

8.4.7 Software upgrade

Software upgrades include: LCD touch screen software, power module DSP software and power module ARM software. Before upgrading, turn off the system on the "switch" page of the touch screen, that is, you must upgrade the software when the system stops running.

1) First, prepare a USB flash drive and a computer, create a new folder in the USB flash drive, and name it "UPDATE" to store the burned files;

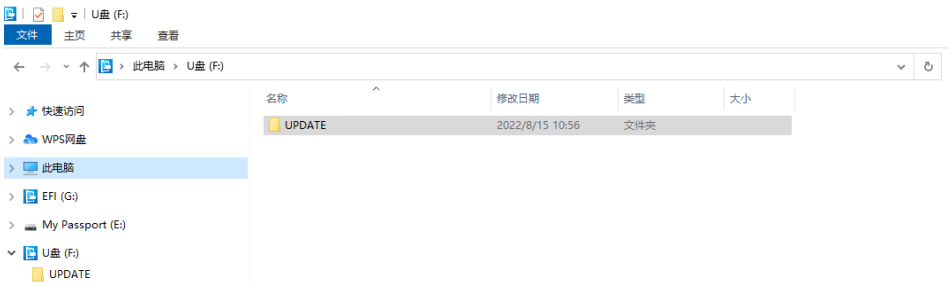


Figure 50 Create a Software Upgrade Folder

2） Copy the firmware of DSP, LCD and ARM required for system upgrade to the UPDATE folder;

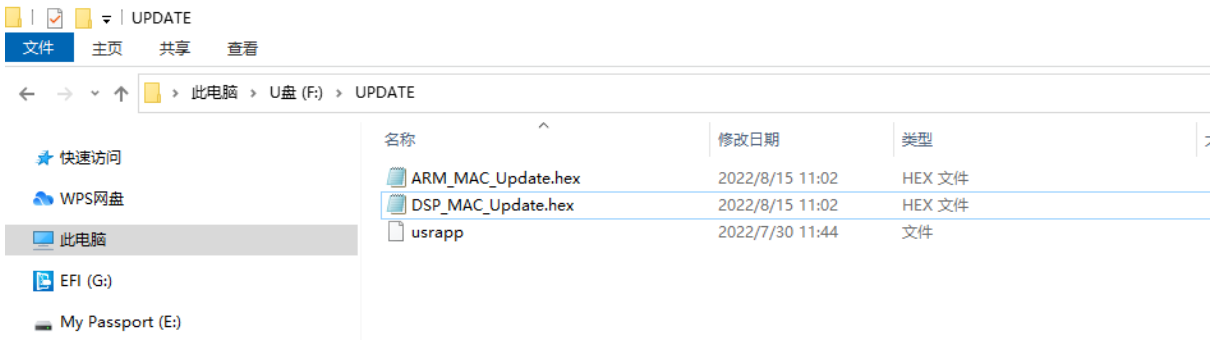


Figure 51 Storage of upgrade software

3） Click "System"-> "System Upgrade" and enter the password "88888" to enter the upgrade page;

Figure 52 Software Upgrade Password Verification

4) Insert a USB flash drive into the back of the touch screen, the interface shows that the USB flash drive is connected, and the upgrade file is detected;

5) Upgrade the LCD touch screen software, click "LCD Upgrade", wait about 15 seconds, and you will be prompted that the upgrade is successful;

Figure 53　LCD upgrade software and restart interface

6）After the touch screen software is finished, click the "Restart" button, and the version will be refreshed to take effect, as shown in Figure 48. Customers can click "Restart" after upgrading DSP and ARM according to the actual situation.

7) To upgrade the power module DSP/ARM, you need to select the module to be upgraded in the module box of the "System Upgrade" interface (if there are multiple modules in the system, it is recommended to upgrade from module 1 first, and then upgrade in setting module 2 after completion until all modules are upgraded);

8) Click "DSP/ARM Upgrade" to prompt that the upgrade has timed out, click "DSP/ARMA Upgrade" again, and wait for about 5 minutes to prompt that the upgrade is successful. Complete the system upgrade.

Figure 53 DSP/ARM Upgrade Interface

8.4.8 Introduction of Environmental Monitoring Interface

Click data-> environmental monitoring to enter the following interface: You can check the real-time environmental status of the system, the setting of air-conditioning parameters and the turn-on and turn-off of the air conditioner in the interface.

Refrigeration mode: when the temperature is greater than or equal to the set refrigeration point, the air conditioning refrigeration is turned on, and when the temperature is lower than the refrigeration point reduction difference, the return difference is 5℃ by default (1 ~ 10℃ can be

adjusted);

Heating mode: when the temperature is lower than the heating point, the air conditioner turns on the heating, and when the temperature reaches the heating point return difference, the return difference is 5℃ by default (adjustable from 1℃ to 10℃);

Figure 54 Environmental monitoring interface

9 Alarm and maintenance

The alarm level is defined as follows:

- Failure: The equipment fails and the system stops running (charging/discharging).
- Warning: the output power of the equipment decreases or some functions fail due to external factors, but the charging and discharging functions of the system are not affected.

9.1.1 Alarm processing

Table 25 Handling Methods of Fault Alarm

Alarm/fault	Components	Cause of problem	Treatment method
Water immersion fault	battery compartment	The energy storage cabinet is immersed.	1. Check whether there is water in the cabinet; 2. Confirm whether the outdoor cabinet is leaking and whether the equipment in the cabinet is in good condition.
Door magnetic alarm	battery compartment	Energy storage door is opened	1. Check whether the cabinet door is completely closed; 2. Check whether the cable on the door magnetic sensor is disconnected; Check whether the position of the door magnetic sensor is offset.
Fire fighting fault	battery compartment	Battery overheating or fire	1. immediately press the EPO button and keep away from the energy storage cabinet; Keep observing from a safe distance for 30 minutes. If there is smoke or fire, please call the fire alarm. If there is no abnormality, manually clear the activity alarm and contact the manufacturer.

Thunder arrester alarm	Electrical warehouse	Thunder arrester is faulty.	1. Check whether the signal line connection of lightning arrester is loose; 2. Check whether the lightning arrester indicator is discolored; Replace AC thunder arrester.
Compressor alarm	air conditioner	1. The wiring is loose. 2. The compressor is damaged.	1. Disconnect the distribution switch of the power, open the air conditioning junction box, and check whether the wiring is loose; 2. Observe whether the compressor is obviously damaged or burnt. If so, contact the manufacturer.
Outdoor fan alarm	air conditioner	1. The wiring is loose. 2. The compressor is damaged.	1. Disconnect the distribution switch of the power, open the air conditioning junction box, and check whether the wiring is loose; 2. Observe whether the compressor is obviously damaged or burnt. If so, contact the manufacturer.
Indoor fan alarm	air conditioner	1. The wiring is loose. 2. The compressor is damaged.	1. Disconnect the distribution switch, open the air conditioning junction box, and check whether the wiring is loose; Observe whether the fan is obviously damaged or burnt. If so, please contact the service hotline.
Over-voltage/under-voltage fault of power grid	Power grid/oil engine	Abnormal voltage on grid-connected side	Check whether the grid-connected side voltage is abnormal;
Over-frequency/under-	Power grid/oil	Abnormal	Check whether the frequency

frequency fault of power grid	engine	frequency of grid-connected side	of the grid-connected side is abnormal;
Island protection fault	Power grid/oil engine	Abnormal voltage on grid-connected side	Check whether the grid-connected side voltage is abnormal;
High/low voltage ride-through alarm	Power grid/oil engine	Abnormal voltage on grid-connected side	Check whether the grid-connected side voltage is abnormal;
Power grid voltage imbalance fault	Power grid/oil engine	Abnormal voltage on grid-connected side	Check whether the grid-connected side voltage is abnormal;
Power grid phase fault	Power grid/diesel engine	The phase sequence of the grid-connected side is wrong.	Adjust any two cables in ABC three wires
DC voltage high/low fault	battery	The battery voltage is abnormal.	Check whether the DC input voltage is abnormal;
Bus over-voltage fault	Energy storage converter	1. Load is unbalanced 2. The software is abnormal.	1. Check whether the DC wiring is loose or abnormal;
Half-voltage unbalance fault of bus	Energy storage converter	1. Load is unbalanced 2. The software is abnormal.	1. Check whether the load is abnormal; 2. Contact the manufacturer

Over-temperature derating alarm	Energy storage converter	The internal temperature is too high.	1. Check whether the air inlet and outlet of the electrical warehouse are blocked; 2. Check whether the internal fan is running normally; 3. Contact the manufacturer
Over-temperature fault of power tube	Energy storage converter	The internal temperature is too high.	1. Check whether the air inlet and outlet of the electrical warehouse are blocked; 2. Check whether the internal fan is running normally; 3. Contact the manufacturer
Balance bridge over-temperature fault	Energy storage converter	The internal temperature is too high.	1. Check whether the air inlet and outlet of the electrical warehouse are blocked; 2. Check whether the internal fan is running normally; 3. Contact the manufacturer
DC over-current fault	Energy storage converter	DC current excess	1. Check whether there is a short circuit or a damaged line on the DC side; 2. Replace the energy storage converter module or contact the manufacturer.
Balanced bridge over-current fault	Energy storage converter	Internal current excess	1. Check whether there is a short circuit or a damaged line on the DC side; 2. Replace the energy storage converter module or contact the manufacturer.
Output overload/over-current fault	Energy storage converter	AC side power/current excess	1. Check whether the grid voltage is normal; 2. Check whether there is a short circuit or a damaged line on the DC side; 3. Check whether the off-grid

			load is excessive; Replace the energy storage converter module or contact the manufacturer.
Current limiting fault by wave	Energy storage converter	AC side current excess	1. Check whether the grid voltage is normal; 2. Check whether the off-grid load is excessive; Replace the energy storage converter module or contact the manufacturer.
Communication interruption fault	Energy storage converter local controller	Communication is down.	1. Check whether the communication network cable between modules is loose or abnormal; Check whether the communication network cable of the local controller is loose or abnormal;
Parallel/synchronous failure	Energy storage converter	Parallel/synchronous signal is interrupted.	1. Check whether the parallel cable is loose or abnormal; 2. Check whether the parallel setting is abnormal; The hardware is damaged.
Open/short circuit fault of relay	Energy storage converter	1. the internal relay is abnormal Software is abnormal	1. Replace the energy storage converter module. 2.Contact the manufacturer to replace the internal panel.
1/2/3 alarm of fan	Energy storage converter	Internal fan is Abnormal	1. Replace the energy storage converter module. 2.Contact the manufacturer to replace the internal panel.

Leakage current fault	Energy storage converter	1. The leakage current is excessive. 2. The software is abnormal.	1. Check whether the leakage current Hall wiring is loose or abnormal; Check whether the grounding wire is disconnected;
Abnormal insulation impedance fault	Energy storage/battery	1. Low ground insulation Software is abnormal	1. Check whether the AC and DC cables are damaged or short-circuited to the ground; Check whether the battery line is damaged or shorted to ground.
Module loss alarm	Energy storage converter	Communication between modules and screens is interrupted.	Check whether the communication network cable between modules is loose or abnormal;
Dc low voltage alarm	Energy storage converter	Battery is not turned on.	Check whether the battery is turned on.

The above alarms and failures are common alarms or failures. If there are any failures other than those in Table 6.1, please contact the manufacturer directly.

9.1.2 Routine maintenance

Under the influence of ambient temperature, humidity, dust, vibration and aging of internal components of inverter, some potential problems may appear in the operation of the system. In order to ensure the long-term and stable operation of the energy storage system, it is necessary to arrange regular inspection by maintenance personnel according to Table 6.2, so as to find and deal with problems in time. It is recommended that the system installed in the industrial park with serious dust, high salt fog or heavy industry should be maintained once every quarter, and the energy storage system in the area with good climate environment should be maintained once every six months.

Table 26 Routine maintenance

Maintenance object	Operation	Reference Standard
Cabinet	● Check the appearance of the whole machine. ● Check the vents. ● Check the door lock	● No obvious coating peeling, scratch or corrosion. ● There is no obvious leakage. ● There is no dust accumulation in the vent. ● Door lock is undamaged.
air conditioner	● Check noise and vibration. ● Clean the filter screen.	● The fan and compressor rotate normally, without jamming or abnormal noise. ● The surface of the filter screen is clean and free of blockage.
Energy storage converter	● Check noise and vibration. ● Check the front panel vent. ● Check the rear copper bar contact surface.	● The front panel fan rotates normally, and there is no jamming or abnormal noise. ● The front panel vent surface is clean and free of blockage. ● There is no corrosion and discoloration of copper bars and contact surfaces and no dust accumulation.
electricity	● Check the thunder arrester. ● Check the contact surface of cable copper bar.	● Thunder protector is normal. ● The connecting wire of screw socket is free from loosening and falling off. ● There is no corrosion and discoloration of copper bars and contact surfaces and no dust accumulation.
Battery pack	● Check noise and vibration. ● Check the contact surface of	● The battery pack fan rotates without jamming or abnormal noise. ● The front panel vent surface is clean and free of blockage.

	cable copper bar.	● The connecting wire of screw socket is free from loosening and falling off. ● There is no corrosion and discoloration of copper bars and contact surfaces and no dust accumulation.

9.1.3 Warranty service

Warranty time

In the case of correct use of products, the warranty period agreed in the commercial contract shall prevail.

Warranty range

During the product warranty period, ZEUSAPPOLLO SOLAR will repair or replace the product for customers free of charge if the product quality problem causes the failure. Customers should reserve a reasonable response time for our company's maintenance, and the replaced products will be handled by our company. Customers need to show the relevant proof of purchasing products, and ensure that the product trademark is clearly visible, otherwise our company has the right not to guarantee the warranty.

Disclaimer has the right not to guarantee the quality, but can still provide paid maintenance services in the following cases.

- The warranty period has expired;
- Unable to provide relevant proof of product purchase;
- Damage caused during transportation, loading and unloading;
- Improper installation, modification or repair by unauthorized personnel, resulting in damage;
- Damage caused by operation under abnormal conditions or environment;
- Machine failure or damage caused by the use of third parts or software;
- Faults caused by fire, earthquake, flood and other irresistible factors.

Abbreviation

BMU	Battery Management unit
BMS	Battery Management System
BCU	Battery Control Unit
EMS	Energy Management System
PCS	Power Conversion System