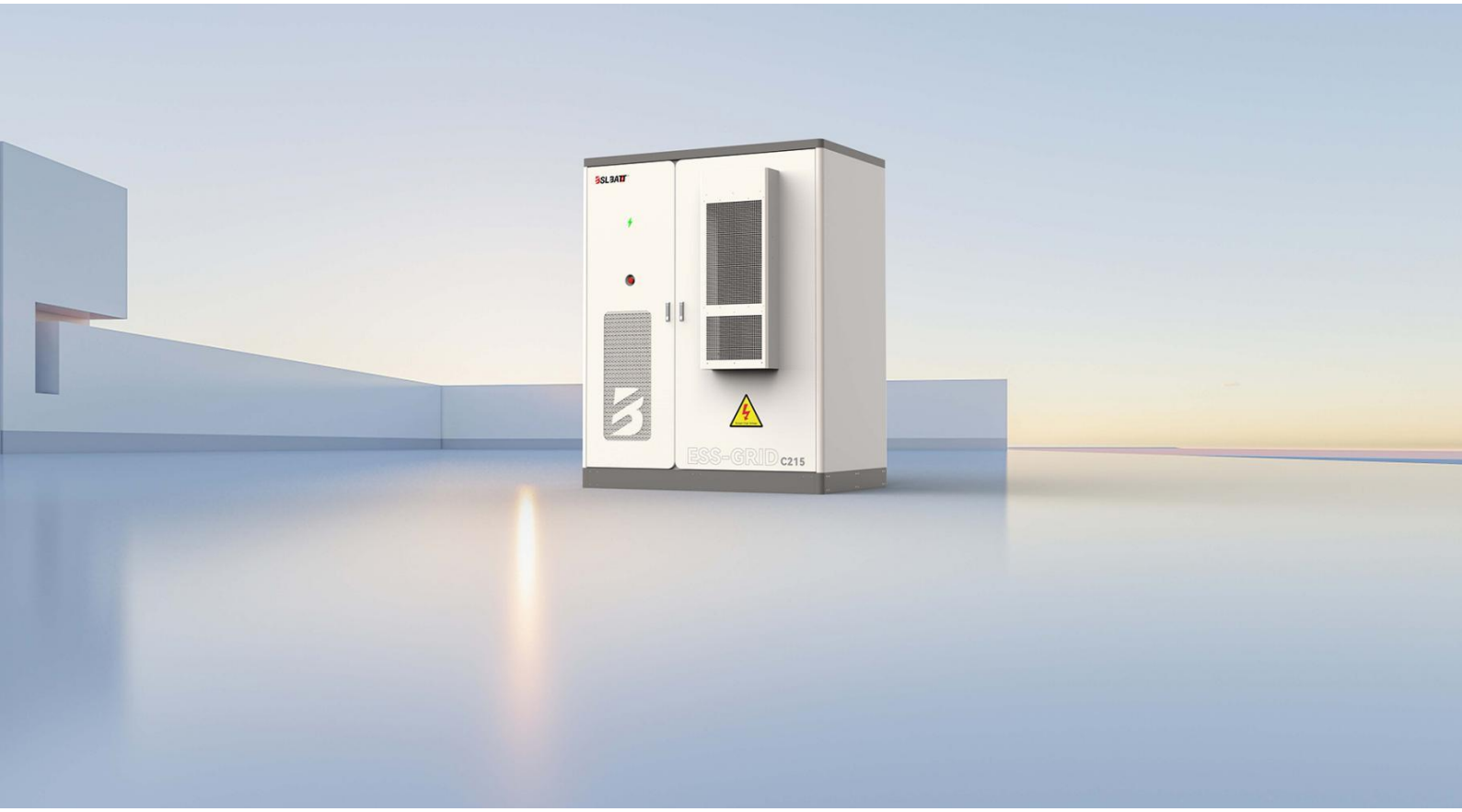
BSL NEW ENERGY TECHNOLOGY CO., LTD

ESS-GRID Cabinet Series

User Manual



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Catalogs

1. Safety Instruction

1.1. Safety Symbol Description

When installing, operating and maintaining the equipment, please read this manual first and follow the identification of the equipment and all safety precautions in the manual. In order to ensure better use of the product and ensure personal and property safety, please read the following symbols carefully.

 Danger: a high potential danger that will result in death or serious injury.

 Warning: Indicates a moderate potential hazard and failure to avoid conditions that could lead to death or serious injury.

 Note: It indicates a low potential danger that may cause moderate or mild injury to personnel.

 Explain: The emphasis on and supplement to the content may also provide tips for the optimization of the product.

1.2. General Security

 **Explain:**

The equipment shall be used in the environment that meets the design specification requirements, otherwise it may cause equipment failure, and the resulting abnormal equipment function or component damage, personal safety accidents and property loss are not within the scope of equipment quality assurance. The installation, operation and maintenance of equipment shall be followed by local laws, regulations and regulations. Safety precautions in the manual are only complementary to local laws, regulations and norms. The Company shall not be liable in case of any of the following circumstances.

- The installation and use environment exceeds the provisions in the relevant international, national and regional standards.
- Not operating in the conditions described in this manual.
- Disassemble, change the product or modify the software code without authorization.
- Operation is not according to the operation instructions and safety warnings in the product and document.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood, debris flow, etc.).
- Damage caused by customer failure to follow transportation and installation requirements.
- Damage caused by the storage conditions not meeting the requirements of the product documentation.

- Damage to device hardware or data due to customer negligence, incorrect operation or intentional damage.
- System damage due to third party or customer reasons, including relocation and installation systems that do not meet the requirements of this manual, and the adjustment, change, or removal of identification marks not meeting the requirements of this manual.
- Defects, failure or damage caused by conduct, events, negligence or accidents other than the reasonable control of the Seller, including power failure or electrical failure, theft, war, disturbance, civil unrest, terrorism, intentional or malicious damage, etc.

Danger:

The equipment has a high voltage, and the non-standard operation may produce electric shock or fire, resulting in death, serious personal injury or serious property loss. Please follow the operation sequence and safety precautions given in this manual and other relevant documents, and standardize the operation:

- Please check the equipment pre-installed cable connection tightening. Check the equipment for damage, such as holes, depressions, or other signs of possible internal damage. Check that the parts inside the equipment are not displaced, and it is forbidden to change the structure and installation order of the equipment without authorization.
- Do not clean the electrical parts inside the equipment with water. If any liquid is found entering the equipment, immediately press the emergency stop switch and notify the site management personnel.
- Installation, wiring, maintenance and replacement operations are prohibited. The voltage at the contact point shall be measured before touching any conductor surface or terminal, and the protective ground wire of the equipment or the parts requiring maintenance is reliably grounded and confirmed that there is no shock hazard.
- Except for the personnel operating on the equipment, other personnel do not approach the equipment. Do not power up the equipment without being installed or confirmed by professional personnel. At least two personnel must be present at the site when the first power up or the main circuit is live operation.

Explain

- The operation behavior and operation tools of users in the process of transportation, handling, installation, wiring and maintenance shall meet the laws, regulations and relevant standards of the country and region.
- During the installation, operation and maintenance, it is necessary to clean up the water, snow and ice or other sundries on the top of the cabinet first, and then open the cabinet door to avoid the sundries falling into the cabinet.

- Reverse engineering, decompiling, disassembly, adaptation, implantation or other derived operation of the equipment software is prohibited, and it is forbidden to study the internal implementation, obtain the equipment software source code, steal intellectual property rights, or to disclose the results of the performance test of the equipment software is prohibited.

1.3. Electrical Safety

1.3.1. Wiring requirements

- Please select the cables that meet the requirements of the local laws and regulations. Similar cables should be tied together, and different types of cables should be laid separately, without mutual winding or cross-laying.
- If the wiring is completed or the wiring leaves in a short time, block the cable mouth and close the cabinet door to avoid the entry of small animals.
- The cables used in the energy storage system must be firmly connected, well insulated, and meet the specifications. The position of cable crossing pipe or crossing hole must be protected to avoid cable damage by sharp edges and burrs.
- After the cable wiring is completed, the cable support and cable clip should be fixed reliably, and the cables in the backfill soil area should be closely fit with the ground to prevent the deformation or damage caused by the cable force during the backfill soil.
- The use of the cables in a high temperature environment may cause the aging and damage of the insulation layer, and the distance between the cables and the periphery of the heating device or the heat source area should be at least 30mm.
- In order to ensure the construction safety of construction, all cables should be laid and installed above 0℃. When handling cables, especially in a low temperature environment, they should be handled lightly.

1.3.2. Earthing requirements

- Do not destroy the ground conductor. The grounding body of the equipment shall be permanently connected to the protective grounding net. Before operating the equipment, check the electrical connection of the equipment to ensure that the equipment is reliably grounded.
- The grounding impedance of the equipment meets the requirements of GB 50054 and local electrical standards.
- Do not operate the equipment when the ground conductor is not installed. For grounding equipment to be installed, the protective ground wire shall be installed first.

1.3.3. Maintenance requirements

- Before connecting or removing the cable, first disconnect the protective switch of the corresponding circuit.
- Use a multimeter with the corresponding voltage level to ensure that the equipment has been completely powered off.
- If there is a live body nearby, please use the insulation plate or insulation belt to block or wrap.
- Use the grounding wire to reliably connect the maintenance circuit with the grounding circuit, and carry out operation and maintenance.

Explain:

- Before connecting the cable, confirm the cable label before connecting.
- If the equipment has multiple input, the input of all the equipment should be disconnected and the equipment can be operated after the equipment is fully powered down.
- After the maintenance, remove the grounding wire between the maintenance circuit and the grounding circuit.

1.4. Mechanical Safety

Pay attention to:

- The bottom enclosure must be removed without a wooden box fork. Take-off and landing should be handled lightly to avoid impact or vibration.
- In the process of transportation, the center of gravity of the box should fall in the middle of the two cargo forks on the forklift truck. Long-distance handling or inversion or tilt is prohibited.
- When transporting the equipment, the large volume of the equipment may cover the view of the operator, so auxiliary personnel should be arranged to help complete the equipment.
- To ensure the safety of drilling in the outer body of the equipment, the appropriate position should be selected before drilling to ensure that there is no short circuit and other effects. The equipment should be blocked during drilling to prevent debris from falling into the equipment and clean the debris after drilling.
- When carrying the equipment by hand, you should be prepared for load-bearing, and you should wear protective gloves, wear anti-smashing shoes and other safety protective appliances.
- Move the equipment carefully during equipment handling to avoid hitting or falling. Avoid scratching equipment surfaces, damaged parts, or cables.

1.5. Battery Safety

Explain

The Company shall not be liable for damage to the battery provided by the Company by:

- Failure to timely charging, acceptance, resulting in overdue battery storage, capacity loss or irreversible damage.
- Drop mechanical damage, leakage, rupture, etc. due to improper operation or failure to connect the battery as required.
- The customer or the third party will not know the company to change the battery use scenario. Including but not limited to: to connect the additional load to the battery, mixed with other brands of batteries, mixed with different rated capacity of batteries, etc.
- Direct damage to the battery caused by the operating environment of field equipment or external power parameters cannot meet the environmental requirements of normal operation. Including the actual operating temperature of the battery is too high or too low, and the power grid situation is bad and frequent power failure.
- The customer does not set the battery operation management parameters correctly or improper maintenance, resulting in frequent battery discharge, the customer expands the capacity or fails to fully charge for a long time.
- The customer did not maintain the battery correctly according to the supporting equipment operation manual, including but not limited to: did not regularly check whether the battery terminal screws are tightened, etc.
- The battery was stolen and lost.
- Batteries exceeding the warranty period.

Danger:

- Do not expose the battery to a high temperature environment or around the heating equipment, such as sunlight, fire source, transformer, heater, etc. Overheated batteries may cause a fire and explosion.
- Do not disassemble, modify or destroy the battery (such as insertion of foreign body, immersion in water or other liquid medium) to avoid battery leakage, overheating, fire or explosion.
- Thermal runaway of battery will produce combustible gases, as well as harmful gases such as CO and F. The accumulation of combustible gas caused by the thermal runaway of the battery has the risk of deflagration and explosion, which may cause personal injury and property loss.
- When installing and maintaining the battery, the exposed cable terminals on the battery should be wrapped with insulation tape. At the same time, avoid foreign

bodies (such as conductive objects, screws, liquids, etc.) entering the battery and causing short circuit.

Warn:

- The battery must be stored in a separate warehouse and in the outer packaging, avoid mixing with other materials, avoid open storage, avoid battery stacking. The site must be equipped with qualified fire-fighting facilities, such as fire-fighting sand, fire extinguishers, etc.
- The battery should avoid impact. When handling the battery, it should be carried in accordance with the direction required by the battery, with no inversion and tilt.
- 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 operating temperature, charging is prohibited to avoid a short circuit inside the battery caused by crystallization at low temperature charging.
- Please dispose of the waste batteries according to the local laws and regulations. Do not treat the batteries as household waste.
- If the battery is more than 8 months away from the last charging time, the battery should be recharged by operation. If the battery is not replenished as required, it may affect the performance and service life of the battery.

Battery Abnormal Handling Measures

Danger:

- When the electrolyte leakage or abnormal odor occurs, contact with the leaked liquid or gas should be avoided. Non-professionals do not approach, please contact the professionals immediately.
- Electrolytes are corrosive, and contact can lead to skin irritation and chemical burns. If the battery electrolyte is exposed, the contact area needs to be cleaned immediately with plenty of water and soap and medical help immediately.
- No battery drops (with packing material or not). If there is no obvious deformation or damage and there is no obvious odor, smoke or fire, the battery should be transferred to an open and safe place for 1h and then processed, and contact the service engineer of the company.
- When the battery falls, there is obvious odor, damage, smoke or fire. People should be evacuated immediately and alarm on time. Professional personnel shall use fire fighting facilities while ensuring safety.

1.6. Maintenance and Replacement

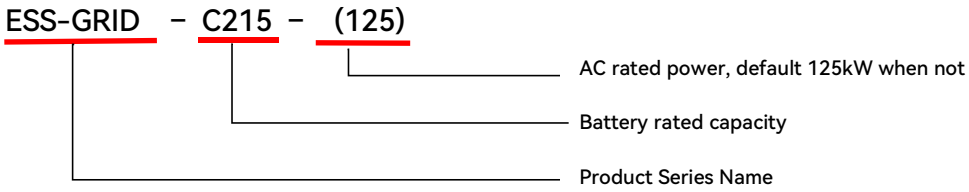
Warn

- No rain, snow, thunder, dust, fog and other weather to open the cabinet door.

- Remove the parts from the cabinet and confirm that the other parts on the cabinet are not loose.
- During maintenance of equipment, live parts shall be covered with insulating materials.
- Avoid touching the running fan (such as fingers, parts, bolts, etc.).
- Do not power on the device before troubleshooting.
- During the system live inspection, attention should be paid to the danger sign on the equipment to avoid standing at the cabinet door.
- Devices other than the battery pack must wait 15 minutes to ensure that the equipment is not powered before operating the equipment.
- After the replacement of power components of the energy storage system or wiring change, manual wiring detection is required to avoid abnormal system operation.
- After completing the maintenance and replacement operations, lock the cabinet door in time and keep the key properly.

2. Product Presentation

2.1. Model Description



Note: Isolation transformer, STS off-grid switching and DC power module are optional components, and the rated output power and battery capacity can be flexibly configured according to the project requirements.

2.2. Product Function

Optical storage integrated outdoor energy storage cabinet integrates energy storage battery, modular STS, modular PCS, modular DC/DC converter, energy management monitoring system, distribution system, environmental control system and fire control system, etc. The modular PCS is easy to facilitate maintenance and capacity expansion. The light storage integrated outdoor energy storage cabinet can reduce the footprint and maintenance channel, and has the characteristics of safe and reliable, fast deployment, low cost, high energy efficiency and intelligent management.

In common application scenarios, the operation strategies of energy storage systems are as follows:

Peak shifting and valley filling: when the electricity price is in the valley section: the energy storage cabinet is automatically charged and standby after full; when the electricity price is at the peak section: the energy storage cabinet is automatically discharged to realize the electricity price arbitrage and improve the economic benefits of the optical storage and charging system.

Optical storage combination: real-time acquisition of local load power, photovoltaic power generation is preferred to self-use and surplus power storage; if photovoltaic power is less than the local load, battery storage power is preferred.

2.3. Electrical Line Diagram

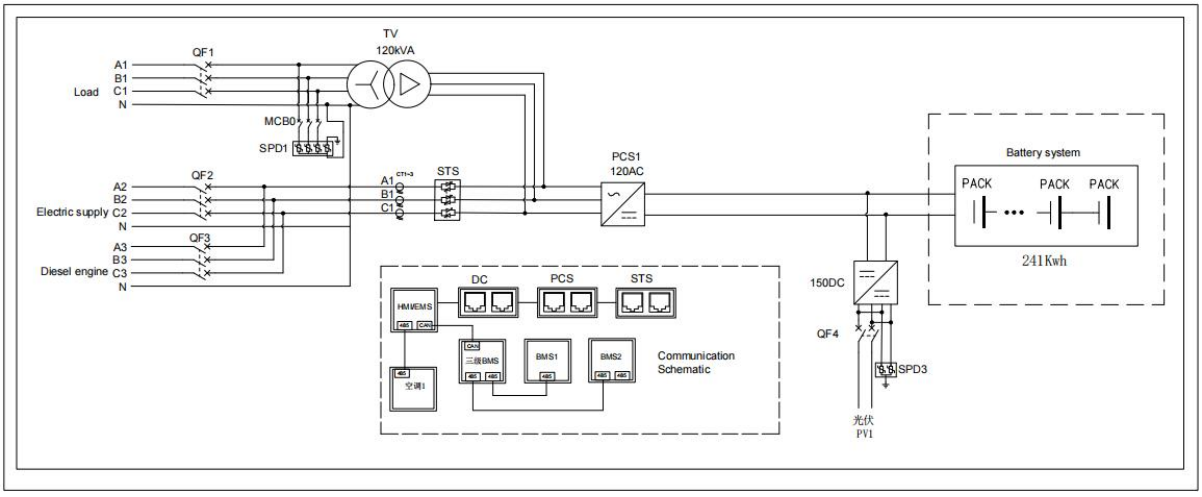


Fig. 2.1 Electrical primary drawing

Description: Figure 2.1 is the system scheme with off-grid connection, with isolated transformer and with photovoltaic input. Different projects have different configurations and slightly different lines, and the actual attached drawings for the shipment shall prevail.

2.4. Product Characteristics

- System productization, integrated energy storage battery, modular PCS, modular STS, modular DC/DC converter, energy management and monitoring system, power distribution system, environmental control system and fire control system, etc., to fully control the operation status and risk of the system;
- The ack-type modular PCS, multi-machine parallel operation and good scalability; PCS modules and total battery power can be selected according to the system capacity requirements of micro grid scenarios, typical configuration: **100kW / 200kWh, 100kW / 215kWh, 120kW / 225kWh, 120kW / 241kWh.**
- Protection level IP54, can perfectly deal with all types of outdoor weather;
- Using the door-mounted embedded integrated air conditioning, does not occupy the cabinet space, improve the available space of the outdoor cabinet, the top structural integrity is better, the waterproof effect is good;
- The local control screen can realize diversified functions such as system operation monitoring, energy management strategy formulation, and remote equipment upgrade.

2.5. Product Parameter

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

Table 2.1 Parameters Table of the Energy Storage System

Model	ESS-GRID C200	ESS-GRID C215	ESS-GRID C225	ESS-GRID C241
Battery Capacity	200kWh	215kWh	225kWh	241kWh
System rated voltage	716.8V	768V	716.8V	768V
System voltage range	627.2V~795.2V	672V~852V	627.2V~795.2V	672V~852V
Cell capacity	280Ah	280Ah	314Ah	314Ah
Battery type	Lithium iron phosphate battery (LFP)			
Module Composition Method	1P*16S*14S	1P*16S*15S	1P*16S*14S	1P*16S*15S
Maximum charge current	140A	140A	157A	157A
Maximum discharge current	140A	140A	157A	157A
Rated AC power	100kW		120kW	
Maximum AC power	110kW		130kW	
Rated AC current	145A		174A	
Maximum AC current	159A		191A	
Rated AC voltage	400V，3W+PE/3W+N+PE			
Rated AC frequency	50/60±5H z			
DC side voltage range	590~920V（3P3W）/ 670~920V（3P4W）			
DC side maximum current	200A			
Total current harmonic distortion rate THDI	<5% (rated power rate)			
Power factor	-1 advance ~ + 1 lag			
The voltage total harmonic distortion rate THDU	<3% (linear load)			
Rated PV (DC / DC) power	100kW			
PV DC voltage range	250~700V			
PV maximum current	160*2A			
Levels of protection	IP54			
Protection level	I			
Isolation method	Transformer isolation: 100 kVA		Transformer isolation: 125 kVA	
Stop self-consumption	<100W (excluding transformer)			
Display	Touch the LCD touch screen			
Relative humidity	0~95% (no condensation)			
Noise	Less than 78dB			
Ambient temperature	-25℃ ~60℃ (drop over 45℃)			
Cooling-down	Intelligent air cooling			

method				
above sea level	2000m (with over 2000m drop)			
BMS communication	CAN			
EMS communication	Ethernet / 485			
Dimensions	1850*1100*2300mm (W*D*H)			
System Weight	2900kg	2990kg	3000kg	3090kg

Note: The actual parameters have been set according to the customer requirements.

2.6. Part Introduction

2.6.1. Battery system

Table 2.2 Battery system parameters

Battery parameters		280Ah cell		314Ah cell	
Cell	Battery type	Lithium iron phosphate battery (LFP)			
	Nominal voltage	3.2V	3.2V	3.2V	3.2V
	Voltage range	2.8V~3.55V	2.8V~3.55V	2.8V~3.55V	2.8V~3.55V
	Vominal capacity	280Ah	280Ah	314Ah	314Ah
	Maximum charge operating temperature range	0~55℃	0~55℃	0~60℃	0~60℃
	Maximum discharge operating temperature range	-30~55℃	-30~55℃	-30~60℃	-30~60℃
Module	Cell series and parallel connection mode	1P16S	1P16S	1P16S	1P16S
	Rated energy	14.336kWh	14.336kWh	16.076kWh	16.076kWh
	Nominal voltage	51.2V	51.2V	51.2V	51.2V
	Voltage range	44.8~56.8V	44.8~56.8V	44.8~56.8V	44.8~56.8V
	Weight (approx)	89kg	89kg	91kg	91 kg
	Overall dimensions (W * D * H)	480*750*226 ±2mm	480*750*226 ±2mm	480*750*226 ±2mm	480*750*226 ±2mm
Battery cluster	Rated energy storage	200kWh	215kWh	225kWh	241kWh
	System rated voltage	716.8V	768V	716.8V	768V
	System voltage range	627.2V~795.2V	672~852V	627.2V~795.2V	672~852V
	Serial and parallel mode	1P*16S*14S	1P*16S*15S	1P*16S*14S	1P*16S*15S
	The number of electric boxes contained	14	15	14	15
	Weight (approx)	1271kg	1360kg	1299kg	1390kg

2.6.2. Battery management system

The energy storage management system consists of the battery management system (BMS) and the energy management system (EMS). The battery comes with a BMS system, which is divided into two levels: BMU and BCU.

The BMU is located in the battery box, completing the data collection of the single cell information inside the battery box, and uploading the data to the BCU, and completing the balance between the single cells in the battery box according to the instructions issued by the BCU.

BCU is located in the main control box, which is responsible for the management of the battery cabinet, accepts the detailed data uploaded by the BMU inside the battery, sampling the voltage and current of the battery cabinet, makes SOC calculation and correction, being responsible for the management of the battery cabinet's pre-charging and standby, charging and discharging, and uploading the relevant data to the EMS.

2.6.3. Electrical system

2.6.3.1 Energy storage converter power (PCS) module

The light storage integrated outdoor energy storage cabinet adopts a modular scheme, and users can configure different numbers of power modules according to the project requirements. Power module parameters of the energy storage converter are as follows:

Table 2.3 Converter module parameters

Model	Monet-100AC	Monet-120AC
Power rating	100kW	120kW
Maximum power	110kW	130kW
The DC working voltage range	580~1000V（3P3W）/ 670~1000V（3P4W）	
Full-load voltage range on the DC side	625~920V（3P3W）/ 670~920V（3P4W）	
Maximum DC current	200A	
Rated AC voltage	400Vac，3W+ PE /3W+N+PE	
Rated frequency	50/60Hz（±5Hz）	
Rated AC current	145A	174A
Overload capacity	110%, normal operation; 120%, 1 min	
Current distortion	<5% (rated power rate)	
Power factor adjustment range	-1 advance ~ + 1 lag	
With an unbalanced load capacity	100%	
Adapt to the battery	Lithium battery / lead-acid / PV modules	
Charging method	Press the BMS instruction / 3-stage / MPPT	
Work pattern	Constant current, constant power, MPPT, AC voltage source, and	

	DC voltage source
Maximal efficiency	98.2%
Dimensions (W * D * H)	520*750*265mm
Weight (approx)	68kg
Isolation method	Non-isolation
Levels of protection	IP21
Working temperature	-25℃ ~ + 60℃ (> 45℃ drop)
Relative humidity	0~95% (non-condensation)
Cooling-down method	Intelligent air cooling
Noise	< 78dB
Above sea level	3000m (> 3000m drop)
Communication interface	CAN

2.6.3.2 DC converter power (DC/DC) module

For islands, mountainous areas, border posts and other remote areas or areas with unstable power supply, or new zero-carbon technology parks. Users can configure the DC converter power module according to the project requirements, and charge the battery through the DC coupling to realize the power supply system integrating photovoltaic and energy storage. The DC converter power module parameters are as follows:

Table 2.4 The module parameters of the DC converter

Model	Monet-50DC
Rated DC power	50kW
Maximum DC power	55kW
The DC working voltage range	200V~1000V
Full-load voltage range on the LV side	312V~850V
Maximum current	80A*2
Low-pressure side input path number	2 (can be 2 independent, can be parallel into 1)
Full-load voltage range on the high-voltage side	500V~900V
Maximum DC current on the high voltage side	110A
High-pressure side input path number	1
Work pattern	Constant pressure, constant current, constant power, and MPPT
Maximum conversion efficiency	98.80%
Dimensions (W * D * H)	483 (excluding mounting ear 444) * 600 * 150mm
Weight (approx)	25kg
Isolation method	Non-isolation

Levels of protection	IP21
Working temperature	-25℃ ~ + 60℃ (> 45℃ drop)
Relative humidity	0~95% (non-condensation)
Cooling-down method	air blast cooling
Noise	< 70dB
Above sea level	3000m (> 3000m drop)
Communication interface	RS485 / CAN (Optional)

2.6.3.3 STS and off-grid switching module

For areas with unstable power grid and frequent power failure, users can configure STS module according to project requirements, and realize automatic control of seamless switching and off-grid through STS. The STS module parameters are as follows:

Table 2.5 STS, and off-grid module parameters

Model	ESS-GRID 150STS
Power rating	150kW
Maximum power	165kW
Rated AC voltage	400Vac，3W+N/3W
Rated frequency	50/60Hz(±5Hz)
Rated AC current	216A
Switching period	<10ms
Maximal efficiency	99%
Dimensions (W * D * H)	483 (excluding mounting ear 444) * 600 * 150mm
Weight (approx)	25kg
Levels of protection	IP21
Working temperature	-25℃℃ ~ + 60℃ (> 45℃ drop)
Relative humidity	0~95% (non-condensation)
Cooling-down method	Intelligent air cooling
Noise	<70dB
Above sea level	3000m (> 3000m drop)
Communication interface	CAN

2.6.3.4 Three-phase isolation transformer

For the off-grid application scenario, the three-phase isolation transformer is configured, and the output terminal and the input terminal are completely disconnected from the input terminal, realizing harmonic filtering and preventing shock current. The isolation transformer module parameters are as follows:

Table 2.6 The module parameters of the three-phase isolation transformer

Model	MTFI-3100A
Power rating	100kVA
Dimensions (W * D * H)	600*410*670mm
Insulation grade	H
Connection group	Dyn11
Primary-side input voltage	400V
Primary-side input current	144A
Rated frequency	50Hz
Secondary-side output voltage	400V
Secondary-side output current	144A
Overload capacity	110%
Cooling-down method	Dry self-cooling
Productiveness	> 97.5%
Noise	≤65dB

2.6.4. Environment control system

The energy storage system is equipped with smoke detectors, emergency stop, door magnetic sensor and fire protection environmental control units, which can fully control the operating state of the system. Schematic diagram of the environmental control system:

Figure 2.2 Internal structure diagram of the cabinet

2.6.4.1 Precision air conditioning parameters

Operational principle:

① Refrigeration: when the temperature inside the cabinet is higher than the refrigeration set point plus refrigeration deviation, it starts refrigeration; when the temperature inside the cabinet is lower than the refrigeration set point, it stops refrigeration.

② heating: when the cabinet temperature is lower than the heating set point, start heating; when the cabinet temperature is higher than the heating set point plus heating deviation, stop heating.

③ Dehumidification: when the humidity inside the cabinet is greater than the dehumidification open humidity (default 80%, range 50~99%), and the temperature inside the cabinet is less than the dehumidification open temperature (default 25 ℃, range 20~40 ℃), turn on the electric heating dehumidification; when the temperature inside the cabinet rises to the dehumidification stop temperature (default 30 ℃, range 25~50 ℃), or humidity falls back to the dehumidification stop humidity (default 75%, range 50~99%), stop heating.

Table 2.7 Precision air-conditioning parameters

Model	AC3000P
Electrical parameters	
Rated operational voltage	220Vac ±15%
Rated current	5A
Rated working frequency	50Hz
Dimensions (H * W * D)	1350×550×250mm
Weight	63kg
Levels of protection	IP54
Refrigerating capacity	3000W
Heat production capacity	2000W
Blowing rate	850m ^{3}/h
Noise	< 70dB
Refrigeration	
Refrigeration opening point	Default 25℃ (setting range: 16~38)
Refrigeration deviation	Default 6℃ (setting range: 1~10)
Heating	
Heat opening point	Default 5℃ (setting range: 5~26)
Thermal deviation	Default 10℃ (setting range: 1~10)
Dehumidification	
The dehumidified opening temperature	Default 25℃ (setting range: 20~40)
The dehumidifying stops the temperature	Default 30℃ (setting range: 25~45)
The dehumidifying turns on humidity	Default 80% (setting range: 50~99)
Dehumidifying stops humidity	Default 75% (setting range: 45~95)
Warning function	
High temperature alarm in the cabinet	30℃ ~60℃ (Setable)
Low temperature alarm in the cabinet	-45℃ ~10℃ (Setable)

High humidity alarm in the cabinet	0%~100% (Setable)
Note: Actual parameters are set according to customer requirements before delivery.	

2.6.4.2 Access control switch

Access control switch detects the door opening status of the equipment.

Table 2.8 Parameters of the access control switch

Name	Parameter
Rated voltage	AC-15: 380V DC-13: 220V
Rated current	AC-15: 0.79A DC-13: 0.14A
Nominal insulation voltage	415V
Rated impact withstand voltage	2.5kV
Operation frequency	Mechanical / electrical: 20 times / min
Service environment	Temperature: -5℃ ~ + 40℃ relative humidity <90% RH (no condensation)

2.6.4.3 Smoke Detector

The smoke detector is used to detect the smoke concentrations in the current environment.

Table 2.9 Parameters of the smoke detector

Name	Parameter
Working voltage	DC12 / 24V (allowed range 9V~33V)
Working current	Monitoring status: <4 mA @ DC 12 V Fire alarm: 28 mA @ DC 28V 52mA@DC 24V 18mA@DC 10V
Relay output	Open normally, with a contact capacity of 1A 30VDC
Work instructions	The monitoring state red light flashes about once every 3s The alarm state the red light is always on
Service environment	Temperature: -20℃ ~ + 60℃ relative humidity <95% RH (no condensation)

2.6.5. Fire extinguisher system

Fire protection system adopts aerosol fire extinguishing device is a new type of environmental protection fire protection product with the world's advanced level. Working principle: when the fire occurs, fire extinguishing device after receiving the electric start signal or flame ignition thermal line, electric initiator or thermal line combustion activate the aerosol agent, aerosol agent through the redox reaction heat release chemical coolant decomposition, realize aerosol agent and coolant involved in the fire fighting.

Table 2.10 Aerosol parameters for fire protection

Model	QRR0.3G/S-Q
Technical parameter	
Drug weight	300g
weight of equipment	860±30g
Spitfall time	≤14s
Outline dimension	46*68.5*255mm
Spitow temperature	400℃, 200℃, and 75℃, respectively
Actual fire fighting efficiency	100g/m^3~130g/m^3
Working environment temperature range	-50℃~+90℃
Relative humidity	≤95%
TH type (thermal sensitivity line) start mode parameters	
Start temperature	170℃
Validity of use	10 years

2.6.6. Local management system

Microgrid Management System (Lotus-ESS) is an intelligent energy management system developed by the company for the microgrid system, which is mainly used for energy storage power stations with various capacities and optical storage and charging power stations. The product integrates human unit state screen (HMI), port control and communication, system parameters and operation strategy setting functions to realize the monitoring and management of the energy storage system. The product hardware resources and parameters are as follows:

Table 2.11 Local controller parameters

Product model	Lotus - ESS
Power input	DC 12V
Output control	3 Isolated Output Switches
Input control	6 isolated input switches
Serial communication	2 isolated RS232, 4 isolated RS485
Field bus	2 CAN bus interfaces
Ethernet port	1 10/100M Ethernet port (RJ45)
Extended storage	1 USB flash drive port, 1 SD card port
Sound alarm	1 controllable buzzer
Program characterization	1 Run Indicator, 1 Status Indicator, 1 Alarm Indicator
Abnormal attribute	1 hardware watchdog timer
Real-time clock	1 RTC real-time clock

2.7. Configuration List

In conclusion, the overall configuration list of the energy storage system under the typical configuration is as follows:

Table 2.12 Overall configuration list of ESS-GRID C215

Name	Model	Unit	Quanti ty	Remarks
Battery system	280Ah，215kWh	Set	1	With control box
Energy storage converter	Monet-50AC	Unit	2	Modularity
The DC converter power Module	Monet-50DC	Unit	2	Modularity
STS and off-grid switching module	Monet-150STS	Unit	1	Modularity
Air conditioning system	AC3000P 220± 15%VAC~50Hz	Set	1	Precision air conditioning
Fire extinguisher system	QRR 0.3G/S-Q	Set	1	Heat-sensitive line starting type
Three-phase isolation transformer	MTFI-3100A	Set	1	Dyn11
Supplementary system	Access control, etc	Set	1	Auxiliary supporting equipment
Management system	Lotus-ESS	Set	1	Comconsists of BMS and EMS

The actual supply configuration shall prevail.

3. Installation and Wiring

3.1. Transportation and Handling

3.1.1. Product transportation

- In order to keep the equipment in a better protective state, it is recommended to use transportation with packaging;
- Equipment transportation shall be transported according to the identification requirements on the package to prevent personal injury and equipment damage;
- Energy storage batteries are not recommended by rail transportation, air transportation. Speed limit requirement: speed limit of 80 km/h on flat road and 60 km/h on rugged road. If there is any conflict, please refer to the local traffic regulations.

3.1.2. Product handling

- When using the forklift to move, ensure that the forklift has enough weight, and pay attention to the center of gravity of the equipment should fall between the feet of the forklift to prevent personal injury and equipment damage;
- With battery transfer, the forklift bearing capacity needs 3t; without battery transfer, the forklift bearing capacity needs 1.5t;
- Recommended knife length of 1.5m, width of 80cm~160cm and thickness of 25mm~70mm.

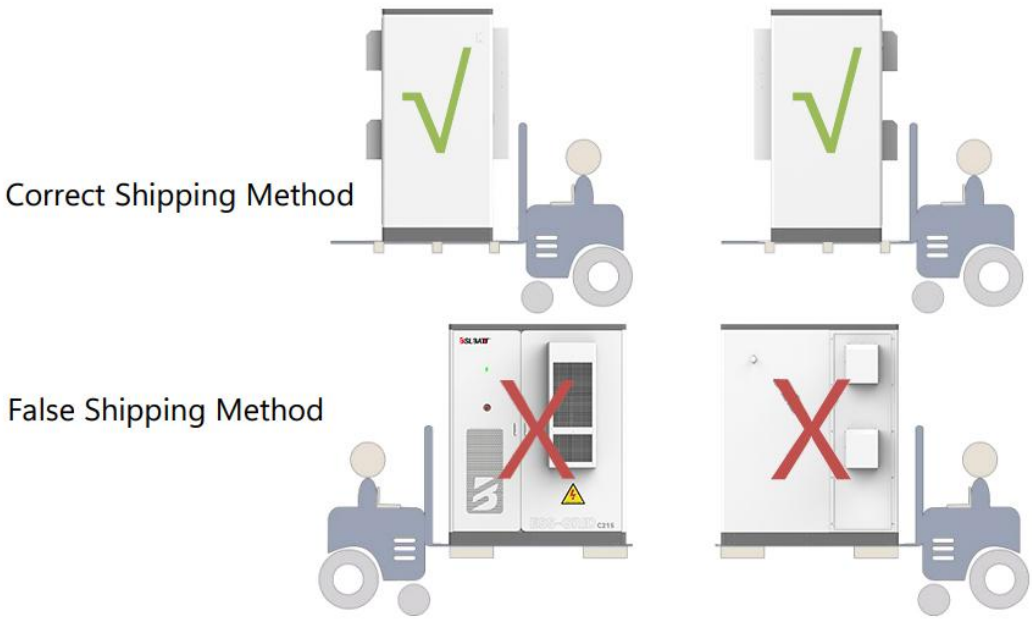


Figure 3.1 Handling schematic diagram

3.2. Packaging and Storage

3.2.1. Product packaging

In order to make the product in a better protective state during transportation, use a specific wooden box packaging. The following basic parameters are listed on the equipment package (including but not limited to), which shall be carefully checked according to the project requirements:

Table 3.1 Packaging parameters table

Parameter	Explain
Model	Product model
Size	Post-packaging product dimensions
Weight	Total product weight after packaging
Characteristic	Front up, carefully placed, center of gravity position, etc

3.2.2. Product storage

If the product is not immediately transported or installed, it must be stored indoors and meet the following conditions:

Table 3.2 Requirements for Product Storage Conditions

Parameter	Condition
Storage temperature (without battery)	-25℃~+60℃
Battery	20℃ ~ 30℃
Store relative humidity	<95% (no condensation)
Height	< 3000m

Note: Long-term storage of batteries is not recommended. Long-term storage, there will be capacity loss in lithium battery. After 12 months of lithium battery storage at the recommended storage temperature, the irreversible capacity loss is generally 3%~10%. The total storage and transportation time of battery packs is not more than 8 months (calculation time from delivery). Power replacement and SOC calibration are required over 8 months, with a minimum of 50% SOC. If the battery is not replenished as required, it may affect the performance and service life of the battery.

3.3. Installation Environment Requirements

The installation layout of the energy storage system must meet the requirements of fire distance or firewall specified in the local standards, including but not limited to GB 51048-2014 Code for Design of the Electrochemical Energy Storage Power Stations and NFPA 855 Standard for theInstallation of Stationary Energy Storage Systems. Energy storage

system is only suitable for outdoor scenes, needs outdoor arrangement, does not support indoor arrangement. General general requirements are as follows:

- The horizontal surface of the installation position shall be above the highest water level in the area. The distance from the airport, landfill disposal site, river bank or dam shall be 2km.
- Choose a well-ventilated place. Do not block the vents and heat dissipation system to prevent high temperature fire. Enough installation space to ensure that the surrounding equipment is not affected by the heat generated by the product; the installation position ensures adequate external wiring space. With convenient transportation conditions, reliable fire suppression system equipment.
- The installation position is far away from the fire source. Do not place inflammable and explosive items around the equipment. If the equipment is installed in a lush vegetation, in addition to routine weeding, the ground below the equipment needs to be hardened to prevent weeds.
- Do not install energy storage system outdoors in salt damage areas to prevent corrosion and fire. Salt damage area refers to the area within 2km from the coast or affected by the sea breeze.
- The energy storage system must be equipped with fences, walls and other protective measures, and safety warning signs must be erected to avoid unauthorized entry during the operation of the equipment, resulting in personal injury or property loss.
- The equipment is installed in the area far away from the liquid, and should not be installed under the water pipe and air outlet; it should not be installed under the air conditioning outlet, vent and equipment room outlet window to prevent the liquid from causing short circuit.

Explain

When the safe spacing of the site selection cannot meet the requirements of the relevant national standards, it is recommended to relocate the site. Site shall be located against scenarios not recommended by industry standards and regulations, including but not limited to the following locations, areas and sites:

- Strong vibration, strong noise source, and strong electromagnetic field interference areas.
- Places that produce or have dust, lampblack, harmful gases, corrosive gases, etc.
- Places that produce or store corrosive, flammable and explosive articles. Within the blasting hazard range.
- Places where underground facilities exist. Dense populated places, high-rise buildings, underground buildings.

- There are rubber soil, soft soil layer and other bad geological conditions, easy to water and easy to sink the ground.
- Within the limits of the mining subsidence (dislocation) area. Areas that may be submerged after a dam or embankment breaks up.
- Seismic fault and fortification intensity higher than nine degrees. There is debris flow, landslides, quicksand, karst cave and other direct harm to the area.
- Important water supply source sanitation protection area.
- Historical relics and historic sites reserve.

If there is no more suitable site selection, it is recommended to install a firewall no less than 3h for safety protection, and the requirements of space for equipment transportation, installation and maintenance are considered. It is recommended to refer to T/CEC 373-2020: the length and height of the firewall should be 1m beyond the outer outline of the energy storage cabinet.

3.4. Preparation Before Installation

1) Check whether the product is intact before installing the product. If any damage trace is found, please retain the evidence and contact the equipment manufacturer.
2) If the product is abnormal, please check the delivery list to see whether the accessories are complete.

Table 3.3, Delivery List

Serial No.	Name	Quantity	Remarks
1	Light storage and integrated outdoor energy storage cabinet	1	Include cabinet door key
2	User's manual	1	
3	Certificate	1	
4	Factory inspection report	1	
5	Container loading list	1	

3) Users need to prepare relevant installation tools before installation.

Table 3.4 List of installation tools

Serial No.	Name	Quantity	Remarks
1	Screw Knife Set	1	
2	Jacket	1	
3	Multimeter	1	
4	Forklift	1	
5	Screws, nuts, gasers	1	

3.5. Mechanical Installation

1) After determining that the product is free and all accessories are complete, refer to the following suggestions:

- Select the installation position of the equipment in advance according to the product size, locate and fix it; the recommended foundation is shown in Figure 3.2.
- Referring to the product weight, the selected installation position should have sufficient load-bearing strength;
- The ground resistance is less than 4 Ω.

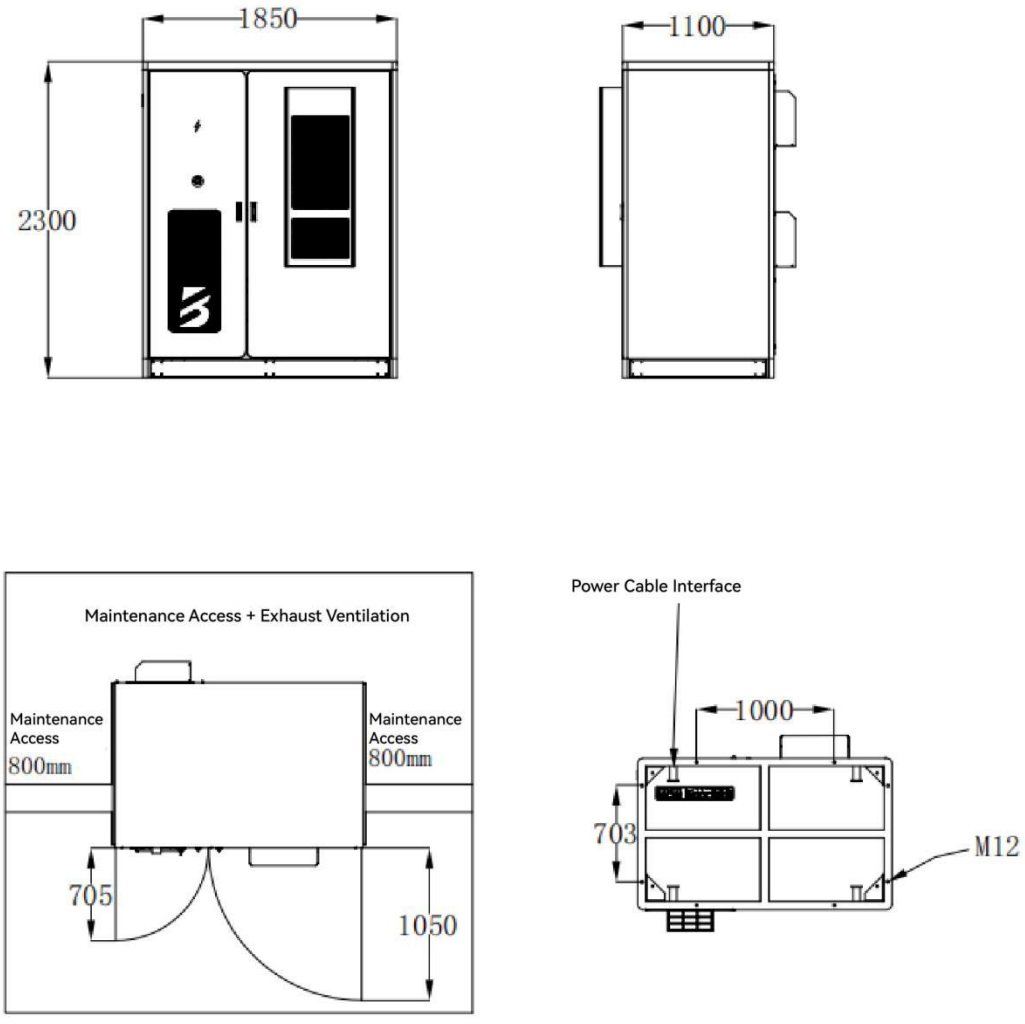


Figure 3.2 Basic Reference Drawing (actual dimension of equipment subject to shipment)

2) After removing the packing wooden box, remove the bottom enclosure panel of the equipment first. The removed panels and screws shall be collected, and they shall be installed after the equipment is installed.

Figure 3.3 Schematic drawing of the bottom enclosure panel of the equipment

3) Place the equipment on the foundation with a forklift, align the fixing hole of the equipment with the embedded nut of the foundation, and tighten with M16X40 bolts.

Figure 3.4 Bolt tightening at the bottom of the equipment

3.6. Electrical Cable Installation

This product adopts all-in-one structure, the DC side has been completed wiring, the site only for the AC side and external communication electrical cable installation. Provide the wiring reference as shown in Table 3.5 according to the product power and cable specifications. The selection of the cable diameter shall comply with the local cable standards. The factors affecting the selection of cables are: rated current, cable type, laying mode, ambient temperature and maximum acceptable line loss.

Table 3.5

Model capacity	AC cable	Null line	Earth wire	Positive and negative DC input (parent level)
50kW	≥3*35mm²	≥35mm²	≥25mm²	≥2*35mm2
100kW	≥3*70mm²	≥70mm²	≥50mm²	≥2*70mm2
150kW	≥3*95mm²	≥95mm²	≥95mm²	≥2*95mm2

Danger:

For conducting electrical installation, refer to the following recommendations:

(1) Before wiring, check that all switches in the equipment are disconnected to ensure that the equipment is not charged;

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

(3) Determine the cable phase order is correct, you can add yellow, green, red and black different color insulation sheath or identification to distinguish, to prevent the phase order error;

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

(5) Communication lines and power cables should be laid separately as far as possible to ensure that the insulation layer of the cable is not damaged during the laying process;

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

(7) All AC cables shall enter the equipment through the bottom inlet hole of the equipment and then connect to the corresponding phase sequence;

(8) After wiring, use fire mud to seal the wiring leakage to prevent external insects and rats from damaging the equipment or cables.

In order to prevent poor contact resistance and heating resistance, the bolts that tighten the terminals meet the torque requirements listed in Table 3.6.

Table 3.6 Wiring moment requirements

Screw size	M4	M5	M6	M8	M10	M12	M14	M16

Torsion (N*m)	1.8~2.4	4~4.8	7~8	22~29	44~58	76~102	121~162	189~252

The entry and exit line of the energy storage system is down in and out. After removing the switch baffle, as shown in Figure 3.5, A/B/C/N copper bar at the lower end of the switch reserves ϕ 11mm, ϕ 13mm to for the customer, or the size according to the customer requirements; the protective ground wire is connected to the PE copper bar, and the grounding impedance of the equipment meets the requirements of the national standard GB 50054 and local electrical standards.

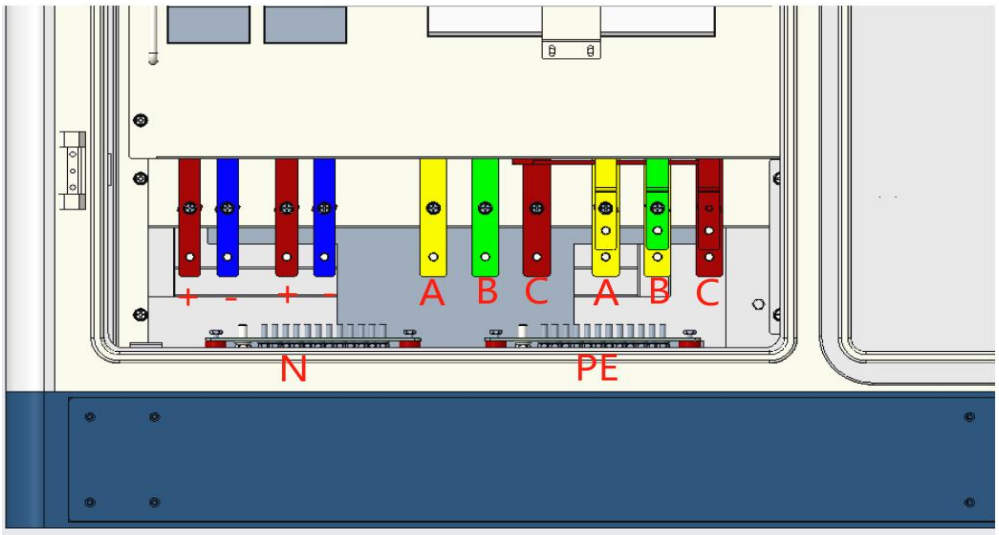
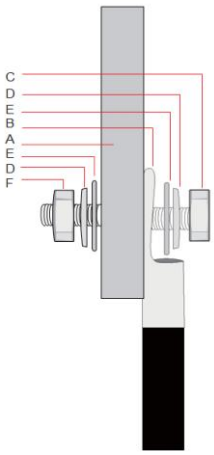


Figure 3.5 Wiring schematic diagram

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



Serial No.	Name
A	Copper Array
B	Wiring Terminal
C	Screws
D	Spring Pad
E	Large Flat Washers
F	Nuts

Name of each of of terminal terminal

Figure 3.6, fixing screw and installation diagram

Pay attention to:

- When using copper wire or copper clad aluminum wire, use copper terminals.

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

4. Start-up and Commissioning

4.1. Check Before Boot

Before the product operation, please ensure that the product has been installed in accordance with the specifications, and conduct a comprehensive and detailed inspection of the machine to ensure that all indicators meet the requirements before starting up.

1) Appearance inspection:
   a、 The equipment looks intact without damage, without rust and paint loss. If the paint is dropped, please replace the paint;
   b、 Equipment labels are clearly visible, and the damaged labels should be replaced in time.
2) Grounding check: the box has a ground point and a solid grounding; the grounding conductor in the box is reliably connected to the box grounding copper row.
3) Cable inspection:
   a、 The cable protective layer package is intact without obvious damage;
   b、 The terminal production conforms to the specification, and the connection is firm and reliable;
   c、 The labels at both ends of each cable are clear and clear, the line meets the principle of separation of strong and weak electricity, and the margin left at the corner should not be tightened;
   d、 The cable mounting bolt has been fastened and the cable pulling is not loose; the plugging of the cable crossing hole has been completed.
4) Copper strip inspection: no obvious cracks or deformation in the copper strip, the lap screws are fastened, there is no dislocation, and no debris on the copper strip.
5) 1 Component inspection: refer to Figure 4, the circuit breaker is in the switch position; the lightning protection indicator is green.

Note: In order to transport safety, we will disconnect one section of the battery module DC cable, the whole cluster of batteries in the open-circuit state, the power needs to be connected to the DC cable, pay attention to the need to put on insulated gloves to operate, inserted into the connector to hear the sound indicates successful access.

Figure 4.1 Location diagram of power distribution switch

4.2. Boot Operation

The operation procedure of product power-on operation is as follows:

1) Confirm that the grid voltage is within the predetermined range (400V±10%) with a multimeter;
2) Refer to Fig. 4.1, close transformer soft start switch MCB2, air-conditioner switch MCB3, auxiliary power switch MCB4~5, close QF2 utility switch to complete transformer soft start.
3) Close the battery auxiliary switch and the high voltage box load switch (rotate to ON position), close the QF1 load switch, close the QF5~6 photovoltaic switches (Note: When using the QF1 oil switch for equipment, remember to disconnect the QF2 utility switch first; when using the QF3 bypass switch for equipment maintenance, remember to disconnect the QF4 load switch first).
4) Set the converter parameters in “System”->“Parameter Setting” interface, and select the required operation mode in “System”->“Operation Mode” interface. In “System” ->“Operation Mode” interface, select the desired operation mode (Manual Mode, Peak Shaving and Valley Filling, Backup Mode);
5) Enable all modules in the “Switch” page of the touch screen, click “Converter on” to complete the power-on.

4.3. Trial Run

After the equipment completes the installation of all electrical structures to meet the start-up conditions, in order to ensure the reliable and stable operation of the energy storage system, the initial operation must be powered up by professional electrical

engineers and technicians 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”->“Environment Monitoring”, enable all the modules in the “Switch” interface, and then click “System On”. Click “System On”;
3) Observe the parameters of PCS, battery and air-conditioner during operation, and stop the machine in time for testing 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 the screen PCS, battery and air conditioner during the running period, and stop the machine in time for testing if there is any abnormality;
7) Run for 0.5 hours;
8) After completing the 1-hour test run without any abnormality, turn off the system in the “switch” interface;
9) According to the project background and demand, you can choose the local manual power control mode, automatic peak shaving mode or backup mode to put into operation formally, and click “system on” in the system interface.

4.4. Shutdown Operation

When the product needs daily maintenance, it needs to be shut down. The normal product shutdown operation is as follows:

1) Click “System Shutdown” on the touch screen switch interface;
2) Referring to Figure 4.1, disconnect the system air conditioning switch MCB3, auxiliary power switch MCB4~5 and battery auxiliary power switch;
3) Disconnect the QF1 oil switch, QF2 utility switch, QF3 bypass switch, QF4 load switch, and QF5~6 photovoltaic switch;
4) Disconnect the battery high voltage control box DC load switch;
5) Wait for the end of busbar discharge, the touch screen goes out, and the equipment completes shutdown.

4.5. Urgent Stop Shutdown

When the product failure or critical situation requires emergency shutdown, the following emergency shutdown operation can be performed:

1) Press the emergency shutdown button “EPO”;
2) Referring to Figure 4.1, disconnect the system auxiliary power switches MCB4~5 and the battery auxiliary power, and disconnect the HV box DC switch;
3) Reset the EPO button after determining that the fault or hazard is removed and operation is required.

Explain

After pressing "EPO" emergency shutdown, you need to QF 1 oil machine switch, QF 2 city power switch, QF 5 ~ 6 photovoltaic switch, auxiliary power switch MCB 4 ~ 5, high voltage box DC switch are turned off, wait for HMI touch screen to wait for 10min before the boot!

5. Running and Operation

This section mainly introduces the LCD touch screen display interface and the corresponding operation control through the man-machine interface. Users can execute various operation commands through the LCD display interface, easily browse the DC, AC and system operation related parameters and data, timely obtain the current equipment status and real-time alarm information, and provide a reliable basis for fault diagnosis. In addition, the LCD touch screen can also display the system software version information and upgrade the various component software through the U disk.

5.1. Man-machine Interface Introduction

After the system is powered, the LCD touch screen enters the startup interface. After 30s, the startup interface disappears, and the system enters the "Home page" interface. As shown in Figure 5.1, the home page interface displays the real-time power, voltage, current, power generation, operation mode, working status and other information of the system.

Figure 5.1 Main Page

Each menu expansion item:

Serial No.	Menu name	Menu project	Parameter function
1	Principal sheet	No	Display the operation status of the system and the charge and discharge curve diagram of the same day
2	Data	Real-time data	All simulated volume data of the converter are shown
		Real-time status	The ter working status and switch status are displayed
		Real-time alarm	Current system alarm information
		Battery data	Battery data display and battery on and off

			setting
		Environmental monitoring	Moving ring monitoring display and air conditioning parameter setting
3	Record	Historical alarm	Display the historical alarm records
		Operation log	Displays the operation log
		Data report	Export history
4	System	system info	Displays system information
		running mode	System operation mode setting
		parameter setting	Converter and battery parameter setting
		Manufacturer setting	Equipment manufacturer setting
		system upgrade	System software upgrade
		Communication Settings	Conduct communication settings
5	Switch	System switch	System open machine
6	HMI, pilot lamp	HMI left-side indicator light	① The first from top is the power indicator: the green light flashes when the HMI touch screen is normally; (flashing frequency 1s once) ② The second one is the status indicator: when the system is faulty, the green indicator is not on; when the system is not faulty, the green indicator is always on; ③ The third one is the fault indicator: the red indicator flashes when the system is faulty; the red indicator is not on when the system is not faulty (flashing frequency 1s once)
7	System lamp	State instructions	① When the system is on standby, and there is a fault, the system light is bright red. ② When the system is running and no fault, the system light turn green ③ When the system is running, and when there is a fault, the system light is bright yellow ④ When the system is on standby, the system light is not on.

5.2. Switch machine operation

Switch machine operation:

1. System turn on: firstly, check the whole machine power up, refer to Fig. 4.1 to close transformer soft start switch MCB2 and auxiliary power switch MCB4~5, close QF2 utility switch to complete transformer soft start.
2. Close QF4 load switch and QF5~6 PV switch. (Note: When using QF2 oil switch for equipment, remember to disconnect QF1 utility switch first; when using QF3 bypass switch for equipment maintenance, remember to disconnect QF4 load switch first);
3. It takes about 30 seconds for the screen to start.

4. Set the converter parameters in “System”->“Parameter Setting” interface, and select the required operation mode in “System”->“Operation Mode” interface. In “System”->“Operation Mode” interface, select the required operation mode, select grid connection and control mode manual, peak shaving and valley filling and backup mode.

Figure 5.2 Operation mode interface

5. On the "switch" page of the touch screen to enable all modules (some modules can be opened as actual needs), click "System Open", and the normal opening time is about 30 seconds, as shown in Figure 5.3.

Figure 5.3 Switch machine interface

6. Converter off: When the converter is running, click "converter off" as shown in Figure 5.3.
7. Break the converter auxiliary power switch MCB 4 ~ 5.
8. Switch QF 2 mains switch, switch QF 4 load switch, QF 5 ~ 6 photovoltaic switch.

5.3. Communication Settings

Description: Communication setting refers to the communication protocol setting between LCD touch screen and battery BMS, LCD touch screen and EMS background.

1、Check that the battery BMS communication line is connected to CAN 2 _ H and CAN 2 _ L on the back terminals of the touch screen;

2、Check that the background EMS communication line has been connected to the touch screen back terminal COM6_A, C OM 6_B or connected to the network port position;

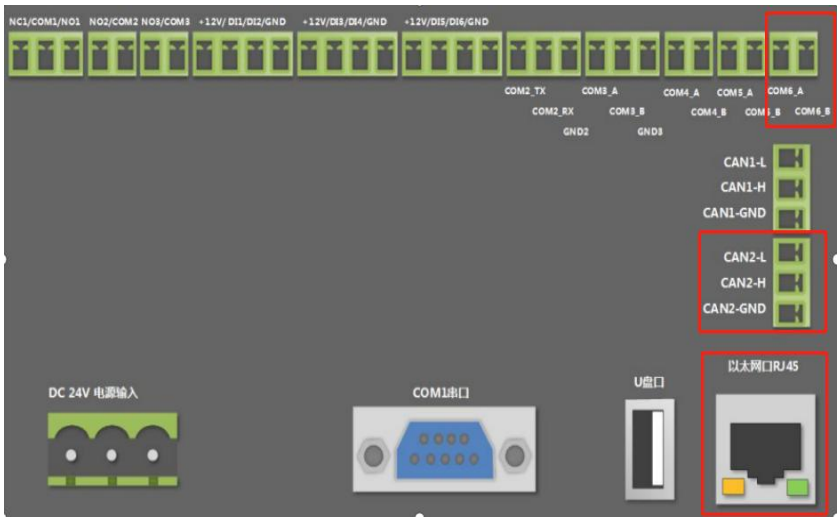


Figure 5.4 Inspection of communication wiring

3、Click the LCD touch screen "System" -> "Communication Settings" to enter the communication settings interface.

Figure 5.5 Communication Settings interface

4、Battery BMS communication setting: set the CAN port rate to 250 kbps;

5、Background EMS communication setting 1: If RS485 communication is adopted, the corresponding local address of the communication panel is set as 1. If multiple energy storage systems connect to the background, the slave address cannot be repeated;

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

Figure 5.6 IP address configuration interface

5.4. Run Mode Settings

5.4.1. Introduction to running mode

The operation mode of optical storage integrated outdoor energy storage cabinet can be divided into three kinds: grid-connected manual mode, grid-connected automatic mode, and off-grid automatic switching.

1. Grid-connected manual mode: The energy storage system is running in grid-connected mode, but the user must manually operate the LCD touch screen. The charging and discharging active power, reactive power and power factor of the energy storage system can be set in the "parameter setting". When the PV power is greater than the load power, the excess power is stored in the battery, and the PV output power is limited; when the PV power is less than the load power, the combined power supply, if supply is not enough; the energy storage power is preferred at night, and the city power is supplied when the energy storage power is lower than the set value.

2. Grid-connected automatic mode: For the application scenarios of peak-shifting and valley filling, the energy storage system will automatically operate grid-connected according to the pre-set time-sharing charging and discharging power. For backup mode application scenario,

photovoltaic priority to battery charging, load power provided by the power grid, when the battery charge to set the SOC limit of 100% time volt shutdown, battery SOC, discharge to 96% photovoltaic boot, the battery charge not discharge, when photovoltaic power is greater than the load power, photovoltaic tracking load power, when photovoltaic power is less than the load power, photovoltaic + battery combined power to the load.

3. Automatic off-grid switching: When the grid suddenly power off, the energy storage converter automatically switches from grid-connected mode to off-grid mode, and the system can output a stable 400V / 50Hz three-phase AC voltage. When the grid suddenly calls, the energy storage converter automatically switches from off-grid mode to grid-connected mode.

Note: A. Off-grid switching can set planned trigger or unplanned trigger, set to unplanned trigger: when the city is off, automatically switch to off-grid operation, the system can output stable 400V / 50Hz three-phase AC voltage; when the city calls, automatically switch to grid-connected mode. Set to plan trigger: running in grid-connected mode can be manually switched to off-grid mode, "off-grid" set to "off-grid", running in off-grid mode can be manually switched to grid-connected mode (premise city power), and "off-grid" set to "grid-grid". The setup interface is shown below:

Figure 5.6 And off-grid setting interface

B. In the grid-connected mode, the anti-countercurrent function can be set to prohibit or enable, which is set to enable: the power of the energy storage system will not be reversed

to the power grid. Set to prohibit: Electricity from the energy storage system can flow into the grid. In the system "System" -> "Parameter Settings" -> "Advanced Settings (password 888888)" -> "MSTS parameters" -> "Antireflux enabling" setting interface as follows:

Figure 5.7 Anti-countercurrent setting interface

5.4.2. Grid-connected manual mode

1、Click "System" -> "Operation Mode" mode to enter the Figure 5.8 page.

Figure 5.8 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 runs according to the set value (the positive value is discharge, and the negative value is charging). The power setting interface is shown in Figure 5.9.

Figure 5.9 Power setting interface

3、Enter the "switch" page according to the "enable" power module (it is recommended to enable all). Finally, click "System Open" to confirm.

Figure 5.10 Switch machine interface

5.4.3. Automatic grid connection mode

Peak-shifting and valley-filling mode:

1、Click "System" -> "Operation Mode", click "Peak cutting and valley filling" button to enter the setting page;

Figure 5.11 Setting interface of peak shifting operation

2、Click "Modify" to set the peak load shifting operation period and power: set the start and end time in period 1, charge and discharge power and capacity; click the next one to enter the period 2 setting, and save and exit after completing all period settings;

Figure 5.12 Peak load filling time setting interface

3、Automatic jump to the following interface, click the complete button;

Figure 5.13 Peak load filling

4、"Control mode" is modified to "peak cutting and valley filling";

Figure 5.14 Control mode of peak shifting

5、This is the automatic mode: pause, click "switch" -> "System open" to complete the local automatic control mode setting.

Figure 5.15 Local control operation mode is turned on

Backup Mode Mode:

1、Click "System" -> "Operation Mode" and click "Backup Mode" button to enter the setting page: allow mains to charge the battery; battery charging power: set the required battery charging power value; set mains charging prohibited: not allowed to charge the battery. Generator: When the generator is allowed to supply power to the load; when the generator is set to enable, the generator is not allowed to supply power to the load. Generator charging: the generator is not allowed to charge the battery when it is

prohibited, the generator is allowed to charge the mains (provided the generator is enabled first) standby SOC: When the battery SOC discharges to the standby power SOC set value, the battery is no longer discharged, and the load is provided by the mains or oil machine.

Figure 5.16 Backup mode setting interface

2、When the oil machine is running in reverse mode, break the power grid switch, close the oil machine switch and close the load switch; click "System" -> "Operation Mode" -> "Grid" to set the generator; click "Reserve mode" button to enter the setting page, set "Generator" to enable, set "Generator Charge" to enable, and set the power value of the required battery charging. After the generator is turned on, the generator supplies power to the load, and then charges the battery to keep the SOC, and the system will automatically switch to off-grid operation to power the load. When the mains is restored, it is necessary to manually turn off the oil machine switch, close the market power switch, set the "power grid" to the city, run the backup mode, implement the backup mode logic of the mains, and no longer charge the battery when charging the battery to the standby power SOC.

3、"Control mode" is changed to "backup mode";

This is the automatic mode: pause, click "switch" -> "System open" to complete the local automatic control mode setting

Figure 5.17 Automatic control operation mode is turned on

5.4.4. And automatically switch off of the network

When the system is running in grid connection, the energy storage converter automatically switches from grid-connected mode, and the system can output stable 400V / 50Hz three-phase AC voltage. When the grid calls, the energy storage converter automatically switches from off-grid to grid-connected mode. The specific setting methods are described as follows:

1. Manual and off-grid switching mode: click "System" -> "Operation Mode" to enter the current page. Select "plan trigger" in "off-grid switch", set to plan trigger: running in grid mode can be manually switched to off-grid mode, will "off-grid" set to "off-grid", running in off-grid mode can manually switch to grid mode (premise mains exists), will "off-grid" set to "grid".

Figure 5.18 Manual and off-grid switching mode setting interface

2. Automatic cut off-grid mode: click "System" -> "Operation mode" to enter the current page, and switch "set to" unplanned trigger ", set to unplanned trigger: when the grid suddenly power off, the energy storage converter will automatically switch from grid-connected mode to off-grid mode, the system can output a stable 400V / 50Hz three-phase AC voltage; when the grid suddenly calls in off-grid mode, the energy storage converter automatically switches from off-grid to grid-connected mode.

Figure 5.19 Automatic parallel and off-grid switching mode setting interface

5.5. Battery Parameter Settings

1. Click "System" -> "Parameter Setting" to enter the current page; the customer sets the upper and lower limit of SOC according to their own requirements; it is recommended that the lower limit of SOC is not less than 5%.

Figure 5.20 Battery charge and discharge setting interface

Note: Battery parameters have been set before the energy storage system leaves the factory, and it is not recommended to modify them by yourself.

5.6. Data Viewing and Export

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

Figure 5.21 Data Report Interface

2. Check the day, month, year and total charge and discharge volume.
3. Insert the U disk, wait for the U disk to connect, click data Export, wait for the export to complete.

Figure 5.22 Data Export Interface

5.7. Software Upgrading

Software upgrade includes: LCD touch screen software, power module DSP software, power module ARM software three software upgrades. Before upgrading, close the system on the touch screen "switch" page; the software must be upgraded while the system stops running.

1. First of all, prepare a U disk, a computer, create a new folder in the U disk, named "U PDATE" for storing burning files;

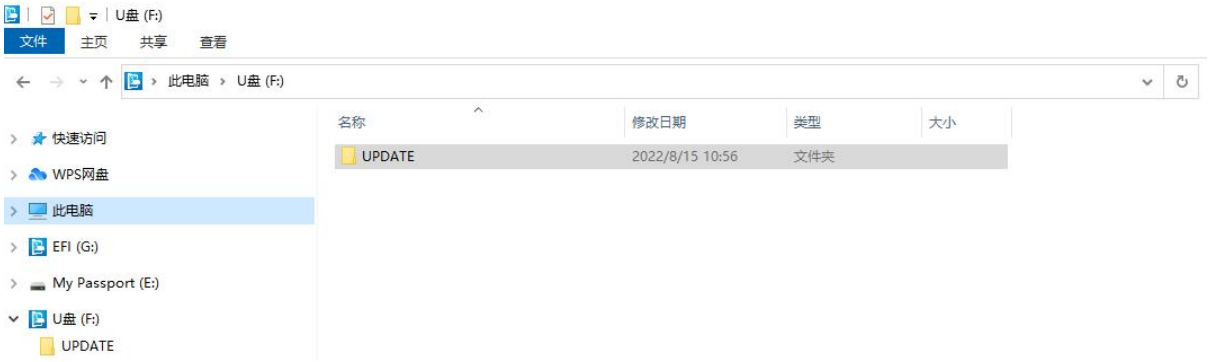


Figure 5.23 Create the upgrade software folder

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

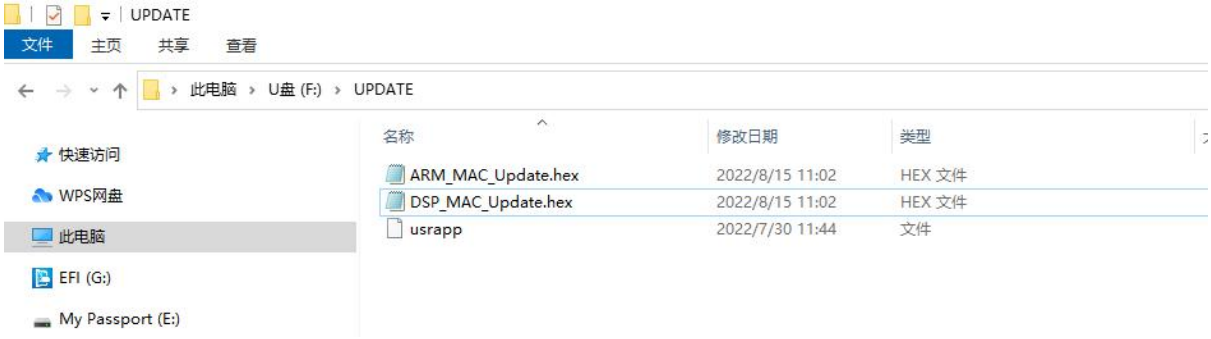


Figure 5.24 Store the upgrade software

3. Click "System" -> "System Upgrade", enter the password "888888", and enter the upgrade page;

Figure 5.25 Upgrade software password verification

4. Insert the U disk on the back of the touch screen, the interface shows that the U disk is connected, and the upgrade file is detected;
5. Upgrade the LCD touch screen software, click "LCD Upgrade", wait for about 15 seconds, there is a prompt to upgrade successfully;

Figure 5.26 LCD upgrade software and restart interface

6. After the LCD touch screen software completes, click the "restart" button to refresh the version, as shown in Figure 5.24. Customers can upgrade the DSP and ARM and then click "Restart".
7. For power module DSP / ARM upgrade, the module to be selected in the module box of "System Upgrade" interface (when there has multiple modules, it is recommended to upgrade from module 1 first, and upgrade in setting module 2 until all modules are upgraded);
8. Click "DSP / ARM Upgrade" and wait about 5 minutes before the upgrade is successful. Complete the system upgrade.

Figure 5.27 The DSP / ARM upgrade interface

5.8. Introduction of the Environment Monitoring Interface

Click “Data”->“Environment Monitoring” to enter the following interface; you can view the real-time environmental status of the system, air conditioning parameter settings and air conditioning on and off in the interface.

Cooling Mode: When the temperature is greater than or equal to the set cooling point, the air conditioner is turned on, when the temperature is lower than the cooling point, the air conditioner is turned off, and the return value is 5℃ by default (1~10℃ adjustable);
Heating mode: when the temperature is lower than the heating point, the air conditioner turns on the heating, when the temperature reaches the heating point plus the return difference value, the return difference value is 5℃ by default (1~10℃ adjustable);

Figure 5.28 Environmental Monitoring Interface

6. Warning and Maintenance

The alarm level is defined as follows:

- Fault: The equipment fails and the system stops running (charge / discharge).
- Alarm: the output power drops or partial function fails due to external factors, but it does not affect the charge and discharge function of the system.

6.1. Warning Processing

Table 6.1 Handling method of fault alarm

Alarm / Fault	Involving parts	The cause of the problem	Method of disposition
Water logging hitch	Battery warehouse	Water immersion in energy storage cabinet	1.Check for water inside the cabinet; 2.Confirm whether the distributed energy storage cabinet is leaking, and whether the equipment in the cabinet is in good condition.
Door magnetic report an emergency	Battery warehouse	The energy storage cabinet door is opened	1.Check whether the cabinet door is completely closed; 2.Check whether the cable on the door magnetic sensor is disconnected; 3.Check the door magnetic sensor position for offset.
Extinguishing and protection hitch	Battery warehouse	The battery is overheated or in fire	1.Press the EPO button immediately, and the message speed is far away from the energy storage cabinet; 2.Observe continuously for 30 min outside of the safe distance. If there is smoke or fire, please call the fire alarm; if not, manually remove the activity alarm and contact the manufacturer.
Lightning protection device report an emergency	Electrical warehouse	Lightning protection device failure	1.Check whether the signal line connection of the lightning protector is loose; 2.Check whether the lightning protection device indicator changes color; 3.Replace AC lightning ter.
Compression engine report an emergency	air-conditioning	1.Free of the wiring 2.Compressor is damaged	1.Disconnect the distribution switch, open the air conditioning junction box, check whether the wiring is loose; 2.Observe whether the appearance of the compressor is obviously damaged, whether there is a burnt flavor, and if so, contact the manufacturer.
Outdoor fan report an emergency	air-conditioning	1.Free of the wiring 2.The fan is damaged	1.Disconnect the distribution switch, open the air conditioning junction box, and check whether the wiring is loose;

			2.Observe whether the fan is obviously damaged and whether there is a burning smell. If so, please contact the service hotline.
Indoor fan report an emergency	air-conditioning	1.Free of the wiring 2.The fan is damaged	1.Disconnect the distribution switch, open the air conditioning junction box, and check whether the wiring is loose; 2.Observe whether the fan is obviously damaged and whether there is a burning smell. If so, please contact the service hotline.
Grid over-voltage / under-voltage hitch	Grid / oil machine	Abnormal voltage on the grid-connected side	Check whether the grid-connection side voltage is abnormal;
Power grid overfrequency / underfrequency hitch	Grid / oil machine	Abnormal frequency of the grid connection side	Check whether the frequency of the grid connection side is abnormal;
Island protection hitch	Grid / oil machine	Abnormal voltage on the grid-connected side	Check whether the grid-connection side voltage is abnormal;
High / low voltage crossing report an emergency	Grid / oil machine	Abnormal voltage on the grid-connected side	Check whether the grid-connection side voltage is abnormal;
Grid voltage imbalance hitch	Grid / oil machine	Abnormal voltage on the grid-connected side	Check whether the grid-connection side voltage is abnormal;
The grid is wrong	Grid / wood machine	Wrong grid connection side phase sequence	Adjust any two cables in the ABC three lines
High / low DC voltage hitch	cell	The battery voltage is abnormal	Check whether the DC input voltage is abnormal;
Bus overpressure hitch	Energy storage converter	1.Load imbalance 2.Software anomaly	1.Check whether the DC wiring is loose or abnormal; 2.Contact the manufacturer
Bus half-pressure imbalance hitch	Energy storage converter	1.Load imbalance 2.Software anomaly	1.Check whether the load is abnormal; 2.Contact the manufacturer
Overtemperature drop report an emergency	Energy storage converter	The internal temperature is too high	1.Check whether the inlet and outlet of the electrical compartment are blocked; 2.Check whether the internal fan is running properly; 3.Contact the manufacturer
The power tube is too warm hitch	Energy storage converter	The internal temperature is too high	1.Check whether the inlet and outlet of the electrical compartment are blocked; 2.Check whether the internal fan is running properly; 3.Contact the manufacturer
The balance bridge is too warm hitch	Energy storage converter	The internal temperature is too	1.Check whether the inlet and outlet of the electrical compartment are blocked;

		high	2.Check whether the internal fan is running properly; 3.Contact the manufacturer
DC current hitch	Energy storage converter	Direct current excess	1.Check the DC side for short circuit or line damage; 2.Replace the energy storage converter module or contact the manufacturer.
Balance bridge over flow hitch	Energy storage converter	Internal current excess	1.Check whether the off-grid load is in excess; 2.Replace the energy storage converter module or contact the manufacturer.
Output overload / overflow hitch	Energy storage converter	AC side power / current excess	1.Check whether the power grid voltage is normal; 2.Check the DC side for short circuit or line damage; 3.Check whether the off-grid load is in excess; 4.Replace the energy storage converter module or contact the manufacturer.
Wave by wave limit hitch	Energy storage converter	AC side current is excess	1.Check whether the power grid voltage is normal; 2.Check whether the off-grid load is in excess; 3.Replace the energy storage converter module or contact the manufacturer.
Communication interruption hitch	Energy storage converter, local controller	Communication interruption	1.Check whether the communication network cable between the modules is loose and abnormal; 2.Check whether the local controller communication network cable is loose and abnormal;
And machine / synchronization hitch	Energy storage converter	And machine / synchronization Signal interruption	1.Check whether the parallel cable is loose or abnormal; 2.Check whether the parallel machine setting is abnormal; 3.Hardware circuit is damaged.
Relay is open circuit / short circuit hitch	Energy storage converter	1.The internal relay is abnormal 2.Software anomaly	1.Replace the energy storage converter module 2.Contact the manufacturer to replace the internal panels
Fan is 1 / 2 / 3 report an emergency	Energy storage converter	The internal fan is abnormal	1.Replace the energy storage converter module 2.Contact the manufacturer to replace the internal fan
leakage current hitch	Energy storage converter	1.The leakage current is excess 2.Software anomaly	1.Check whether the leakage current of Hall wiring is loose or abnormal; 2.Check whether the grounding wire is disconnected;
Insulation impedance abnormal hitch	Energy storage converter / battery	1.Low insulation to the ground 2.Software anomaly	1.Check whether the AC / DC cable is damaged or short-circuit to the ground; 2.Check the battery circuit for breakage or short circuit to the ground.
Module lost report an emergency	Energy storage converter	Module to-screen communication is interrupted	Check whether the communication network cable between the modules is loose and abnormal;
Dc is low report an emergency	Energy storage converter	The battery is not on	Check that the battery is turned on;

Low voltage side 1 road 2 road low voltage	Photovoltaic DC converter	The photovoltaic voltage open-circuit voltage is below 250V	Use the multimeter photovoltaic switch whether the positive and negative DC voltage is more than 250V.

Warning: The above alarms and faults are common alarms or faults. If there is any faults other than Table 6.1, please contact the manufacturer directly.

6.2. Routine Maintenance

Due to the ambient temperature, humidity, dust, vibration, and the aging of the inverter internal components, some potential problems may occur during the operation of the system. In order to enable the energy storage system to run stably for a long time, maintenance personnel need to arrange to inspect regularly according to Table 6.2 to find and deal with problems in time.

Systems installed in severe dust, high salt fog or heavy industrial parks are recommended to be maintained once a month, and energy storage systems in areas with good climate conditions every 3 months.

Table 6.2: Routine Maintenance Work

Maintaining objects	Movement	Reference standard
Box	● Check the appearance of the whole machine ● Check the vents ● Check the door lock	● No obvious coating peeling, scratches or rust ● No obvious traces of water leakage ● No dust accumulation in the vents ● No damage to the door lock
Air-conditioning	● Check for the noise and vibration ● Clean the filter	● The fan and compressor rotate normally, without lag and abnormal sound ● The surface of the filter screen is clean without blockage
Energy storage converter	● Check for the noise and vibration ● Check the front panel air vents ● Check the copper end of the contact end	● The front panel fan rotates normally, with no lag, abnormal sound ● The surface of the front panel vents is clean without blockage ● Copper row and contact surface have no corrosion and discoloration, and no dust accumulation
Electrical	● Check the lightning protection device ● Check the cable copper row contact surface	● The lightning protection device is normal ● The screw socket connection line is not loose and detached ● Copper row and contact surface have no corrosion and discoloration, and no dust accumulation
Battery pack	● Check for the noise and vibration	● Battery pack fan rotation without lag, abnormal sound ● The surface of the front panel vents is clean without

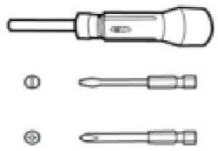
	● Check the cable copper row contact surface	blockage ● The screw socket connection line is not loose and detached ● Copper row and contact surface have no corrosion and discoloration, and no dust accumulation

6.3. Ash Cleaning Operation Instruction Book

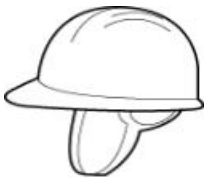
6.3.1 Preparation before maintenance

⚠ Pay attention to

Please prepare at least the following tools, such as insufficient tools for maintenance; used tools, cross screwdrivers and other handles require insulation protection, or insulation tools.

 Phillips Screwdrivers	 Multimeter	 Rubber Hammer	 Insulated Ladder
 Dust Catcher	 High-pressure Water Guns		

Personal protection tools

 safety gloves	 eye shield	 dust mask	 safety shoe
 reflective vest	 safety helmet	 Medical box	

6.3.2 Monthly maintenance

Maintenance objects	Maintenance action	Reference standard	Whether the system is down
Box	● Cleaning vents ● Cleaning dustproof cotton ● Rinses the appearance	● No dust accumulation in the vents ● No insects, rats, snakes and other animals enter ● Duproof cotton no obvious discoloration and sundries	yes
Air-conditioning	● Cleaning Radiator	● The fan rotates normally, with no lag and abnormal sound ● The radiator surface is clean without blockage	yes
Electrical distribution area	● Check for any foreign body in the power distribution area	● The area is clean and free from foreign matter	yes
Note: It is recommended to clean once every sandstorm occurs in the dust area; it is recommended to clean once before summer; keep the filter or condenser free according to the actual situation; use dust cotton for up to 2 years. **Recommended tool:** pressure water gun.			

6.3.3 Operation steps

Step 1: Power off the system;

1) Click the touch screen switch interface and click "System Off";

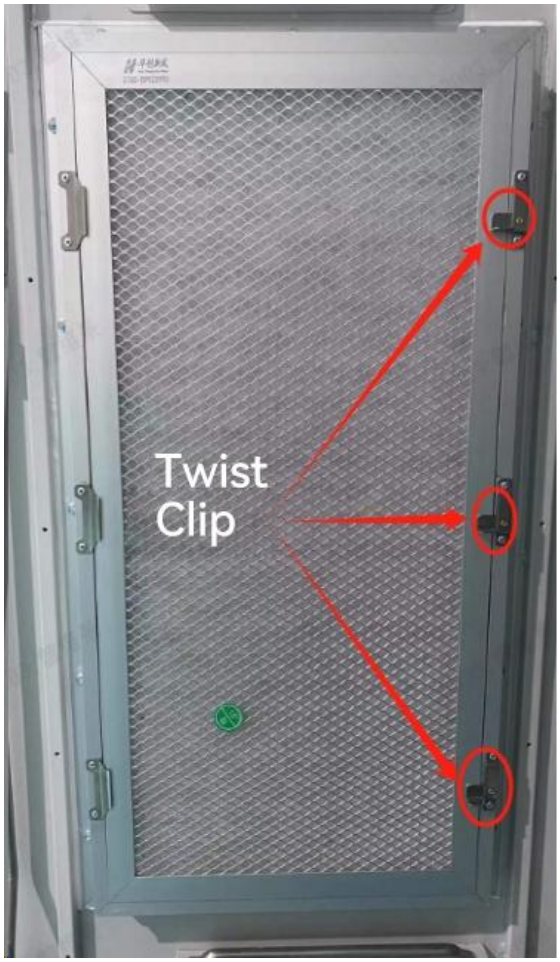
2) Break off system auxiliary power switch MCB 4 ~ 5 and battery auxiliary power switch;
3) Break off QF 1 oil machine switch, QF 2 mains switch, switch QF 4 load switch, QF 5 ~ 6 photovoltaic switch;
4) Break off the battery high voltage control box DC load switch;
5) Wait for the bus discharge to end, the touch screen is off, and the equipment is off;
6) Turn off the upper level distribution switch of the energy storage equipment and

hang the "No closing" maintenance sign.

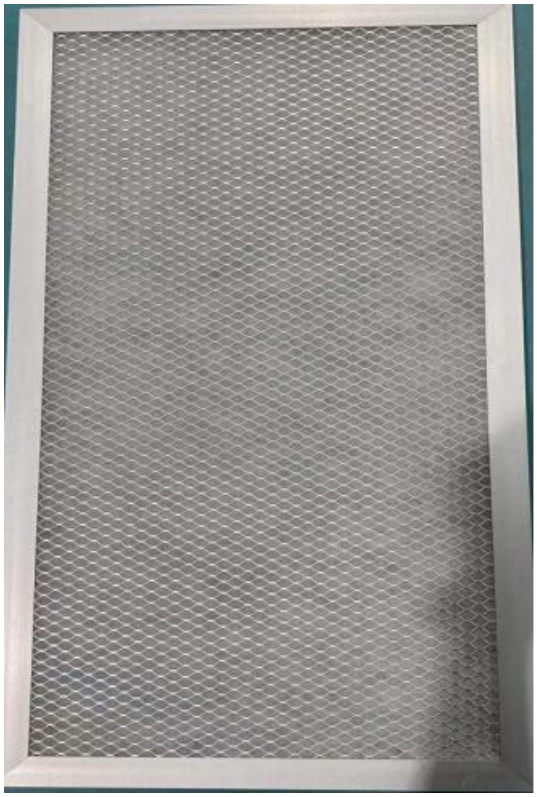
Step 2: Open the system cabinet door with special tools and keys;

Step 3: Disconnect the circuit breaker of the superior distribution box of the city and hang the "No closing". Use the multimeter to measure whether the equipment is still charged, and the next operation until the equipment is no longer charged;

Step 4: Open the cabinet door, release the buckle of the dust proof cotton frame, remove the dust proof cotton, and put the aluminum alloy frame and dust proof cotton flat in the safe placement area;



Step 5: Use the high-pressure water gun to wash the dust-proof cotton, if too dirty, the detergent can be used for cleaning;



Step 6: Put the cleaned dust-proof cotton into the aluminum alloy dust-proof cotton frame to dry, and fix it with a buckle;

Step 7: See Operation 5.2 for the restart.

6.4. Warranty Services

6.4.1. Warranty period

The warranty period agreed in the commercial contract shall prevail in case of correct use of the product.

6.4.2. Warranty scope

During the warranty period, the Company will repair or replace the product free of charge for the customer if the failure is caused by the quality problem of the product itself. The customer should reserve a reasonable response time for the Company's maintenance, and the replaced product will be handled by the Company. Customers need to show proof of purchase of the product, and ensure that the product trademark is clearly visible, otherwise the Division has the right not to be warranty guarantee.

6.4.3. Disclaimer

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

- The warranty period has been exceeded;
- Unable to provide the relevant proof of product purchase;
- Damage caused during transportation, loading and unloading;
- Damage caused by incorrect installation, modification or repair by unauthorized personnel;
- Damage caused by operation under abnormal use conditions or environment;
- Malfunction or damage to the machine caused by the use of non-intercom components or software;
- Fault caused by fire, earthquake, flood and other irresistible factors.