SmartGen

MAKING CONTROL SMARTER

# ESSA215-768-05C

# AIR-COOLED ENERGY STORAGE CABINET

# USER MANUAL


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**Table 1 Software Version**

| Date | Version | Note |
|---|---|---|
| 2024-06-21 | 1.0 | Original release. |
| | | |
| | | |
| | | |

**Table 2 Notation Clarification**

| DANGER |
| --- |
| Indicates a situation with a high potential risk that could lead to death or serious injury if not avoided |

| WARN |
| --- |
| Indicates a situation with a medium potential risk that could lead to death or serious injury if not avoided. |

| CAUTION |
| --- |
| Indicates a situation with a low potential risk that could lead to moderate or minor injuries if not avoided. |

| NOTE |
| --- |
| Indicates a potential risk that could lead to equipment malfunction or property loss if not avoided. |

**Terminology:**

PCS (Power Conversion System): Power conversion system, i.e., energy storage converter.
BMS (Battery Management System): Battery management system.
BCU (Battery Control Unit): Battery control unit.
BMU (Battery Management Unit): Battery management unit.
SOC (State of Charge): Charge status.
SOH (State of Health): Health status.
SOP (State of Power): Power status.
SOE (State of Energy): Energy status.

# CONTENT

# 1 PRECAUTIONS

## 1.1 PERSONNEL REQUIREMENT

The lifting and transportation, installation and wiring, operation and maintenance of the energy storage cabinet must be carried out by professional electrical technicians who meet local specifications. Operators are required to meet the following requirements:

- Should have certain professional knowledge of electronic and electrical wiring and machinery, and be familiar with electrical and mechanical schematic diagrams.
- Should be familiar with the composition and working principle of energy storage cabinet and its pre- and post-stage equipment.
- Professional training related to the installation and commissioning of electrical equipment should be received.
- Should have the ability to respond to danger or emergencies that occur during installation or commissioning.
- Should be familiar with the relevant standards and norms of the country where the project is located.

## 1.2 ELECTRICAL SAFETY

**DANGER**

- Risk of electric shock by touching the power grid or the contacts, terminals, etc., that are connected to it inside the device!
- Voltage can be generated on either the battery side or the grid side, so always be careful to use a standard voltmeter to confirm that there is no voltage before touching it.
- Disconnect the power supply of the energy storage cabinet, the battery will not be powered off immediately, be sure to wait 10 minutes to ensure that the device is completely unpowered before operation.

**DANGER**

- Lethal high voltage inside the product!
- Pay attention to and obey the warning labels on the product.
- Comply with the safety precautions listed in this manual and other relevant documents for this device.
- Comply with the relevant protection requirements and precautions for the battery.

**CAUTION**

- All lifting and transportation, installation and wiring, operation and maintenance, etc., must comply with the relevant rules and regulations of the region in which the project is located.
- Be sure to use the energy storage cabinet in accordance with the requirements of this manual. Otherwise, it may result in damage to the device.

| NOTE |
| --- |
| In order to prevent mal-operation or accidents caused by unrelated personnel approaching the energy storage cabinet, please obey the following precautions:<br>• Place eye-catching warning signs around the energy storage cabinet to prevent accidents caused by mal-closing.<br>• Set up warning signs or set up safety warning tapes in the vicinity of the equipment. |

## 1.3 BATTERY SAFETY

In order to use the product safely, ask the technician to read carefully and comply with the following safety requirements. The Company is not responsible for abnormal product function, components damage, personal safety accidents, property loss, etc., caused by the following reasons.

- Failure to charge the battery within the time limit due to customer reasons, resulting in capacity loss or irreversible damage to the battery;
- Battery damage, dropping, leakage, etc. caused by improper operation or failure to operate the battery in accordance with the requirements;
- Battery damage caused by over-discharge of the battery due to the customer's failure to power on in time;
- Battery damage caused by improper charging and discharging of equipment due to customer reasons;
- Due to improper maintenance of the customer, the battery is frequently over-discharged, the customer's on-site expansion or long-term failure to fully charge, etc.;
- Battery damage caused by incorrect battery operation parameters due to customer reasons;
- Direct damage to the battery caused by the on-site operating environment not meeting the environmental requirements of normal operation;
- Change the battery usage scenario due to customer reasons, including but not limited to connecting additional loads to the battery by yourself;
- The customer did not perform proper maintenance on the battery;
- Product damage caused by the customer's continued use of batteries beyond the warranty period;
- Product damage caused by the use of defective or deformed batteries;
- Mixing the batteries provided by the company with other batteries, including but not limited to: mixing with batteries of other brands, mixing with batteries with different rated capacities, etc.;
- Product damage or other property loss caused by storing or installing batteries with flammable/explosive materials;
- Battery-related operations must be performed by professionals, and personal safety accidents and property losses caused by failure to wear protective equipment that meets the standards during operation;
- Battery damage caused by eating, drinking, smoking, etc. near the battery;
- The battery was stolen.

## 1.4 LIFTING & TRANSPORTATION

| ⚠ CAUTION |
| --- |
| • If you need to walk on top of the equipment, follow the working at height procedures. |

## 1.5 INSTALLATION & WIRING

| ⚠ CAUTION |
| --- |
| • During the whole process of mechanical installation, the relevant standards and requirements of the project location must be strictly observed. Only equipment designated by the company may be used. Otherwise, it may result in impaired protection and injury to personnel. |

## 1.6 OPERATION & MAINTENANCE

| ⚠ CAUTION |
| --- |
| • When maintaining and overhauling energy storage cabinets, personal protective equipment is required.<br>• Maintenance personnel must wear safety goggles, helmets, insulated shoes, gloves, etc.<br>• There are no parts inside the battery cell that can be maintained by the user.<br>• The battery cannot be maintained by the user and should only be removed, replaced or disposed of by an approved person of our company.<br>• To reduce the risk of electric shock, do not perform any other repair operations other than this manual.<br>• If necessary, contact the company's customer service staff for repair.<br>• To ensure continuous fire protection, internal components should only be replaced by professionals. |

| ⚠ DANGER |
| --- |
| • Disassembling or incinerating the battery may result in a fire. |

| NOTE |
| --- |
| • Do not paint any component inside or outside the device.<br>• Do not use detergents to clean the device or expose it to harsh chemicals. |

## 1.7 PRODUCT SCRAP

When the whole cabinet or individual equipment inside the energy storage cabinet needs to be discarded, it cannot be disposed of as a regular waste product. Some components of the internal machine can be recycled and reused, and at the same time, some components will cause pollution to the environment.

Please contact your local authorized recycling professional to dispose of the product and internal components properly.

# 2 PRODUCT INFORMATION

## 2.1 PRODUCT INTRODUCTION

The energy storage medium of this cabinet is a lithium iron phosphate battery with high safety and high cycle life, which has the characteristics of modularization and easy installation and maintenance. The cabinet contains battery box, high-voltage box, energy management system EMS, energy storage converter, fire control system, air conditioning system, etc.

It can be widely used in user scenarios such as buildings, shopping malls, hotels, and PV, energy storage and charging pile, and has many functions such as load tracking, peak load shifting, power expansion, emergency power backup, and grid-connected revenue, so as to meet the energy needs of industrial and commercial enterprise users to reduce costs and increase income.

## 2.2 ELECTRICAL TOPOLOGY DIAGRAM OF ENERGY STORAGE CABINET

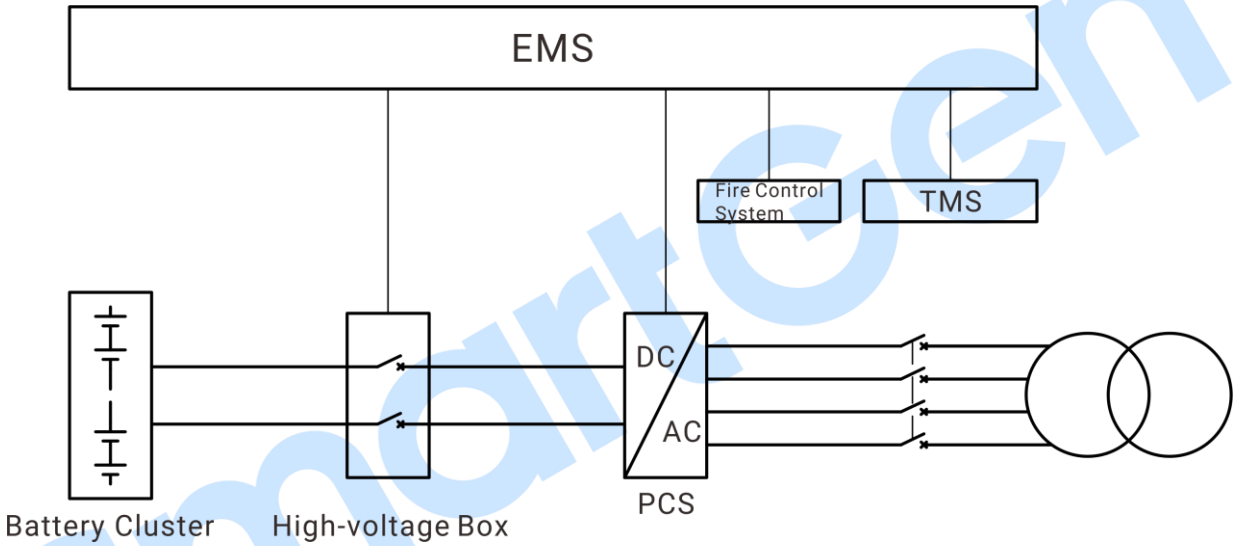



**Fig.1 Topology Diagram**

## 2.3 TECHNICAL PARAMETER

**Table 3 Technical Parameters**

| Items | Parameters |
|---|---|
| Model | ESSA215-768-05C |
| Rated Capacity | 215kWh |
| Rated Output Power | 100kW |
| External Wiring Method | 3P3W+PE |
| Admissible Grid Side Voltage | AC400V (-15%~10%) |
| Admissible Grid Frequency | 50Hz/60Hz |
| External Communication Port | RS485, ETHERNET |
| Cell Type | LFP 3.2V/280Ah(25±2)°C |
| Battery Box Configuration | 1P16S |
| Battery System Configuration | 1P240S |
| Extinguishing Agent | Perfluorohexanone |
| Air Conditioning System | Refrigeration, heating, air supply, dehumidification, self-check, |

| Items | Parameters |
|---|---|
| | communication |
| Overall Dimensions (W*D*H) | 1500mmx1338mmx2200mm |
| Protection Level | IP54 |
| Working Temperature | -20°C ~50°C (>45°C derating) |
| Working Humidity | (0~95)% (no condensation) |
| Working Altitude | ≤2000m |
| Weight | 2.4t |

## 2.4 APPEARANCE AND DIMENSION


**Fig.2 Appearance of the Energy Storage Cabinet**

Unit: mm

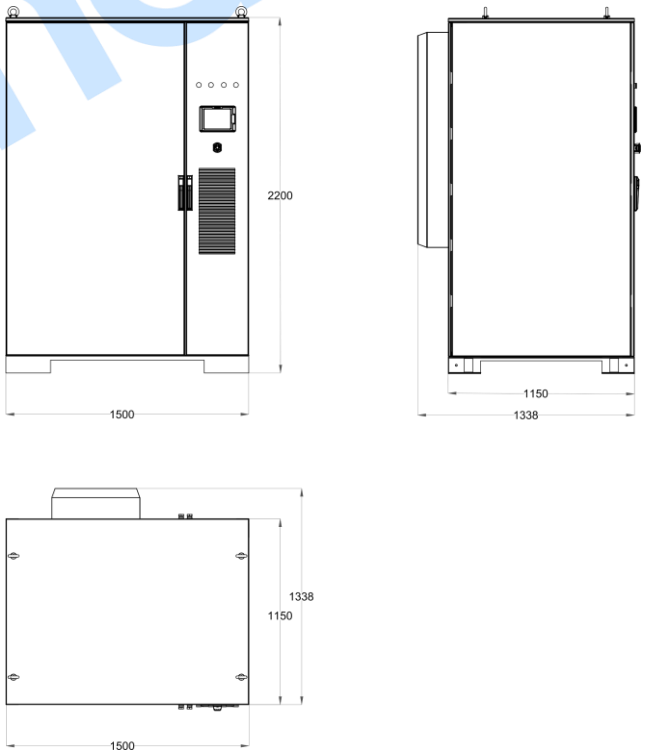



**Fig.3 Overall Dimensions**

## 2.5 MAIN EQUIPMENT

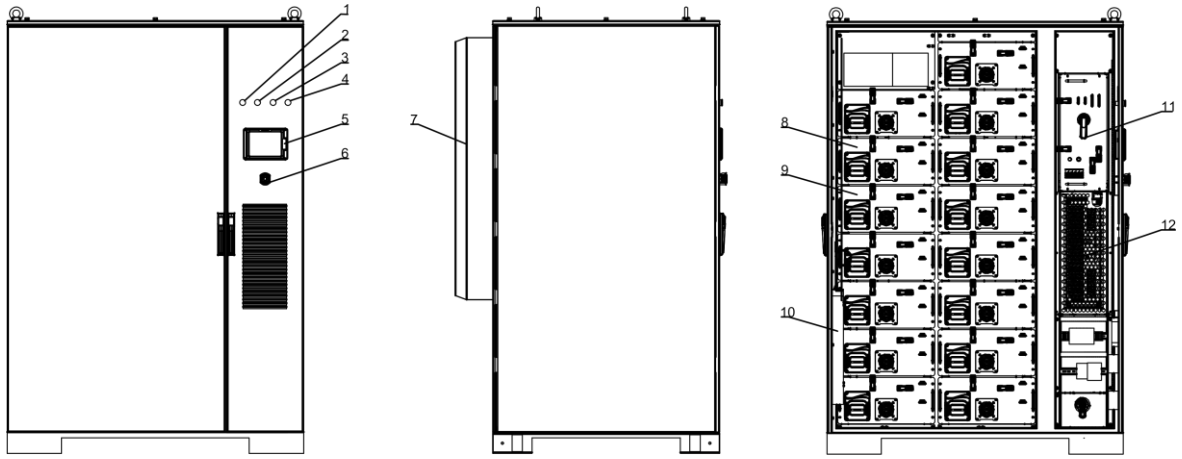



**Fig.4 Main Equipment**

**Table 4 Main Equipment List**

| No. | Equipment | Function Description |
|---|---|---|
| 1 | Fire Buzzer | When the fire control system warns or alarms, the buzzer lights up and sounds at the same time. |
| 2 | Alarm Indicator (Red) | When the energy storage system fails, the alarm indicator lights up. |
| 3 | Running Indicator (Green) | When the energy storage system is operating normally, the running indicator lights up. |
| 4 | Power Indicator (Green) | When the DC power supply of the energy storage distribution system is normally, the power indicator lights up. |
| 5 | EMS Controller | Energy management system controller. |
| 6 | Emergency Stop Button | In case of emergency, press the emergency stop button to stop the energy storage system. |
| 7 | Air Conditioning System | Conduct refrigeration, heating, air supply, dehumidification, self-check according to the detection parameters |
| 8 | Battery Box A | There are 8 battery box A in total |
| 9 | Battery Box B | There are 7 battery box B in total |
| 10 | Fire Extinguishing Device | Filled with perfluorohexanone extinguishing agent. |
| 11 | High-voltage Box | The battery cluster is connected to the protection and control unit at the DC end of the power electronics at the post-stage. |
| 12 | PCS | Power conversion module. |

## 2.6 BATTERY BOX

### 2.6.1 APPEARANCE

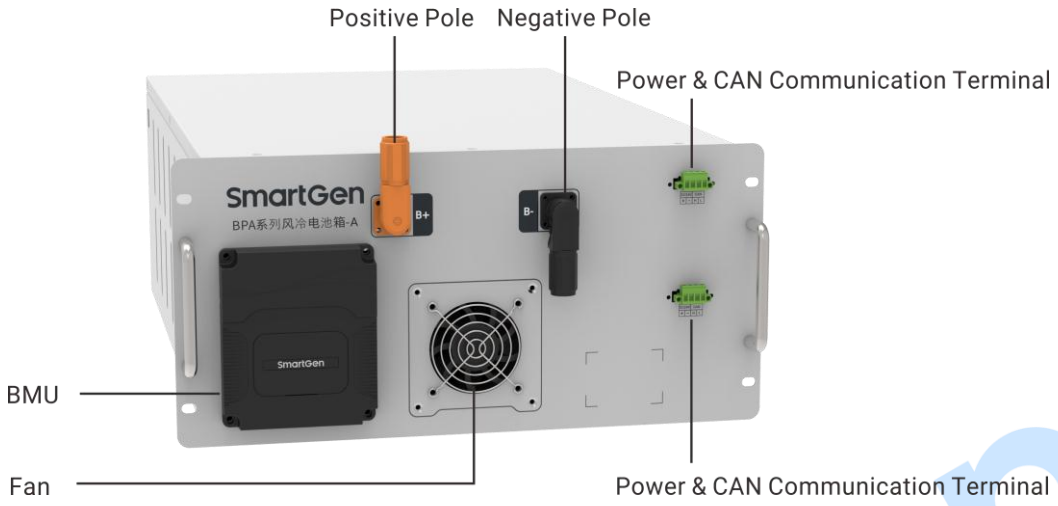



**Fig.5 Appearance of Battery Box A**

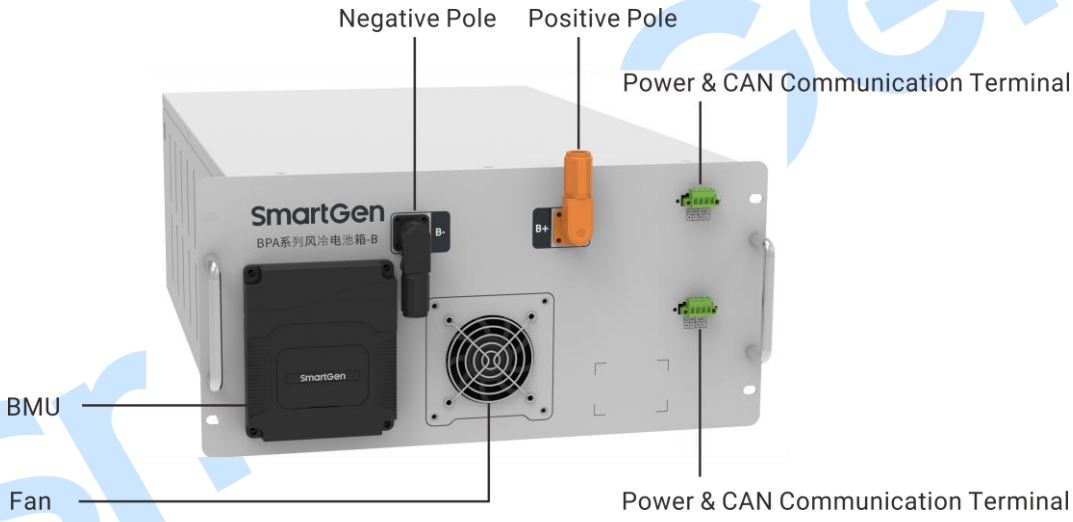



**Fig.6 Appearance of Battery Box B**

### 2.6.2 TECHNICAL PARAMETER

**Table 5 Technical Parameter**

| Item | Parameter |
|---|---|
| Battery Box A Model | BPA16-280-A |
| Battery Box B Model | BPA16-280-B |
| Cell Type | LFP |
| Cell Specification | 3.2V/280Ah |
| Group Method | 1P16S |
| Rated Energy | 14.336kWh |
| Rated Voltage | DC51.2V |
| Working Voltage Range | DC44.8~57.6V |
| Maximum Continuous Charge Rate | 0.5C |

| Item | Parameter |
|---|---|
| Maximum Continuous Discharge Rate | 0.5C |
| Heat Dissipation | Air-cooled heat dissipation |
| Dimensions (W*D*H) | 490mmx737mmx235mm |
| Weight | 120kg |

### 2.6.3 TERMINAL DEFINITION

**Table 6 Definition of Power & CAN Communication Terminal**

| Figure | No. | Definition | Function |
|---|---|---|---|
| DC24V CAN-1<br>+ – H L | 1 | DC24V+ | DC24V power supply positive pole |
| | 2 | DC24V- | DC24V power supply negative pole |
| | 3 | CAN-1H | Module communication port CAN-1H |
| | 4 | CAN-1L | Module communication port CAN-1L |

## 2.7 HIGH-VOLTAGE BOX

### 2.7.1 APPEARANCE

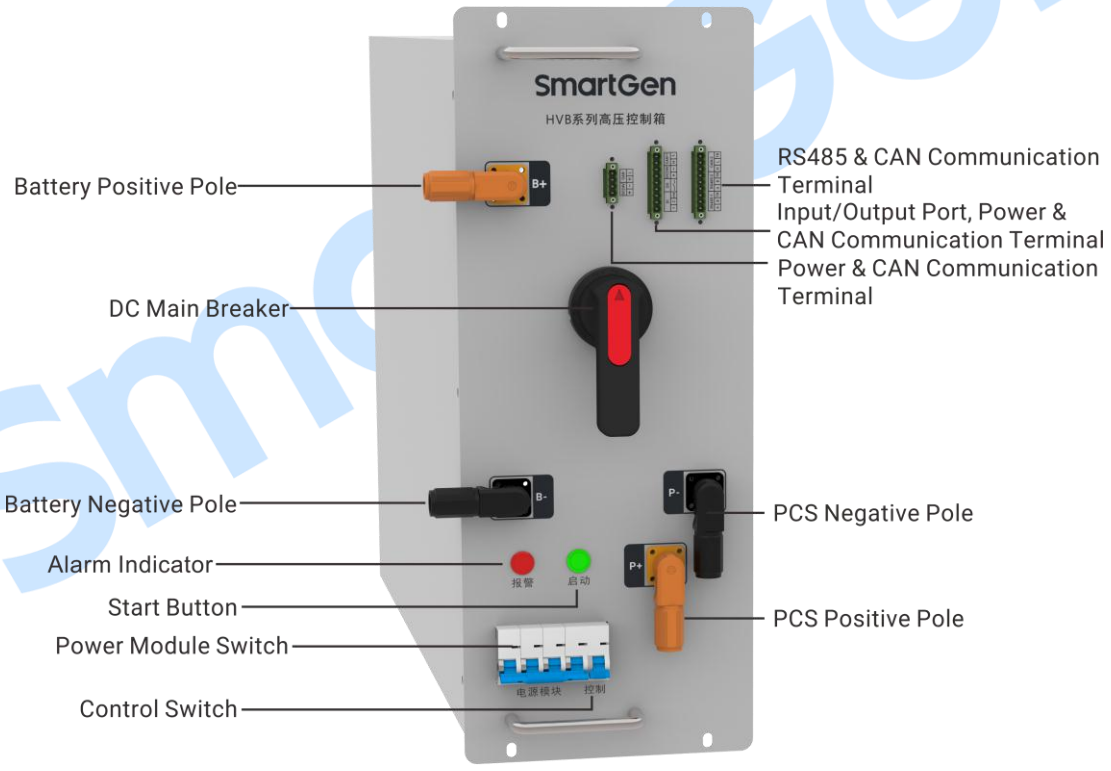



**Fig.7 High-voltage Box Appearance**

### 2.7.2 TECHNICAL PARAMETER

**Table 7 Technical Parameter**

| Item | Parameter |
|---|---|
| Model | HVB1000-200-S |
| Maximum Working Voltage | DC1000V |
| Maximum Working Current | 200A |

| Item | Parameter |
|---|---|
| Auxiliary Power Supply | DC24V |
| Dimensions (W*D*H) | 235mmx757mmx594mm |
| Weight | 29kg |

### 2.7.3 TERMINAL DEFINITION

**Table 8 Definition of Power & CAN Communication Terminal**

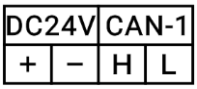
| Figure | No. | Definition | Function |
|---|---|---|---|
|  | 1 | DC24V+ | DC24V power supply positive pole |
| | 2 | DC24V- | DC24V power supply negative pole |
| | 3 | CAN-1H | Module communication port CAN-1H |
| | 4 | CAN-1L | Module communication port CAN-1L |

**Table 9 Definition of Input/Output Port, Power & CAN Communication Terminal**

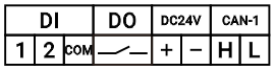
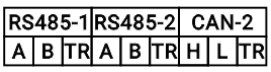
| Figure | No. | Definition | Function |
|---|---|---|---|
|  | 1 | DI-1 | Emergency stop input, valid for DI-COM |
| | 2 | DI-2 | Alternate programmable input port 2, valid for DI-COM |
| | 3 | DI-COM | Common end of programmable input port |
| | 4 | DO-1 | Standby passive normally open contact output, capacity 1A DC30V |
| | 5 | DO-1 | |
| | 6 | DC24V+ | Standby DC24V power supply positive pole |
| | 7 | DC24V- | Standby DC24V power supply negative pole |
| | 8 | CAN-1H | Module communication port CAN-1H |
| | 9 | CAN-1L | Module communication port CAN-1L |

**Table 10 Definition of RS485 & CAN Communication Terminal**

| Figure | No. | Definition | Function |
|---|---|---|---|
|  | 1 | RS485-1A | Module communication port RS485-1A |
| | 2 | RS485-1B | Module communication port RS485-1B |
| | 3 | RS485-1TR | According to the user's on-site wiring, it is shorted with RS485-1A terminal for accessing 120Ω terminal impedance matching resistor. The factory product has been shorted. |
| | 4 | RS485-2A | Module communication port RS485-2A |
| | 5 | RS485-2B | Module communication port RS485-2B |
| | 6 | RS485-2TR | According to the user's on-site wiring, it is shorted with RS485-2A terminal for accessing 120Ω terminal impedance matching resistor. The factory product has been shorted. |
| | 7 | CAN-2H | Module communication port CAN-2H |
| | 8 | CAN-2L | Module communication port CAN-2L |

| Figure | No. | Definition | Function |
|---|---|---|---|
| | 9 | CAN-2TR | The communication port of the module TR is shorted with CAN-2H, and the factory product has been shorted. |

## 2.8 ENERGY MANAGEMENT SYSTEM (EMS)

The energy management system (EMS) is the core control part of the energy storage cabinet, which regulates the battery box, high-voltage box, energy storage converter, fire control system, air conditioning system and other equipment.

EMS can monitor the data and status of each energy source, control the power distribution between each energy source, support peak shaving, new energy consumption, demand-side response, and customize control strategies.

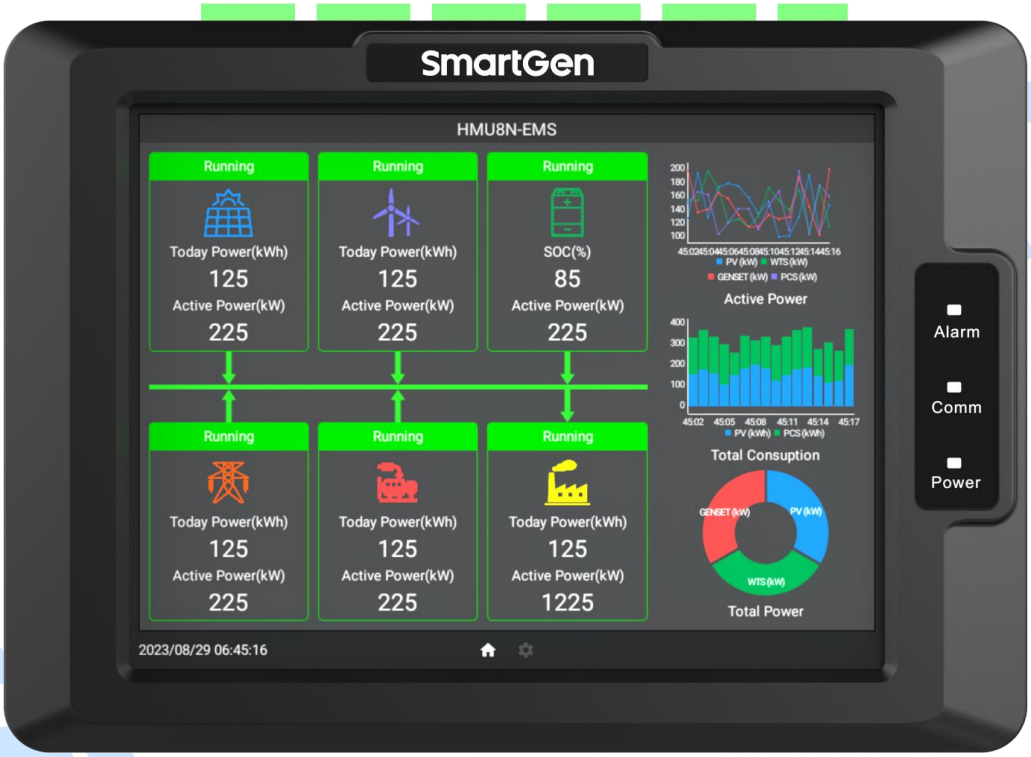



**Fig.8 HMU8N-EMS Front Panel**

## 2.9 PCS

The energy storage converter PCS adopts digital control technology, which can realize grid-connected charging and discharging and off-grid operation.

**Table 11 Technical Parameter**

| Item | Category | Parameter |
|---|---|---|
| Battery Interface Parameters | Voltage Range | DC650V~DC900V |
| | DC Maximum Current | 170A |
| AC Grid-connected Parameters | Output Line System | 3P4W |
| | Rated Power | 100kW |
| | Rated Voltage | AC 380V/400V |
| | Rated Current | 151A |
| | Voltage Range | -15%~+10% |

| Item | Category | Parameter |
|---|---|---|
| | Rated Frequency | 50Hz/60Hz |
| | Frequency Range | ±2Hz |
| | Power Factor Range | -0.9~+0.9 |
| | Output Current Harmonic | ≤3% (rated power) |
| | Charge/Discharge Conversion Time | <100ms |
| AC Off-grid Parameters | Output Line System | 3P4W |
| | Rated Power | 100kW |
| | Rated Voltage | AC 380V/400V |
| | Voltage Accuracy | 1% |
| | Rated Current | 151A |
| | Rated Frequency | 50Hz/60Hz |
| | Frequency Accuracy | ±0.2Hz |
| | Output Voltage Harmonic | 3% (linear full load) |
| | Unbalanced Load Capacity | 100% |
| | Overload Capacity | ≤105%: long-term operation;<br>105%~110%: ≥10min;<br>110%~120%: ≥1min |
| Working Conditions | Working Temperature | -20°C ~55°C (derating above 45°C) |
| | Storage Temperature | -40°C ~70°C (without battery) |
| | Relative Humidity | 0%RH~95%RH, no condensation |
| | Working Altitude | 2000m; 2000m~4000m derating use |
| | Noise | <75dB |

## 2.10 FIRE CONTROL SYSTEM

### 2.10.1 GENERAL PRINCIPLE

Please comply with the fire codes and regulations of the country where the project is located.

Regularly inspect and maintain fire-fighting equipment to ensure that the functional indicators are normal.

### 2.10.2 FIRE EXTINGUISHING DEVICE

The energy storage cabinet is equipped with a combustible gas detection and alarm system and a gas fire extinguishing system, which detects through fire detection devices such as combustible gas, smoke sensor, temperature sensor, and thermal line, and sends signals for fire warning and fire extinguishing when abnormalities are detected.

**Table 12 Technical Parameter**

| Item | Parameter |
|---|---|
| Type of Agent | Perfluorohexanone |
| Operating Temperature of the Thermal Line | (180 ±15)°C |
| Operating Temperature of the Thermomagnetic Generator | (90±10)°C |

## 2.11 AIR CONDITIONING SYSTEM

The air conditioning system has the functions of refrigeration, heating, air supply, dehumidification, and self-check, communication.

When install the equipment, it should ensure that the ventilation around the air conditioner is good, so that the inlet and outlet sides and the equipment in the energy storage cabinet are kept at least 30cm, otherwise, it is easy to cause short circuit in the return air and poor heat exchange effect.

The air-conditioning drain circuit should be kept smooth to avoid blocking the drain outlet.

## 2.12 TRANSPORTATION AND STORAGE PRECAUTIONS

| ⚠ CAUTION |
| --- |
| • Failure to transport and store in accordance with the requirements of this manual may result in the void of the warranty. |

## 2.13 TRANSPORTATION METHOD

Energy storage cabinets can be transported by land and sea. The energy storage cabinet is easy to transport through the integrated design and easy-to-use hoisting design.

## 2.14 TRANSPORTATION REQUIREMENT

All kinds of equipment in the cabinet have been installed and fixed in the cabinet before leaving the factory, and the overall hoisting and transportation can be carried out during transportation.

| NOTE |
| --- |
| • In the whole process of loading, unloading and transportation, the safety regulations of outdoor cabinet operations in the country/region where the project is located must be observed!<br>• Any tools used in the operation should be maintained.<br>• All personnel involved in loading, unloading and securing should receive appropriate training, especially in the area of safety. |

| ⚠ CAUTION |
| --- |
| • During the whole process of loading, unloading and transportation, it is necessary to keep in mind the mechanical parameters (dimensions and weight) of the equipment at all times. |

The following conditions need to be met to transport mobile devices:

- The doors of each cabinet of the equipment are locked.
- According to the site conditions, choose the appropriate crane or lifting tool. The chosen tool must have sufficient weight capacity, arm length and radius of rotation.
- If it is necessary to move on slopes, etc., additional towing equipment may be required.
- Remove all obstacles that exist or may exist during the movement, such as trees, cables, etc.
- The equipment should be transported and moved under better weather conditions as far as possible.
- Be sure to set up warning signs or warning tapes to avoid non-staff entering the lifting and transportation area to avoid accidents.
- When transporting by land, be sure to use ropes to fix the top ring of the equipment with the transport vehicle to avoid excessive tilt angle of the equipment during transportation.

## 2.15 STORAGE REQUIREMENT

- In order to prevent condensation inside the energy storage cabinet or being soaked by rainwater

at the bottom of the house during the rainy season, the energy storage cabinet should be stored in a higher place.

- The base of the cabinet must be raised, and the specific lifting height should be reasonably determined according to the geology, meteorology and other conditions on the site. At the same time, when the ambient temperature is too low, it should also provide heating for the internal equipment of the energy storage cabinet.
- Store the energy storage cabinet on a dry, flat, sturdy ground with sufficient carrying capacity and without any vegetation cover. The storage ground must be flat, without stagnant water, uneven or undulating, and the flatness should not be greater than 5mm.
- Before storage, ensure that the door of the energy storage cabinet and the cabinet door of each equipment inside are locked.
- Storage environment temperature: -30°C~+60°C. Recommended storage temperature: -30°C~+25°C.
- It is not recommended to store batteries for a long time because there will be capacity decay when stored for a long time. In addition, even if the battery is stored at the recommended optimal storage temperature, the irreversible capacity decay will occur due to the influence of the time, and the longer the storage time, the greater the irreversible attenuation.
- Relative humidity of storage environment: (0~95)%, no condensation.
- The air inlet and outlet of the energy storage cabinet are effectively protected, and effective measures are taken to prevent rain, sand and dust from invading the inside of the cabinet.
- Regular inspections. At least once every half month, check whether the cabinet and internal equipment are intact.
- Before installing the energy storage cabinet for long-term storage (storage time of more than half a year), the cabinet door should be opened for visual inspection, and the outside of the cabinet should have no condensation. Make sure that the cabinet and internal equipment are in good condition. At the same time, it is necessary to check after powering on and starting. If necessary, it must be tested by a professional before installation.
- The battery box needs to be stored in a clean and dry place, and should not be exposed to the sun and rain. The storage location does not allow the presence of harmful gases, flammable, explosive products and corrosive chemicals, to avoid mechanical impact, heavy pressure and strong magnetic field, and to avoid direct sunlight.
- Pay attention to the surrounding harsh environment, such as sudden cold, sudden heat, collision, etc., to avoid damage to the battery box.
- Conduct regular inspections to check whether the packaging is intact to avoid insect bites, and replace them immediately if they are damaged.
- The box must not be tilted or turned upside down.
- Calculated from the date of delivery, the energy storage cabinet with a storage period of more than 6 months under the above conditions should be charged and discharged once to make the system SOC reach 30%~40%, and the SOC should be consistent after charging.
- Installation

**⚠ DANGER**

- During the whole process of mechanical installation, the relevant standards and requirements of the project location must be strictly observed.

## 2.16 PRE-INSTALLATION INSPECTION

### 2.16.1 DELIVERABLE INSPECTION

Check that the deliverables are complete against the enclosed packing list.

### 2.16.2 DEVICE INSPECTION

- Check that the actual cabinet received is the same as the model ordered.
- Inspect the product and internal equipment to ensure that there is no damage.
- If you find a problem or have questions, please contact the carrier or our company in time.

**⚠ DANGER**

Only equipment that is intact and free of any damage should be installed! Before installation, make sure that:

- The cabinet itself is intact and free of any damage.
- All equipment in the cabinet is in good condition and has not been damaged.

## 2.17 INSTALLATION ENVIRONMENT REQUIREMENT

### 2.17.1 SITE SELECTION REQUIREMENT

- When selecting the installation site, the characteristics of the climatic environment and geological conditions (such as stress wave emission and groundwater level) of the installation site should be fully considered.
- The surroundings are dry and well ventilated.
- Ensure that there are no trees around the installation location to prevent high winds from blowing over branches or leaves and blocking the doors or air intakes of the integrated energy storage system.
- It should be kept away from areas where toxic and harmful gases are concentrated; Keep away from flammable, explosive, corrosive materials.
- To avoid noise, the equipment should be installed away from residential areas.

### 2.17.2 FOUNDATION REQUIREMENT

**⚠ DANGER**

- The equipment is heavy, and the conditions of the installation site (mainly referring to geological conditions and environmental and climatic conditions, etc.) should be investigated in detail before the foundation is built. Only on this basis can the design and construction of the foundation begin.

Unreasonable foundation construction scheme will bring great difficulties or troubles to the placement of equipment, opening and closing doors and later operation, etc., therefore, the foundation must be designed and built in accordance with certain standards in advance to meet the requirements of mechanical support, cable routing, later maintenance and overhaul.

The following requirements should be met at least when constructing the foundation:

- The bottom of the foundation pit for the construction of the foundation must be compacted and filled.
- The tolerance of the upper surface of the foundation is required to be ±5mm from the installation size of the cabinet base.

Unit: mm

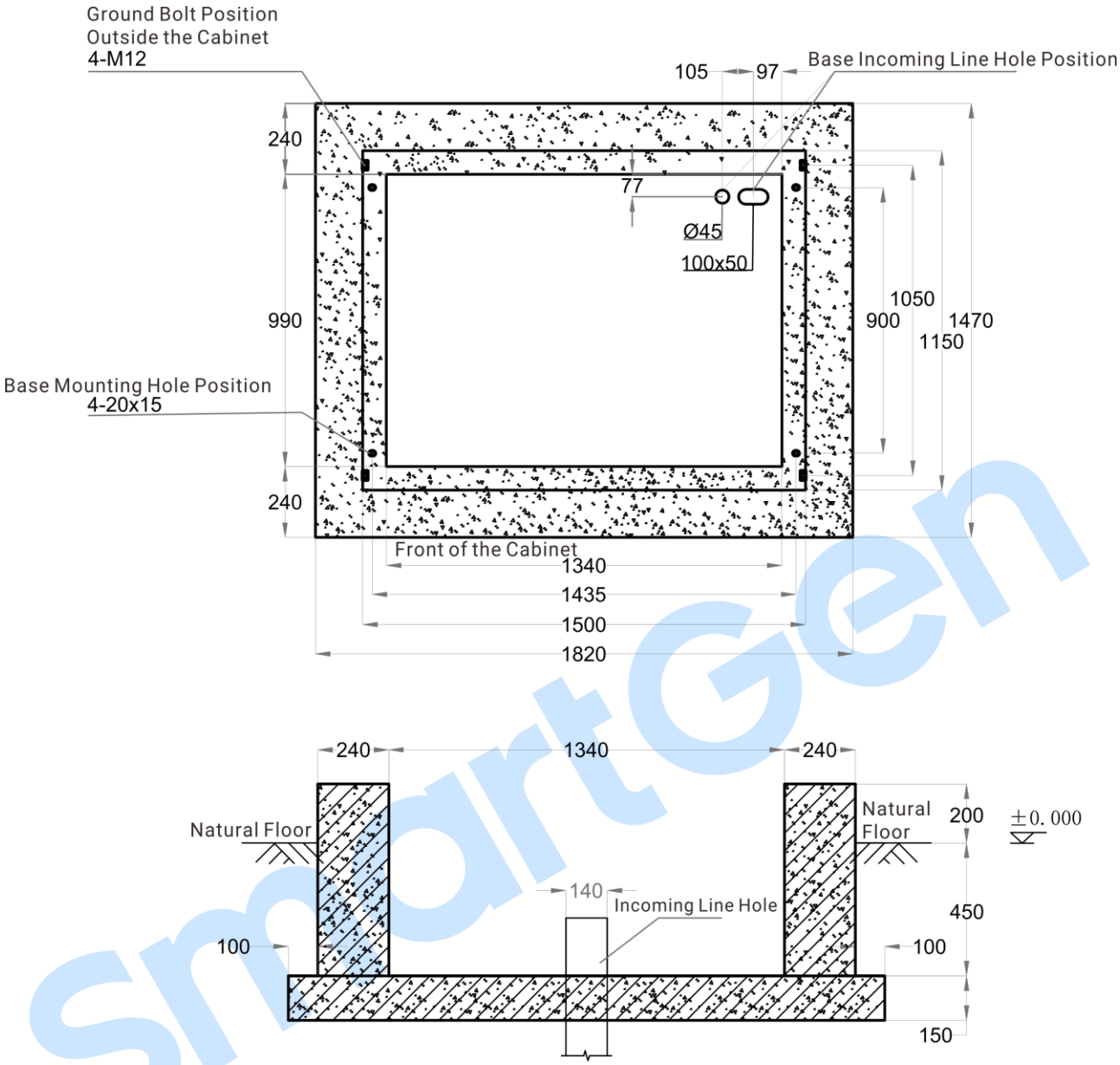



**Fig.9 Reference Drawing of the Base Installation Size**

- The foundation should be sufficient to provide effective load-bearing support for the equipment.
- Raise the cabinet to prevent rain from eroding the base and interior of the cabinet. It is recommended that the foundation be about 200mm higher than the horizontal ground at the installation site.
- Drainage measures need to be constructed in combination with local geological conditions.
- Construction of cement foundations with sufficient cross-sectional area and height. The height of the foundation is determined by the construction party according to the geology of the site.
- Cable routing should be taken into account when building foundations.

| NOTE |
| --- |
| • The muck excavated during the construction of the foundation should be cleaned immediately so as not to affect the hoisting and transportation of subsequent equipment. |

- The maintenance platform is built around the foundation, which brings convenience for later maintenance.

- According to the location and size of the cable inlet and outlet on the cabinet, in the foundation construction, sufficient space should be reserved for the AC side cable trough and the cable conduit should be embedded in advance.
- Determine the specification and number of perforated pipes according to the cable model and the number of incoming and outgoing lines.
- Both ends of all embedded pipes are temporarily sealed to prevent impurities from entering; Otherwise, it is inconvenient to wiring in the later stage.
- Once all cables are connected, cable inlets and outlets, as well as connectors, are sealed with refractory mud or other suitable materials to prevent rodents from entering.

| NOTE |
| --- |
| • Embedded grounding units should be conducted according to the relevant standards of the country where the project is located. |

### 2.17.3 INSTALLATION SPACE REQUIREMENT

In order to ensure better heat dissipation and maintenance of the equipment, it is recommended to reserve enough space around the cabinet installation location.

Unit: mm

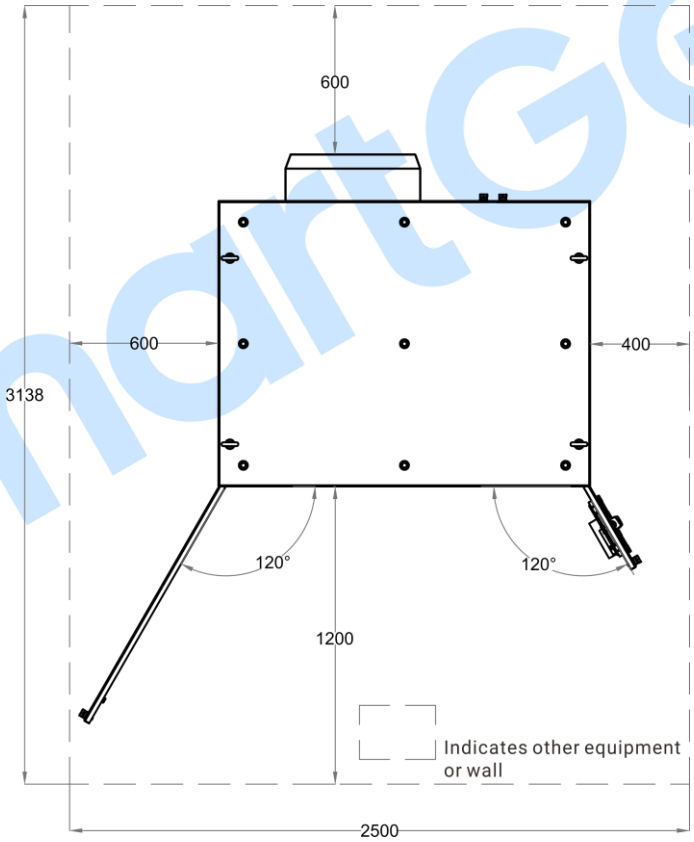



**Fig.10 Reference Drawing of Installation Space Size**

## 2.18 FORKLIFT TRANSPORTATION

If the installation site is flat, the energy storage cabinet can be moved by forklift. The bottom of the energy storage cabinet is equipped with fork holes specially designed for forklift transportation. The energy storage cabinet is moved through the fork hole.

If forklift transportation method is used, the following requirements should be met:

- Forklifts should be equipped with sufficient load capacity.

- The length of the prongs should meet the requirements of the device.
- The transportation, movement and lowering of the energy storage cabinet should be slow and steady. It is advisable to try shipping.
- Only place the energy storage cabinet in a stable place. The place should be well drained without any obstructions or bulges.

| NOTE |
| --- |
| • Move the energy storage cabinet through the bottom fork hole. Under no circumstances can a mobile device be moved by inserting the prongs into a location other than the fork hole. |

## 2.19 LIFTING AND TRANSPORTATION

### 2.19.1 PRECAUTIONS FOR LIFTING

| ⚠ DANGER |
| --- |
| • In the whole process of lifting the equipment, it is necessary to operate in strict accordance with the safety operation procedures of the crane.<br>• It is strictly forbidden to stand within 5m~10m of the operation area. In particular, it is strictly forbidden to stand under the crane arm and under the lifting or moving machine to avoid casualties.<br>• In case of bad weather conditions, such as heavy rain, fog, strong wind, etc., the lifting work should be stopped. |

When lifting the equipment, at least the following requirements must be met:

- Site safety must be ensured when lifting.
- When carrying out lifting and installation operations, there should be professionals on site to command the whole process.
- The sling used should be strong enough to bear the weight of the equipment.
- Ensure that all sling connections are safe and reliable, and that each section of slings connected to the corner pieces is of equal length.
- The length of the sling can be adjusted appropriately according to the actual requirements of the site.
- During the whole lifting process, the equipment must be guaranteed to be stable and not deflected.
- Take all necessary auxiliary measures to ensure the safety and smooth lifting of the equipment.
- During the lifting process of the equipment, it is strictly forbidden to stand within the scope of the crane operation!

### 2.19.2 LIFITING OPERATION

In the process of lifting the equipment, each operation link should be carried out according to the following requirements:

- The equipment should be lifted vertically, and the drag phenomenon on the ground or the top of the lower cabinet should not appear when lifting, and the cabinet should not be dragged on any surface.
- After the equipment is lifted 300mm away from the support surface, it should be suspended, the connection between the spreader and the equipment should be checked, and it can be lifted only after confirming the firm connection.
- After the equipment is in place, it should be placed gently and landed smoothly, and it is strictly forbidden to place the equipment outside the vertical landing by shaking the spreader.
- The site where the equipment is placed should be solid and flat, well drained, and free of obstacles or protrusions.

### 2.19.3 FIXING

After transporting the outdoor cabinet to the installation position, it is fixed according to the actual need for fixing.

## 2.20 BATTERY BOX INSTALLATION

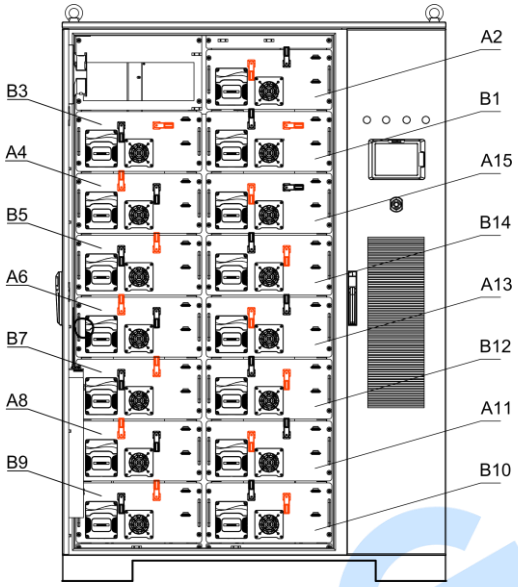



**Fig.11 Battery Box Layout**

**NOTE:** The battery box should be installed in strict accordance with the arrangement order of battery box A, box B and boxes 1-15.

## 2.21 SAFETY PRECAUTION OF ELECTRICAL CONNECTION

**⚠ DANGER**

High pressure danger! Electric shock danger!

- It is strictly forbidden to touch the live part!
- Before installation, please make sure that both the AC and DC sides are de-energized.
- Do not place the device on flammable surfaces.

**⚠ DANGER**

The ingress of wind, sand and moisture may damage the electrical equipment in the energy storage system or affect the operation performance of the equipment!

- Electrical connection work should be avoided during the sandstorm season, or when the relative humidity in the surrounding environment is greater than 95%.
- When there is no wind and sand, and the weather is sunny and dry, start the connection work.

**⚠ DANGER**

- When the fuse of the high-voltage box produces a protective action, the fuse and the DC contactor in the high-voltage box must be replaced at the same time.

**⚠ DANGER**

- All electrical connections must be made in strict accordance with the wiring diagram.
- All electrical connections must be made when the device is completely de-energized.

| ⚠ DANGER |
| --- |
| • Only qualified electrical engineers are allowed to carry out work related to electrical connections. Please comply with the requirements given in this manual. The Company shall not be liable for any death, injury or property loss caused by ignoring these safety instructions. |

| NOTE |
| --- |
| • The installation design of the energy storage cabinet must comply with the relevant standards or specifications of the country where the project is located.<br>• If the installation is not carried out in accordance with the installation design requirements given in this manual, and the system failure is caused, it will not be covered by the warranty. |

## 2.22 PREPARATION BEFORE WIRING

### 2.22.1 INSTALLATION TOOL PREPARATION

Safety gloves, protective glasses, safety shoes, protective clothing, torque screwdrivers, wire strippers, hydraulic pliers, heat guns, multi-meters, screwdrivers, torque wrenches, etc.

### 2.22.2 CABLE PREPARATION

The selected cable must meet the following conditions:

- It has sufficient current-carrying capacity. Factors affecting the current-carrying capacity of a conductor include, but are not limited to, environmental conditions, type of conductor insulation material, cable laying, cable material and cross-sectional area.
- The diameter of the cable must be selected according to the maximum current carrying capacity, and there must be a margin for the length.
- The specifications and materials of the three-phase AC output cable should be consistent.
- Be sure to choose a flame-retardant cable.

| NOTE |
| --- |
| • The cables used should comply with local laws and regulations.<br>• The cable colors mentioned in the illustration in this manual are for reference only, please select the cable according to the local cable standard. |

### 2.22.3 COPPER WIRE ACCESS

If you choose a copper cable, use a copper terminal.

### 2.22.4 ALUMINUM WIRE ACCESS

If you choose an aluminum cable, you will need to use a copper-aluminum transition terminal.

### 2.22.5 CABLE ENTRY DESIGN

The cable connecting the storage cabinet to the external equipment can be accessed from the bottom cable entry of the cabinet.

## 2.23 GROUND CONNECTION

| NOTE |
| --- |
| • The grounding method shall comply with the standards and regulatory requirements of the place where it is installed. |

There are two types of grounding methods: welding with a grounding flat steel or using a grounding cable.

- Grounding flat steel (recommended).
- Grounding cable, using a copper grounding cable, reliably connects the grounding point with the cabinet grounding point. (with M12 bolts).

Please combine the actual situation of the project site and follow the instructions of the power station staff to install the external grounding. After the end of the grounding connection, the grounding resistance must be measured, and the resistance value shall not be greater than 4Ω.

| NOTE |
| --- |
| • The specific grounding resistance value needs to follow the relevant national/local standards and regulations. |

## 2.24 WIRING DIAGRAM BETWEEN BATTERY BOX

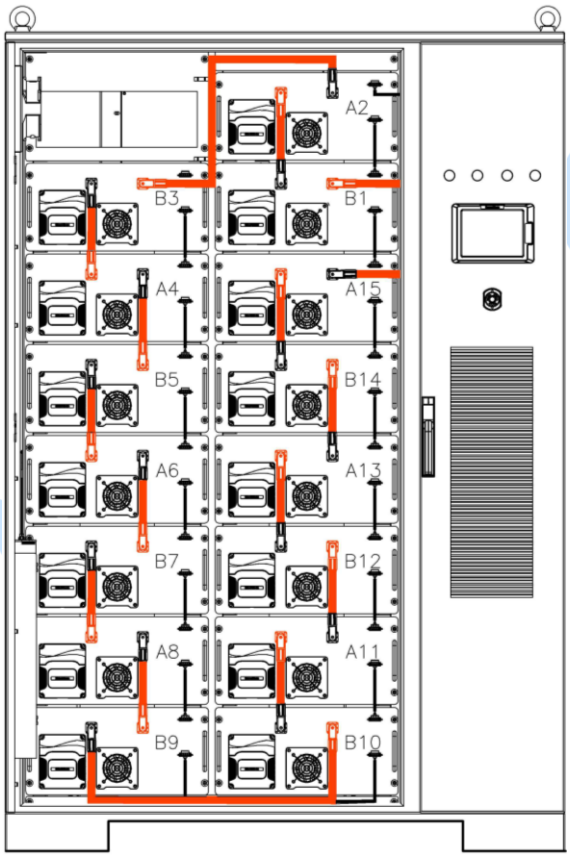



**Fig.12 Power Line, Communication Line Diagram Between Battery Box**

## 2.25 CABLE CONNECTION

- Tools to prepare: installation gloves, protective masks, safety shoes, screwdrivers, Phillips bolts, power cables, etc.
- Wear insulated shoes and insulated gloves before connecting the power line. Disconnect the cables between the battery box and the high-voltage box before connecting the power cable between the battery boxes.
- The positive pole of the aviation plug needs to be inserted into the positive base, and the negative plug needs to be inserted into the negative base, the positive electrode is orange and the negative electrode is black. When the aviation plug is plugged in tightly, it will make a "click" sound.

## 2.26 EXTERNAL WIRING TERMINAL DIAGRAM

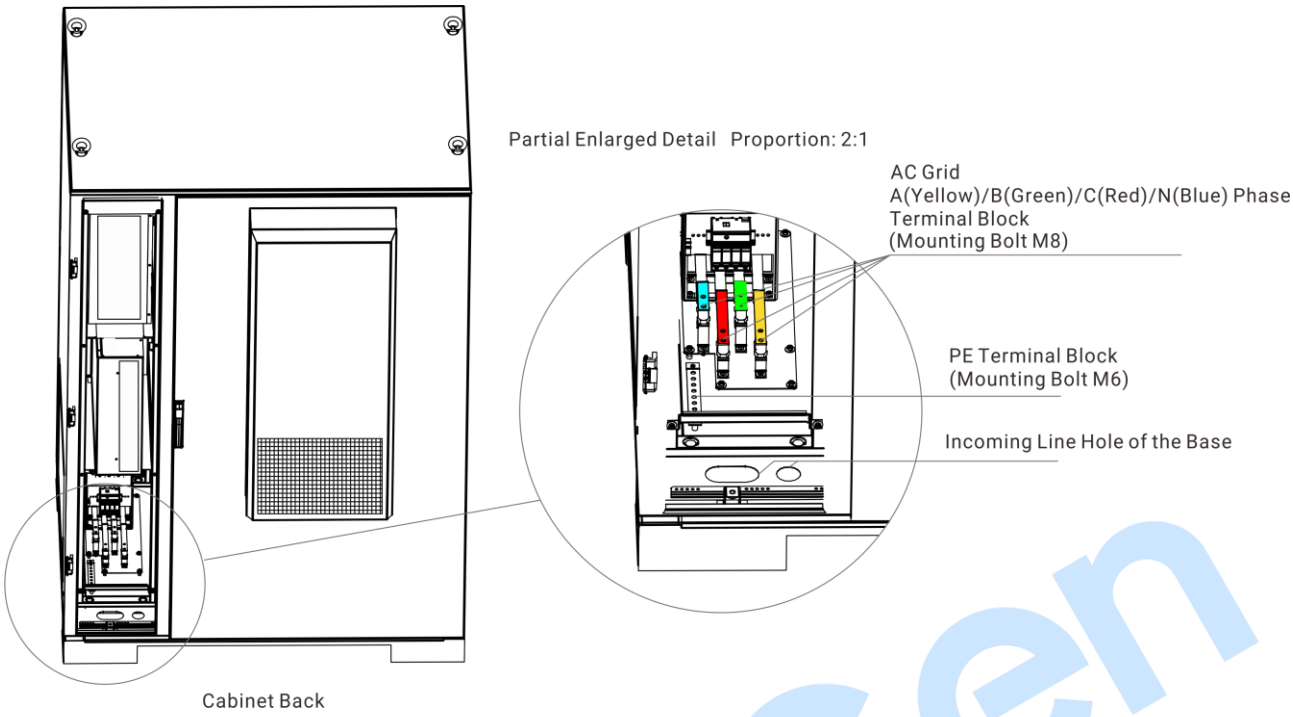



**Fig.13 External Wiring Terminal Diagram of the Cabinet**

| NOTE |
| --- |
| • The terminals on the AC grid side should be installed vertically to ensure the safety requirements between the terminals. |

## 2.27 OPERATION AFTER WIRING

After all electrical connections have been made, the wiring should be thoroughly and carefully inspected. At the same time, you need to do the following:

- Check that all air inlets and outlets are free of foreign objects or blockages.
- For the inlet and outlet holes of the outdoor cabinet and the gaps around it, use fireproof and waterproof materials to tightly seal and plug them.

| ⚠ DANGER |
| --- |
| • Failure to seal properly can result in moisture entering the device.<br>• Failure to seal properly can lead to rodent entry. |

| NOTE |
| --- |
| • After the door is closed, make sure that the sealing strip around the door cannot be curled! |

- Lock cabinet doors and box doors.

## 2.28 PRECAUTION

The instructions for safe use in this manual must be strictly followed at all times. In order to avoid casualties and property loss that may occur during installation or operation, and to effectively extend the service life of the product, please be sure to read the safety instructions carefully.

Incorrect use or mishandling may endanger the following:

- The life and personal safety of the operator or third parties.
- Energy storage battery systems or other property belonging to the operator or third parties.

NOTE

• The safety precautions in this manual cannot contain all the specifications that should be followed, and all work should be carried out in combination with the actual situation on site.
• We will not be liable for any loss caused by not following the safety precautions in the manual.

⚠ DANGER

• When installing equipment with hazardous voltages, it is important to follow the relevant codes and local installation safety guidelines.
• Please follow the rules regarding the proper use of tools and personal protective equipment.
• All connections must be made under clear guidance, and any form of speculation and fuzzy attempts are strictly prohibited.
• Tools with an insulating protective layer must be used.

- The connecting cable should meet the requirements of voltage and current.
- Each connector must be safe and reliable to ensure that there will be no loose or false contact problems. The joints must be corrosion-resistant, wear-resistant, and shock-resistant.
- All kinds of connections must meet the requirements of relevant national standards, and all forms of arcing must be strictly prevented.
- The connection between the internal batteries must have anti-vibration and anti-loosening devices, and the connection of temperature, voltage and current sensors must also be safe and reliable to prevent loosening, aging and extrusion. It is strictly forbidden to expose any metal to each induction line.
- Any form of short circuit during connection is strictly prohibited.
- It is strictly forbidden for operators to operate without wearing protective equipment.
- Connect key points: Make sure the connection is correct, reliable (not loose), in good contact, and free of short circuits.
- Once the connection is complete, it must be measured and confirmed point by point.
- All connection points must be made in such a way that they do not come into contact with the outer box or other components, or short circuit.
- If there are other uncertain factors, it is necessary to consult the company's technical personnel to confirm before implementation.

# 3 COMMISSIONING

## 3.1 POWER-ON

### 3.1.1 ILLUSTRATION

**DANGER**

• Only after being confirmed by professionals and approved by the local power department can the energy storage cabinet be put into operation.

**DANGER**

• For energy storage cabinets with long downtime, before powering on, the equipment must be comprehensively and meticulously inspected to ensure that all indicators meet the requirements before powering on.

### 3.1.2 CHECK BEFORE POWERING ON

Before powering on, check the following items carefully to ensure that they are correct:

- The equipment of the energy storage cabinet has been installed firmly.
- Check whether the wiring is correct.
- The emergency stop button is in the released state.
- Check to make sure there are no ground faults.
- Use a multi-meter to check whether the AC and DC side voltages meet the starting conditions and there is no danger of overvoltage.
- Check to make sure no tools or parts are left inside the device.
- Check that all air inlets and outlets are free of foreign objects or blockages.

### 3.1.3 POWER-ON SWITCH OPERATION

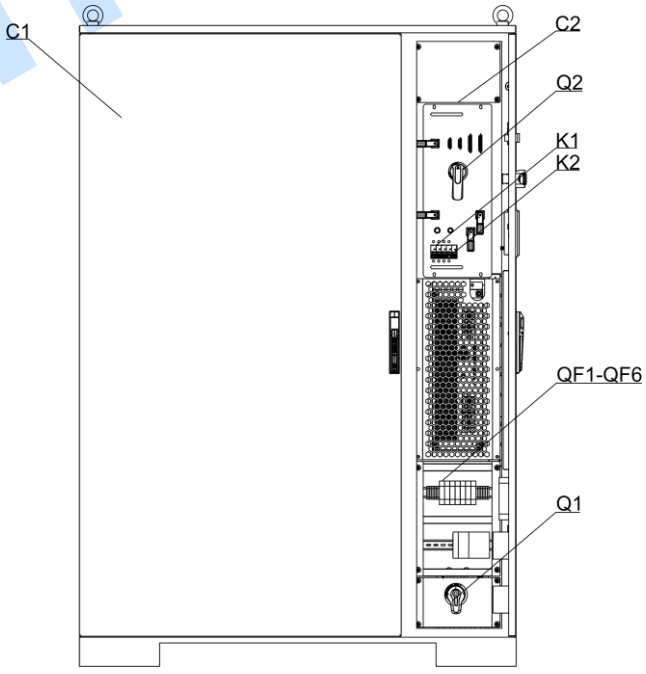



**Fig.14 Operation Switch Position Diagram**

**Table 13 Technical Parameter**

| No. | Item | Description |
|---|---|---|
| 1 | C1 | Battery compartment |
| 2 | C2 | Electrical compartment |
| 3 | Q2 | DC main circuit breaker for high voltage box |
| 4 | K1 | The power module switch of the high-voltage box, the control switch of the input end of the high-voltage power module in the high-voltage box |
| 5 | K2 | The high-voltage box control switch, the DC24V output control switch of the high-voltage power module in the high-voltage box |
| 6 | QF1 | The AC side power switch of the charger of the electrical compartment, which controls the DC power supply of the power distribution system |
| 7 | QF2 | Power switches for fire protection systems and water detect systems |
| 8 | QF3 | Energy storage cabinet light switch |
| 9 | QF4 | AC power switch for electrical compartment fan |
| 10 | QF5 | AC power switch for air conditioning system |
| 11 | QF6 | Socket AC output power switch |
| 12 | Q1 | AC main circuit breaker |

**Step 1:**

- Close the AC main circuit breaker Q1, and the AC side of the main circuit is powered on;
- Close QF1, and the AC side of the charger (for DC power supply of the power distribution system) is powered on;
- Close QF2, firefighting and water detect are powered on;
- Close QF3 (close according to the on-site lighting situation), and the energy storage cabinet lighting is powered on;
- Close QF4, and the AC fan in the electrical compartment is powered on;
- Close QF5, and the air conditioner is powered on;
- Close QF6, and the AC socket power is powered on.

**Step 2:**

- Close DC main circuit breaker Q2 of the high-voltage box;
- Close the power module switch K1 of the high-voltage box, and the input control switch is closed;
- Close the control switch K2 of the high-voltage box, and the DC24V output control switch is closed;
- Press the start button of the high-voltage box, and the main DC circuit in the high-voltage box is turned on and the DC24V outputs.

**Step 3:**

- Control the software to control the system to start.

Power-on ends.

### 3.1.4 START AND COMMISSIONING

Step 1: After powering on, check whether each device communicates successfully on the EMS display page, and check the troubleshooting page if the communication between devices is abnormal.

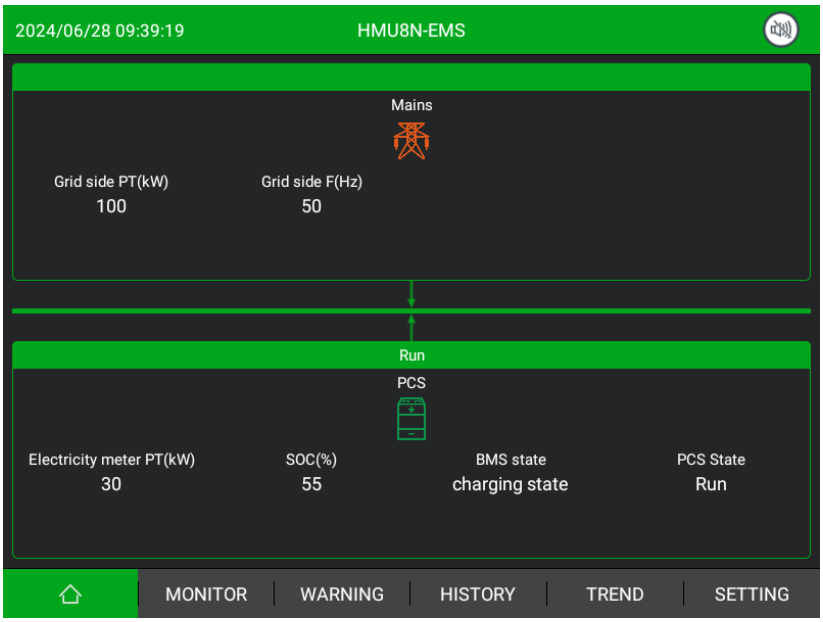



**Fig.15 Main Interface of EMS System**

PCS runs normally:

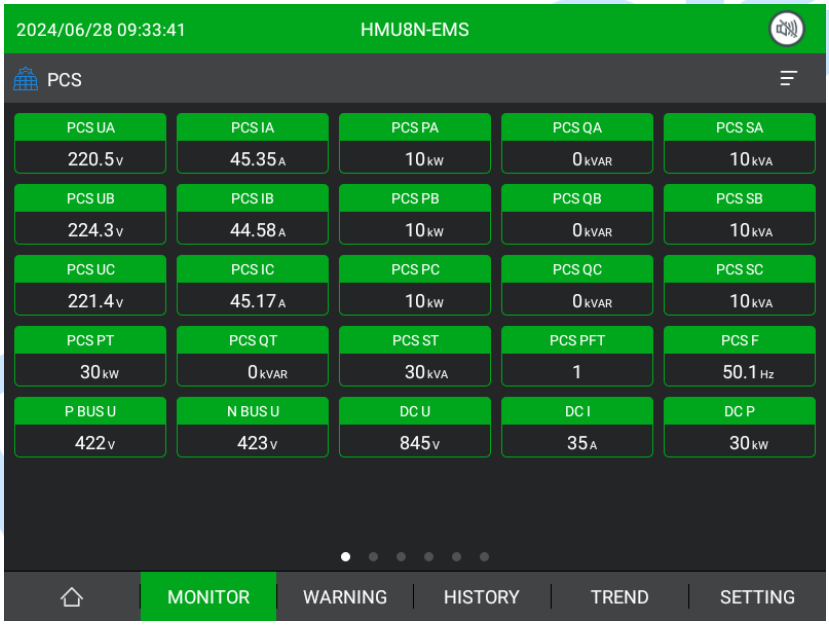



**Fig.16 PCS Data Display Interface**

BMS runs normally:

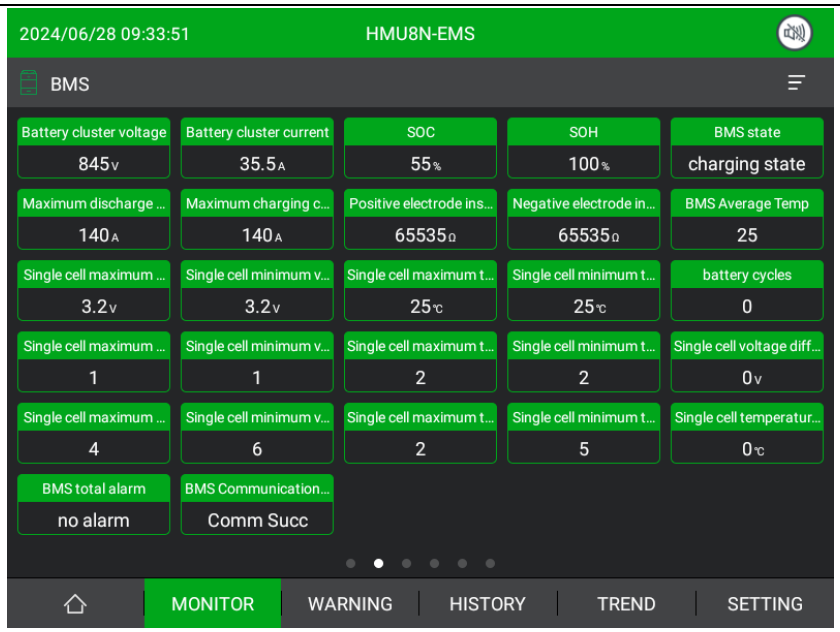



**Fig.17 BMS Data Display Interface**

Step 2: Enter the setting page, in the PCS control function, select PCS on, then wait for PCS to start, and observe whether PCS enters the running state on the PCS display page.

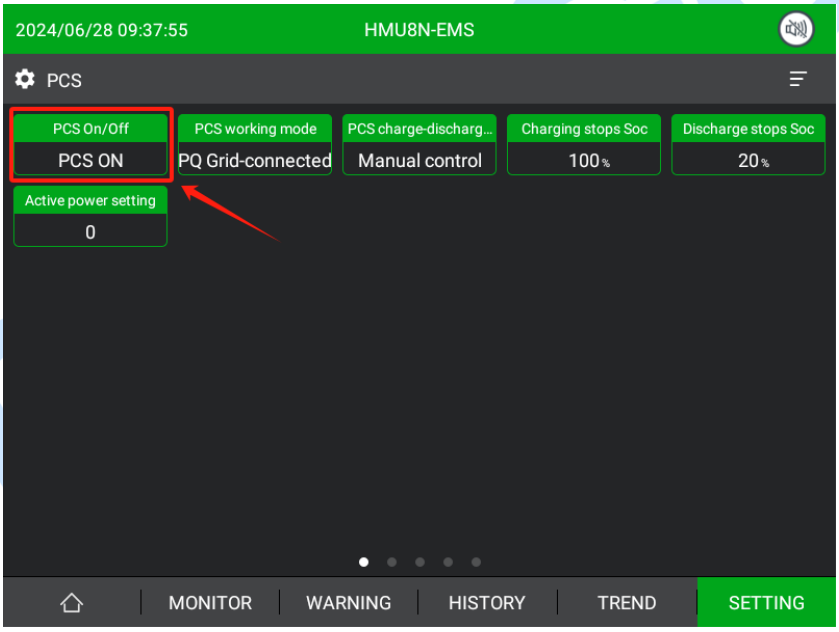



**Fig.18 Key Interface of PCS Start/Stop Control**

Step 3: On the setting page, in the charge and discharge control mode, change the control mode from standby to manual charge and discharge.

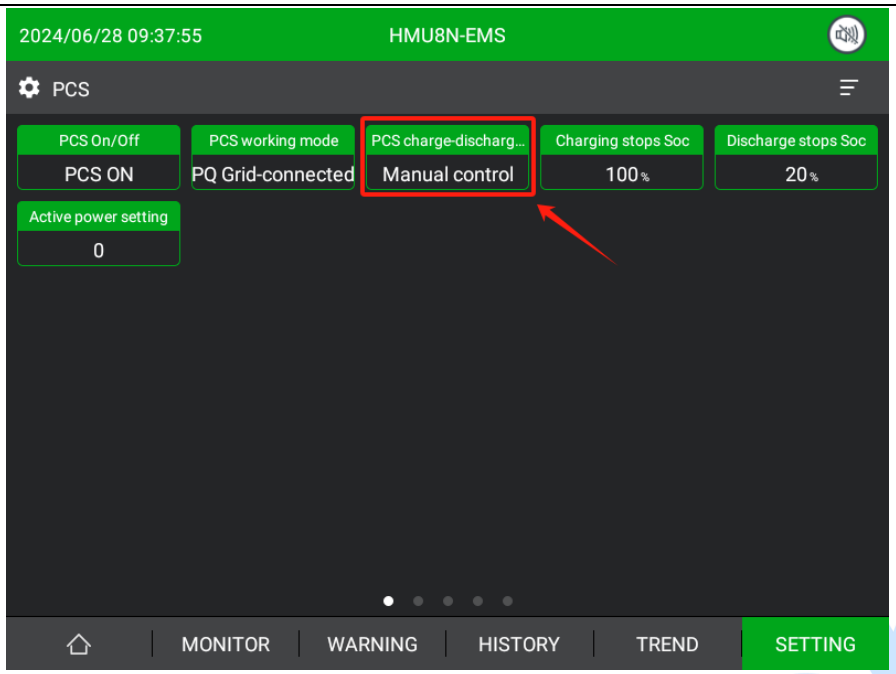



**Fig.19 Key Interface of Charge/Discharge Control Mode**

Step 4: Perform a charge and discharge test on the energy storage cabinet by setting the active power in the manual charge and discharge mode. After setting the charge and discharge power, it enters PCS and BMS display page, then check whether the power and charge and discharge status are normal.

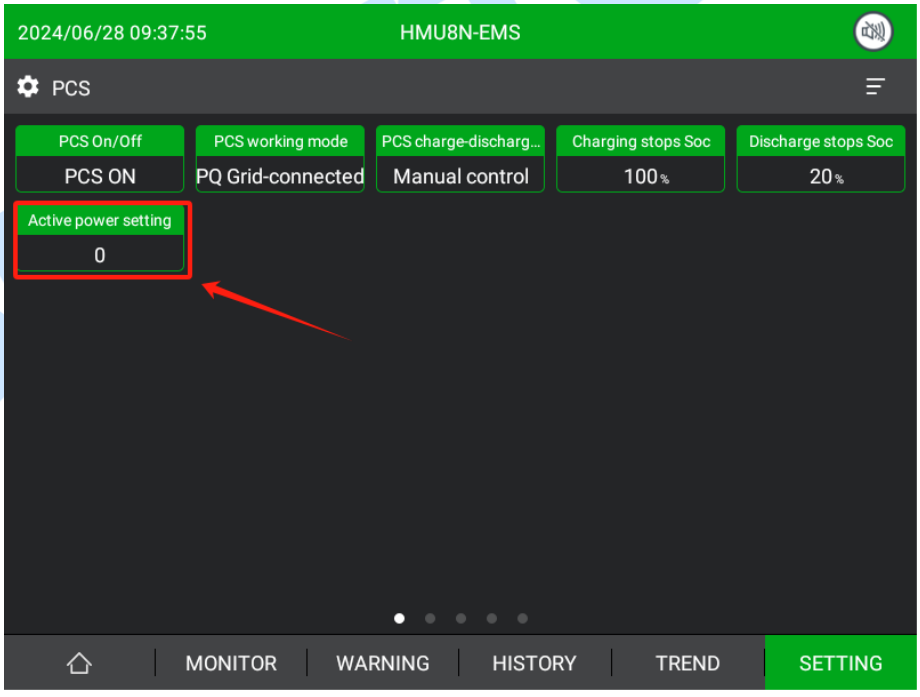



**Fig.20 Key Interface of Manual Charge/Discharge Power Setting**

Step 5: After the trial operation of the energy storage cabinet is normal, modify the active power setting to 0.0 and the control mode to standby to complete it.

### 3.1.5 PEAK LOAD SHIFTING

Step 1: After the trial operation of the energy storage cabinet is normal, enter the setting page and

set the control mode to fixed period control; Enter the anti-countercurrent function control, turn on the function, and set the minimum load power of the mains according to the demand.

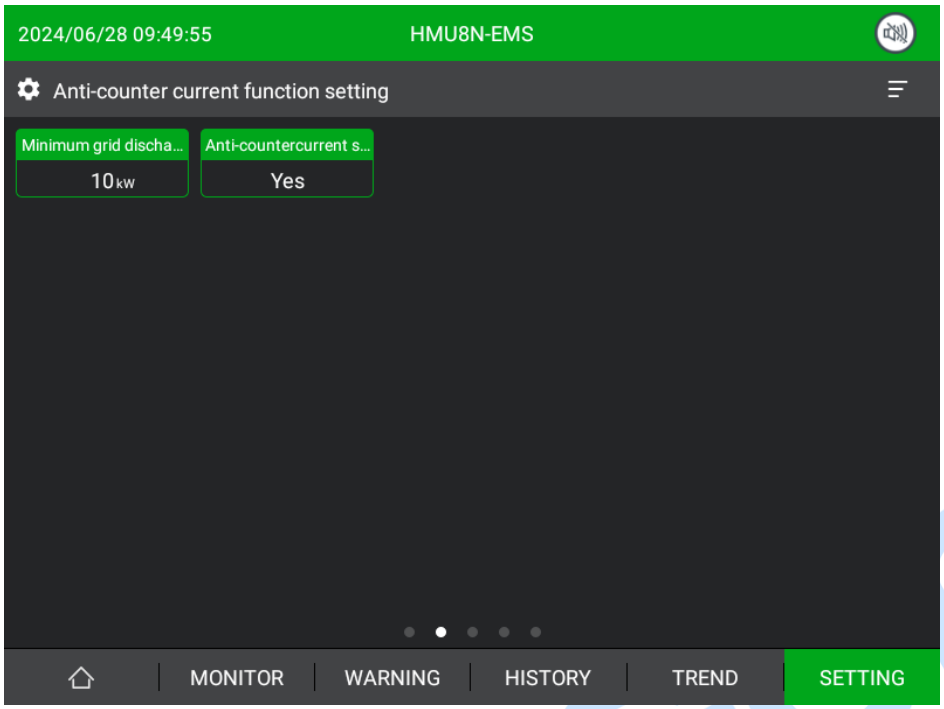



**Fig.21 Anti-countercurrent Control Interface**

Step 2 Draw down the setting page, there are 6 charging and discharging periods that can be set, take the fixed period 1 setting as an example, enable to turn on the function of this period, start H and start M are the start hours and start minutes of charge and discharge, end H and end M are the end hours and end minutes of charge and discharge, and the active power settings are the active power settings for charging and discharging in this period, and the use can be set differently according to the scene.


**Fig.22 Charge/Discharge Setting Interface in Fixed Period**

## 3.2 POWER OFF

### 3.2.1 SCHEDULED SHUTDOWN

**Step 1**

• Control the software to control the shutdown, (in special cases, the emergency stop button can be pressed outside the energy storage cabinet).

**Step 2**

• Disconnect the control switch K2 of the high-voltage box;
• Disconnect the switch K1 of the power module of the high-voltage box;
• Disconnect the DC main circuit breaker Q2 of the high voltage box;

**Step 3**

• Disconnect the charger AC power switch QF1;
• Disconnect the firefighting, water detect power switch QF2;
• Disconnect the power switch QF3 of the energy storage cabinet lighting lamp;
• Disconnect the AC fan power switch QF4 in the electrical compartment;
• Disconnect the power switch of the air conditioner QF5;
• Disconnect the AC socket power switch QF6;
• Disconnect the AC main circuit breaker Q1.

**Step 4**

• Check the power after the system discharge is completed.

Power-off ends.

### 3.2.2 UNSCHEDULED (EMERGENCY) SHUTDOWN

In the event of an emergency, you will need to contact your local fire department professional.

## 4 TROUBLESHOOTING

**Table 14 Common Troubleshooting**

| No. | Fault Phenomenon | Cause of the Fault | Troubleshooting |
|---|---|---|---|
| 1 | Abnormal energy storage system working | • The distribution system is not supplied with power;<br>• Partial circuit breaker is not closed;<br>• Other reasons. | • Check whether the power indicator of the energy storage cabinet is on;<br>• Check whether the relevant circuit breaker is closed according to the operation steps of the power-on switch;<br>• If it still not work properly, please contact the manufacturer for after-sales service;<br>• Can be re-run after troubleshooting. |
| 2 | System and single overvoltage shutdown protection | • The system and single voltage is higher than the protection value;<br>• The battery sampling harness is broken or the sampling plug-in connection is unreliable;<br>• The BMU is working abnormally;<br>• Other reasons. | • Re-plug the BMU sampling and power supply plug;<br>• Check the system battery voltage, replace it if the battery cell is damaged. |
| 3 | System and single undervoltage shutdown protection | • The system and single voltage is lower than the protection value;<br>• The battery sampling harness is broken or the sampling plug-in connection is unreliable;<br>• The BMU is working abnormally;<br>• Other reasons. | • Re-plug the BMU sampling and power supply plug;<br>• Check the system battery voltage, replace it if the battery cell is damaged. |
| 4 | Charge and discharge overtemperature shutdown protection | • The system temperature is higher than the protection value;<br>• The battery sampling harness is broken or the sampling plug-in connection is unreliable;<br>• The BMU is working abnormally;<br>• Other reasons. | • Re-plug the BMU sampling and power supply plug;<br>• Check whether the air conditioner is running normally, if not, please contact the manufacturer's after-sales service;<br>• It can re-run after troubleshooting. |

| No. | Fault Phenomenon | Cause of the Fault | Troubleshooting |
|---|---|---|---|
| 5 | Charge and discharge undertemperature shutdown protection | • The system temperature is lower than the protection value;<br>• The battery sampling harness is broken or the sampling plug-in connection is unreliable;<br>• The BMU is working abnormally;<br>• Other reasons. | • Re-plug the BMU sampling and power supply plug;<br>• Check whether the air conditioner is running normally, if not, please contact the manufacturer's after-sales service;<br>• It can re-run after troubleshooting. |
| 6 | Charge and discharge overcurrent shutdown protection | • The system charge and discharge current is higher than the protection value. | • Check whether the PCS end is normal, if not, please contact the manufacturer's after-sales service;<br>• It can re-run after troubleshooting. |
| 7 | System insulation failure | • Insulation detection failure;<br>• System leakage. | • Remotely turns off the PCS, BMS relay at the background and contact the manufacturer's after-sales service.<br>• It can re-run after troubleshooting. |
| 8 | BCU and BMU communication failure | • The BMS system is not powered;<br>• The corresponding CAN communication line is loose. | • Check whether the BMS system has normal power supply;<br>• Check whether the corresponding BCU and BMU communication plugin is loose; whether the wiring harness is damaged;<br>• It can re-run after troubleshooting. |
| 9 | BMS and PCS communication failure | • The BMS system is not powered;<br>• The PCS system is not powered;<br>• The corresponding communication line is loose. | • Check whether the entire energy storage system has normal power supply;<br>• Check whether the corresponding BAU and PCS communication plugin is loose; whether the wiring harness is damaged;<br>• It can re-run after troubleshooting. |

| No. | Fault Phenomenon | Cause of the Fault | Troubleshooting |
|---|---|---|---|
| 10 | Air conditioner and EMS communication failure | • The energy storage system is not powered on;<br>• The corresponding communication line is loose. | • It can re-run after troubleshooting. |