

# **User's Manual for Integrated Photovoltaic and Energy Storage On/Off-grid Air-cooled System (100kW/215.04kWh)**

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**Guangzhou Felicity Solar Technology Co., Ltd.**

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# 1 About This Manual

## 1.1 Preface

Dear customers, thank you for choosing the outdoor cabinet energy storage system developed and manufactured by our company. We sincerely hope that this product will cater to you. We're looking forward to receiving your valuable feedback on its performance and functionality for our further improvements.

## 1.2 Applicable products

>This Manual applies to the following models of outdoor cabinet energy storage systems.

Table 1

Model	Rated power	Rated Battery Capacity	Cabinet
FLS-MES215AC-S	100kW	215.04kWh	Outdoor cabinet

## 1.3 Manual description

This Manual is intended for engineers and technicians involved in the transportation, installation, and operation of energy storage products.

Users should have a certain level of expertise in electronics, electrical wiring, and mechanical systems, and be familiar with electrical and mechanical schematics.

They should have received professional training related to the installation and commissioning of electrical equipment.

Please read this Manual carefully before transporting, installing, or operating the product.

Users should be familiar with the relevant standards and regulations of the country/region where the project is located.

This Manual should be used in conjunction with the manuals of other component products.

Our Company reserves all rights, including those related to the images, marks, and symbols used in this Manual.

The contents of this Manual are subject to periodical updates or revisions for product development without prior notice.

## 1.4 Symbol description

To ensure the safety of users and their property in using this product, and to facilitate better use of the product, this Manual provides relevant information and uses appropriate symbols for emphasis. Below are the symbols that may be used in this Manual. Please read them carefully.

 <b>危險</b>	It indicates a potential hazard with a high level. Failure to avoid this hazard may result in death or serious injury.
--	--

 <b>警告</b>	It indicates a potential hazard with a medium level. Failure to avoid this hazard may result in death or serious injury.
--	--

 <b>小心</b>	It indicates a potential hazard with a low level. Failure to avoid this hazard may result in moderate or minor injury.
--	--

 <b>注意</b>	It indicates a potential risk. Failure to avoid this risk may result in an equipment failure or fault report.
--	---

	“Note” provides emphasis, supplementary information, or tips for optimizing product use.
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Please **ALWAYS** pay attention to the hazard warning labels on the product. These labels include:

Table 2

Identification	Description
	This symbol indicates that the product contains high voltage inside. Touching it may result in an electric shock hazard.
	This symbol indicates the protective earth (PE) terminal. It must be securely grounded to ensure operators' safety.

## 1.5 Terminology

Unless otherwise specified, the following terms will be used to refer to the aforementioned equipment:

Table 3

No.	Abbreviation	Full Name
1	ESS	Energy storage system
2	MPS	Multi-Power Source
3	BAT	Battery Cluster
4	HVAC	Heating Ventilation Air Conditioning
5	FSS	Fire suppression system
6	BMS	Battery Management System
7	EMS	Energy Management System
8	UPS	Uninterruptible Power Supply

## 2 Safety Instructions

### 2.1 Personnel requirements

- ◆ Only qualified electricians or personnel with professional qualifications are permitted to perform operations on this product.
- ◆ Operators shall be thoroughly familiar with the structure and working principles of the entire energy storage system.
- ◆ Operators shall be fully acquainted with the product manuals of the interior electrical equipment.
- ◆ Operators shall be fully familiar with the relevant standards of the country/region where the project is located.

	<ul style="list-style-type: none"><li>● NEVER perform maintenance or repair operations while the equipment is energized!</li><li>● At Least <b>two personnel</b> must be present on-site when performing maintenance or repairs on the equipment. Maintenance or repair operations may only be carried out after the equipment has been safely disconnected and a 15-minute waiting period has elapsed to allow the converter to discharge completely.</li></ul>
---	--

### 2.2 Operational warnings

When performing installation, routine maintenance, or repair operations on the outdoor cabinet energy storage system, to prevent unauthorized personnel from approaching and causing accidental operations or accidents, please follow the instructions below:

- ◆ Prominently mark the switches inside the outdoor cabinet to prevent accidental switching.
- ◆ Place warning signs or set up safety warning tapes near the operating area.
- ◆ After completing maintenance or repair operations, ALWAYS remove the cabinet door key and store it securely.

### 2.3 Cabinet labels

- ◆ The warning labels inside the outdoor cabinet contain important information for the safe operation of the energy storage MPS. Do NOT tear off or damage these labels under any circumstances!
- ◆ The nameplate installed on the inner side of the front door of the outdoor cabinet contains important parameter information related to the product. Do NOT tear off or damage these labels under any circumstances!
- ◆ If the cabinet labels are damaged or become illegible, please make sure to contact our Company immediately.

	<ul style="list-style-type: none"><li>● Ensure that the cabinet labels are always legible.</li><li>● If the cabinet labels are damaged or become illegible, they must be replaced immediately.</li></ul>
---	--

## 2.4 Safety precautions

### 2.4.1 Electrical safety

 危険	<p>The product contains lethal high voltage inside!</p> <ul style="list-style-type: none"><li>● NEVER touch terminals or conductors connected to the grid circuit.</li><li>● Pay attention to all instructions or safety documentation related to grid connections, and comply with the warning labels on the product.</li><li>● Follow the safety precautions listed in this Manual and other relevant documents for this equipment.</li></ul>
---	---

 危険	<p>Damaged equipment or system malfunctions may cause an electric shock or fire!</p> <ul style="list-style-type: none"><li>● Conduct a preliminary visual inspection of the equipment against damage or other hazards before operation.</li><li>● Check other external equipment or circuit connections are secure.</li><li>● Ensure the equipment is in a safe state before operating.</li></ul>
---	---

### 2.4.2 Electrostatic protection

 注意	<p>Static-sensitive components on circuit boards or elsewhere may be damaged due to improper handling or contact by operators.</p> <ul style="list-style-type: none"><li>● Operators shall avoid unnecessary contact with circuit boards.</li><li>● Operators must follow electrostatic protection guidelines, such as wearing anti-static wrist straps.</li></ul>
--	--

### 2.4.3 Precautions for energy storage battery packs

 危険	<ul style="list-style-type: none"><li>● Lethal high voltage exists between the positive and negative terminals of the energy storage battery pack connected to the energy storage converter!</li><li>● When maintaining the equipment, ensure that the connection between the energy storage converter and the energy storage battery pack is completely disconnected.</li></ul>
---	--

## 2.5 Environmental space

### 2.5.1 Escape route requirements

To ensure prompt evacuation of staff from the site in the event of an accident, please follow the below:

- ◆ Do NOT place flammable or explosive materials around the outdoor cabinet energy storage system.
- ◆ Do NOT pile up debris in the escape route or occupy it in any form.

## 2.5.2 Moisture protection

Do NOT use the outdoor cabinet energy storage system in environments exceeding the specified humidity levels!

 <p>注意</p>	<p>To ensure the normal functioning of the outdoor cabinet, please follow the below:</p> <ul style="list-style-type: none"> <li>● Do NOT open the cabinet door when the air humidity exceeds <b>95%</b> or when condensation is present.</li> <li>● Avoid performing maintenance or repair operations on the outdoor cabinet energy storage system during rainy or humid weather conditions.</li> </ul>
---	---

## 2.6 Testing specifications

### 2.6.1 Live measurement

 <p>危险</p>	<p>The equipment carries high voltage, and accidental contact may result in a fatal electric shock risk. Therefore, when performing live measurements:</p> <ul style="list-style-type: none"> <li>● Take protective measures (such as wearing insulation gloves and shoes).</li> <li>● <b>Ensure that at least two personnel</b> are present on-site to guarantee personal safety.</li> </ul>
---	---

### 2.6.2 Use of measuring equipment

When performing electrical connections, trial operations, or other operations on the outdoor cabinet energy storage system, relevant electrical measuring equipment must be used to ensure that electrical parameters meet requirements.

 <p>警告</p>	<ul style="list-style-type: none"> <li>● Select high-quality measuring equipment with ranges and usage conditions that comply with on-site requirements.</li> <li>● Ensure that the connection and use of the measuring equipment are correct and standardized to avoid hazards such as arcing.</li> </ul>
---	--

## 2.7 Configuration requirements

The parameters in the equipment are closely related to the operation of the outdoor cabinet energy storage system. These parameters should only be modified after a reliable analysis and evaluation of the system and energy storage equipment's operating conditions.

 <p>警告</p>	<ul style="list-style-type: none"> <li>● Inappropriate parameter settings may affect the functioning of the outdoor cabinet energy storage system!</li> <li>● Only authorized professionals are permitted to configure the parameters of the outdoor cabinet energy storage system.</li> </ul>
---	--

## 2.8 Maintenance or repair

When performing maintenance or repair operations on the equipment, please pay attention to the following points:

- ◆ Set up maintenance signs and ensure that the outdoor cabinet energy storage system cannot be accidentally re-energized.
- ◆ Use a multimeter to confirm that all energized components inside the outdoor cabinet energy storage system have been disconnected.
- ◆ Ensure the equipment is properly grounded.
- ◆ Energized components must be insulated using insulating materials.
- ◆ After shutting down the outdoor cabinet energy storage system and disconnecting both AC and DC power supplies, wait at least 15 minutes before performing maintenance or repair operations.
- ◆ Throughout the maintenance and repair process, ensure that escape routes remain completely clear.

## 2.9 Product disposal

- ◆ When the outdoor cabinet energy storage system needs to be scrapped, it must not be treated as regular waste.
- ◆ Please contact an authorized local professional recycling agency designated by our Company.

## 2.10 Precautions

During actual operations, the following protective or emergency measures shall be taken based on on-site requirements:

- ◆ When performing maintenance, repairs, or other operations on the equipment, relevant personnel shall take appropriate protective measures as needed, such as wearing anti-noise earplugs, insulated shoes, and heat-resistant gloves.
- ◆ The installation site of the outdoor cabinet energy storage system is usually located far from urban areas. Prepare corresponding emergency rescue facilities as needed for a timely response when required.
- ◆ Take all necessary auxiliary measures to ensure the safety of personnel and equipment.

 <b>注意</b>	All operations on the outdoor cabinet energy storage system must comply with the relevant standards of the country/region where it is located.
--	--



All descriptions in this Manual are for standard outdoor cabinet energy storage systems. Should you have special requirements, please inform our staff when placing an order. Please refer to the actual product you receive for specific details.

This Manual does not cover all possible situations during operation, maintenance, or repair. Should you encounter those not explained in this Manual, please contact our Company promptly.

### 3 System Introduction

#### 3.1 System overview

- ◆ The outdoor cabinet energy storage system consists of a battery cluster, converter, EMS, BMS, active fire suppression device, HVAC and other units.
- ◆ The converter provides AC power to the load through an isolation transformer. The STS (Static Transfer Switch) enables on-grid and off-grid switching.
- ◆ This system can operate in different modes based on actual project requirements and operational strategies.
- ◆ The MPPT (Maximum Power Point Tracking) photovoltaic controller charges the battery directly from the photovoltaic power source, offering greater flexibility in photovoltaic capacity.
- ◆ The outdoor cabinet energy storage system has an IP54 protection rating.

##### 3.1.1 Models

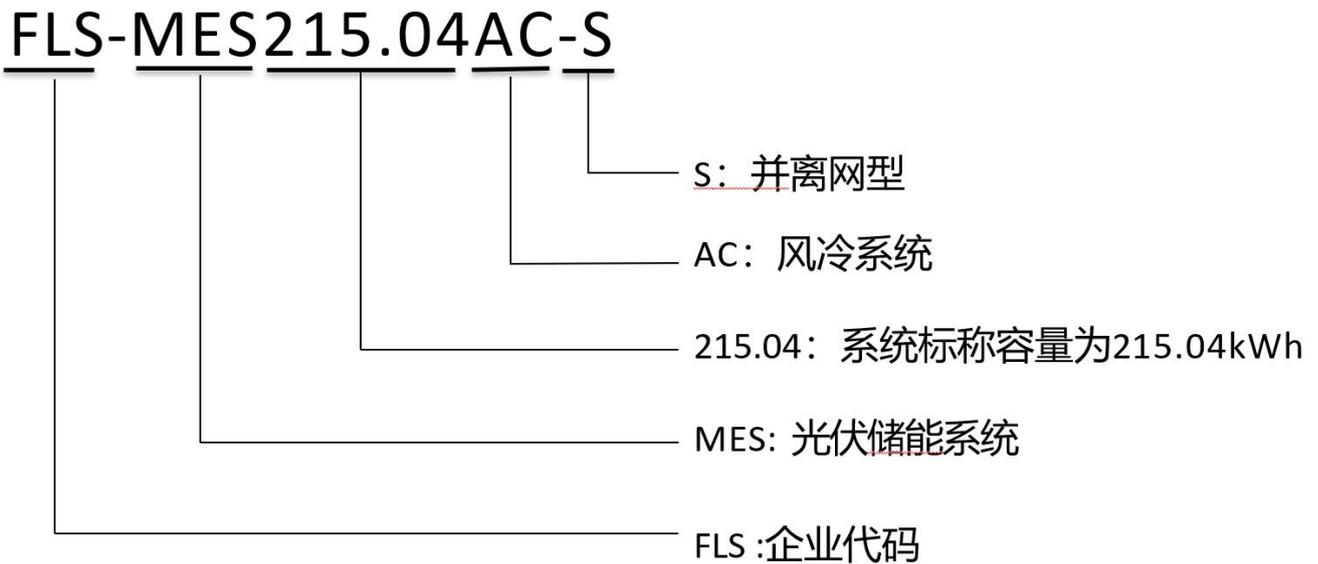


Figure 3.1 Models

Model identification:

Identific	Indications	Value
S	On-grid and off-grid type	On-grid and off-grid operation
AC	Cooling type	HVAC cooling for battery pack
215.04	Energy rating	Battery nominal energy of 215.04kWh
MES	System type	Photovoltaic energy storage system
FLS	Enterprise code	Abbreviation for Felicity

### 3.1.2 Product application system diagram

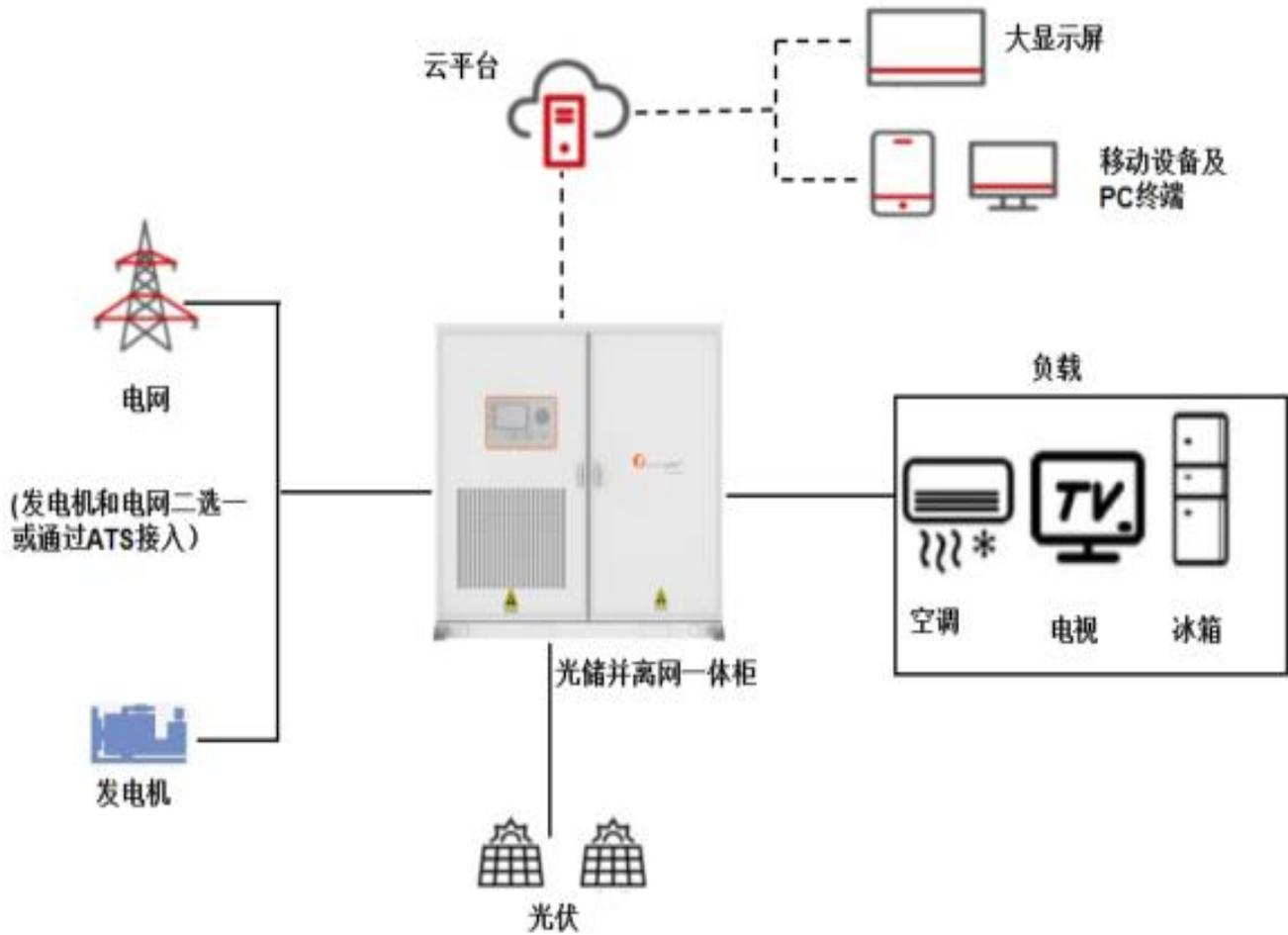
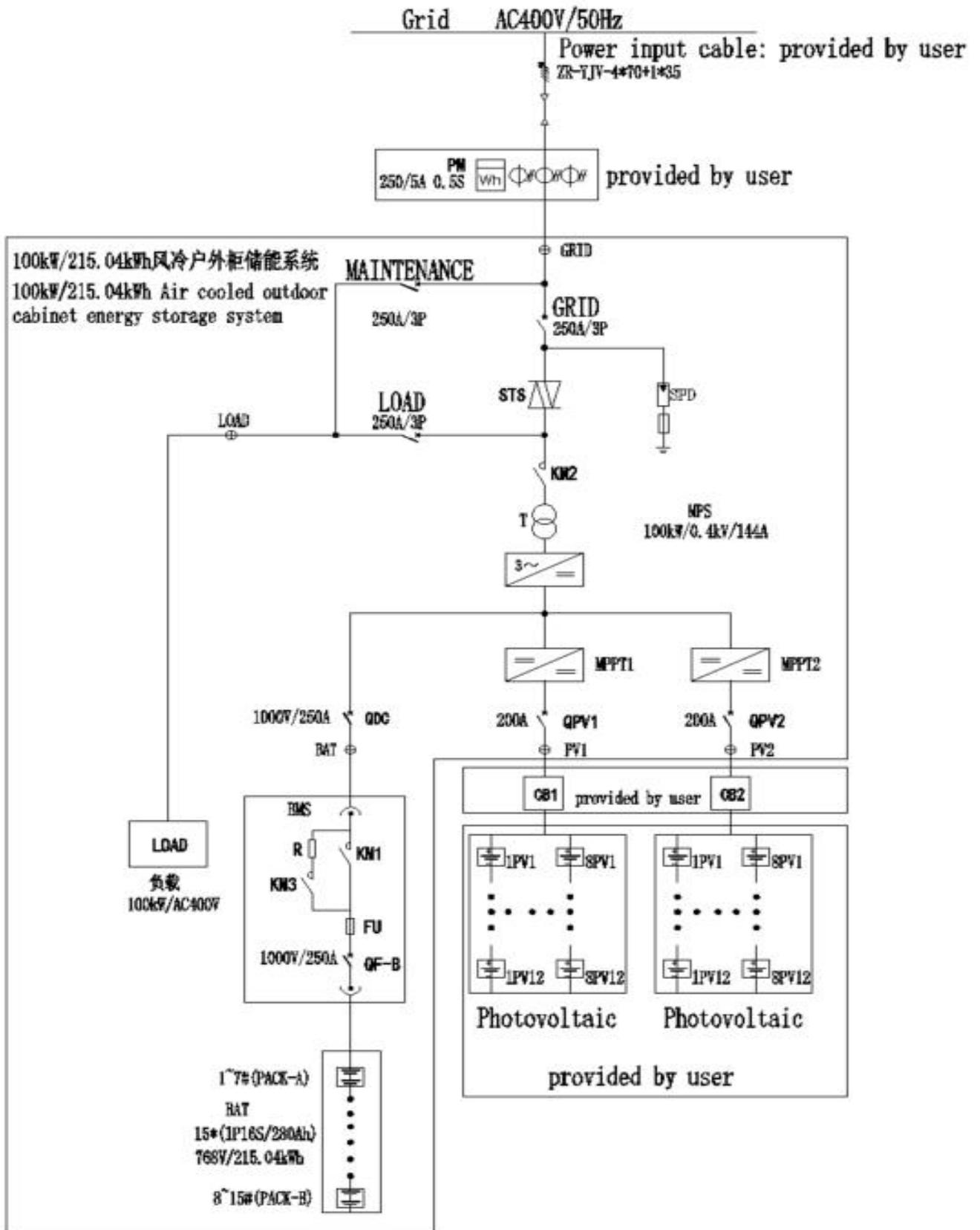


Figure 3.2\_Product Application System Diagram



### 3.1.3 Electrical primary system diagram

Figure 3.3\_Product Electrical System Diagram

### 3.1.4 Product communication topological diagram

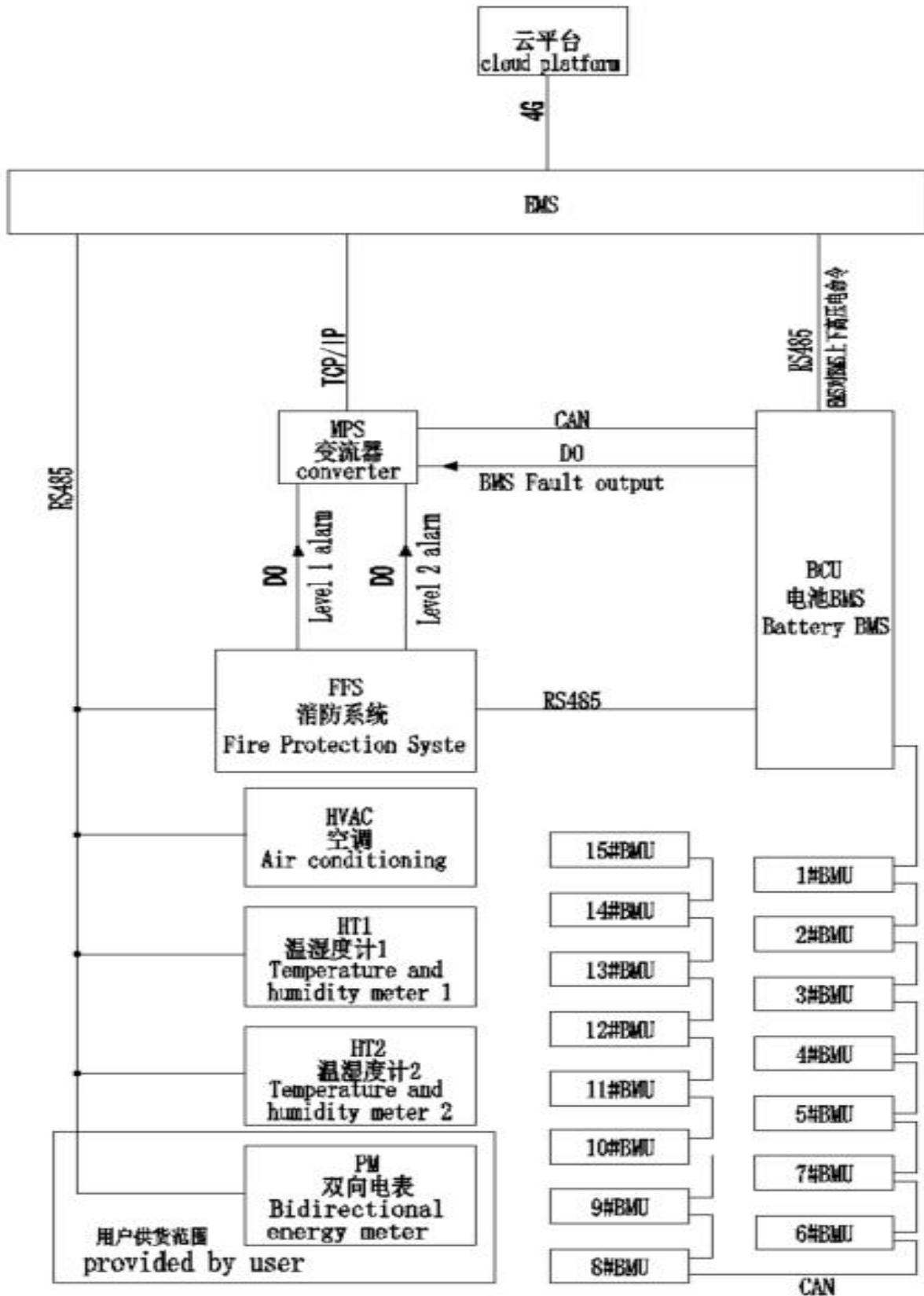


Figure 3.4\_Product Communication Topological Diagram

### 3.2 Operating ambient

Operating temperature: 0~45°C

Storage temperature: -20~55°C

Relative humidity: ≤95% (non-condensing)

Do NOT use in locations exposed to fire or explosion hazards.

The height of the foundation should be higher than that of the local flood. The foundation shall be of a reinforced concrete structure with embedded steel plates to facilitate the installation of the outdoor cabinet.

### 3.3 System features

**High integration:** The outdoor cabinet energy storage system, which is integrated into a standard outdoor cabinet, is a microgrid product designed by our Company. It features built-in EMS functionality for improved energy efficiency management and new IGBT modules with triple fire suppression for safety and reliability.

**Easy management:** Battery capacity can be flexibly configured according to different customer requirements.

**Strong adaptability:** Equipped with a built-in isolation transformer, it has strong load adaptability.

**High efficiency:** 92% for battery, and 87% for system.

**Long life:** battery cycle times ≥ 6,000.

The standardized product supports quick installation and deployment. It supports integration with photovoltaic systems, grid power, diesel generators, and loads.

It enables automatic grid connection and automatic switching between on-grid and off-grid modes.

Application scenarios: Off-grid areas, areas without electricity (or with power shortages), and remote rural areas.

### 3.4 System parameters

The following table sets forth system parameters for the DC side, the photovoltaic input side, the AC on-grid side, the AC off-grid side, and the entire product:

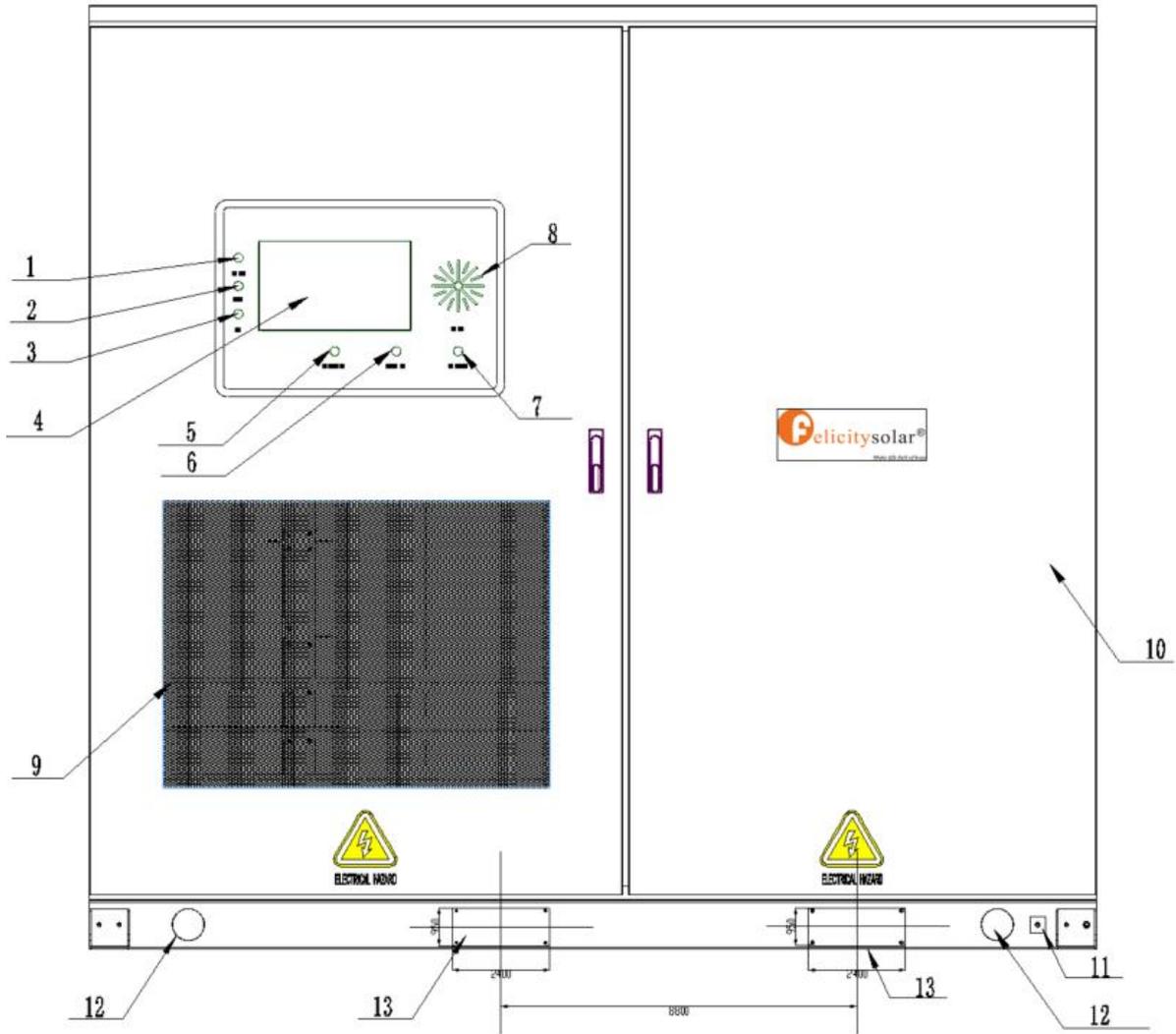
DC side parameter					
Battery type	Lithium iron phosphate battery 3.2V/280Ah	Voltage range	DC600~876V	PACK capacity and configuration	14.336kWh/1P16S
Protective measures	Isolation switch + fuse	PACK protection Grade	IP20	System capacity and configuration	215.04kWh/1P240S

Rated current	140A	Charge/discharge ratio	0.5Cp@25°C	DC side efficiency	92%
<b>PV Input Parameters</b>					
Maximum input power	240kWp	MPPT input voltage range	DC250V-850V	Maximum PV input voltage	DC1000V
Maximum current	120x2	PV Short-circuit current (Isc)	130A*2		
<b>AC side parameters (on-grid)</b>					
Rated power	100kW	Rated voltage	AC400V, 3W+N+PE	Voltage range	AC320V-460V
Rated current	144A	Rated frequency	50Hz/60Hz	Frequency range	45-55/55-65Hz
THDI	<3%	Power factor	1 (0.8 leading ~ 0.8 lagging configurable)	Isolation transformer	270:400
<b>AC side parameters (off-grid)</b>					
Rated power	100kW	Rated voltage	AC400V, 3W+N+PE	THDU	<2% linear
Rated current	144A	Rated frequency	50Hz/60Hz	Overload capacity	110% long-term overload
<b>System parameters</b>					
Comprehensive system efficiency	87%&0.5P, under standard conditions	Communication mode	CAN, Modbus TCP, Modbus RTU	Fire suppression system	perfluorohexanone + active early warning + water fire suppression
Depth of discharge	5~95%	Charge/discharge ratio	0.5Cp	Refrigerating capacity	2kW
Cooling method	Intelligent temperature-controlled air cooling	Rated refrigerating capacity	5.0kW	Operating temperature	-20°C~55°C (derating if the temperature > 45°C)
Cabinet ingress protection grade	IP54	Relative humidity	5~95%RH, no condensation	Noise	<75dB
Weight	4,100kg	Altitude	≤2,000m	Dimensions (mm)	1400L×1400D×2200 H

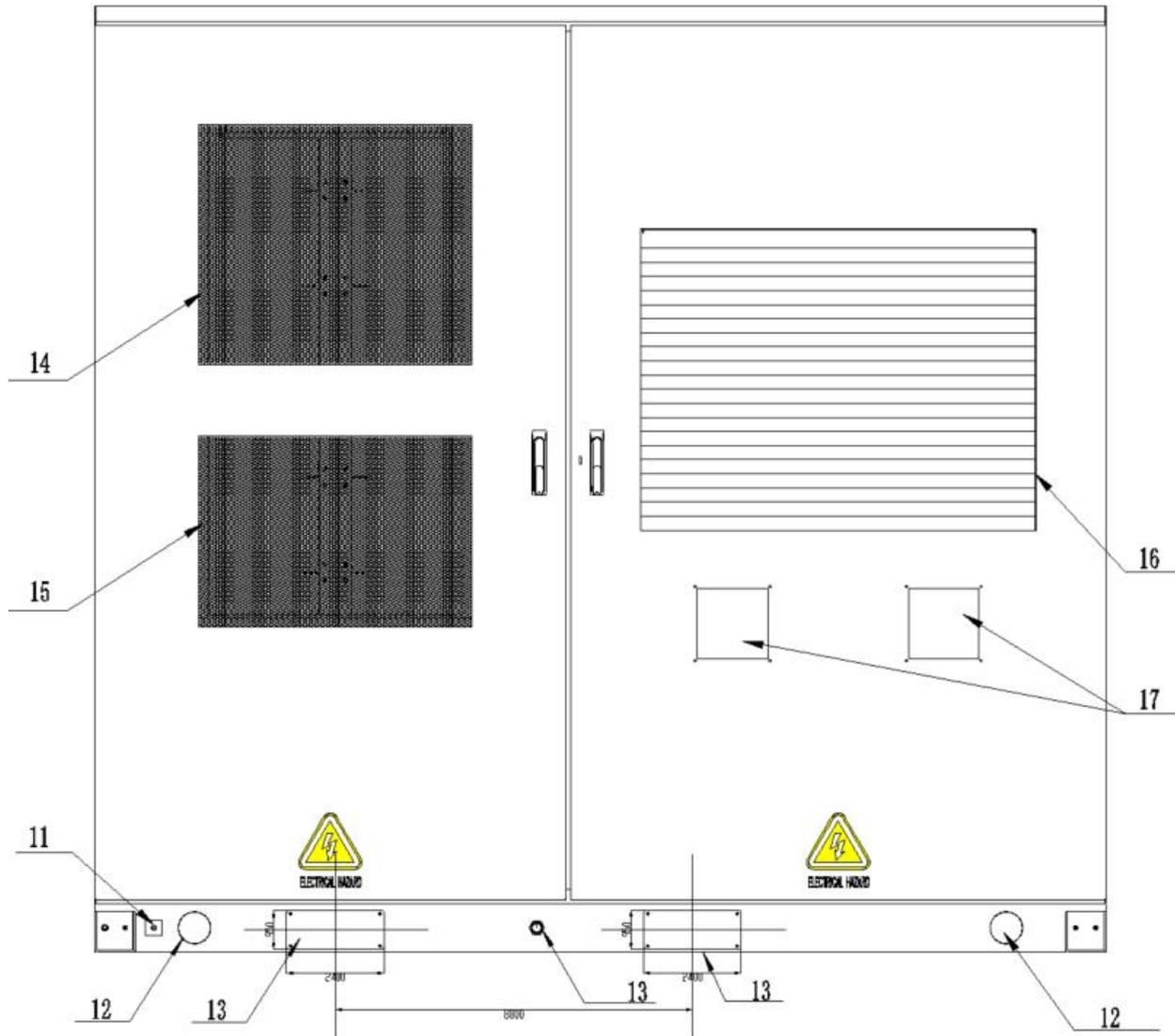
**Table 2-1** Product Technical Parameters

### 3.5 About product appearance

#### 3.5.1 Introduction to product appearance components



**Figure 3.5** Front View of the Cabinet



**Figure 3.6 Rear View of the Cabinet**

No.	Module description	Maximum number of configurations of a single energy storage system	Description
1	Green indicator	1	Incoming power indicator
2	Green indicator	1	Running indicator
3	Red buzzer	1	Energy storage system fault indicator
4	Touch screen	1	Touch screen
5	Fire suppression emergency stop button	1	For emergency stopping in case of fire suppression
6	Scram button	1	For emergency stop of the energy storage system
7	Fire suppression activation button	1	For activation of the fire suppression system
8	Audible and visual alarm	1	Fire suppression failure alarm
9	Inlet/outlet of the electrical	1	Inlet + filter

	compartment		
10	Cabinet	1	Outdoor cabinet of the integrated PV energy storage on/off-grid air-cooled system
11	Cabinet grounding	2	Cabinet shell and grounding network reliably grounded
12	Telescopic lifting arm	4	For lifting
13	Forklift hole	2	For lifting

14	HVAC heat outlet	1	Outlet + filter
15	HVAC inlet	1	Inlet + filter
16	MPS heat exhaust grille	1	Outlet + louver + filter
17	Exhaust fan	2	Cooling fan + louver + filter

Figure 3.1 Product Exterior Configuration

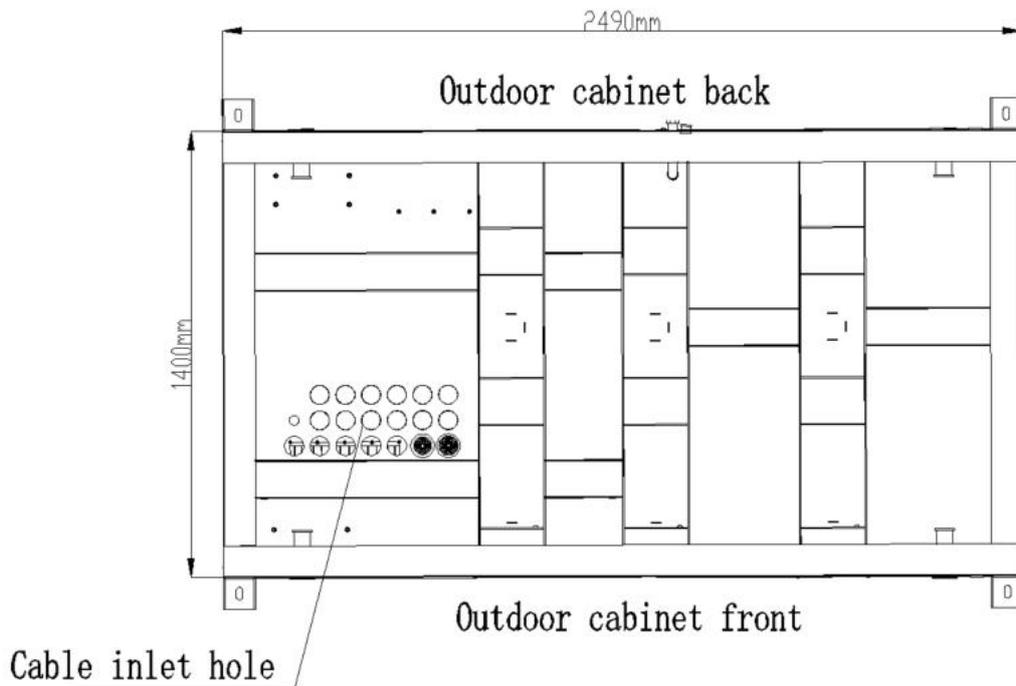


Figure 3.7 Cabinet Bottom Layout Diagram

**3.5.2 Outdoor cabinet dimensions:**



2,490\*1,400\*2,350 (W\*D\*H: mm)

Figure 3.8\_Cabinet Dimension Diagram

### 3.5.3 Introduction of key components

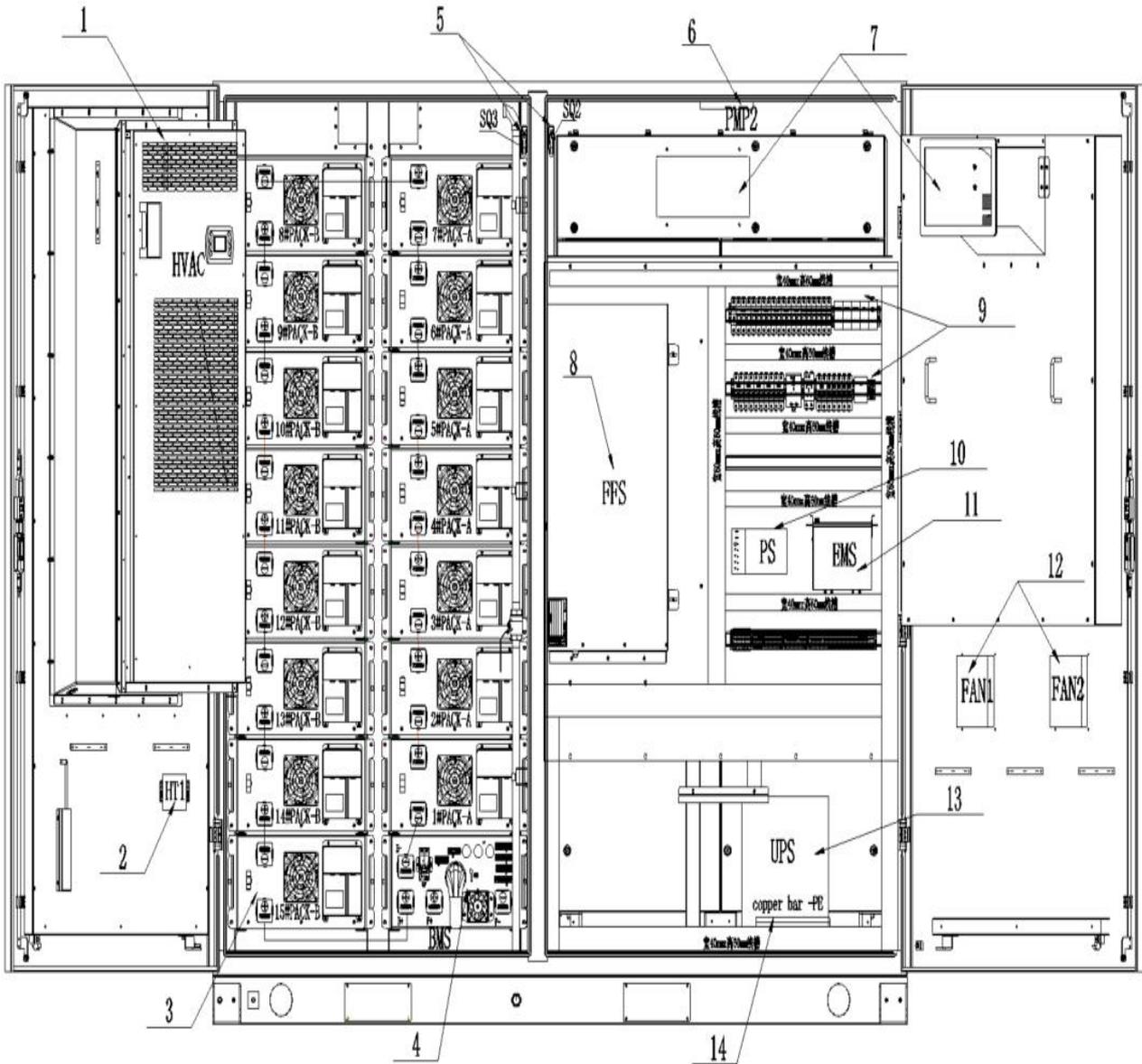


Figure 3.9\_Back Interior Layout of the Integrated Cabinet

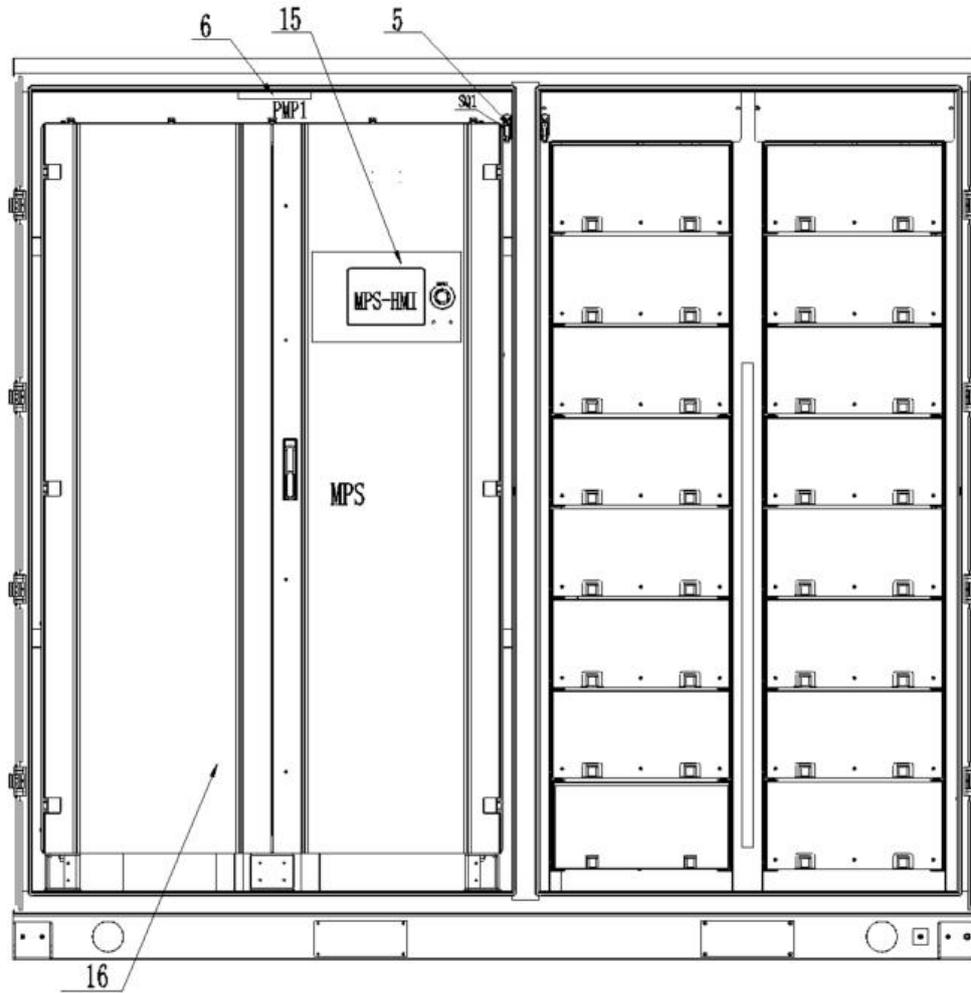


Figure 3.10 \_Front Interior Layout of the Integrated Cabinet

No.	Symbols	Module description	Quantity	Description
1	HVAC	Heating Ventilation Air Conditioning	1	Used for battery cooling.
2	HT1-HT2	Hygrothermograph	2	Used to detect the temperature of the battery compartment and the electrical equipment
3	1#-15#PACK	Battery PACK	15	A battery pack is a battery assembly in which battery cells are connected in series with a pair of positive and negative terminals for external output. It contains a battery management module. The battery management module consists of a BMU (battery management unit) and a battery optimization module.
4	BMS	High Voltage Box and BMS system	1	Manages and maintains individual battery cells against overcharging and over-discharging and monitors battery status.
5	SQ1-SQ3	Access control	3	Limit switch on the cabinet door
6	PMP1-PMP2	Lighting	2	Cabinet lighting
7		MPS heat dissipation duct	1	Used for internal heat dissipation of the MPS

8	FFS	Fire suppression device	1	When the thermal runaway of the pack is detected, the fire suppression device will be activated to extinguish the fire
9	Mounting plate		1	Auxiliary power supply electrical components
10	PS	DC switching power supply	1	Provide a 24V DC power supply
11	EMS	Energy Management System	1	Communication with PCS, BMS, HVAC, and temperature/humidity sensors is achieved via LAN ports and RS485 interfaces to schedule energy in the energy storage system
12	FAN1-FAN2	Heat elimination fan	2	Used for heat dissipation of the electrical compartment
13	UPS	UPS	1	Used to provide power for key components in off-grid state to achieve black start
14	copper bar - PE	Ground Copper Row	1	System grounding copper row
15	MPS-HMI	The MPS comes with a built-in touchscreen	1	Used for issuing charge/discharge control strategies and displaying data
16	MPS	Hybrid converter	1	Controls the charging and discharging of the battery pack and converts AC and DC currents

Table 3.2 Description of Interior Component Configuration of Product

## 4 Functional Units

### 4.1 Multi-Powersource



Figure 4.1\_100Kw Multi-Power Source

(1,200X800X2,050(W\*D\*H mm))

#### Converter features

The energy storage converter adopts advanced digital control technology, optimizing control performance and enhancing system reliability. It is suitable for various battery charging and discharging needs. Its main performance characteristics are as follows:

- ◆ Integrated solution, which supports simultaneous connection of loads, batteries, grid or diesel generators, and PV systems.
- ◆ It supports self-consumption, battery priority, and peak shaving/valley filling modes.
- ◆ BMS communication supports RS485 and CAN communication.
- ◆ Can be dispatched by the EMS via RS485, Ethernet, or CAN communication.
- ◆ The integrated EMS functionality ensures a stable power supply and maximizes renewable energy utilization.
- ◆ Flexibly supports lithium and lead-acid batteries; and predicts battery capacity and discharge time.
- ◆ The expandable PV controller allows flexible configuration of PV capacity.
- ◆ Features a strong ability to handle three-phase unbalanced loads in off-grid mode.
- ◆ Industrial frequency is designed to ensure strong resistance to impact and surges.

**Technical parameters:**

Table 8

Model	100kW
<b>AC (on-grid)</b>	
Maximum power (kVA)	110kVA
Active power (kW)	100kW
Rated voltage	400V
Rated current (A)	144A
Voltage range	320V-460V
Rated frequency	50/60Hz
Frequency range	45-55/55-65Hz
THDI	<3%
Power factor	1.0 (0.8 leading ~ 0.8 lagging configurable)
AC configuration	Three-phase four-wire + ground (3W+N+PE)
Isolation transformer	270/400
<b>AC (off-grid)</b>	
Maximum power	110kVA
Active power	100kW
Rated voltage	400V
Rated current	144A
THDU	<2% linear
Rated frequency	50/60Hz
Overload capacity	110% long-term

<b>PV input</b>	
Maximum PV input voltage	1000V
Maximum PV power	120/180/240kW
MPPT voltage range	250VDC-850VDC
<b>Battery</b>	
Battery voltage range	420V-850V
Maximum charging power	120/180/240kW
<b>General data</b>	
Dimensions (width/depth/height)	1,200×800×2,050mm
Weight	936kg
Operating ambient temperature	-20°C ~ +55°C
humidity	0~95% (non-condensing)
Ingress protection grade	IP20
Noise	<70dB
Altitude	5,000m (Derating above 3,000m)
Standby power consumption	<30W
Cooling method	Air cooling
Display	Touch LCD display
BMS communication interface	RS485/CAN
Local communication	RS485, TCP/IP

## 4.2 Battery system

### 4.2.1 Composition of the battery energy storage system

The product is designed for energy storage in power systems, utilizing lithium iron phosphate batteries. The battery system features a modular design, making it easy to transport, install, and maintain.

Each module consists of 16 cells with a capacity of 280Ah. The internal integration of a BMS and thermal management design ensures the safety and intelligent management of the energy storage battery system. It can be combined with renewable energy generation, grid-side, and user-side applications for various energy storage functions such as peak shaving, frequency regulation, output smoothing, grid support, and peak shaving/valley filling.

### 4.2.2 Battery clusters

The battery cluster consists of 15 battery modules (15 sets of 1P16S modules) in series and 1 high voltage control box, with a power of 215.04kWh.

Table 10

No.	Name	Specification	Remarks
1	Battery module model	A16	
2	Configuration	15*(1P16S)	
3	Nominal capacity	280Ah@0.5C, 25°C	
4	Nominal voltage	768V (240cells)	Shipping capacity 40%SOC
5	Operating voltage range	600V~876V	Use out of range will damage the battery, and there will be safety risks
6	Maximum sustained charging ratio	0.6C@25°C	168A
7	Maximum sustained discharging ratio	0.6C@25°C	168A
8	Nominal weight	About 1,800kg	
9	Nominal energy	215.04kWh	25°C@0.5C rated
10	* Insulation standard	Battery box insulation resistance > 1MΩ (1,000VDC)	Refer to GB36276-2018
11	* Dielectric strength standard	3,110VDC, no breakdown or flashover occurs	Refer to GB36276-2018
12	Maximum charging voltage of a cell	3.65V	For any battery cell, use out of range will damage the battery, and there will be safety risks
13	Minimum discharging voltage of a cell	28	For any battery cell, use out of range will damage the battery, and there will be safety risks
14	Instantaneous maximum discharging current	280A@60S	Do NOT use exceeding the range. Use out of range will damage the battery, and there will be safety risks
15	Instantaneous maximum charging current	280A@60S	Do NOT use exceeding the range. Use out of range will damage the battery, and there will be safety risks
16	High-temperature protection for charging and discharging	> 55°C	Temperature of individual cells within a battery cluster
17	Low-temperature protection for charging and discharging	< 0°C	Temperature of individual cells within a battery cluster
18	Operating ambient temperature range (°C)	Charging 0°C ~55°C Discharging -20°C ~ 55°C	Do NOT use exceeding the range. Use out of range will damage the battery, and there will be safety risks.



## CAUTION

- The pre-charge voltage difference for multiple clusters should be  $\leq 30V$ .
- Multiple battery modules + 1 high-voltage box can be integrated into a battery system. The default maximum number of series connections for modules is 15. If exceeding the limit, the technical specifications must be confirmed with our Company. If not confirmed with our Company, we will not assume any responsibilities!
- For high salt fog (C4 and above), high temperature (ambient temperature  $>35^{\circ}C$ ), high humidity (humidity  $\geq 95\%$  or with condensation), high ultraviolet (UV index  $\geq 10$ ), and special environmental areas, customers must explicitly specify these conditions. If not specified, the product will be supplied as a standard product, and we will not assume any responsibilities for losses caused by the above environmental conditions!
- Maximum operating temperature range: charging:  $0^{\circ}C \sim 55^{\circ}C$ ; discharging:  $-20^{\circ}C \sim 55^{\circ}C$ . If operating after long-term low-temperature storage, the internal cell temperature must be  $T > 0^{\circ}C$  during charging, and sufficient heating should be maintained to reach the optimal cycling temperature of  $25 \pm 2^{\circ}C$ .
- Under no circumstances should the operating current of the battery module exceed 280A. Usage beyond this range may cause irreversible damage to the battery and pose safety risks. Any loss caused by such conditions is not covered under warranty.

### 4.2.3 Battery box introduction

I. The battery box contains a box, battery modules, fans, high-voltage connectors, slave control components, and more, as shown in Figure 1. Among them:

#### 1. Box:

- 1) Upper cover: provides basic protection for the battery box. Both sides of the cover are designed with air inlets.
- 2) Lower box: supports and installs the battery modules. The bottom is equipped with sliders to facilitate the sliding of the battery box on the battery rack.
- 3) Front panel: serves as the electrical connection interface. Both sides are equipped with mounting ears and handles. The mounting ears are used to secure the battery box and the handles assist operators in removing the battery box from the rack.

#### 2. Battery modules:

- 2 Two sets of 8S modules are installed in the battery box, connected in series, with a rated voltage of 51.2V and a rated capacity of 280Ah.

#### 3 High-voltage connectors:

The positive and negative connectors of the battery box are located on the left side of the front panel.

Orange represents positive and black negative. Connectors are connected to external cables or copper bars in the form of self-locking bolts. The connector is equipped with a protective cover. The protective cover must be placed on the connector base when the connector is not operating.

#### 4 Fans:

The fan is located in the middle of the front panel and exhausts air to discharge heat.

#### 5 Slave control components:

The slave control components comprise the slave board and its shell, which are installed on the right side

of the front panel. The slave control components collect voltage and temperature information from the battery modules and report the information through CAN communication.

6 Shielding plate:

The shielding plate is fixed on the mounting ears on the front panel of the battery box, providing physical protection for the connectors, wiring harnesses, and slave control components on the front panel.

The following figure illustrates the structure of the battery box panel:

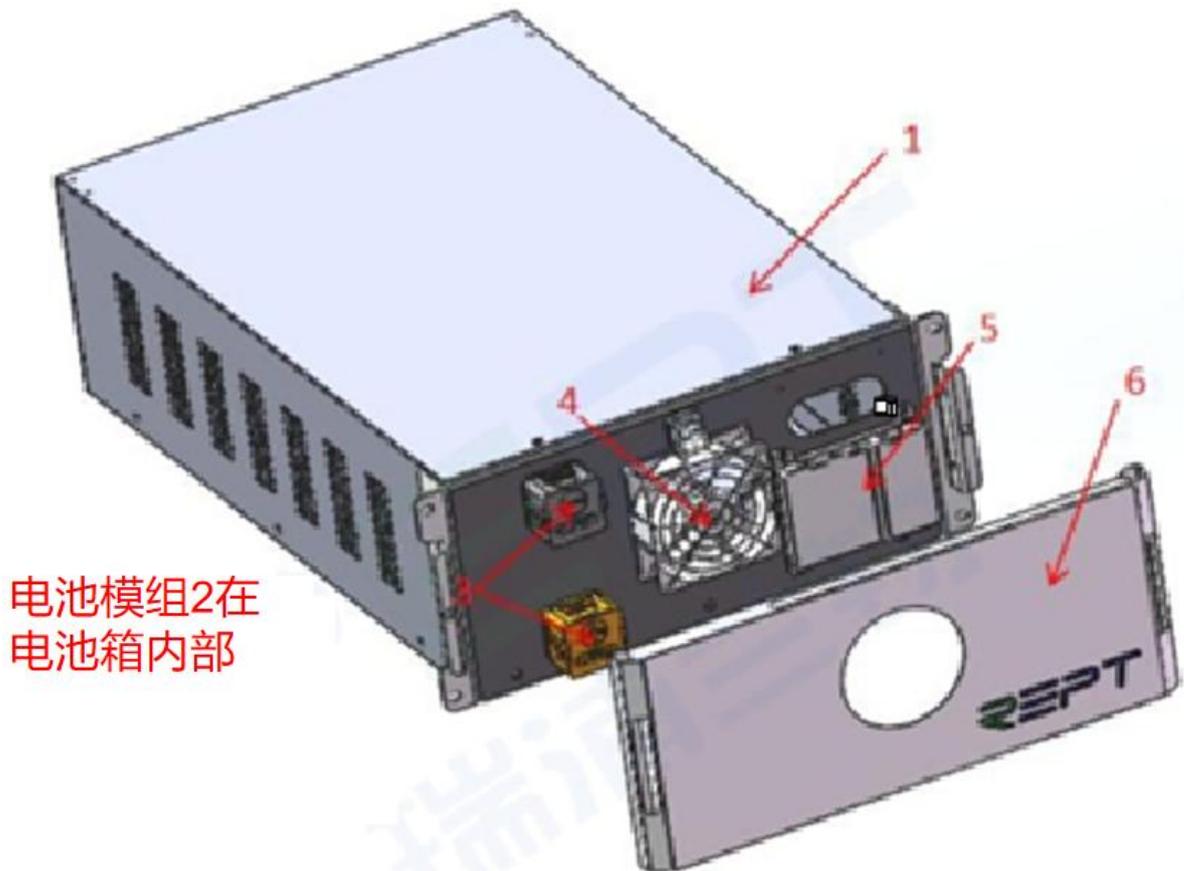


Figure 4.2 Schematic Diagram of the Battery Box Composition

II. Types of battery box:

The battery packs come in two types: Type A and Type B. The high-voltage connector of Type A box is positive on top and negative on the bottom; and the high-voltage connector of Type B box is negative on top and positive on the bottom. To facilitate series connections, the battery boxes housed in the same column of the battery rack shall be of the same category.

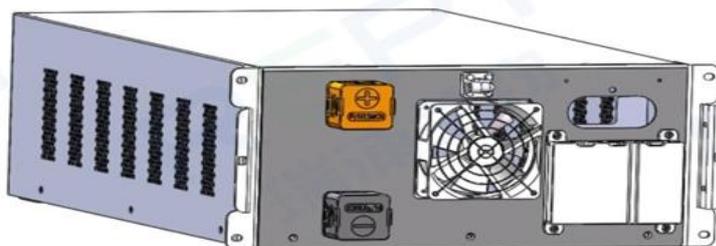


Figure 4.3 Type A Electrical Box

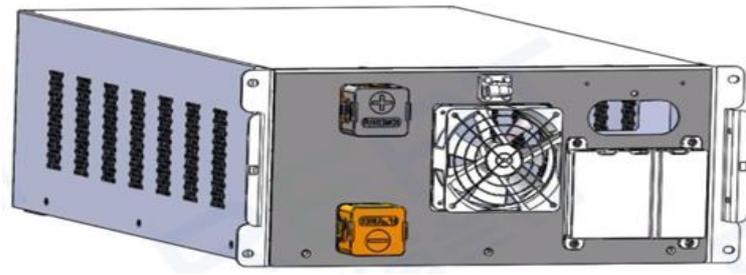


Figure 4.4 Type B Electrical Box

#### 4.2.4 Composition of a high-voltage box

The high-voltage control box comprises the box body, control circuit, and electrical components located on the front panel. Among them: 1. Box:

- 1) Upper cover: provides basic protection for the high-voltage box. Both sides of the cover are designed with air inlets.
- 2) Lower box: supports and installs the electric components. The bottom is equipped with sliders to facilitate the sliding of the high-voltage box on the battery rack.
- 3) Front panel: serves as the electrical connection interface. Both sides are equipped with mounting ears and handles. The mounting ears are used to secure the high-voltage box and the handles assist operators in removing the high-voltage box from the rack.

##### 2. Control circuit

The control circuit comprises the main positive relay, main negative relay, pre-charged relay, pre-charged resistor, fuse, and manual isolation switch. The connection is shown in Figure 4. The relays perform connecting and disconnecting actions according to the power-on and power-off logic of the BMS. The fuse is designed for external short-circuit protection. The manual isolation switch allows operators to manually connect or disconnect each cluster of high voltage.

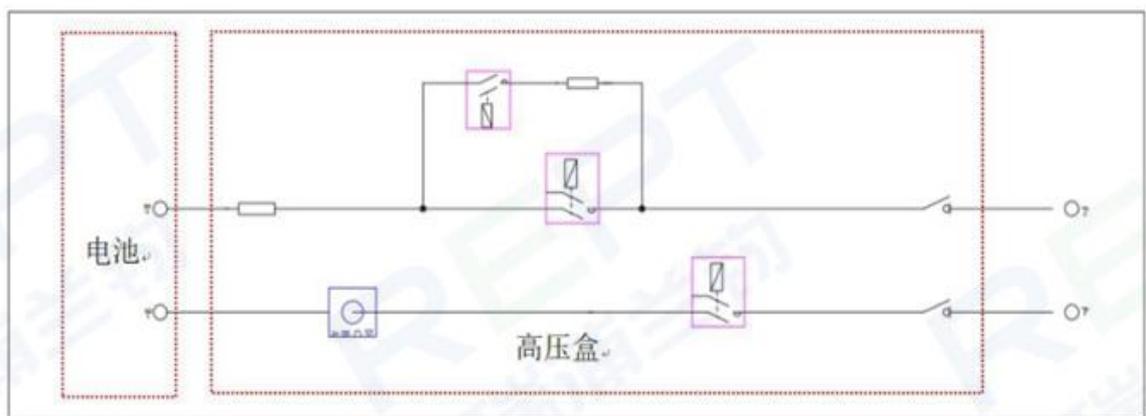


Figure 4.5 High-Voltage

##### Control Topology

3. Electrical components on the front panel:

- 1) High-voltage connectors (B+, B-, P+, and P-):

B+ and B- are high-voltage input connectors, which are connected to the total positive and total negative terminals after the battery box is connected in series; P+ and P- are high-voltage output connectors, which are connected to external charging and discharging devices such as PCS;

2) Low-voltage power on/off switch (QF):

The low-voltage power on/off switch is a miniature circuit breaker used to control the 24V power supply for the low-voltage system (e.g., BMS) within the battery cluster;

3) High-voltage power on/off switch (QS):

The high-voltage power on/off switch, also known as the manual isolation switch, is used to connect or disconnect the high-voltage output of the battery cluster. When disconnected, P+ and P- are de-energized;

4) Fan:

Used for cooling the high-voltage control box. The fan operation is controlled by the BMS strategy.

5) Low-voltage connectors (J1, J2, J3, J4, and J6):

J1: diagnostic interface, used for debugging;

J2/J3: communication interface between primary controllers, used for BMS communication between multiple clusters, connected in a daisy-chain manner;

J4: slave controller communication interface, used for BMS communication between the secondary-level master controller and slave controllers within the cluster;

J6: Fan power supply interface, used to supply power to the fans in each battery box within the cluster;

6) AC power connector (J5):

J5: AC auxiliary power interface. The power for the BMS system within the cluster is supplied through this interface from an external 220VAC source;

7) Indicators:

Alarm: alarm indicator; LV: low-voltage power-on indicator; HV: High-voltage power-on indicator.

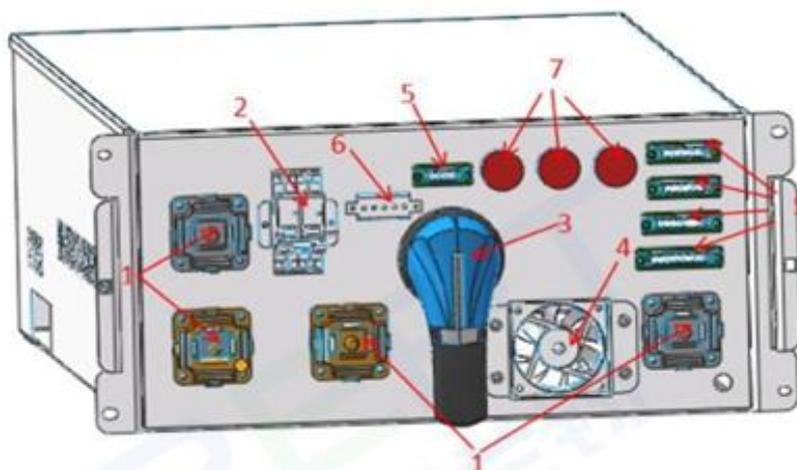


Figure 4.6 Schematic Diagram of the High-voltage Box

#### **4.2.5 BMS-BMU of the battery system**

Primary BMS – The BMU is located inside the battery module and is designed for monitoring battery-related information within the battery box, such as individual cell voltage, temperature, and the total voltage of each module. Each BMU collects data from one battery module and transmits the data to the BCMU (Battery Cluster Management Unit) via the CAN BUS. Additionally, the BMU performs cell balancing within the battery module based on commands issued by the BCMU.

#### **4.2.6 BMS-BCMU of the battery system**

Secondary BMS – The BCMU is located inside the high-voltage box and is designed for managing the battery cluster. It receives detailed data uploaded by the BMUs inside the battery rack, samples the total voltage and current of the battery cluster, and performs calculations and corrections for battery, SOC (state of capacity) and SOH (state of health). It manages the precharge and charge/discharge processes of the battery pack by controlling the contactor switches, balances the voltage between battery clusters, and uploads relevant data to the EMS via Modbus-RTU. 1 BCMU manages 1 battery cluster.

#### **4.2.7 BMS functions**

1. High-precision monitoring and reporting of battery analog data include real-time voltage detection of the battery cluster, charge/discharge current detection of the battery cluster, terminal voltage detection of individual battery cells, multi-point temperature detection of the battery pack, and insulation monitoring of the battery cluster.

2. Battery system operation alarms, local display, and reporting functions

It comprises an overvoltage alarm for the battery system, an undervoltage alarm for the battery system, an overcurrent alarm for the battery system, a high-temperature alarm for the battery system, a low-temperature alarm for the battery system, a leakage alarm for the battery system, a communication abnormality alarm for the battery management system, and an internal abnormality alarm for the battery management system.

3. Battery system protection functions

When the battery management system encounters analog parameters (voltage, current, temperature, etc.) exceeding safety thresholds, the BMS will perform fault isolation, remove the faulty battery cluster from operation, report the protection information, and display it locally and on the cloud platforms.

## 4.3 HVAC system

### 4.3.1 HVAC appearance and parameters

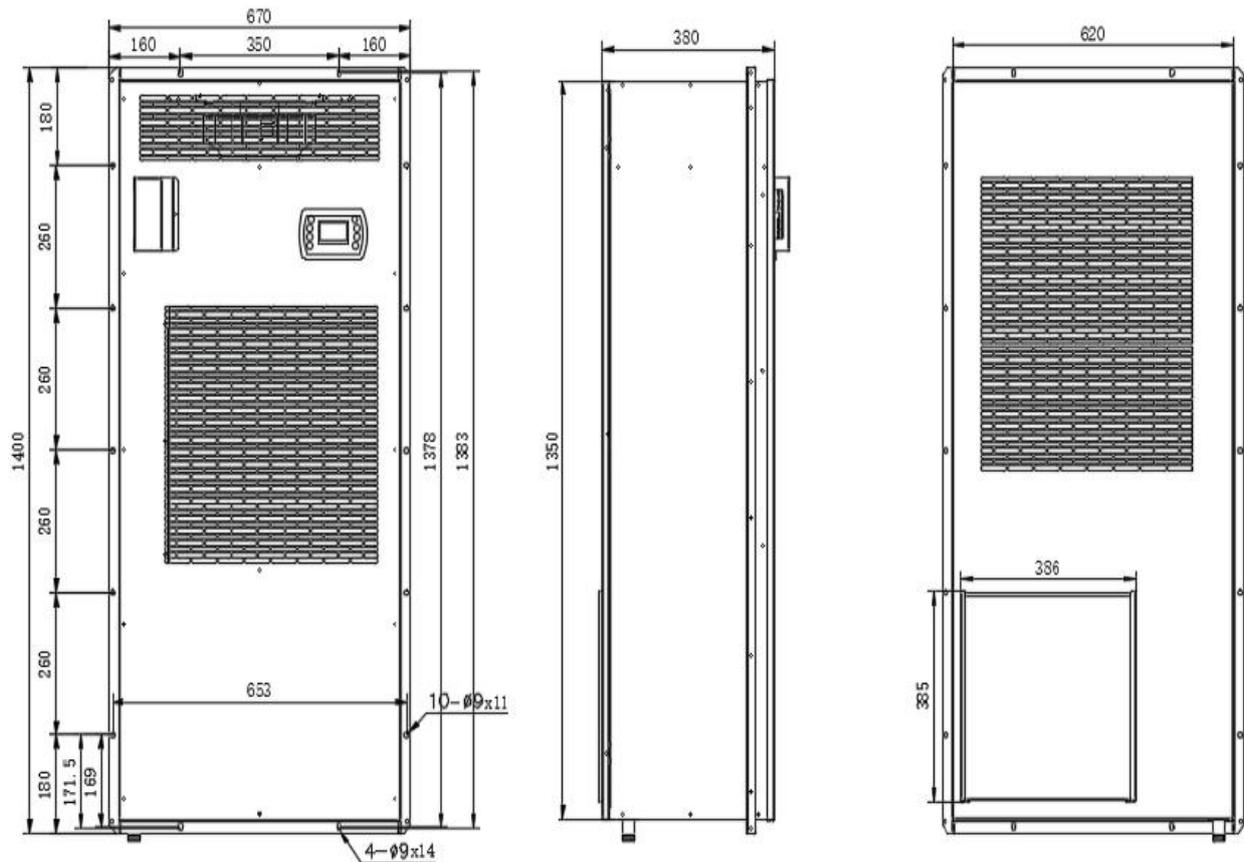


Figure 4.7\_HVAC Dimension Diagram

>As shown in Figure 4.7, this is an intelligent temperature control system. The system uses a wall-mounted integrated series HVAC to ensure a suitable temperature environment during high battery discharge rates. The selected HVAC model is suitable for scenarios where cabinet equipment generates significant heat, internal equipment is sensitive to environmental temperature, and complete isolation between internal and external equipment is required. This product is versatile, integrating external fan control and external HVAC interlock functions. It is highly reliable, easy to install, and ready to operate immediately after startup without complex debugging.

> The internal air circulation path absorbs hot air from the lower part of the HVAC and discharges cold air from the upper part into the air duct. The external air circulation path absorbs external cold air from the lower part and discharges hot air from the upper part after heat exchange.

> The temperature control system and the HVAC operation are fully automatically controlled based on the internal cabinet temperature. The controller detects the return air temperature inside the cabinet through an internal circulation temperature sensor and compares it with the set value to control the compressor or fan operation. It can also accept remote control from the EMS.



## WARNINGS

- Do NOT arbitrarily set HVAC operating parameters. Settings must be performed by professional technical personnel!
- If you have to set HVAC operating parameters, please carefully read the HVAC user manual to understand the settings before making any change!

**HVAC parameters:**

Table 13

Model	RVAC-50ZEDM
Dimensions (width/depth/height)	620 × 380×1,400mm
Dimensions (width/depth/height) (with Flange)	670×380×1400mm
Net weight	95kg
Installation method	Door-mounted
Application environment	Outdoor
Operating temperature range	-25°C ~ 55°C
Noise grade	65dB(A)
IP protection rating	IP55
Refrigerant	R134A
CE certification	Yes
Cooling capacity @ L27 (47%)/L35	5kW
Electric heating power	3kW
Refrigeration operating power	2kW
Maximum refrigerating current	10.7A
Maximum current (active dehumidification)	26.7A
Airflow volume	1,600m <sup>3</sup> /h
Power supply range	1PH, 220±10%, 50Hz
Communication port	RS-485 port, MODBUS-RTU communication protocol
Active dehumidification	Standard
Airflow direction	Upper side air supply, lower side air return

**The above specifications are for reference only. Actual products may vary.**

#### 4.4.2 HVAC functions:

> The operation of the HVAC is automatically controlled according to the temperature inside the cabinet. The controller detects the return air temperature inside the cabinet through an internal circulation temperature sensor and compares it with the set value to control the compressor or fan operation.

> Cooling start point = cooling point + return difference. When the temperature inside the cabinet exceeds the cooling start point, the cooling starts. When the temperature inside the cabinet is lower than the cooling point, the cooling stops.

Table 14

Parameters	Default value	Setting range	Unit	Setting point description
Cooling point	25	[15 ~ 50]	°C	Temperature point at which refrigeration operation stops
Return difference	2	[1 ~ 10]	°C	Sensitivity of temperature control

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

> Heating start point = heating point - return difference. When the temperature inside the cabinet is lower than the heating start point, the heating starts. When the temperature inside the cabinet is higher than the heating point, the heating stops.

Table 15

Parameters	Default value	Setting range	Unit	Setting point description
Heating point	15	[-15 ~ 25]	°C	Temperature point at which heating stops
Return difference	2	[1 ~ 10]	°C	Sensitivity of temperature control

> Dehumidification start point = dehumidification point + return difference. When the humidity inside the cabinet is higher than the dehumidification start point, dehumidification starts. When the humidity inside the cabinet is lower than the dehumidification point, dehumidification stops.

Table 16

Parameters	Default value	Setting range	Unit	Setting point description
Dehumidification point	75	[40 ~ 90]	%	Humidity point at which dehumidification stops
Return difference	8	[1 ~ 30]	%	Sensitivity of humidity control

#### 4.4.3 HVAC drain pipe installation:

1. Prepare the HVAC drain pipe and accessories; and prepare a Phillips screwdriver and Phillips round-head screws.



Figure 4.8\_HVAC Drain Pipe

2. Take out the HVAC drain pipe and locate the drain outlet on the HVAC. Slide the pipe clamp onto the drain pipe first, then connect the drain pipe to the outlet. Once connected, tighten the pipe clamp and adjust the drain pipe to the appropriate position for proper drainage.

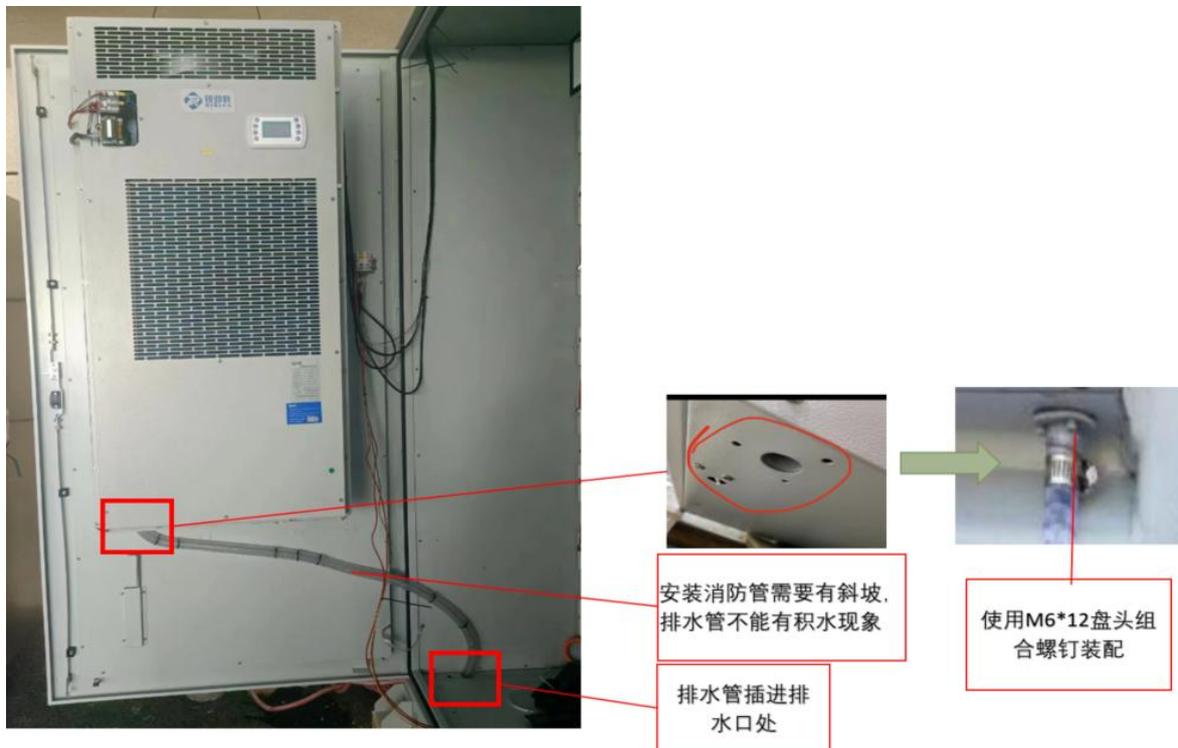


Figure 4.9\_Installation Position of Drain Pipe

3. After installation, ensure the drain pipe is properly installed and securely fastened.

## 4.5 Fire suppression system

The fire suppression system for the energy storage battery cabinet is installed inside the outdoor cabinet. It consists of three parts: the audible and visual alarm system, the perfluorohexanone fire suppression system, and the water-based fire suppression system. Perfluorohexanone is a colorless, odorless, toxic, and non-combustible chemical with excellent thermal stability and chemical stability. When perfluorophenone is sprayed onto a fire, it quickly evaporates and forms a colorless gas layer that isolates oxygen from the air and thus suppresses flame combustion.

The fire suppression device integrates the fire control unit, perfluorohexanone fire extinguishing agent and its control valve in the interior, and integrates the smoke detector, composite gas detector, cabin level fire suppression sprinkler, pack level connection pipe in the exterior, and displays the fire suppression data on the cabinet screen.

### 4.5.1 Detection and alarm system

The detection and alarm system can identify potential fire hazards at the very early stage, minimizing the likelihood of a fire. The system comprises thermal runaway composite detectors and audible and visual alarms. The composite detector is capable of detecting both temperature and gas concentration, and it triggers an alarm signal when the temperature or flammable gas concentration inside the outdoor cabinet reaches the alarm threshold. The alarm signal is transmitted to the EMS and MPS. Upon receiving the signal, the outdoor cabinet stops charging/discharging, and the audible and visual alarm is activated.

### 4.5.2 Fire extinguishing system

The fire extinguishing system of the energy storage battery cabinet is a perfluorohexone fire detection tube-based extinguishing device. When the control unit detects a thermal runaway hazard, it directly activates the fire extinguishing agent cylinder. The cylinder pre-fills the fire extinguishing agent into the fire detection tubes inside each module. The fire detection tubes are arranged along the safety valves of the battery cells. When the safety valve of a lithium battery is opened, the high temperature instantly melts the fire detection tubes, releasing the extinguishing agent onto the safety valve of the thermal runaway cell. This method delivers higher cooling efficiency and faster fire suppression. At the same time, a signal is sent to the EMS, causing the system to shut down while retaining power for fire suppression purposes. When the temperature inside the battery compartment reaches  $\geq 65^{\circ}\text{C}$ , the fire extinguishing agent cylinder and compartment-level control valve are activated. The extinguishing agent is released through compartment-level nozzles to ensure the suppression of external electrical fires.

### 4.5.3 Anti-misoperation function

Whether it is a flammable gas warning or a BMS warning linkage, the timeliness of response is critical against lithium battery fires. While pursuing fast response, the reliability of the system is compromised. Therefore, the design of the device must consider the possible false activation signals under high-sensitivity detection and linkage conditions. This device is designed with a 0-delay warning linkage activation, but it also comes with an anti-misoperation function to prevent false starts. If the fire suppression device is accidentally activated, pressing the "FIRE EMERGENCY STOP" button on the front door of the energy storage cabinet will stop the release of the fire extinguishing agent into the battery compartment and battery packs.



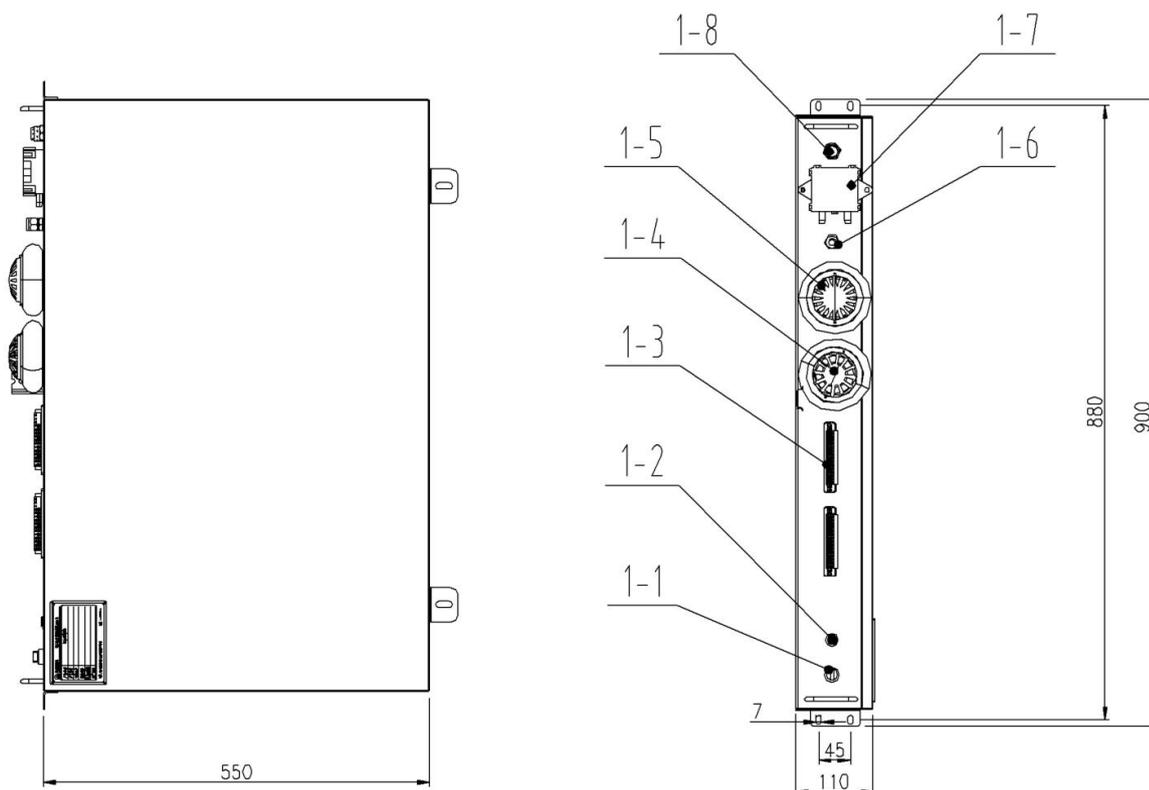
Figure 4.10\_Fire Suppression Emergency Stop Button

#### 4.5.4 Water-based fire suppression system

In addition to the fire suppression system, the integrated energy storage cabinet is equipped with a backup water-based fire suppression system to prevent the spread of fire in case the primary extinguishing system fails to fully control it. Water-based fire suppression pipes are installed inside the battery compartment, equipped with temperature-sensitive glass bulbs. If the gas-based fire extinguishing system fails to suppress a lithium battery fire, the water-based fire suppression valve (located outside the energy storage cabinet, at least 10 meters away) can be manually opened. When the temperature inside the battery compartment rises to the threshold of the glass bulb (68°C or 79°C optional), the fire suppression water is sprayed directly from the nozzles.

Fire suppression pipe pressure: 1.8 MPa.

#### 4.5.5 Layout diagram of the fire suppression system



1-1 debugging switch button, 1-2 power switch, 1-3 terminal block, 1-4 smoke detector, 1-5 temperature sensor, 1-6 pack-level output pipe, 1-7 composite gas sensor, 1-8 compartment-level nozzle

Figure 4.11\_Schematic Diagram of the Fire Suppression System

#### 4.5.6 Control logic diagram

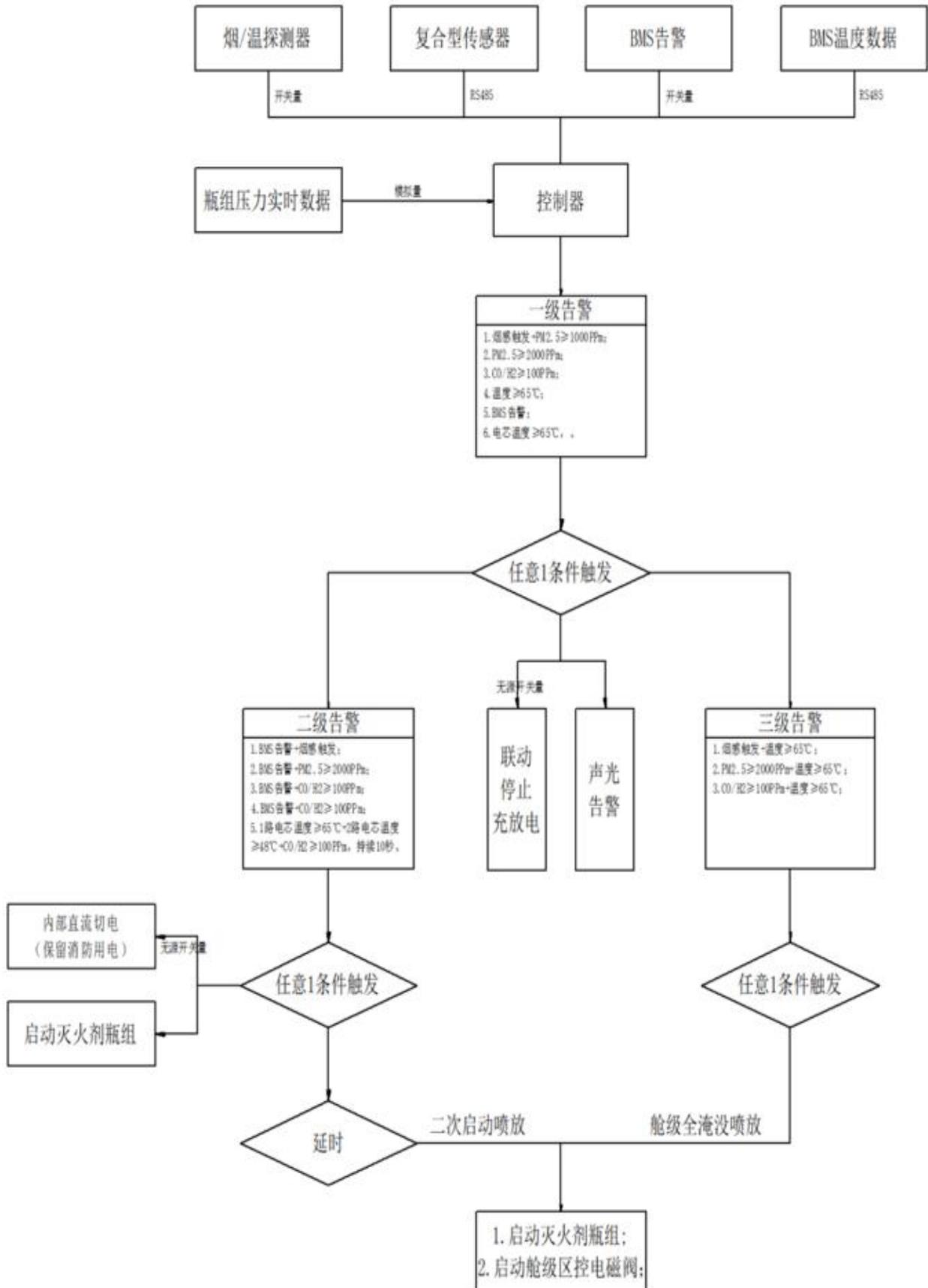


Figure 4.12\_Control Flow Diagram of the Fire Suppression Device

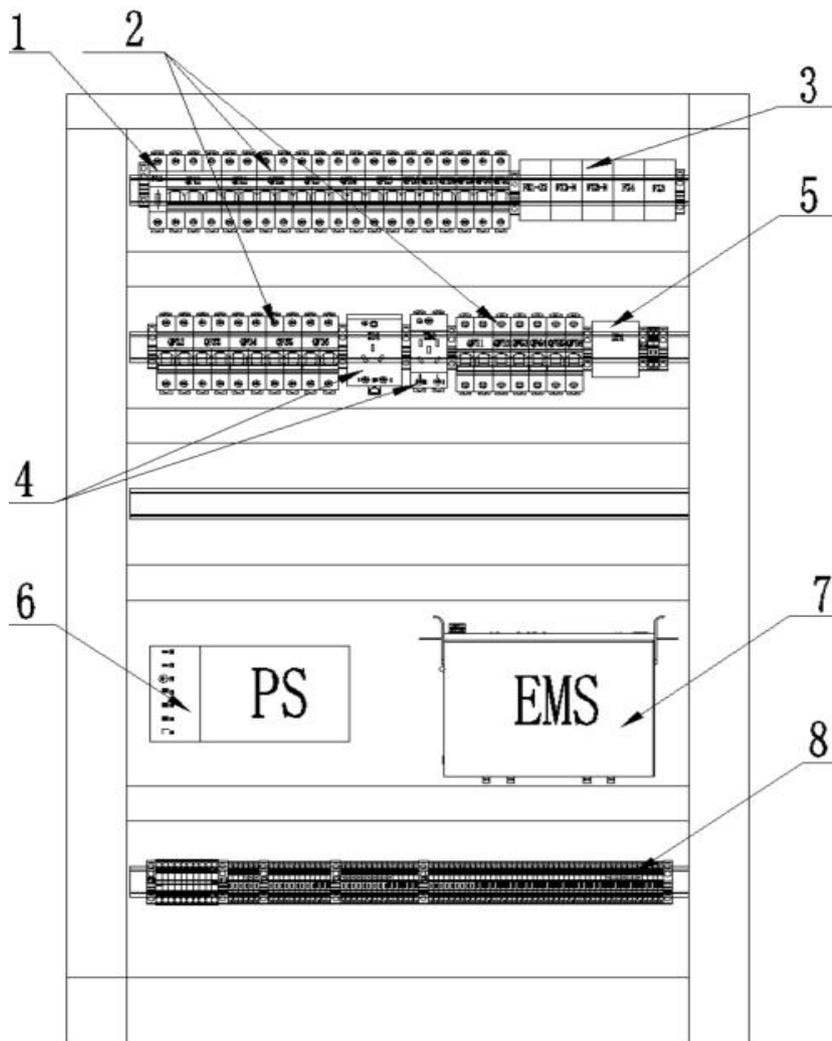
**Technical parameters of the perfluorohexanone device:**

- ◆ Model: YFJ-10/2.5-JA-02
- ◆ Service life: 15 years
- ◆ Activation method: electric activation/thermal activation
- ◆ Storage temperature: -10°C~ +50°C
- ◆ Protected space  $\leq 4.5\text{m}^3$
- ◆ Perfluorohexanone capacity: 5L×2

**4.6 Auxiliary power supply system**

The auxiliary power supply system integrates components such as circuit breakers, AC/DC power switches, UPS (Uninterruptible Power Supply), terminal blocks, and more. Figure 4.13 shows the layout diagram of the electrical installation board.

Figure 4.13\_



Layout Diagram of the Electrical Installation Board

Table 18

No.	Name
1	Fuse
2	Circuit breaker
3	Terminal junction box
4	Maintenance socket
5	Temperature and humidity sensor
6	AC/DC power switch
7	EMS
8	Terminal block

Note: This equipment is part of the power distribution control system. Only personnel with relevant professional knowledge should operate it.

#### 4.6.1 UPS power supply equipment

The UPS provides an ideal, uninterrupted, and high-quality power supply for critical components such as the Fire suppression system, the EMS, the BMS main control, and other important circuits. It is equipped with an LCD display located on the front panel of the case. The control panel allows users to operate the UPS, view its operating status, set parameters, and check alarms. Moreover, it also provides multiple functional interfaces for ease of operation by customers, as shown in the following figure:

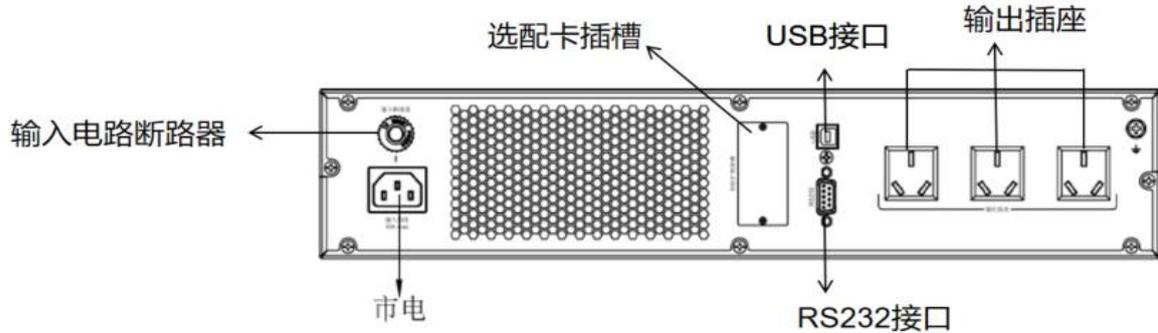


Figure 4.14\_Rear View of UPS

UPS specifications and model: UPS2000-G-1KRTS, 1kVA, built-in 800W battery

#### 4.7 EMS controller

The EMS controller integrates data collection from all local devices, efficient remote service management, and local control strategies. It serves as the core of the microgrid system, enabling unified management of the microgrid system, including centralized monitoring of operating parameters, alarm management, and historical data storage. Additionally, the EMS controller integrates with a big data cloud platform to provide advanced functionalities such as intelligent operation and maintenance, big data analysis and processing, trend prediction, fault prediction, and optimization of operating strategies.

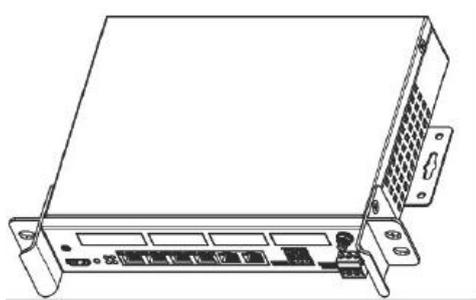


Figure 4.15\_EMS Controller

##### 1. Data collection:

- 1) Collect and display converter-related parameters, including: voltage, current, DC-side parameters, three-phase active power, reactive power, frequency, operating status, alarm and fault information, and other common inverter data.
- 2) Collect and display battery-related parameters, including total battery voltage and current, maximum/minimum temperature of individual cells, maximum/minimum voltage of individual cells, SOC, SOH, fault, and alarm information.
- 3) Collect and display environmental data from the outdoor cabinet, such as temperature, humidity, and other environmental parameters.
- 4) Display alarm information from auxiliary devices in the outdoor cabinet, such as HVAC, access control, water sensors, and other safety equipment.

##### 3. Database management:

Supports functions such as real-time data views, historical data views and historical event views, as well as data report printing, and event and log management. Allows users to view equipment operating conditions, modification records of important parameters, and fault/alarm event information at any time.

#### 4. User permission management:

Default users only have access to view system data. Any change to operating modes or parameters requires access confirmation.

#### 5. Energy management:

Based on project requirements, the converter is equipped with standard operating strategies such as self-consumption, peak shaving/valley filling, and battery priority modes.

#### 6. Cloud monitoring:

The EMS controller is equipped with a 4G communication interface, enabling data transmission to both the local EMS backend and the existing EMS cloud platform. Users can monitor the system's operating status through the cloud platform.

#### 7. HMI:

The system can provide both local and remote HMI capabilities, including but not limited to real-time data monitoring, historical data query, alarm and fault information query, equipment control, parameter value setting interfaces

#### 8. Specifications and parameters

Specifications	Parameters	Remarks
<b>Product name</b>	EMS controller	WL-EMS-1000
<b>Wireless network</b>	4G full netcom	Supports 4G Cat.1 or 4G Cat.4 for full network compatibility
<b>Power supply</b>	DC24V/1A or DC12V/2A	Reference power supply range: DC12~48V
<b>Operating power</b>	10W	Full load operation <15W
<b>Hardware parameters</b>	ARM industrial-grade CPU	4-core 1.8GHz
	8GB EMMC storage	Onboard 8GB FLASH
	2GB LPDDR4	Onboard 2GB RAM
	256GB hard drive	Onboard 256GB hard drive
	Rack dimension	25.7 x 18.5 x 4.5cm (L x W x H)
	Host dimension	21 x 16.5 x 4.5cm (L x W x H)
	Approximate weight	Around 2kg
<b>Communication Interfaces</b>	Ethernet	There are 6 ethernet ports, including: 2 WAN ports, 10/100/1000M self-adaptive 4 LAN ports, 10/100M self-adaptive
	Industrial serial ports	8 RS485 ports
	CAN bus	2 ports
	DI	16 ports
	DO	8 relay output channels, including: 2 normally closed, and 6 normally open
	4G antenna interface	1 x 4G antenna interface (50Ω/SMA female connector)
	TF card slot	1 x standard TF card slot
	SIM card slot	Built-in SIM card slot, micro card (supports optional

	USB interface	2 x USB 2.0 interfaces (can be used for touchscreen)
	HDMI interface	1 x HDMI interface (for external display)
	Type-C interface:	DEBUG serial port for debugging
	Grounding screws	Grounding connection
	Buttons	Reset buttons
	Indicators	LED Indicators (PWR, RUN, NET, WiFi)
<b>Others</b>	MTBF	>100,000 hours
	Operating temperature	-20°C ~ 60°C
	Storage temperature	-40°C ~ 85°C
	Operating humidity	≤ 95%RH (no condensation)

## 5 Mechanical Installation

### 5.1 Space requirements

In installing the product, sufficient and appropriate distance must be set aside from walls and other equipment to meet the requirements for maintenance of access, escape routes, and ventilation.

Figure 4.16 illustrates the space requirements for the normal operation of the outdoor cabinet energy storage system. If site conditions allow, it is recommended to choose a larger spacing to ensure the reliable and efficient operation of the product.

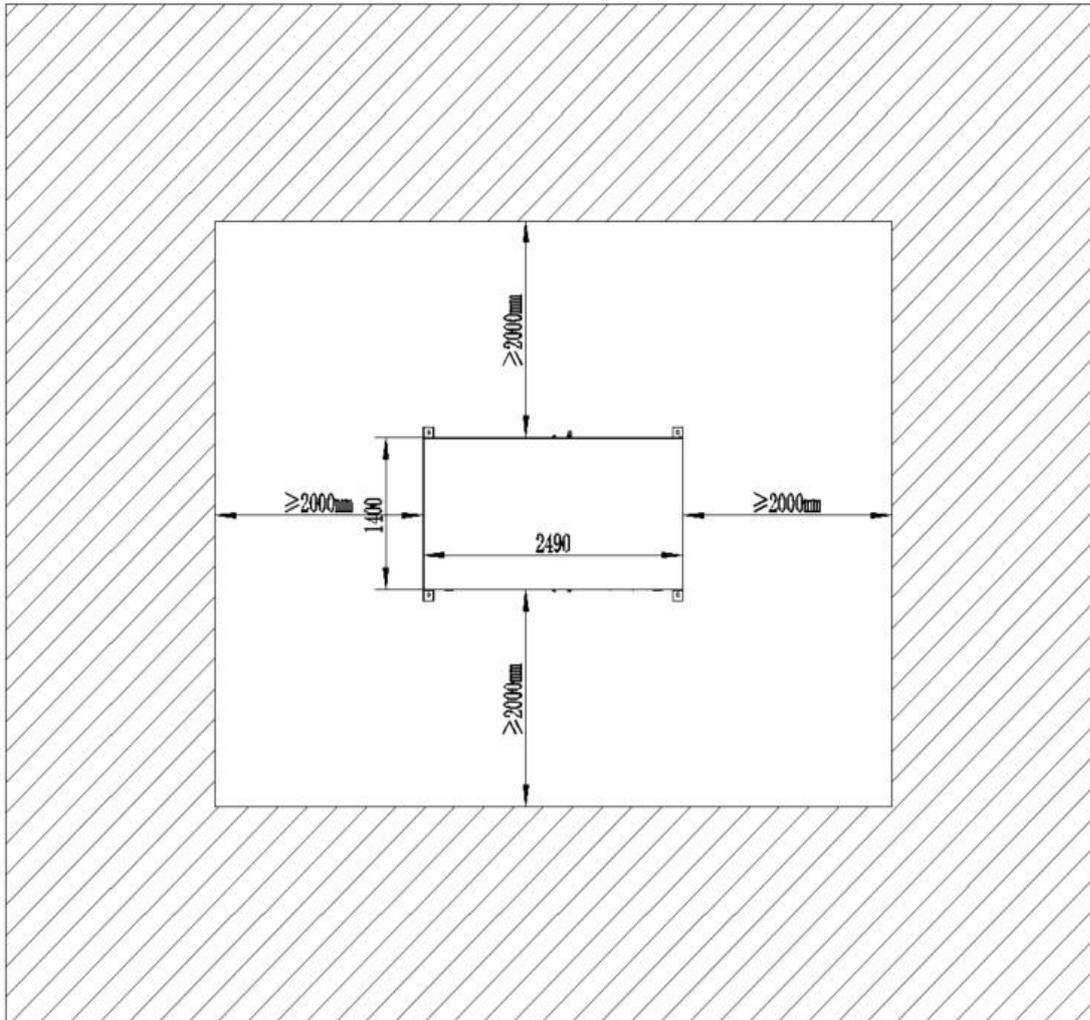


Figure 5.1 \_ Installation Space Dimensions

## 5.2 Foundation construction

### Siting for installation

When siting for installation, please adhere to the following principles:

- ◆ Fully consider the climatic environment and geological conditions (e.g., stress wave emission, groundwater level) of the installation site.
- ◆ The surrounding environment should be dry, well-ventilated, and away from flammable or explosive areas.
- ◆ The soil at the installation site requires a certain degree of compactness. It is recommended that the relative compactness of the soil be  $\geq 98\%$ . If the soil is loose, make sure to stabilize the foundation.
- ◆
- ◆ The height of the foundation should be higher than that of the local flood. The foundation adopts a reinforced concrete structure with embedded steel plates to facilitate the installation of the outdoor cabinet.
- ◆ Steel plates must be pre-embedded at the standard positions indicated in the drawings, and the outdoor cabinet can be connected to the steel plates (either by welding or twist locks).
- ◆ All plane tolerances are  $\pm 5\text{mm}$ .

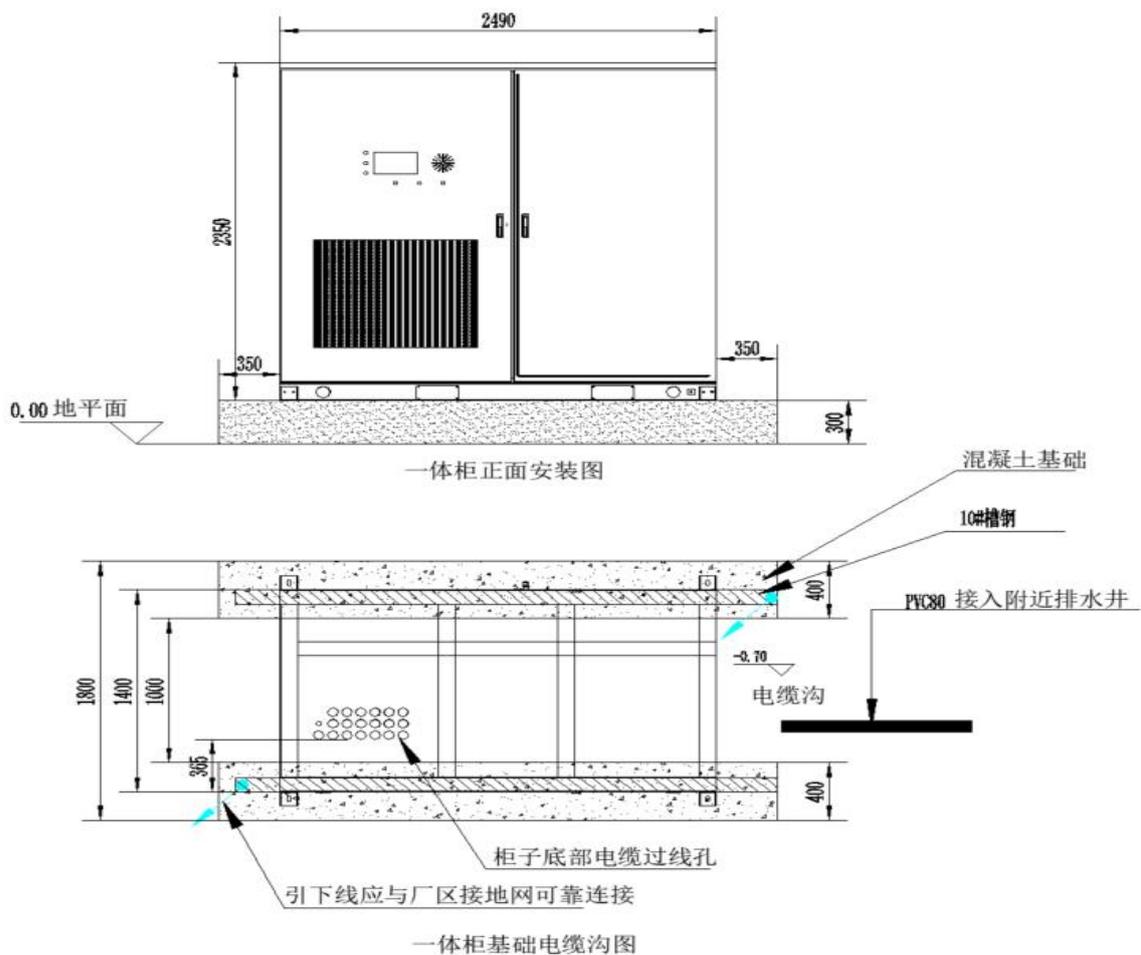


Figure 5.2\_ Foundation Reference Diagram 1

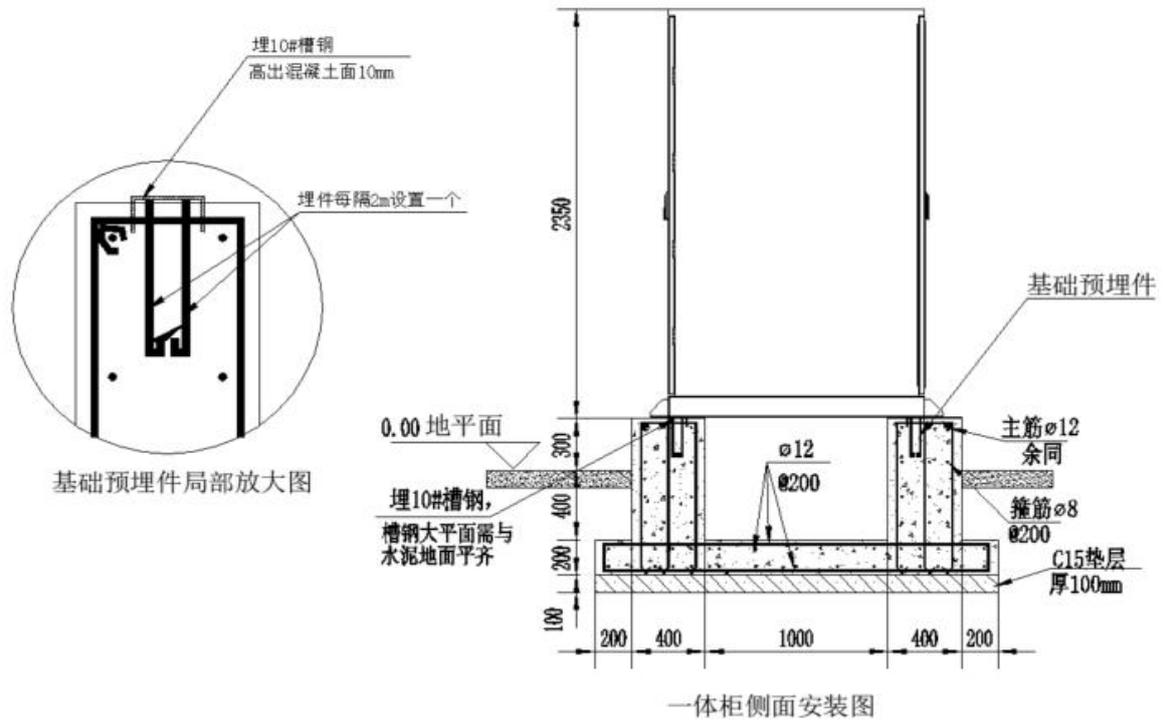


Figure 5.3 Foundation Reference Diagram 2 (Refer to the project foundation drawing for actual details)

## 5.3 Condition for transportation

>The various equipment housed in the outdoor cabinet energy storage system is pre-installed and fixed before delivery. It can be transported using only bottom lifting and forklift transportation.



### WARNINGS

Throughout loading, unloading, and transportation, the safety regulations for outdoor cabinet energy storage system operations of the country/region where the project is located must be followed!

- Both the outdoor cabinet energy storage system and any tool used in the operation shall be maintained.
- All personnel involved in loading, unloading, and securing shall receive appropriate training, especially in safety.

#### **The following conditions must be met for transporting the outdoor cabinet energy storage system:**

All doors of the outdoor cabinet shall be locked securely.

Based on site conditions, select a suitable forklift or lifting tool; the chosen tool must have a sufficient load-bearing capacity, arm length, and rotation radius.

Additional traction devices may be required if moving on slopes, etc.

Clear all existing or potential obstacles (e.g., trees, cables) during the moving process.

Transportation shall ideally be carried out under favorable weather conditions.

Warning signs or caution tapes must be set up to prevent unauthorized personnel from entering the lifting and transportation area against accidents.

## 5.4 Forklift transportation

If the installation site is flat, a forklift can be used to move the outdoor cabinet. The bottom of the outdoor cabinet is equipped with dedicated forklift slots for transportation. The outdoor cabinet can be moved using these forklift slots.

#### **If the forklift transportation is used, the following requirements shall be met:**

1. The forklift must have a sufficient load-bearing capacity (at least 5 tons).
2. The forklift forks shall measure more than 1,600mm in length.
3. The forks shall be inserted into the forklift slots at the bottom of the outdoor cabinet (refer to the figure below for the position of the forklift slots). The depth of fork insertion shall match the depth of the slots, which is 1,600mm.
4. The transportation, movement, and placement of the outdoor cabinet shall be done slowly and steadily.
5. Place the outdoor cabinet on a flat and stable surface, which shall be well drained and free of any obstacle or bump. The outdoor cabinet shall be fixed using its 6 bottom corner fittings.

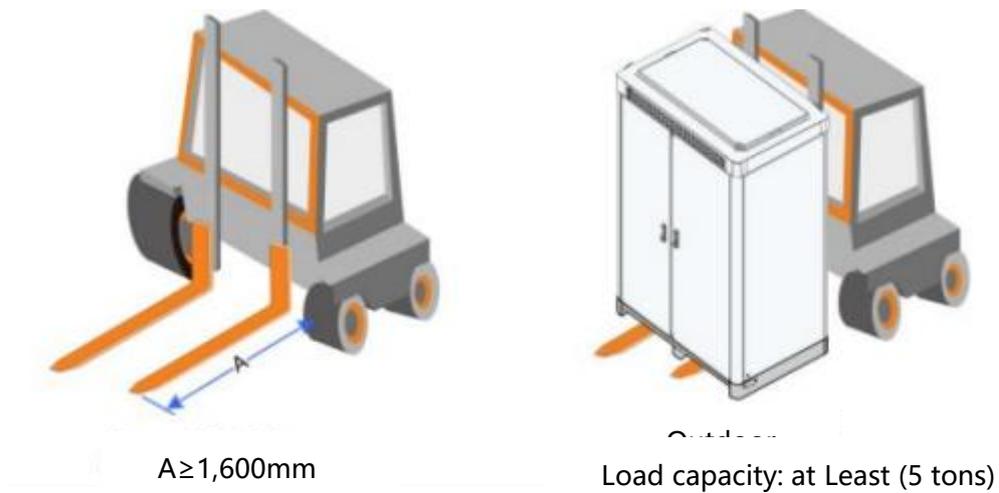


Figure 31\_Forklift Transportation



## WARNINGS

- Throughout the transportation, the safety operating procedures for forklifts and cranes must be strictly followed.
- No personnel are allowed within a 5m ~ 10m range of the operating area. No standing under the lifting arm or the machine being lifted or moved against casualties.
- In case of severe weather conditions (e.g., heavy rains, fog, strong winds, etc.), operation must be stopped immediately.

## 6 System Installation

### 6.1 Precautions

Installation must be performed by professionally trained personnel.

Read this Manual carefully before installation and use. If the equipment is damaged due to failure to follow this Manual, our Company reserves the right to deny warranty claims.

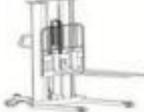
Adhere to product safety regulations and ensure installation is performed with power OFF.

High voltage exists inside the product. Unauthorized personnel are prohibited from approaching, operating, or touching the equipment against the risk of an electric shock.

### 6.2 Tool preparation

#### Installation tools

Before wiring, prepare at least the following tools and components:

	m / 270 kgf.cm)	cm)	
			
2	扭矩限制器	与扭矩扳手一起使用	
3	六角头	握住托盘架(4毫米尖端)	
4	刀	开箱	
5	叉车	交付机架, 托盘和开关设备	
6	托盘升降机	运输托盘	
7	绝缘扭力扳手	用于安装大电流电缆	

 <p>注意</p>	<p>Use insulated tools to prevent accidental electric shocks or short circuits. If insulated tools are unavailable, wrap the metal surfaces of the tools with insulating tape before use.</p>
---	---

### 6.3 Environmental requirements

- ◆ The installation area shall be clean and tidy.
- ◆ The installation location must support the weight and dimensions of the product.
- ◆ Install the product on a solid, flat surface; and do NOT tilt or shake it.
- ◆ The installation area shall not be excessively humid to ensure optimal operating conditions.
- ◆ Do NOT install the product near flammable or explosive materials.

### 6.4 Cabinet grounding

#### Grounding method:

Lightning protection and grounding for outdoor cabinets serve as an important measure to ensure the safe use of outdoor cabinets in lightning weather conditions. Proper installation of the grounding device, proper grounding of the outer wall of the outdoor cabinet, proper deployment of the grounding system, and regular testing and maintenance can reduce the risk of lightning strikes on the outdoor cabinet and secure personnel and goods. Therefore, when the outdoor cabinet is used, attention should be paid to the outdoor cabinet. Lightning protection and grounding method: You can make lightning rods in the building above the top of the outdoor cabinet and then just leave the top exposed. Extend the grounded portion downward with an insulated pipe, not in contact with the cabinet. Do Not install lightning rods directly on the top contact surface of the outdoor cabinet.

After the outdoor cabinet is placed and fixed according to the infrastructure requirements, locate the ground position on the front and back of the outdoor cabinet shell, and connect it with 40x4mm galvanized flat steel. Connect one end of the galvanized flat steel to the copper block (M10x30) grounded on the outdoor cabinet shell, and connect the other end to the ground grid.



外壳接地: 40x4镀锌扁钢



Figure 6.1 \_ Outdoor Cabinet Front Grounding Icon

Figure 6.2 \_ Cabinet Shell Grounding Diagram

## 6.5 Internal equipment

### 6.5.1 Battery box/high-voltage box installation

For safety during transportation, the battery packs and DC/DC modules are disassembled and packed separately before shipment. (If the battery packs are not disassembled, skip the following steps.)

#### 1. Battery box inspection:

Check the battery delivery list to confirm the correct model and quantity. Inspect the wooden box for visible damage.

#### 2. Battery cluster installation list:

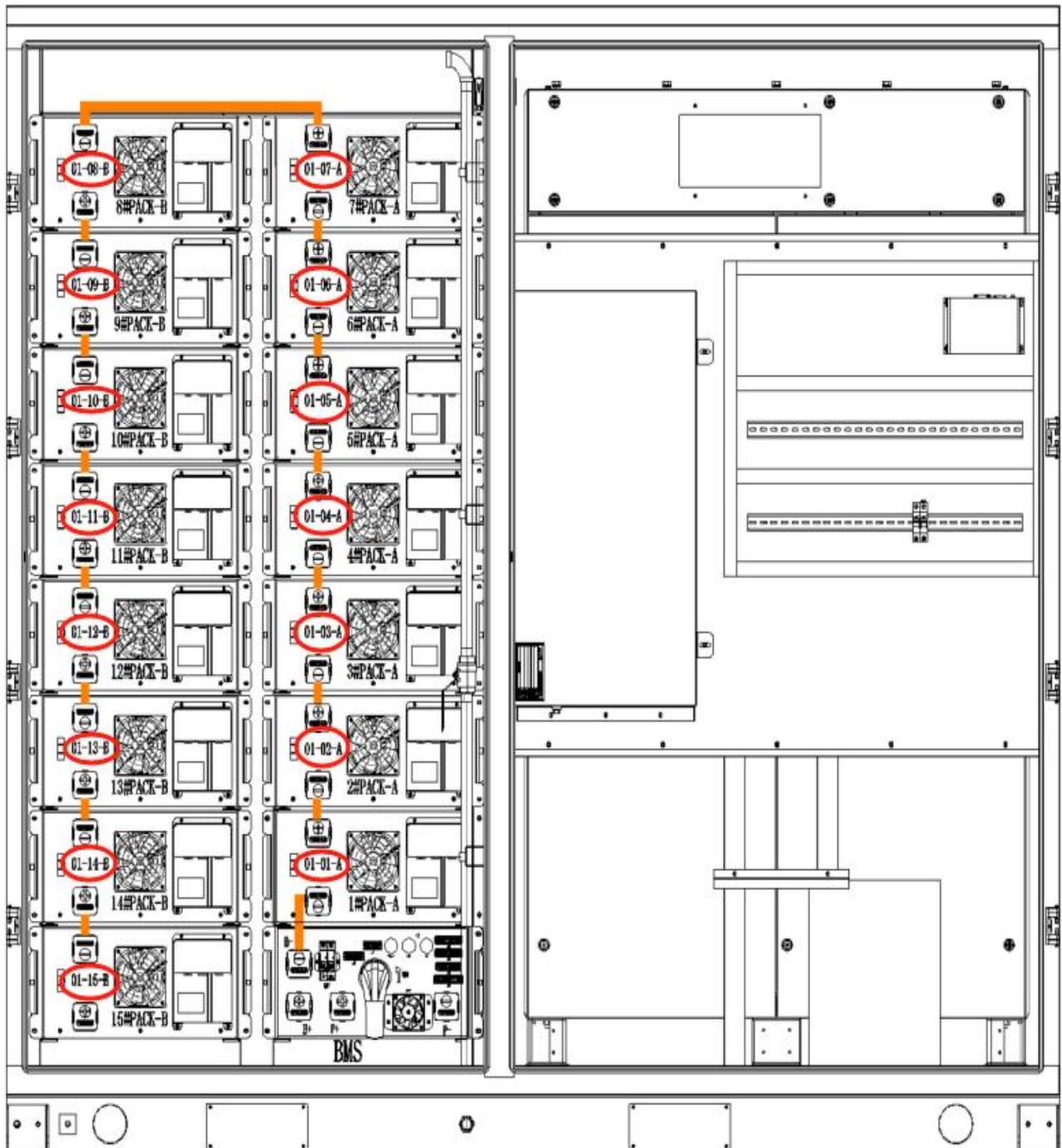
No.	Part name	Illustration	Quantity	No.	Part name	Illustration	Quantity
1	Battery rack		1	5	High-voltage box		1
2	Battery pack A		7	6	Series copper rows (among battery packs)		13
3	Battery pack B		8	7	Series copper rows (Between battery packs: 7# Pack A to 8# Pack B)		1
4	Shielding plate		15	8	Series copper rows (Battery pack connected to high-voltage box)		1

3、The required fasteners are as follows:

序号	零件名称	图示	数量	备注
1	六角法兰面螺栓 M5×16		64	用于电池箱和电池架的固定 (推荐扭力 4.7NM±0.5)
2	六角法兰面螺栓 M8×16		34	用于串联铜排和电池箱输出极的固定 (推荐扭力 14NM±1)
3	扎带和杉树形固定头装配件		40	安装在电池架上，用于固定高低压线束

## 6.5.2 Battery box/high-voltage control box installation

1. The battery box/high voltage control box is installed into the battery rack from the front side, please ensure that there is enough space for operation on the front side (recommended  $\geq 1.5\text{m}$ , if using an electric forklift for the installation, it is necessary to consider the forklift's movement and turning space);



2. Ensure the right numbering sequence of the battery boxes during installation. For standard battery racks, the number-position correspondence is shown in Figure 6.3:

Figure 6.3\_Number-Position Correspondence

Notes:

1) The serial number of the battery can be identified according to the label content on the front panel of the battery

box, e.g., 01-05-A indicates Cluster 01, Box 05-A.

3. After the battery module is unpacked, check that the shell is intact, the bolts are fastened, and the protective covers of the positive and negative output terminals are in place. After the installation state is checked OK, it can be transported to the climbing forklift by crane or manual handling:
4. After the battery module is lifted to the designated position by the climbing forklift, slowly push the battery box into the corresponding position of the battery rack.

Notes:

- 1). The installation sequence for the battery box/high-voltage box is from top to bottom to ensure that the forklift gears will not interfere with the lower battery box;
- 2).  Transport the battery module to the position where the bottom of the battery module is in contact with the L-shaped guide rail of the bracket, and then push the battery module in. Do Not leave a gap between the slotting teeth and the L-shaped guide rail to ensure that the bottom of the battery is solidly supported during the push-in process to prevent falling;
5. After pushing it in place, each battery box needs to be securely locked to the battery frame with 4 hexagonal flange bolts M5×16, and the recommended torque is  $4.7\text{NM} \pm 0.5$ , as shown in Figure 6.4;

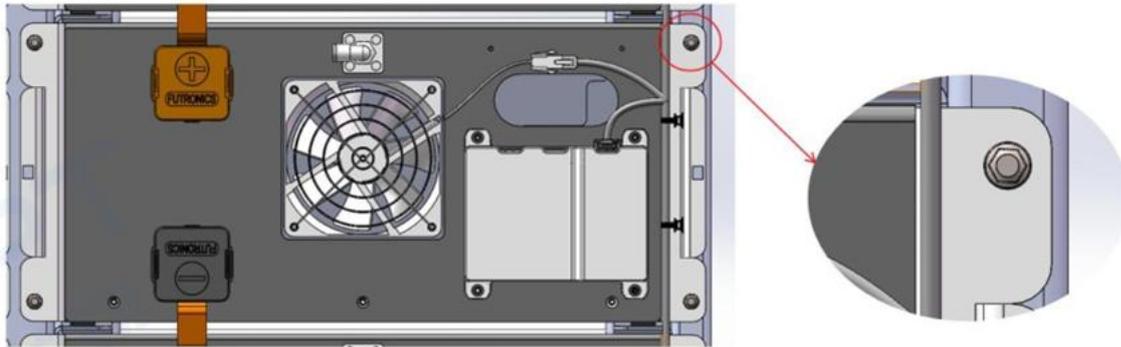


Figure 6.4\_ Battery Box Fastening Diagram

## 6.5.2 MPPT controller installation

Due to transportation vibrations, the DC/DC module in the MPS is disassembled and packed inside the outdoor cabinet. Check the module quantity against the delivery list.

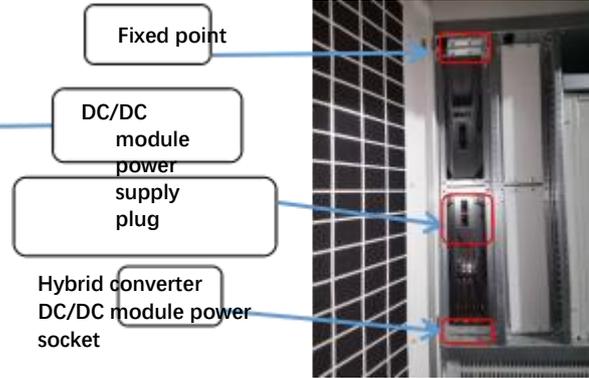
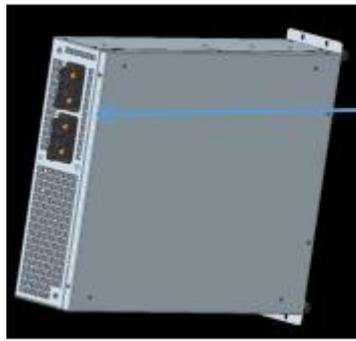


Figure 6.5\_ DC/DC Module

Figure 6.6\_ Chassis Fixing Points Diagram

**Installation steps:**

1. Use a torque wrench to remove the screws from the DC/DC module fixing points in the MPS.
2. Unpack the DC/DC module and lift it to the corresponding height of the MPS.
3. Align the bottom of the DC/DC module with the rail surface of the MPS.
4. Align the power plug of the DC/DC module with the power socket of the MPS. Slowly push the power plug of the DC/DC module horizontally to the fixed point of the MPS. Then, fine-tune the module until the mounting hole of the module is aligned with the threaded hole of the fixed point of the MPS.
5. Tighten the module using the provided bolts, as shown in Figure 6.6.
6. Repeat the steps to install the next module.



Figure 6.7\_Complete Module Installation Diagram



警告

1. Do NOT place the DC/DC module on the ground randomly. Make sure the right power plug position during installation.
2. PCS MPS does not require DC/DC module installation.
3. The DC/DC module must be carried and assembled by two persons. Avoid forceful installation.

## 7 Electrical Connection

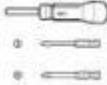
### 7.1 Safety precautions

Throughout electrical connection process and any other operation on the outdoor cabinet energy storage system, always adhere to the following rules:

1. Disconnect all external connections to the outdoor cabinet energy storage system, as well as connections to internal power supplies.
2. Ensure all disconnection points cannot be accidentally re-energized.
3. Use a multimeter to confirm that the equipment is completely de-energized. Measure the high-voltage box to ensure it is non-conductive.
4. Ground the outdoor cabinet energy storage system.
5. Insulate any potentially live part using insulating materials during operation.

### 7.2 Wiring preparation

#### 7.2.1 Tools required before wiring

				
Electric screwdriver	Torque socket tool	Torque spanner	Diagonal pliers	Wire stripper
				
Torque screwdriver	Rubber hammer	Utility knife	Wire cutter	Wire crimper
				
Cord end terminal wire crimper	Disassembling tool	Cable tie	Vacuum cleaner	Multimeter
				
Marker pen	Tape measure	Spirit level	Hydraulic plier	Heat shrink tubing
				
Heat gun				

### 7.2.2 Protective tools

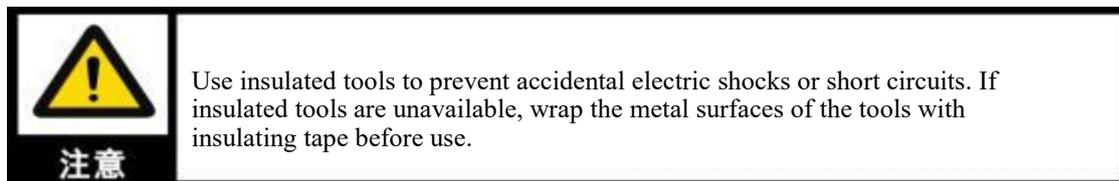
It is recommended to use the following protective tools during wiring:



Figure 7.1\_ Protective Tools Diagram

### 7.2.3 Inspecting copper rows and cables

1. Before making electrical connections, check the integrity and insulation of all copper rows and cables. Replace any damaged cable immediately. Poor insulation or damaged cables may pose hazards.
2. All internal wiring between devices in the energy storage system has been completed before delivery.
3. Users shall inspect the connection cables are intact. If any damage is found, replace the cable with one of the same specification and model.
4. Check that the connection cables are secured. Ensure that all terminals are secured.



### 7.2.4 Cabling specifications

The cables used in the system can generally fall under two types for power and communication. When laying communication cables, keep them away from power cables, and keep cables at right angles at the intersection. Keep the cable as short as possible and keep it apart from the power cable. It is recommended that the insulation impedance of the positive and negative electrodes of the DC end to the ground be more than 1MΩ. Power cables and communication cables shall be placed in separate cable ducts to avoid long-distance parallel routing, thereby reducing electromagnetic interference caused by output voltage transients. The distance between the power cables and the communication cables shall be greater than 0.3m. When the wires are cross-distributed, the cross angle shall be 90 degrees, and the distance can be appropriately reduced.

### 7.3 Battery cluster wiring

The operating voltage of the battery cluster is 600V-876V. The minimum voltage of the battery shall not be lower than 600V and the maximum voltage shall not exceed 876V.

#### 7.3.1 About product accessories

The following figures show the product accessories:



Figure 7.2 Communication Harness of the Battery Pack



Figure 7.3 Inter-Battery Series Copper Row



Figure 7.4 Inter-Battery Series Copper Row



Figure 7.5 Battery Total Negative Series Copper Row



Figure 7.6 Battery Total Positive Series Copper Row

### 7.3.2 Battery cluster High-voltage DC side connection

	<ol style="list-style-type: none"> <li>1. Always wear insulated gloves when connecting high-voltage wirings. Prepare tools such as a multimeter and torque wrench.</li> <li>2. Ensure the positive and negative terminals of the battery box are not reversed. Before wiring, measure the insulation resistance between the positive/negative terminals and the casing of each battery box. The recommended test voltage is 500V DC, and the insulation resistance requirement is <math>\geq 60\text{M}\Omega</math>.</li> <li>3. Before connecting each high-voltage copper bar/cable, use a multimeter to measure the voltage between the two points to be connected. Ensure there is no voltage between the points before making the connection.</li> </ol>
---	--

#### The method for DC high-voltage side wiring is as follows:

Step 1: Disconnect the DC switch QS of the high-voltage box (BMS), ensuring it is in the off position, and rotate the handle to the “OFF” position. Then use a multimeter to measure that the battery input terminal on the high-voltage box is not on;

Step 2: Measure the open-circuit voltage of the battery box with a multimeter to ensure that it is within the permissible range;

Step 3:

- 1) A cluster contains 15 battery boxes and 1 high-voltage box, which are equipped in 2 columns, with each column having a total of 8 layers: the high-voltage box is on the right column at the bottom, battery box A on the right above 7 layers, and battery box B on the left 8 layers. Before installation, ensure that the sequence and layout of A/B box are correct, and install the copper rows strictly according to the battery cluster layout diagram. Otherwise, a short circuit may occur.
- 2) After the positive and negative terminals of 15 battery boxes are connected in series, the total positive and the total negative are connected to B+/B- of the high-voltage box, and the wiring sequence is shown in Figure 7.8;
- 3) There are five types of high-voltage power lines:

No.	Description	Connection cables
①	Negative input from battery box to high-voltage box B-	Copper row
②-⑮	Series wiring harness among the PACKs	Copper row
⑰	Positive input from battery box to high-voltage box B+	50mm <sup>2</sup> cable
⑰	High-voltage box P+ to MPS BAT+	50mm <sup>2</sup> cable
⑱	High-voltage box P- to MPS BAT-	50mm <sup>2</sup> cable

- 4) Under safety conditions, use the M8×16 screws provided with the battery box to connect the battery copper rows. Remove the plastic cover from the battery terminals to connect the series copper rows. Tighten the screws and install the plastic cover of the battery terminal. Note:

After completing each copper row connection, reinstall the plastic cover before proceeding to the next connection. Refer to Figure 7.7). The connection sequence shall be High-Voltage Box→1#PACK→2#PACK→...→15#PACK.



Figure 7.7\_Battery Terminal Plastic Cover

- 5) Connect the B-terminal of the high-voltage box to the negative terminal of the upper battery box. Connect the series copper rows among the battery packs. Connect the positive terminal of the last battery box to the B+ terminal of the high-voltage box using a “50mm<sup>2</sup> positive cable”, completing the high-voltage series connection.

Connect the P+ terminal of the high-voltage box to the BAT+ terminal of the MPS using a 50mm<sup>2</sup> cable. Connect the P-terminal of the high-voltage box to the BAT- terminal of the MPS using a 50mm<sup>2</sup> cable, completing the high-voltage DC side wiring.

- 6) Secure all copper rows/cables to the battery box high-voltage terminals using M8×16 bolts. The recommended torque is 14NM±1.

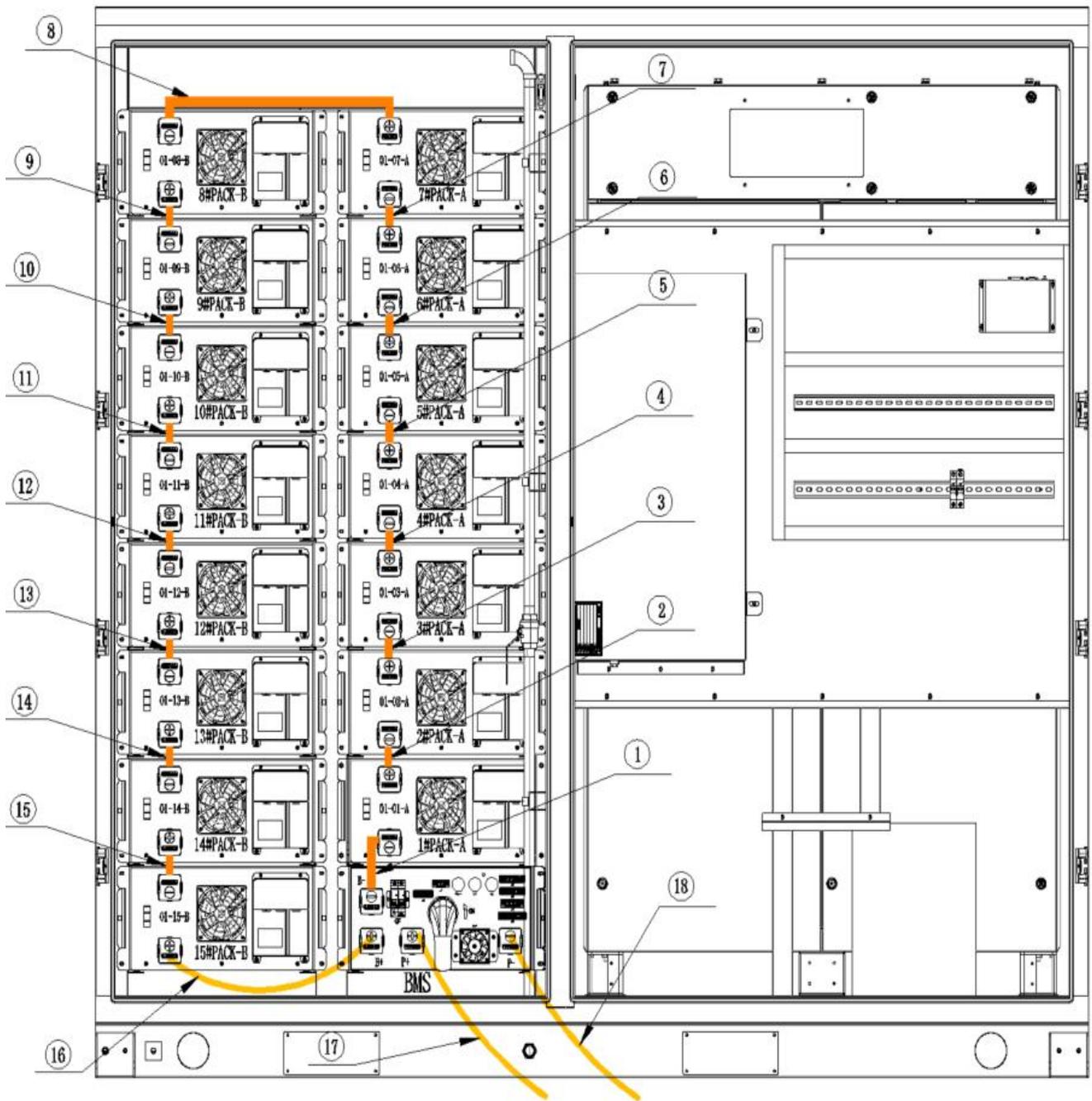


Figure 7.8\_ Battery Cluster High-voltage Side Wiring Sequence Diagram

### 7.3.3 Battery cluster low-voltage communication cable connection

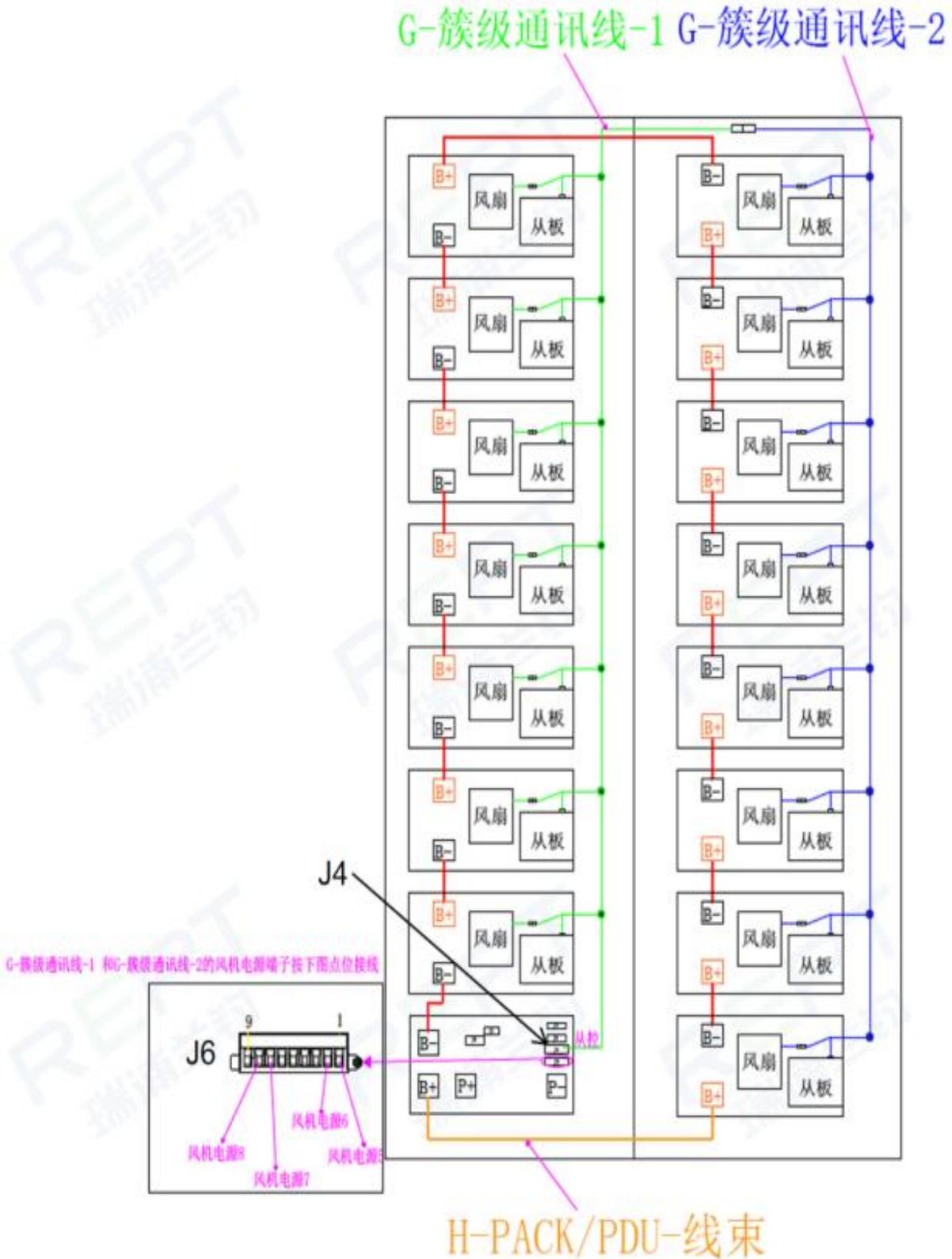


Figure 7.8\_High-voltage Box J4 Communication Cable Wiring Diagram

Figure 7.1 Low-voltage Communication Cable Connection of the Battery Cluster

Harness name	Start point	End point	Description
J4:G-cluster communication cable-1	High-voltage box J4	1#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	2#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	3#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	4#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	5#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	6#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	7#PACK-A slave board/fan	Communication harness between high-voltage box and PACK
J4:G-cluster communication cable-1/2	G-cluster communication cable-1	G-cluster communication cable-2	Communication harness between high-voltage box and PACK
J4:G-cluster communication cable-2	High-voltage box J4	8#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	9#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	10#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	11#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	12#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	13#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
	High-voltage box J4	14#PACK-B slave board/fan	Communication harness between high-voltage box and PACK
J4	High-voltage box J4-fan power supply 5	High-voltage box J6-1	PACK fan power supply 0V
	High-voltage box J4-fan power supply 6	High-voltage box J6-2	PACK fan power supply 0V
	High-voltage box J4-fan power supply 7	High-voltage box J6-7	PACK fan power supply 24V+
	High-voltage box J4-fan power supply 8	High-voltage box J6-8	PACK fan power supply 24V+
J1			Debugging port, no customer wiring required

J2	High-voltage box J2-1	High-voltage box J4-1	Active wake-up, pre-wired before delivery
J3			Pre-wired before delivery. Refer to the detailed drawings for specific connections
J5			Pre-wired before delivery. Refer to the detailed drawings for specific connections

## 7.4 Multi-power source (MPS) wiring

Users must follow local electrical connection standards for external wiring. External cables shall be designed in compliance with local regulations and environmental conditions.



Before wiring, ensure that the grid input circuit breaker (GRID), the bypass circuit breaker (MAINTENANCE), the load circuit breaker (LOAD), the PV circuit breaker (PV), and the battery isolation switch (QDC) are all in the OFF position, and put up warning labels on them to prevent accidental operation.

警告



Power cables should be wired through cable trenches or metal conduits against mechanical damage or radio frequency interference with surrounding equipment.

警告

### 7.4.1 MPS external wiring terminals

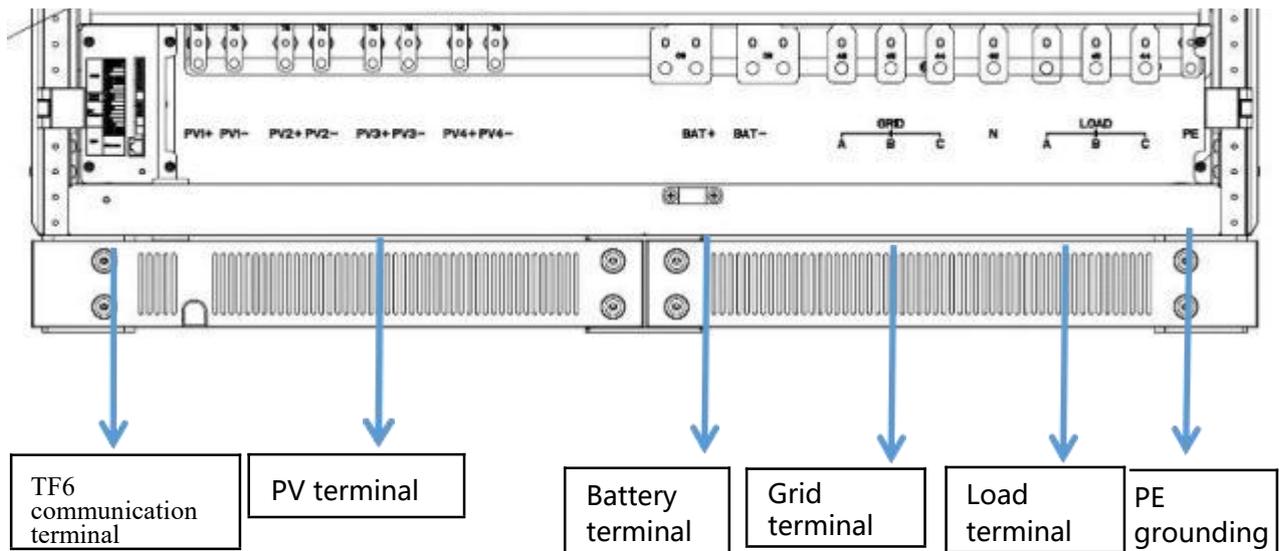


Figure 7.9\_MPS External Terminal Wiring Diagram

### 7.4.2 MPS DC side connection

- The high-voltage box is connected to the DC side of the hybrid converter (MPS) as shown in Table 7.2.

Table 7.2: DC Side High-voltage Box Wiring Correspondence

Start point	Mounting hole diameter	End point	Mounting hole diameter	Cable outer diameter	Supplier
Converter BAT+	Φ12	High-voltage box P+	Φ12	50mm <sup>2</sup>	Felicity
Converter BAT-	Φ12	High-voltage box P-	Φ12	50mm <sup>2</sup>	Felicity

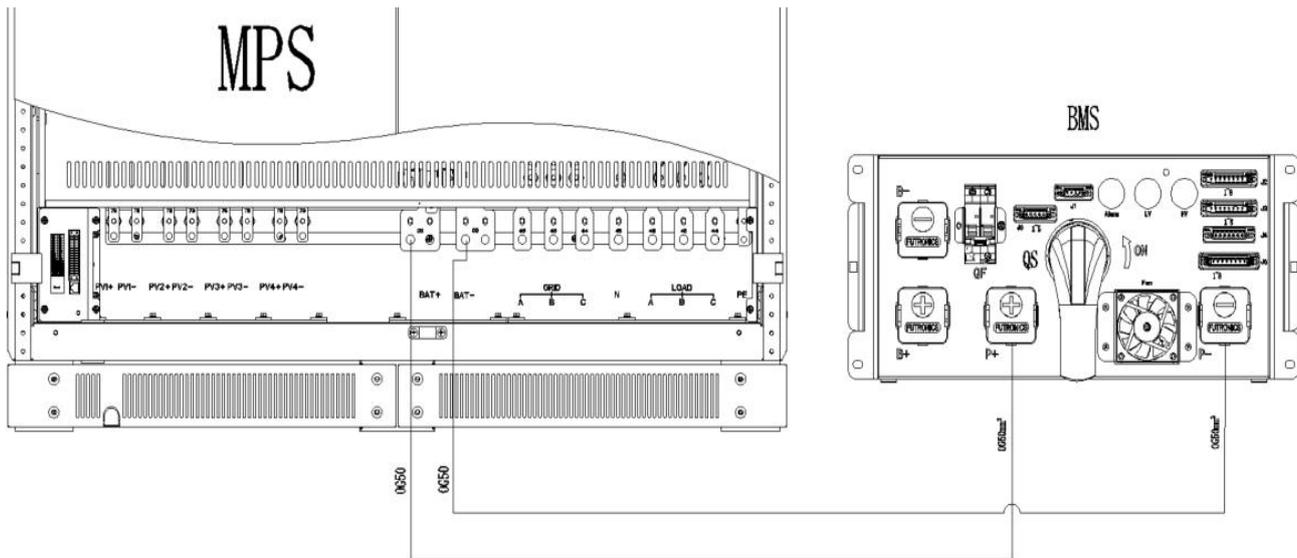


Figure 7.10\_Converter and Battery High-voltage Box Wiring Diagram

**The wiring steps are as follows:**

- 1) Ensure the high-voltage box disconnecting switch (QS) is in the “OFF” position.
- 2) Disconnect the battery power cables from the “P-” and “P+” terminals on the high-voltage box.
- 3) Confirm that each converter circuit breaker (QCD), the external grid power circuit breaker (GRID), and the bypass maintenance circuit breaker (MAINTENANCE) are OFF, that is, in the "OFF" position. Use a multimeter to confirm that all terminals on the converter copper rows are de-energized (voltage = 0V).
- 4) Connect the “P-” and “P+” battery power cables from the high-voltage box to the “BAT-” and “BAT+” copper row terminals on the converter, respectively. Tighten the terminal screws using a socket tool.

2. PV DC Side Wiring

Table 7.3 DC Side PV Wiring Correspondence

Start point	Mounting hole diameter	End point	Mounting hole diameter	Cable outer diameter	Supplier
Converter (PV1+)	Φ12	Combiner box (CB1+)	Based on physical object	50mm <sup>2</sup>	Customer
Converter (PV1-)	Φ12	Combiner Box (CB1-)	Based on physical object	50mm <sup>2</sup>	Customer
Converter (PV2+)	Φ12	Combiner box (CB2+)	Based on physical object	50mm <sup>2</sup>	Customer
Converter (PV2-)	Φ12	Combiner Box (CB2-)	Based on physical object	50mm <sup>2</sup>	Customer

1) Before connecting external cables to the MPS, the cables must be routed through the cable entry holes at the bottom of the outdoor cabinet. Follow the requirements below for cable routing.

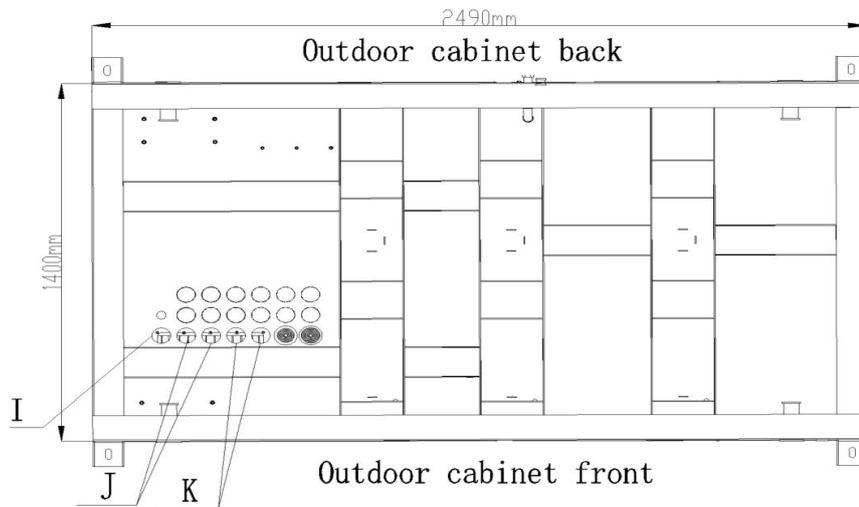


Figure 7.11\_ Outdoor Cabinet Bottom Cable Entry Hole Layout

- I: External communication cable entry hole
- J: PV or battery cable entry hole
- K: Grid, diesel generator, or load cable entry hole

- 2) Ensure the PV1~PV4 breakers on the hybrid converter are in the “OFF” position.
- 3) Verify that the breakers on the external PV combiner box are OFF.
- 4) Identify and label the positive and negative terminals of the external PV cables.
5. Route the external PV cables through the entry hole and connect them to the “PV+” and “PV-” copper rows on the MPS.
6. Tighten the external cables securely on the MPS copper rows. After confirming the correct phase sequence, seal the cable entry holes to prevent environmental factors or pests from damaging the equipment.



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Ensure all operations are performed with power OFF against any personal injury or equipment damage.

- DC switches must be in the OFF position.
- Use a multimeter to confirm that the DC side busbars are de-energized.

### 7.4.3 MPS AC side connection

All converter models include grid connections. The corresponding relationships are detailed in the table below. For wiring positions, refer to Figure 7.9 \_MPS External Wiring Terminals Diagram and Figure 7.12\_ Grounding Copper Rows External Wiring Terminal Diagram.

Table 7.4 MPS AC Side External Wiring Correspondence

Start point	Mounting hole diameter	End point	Mounting hole diameter	Cable outer diameter	Supplier
GRID-A	Φ12	Grid-A	Based on physical object	70mm <sup>2</sup>	Customer
GRID-B	Φ12	Grid-B	Based on physical object	70mm <sup>2</sup>	Customer
GRID-C	Φ12	Grid-C	Based on physical object	70mm <sup>2</sup>	Customer
N	Φ12	Neutrality point	Based on physical object	70mm <sup>2</sup>	Customer
P/E	Φ8	Protective grounding wire	Based on physical object	35mm <sup>2</sup>	Customer
LOAD-A	Φ12	Load-A	Based on physical object	70mm <sup>2</sup>	Customer
LOAD-B	Φ12	Load-B	Based on physical object	70mm <sup>2</sup>	Customer
LOAD-C	Φ12	Load-C	Based on physical object	70mm <sup>2</sup>	Customer
Ground copper bar-PE	Φ8	Protective grounding wire	Based on physical object	35mm <sup>2</sup>	Customer

The ground copper bar is installed at the back of the MPS

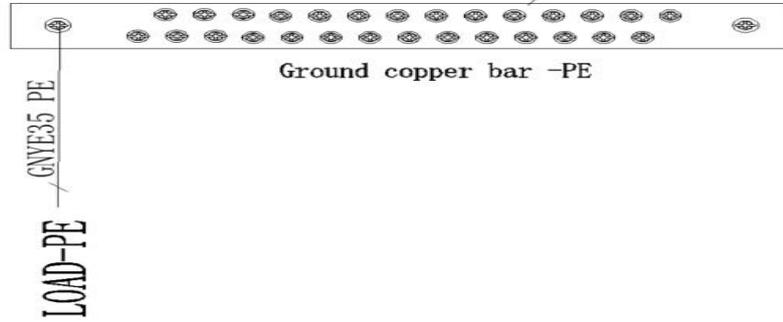


Figure 7.12\_Grounding Copper Row External Terminal Wiring Diagram

### AC side wiring steps:

1. Confirm that the external grid input breaker, converter grid breaker (GRID), the load breaker (LOAD), the bypass maintenance breaker (MAINTENANCE), and external load breaker are OFF, that is, in the "OFF" position.
2. Measure with a multimeter to confirm that all terminals are de-energized (voltage = 0V).
3. Route the external grid and load cables through the cable entry holes at the bottom of the outdoor cabinet.
4. Confirm the phase sequence of the external cable and make line marking. AC output three-phase cables A, B, C, N, and PE shall be equipped with yellow, green, red, blue, and yellow-green insulation sleeves respectively to distinguish the phase sequence.
5. Connect the phases A, B, and C of the grid to the corresponding inverters as per Table 7.4, and connect the external ground cable to the PE copper row terminal on the inverter.
6. Tighten the external cables securely on the inverter copper rows. After confirming the correct phase sequence, seal the cable entry holes to prevent environmental factors or pests from damaging the equipment.

## 7.5 UPS wiring

1. Connect UPS output cables: Insert the power output plug into the corresponding power output socket on the rear panel of the UPS. In case of a power outage, the UPS will automatically supply power to the load using its internal battery.
2. Insert the power input plug into the corresponding power input socket on the rear panel of the UPS.

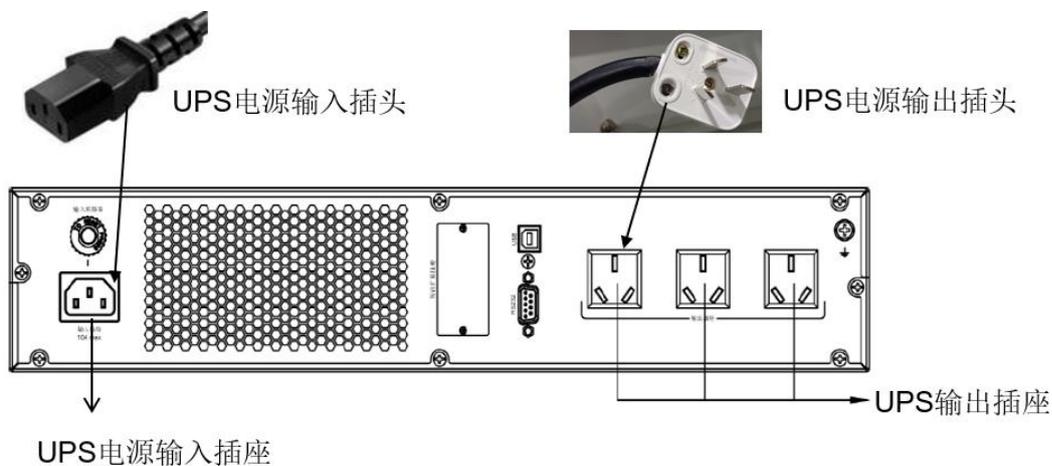


Figure 7.13\_UPS Rear Panel Wiring Diagram

### 7.6 Cabinet shell grounding

Locate the ground position on the front and the back of the outdoor cabinet shell, and connect it with 40x4mm galvanized flat steel. Connect one end of the galvanized flat steel to the copper block (M10x30) grounded on the outdoor cabinet shell, and connect the other end to the ground grid. The wiring position is shown in Figure 7.14.

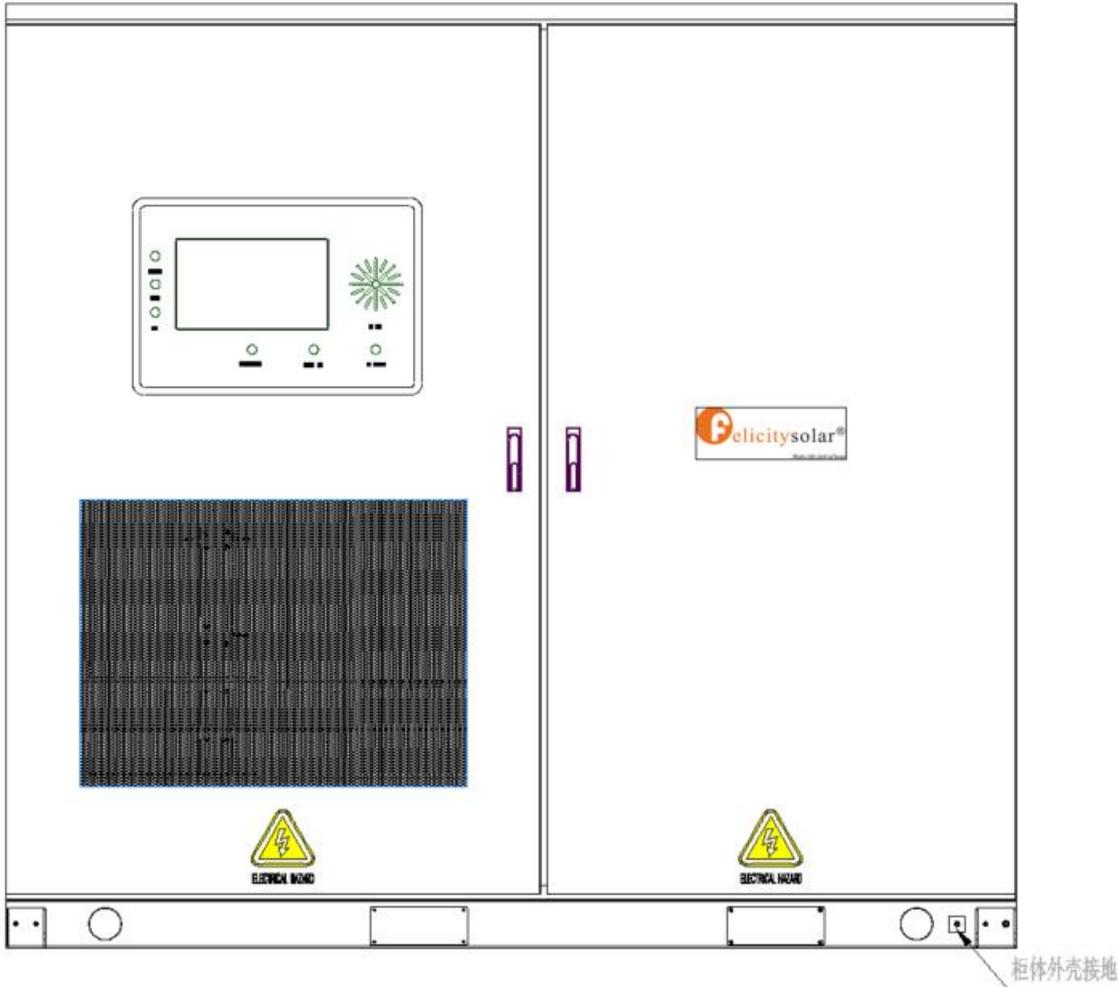


Figure 7.14\_ Cabinet Shell Grounding Layout Diagram

For the sake of safety, all equipment shells need to be grounded through PE conductors. The PE copper row inside the optical storage cabinet has already been reliably connected to the shell of the optical storage cabinet. When the PE connection is performed, the PE grounding copper row shall be reliably connected to the equipotential connection device in the installation site or the electrical control room. The diameter of the grounding cable is not less than half of that of the grid inlet phase wire, and the grounding resistance of the grounding cable is less than  $1\Omega$ .



There are several connecting wires connected to the PE copper row, and those wires are shell grounding of the internal equipment of the optical storage cabinet. Do NOT change them without authorization against the danger of electric shocks!

### 7.7 External Communication Terminal Wiring Diagram

The user's incoming Two-way anti-reverse flow RS485 communication cable should be connected to the lower end of the terminal block XT5 on the outdoor cabinet's electrical installation board. Refer to Figure 7.15 for details.

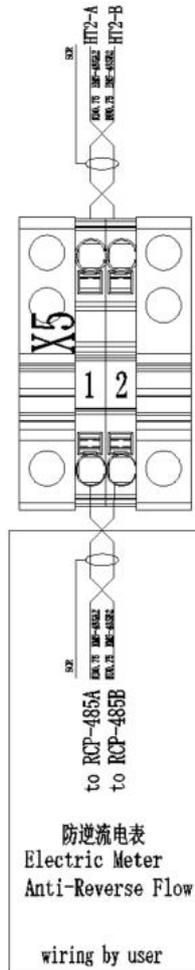


Figure 7.15\_External Communication Terminal Wiring Diagram



Wiring personnel should possess a certain level of expertise in electronics, electrical wiring, and mechanical systems, and be familiar with electrical and mechanical schematics.

#### System grounding:

The grounding copper row inside the MPS must be reliably connected to the grid ground or external ground using a grounding cable.

- 1. Screws and other fastening parts are pre-installed at the corresponding terminals when the equipment is delivered.
  - i 2. Ensure the copper lug of the external input cables match the screw size of the equipment.
  - 3. Check the material of external terminal connection points. If connecting copper to aluminum, use a dedicated copper-aluminum connector. Never connect them directly!

## 7.8 Post-wiring inspection

A post-installation check is required after the optical storage cabinet is installed:

Item	Result
1. The equipment is placed and installed in a reasonable position to meet the requirements for load bearing and environmental protection;	(√/×)
2. The power cables are correctly connected, the ground wire is well connected to the ground network, and the construction unit is required to test the grounding resistance value;	(√/×)
3. Check whether the main line is connected incorrectly/the wire sequence is reversed, and judge whether it affects the safe operation of the energy storage system;	(√/×)
4. Confirm that the communication cables have all been correctly connected, and that there is no open circuit or short circuit in the connections.	(√/×)

	<p>The electrical wiring inspection needs to be completed by qualified personnel;</p> <p>After turning off the switch, the equipment is already charged with high voltage. Do NOT touch any parts of the optical storage cabinet unprotected.</p>
--	---

## 8 Trial Operation of Energy Storage System

### 8.1 Pre-system startup inspection

Before the trial operation, thoroughly check the installation of each equipment, especially check whether the DC and AC voltage meets the requirements of the converter, as well as the polarity and the phase sequence are correct.

Confirm all connections comply with relevant standards and specifications. Ensure the system is reliably grounded. Grounding resistance is critical for system safety and must meet requirements before the first trial run.

#### Step 1: outdoor cabinet external grounding check

Refer to Section 6.4 Cabinet grounding to confirm the external grounding wire is connected and secure.

#### Step 2: MPS wiring check

1. Confirm the wiring condition of the bottom wiring terminal of the MPS and whether all AC/DC circuit breakers are disconnected, that is, in the "OFF" position; and the switch of the external input power supply should also be off.
2. Ensure the terminals labeled PV+, PV-, BAT+, BAT-, GRID, LOAD, and PE are securely and correctly connected.
3. Inspect the communication board for loose or disconnected wires.

The bottom wiring diagram of MPS0100 is shown in Figure 8.1 below:

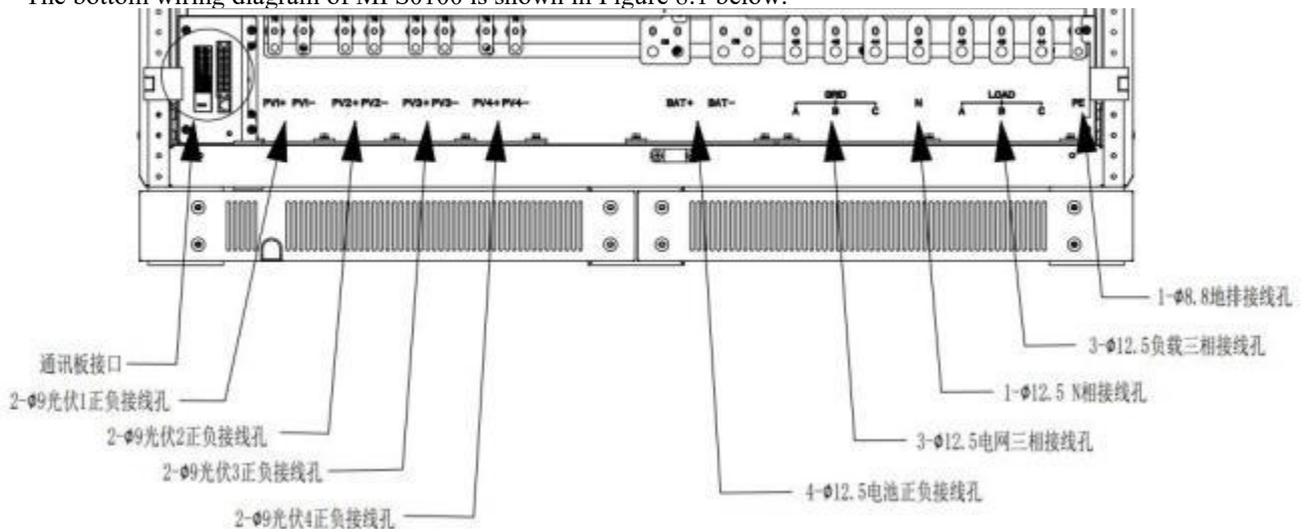


Figure 8.1\_ MPS0100 Bottom Wiring Diagram

### Step 3: electrical installation board and emergency stop button wiring check

Before starting any device, ensure that the cables to the internal electrical components on the electrical mounting board are not loose; The ESD1 switch on the front door of the outdoor cabinet is turned on; All mini circuit breakers are off;

### Step 4: UPS wiring check

Refer to Section 7.5 UPS Wiring to inspect and confirm the UPS output and input power cables are securely and correctly connected.

### Step 5: battery cluster wiring check

1. Refer to Section 7.3 Battery cluster wiring to check the polarity and tightness of the copper row connections on the battery packs.
2. Ensure the communication and fan cables between battery packs are correctly and securely connected.
3. Check for loose or disconnected wires on the high-voltage box. Ensure the DC switch is off (i.e. in the “off” position).

## 8.2 System power-up steps



In the event of a hazardous situation, press the ESD1 emergency stop button on the outdoor cabinet door and the EPO emergency stop button on the MPS converter cabinet door!



Before powering up, make sure that all switches on the DC and AC sides of the energy storage converter are disconnected!

### Step 1: UPS startup

UPS power-on: Long press the “ON/MUTE” button for 5s. When the screen lights up, Do Not release the button until there is “OUTPUT” on the panel, at which time you can release the button, see Figure 8.2 below.



Note: For detailed operation, please refer to the UPS User's Manual.

Figure 8.2 UPS Operation Panel

### Step 2: Follow the sequence of operations

- 1、 After confirming the safety, power on the DC side at high voltage: close the DC disconnecting switch QS on the high voltage box (that is, turn the switch to the "ON" position).
- 2、 Close the QF32 BMS (If the battery cabinet is to be expanded, close QF33 1#BMS - QF34 2#BMS - QF35 3#BMS successively).
3. Close the AC circuit breaker (QF) on the high-voltage box BMS. At this time the low voltage indicator LV is always on. Wait a few seconds and then the high voltage indicator HV is always on;
4. Measure the voltage of  $BAT\pm$  of the MPS, if the DC side voltage is lower than 850V and the polarity is correct, proceed to the next step;
5. Close the MPS auxiliary power switch KB1 and the contactor power switch KB2 (for hybrid on/off-grid models, also close KB3); close the QDC switch and wait for the MPS screen to start up completely.
6. After the MPS screen starts, if there are any system abnormalities, alarm signals will appear immediately on the screen. Click the alarm icon at the upper right corner of the screen to view the alarm information. If other alarms appear, troubleshoot the cause before powering on the device;
7. Click "Menu" on the screen, then select Switch. Click “DC/AC Converter ON”, and then click “OK” in the pop-up window. Wait for the MPS to start (Normally, the MPS will start automatically);
8. After the MPS starts, close the LOAD switch on the load side. Use a multimeter to measure the voltage between each phase (A, B, or C) and the neutral (N) on the load side. Ensure the voltage is within the normal range. If the voltage is correct, proceed to the next step;

9. Close the auxiliary power circuit breakers: Close QF11 MAIN and QF21 UPS\_IN, and wait a moment before the UPS switches to the mains inverter state and charges the battery inside the UPS.

10. Close the QF22 HVAC (if there is an expanded battery cabinet, then close the following in sequence: QF23 1#HVAC - QF24 2#HVAC - QF25 3#HVAC) - QF26 FAN - QF27 BMS FAN (If there is an expanded battery cabinet, then close the following in sequence: QF28 1#BMS FAN - QF29 2#BMS FAN - QF30 3#BMS FAN) - QF31 Light - QF36 AC/DC - QF51 EMS - QF52 FFS - QF53 HT (If there is an expanded battery cabinet, then close the following in sequence: QF54 1# HT-QF55 2#HT-QF56 3#HT). After the switches are closed in sequence, the system is powered on.

### Step 3:

When you need to turn on the DC/DC module, use a multimeter to measure the voltage of the connected positive and negative PV terminals. If the voltage is within the working range and the polarity is correct, close the switch button on the module and turn it to the "ON" position, then close the "QDC" switch. Check the PV page data on the screen to confirm everything is normal before proceeding with the DC/DC operation: click "Menu" on the screen, then click "Switch", followed by "DC/DC Converter On", and finally click "Confirm" in the pop-up window. Wait for the DC/DC to start up.

### Step 4:

When it is necessary to use the grid side, use a multimeter to measure whether the voltage of phase A/B/C and pole N of the grid side is within the normal range; Check by clicking the "Menu" on the screen, then clicking "System", and then clicking the parameter to the right of "Constant Power (AC)", when the existing parameter is changed to "-5", the battery will be charged at 5KW power, and the specific parameter will be modified according to the actual demand.

## 8.3 System power-off procedure

### Step 1: MPS shutdown operation

1. When operating at high power, the grid or load power must be gradually reduced before bringing down the MPS power:

- ◆ When the MPS is charging batteries, click "Menu" on the screen, then click "System", and then the parameter to the right of "Constant power (AC)" to gradually reduce the existing parameter, for example, the current parameter is "-100", then change it to "-80", wait 5 seconds, then change it to "-60", and wait 5 seconds, until it changes to "0".
- ◆ When the PCS is discharging batteries, for example, if the parameter to the right of Constant Power (AC) is "100", change it to "80", wait 5 seconds, change it to "60", and wait 5 seconds, until it changes to "0".

2. If you are using the DCDC module, you need to click "Menu" on the screen first, then click "Switch", followed by "DCDC Converter Off", and then click "OK" on the pop-up window; Disconnect the switch button on the module and turn it to the "OFF" position.

3. Click "Menu" on the screen, then click "Switch", followed by "ACDC Converter Off", and then click "Confirm" on the pop-up window; Wait for the MPS to stop.

4. With the MPS is shut down, disconnect the following switches in turn:

1). Disconnect the AC circuit breaker QF on the high-voltage box BMS (i.e. turn the switch to the "OFF" position);

2). Disconnect QF32 BMS (If the battery cabinet is to be expanded, disconnect QF35 3#BMS - QF34 2#BMS - QF33 1#BMS successively).

3). Turn off the DC side load switch QDC (that is, turn the switch to the "OFF" position);

4). Disconnect the disconnecting switch QS on the high-voltage box BMS (that is, turn the switch to the "OFF" position);

5). Disconnect DC 24V power supply: (If the battery cabinet is to be expanded, disconnect QF56 3# HT - QF55 2# HT - QF54 1#HT - ) QF53HT - QF52 FFS - QF51 EMS successively);

6). Disconnect AC power supply: disconnect QF36 AC/DC - QF31 Light - (If the battery cabinet is to be expanded, disconnect the following successively: QF30 3#BMS FAN - QF29 2#BMS FAN - QF28 1#BMS FAN - ) QF27

BMS FAN - QF26 FAN - (If the battery cabinet is to be expanded, disconnect the following successively: QF25 3#HVAC - QF24 2#HVAC - QF23 1#HVAC -) QF22 HVAC - QF21 UPS - QF11.

5). Disconnect load circuit breaker (LOAD) - KB3 - KB2 - KB1 - circuit breakers on the grid side (GRID) - circuit breakers on the PV side (QPV).

### **Step 2: UPS shutdown operation**

Press the “OFF//ENTER” button on the UPS panel for 2s, at this time the UPS will turn off the inverter and the machine will be completely powered down after a few seconds.

Note: For detailed operation, please refer to the UPS User's Manual.

## **8.3 Counter-current protection of the system**

The system's counter-current prevention requires an external meter, which is usually connected to the grid connection point of the energy storage system and detects the direction and magnitude of current flow at the grid connection point. The meter transmits the information to the EMS through the RS485 port, and the EMS communicates with the PCS inverter. The inverter then performs counter-current control to lower the inverter power.

When the electric meter is installed, the current direction is toward the energy storage cabinet (CT primary wire direction: the power grid cable enters from P1 and exits from P2). If the “instantaneous total active power” on the anti-current meter and the anti-current meter interface on the cloud platform is positive, it indicates that power is taken from the grid, as shown in Figure 8.3; if it is negative, it indicates that the energy storage system discharges to the grid, as shown in Figure 8.4.

When using the counter-current prevention function of the energy storage system, the optional supporting meter model is: DTSD1352-CF with RS485 communication from Acrel.



Figure 8.3 \_Power Taken from the Grid (Data Read from the Cloud Platform)



Figure 8.4 \_Power Discharged to the Grid (Data Read from the Anti-current Meter)

## 9 Delivery and Storage

### 9.1 Nameplate identification

The nameplate provides essential information for identifying the equipment, including: equipment model, serial number, main technical parameters, dimensions, etc.



#### WARNINGS

The nameplate contains critical information about the equipment, which shall be protected during transportation, installation, maintenance, and repair operations. Do NOT damage or remove the nameplate!

### 9.2 Product inspection

The outdoor cabinet energy storage system has been carefully inspected and securely packaged by our Company before delivery. However, collisions or damage may still occur during transportation.

Upon receiving the equipment, the first step is to inspect the integrity and condition of the shipment. At a minimum, check the following carefully:

- ◆ Compare the received items with the "Supply Scope" to ensure all components are included.
- ◆ Ensure the received outdoor cabinet energy storage system and internal equipment models match your order.
- ◆ Carefully check the outdoor cabinet energy storage system and internal equipment for any damage that may have occurred during transportation.
- ◆ If any problems or doubts are found during the inspection, contact the transporter or our Company immediately.



#### WARNINGS

Only a complete and undamaged outdoor cabinet energy storage system can be installed and commissioned! Before starting the installation, make sure that:

- The outdoor cabinet energy storage system itself is intact and undamaged.
- All equipment inside the outdoor cabinet energy storage system is intact and undamaged.

### 9.3 Storage

If installation is not immediate after delivery, store the outdoor cabinet energy storage system as described below:

- ◆ To prevent condensation inside the outdoor cabinet or waterlogging at the base during rainy seasons, store the system indoors, such as a large warehouse or workshop.
- ◆ If outdoor storage is unavoidable due to site conditions, elevate the base of the outdoor cabinet. The height should be determined based on local geological and meteorological conditions. Provide heating for the internal equipment when the ambient temperature is too low.

- ◆ Storage environment temperature:  $-30^{\circ}\text{C}\sim+50^{\circ}\text{C}$ . Relative humidity: 5%~95%, with no condensation. Store the outdoor cabinet energy storage system on a dry, flat, solid, and load-bearing surface without any vegetation. The ground must be flat, with no water accumulation, bumps, or unevenness.
- ◆ Ensure the outdoor cabinet doors are securely locked during storage.

## 10 Maintenance and Faults

### 10.1 Precautions

Due to the combined effects of ambient temperature, humidity, dust and vibration, the internal equipment of an outdoor cabinet energy storage system may deteriorate, thus degrading the performance of the equipment and even possibly leading to failure. Therefore, routine and regular maintenance of the outdoor cabinet energy storage system is necessary to ensure its proper operation and designed service life. All measures and methods to help keep equipment in good working order are necessary for maintenance. If there is a malfunction, and you can not solve the problem with the help of this Manual, please contact us. In addition, you are recommended to provide some information, so that we can provide you with better service:

- ◆ Photos of the failure site;
- ◆ Product model and serial number;
- ◆ Information on the parameters of photovoltaic modules, grid, diesel generator, and load connected to the outdoor cabinet energy storage system;
- ◆ Communication connection scheme;
- ◆ Failure information and brief description.

#### 10.1.1 General safety rules

To ensure the safety of operators, the outdoor cabinet energy storage system must comply with the following safety rules during maintenance or overhaul:

- ◆ Disconnect all external live connections.
- ◆ Check the power supply of the device.
- ◆ Make sure the outdoor cabinet energy storage system is not accidentally re-energized.
- ◆ Use a multimeter to measure to ensure that the interior of the outdoor cabinet energy storage system is completely de-energized.
- ◆ Ensure that the outdoor cabinet energy storage system is realizably grounded.
- ◆ Use insulating materials to insulate the parts that may be live near the operating parts.



警告

Only qualified and authorized personnel are allowed to maintain the outdoor cabinet energy storage system. During maintenance, do NOT leave screws, washers and other metal parts in the outdoor cabinet energy storage system against damage!

## 10.2 Maintenance tasks and periods

Table 10.1 \_ List of Maintenance Items

Maintenance item	● Maintenance content	Recommended interval
Record retention	◆ Use the standard communication data cable to export data and save backup.	1 month
Converter check	<ul style="list-style-type: none"> <li>◆ Check whether the appearance of the energy storage converter and the cabinet door panel are damaged, deformed, or rusted.</li> <li>◆ Listen to the energy storage converter operation to check for any abnormal sound.</li> <li>◆ Observe the running parameters through the touch screen LCD of MPS.</li> <li>◆ Use a thermal imager and other tools to detect system heating.</li> <li>◆ Check whether the ventilation, ambient temperature, humidity, dust, etc. around the converter meet the requirements.</li> </ul>	Half a year
Duct cleaning	<ul style="list-style-type: none"> <li>◆ Check there is no dust in the air duct.</li> <li>◆ Listen for abnormal vibration when the fan is running.</li> <li>◆ Use compressed air and turn on the fan for cleaning.</li> <li>◆ Clean or replace the air filter.</li> </ul>	Half a year (or shorter if necessary for harsh environments)
Safety functions	<ul style="list-style-type: none"> <li>◆ Check whether the EPO button on the outside of the MPS cabinet is not working.</li> <li>◆ Check whether the LCD touch function of MPS is not working.</li> </ul>	Half a year
Circuit connection	<ul style="list-style-type: none"> <li>◆ Check all electrical connections for looseness or poor contact.</li> <li>◆ Inspect all cables and the skins in contact with metal surfaces for breakage or scratches.</li> <li>◆ Check whether the insulation wraps on all terminals are not detached.</li> <li>◆ Check screw locations for signs of overheating.</li> <li>◆ Check the wiring copper rows and screws for color change.</li> </ul>	1 year
Circuit breaker maintenance	<ul style="list-style-type: none"> <li>◆ Check all circuit breakers for failure.</li> <li>◆ Check the circuit breaker or load switch for damage.</li> </ul>	1 year
Identification inspection	<ul style="list-style-type: none"> <li>◆ Check body warning labels and other equipment markings.</li> <li>◆ If you find any marking blurred or damaged, please replace it promptly</li> </ul>	1 year
Exterior Paint Inspection for Outdoor Cabinet	◆ Check the exterior surface of the cabinet, if there are any paint losses or damage, please use RAL7035 to repair the paint in time;	3 months
Fire suppression system inspection	<ul style="list-style-type: none"> <li>◆ Check all electrical connections of smoke detectors, temperature detectors, fire suppression gas tanks, and perfluorohexanone fire extinguishers for looseness or poor contact;</li> <li>◆ Check the appearance of all fire suppression devices for damage;</li> <li>◆ It is forbidden to disassemble the system components by yourself to avoid damaging the equipment and spraying by mistake;</li> </ul>	Half a year
Battery system	<ul style="list-style-type: none"> <li>◆ Check whether the DC load switch on the high-voltage box is disconnected;</li> <li>◆ Check the appearance of the battery/battery pack for cracks, scratches, deformations, rust, stains, electrolyte leakage and other defects;</li> <li>◆ Check all communication connections, connecting cables and busbars for damage and ensure that the insulation is intact;</li> <li>◆ Check whether the open-circuit voltage of each cluster meets the requirements;</li> </ul>	3 months

	<ul style="list-style-type: none"> <li>◆ Anti-loosening check: Ensure that all high-voltage electrical connections have been tightened as required and that there are no loose connections;</li> <li>◆ When the battery is idle for a long period of time, be sure to fully charge and discharge it every three months;</li> <li>◆ Do Not disassemble or dismantle the batteries in the battery pack during maintenance;</li> <li>◆ In accordance with the requirements of the packaging label, the battery should not be rained, exposed to sunlight, flipping, etc.</li> </ul>	
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Table 10.2

Item list	Inspection method	Recommended interval
System status and cleaning	<p>Check the following items and correct them immediately if they do not meet the requirements:</p> <ul style="list-style-type: none"> <li>• Check whether the equipment inside the outdoor cabinet is damaged or deformed.</li> <li>• Check for abnormal noise during the running of internal devices.</li> <li>• Check whether the temperature in the outdoor cabinet is too high.</li> <li>• Check whether the humidity and gray level inside the outdoor cabinet are within the normal range.</li> </ul> <p>Clean it if necessary.</p> <ul style="list-style-type: none"> <li>• Check whether the air inlet and air outlet of the outdoor cabinet are blocked.</li> </ul>	1 year
Alarm Identification	Check whether the warning signs, labels, etc. are clearly visible and free of defacement. Replace them if necessary.	1 year
Cable Shield Grounding	Check whether the cable shield is in good contact with the insulation sleeve; whether the grounding copper row is fixed in place.	1 year
Lightning protection devices and fuses	Check that the lightning protection devices, fuses, etc. are in good condition.	1 year
Corrosion	Check the inside of the battery compartment for oxidation or corrosion.	1 year

Table 10.3

Item list	Inspection method	Recommended interval
Cabinet exterior	<p>Check the following items and correct them immediately if they do not meet the requirements:</p> <ul style="list-style-type: none"> <li>• Check there are no flammable objects on the top of the outdoor cabinet.</li> <li>• Check the welding points between the outdoor cabinet and the foundation steel plate are firm and there is no rust.</li> <li>• Check the outdoor cabinet shell is undamaged, and there is no paint peeling or oxidation, etc.</li> <li>• Check the door locks can be opened flexibly.</li> <li>• Check that seals, etc. are fixed securely.</li> </ul>	Half a year
Cabinet interior	Check the outdoor cabinet for foreign objects, dust, dirt and condensate.	Half a year
Inlet and outlet	Check the heat sink temperature and dust. If necessary, use a vacuum cleaner to clean the cooling module.	Half a year
Wiring and cable layout	<p>Wait until the equipment inside the outdoor cabinet is completely powered off before starting to check!            During the check, if you find any nonconformities, please correct them immediately.</p> <ul style="list-style-type: none"> <li>• Check whether the cable layout is standard and short circuit exists. If there is an anomaly, correct it immediately.</li> <li>• Check all inlet and outlet cable holes of the outdoor cabinet to ensure they are well sealed.</li> <li>• Check the interior of the outdoor cabinet for any sign of water leakage.</li> <li>• Check whether the power cable connections are loose, and re-tighten them according to the previously specified torque.</li> <li>• Check power cables and control cables for any non-destructive damage, especially on the surfaces in contact with metal, to see if there are signs of cuts or scratches.</li> <li>• Check whether the insulation tape on the power cable terminals is intact or if there is any peeling.</li> </ul>	Half a year
Screws	Check whether screws are dropped inside the outdoor cabinet.	Half a year

Table 10.4

Item list	Inspection method	Recommended interval
Safety functions	<ul style="list-style-type: none"> <li>• Check the shutdown function of the emergency stop button.</li> <li>• Simulate a shutdown.</li> <li>• Check the warning labels and other equipment labels on the device. If any are found to be faded or damaged, replace them promptly.</li> </ul>	3 months
Internal component check	<ul style="list-style-type: none"> <li>• Check the cleanliness of the circuit boards and components.</li> <li>• Check the HVAC temperature and dust. If necessary, use a vacuum cleaner to clean the HVAC unit.</li> <li>• Replace the air filter if necessary.</li> </ul> <p>CAUTION! The ventilation of the air intake must be checked. Otherwise, if the HVAC cannot be effectively cooled, it may malfunction due to overheating.</p>	3 months
Component maintenance	<ul style="list-style-type: none"> <li>• Perform routine checks (every six months) on all metal components for corrosion.</li> <li>• Conduct an annual inspection of contactors (including auxiliary switches and micro switches) to ensure their mechanical operation is in good condition.</li> <li>• Check operating parameters. (especially voltage and insulation, etc.).</li> </ul>	3 months



表格中仅为推荐的产品例行维护周期。实际的维护周期应结合产品的具体安装环境而合理确定。

电站规模，所处位置，及现场环境等因素均会影响到产品的维护周期。若运行环境风沙较大或灰尘较厚，非常有必要缩短维护周期，加大维护频率。

## 10.3 Troubleshooting

### 10.3.1 Fault diagnosis

When the energy storage converter fails to output as expected or experiences abnormal changes in charging/discharging capacity, please check the following:

Open-circuit voltage of the energy storage battery; whether the machine is faulty; ensure the grid is correctly connected and powered; and the communication of the metering equipment is functioning properly.

### 10.3.2 Non-alarm faults

#### Excessive machine noise:

- ◆ Check whether the power is within the normal range; measure the on-grid current and voltage waveforms are normal; and inspect and replace the cooling fan if necessary.

**Network communication mode:**

- ◆ Check the IP address, subnet mask, and gateway are correctly configured.
- ◆ Ensure the communication cable is a straight-through cable and is properly connected.
- ◆ If all the above checks are normal, try replacing the LCD monitoring board.

**Serial communication mode:**

- ◆ Check the wiring to ensure all connections are secure and the A/B lines are not reversed.
- ◆ If the communication adapter is mismatched, replace it and try again.
- ◆ Check that the local address and baud rate match those of the host computer. Check the communication connection between the LCD screen and the DSP board.

### 10.3.3 Alarm fault list

The MPS LCD may display alarm items, and the corresponding solutions are shown in Table 10.5 below:

Table 10.5 Converter DCAC Alarm Fault Handling Methods

Functional unit	Fault symptom or code	Troubleshooting method
Converter_DCAC	Low battery voltage	Disconnect the DC load switch and check the DC side voltage and energy storage battery configuration;
	Low battery voltage auxiliary power	Disconnect the DC load switch and check the DC side voltage and energy storage battery configuration
	Low battery power	Disconnect the DC circuit breaker load switch and check the status of the energy storage battery
	Battery reverse connection fault	Shut down and swap the DC side input bus
	Bus overvoltage fault	Shut down and check the DC side voltage
	Bus short circuit fault	Shut down and check the DC bus wiring
	Grid overvoltage	Shut down and check the grid connection point voltage
	Low grid voltage	Shut down and check the grid connection point voltage
	Grid voltage phase reversal	Disconnect the grid power supply switch, shut down and check the three-phase wiring
	Abnormal grid frequency	Shut down and check the grid voltage
	DC contactor fault	Shut down and check whether the DC contactor is damaged
	Output contactor open	Shut down and check whether the AC contactor is damaged
	Output contactor short circuit	Shut down and check whether the AC contactor is damaged
	AC fan fault	Shut down and check the AC fan
	AC auxiliary power fault	Shut down and check the AC auxiliary power board
	DC auxiliary power fault	Shut down and check the DC auxiliary power board
	15V power supply fault	Shut down and check the AC and DC auxiliary power boards
	Converter overcurrent	Shut down and check whether the converter input/output is short-circuited or if the converter is overloaded
	Converter wave-by-wave current limiting	Shut down and check whether the converter input/output is short-circuited or if the converter is overloaded
	Converter fault	Shut down and repeat the pre-startup inspection of the converter
	Converter overtemperature	Shut down and check whether the converter fan is faulty and if the air duct is unobstructed
	Converter phase loss fault	Shut down and check the AC side wiring
	Converter out of sync	Shut down and check the converter settings
	Lightning protection fault	Shut down and check the converter's lightning protection device
	BMS communication fault	Shut down and check whether the communication cable between the converter and the battery system is loose
	Overloaded	Shut down and check the load capacity
Islanding protection	Shut down	

Table 10.6 Converter DCAC Alarm Fault Handling Methods

Functional unit	Fault symptom or code	Troubleshooting method
Converter_DCDC	Drive line fault	Shut down and check whether the internal drive line is loose
	Insulation impedance abnormality	Shut down and check the converter grounding and whether the cables are aged or damaged
	EPO	Shut down
	CT or Hall sensor open circuit	Shut down and check the CT wiring
	DC transformer overcurrent	Shut down, troubleshoot, and restart after the fault is eliminated
	DC converter wave-by-wave current limiting	Shut down, troubleshoot, and restart after the fault is eliminated
	DC transformer overtemperature	Shut down, troubleshoot, and restart after the fault is eliminated
	Output overloaded	Shut down and check the load capacity
	High-voltage side voltage (buck mode input)	Shut down, check the high-voltage side voltage, and restart after the fault is eliminated
	High-voltage side bus overvoltage fault	Shut down, disconnect the input/output switch, check the high-voltage side voltage, and restart after the fault is eliminated
	High-voltage side bus short circuit fault	Shut down, disconnect the input/output switch, check the high-voltage side wiring, and restart after the fault is eliminated
	High-voltage side input reverse connection fault	Shut down, disconnect the input/output switch, check the high-voltage side wiring, and restart after the fault is eliminated
	Low-voltage side undervoltage (boost input terminal)	Shut down, check the low-voltage side voltage, and restart after the fault is eliminated
	Low-voltage side bus overvoltage fault	Shut down, disconnect the input/output switch, check the low-voltage side voltage, and restart after the fault is eliminated
	Low-voltage side bus short circuit fault	Shut down, disconnect the input/output switch, check the low-voltage side wiring, and restart after the fault is eliminated
	Low-voltage side reverse connection fault	Shut down, disconnect the input/output switch, check the low-voltage side wiring, and restart after the fault is eliminated
	Drive cable fault	Shut down and check the IGBT drive cable
	Lightning protection fault	Shut down, disconnect the input and output switches, and replace the lightning protection module in the cabinet
	Insulation impedance abnormality	Shut down, disconnect the input/output switch
	DC auxiliary power fault	Shut down, and replace the auxiliary power board
	DC fan fault	Shut down, and check the fan air duct and power supply
	Emergency shutdown	Shut down, disconnect the input/output switch, and check the fault
	DC converter out of sync	Shut down, disconnect the input/output switch, check the parallel network cable, and restart the DC module
	High-voltage side contactor open	Shut down, disconnect the input/output switch, and replace the DC contactor
	High-voltage side contactor short circuit	Shut down, disconnect the input/output switch, and replace the DC contactor
	Low-voltage side contactor open	Shut down, disconnect the input/output switch, and replace the DC contactor
Low-voltage side contactor short circuit	Shut down, disconnect the input/output switch, and replace the DC contactor	

Table 10.7 HVAC Alarm Fault Handling Methods

Functional unit	Fault symptom or code	Troubleshooting method
HVAC system	Poor cooling effect	<ol style="list-style-type: none"> <li>1. Check for dirt on the indoor and outdoor heat exchangers or filters; and clean the dirt if any;</li> <li>2. If a hot air short circuit is caused by the outdoor unit air blowing barrier, ensure that there is no barrier 2 meters in front of the air outlet;</li> <li>3. Check for slow leaks in the system's refrigerant. If found, check the system's piping for leaks, repair by welding, and replenish the refrigerant to the specified amount;</li> <li>4. Check whether the indoor fan speed has decreased. Check the fan capacitor or rotation direction, and replace the fan when its performance deteriorates;</li> <li>5. Check for excessively high exhaust temperature, insufficient refrigerant, overpressure, or underpressure conditions. If found, replenish the refrigerant appropriately;</li> <li>6. Check for excessively low exhaust temperature, excessive refrigerant, high pressure low, evaporator frosting, too low room temperature setting, or abnormal operation of the condensation pressure controller. If found, reduce the amount of refrigerant.</li> </ol>
	Overpressure or alarm	<ol style="list-style-type: none"> <li>1. Check whether the refrigerant circuit contains non-condensable gases. If present, release the refrigerant, re-evacuate, and add refrigerant;</li> <li>2. Check whether the expansion valve is blocked or stuck. If so, replace the expansion valve;</li> <li>3. Check whether the outdoor fan motor speed has decreased or whether it fails to start. Check the fan winding resistance and capacitor; and replace the capacitor or fan if necessary;</li> <li>4. If the filter drier is clogged, replace the filter drier.</li> </ol>
	Underpressure or alarm	<ol style="list-style-type: none"> <li>1. If the condensing pressure switch is abnormal during low temperature operation, check the parameters of the computer board or the setting value of the pressure switch;</li> <li>2. If refrigerant leaks in the system, check the leakage point of the pipe and add proper refrigerant after welding;</li> <li>3. The indoor temperature of the controller is low. Check the parameter settings. The indoor temperature cannot be lower than 22°C;</li> <li>4. If the indoor air volume is insufficient, check whether the indoor fan works properly;</li> <li>5. The expansion valve and distributor capillary tube are frosted, the expansion valve is blocked or stuck, and the amount of refrigerant is insufficient;</li> </ol>
	Abnormal unit operation	<ol style="list-style-type: none"> <li>1. There is no power supply on the computer board, and the fuse on the board is burned out. Check whether the power cable of the communication cable is connected backwards and replace it with a new fuse</li> <li>2. Power circuit breaker tripped, check the wiring of electrical components or if the motor is short-circuited</li> <li>3. If the relay is damaged or does not work, check the wiring plug and relay coil;</li> <li>4. The power supply voltage is too high or too low, and the fluctuation range shall not exceed ±20%</li> <li>5. If the power light on the computer board is not on and there is no power supply, check whether the fuse on the computer board is blown</li> </ol>
	Abnormal unit operation	<ol style="list-style-type: none"> <li>6. If the communication light on the computer board is not on, check whether the communication cable of the computer board is loose or the communication module is damaged</li> <li>7. If the communication light on the wire controller is not on, check whether the wire controller communication cable is loose or the communication module is damaged</li> <li>8. If the running light on the wire controller and computer board is not on, check whether the local power is on and whether the remote shutdown is performed;</li> <li>9. If the indoor fan motor thermal overload protection is activated, check the winding resistance value to determine whether it is damaged</li> <li>10. The outdoor fan motor over-temperature protection is activated, the unit has been running at low temperatures for an extended period, and the motor is prone to overheating at low speeds</li> </ol>

		<p>11. High or low pressure alarm cannot be reset, check whether the wiring is loose; replace the switch if it cannot be disconnected</p> <p>12. Exhaust temperature over-temperature protection: check the high pressure, low pressure, and refrigerant charge level</p>
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Table 10.8 UPS Alarm and Fault Handling Methods

Functional unit	Fault symptom or code	Troubleshooting method
UPS System	The main power supply is normal, but the LCD does not light up and there is no buzzer.	<p>Check if the input power cord is loose.</p> <p>Plug the utility input power cord correctly into the utility input of the UPS.</p>
	<p>The LCD panel has a graphic display , and  is blinking, while a buzzer sounds once per second.</p>	<p>1. Confirm whether all battery wiring is correct.</p>
	<p>The LCD panel has a graphic display ,  and  is blinking while the buzzer sounds twice per second.</p>	<p>1. UPS overload, please remove the excessive load from the UPS output.</p> <p>2. The UPS is overloaded and the UPS is currently being bypassed to supply power to the equipment directly from the power grid. Please remove the excessive load from the UPS output.</p> <p>3. Multiple overloads have occurred in a short period of time, the UPS has been locked in the bypass mode and the equipment is connected directly to the mains. Please remove the excessive load from the UPS output first, and then shut down and restart the UPS system.</p>
	Battery provides less backup time than the specification	<p>1. The battery may not be full, please charge it for at least 5 hours, and then, check the battery level again. If the battery level is still low, contact your dealer or the Huawei Customer Service Center.</p> <p>2. Battery failure, contact your dealer or the Huawei Customer Service Center to replace the battery.</p>

Table 10.9 Fire Suppression System Alarm Fault Handling Methods

Functional unit	Fault symptom or code	Troubleshooting method
Fire suppression system	Pressure sensor 1 low alarm	<ol style="list-style-type: none"> <li>1. Ensure that the pressure sensor works properly. If the monitoring device is damaged, false alarms may occur. Repair or replace the device if necessary.</li> <li>2. Check whether there are leaks in the cylinder valves, pipes or seals, and repair or replace them if necessary;</li> <li>3. If the ambient temperature is too low, the gas pressure in the cylinder may decrease within a short period of time.</li> </ol>
	Pressure sensor 1 high alarm	<ol style="list-style-type: none"> <li>1. Ensure that the pressure sensor works properly. If the monitoring device is damaged, false alarms may occur. Repair or replace the device if necessary.</li> <li>2. The filling amount of fire extinguishing agent or driving gas exceeds the design standard. If overfilling is confirmed, contact us to adjust the filling amount.</li> <li>3. If the ambient temperature is too high, the pressure in the cylinder may increase within a short period of time.</li> </ol>
	Composite sensor communication fault	<ol style="list-style-type: none"> <li>1. Ensure that the cable between the sensor and the controller is not loose, broken, or oxidized, and the connector is not loose.</li> <li>2. Check communication protocols or configurations and correct them if necessary.</li> <li>3. Replace the composite sensor module.</li> </ol>
	BMS communication fault	<ol style="list-style-type: none"> <li>1. Ensure that the cable between BMS and the controller is not loose, broken, or oxidized, and the connector is not loose.</li> <li>2. Check communication protocols or configurations and correct them if necessary.</li> </ol>

Battery Fault Alarm List								
No.	Internal Fault Code	Fault Name	BMS Fault Level (Higher level represents more severe situation)	SBCU Treatment (If there is a fault lamp, the corresponding pin will be energized, and the fault indicator will be on)	Judgment Condition (Continuous)	Cancel Condition	Remarks	Module
1	0x1011	Battery cluster cell overtemperature alarm	1	Transmit fault signals externally	Temp_max>50°C	<45°C	Recoverable	SBCU
2	0x1012		2	Transmit fault signals externally, and limit power	Temp_max>55°C	<50°C	Recoverable	SBCU
3	0x1013		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Temp_max>60°C	<55°C	Recoverable	SBCU
4	0x1021	Battery cluster undervoltage alarm	1	Transmit fault signals externally	Temp_min<5°C	>10°C	Recoverable	SBCU
5	0x1022		2	Transmit fault signals externally, and limit power	Temp_min<0°C	>5°C	Recoverable	SBCU
6	0x1023		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Temp_min<-30°C	>0°C	Recoverable	SBCU
7	0x1031	Battery cluster cell overvoltage alarm	1	Transmit fault signals externally	>3.650mV	<3.600mV	Recoverable	SBCU
8	0x1032		2	Transmit fault signals externally, and limit power	>3700mV	<3650mV	Recoverable	SBCU
9	0x1033		3	Transmit fault signals externally, limit power, and request a high voltage reduction, and immediately cut off the main circuit relay	>3800mV	<3700mV	Recoverable	SBCU
10	0x1041	Battery cluster cell undervoltage alarm	1	Transmit fault signals externally	<2500mV	>2600mV	Recoverable	SBCU
11	0x1042		2	Transmit fault signals externally, and limit power	<2400mV	>2500mV	Recoverable	SBCU
12	0x1043		3	Transmit fault signals externally, limit power, and request a high voltage reduction, and immediately cut off the main circuit relay	<2300mV	>2400mV	Recoverable	SBCU
13	0x1051	Battery cluster charging current exceeding limit alarm	1	Transmit fault signals externally	>105%*AllowCurr See remarks for details	<100%*AllowCurr See remarks for details	Recoverable	SBCU
14	0x1052		2	Transmit fault signals externally, and limit power	>110%*AllowCurr See remarks for details	<105%*AllowCurr See remarks for details	Recoverable	SBCU
15	0x1053		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	>130%*AllowCurr See remarks for details	/	Unrecoverable	SBCU
16	0x1061	Battery cluster discharging current exceeding limit alarm	1	Transmit fault signals externally	>105%*AllowCurr See remarks for details	<100%*AllowCurr See remarks for details	Recoverable	SBCU
17	0x1062		2	Transmit fault signals externally, and limit power	>110%*AllowCurr See remarks for details	<105%*AllowCurr See remarks for details	Recoverable	SBCU
18	0x1063		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	>130%*AllowCurr See remarks for details	/	Unrecoverable	SBCU
19	0x10A1	Cell voltage accumulation and overvoltage alarm in battery cluster	1	Transmit fault signals externally	Vsum>3.65V*N	Vsum<3.6V*N	N indicates the number of battery strings	SBCU
20	0x10A2		2	Transmit fault signals externally, and limit power	Vsum>3.7V*N	Vsum<3.65V*N	N indicates the number of battery strings	SBCU
21	0x10A3		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Vsum>3.8V*N	Vsum<3.7V*N	N indicates the number of battery strings	SBCU
22	0x10B1	Cell voltage accumulation and undervoltage alarm in battery cluster	1	Transmit fault signals externally	Vsum<2.50V*N	Vsum>2.60V*N	N indicates the number of battery strings	SBCU
23	0x10B2		2	Transmit fault signals externally, and limit power	Vsum<2.40V*N	Vsum>2.50V*N	N indicates the number of battery strings	SBCU
24	0x10B3		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Vsum<2.30V*N	Vsum>2.40V*N	N indicates the number of battery strings	SBCU

25	0x10C1	Low insulation fault (single cabinet with no MBCU)	1	Transmit fault signals to EMS	$\leq 1,000\Omega/V$	$> 1,100\Omega/V$	Recoverable	SBCU
26	0x10C2		2	Transmit fault signals to EMS, and limit power	$\leq 500\Omega/V$	$> 600\Omega/V$	Recoverable	SBCU
27	0x10C3		3	Transmit fault signals to EMS, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	$\leq 100\Omega/V$	/	Unrecoverable	SBCU
28	0x10D1	Battery cluster excessive temperature difference alarm	1	Transmit fault signals externally	$> 8^{\circ}C$	$< 6^{\circ}C$	Recoverable	SBCU
29	0x10D2		2	Transmit fault signals externally, and limit power	$> 13^{\circ}C$	$< 8^{\circ}C$	Recoverable	SBCU
30	0x10D3		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	$> 15^{\circ}C$	$< 13^{\circ}C$	Recoverable	SBCU

31	0x10E1	Battery cluster cell excessive voltage difference alarm	1	Transmit fault signals externally	$> 500mV$	$< 300mV$	Recoverable	SBCU
32	0x10E2		2	Transmit fault signals externally, and limit power	$> 3600mV$	$< 500mV$	Recoverable	SBCU
33	0x10E3		3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	$> 4000mV$	$< 3,600mV$	Recoverable	SBCU
34	0x10F1	Low battery cluster SOC alarm	1	Transmit fault signals externally	$< 3\%$	$> 5\%$	The threshold is subject to the actual operating conditions	SBCU
35	0x1103	Battery cluster voltage mismatch fault	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	$ \text{Slave plate voltage sum} - \text{internal bus voltage}  > 40V$	/	Recoverable this time	SBCU
36	0x1183	Low battery cluster SOH alarm	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	SOH $< 60\%$	/	Unrecoverable	SBCU
37	0x2013	Battery cluster communication loss between SBCU and BMU	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	No signal received    life signal unchanged	Life signal changed	Recoverable	SBCU
38	0x20B1	Battery cluster SBCU internal bus voltage sampling fault (after connecting to high voltage)	1	Transmit fault signals externally, and the cluster disables the insulation detection function	Invalid internal bus voltage sampling	Normal sampling	Recoverable	SBCU
39	0x20B3	Battery cluster SBCU internal bus voltage sampling fault (before applying high	3	Transmit fault signals externally, and the cluster disables the insulation detection function, with high voltage prohibited	Invalid internal bus voltage sampling	Normal sampling	Recoverable	SBCU

		voltage)						
40	0x20C3	Battery cluster SBCU external bus voltage sampling fault	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Invalid external bus voltage sampling	Normal sampling	Recoverable	SBCU
41	0x20D3	Battery cluster SBCU insulation sampling circuit fault (before applying high voltage)	3	Transmit fault signals externally, and the cluster disables the insulation detection function, with high voltage prohibited	Invalid insulation sampling partial voltage value	Normal sampling	Recoverable	SBCU
42	0x20E3	Battery cluster high-voltage box current sampling module fault	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Current sampling value reading fails	Current sampling value reading succeeds	Recoverable	SBCU
43	0x20F1	SBCU-EE storage failure	1	Transmit fault signals externally	Communication of EE fails while reading or writing	Communication of EE succeeds while reading or writing	Recoverable	SBCU
44	0x2153	Communication loss between SBCU and EMS (for air-cooled single cabinet)	3	Transmit fault signals to EMS, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	No signal received    life signal unchanged	Life signal changed	Recoverable	SBCU
45	0x3173	33772 communication loss	3	Transmit fault signals to EMS, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Unsuccessful reboot for 10 times within 1s	Communication recovered	Recoverable	SBCU
46	0x4013	Failure to connect the main positive circuit relay in the battery cluster high-voltage box	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Open-circuit fault	/	Unrecoverable this time	SBCU
47	0x4023	Failure to connect the main negative circuit relay in the battery cluster Open/close fault	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Open-circuit fault	/	Unrecoverable this time	SBCU
48	0x4053	Failure to connect budget report pre-charge relay in the battery cluster high-voltage box	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Open-circuit fault After the pre-charge instruction is issued, the total external pressure is $\leq 200V$	/	Unrecoverable this time	SBCU
49	0X40E3	AC/DC1 fan power relay (KM4) open circuit (air cooled)	2	Transmit fault signals to EMS, and limit power	The relay cannot be disconnected and its feedback does not correspond to the SBCU control commands	/	No	SBCU
50	0x40F2	Failure to disconnect the main positive circuit relay in the battery cluster high-	3	Transmit fault signals to EMS, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Sticking failure	/	Unrecoverable	SBCU

		voltage box						
51	0x40F3	Failure to disconnect the main negative circuit relay in the battery cluster high-voltage box	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Sticking failure	/	Unrecoverable	SBCU
52	0x4103	AC/DC1 fan power relay (KM4) adhesion (air cooled)	1	Transmit fault signals to EMS	The relay cannot be disconnected and its feedback does not correspond to the SBCU control commands	/	No	SBCU
53	0x4132	Failure to disconnect budget report pre-charge relay in the battery cluster high-voltage box	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	Sticking failure	/	Unrecoverable this time	SBCU
54	0x4143	Battery cluster relay sticking detection circuit failure	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	The relay cannot be disconnected and its feedback does not correspond to the SBCU control commands	/	Unrecoverable this time	SBCU
55	0x5013	Battery cluster short circuit fault	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Unrecoverable this time	SBCU
56	0x5123	Battery cluster precharge failure	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Unrecoverable this time	SBCU
57	0x5182	Battery cluster SBCU wakeup loss	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Recoverable	SBCU
58	0x5192	Battery cluster and system voltage mismatch fault	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Unrecoverable	SBCU
59	0x8023	Battery cluster thermal runaway alarm	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Unrecoverable	SBCU
60	0x9012	Manual disconnect switch (QS) in the high-voltage box of the battery cluster is disconnected	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Unrecoverable this time	SBCU
61	0x9022	Fuse (FU) in the battery cluster high-voltage box is disconnected	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Unrecoverable this time	SBCU
62	0x9052	Excessive temperature in the high-voltage box of the battery cluster	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Recoverable	SBCU

63	0x9062	Battery cluster SBCU relay drive supply voltage abnormal	3	Transmit fault signals externally, limit power, and request a high voltage reduction. If the reduction command is not received within 5s, cut off the main circuit relay.	/	/	Recoverable	SBCU
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## Appendix I:

### Quality Assurance

- ◆ For products that develop faults during the warranty period, our Company will provide free repair or replacement with a new product.
- ◆

#### Evidence required

During the warranty period, our Company requires customers to provide proof of purchase, such as an invoice and the purchase date. Additionally, the product's trademark must be clear. Otherwise, we reserve the right to deny quality assurance.

#### Conditions

- ◆ After replacement, the unqualified products shall be handled by our Company
- ◆ Customers shall allow our Company a reasonable amount of time to repair the faulty equipment

#### Exclusions from quality assurance

Our Company reserves the right to deny quality assurance under any of the following circumstances:

- ◆ The complete machine or components have exceeded the free warranty period.
- ◆ Damage caused during transportation.
- ◆ Incorrect installation, modification, or use.
- ◆ Operation in environments that are excessively harsh, as specified in this Manual.
- ◆ Machine malfunctions or damage caused by installation, repair, alteration, or disassembly performed by personnel not authorized by our Company.
- ◆ Installation or use beyond the scope specified in relevant international standards.
- ◆ Machine malfunctions or damage caused by the use of non-standard or non-company parts or software.
- ◆ Damage caused by abnormal natural conditions. If a product fault occurs due to any of the above reasons and the customer requests repair services, our Company's service organization may provide paid repair services after evaluation.



To continuously improve customer satisfaction, our Company's products and product manuals are subject to ongoing updates and upgrades. If there are discrepancies between the manual in your possession and the product, it may be due to version differences. Please refer to the specific product for accurate information. Should you still have questions, please contact our Company.

# 11

## Touch Screen

### 11.1 Operation Interface

Taking the MPS-500KW for example, the LED touchscreen is installed on the front of the converter cabinet door. Users can monitor the converter, read its data, and set parameters through the touchscreen. The touchscreen interface is shown in the figure below:



Figure 11-1 LCD Homepage

Table 11-1 Homepage Area Function Descriptions

Functional Area	Description
Basic Information	Displays the Company logo, machine model, and time
Menu	Allows selection of various functional menus
Homepage	Displays the current and voltage on both the AC and DC sides of the converter
Running status	Displays communication status, current converter status, alarms, and quantity of status

### 11.2 User password

When not logged in, access to the system interface is restricted. Users cannot view or modify basic and advanced setting parameters.

When logged in as "User", working modes can be switched, and users can modify basic setting parameters related to the working mode. Advanced setting parameters can be viewed but not modified.

When logged in as "Maintenance" or "Super User", both basic and advanced setting parameters can be set.

The default password is 123456. If advanced setting parameters need to be modified, please contact maintenance personnel.

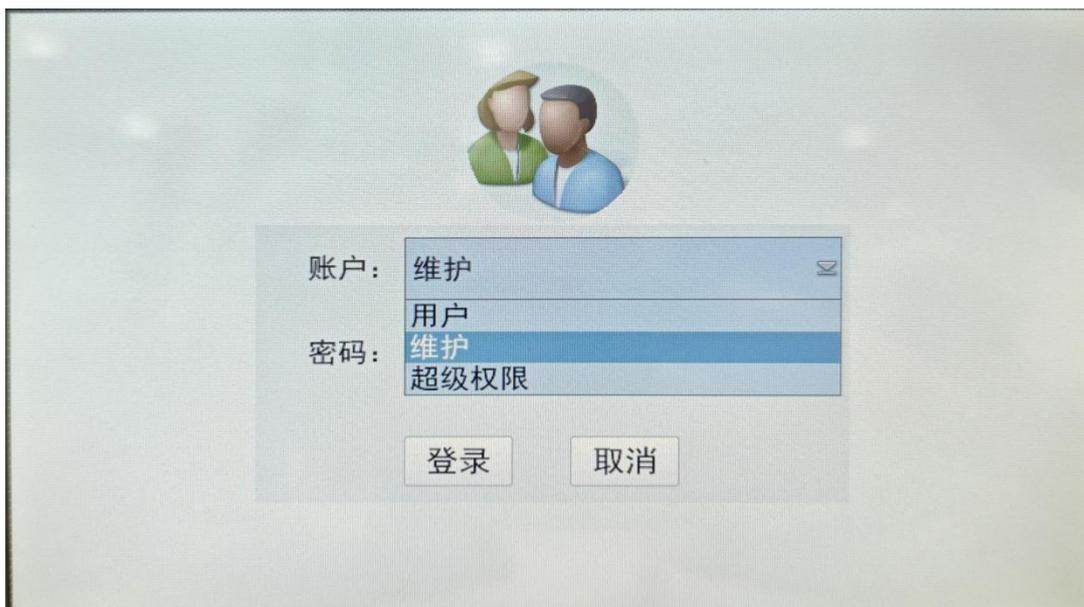


Figure 11-2 Account Login Interface

Table 11-2 Indicator Status

Indicators	Function	Status	Represents
Indicator 1	System running indicator	Green, steadily on/off	Monitoring system abnormal
		Green, flashing	Monitoring system abnormal
Indicator 2	Inverter indicator	Green, steadily on	Power conversion system normal working
		Green, flashing	Energy storage converter in soft-start mode
		Off	Energy storage converter not working
Indicator 3	Alarm indicator	Red, flashing	The energy storage converter has an alarm
		Off	The energy storage converter has no alarm

**Note:** Indicator 1, Indicator 2, and Indicator 3 are status indicators located on the left side of the touchscreen, arranged from top to bottom.

### 11.3 Alarm buzzer

Table 11-3 Alarm Buzzer Modes

Beeps once every second	This sound is generated when an alarm is generated on the converter
-------------------------	---

### 11.4 Communication settings

Communication parameters can be set, including the device address (Modbus address) and the baud rate for RS485 communication with the host computer. The device can communicate with the BMS in the following ways: no communication, CAN, or serial port.

The device supports two communication methods with the host computer: RS485 serial communication and network communication.

The setting methods are as follows:

### RS485 serial communication

The Modbus address ranges from 1 to 247. Each Modbus address is unique. The default baud rate for serial communication is 9600bps, 8 data bits, 1 stop bit, and no parity bit.

### Network communication

Default IP address: 192.168.1.100

Default subnet mask: 255.255.255.0

Default gateway: 192.168.1.1, Port: 502 communication

The default baud rate for CAN1 communication (internal communication) is 500kbps.

The baud rate of CAN2 communication (battery BMS) can be set to 125/250/500kbps.

## 11.5 Introduction to the interfaces

### 11.5.1 Introduction to the homepage

Taking the MPS-100KW for example, the main interface mainly displays machine model, time, battery information, converter information, operation status, and alarm information.

As shown in Figure 11-3:



Figure 11-3 Main interface

1. Click the "Battery" icon on the main page to view battery properties.
2. Click the converter icon to view "Real-time Data".
3. Click the triangle "Alarm" icon at the upper right corner of the screen to view all alarms.



Figure 11-4 Alarm Item Directory

The converter display alarms are divided into AC alarm description and DC alarm description. In this case, the AC alarm indicates that the BMS communication is faulty, and the DC alarm indicates that the DC converter is overcurrent. For details about how to rectify the fault, see Chapter 10 Fault Alarms and Troubleshooting Methods.

Table 11-4 Menu Expansion Items

No.	Menu Name	Menu Items	Parameter Function
1	Homepage	Battery	If the lithium battery is connected, the battery analog quantity, status quantity, and alarm quantity are displayed; If a lead-acid battery is connected, the lead-acid battery data page is displayed
		PV	PV input voltage and current
		Converter	Displays real-time data
		Load	Voltage, current, and load power
		Grid	Grid input voltage, current, and meter power
2	Status	MPS data	Converter data display
		MPS status	Displays converter operating status and switch status
		MPS alarms	Current system operation information and alarms
		Battery data	Real-time monitoring data of the battery
3	Records	Data reports	Statistics on PV, load, battery, and grid charging/discharging quantities

		Export data	Statistics on exports historical records, operation logs, and electric quantity
		Historical records	Displays status records and historical fault records during operation
		Operation logs	Records important parameter modifications made during system settings
4	System settings	DC/AC parameter settings	On-grid mode, operation mode, constant power, etc.
		DC/AC parameter settings	Working mode, step-up/step-down voltage, etc.
		Battery settings	Battery parameters setting
		Automatic operation time settings	Sets the time period for automatic system operation
		System information	Displays PCS version number
		Advanced settings	Function settings, system parameters, DC/AC debugging, and DC/DC debugging
5	Switch	Converter switch	Turns on/off the DC/DC converter or sets it to the standby mode
			Turns on/off the DC/AC converter or sets it to the standby mode

### 11.5.2 Real-time data overview

Users can click on the icons on the main interface to view real-time data of the converter, PV side, load side, battery side, and grid side. Additionally, users can access the status main interface by clicking "Menu" → "Status".

On this interface, users can query the following four types of data: "MPS Data", "MPS Status", "MPS Alarms", and "Battery Data". By observing the feedback data from these four real-time parameters, users can monitor the converter. The MPS data is shown in Figure 11-5.



Figure 11-5 Converter Data

Under the MPS data list, 12 buttons indicate the number of DC/DC modules. The number of offline modules is dimmed. Users can also click "Power Grid" or "Load" on the right to query real-time monitoring data.



100kW-TS						2024-08-23 09:18:14					
设备数据		设备状态		设备告警		电池数据		BMS告警			
名称	数值	名称	数值	名称	数值	名称	数值	名称	数值	名称	数值
直流输入断路器	闭合	DCAC 变流器使能	使能	DCDC 变流器使能	禁止						
直流接触器	闭合	直流软启动	完成	运行模式	降压						
维修旁路断路器	断开	变流器状态	并网充电	高压侧软启动	未启动						
输出断路器	闭合	无功调节方式	禁止	低压侧软启动	未启动						
输出接触器	闭合	LVRT	无	高压侧接触器	断开						
电网断路器	闭合	DI1	禁止	低压侧接触器	断开						
DCAC 绝缘检测	禁止	DI2	禁止	变流器状态	关闭						
远程发电机控制	禁止	DI3	禁止	DCDC 绝缘检测	禁止						
发电机DO信号	禁止	DI4	禁止								
DO2	禁止	DI5	禁止								
DO3	禁止	DI6	禁止								

1 2 3 4 5 6 7 8 9 10 11 12

菜单 主机-00 变流器并网充电 电池优先 变流器2关闭

Figure 11-6 MPS Status

The MPS status primarily displays the operating status of various circuit breakers, contactors, and the converter. This interface allows users to intuitively and conveniently understand the operating status of the MPS. The data on this interface is divided into three columns, with each data point having its corresponding status: the first two columns display the real-time status of the DC/AC modules; and the third column displays the status of the DC/DC modules. Clicking on a module number will display the corresponding real-time status in the first column on the right.

### 11.5.3 Record menu overview



100kW-TS						2024-08-23 09:20:05	
数据报表		导出数据		历史记录		操作日志	
	日电量(kWh)	月电量(kWh)	年电量(kWh)	总电量(kWh)	2024/08/23		
PV发电量	0	0	0	0	↑		
负载耗电量	1	1	1	1	↓		
电池充电量	2.6	2.6	2.6	2.6	年 - 年 +		
电池放电量	0.3	0.3	0.3	0.3	月 - 月 +		
电网购电量	4	4	4	4	日 - 日 +		
电网卖电量	0	0	0	0			

菜单 主机-00 变流器并网充电 电池优先 变流器2关闭

Figure 11-7 Record Menu Interface

Click "Menu" → "Record" to enter the record menu interface. On this interface, users can click query "Data Report", "Export Data", "Historical Records", and "Operation Logs".

The primary function of this section is to collect MPS charging/discharging data and operation records for ease of query by users.

To export data, click the "Export Data" button in the record menu. A USB drive formatted in FAT32 must be connected.

Users can select the data to export, such as "Historical Records", "Operation Logs", or "Data Reports". After exporting, click "Eject USB" to safely remove the USB drive.



Figure 11-8 Data Export

### 11.5.4 Parameter settings

On the menu interface, click "Menu" → "System" → "Hybrid Mode", "Self Consumption", "Battery Priority", "Optimal Mode", "Manual Mode", "Distributed Inverter" → "DC/AC Parameters", "DC/DC Parameters", "Battery Setting Parameters", and "Time Range Settings".



Figure 11-9 DC/AC Parameter Settings

MPS on-grid mode: Users can set the system to On-grid, Off-grid, or Automatic. The on-grid mode is that the converter is connected to the grid, which can take power from the grid or input the PV power generation into the grid. Off-grid mode is not connected to the power grid, and the battery is charged and loaded by PV power generation. Automatic mode is the internal automatic switching on- or off-grid mode. The default mode is the on-grid mode.

Constant power setting: The system defaults to AC constant power control. Positive power indicates discharging, while negative power indicates charging. The control precision is 0.1 kW, effective in the CP\_N&P control mode.



Figure 11-10 DC/DC Parameter Settings

1. Operating mode: Set the working mode of DC-DC converter, CV is the constant voltage mode, CC is the constant current mode, and MPPT is the PV automatic tracking mode, which is the default mode.
2. Stepping-up/stepping-down voltage: When the input voltage is greater than the output voltage, set it to the stepping-down mode; and when the input voltage is less than the output voltage, set it to the stepping-up mode (Apply factory settings according to the project).
3. Number of modules: Specifies the number of modules delivered by the device.
4. Current calibration value: Used to calibrate DC/DC current. This parameter takes effect when “Battery Current Feedback Type” is set to “Corrected value”.
5. Outer loop centralized control: Manages power imbalance between multiple PV modules with significant power fluctuations.
6. IV curve scanning: For internal debugging only.



Figure 11-11 Battery Setting Parameters

1. On-grid DOD and off-grid DOD: These two parameters do not need to be set as they are not currently used in control logic;
2. Off-grid DOD protection release SOC: When DOD protection is active, it is released when the current SOC reaches the set value, allowing the battery to continue discharging.
3. Charging voltage upper limit: The converter shuts down when the charging voltage reaches this value.

4. Return difference of charging voltage upper limit: When the battery is charging, the converter shuts down when the total battery voltage reaches the upper limit. The converter automatically starts when the total battery voltage drops below the upper limit minus the return difference value.
5. Discharging voltage lower limit: The converter shuts down when the discharging voltage reaches this value.
6. Return difference of discharging voltage lower limit: When the battery is discharging, the converter shuts down when the total battery voltage reaches the lower limit. The converter restarts when the total battery voltage rises above the lower limit plus the return difference value.
7. Charging current limit: The maximum allowable current on the battery side to prevent overcharging.
8. Discharging current limit: The maximum allowable current on the battery side to prevent over-discharging.
9. Diesel generator start SOC: The generator starts when the specified SOC is reached. In the lithium battery mode, if both generator start SOC and generator stop SOC are set to 0, generator-related parameters cannot be set, and the generator control logic is not executed.
10. Diesel generator stop SOC: The generator stops when the specified SOC is reached. In the lithium battery mode, if both generator start SOC and generator stop SOC are set to 0, generator-related parameters cannot be set, and the generator control logic is not executed.
11. Forced charging start voltage: When the lowest single-cell voltage drops below this value, the AC side charges the battery at 10% of the rated power. In the lithium battery mode, when the forced charging start voltage and the forced charging stop voltage are both 0, the forced charging logic is not executed.
12. Forced charging stop voltage: When the highest single-cell voltage exceeds this value, forced charging stops, and the system returns to its previous state. In the lithium battery mode, when the forced charging start voltage and the forced charging stop voltage are both 0, the forced charging logic is not executed.
13. DC/AC single-cell protection voltage: When the battery current feedback type is set to "Calculated value", the converter uses linear current limiting to restrict the charging current when the highest single-cell voltage reaches the protection voltage minus the return difference of protection voltage.
14. DC/AC single-cell protection voltage return difference: The return difference of DC/AC single-cell protection voltage.

### 11.5.5 Setting the Automatic Running Time

Click "Automatic Running Time" in the system menu to enter the setting of peak shaving/valley filling charging/discharging time, which can be set according to the local electricity price difference or the real peak/valley electricity consumption time.



Figure 11- 12 Automatic Operation Time Settings

1. Schedule: Switch the currently displayed schedule. When the cycle mode is set to Daily Cycle, only the daily schedule can be viewed. When the cycle mode is set to Weekly Cycle, the schedules for Monday to Sunday can be viewed.

2. Option: Once enabled, the system will automatically operate according to the set time period and selected functional mode.
3. Start time: The system will start automatic operation at this time.
4. End time: The system will stop automatic operation at this time.
5. Function: The function to be executed during the working time. Two options are available: the peak shaving/valley filling mode; and the economic mode.
6. Power:
  - ① In peak shaving/valley filling mode, a positive value indicates discharging, and a negative value indicates charging. In the economic mode, if the charging method is set to "None", this setting is invalid;
  - ② In economic mode, if the charging method is set to "Generator Charging" or "Grid Charging", it limits the charging power on the AC side.
7. Target SOC: This mode takes effect only in economic mode and the charging mode is set to "None", and it executes the "Self-consumption" mode: When the current SOC is higher than the target SOC, the PV and battery provide the energy required by the load. When the current SOC is lower than or equal to the target SOC, the PV and power grid provide the energy required by the load, and the battery charges with low power.
8. Charging method: Only effective in the Economic Mode.
  - ① The charging mode is set to "None": it executes the "Self-consumption" mode. When the current SOC is higher than the target SOC, the PV and battery provide the energy required by the load. When the current SOC is lower than or equal to the target SOC, the PV and power grid provide the energy required by the load, and the battery charges with low power;
  - ② The charging mode is "generator charging": the "battery priority" mode is executed. When the current grid voltage is lower than 100V and the current SOC is lower than the target SOC, the generator starts, and the generator provides the energy required by the load;
  - ③ The charging mode is "grid charging": the "battery priority" mode is executed. The generator is turned off, and the grid charges the battery while providing the energy required for the load.

### 11.5.6 System information

The system information interface displays the protocol version and IP address settings of the MPS operating system. After setting the address, click the restart button to apply the settings, as shown in Figure 11-13:

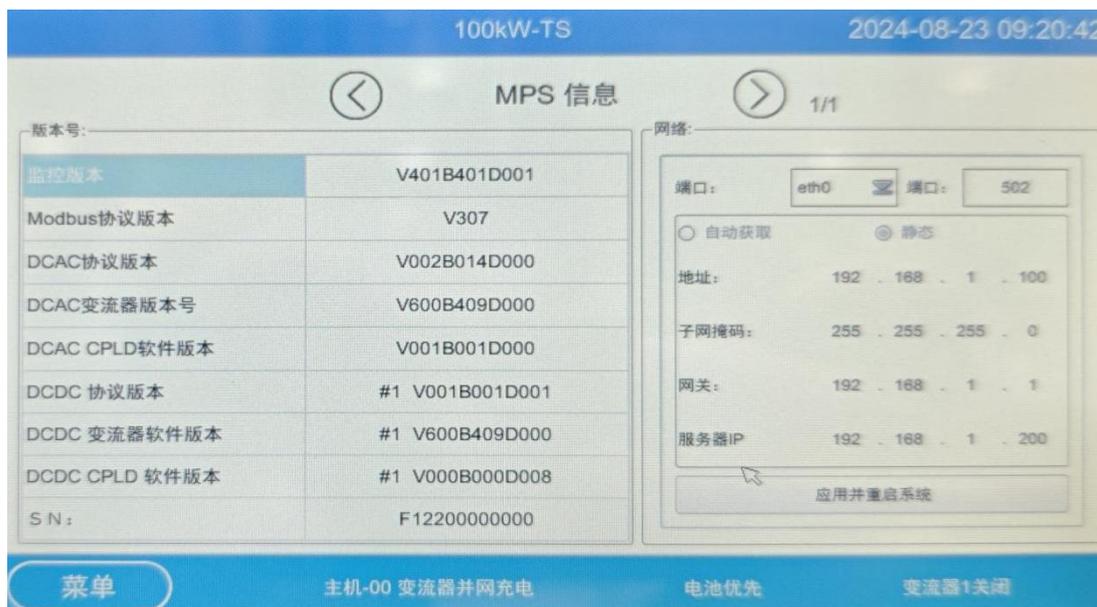


Figure 11-13 System Information

### 11.5.7 Advanced settings

Access the advanced settings by navigating to "Menu" → "System" → "Advanced Settings". Advanced settings consist of seven sections: function settings, system settings, devices, DC/AC debugging, DC/DC debugging, monitoring debugging, and port messages.



功能设置 1		高级设置		1/8		退出
功率控制类型	CP_N&P	串口通信地址	1	电池容量告警	禁止	
输出无功方式	不可调节	串口 2(bps)	9600	BMS通信故障判断时间(s)	20	
输出无功功率(Kvar)	0	串口 3(bps)	9600	EMS通信故障判断时间(s)	120	
输出功率因数	1	串口 4(bps)	9600	语言	中文	
恒压值(V)	600	串口 5(bps)	9600	声音	使能	
恒流值(A)	0	串口 6(bps)	9600	清除数据	清除	
输出功率限制(kW)	110	CAN 1(kbps)	500	系统升级	升级	
设备号	主机-00	CAN 2(kbps)	250	备份设置参数	备份设置	
并机	禁止	能量优先级	电网>电池	恢复备份设置参数	恢复备份	

菜单      主机-00 变流器并网充电      电池优先      变流器3关闭

Figure 11-14 Function Setting 1

1. Power control types:

- ① Constant Voltage (CV) mode: The converter operates in the constant voltage mode on the DC side.
- ② Constant Current (CC) mode: The converter operates in the constant current mode on the DC side.
- ③ AC Constant Power (CP\_AC) Mode: The power level can be set under "Constant Power". The value

represents a corresponding power: a positive value indicates discharging, and a negative value indicates charging. For example, setting -5 indicates that the AC side charges the battery at -5KW. Due to inverter losses, the DC side power will be smaller than that on the AC side; and setting 5 indicates that the AC side outputs at 5KW. Due to inverter losses, the DC side power will be greater than that on the AC side.

2. Output reactive power mode: Unadjustable by default. Power factor, reactive power, and non-unadjustable are available.
3. Output reactive power: This parameter can change the reactive power Q. Positive values indicate reactive power lead and negative values indicate reactive power lag.
4. Output power factor: This parameter can be changed to power factor Pf. The power factor is equal to the ratio of active power to applied power. Positive value indicates reactive power lead and negative value indicates reactive power lag.
5. Constant voltage value: If the constant voltage value is modified, the machine will operate at a constant voltage value, and the machine will act as a constant voltage source.
6. Constant current value: If the constant current value is modified, the machine will charge and discharge the battery at a constant current value, with positive value representing discharging, and negative value representing charging.
7. Upper output power limit: Limit the set value of AC measured power of the converter.
8. Device ID: The device ID can be set from M\_01 to M\_12.
9. Parallel operation: Enable this parameter when multiple devices are connected from the network.
10. Serial port communication address: The default value is 1 and the value ranges from 1 to 255. It is used to match serial port communication addresses.
11. Serial port: The 6 baud rate of the serial port is 1200, 2400, 4800, 9600, 19200, and 38400. The default baud rate of the serial port is 9600bps, 8 data bits, with no parity, and 1 stop bit (8, N, 1).
12. Port CAN1: The baud rate for internal communication. The default baud rate is 500kbps and cannot be modified.
13. CAN2 port: The baud rate is 100, 125, 250, 500, and 800kbps. The default baud rate is 500kbps.
14. Battery capacity alarm: enabled, or disabled. Effective in grid expansion mode to prevent battery over-discharge. When the battery SOC is below the "Charging SOC" or "On-grid DOD", the system enters low battery capacity protection. If the load still exceeds the set grid capacity and requires battery discharge, the system will shut down after 3 minutes of continuous discharge.
15. BMS communication fault determination time: The BMS communication fault determination time refers to the BMS communication fault when the BMS communication is disconnected and the communication is not recovered after a preset period of time.

16. Clear data: Clears previous system records and operation data.
17. System upgrade: Before upgrading, please confirm: The EPO is pressed; and the DC/DC module's rocker switch is set to "OFF".
18. Backup setting parameters: It refers to backing up the current parameters set on the device so that the backup parameter settings can be restored when needed.
19. Restore backup settings: Restore the device to the last backup settings and restart it.



Figure 11-15 Function Setting 2

20. Protocol version: View the current protocol version. The default protocol version is V1.0.
21. Restore factory defaults: Restore the factory defaults.
22. Battery current feedback type: there are three types for battery current feedback: "Calculated value", "BMS value", and "Corrected value".
23. Calculated Value: The PCS uses linear current limiting to restrict charging current when the highest single-cell voltage reaches the protection voltage minus the return difference of protection voltage.
24. BMS value: PCS limits the charging current at this time according to the charging current limit value uploaded by BMS.
25. Corrected value: The device will correct the DC/DC current according to the value set in "Current Corrected Value" on the DC/DC parameters page. The default is a calculated value.
26. Release charge prohibition flag: The charge prohibition is released when the battery SOC is below the selected value. There are four options: follow the battery, 95%, 90%, and 85%.
27. Release discharge prohibition flag: The charge prohibition is released when the battery SOC is below the selected value. There are four options: follow the battery, 5%, 10%, and 15%.
28. Meter countercurrent prevention: Enable, or Disable. Enable indicates that system current cannot flow to the power grid, and Disable indicates that system current can flow to the power grid.
29. User Password: allows resetting the user password. The default user password is 123456. (Note: User password must be six digits)
30. Maintenance password: allows resetting the maintenance password. (Note: User password must be six digits)
31. Meter model: Select the meter model based on the meter type. Currently available models are: DTSD1352, AMC96\_E4\_KC, ADL3000\_E\_B, and AMC72\_96.

100kW-TS		2024-08-23 09:23:56	
系统设置		高级设置	
功率变化率(kW/s)	20	机器型号	MPS-TS
电网频率上限(Hz)	0.2	机器容量	100
电网频率下限(Hz)	-0.5	变压器变比	270:400
电网电压保护上限(%)	+15	输出电压等级	400
电网电压保护下限(%)	-15	输出频率等级	50
高穿使能	禁止	逆变器防逆流	可逆流
低穿使能	禁止	过频降载	禁止
孤岛使能	禁止	负载负序补偿使能	使能
一次调频使能	禁止	负载正序无功补偿使能	使能

菜单      主机-00 变流器并网充电      电池优先      变流器2关闭

Figure 10-16 System Settings

1. Power change rate: the rate at which power changes per unit time.
2. Upper limit of power grid frequency variation range: the maximum range of frequency variation allowed on the AC side, which can be selected as 0.2, 0.5, or 1.5.
3. Lower limit of power grid frequency variation range: the maximum range of frequency variation allowed on the AC side, which can be selected as -0.5, -1, -2, or -5.
4. Upper limit of voltage protection range: the upper limit of the voltage variation range allowed on the AC side. The value can be 10, 15, or 20.
5. Lower limit of voltage protection range: the lower limit of the voltage variation range allowed on the AC side. The value can be -10, -15, or -20.
6. High voltage ride-through (HVRT) enable: Enable or Disable. (Note: This is generally used in large on-grid power plants.)
7. Low voltage ride-through (LVRT) enable: Enable or Disable. (Note: This is generally used in large on-grid power plants.)
8. Islanding enable: When islanding effect is detected (in PV on-grid systems, when there is a failure in the large power grid, and the PV on-grid converter power generation and the local load on the low-voltage side of the grid just matches in terms of power, it may maintain a self-sufficient power generation state, creating an "islanding" phenomenon, which endanger maintenance personnel), the converter will automatically shut down. Two options are available: Allow or Forbidden. (Note: This is generally used in large on-grid power plants.)
9. Primary frequency modulation enable: When the frequency of the power grid deviates from the rated value, the power grid frequency is maintained by controlling the increase or decrease of the active power. Two options are available: Allow, or Forbidden. (Note: This is generally used in large on-grid power plants.)
10. Machine model: The factory settings shall prevail and generally cannot be modified.
11. Machine capacity: The factory values shall prevail and cannot be changed.
12. Transformer ratio: The factory name tag shall prevail and cannot be modified.
13. Output voltage level: The factory values shall prevail and generally cannot be modified.
14. Output frequency level: the default is 50Hz, and generally 50Hz or 60Hz.
15. Anti-reverse power flow for converter: reverse power allowed or reverse power prohibited. Reverse power allowed means converter current is allowed to flow to the grid. Reverse power prohibited means converter current is prohibited from flowing to the grid.
16. Overfrequency load reduction: Enable or Disable are optional. (Note: This is generally used in large on-grid power plants.)
17. Load negative sequence reactive power compensation enable: Enable or Disable. The system compensates the negative sequence reactive power of the load.
18. Load positive sequence reactive power compensation enable: Enable or Disable. The system compensates the positive sequence reactive power of the load.
19. DC/AC insulation detection enable: Enable or Disable. (Note: Default is Disable.)

20. DC/DC insulation detection enable: Enable or Disable. (Note: Default is Disable.)
21. Constant voltage parallel operation enable: Enable or Disable. (Note: This setting is used in constant voltage parallel operation mode.)
22. QP curve: Enable or Disable. (Note: This is generally used in large on-grid power plants.)



设备	使能/禁止	常闭/常开	动作	功能
DI 1	禁止	常开	关机	EPO
DI 2	禁止	常开	提示	关机
DI 3	禁止	常开	提示	行程开关
DI 4	禁止	常开	提示	ATS信号
DI 5	禁止	常开	提示	水浸
DI 6	禁止	常开	提示	消防
DO 1	使能	常开	提示	发电机
DO 2	禁止	常开	提示	告警信号
DO 3	禁止	常开	提示	运行信号

菜单      主机-00 变流器并网充电      电池优先      变流器1关闭

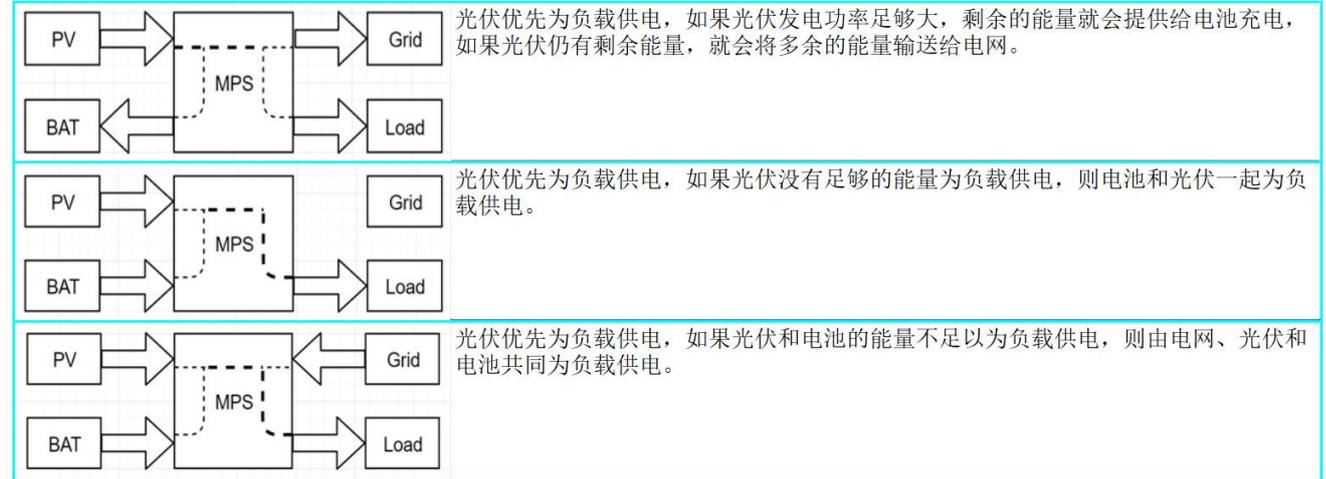
Figure 10-17 Devices

1. Enable/Disable: Input dry contact. Enable: When the dry contact detects a state inconsistent with the specified Normally Open (NO)/Normally Closed (NC) state, an action is triggered. Disable: When the dry contact detects a state inconsistent with the specified NO/NC state, no action is performed.
2. NC/NO: Set to Normally Closed circuit (NC) or Normally Open circuit (NO) depending on the on-site setting.
3. Action: When the dry contact is enabled, the device will perform the selected action upon signal change. Optional actions: Alert and Shutdown. When the function description is "EPO" or "Shutdown", the action is fixed as "Shutdown."
4. Function: When the dry contact is enabled, the device will respond with the corresponding alarm and action for the selected function upon signal change. Trigger signals include: EPO, Shutdown, Limit Switch, ATS Signal, Water Intrusion, Fire Suppression. When the function description is "EPO" or "Shutdown", the action is fixed as "Shutdown."

## 11.6 MPS working mode

MPS working mode can be set on the touch screen. Users can click "Operation Mode" in "Menu" → "System" → "DC/AC Parameter Setting" to select the working mode according to different requirements (for reference):

### 1. "Self-consumption" mode:



### 2. "Battery priority" mode:



### 3. Hybrid mode:

选择	开始时间	结束时间	功能	功率	目标SOC	充电方式
✓	08:00	10:00	削峰填谷	10	90	无
✓	08:00	10:00	经济模式	10	90	无
✓	08:00	10:00	经济模式	10	90	发电机充电
✓	08:00	10:00	经济模式	10	90	电网充电



“混合模式”主要有以下这些功能:

#### 1、经济模式

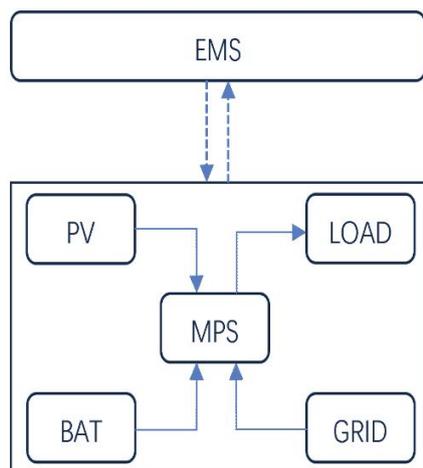
a、充电方式为“无”：执行“自发自用”模式，当前SOC高于目标SOC时，由PV和电池提供负载所需的能量，当前SOC低于等于目标SOC时，由PV和电网提供负载所需的能量，电池小功率充电。

b、充电方式为“发电机充电”：执行“电池优先”模式，当前电网电压低于100V且当前SOC低于目标SOC时，开启发电机，由发电机提供负载所需的能量。

c、充电方式为“电网充电”：执行“电池优先”模式，关闭发电机，电网给电池充电，同时提供负载所需的能量。

#### 2、削峰填谷：根据设定的功率值的正负(正放负充)来控制对电池的充放。

#### 4. Manual mode:



“手动模式”没有操作逻辑，可手动控制电池充电和放电。该模式适用于以下情况：  
1、电池充放电测试。  
2、能量管理系统 (EMS) 调度。

Note: If the anti-reverse function is enabled, the system will not supply power to the grid once it enters any of the three working modes, i.e., the self-consumption, the hybrid mode or the battery priority mode.

## 11.7 Converter status description

The energy storage converter has a total of 6 states, as shown in Figure 11-18 below:

Figure 11- 18 Converter Status

Status	Description
<b>Operation</b>	The energy storage converter works normally.
<b>Standby</b>	When the converter receives a standby command from the LCD screen or the upper computer during the standby or the operation mode, it switches to the standby state. In the standby state, the AC and DC contactors of the converter are closed, and the system is in a hot standby state. When the LCD screen or upper computer performs relevant controls, the converter can respond quickly.
<b>Fault</b>	When a fault occurs in the energy storage system, the converter stops working and automatically disconnects the AC and DC side contactors, separating the main circuit from the battery, grid, or load. In the fault state, the system continuously monitors whether the fault is resolved. If the fault is not resolved, it remains in the fault state; if the fault is resolved, it enters the standby state after a default 30 seconds.
<b>Shutdown</b>	If the energy storage converter is in the normal "Operation" state, the user can issue a shutdown command through the upper computer to stop the converter, or shut it down using the power-off button on the LCD screen's shutdown page.
<b>Emergency stop</b>	In case of a fault or emergency, press the Emergency Power Off (EPO) button to stop the converter.
<b>Shut down</b>	All circuit breakers of the energy storage converter are disconnected, and the switches are reset.

**Note:** When the energy storage converter develops a fault or power module failure, it is prohibited to power it on again through the touch screen. Power can be restored only after confirming no issues during a power-off check; otherwise, the machine may be damaged.

## 10.8 Shutdown in case of fault or emergency

In case of an emergency or fault, follow these steps:

**Step 1:** Press the Emergency Power Off “EPO” button;

**Step 2:** Disconnect the DC side circuit breaker or the AC circuit breaker of the load switch;

**Step 3:** Reset the EPO button after confirming that the danger or fault is removed and needs to run.

**Notes:**

- The EPO button is only for use in case of a machine failure or an emergency. For normal shutdowns, use the shutdown command via the touch screen panel.
- In case of an emergency, make sure to press the EPO button directly to ensure a rapid response.

## 11.9 Use of maintenance bypass

The maintenance bypass circuit breaker (MAINTENANCE) as shown in Figure 9-1 is normally open. The maintenance bypass is designed to ensure that the load remains powered (provided the grid is energized) when the MPS converter is under maintenance or faulty. When the maintenance bypass is closed, it connects the diesel generator or the grid to the load.

Specific operating steps are as follows:

- (1) Confirm that the diesel generator is operating normally or that the grid is energized;
- (2) Shut down the MPS converter;
- (3) Disconnect all switches;
- (4) Remove the baffle plate from the maintenance bypass circuit breaker;
- (5) Close the maintenance bypass circuit breaker;

**Note:** After equipment maintenance or fault recovery, the maintenance bypass must be opened, and the baffle plate must be reinstalled on the maintenance bypass circuit breaker.

## 11.10 On-grid conditions

Unless otherwise specified, the MPS can operate normally under the following grid conditions:

- 1) The harmonic voltage of the grid shall not exceed the requirements of local national and grid standards and regulations;
- 2) The unbalance of the three-phase voltage at the AC output shall not exceed the requirements of local national and grid standards and regulations;
- 3) The permissible deviation of grid voltage shall meet the requirements of local national and grid standards and regulations;
- 4) The permissible deviation of grid frequency shall meet the requirements of local national and grid standards and regulations.

### 11.10.1 On-grid mode selection

- 1) When the on-grid mode is set to "Automatic", the system automatically switches between the on-grid and off-grid modes. When the grid-side voltage is normal, the converter operates in the on-grid mode (PQ); when power grid is lost, the converter operates in the off-grid mode (VF).
- 2) When "On-grid" is selected, the converter operates in the on-grid mode (PQ). If the power grid is lost, the converter will shut down directly.
- 3) When "Off-grid" is selected, the converter operates in the off-grid mode. When the power grid is lost, the MPS internally detects abnormal grid-side voltage, and the MPS automatically switches to the battery priority mode, where the battery discharges to supply power to the load.