User Manual - V1.0

Outdoor Energy Storage System

GS125-261LS

Zhuhai Virtual Power Plant Technology Co., Ltd.

Document Release and Revision History

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1. Preface

1.1 Declaration

This manual details the installation, use, operation, maintenance, troubleshooting, and technical performance of the energy storage cabinet. Users are advised to thoroughly read and understand this manual before installation and to keep it properly for future reference.

Due to equipment iteration upgrades or other reasons, the content of this manual will be updated periodically. Users should refer to the actual purchased product as the standard and may obtain the latest version of the manual through official or sales channels. Unless otherwise agreed, this manual serves only as a usage guide. All statements, information, and recommendations contained herein do not constitute any explicit or implicit warranty. Without the written permission of our company, no organization or individual may excerpt or copy part or all of this manual's content, nor disseminate it in any form.

1.2 Safety Tips

During transportation, storage, installation, operation, and use of the equipment, strict compliance with the manual's content and all safety precautions indicated on the equipment and in the manual is mandatory. Furthermore, relevant international, national, or regional standards must be observed. Any unauthorized operations are prohibited. The precautions in this manual do not encompass all safety requirements. Our company assumes no responsibility for personnel or equipment damage resulting from violations of safety operation requirements or breaches of design, manufacturing, and equipment usage safety standards.

This equipment shall be operated in environments that comply with the design specifications; failure to do so may result in equipment malfunction, abnormal operation, or component damage, which are not covered under the product warranty. The company shall not be held liable for any personal injury, property damage, or other losses that may arise otherwise.

1.3 Safety Precautions

1.3.1 Warning Signs

Warning: Indicates precautions or instructions which, if improperly executed, may pose a risk to the user's personal safety or cause serious damage.

Danger: Indicates precautions or instructions which, if improperly executed, may pose a risk to the user's personal safety or cause severe damage.

Caution: Indicates precautions or instructions which, if improperly executed, may pose a risk to the user's personal safety or cause minor damage.

1.3.2 Safety Rules

- During equipment installation and replacement, power must be disconnected and proper grounding ensured to prevent electric shock; installation and maintenance must be performed by professional personnel.
- All equipment cables must be securely connected, well insulated, and appropriately sized. Loose, damaged, or undersized cables can cause circuit faults, potentially resulting in severe equipment damage, personal injury, or fire.
- Equipment that has been tipped over must not be installed directly, even if its exterior is undamaged, as internal damage may cause system malfunction or circuit short circuits. It must be inspected by professional personnel and confirmed to be free of damage before installation is permitted.

- If water ingress or residual moisture is detected inside the cabinet during installation, professional personnel must be notified for inspection; otherwise, it may result in safety incidents.
- Improper use and storage of the battery carry risks of explosion and burns; The battery must not be exposed for prolonged periods to high-temperature environments exceeding the limits specified in this manual, as this may lead to fire.

⚠ 警告

- Any malfunction potentially affecting the equipment's safety performance must be rectified by professional personnel before restarting.
- The product shall be installed by the company’s professional technical personnel or authorized professional organizations. Unauthorized installation or modification may cause safety hazards or equipment damage. The company assumes no responsibility for any resulting losses.

1.3.3 Safety Notes

The energy storage cabinet must be operated strictly in accordance with safety measures and relevant operating procedures; any incorrect operation may cause personal injury and equipment damage. Before commencing operation, ensure that operators have thoroughly read this manual to prevent electric shock and burn incidents.

(1) Personnel responsible for the operation and maintenance of the battery system must have undergone specialized training and obtained certification for electrical equipment operation;

(2) Before connecting cables, verify that the cables and their markings correspond to the actual installation situation prior to connection;

(3) The equipment installation site must be equipped with safety protective barriers, proper isolation measures, and appropriate safety signage;

(4) Do not place flammable materials next to the battery system.

(5) Before installing or removing power cables, the corresponding power switches must be turned off.

(6) Do not open the equipment cabinet door unauthorized during operation; risk of electric shock.

(7) During operation, specialized tools with insulation must be used.

(8) Conductive items such as watches, bracelets, bangles, and rings are strictly prohibited during operation; do not touch the battery system with wet hands.

(9) Maintenance must comply with operating procedures, including wearing insulating gloves, insulating footwear, and safety glasses; a supervisor must be present during work.

(10) Battery pack maintenance must be conducted by professional personnel; disassembly by non-professionals is strictly prohibited. During use or maintenance operations, any wear or damage to the internal or external wiring of the battery pack is strictly prohibited to prevent hazards.

2. System Introduction

2.1 Product Overview

2.1.1 Product Description

The GS125-261LS is an integrated commercial and industrial energy storage product, incorporating the battery system, inverter system, BMS/EMS, temperature control, and fire protection systems. This product facilitates the storage and discharge of electrical energy and is primarily applied in user-side commercial and industrial energy storage scenarios.

The system integrates the energy storage battery system, PCS module, liquid cooling heat dissipation system, and perfluorohexanone fire protection system, providing customers with a safe, reliable, and efficient commercial and industrial energy storage solution that meets conventional energy storage system requirements including peak-valley arbitrage, demand management, and grid connection applications.

2.1.2 Product Appearance and Dimensions

The outline of the GS125-261LS unit is shown in Figure 2-1, with dimensions (unit: mm) of 1400 × 1000 × 2280 (L × W × H), provided for reference during installation.

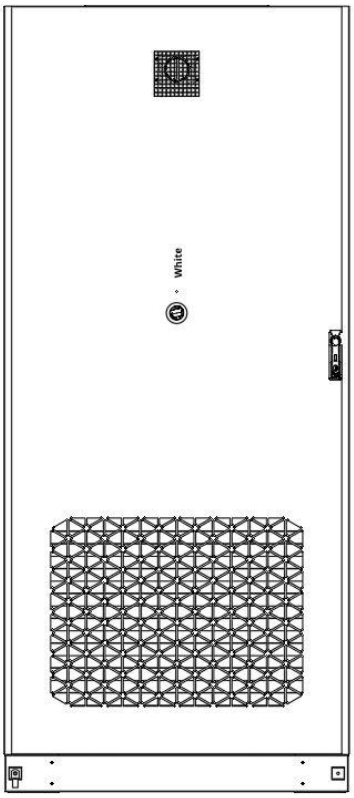


Figure 2- 1Unit Outline Drawing

2.2 Technical Specifications

Item		Specification Parameters
AC Side Parameters	Rated Power	125kW
	Output Voltage	400 V / 230V (-15%~15%)
	Grid Frequency	50Hz / 60Hz
	Power Factor	-1~1
	Wiring Method	Three-phase Four-wire + PE
	Maximum Output Current	200A

DC Side Parameters	Battery Cell Type	LFP 3.2V/314Ah
	Rated Capacity	261kWh
	Depth of Discharge	≤100% DOD (Recommended)
	Voltage Range	650~950V
	Maximum Current	157A
	Battery Pack Specifications	166.4V/314Ah(1P52S)
	Number of Battery Packs	5 units
System Parameters	Operating Temperature	-30 to 55℃ (Derating above 45℃)
	Relative Humidity	0 to 95%, Non-condensing
	Altitude	3000 m (Derating above 2000 m)
	Noise	<70dB@1m
	Communication Methods	LAN, 4G (optional), BT (optional), WiFi (optional)
	Protection Rating	IP54
	Corrosion Resistance Rating	C3, Entire Cabinet Galvanized Steel Plate
	Heat Dissipation Method	Liquid Cooling
	Isolation Method	Non-Isolated
	Fire Protection Method	Pack-level Perfluorohexanone Fire Suppression + Explosion Relief System + Water Fire Protection (Energy Storage Cabinet)
	Third-Party Certification	CB/CE, Transportation
	System Dimensions (L×W×H)	1400*1000*2280mm
	System Weight	2330±10KG

Table 2- 1Main Technical Parameters

2.3 Main System Components

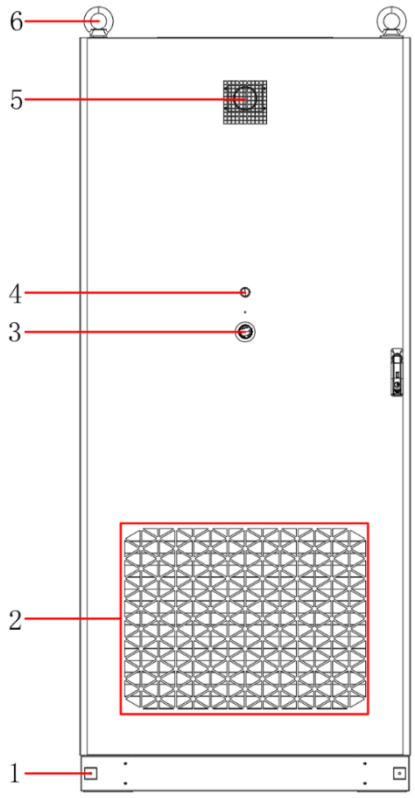


Figure 2- 2Component Description (External)

Serial Number	Module Description	Configured Quantity	Instructions
1	Cabinet Grounding	4	External Grounding Terminal of the Energy Storage System
2	Cooling Air Inlet	1	Power Distribution Compartment Air Inlet
3	Emergency Stop Switch	1	Energy Storage System Emergency Stop
4	Operation Indicator Light	1	Operating Status Indicator: ● Red Light Solid On: Abnormal Status Warning ● Green Light Solid On: Normal Operating Status
5	Audible and Visual Alarm	1	Internal Fault Alarm
6	Lifting Eye	4	Energy Storage System Lifting (Optional Accessory)

Table 2- 2Main Component Description (External)

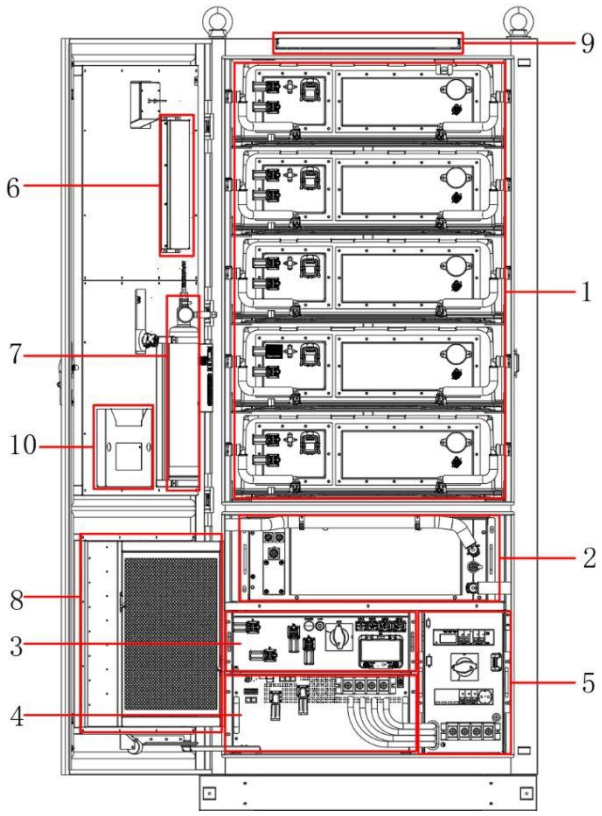


Figure 2- 3Component Introduction (Internal)

Serial Number	Module Description	Configured Quantity	Instructions
1	Battery Pack	5	The battery pack for storing and outputting electrical energy is composed of 52 battery cells, connection busbars, a sampling harness, and a BMU (Battery Management Unit), among other components.
2	Liquid Cooling Unit	1	Liquid Cooling and Heating Host
3	High Voltage Box	1	Control and Management of the Battery System High-Voltage Power Circuit
4	PCS	1	Energy Storage Converter System
5	Distribution Box	1	Functions of AC Side Overload and Short-Circuit Protection, Lightning Protection, and Energy Metering
6	ECS	1	Integrated Centralized Control Unit of the Energy Storage System
7	Fire Extinguishing Device	1	Stored-Pressure Perfluorohexanone, 3 kg Fire Extinguishing Agent

8	Sound-Absorbing Louvers	1	Sound Insulation and Noise Reduction
9	Smoke Exhaust Fan and Explosion Vent	1	Emergency Smoke Exhaust and Explosion Venting in Case of Battery Thermal Runaway
10	Folder	1	File Placement

Table 2- 3Description of Main Components (Internal)

2.4 Functional Diagram

2.4.1 System Topology Diagram

The BCS of the Energy Storage Cabinet is a centralized control system; the BCS communicates with the BMU to control the battery side, thereby managing the operation of the battery system. Communicate with the PCS Module for energy management and power dispatch, implementing functions such as peak shaving, valley filling, and demand management. Communicate with dynamic environment monitoring equipment, including fire composite detectors, liquid-cooled main units, and water immersion sensors, to ensure the energy storage system operates safely under suitable environmental conditions. Communicate with the ECS to achieve centralized data processing, cloud data transmission, and reception and execution of cloud-based strategies. The topology of the energy storage system is shown in Figure 2-4.

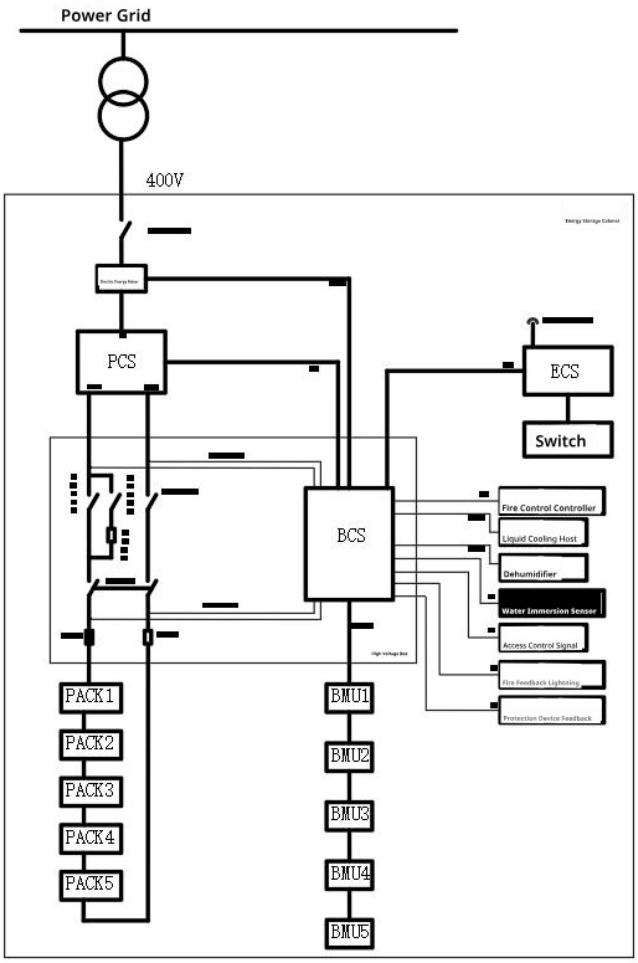


Figure 2- 4Energy Storage System Topology Diagram

3. Component Introduction

3.1 Battery Pack

The battery pack, which stores electrical energy and outputs it externally, consists of 52 battery cells, a connection busbar, sampling harness, and BMU (Battery Monitoring Unit). It includes internal voltage and temperature measurement functions for the battery cells.

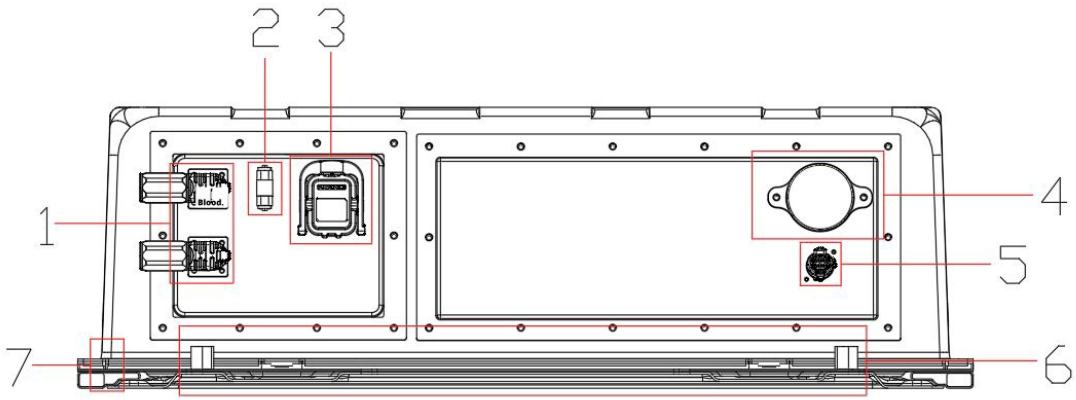


Figure 3- 1Battery Pack Appearance

Item No.	Name	Configured Quantity	Function Description
1	Power Interface	2	Main Power Input/Output Interface
2	Fire Sprinkler	1	Injects fire extinguishing gas into the PACK through this sprinkler to prevent the spread of thermal runaway
3	Manual Maintenance Switch	1	Provides electrical isolation terminal during PACK maintenance
4	Explosion Vent Valve	1	Releases high-pressure and high-temperature gases generated by battery thermal runaway to prevent excessive internal pressure
5	Communication Interface	1	Communication interface between PACKs or between PACK and BCS
6	Coolant Inlet/Outlet	2	Used for coolant inlet and outlet connections
7	Grounding Terminal	1	For PACK enclosure grounding

Table 3- 1Battery Pack Panel Description

Item No.	Technical Specifications	Parameters
1	Battery Cell Nominal Capacity	3.2V/314Ah
2	Battery Cell Material	Lithium Iron Phosphate
3	Battery Configuration	1P52S
4	Operating Voltage	145.6V~187.2V

5	Rated Voltage	166.4V
6	Standard Charge and Discharge Current	≤0.5C
7	Nominal Capacity	52.2kWh
8	Operating Temperature	Charging: 0～60℃; Discharging: -30～60℃
9	Storage Temperature	-20℃～45℃; ≤1 month 0℃～35℃; ≤1 year
10	Dimensions (L×W×H)	1140*790*247.7mm
11	Weight	330±3Kg
12	Communication Interface	Daisy Chain
13	Cooling Method	Liquid Cooling

Table 3- 2Technical Specifications

3.2 Energy Storage Converter

Energy Storage Converter The primary function is to realize energy conversion and bidirectional flow between the power grid and the battery, to monitor and manage the exchange process, and to support both grid-connected and off-grid operating modes. This product uses the EPCS125-AM-F model PCS, as detailed below:

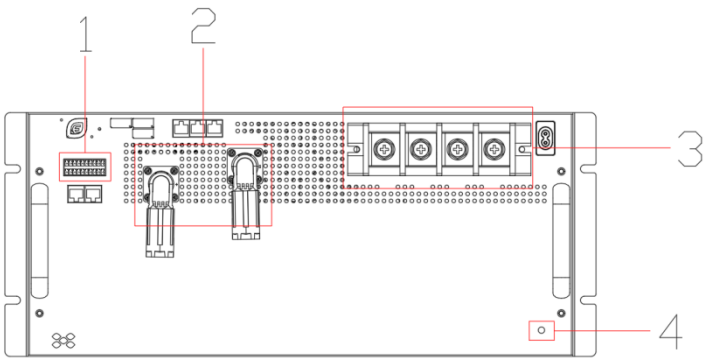


Figure 3- 2PCS Appearance Diagram

Item No.	Name	Configured Quantity	Function Description
1	Communication Terminals	1	External Communication Port
2	DC Power Port	2	DC Side Power Wiring Port
3	AC Power Port	1	AC Side Power Wiring Port

4	Grounding Terminal	1	For PCS Enclosure Grounding

Table 3- 3PCS Panel Description

Item		Parameters
DC Side	Operating Voltage Range (V)	680-950V
	Number of Input Channels	1
	Maximum Current (A)	203
AC Measurement (Grid-Connected)	Rated Voltage (V)	230V/400V
	Voltage Deviation	-15%~+15%
	AC Output Type	(3W+PE) Three-Phase Three-Wire / (3W+N+PE) Three-Phase Four-Wire
	Rated Output Power (kW)	125kW
	Maximum Current (A)	200
	Rated Grid Frequency (Hz)	50/60
	Power Factor	0.99
	Power Factor Range	1 (Leading) ~ 1 (Lagging)
	Current Distortion Rate	<2% (Rated Power)
	Overload Capacity	110% Continuous
	Maximum Efficiency	98.5%
AC Measurement (Off-Grid)	Rated Output Voltage	230/400
	AC Voltage Harmonics	<3% (Linear Load)
	Rated Frequency (Hz)	50/60
	Rated Output Power (kW)	125
	Maximum Output Current (A)	200
General Parameters	Dimensions (L×W×H)	785×520×232mm
	Altitude (m)	Up to 4000 m (Derated Above 2000 m)
	Operating Temperature	-30℃ to 55℃ (Derated Above 45℃)
	Storage Temperature	-45℃～70℃
	Humidity	0% RH to 95% RH, Non-condensing
	Cooling Method	Intelligent Air Cooling
	Protection Rating	IP20
	Communication Interface	CAN/RS485/Ethernet
	Grid Support	L/HVRT, Active and Reactive Power Control

Table 3- 4PCS Technical Parameters

3.3 High Voltage Box

The High Voltage Box is responsible for DC bus control, DC bus output short-circuit protection, communications with internal and external equipment, and power supply functions.

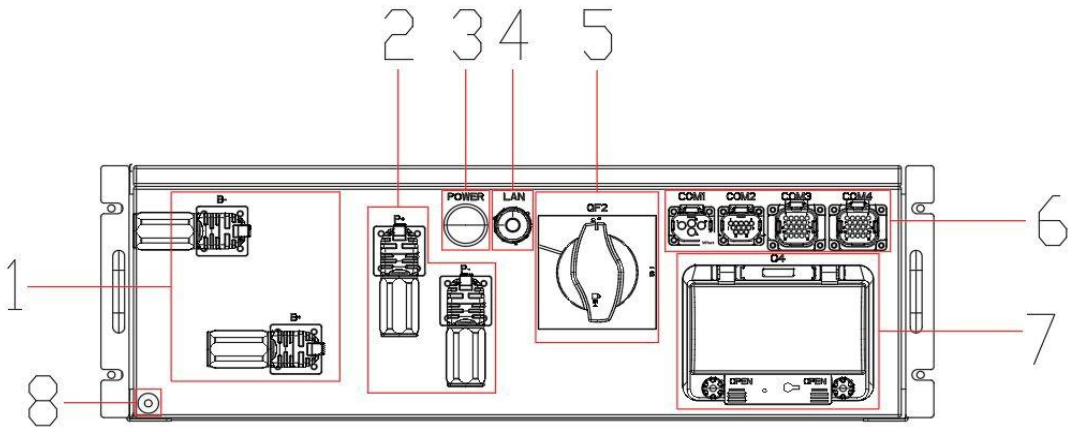


Figure 3- 3High Voltage Box Appearance Diagram

Item No.	Name	Configured Quantity	Function Description
1	DC Bus Interface	1	DC Output Bus Positive and Negative Terminals
2	Battery Cluster DC Interface	1	Battery System Positive and Negative Terminals
3	Indicator Light	1	Power-On Status Indicator
4	Network Port	1	BCS External Network Port
5	DC Main Switch	1	DC Input Main Switch
6	External Interfaces	4	Includes AC 220V Power Input, DC 24V Output, Dry Contact Detection, and Communication Interfaces
7	DC 24V Switch	1	DC 24V Output Switch
8	Grounding Terminal	1	Used for Grounding the High Voltage Box Enclosure

Item No.	Technical Specifications	Parameters
1	Rated Voltage	DC1000
2	Rated Current	250A
3	Dimensions (L×W×H)	785*564*177mm
4	Weight	35±1KG

Table 3- 5High Voltage Box Panel Description

Table 3- 6High Voltage Box Parameter Description

3.4 Distribution Box

Distribution Box The primary function is to distribute electrical energy from the grid to various electrical devices, ensuring reasonable and safe power transmission. It also includes AC Side Overload and Short-Circuit Protection, Lightning Protection, and Energy Metering functions.

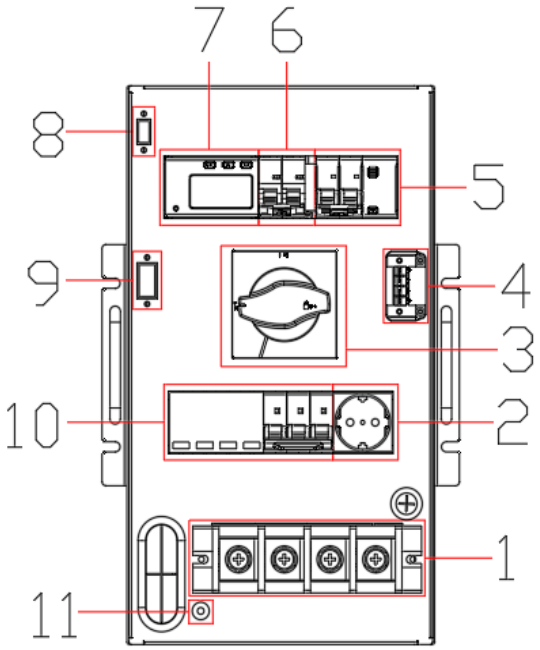


Figure 3- 4Distribution Box Appearance Diagram

Item No.	Name	Configured Quantity	Function Description
1	AC Input Interface	1	Grid AC Side Entry Interface
2	Socket	1	Peripheral Equipment Power Supply AV230V During Commissioning
3	AC Main Switch	1	Grid AC Input Main Switch
4	AC Power Output Switch	1	Output of AC Power for Use by Other Equipment in the Energy Storage Cabinet
5	Leakage Protection Switch	1	Leakage Protection Circuit Breaker
6	Liquid Cooling Main Unit Switch	1	Liquid Cooling Main Unit AC Input Switch
7	Electric Meter	1	Electric Energy Measurement
8	Communication Interface	1	Electric Meter and BCS Communication Interface

9	Dry Contact Interface	1	Lightning Protection, AC Input Main Switch, and Leakage Protection Switch Dry Contact Interface with BCS
10	AC Lightning Protector and Protective Switch	1	AC Lightning Protection Function
11	Grounding Terminal	1	Used for Distribution Box Enclosure Grounding

Table 3- 7Distribution Box Panel Description

Item No.	Technical Specifications	Parameters
1	Rated Voltage (V)	AC380
2	Rated Current (A)	250
3	Dimensions (L×W×H)	400*235*417mm

Table 3- 8Distribution Box Parameter Description

3.5 Liquid Cooling Unit

Liquid Cooling Unit Used to regulate the battery pack temperature within the energy storage system, ensuring consistent operation within the appropriate temperature range to maintain the system's optimal operational state, supporting intelligent cooling and heating modes.

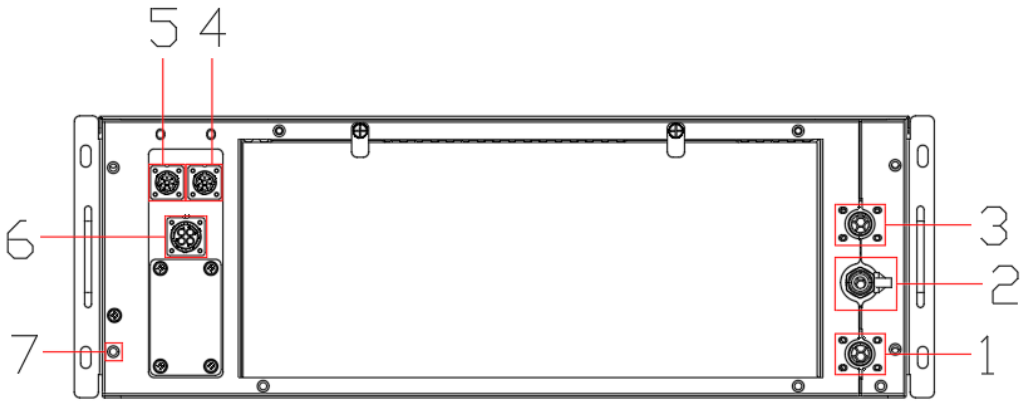


Figure 3- 5Liquid Cooling Unit Appearance Diagram

Item No.	Name	Configured Quantity	Function Description
1	Water Outlet	1	Chilled Liquid Outlet Interface
2	Filling/Draining Port	1	Chilled Liquid Filling/Draining

			Interface
3	Water Inlet	1	Chilled Liquid Inlet Interface
4	Communication Interface	1	External Communication Interface of the Liquid Cooling Unit
5	Debug Interface	1	For Use During Debugging
6	Power Interface	1	AC 220V Input Interface
7	Grounding Terminal	1	For Grounding the Liquid Cooling Unit Enclosure

Table 3- 9Liquid Cooling Unit Panel Description

Item No.	Technical Specifications	Parameters
1	Operating Voltage Range	220Vac，50/60Hz
2	Cooling Capacity	5kW
3	Heating Capacity	2kW
4	Cooling Input Power	2.5kW
5	Operating Ambient Temperature Range	-30℃~55℃
6	Operating Environment Humidity Range	5%~95%
7	Storage Environment Temperature	-40℃~70℃
8	Operating Altitude	≤1000 m (derating <5% for every additional 1000 m, maximum operating altitude ≤4000 m)
9	Overall Dimensions (L×W×H)	900×700×245 mm (excluding flange)
10	Coolant	50% Ethylene Glycol Solution

Table 3- 10Liquid Cooling Unit Technical Specifications

3.6 Fire Protection System

3.6.1 Composition of the Fire Protection System

The fire protection system employs a triple protection strategy comprising active explosion venting, agent-based extinguishing, and water fire protection, featuring PACK-level and battery compartment-level extinguishing mechanisms, and consists of four components:

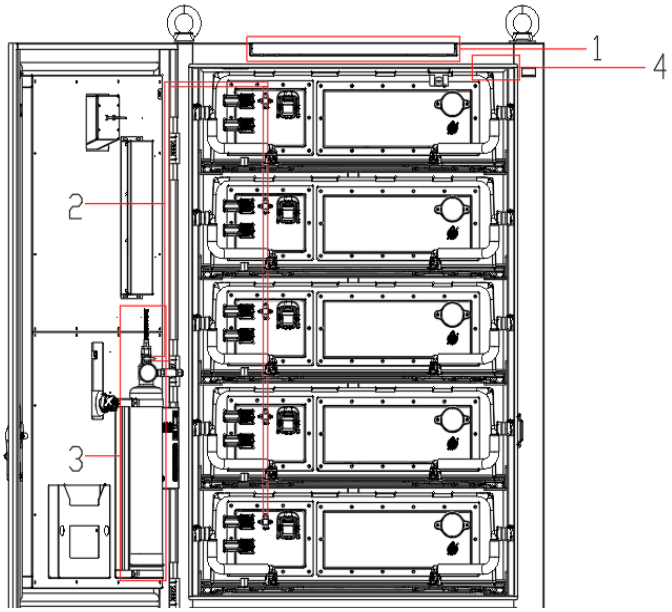


Figure 3- 6Schematic Diagram of Fire Protection System Components

Item No.	Name	Configured Quantity	Function Description
1	Active Explosion Venting Device	1	Release of High-Pressure, High-Temperature Gas to Prevent Combustion Explosion
2	Fire Detection Pipeline	1	Used for Storage and Transport of Agent
3	Agent Bottle	1	Perfluorohexanone Agent, Dosage 3 kg
4	Water Fire Protection Pipeline Interface	1	Water Fire Protection Inlet, Equipped with Glass Globe Fire Sprinkler

3.6.2 Operating Principle

This product employs a three-level fire protection system as follows:

Level One Active Detection, Early Warning, and Suppression: The composite detector can monitor multiple parameters including CO, VOC (flammable gases), smoke, and temperature. When these parameters reach preset thresholds, an alarm is triggered, activating the perfluorohexanone extinguishing system and notifying the ECS of the fire event. The ECS controls the local audible and visual alarms and initiates system energy storage shutdown,

simultaneously opening the top explosion relief vent to coordinate with the smoke exhaust fan for smoke expulsion, thereby reducing smoke and gas concentration and temperature, and mitigating fire and deflagration risks.

Secondary passive fire suppression: Upon battery cell ignition and fire detection tube rupture, the perfluorohexanone extinguishing agent continuously discharges toward the ignition point;

Tertiary passive water fire protection: When the fire intensifies or a battery reignites, the flames rupture the temperature-sensitive glass bulb of the sprinkler head within the battery compartment. Firefighters remotely open the hydrant, and extinguishing water is injected through pre-installed piping into the battery compartment, effectively suppressing the fire.

3.7 Combiner Cabinet (Optional)

The energy storage cabinet supports parallel connection of multiple cabinets and can be optionally used with a combiner cabinet. One combiner cabinet can accommodate up to four parallel-connected energy storage cabinets. The primary role of the combiner cabinet is line distribution and connection, providing a centralized connection point, along with overload and short circuit protection on the main circuit.

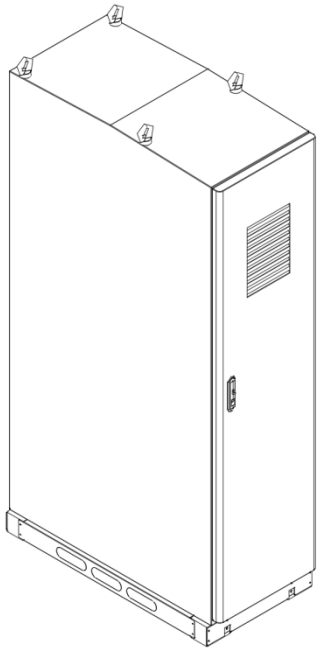


Figure 3- 7Combiner Cabinet Outline Diagram

Item No.	Technical Specifications	Parameters
1	Rated Voltage (V)	AC380
2	Output Power (kW)	525
3	Output Current (A)	800
4	Dimensions (L×W×H)	1200*600*2280mm
5	Weight (kg)	220

Table 3- 11Combiner Cabinet Parameter Description

4. Storage and Transportation

4.1 Transportation Requirements

危险

Violent handling during installation or removal is prohibited, as it may cause internal battery short circuit, damage (leakage, rupture, etc.), fire, or explosion within the cabinet body.

警告

- Handling during transportation shall comply with the orientation requirements specified on the packaging; inversion, tilting, dropping, mechanical impact, exposure to rain or snow, and immersion in water are strictly prohibited.
- Transportation and warehousing service providers must hold hazardous materials operation qualifications in accordance with the applicable laws and standards of their locality. Transportation shall be conducted using rigid box trucks; the use of open-top vehicles is strictly prohibited.
- Transportation shall be conducted via sea or roads with good conditions; rail and air transport are not supported. Vibrations and tilting should be minimized during transportation.

- Before transportation, compliant and accurate declarations must be made. Packaging and label markings shall be inspected to ensure they are complete and undamaged, with no signs of odor, leakage, smoke, or fire; otherwise, transportation is forbidden.
- During handling and transportation, care must be taken to handle items gently. Side placement and inversion are prohibited. Moisture-proof measures must be implemented. Packaging should be securely tied to prevent displacement, with hazardous material labels facing outward.

4.2 Forklift Operation Requirements

- The forklift used must have adequate load capacity (at least 5 tons);
- Forklift forks may be inserted from all sides of the cabinet body. The forks should be inserted to the full depth of the cabinet body. Forklift schematic diagrams are illustrated in Figures 4-1, 4-2, and 4-3;
- During lifting, lowering, and movement, operations must be conducted slowly and steadily.
- During forklift loading, it is recommended to tie a safety rope around the cabinet body and connect it to the forklift crossbeam;
- It is recommended to prioritize side forklift handling for the Energy Storage Cabinet, as illustrated in Figure 4-1.

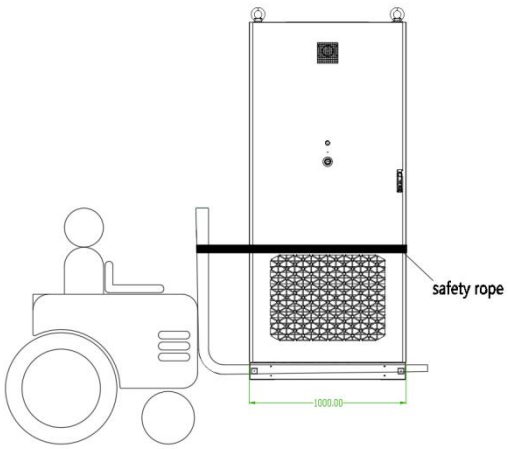


Figure 4- 1Schematic of Energy Storage Cabinet side forklift handling (forklift insertion is only permitted from the battery compartment side).

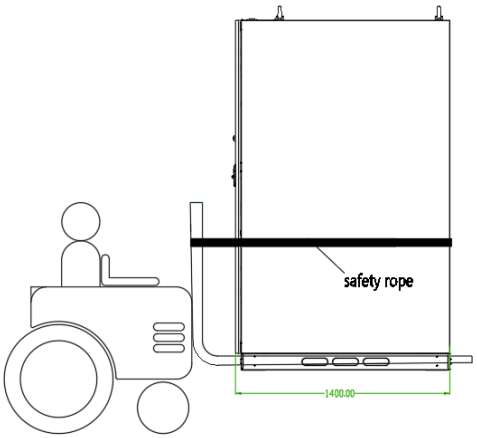


Figure 4- 2Schematic of Energy Storage Cabinet front/rear forklift handling.

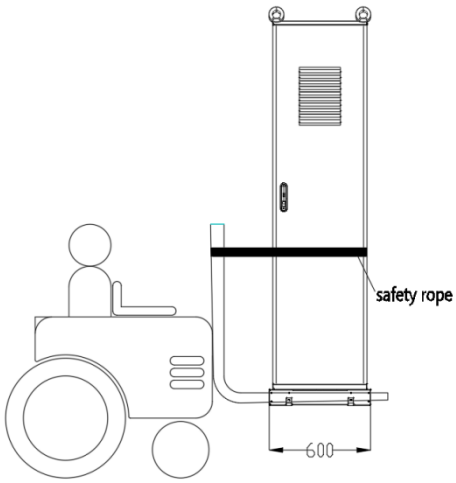


Figure 4- 3Schematic of Combiner Cabinet side forklift handling.

4.3 Requirements for Lifting Operations (lifting rings are optional).

4.3.1 Preparations before Lifting

① Crane Preparation:

The total weight of the Energy Storage Cabinet is approximately 2.7 tons. Please select the crane lifting capacity based on the total equipment weight and site conditions.

Recommended capacity: 5 to 8 tons.

② Tool Preparation:

Wire rope, hooks, M24 lifting rings, hex key wrench (19 mm across flats), etc.

③Using an Allen wrench, unscrew the four plugs at the lifting ring installation points on the top of the energy storage cabinet, as shown in Figure 4-4: The same procedure applies to the combiner cabinet.

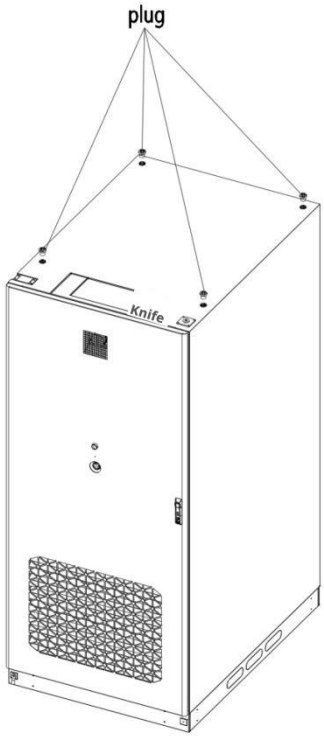


Figure 4- 4Energy Storage Cabinet Plug Removal Diagram

④Screw the M24 lifting rings into the lifting ring installation points on the top of the energy storage cabinet. Ensure the lifting rings are fully tightened and not loose, as shown in Figure 4-5: The same procedure applies to the combiner cabinet.

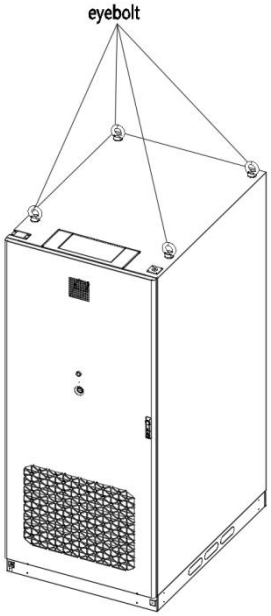


Figure 4- 5Energy Storage Cabinet Lifting Ring Installation Diagram

4.3.2 Lifting Procedures

①The lifting process must strictly follow the lifting diagram. For details, refer to Figure 4-6;

②The lifting must be carried out vertically; dragging on the ground is prohibited;

③ After the cabinet body is lifted approximately 300 mm off the ground, pause movement and inspect the lifting equipment connections. Only proceed with lifting once the connections are confirmed secure;

④ The entire lifting process should be conducted slowly, with close attention to the cabinet body's balance. Excessive movement speed is prohibited;

⑤ Standing beneath the cabinet body or crane during the entire lifting process is strictly prohibited;

⑥ The same procedures apply to the combiner cabinet;

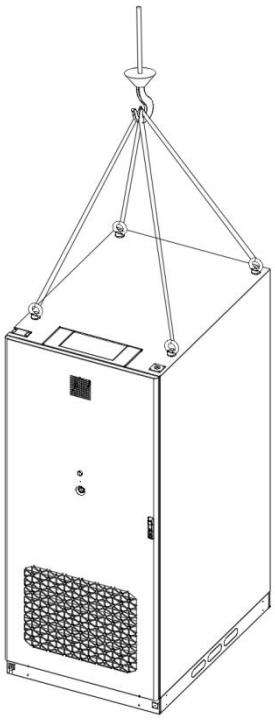


Figure 4- 6Energy Storage Cabinet Lifting Diagram

4.4 Storage Requirements

The energy storage cabinet is recommended to be stored indoors, away from direct sunlight and rain, in a dry, well-ventilated environment. The surrounding area must be clean, free of significant infrared or other radiation, organic solvents, corrosive gases, and conductive metallic dust, and kept away from heat and fire sources.

⚠ 注意

- When storing the energy storage cabinet, it must be placed correctly according to the markings on the packaging box. Placement upside down, sideways, or at an incline is strictly prohibited.
- During storage, the energy storage cabinet must be disconnected from all external connections, and its indicator lights should be turned off.
- Storage Environment Requirements:

Item No.	Item	Parameters
1	Average Daily Storage	≤30°C

	Temperature	
2	Permissible Storage Temperature	Short-term Storage Temperature Range (within 1 month): -20°C ~ 45°C
		Long-term Storage Temperature: 0°C ~ 35°C
3	Storage Humidity	≤95%, non-condensing

Table 4- 1Storage Environment Requirements

5. Equipment Installation and Operation

5.1 Precautions before Installation

⚠ 注意

- To prevent equipment overturning, secure the box containing the equipment to the forklift with ropes before moving. Handle the equipment carefully; impacts or drops may cause damage.
- When removing the outer packaging, please implement protective measures for work at height. Once the equipment is positioned, carefully remove the packaging to avoid damaging the equipment. Ensure the equipment remains stable during the packaging removal process.
- If the installation environment is unfavorable, after removing the packaging, apply dustproof and anti-condensation measures (such as using dust covers, plastic films, or fabric coverings) to prevent internal battery condensation or dust buildup that could cause corrosion and failure.

5.2 Preparations before Installation

5.2.1 Installation Environment Requirements

The energy storage system installation environment shall comply with the following requirements:

Project Content	Environmental Requirements
Installation Site Requirements	Indoor or outdoor locations that are spacious and well-ventilated
	Necessary fireproofing, waterproofing, and rodent-proofing treatments
	The ground on which the Cabinet Body is placed must have a flatness deviation ≤ 5 mm/m, preferably a concrete hardened surface (Strength ≥ C30) or Steel Structure Platform, with a uniformly distributed load capacity ≥ 2000 kg/m².
Foundation Requirements	The installation surface must be flat and dry; installation is prohibited on soft soil, filled areas, or low-lying sites prone to water accumulation.
	The placement ground must have a flatness deviation ≤ 5 mm/m, preferably a concrete hardened surface (Strength ≥ C30) or Steel Structure Platform, with a uniformly distributed load capacity ≥ 2000 kg/m².
Space Requirements	Adequate space must be maintained at the front, back, both sides, and above the equipment to allow for ventilation and maintenance.
Ambient Temperature	-20 to 45°C
Relative Humidity	≤95%, no condensation
Altitude	≤2000m

Table 5- 1Installation Environment Requirements

5.2.2 Installation Site Requirements

The energy storage equipment shall be installed on concrete or other non-combustible surfaces. The installation surface must be level, stable, flat, and have sufficient load-bearing capacity. Depressions or tilting are strictly prohibited.

When constructing the foundation, the equipment's cable outlet requirements must be considered. Cable trenches or other outlet openings shall be reserved. Since the equipment features bottom cable outlets, cables must be routed through the trench. Therefore, an on-site

trench must be pre-installed. The following requirements apply to the trench: it must be equipped with necessary waterproof and moisture-proof designs to prevent cable aging and short circuits, which could affect the normal operation of the energy storage equipment.

Due to the high power of the equipment, thicker cables are required; therefore, the trench design must fully consider the cable cross-sectional area.

The customer may determine the number of cable brackets as needed; the brackets must fully account for the weight and dimensions of the equipment.

When laying cables, communication cables, power cables, and current cables must be segregated. DC and AC circuits must be laid separately, with a minimum spacing of 300 mm between different cables.

The installation site should have a dry climate, adequate ventilation, and be situated away from Class A factories or flammable and explosive areas.

The foundation soil must possess sufficient compaction. It is recommended that the relative compaction of the installation site soil exceeds 98%. If the soil is loose, appropriate measures must be implemented to ensure foundation stability.

The spatial requirements for the energy storage cabinet installation are illustrated below: a distance of 1.5 meters between the rear of the cabinet and the isolation barrier, 2 meters between the front of the cabinet and the isolation barrier, and 1 meter on each side between the cabinet and the isolation barrier. Specific installation distances shall comply with applicable local design and installation codes.

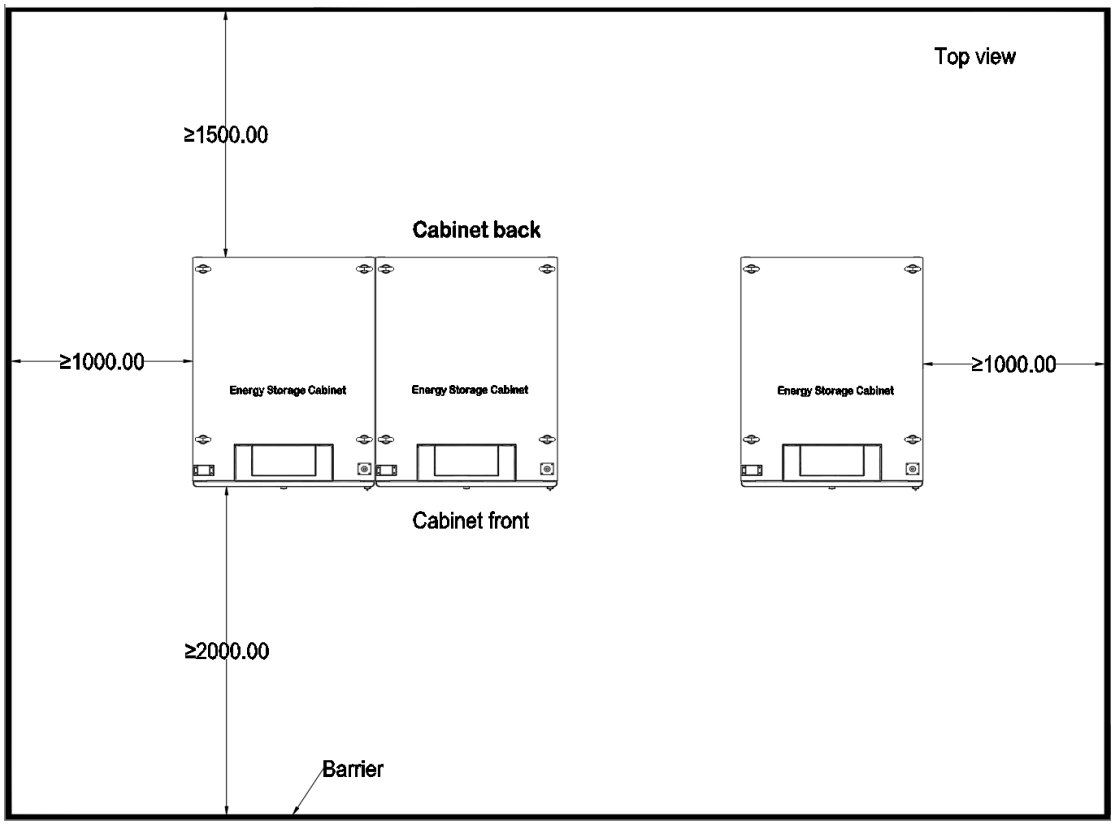


Figure 5- 1Space Requirements for Energy Storage Cabinet Installation Site

5.2.3 Equipment Ventilation Requirements

Operation of the energy storage equipment generates substantial heat. Excessive equipment temperature can lead to deterioration of the electrical parameters of the energy storage equipment and may cause damage. To ensure adequate heat dissipation, the installation environment must meet the following requirements:

① Equipment shall be installed in a well-ventilated environment.

② The air inlet must guarantee an adequate supply of fresh air.

③ It is recommended that the equipment's ventilation system be separated from other ventilation systems in the control room.

If overheating of the equipment is detected, verify that the ventilation openings are unobstructed and properly ventilated.

The integrated energy storage battery cabinet utilizes a front air intake and rear air exhaust design; the locations of the air inlet and outlet are illustrated in the figure below.

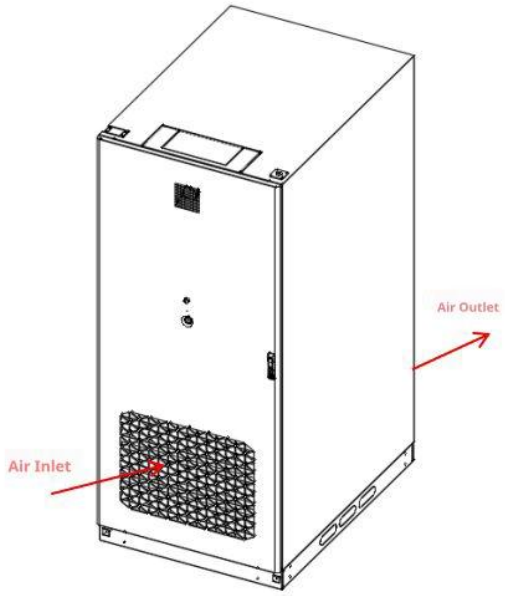
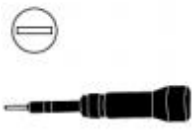


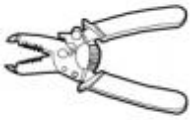
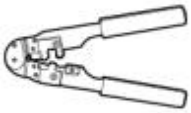
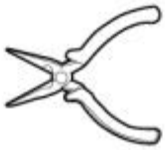
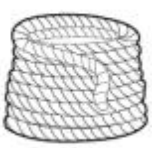
Figure 5- 2Illustration of Equipment Air Inlet and Outlet

5.2.4 Installation Tools Description

Prior to equipment installation, prepare the following tools:

- The tools shown are for reference only; please refer to the actual items.
- Due to varying onsite conditions, this tool list does not fully enumerate all tools that may be required. Installation personnel and users should prepare additional tools as necessary according to actual conditions.

Installation Tools	 Insulated Phillips torque screwdriver	 Insulated torque socket wrench (including extension bar) Socket specifications: 7 mm to 19 mm Socket depth ≥ 32 mm Socket interface matched to torque	 Flat blade insulated torque screwdriver	 Diagonal cutting pliers

		wrench Torque range: 1.2 N·m to 45 N·m		
	 Wire stripper	 Wire cutter	 Rubber mallet	 Utility knife
	 RJ45 crimping pliers	 Hydraulic pliers	 Needle-nose pliers	 Marker pen
Installation Tools	 Steel tape measure	 Spirit level	 Multimeter DC voltage range ≥ 1500 V	 Impact drill
	 Impact drill bit Φ16mm	 Heat shrink tubing	 Hot air gun	 Cable tie
	 Insulating ladder (height	 Liftin g rope	 Vacuum cleaner	 Powered forklift (forklift

	≥ 1.7 m)	length ≥2110mm×4		load capacity ≥ 3 t) Recommended fork length ≥ 1800 mm Width 230mm~300 m m Thickness 25mm~80m m)
	 Crane (lifting capacity ≥ 3 t; working radius ≥ 2 m)	-	-	-
Protective equipment	 Insulating gloves	 Protective gloves	 Protective goggles	 Dust mask
	 Insulating shoes	 Reflective Vest	 Safety Helmet	 Safety Belt

Table 5- 2Description of Installation Tools

5.3 Installation Procedure

Step 1: After placing the energy storage cabinet in the designated location, secure the cabinet body base using M12 bolts, as shown in Figures 5-3 and 5-4 below:

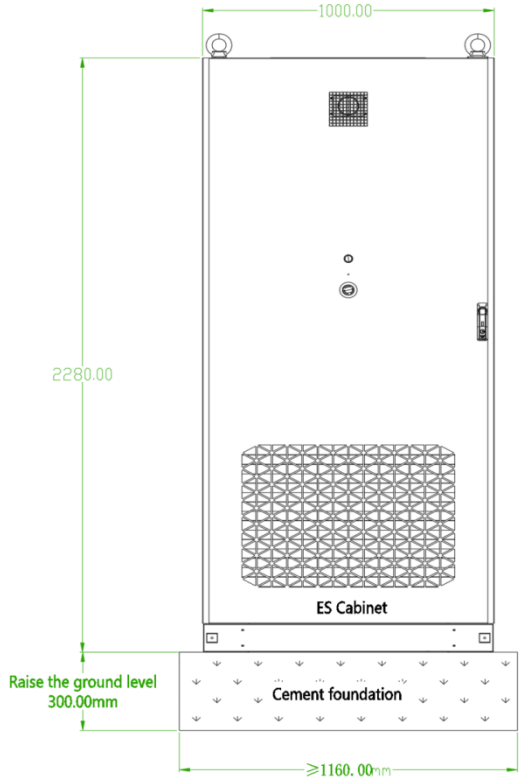


Figure 5- 3Energy Storage Cabinet Fixing Diagram

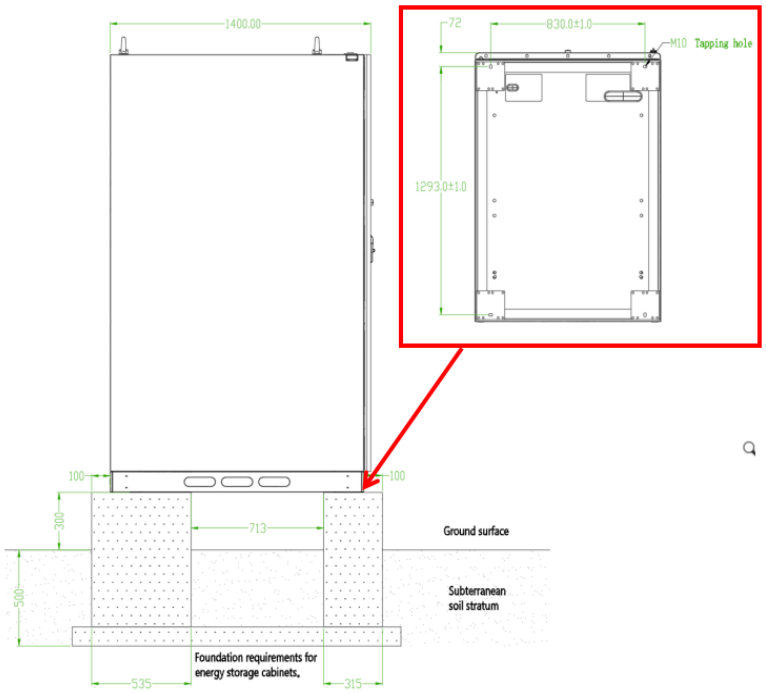


Figure 5- 4Base Fixing Diagram

Note: If a combiner cabinet is present, after placing it in the designated location, secure the cabinet body base using M12 bolts, as shown in Figures 5-5 and 5-6 below:

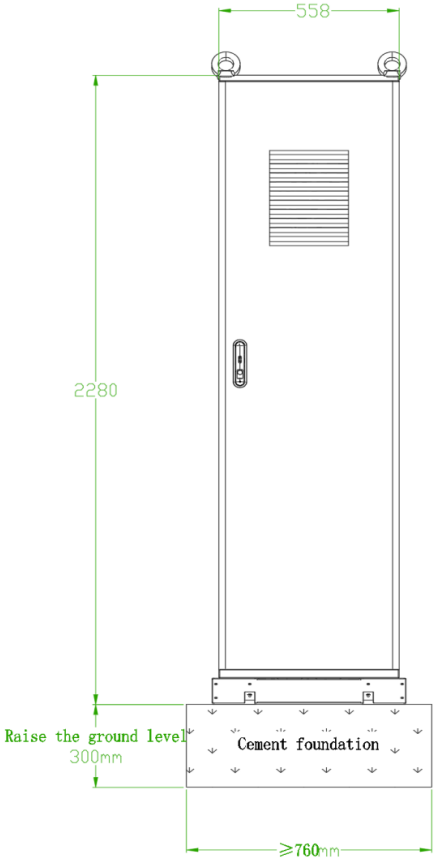


Figure 5- 5Combiner Cabinet Fixing Diagram

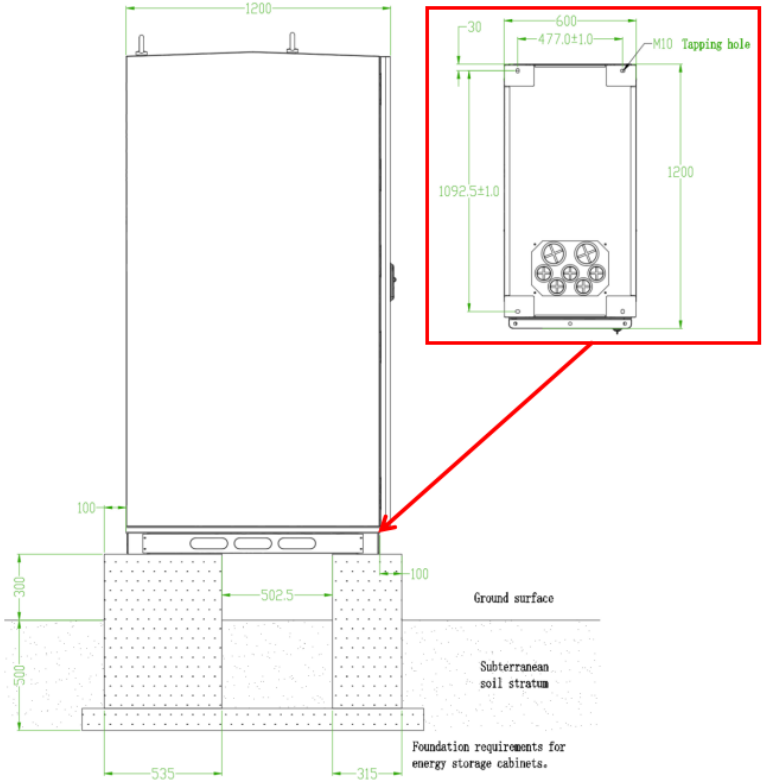


Figure 5- 6Combiner Cabinet Base Fixing Diagram

Step 2: Cabinet Grounding

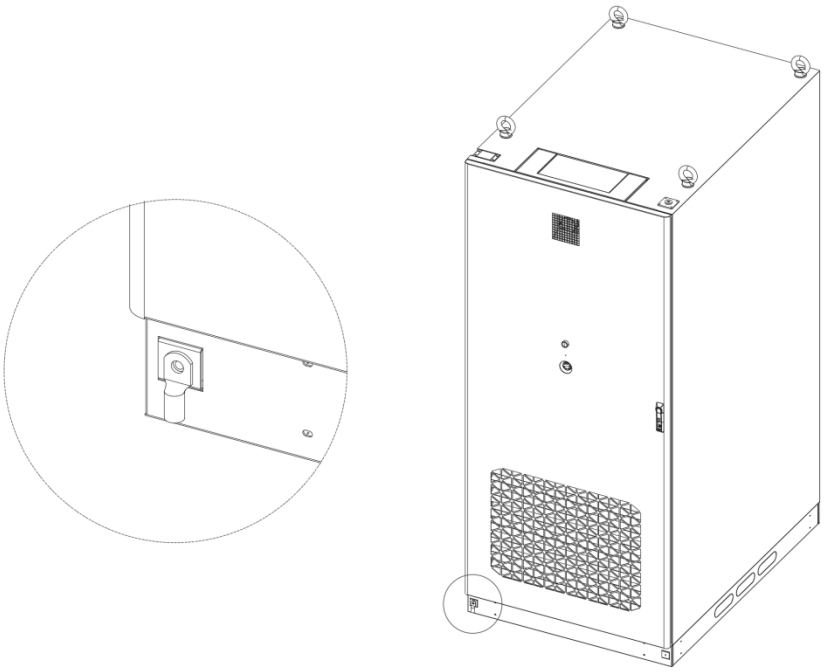


Figure 5- 7Grounding Location Diagram

Note: If the grounding copper busbar inside the cabinet is already properly grounded, grounding at this point is not required. Refer to the following for specific wiring harness specifications, and consult the cabinet cable selection table.

Step 3: Internal Cabinet Wiring

The A/B/C three-phase, N line, and PE line are shown in the figure. Wiring should be performed according to the schematic in Figure 5-8. The tightening torque for each phase sequence is listed in Table 5-1.

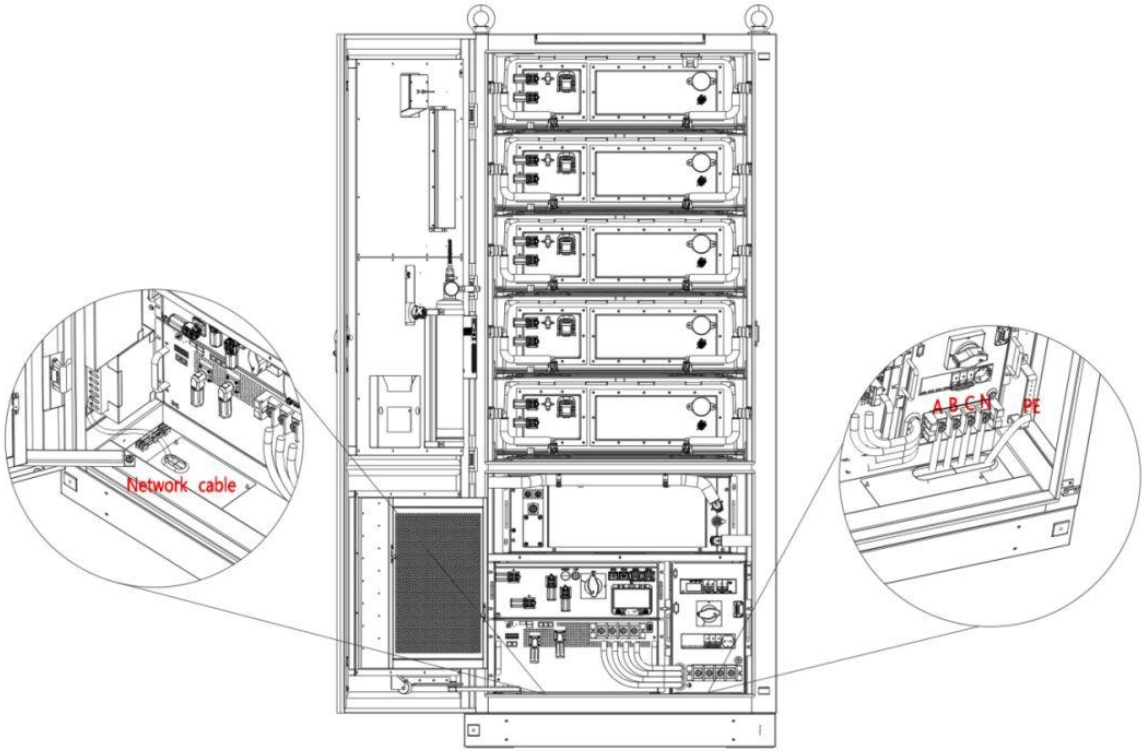


Figure 5- 8Schematic Diagram of Internal Wiring for the Energy Storage Cabinet

Step 4: After completing the grid wiring, install the sealing plates around the equipment base.

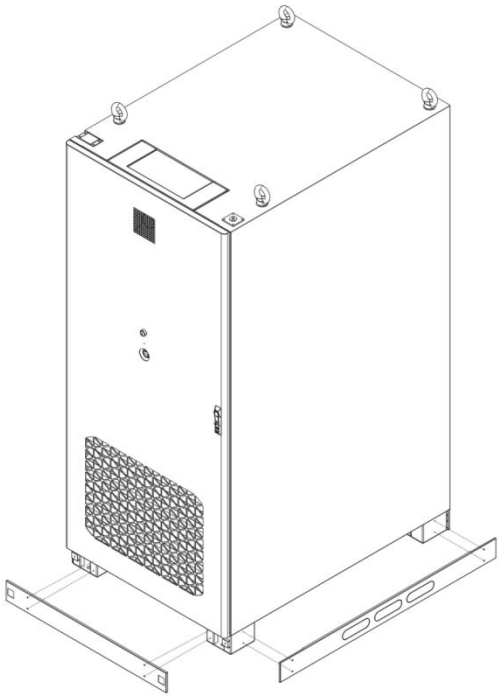


Figure 5- 9Sealing Plate Installation

Note: If multiple cabinets are placed side by side, the sealing plates between the cabinets may be omitted.

Phase Sequence	Thread Specification	Torque Requirement (NM)
N	M4	1.5
	M6	5
	M8	15
PE	M4	1.5
	M6	5
	M8	15
A/B/C	M10	25
	M12	45
	M14	70

Table 5- 3Locking Torque Requirements for Each Phase Sequence

Note: If a Combiner Cabinet is present, the wiring locations are shown in Figure 5-10 below. User grid connection point cables must be connected to the copper bars A, B, and C above the circuit breaker and N, PE below it. Cables from the Energy Storage Cabinet to the Combiner Cabinet must be connected to the copper bars A, B, C, N, and PE below the circuit breaker. The locking torque for each phase sequence is specified in Table 5-4.

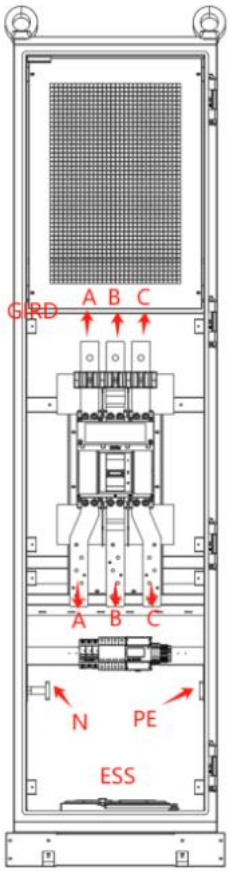


Figure 5- 10Combiner Cabinet Internal Wiring Diagram

Phase Sequence	Thread Specification	Torque Requirement (NM)
N	M8	15
	M10	25
PE	M8	15
	M10	25
A/B/C	M10	25
	M12	45
	M14	70

Table 5- 4Locking Torque Requirements for Each Phase Sequence

Note: On-site, select appropriate distribution cables according to the number of Energy Storage Cabinets; refer to the table below:

Item No.	Number of Cabinets in Parallel	Cable Specifications (Copper Cable Recommended)	Remarks

1	1 Main Cabinet	3*95mm²+50mm²（N）+50mm²（PE）	No Combiner Cabinet
2	1 Main Cabinet + 1 Slave Cabinet	2*（3*95mm²+50mm²（N）+50mm²（PE））	1 Combiner Cabinet
3	1 Main Cabinet + 2 Slave Cabinets	3*（3*95mm²+50mm²（N）+50mm²（PE））	1 Combiner Cabinet
4	1 Main Cabinet + 3 Slave Cabinets	4*（3*95mm²+50mm²（N）+50mm²（PE）)	1 Combiner Cabinet
5	1 Main Cabinet + 4 Slave Cabinets	5*（3*95mm²+50mm²（N）+50mm²（PE））	2 Combiner Cabinets
6	1 Main Cabinet + 5 Slave Cabinets	6*（3*95mm²+50mm²（N）+50mm²（PE））	2 Combiner Cabinets
7	1 Main Cabinet + 6 Slave Cabinets	7*（3*95mm²+50mm²（N）+50mm²（PE））	2 Combiner Cabinets
8	1 Main Cabinet + 7 Slave Cabinets	8*（3*95mm²+50mm²（N）+50mm²（PE））	2 Combiner Cabinets

Table 5- 5 Parallel Cabinet Cable Selection Reference Table

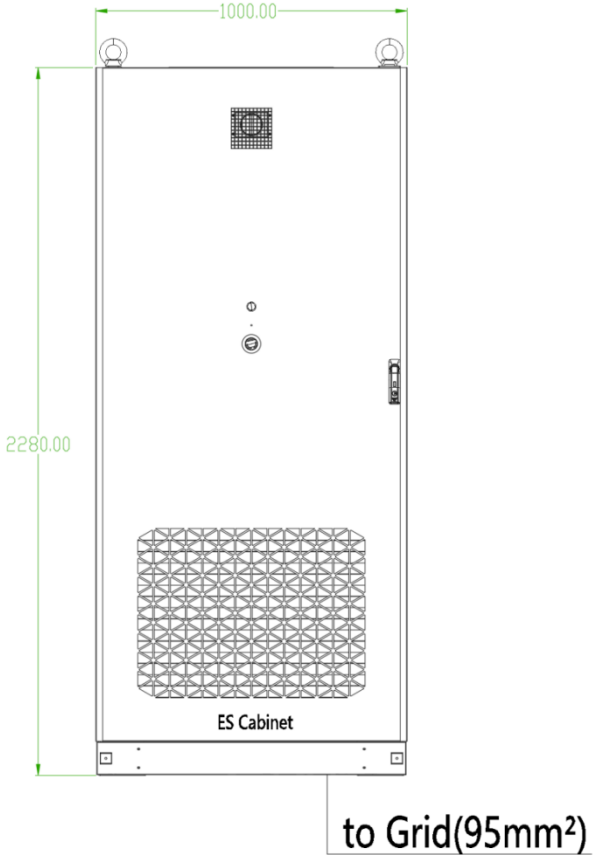


Figure 5- 11Single Energy Storage Cabinet Connection Diagram

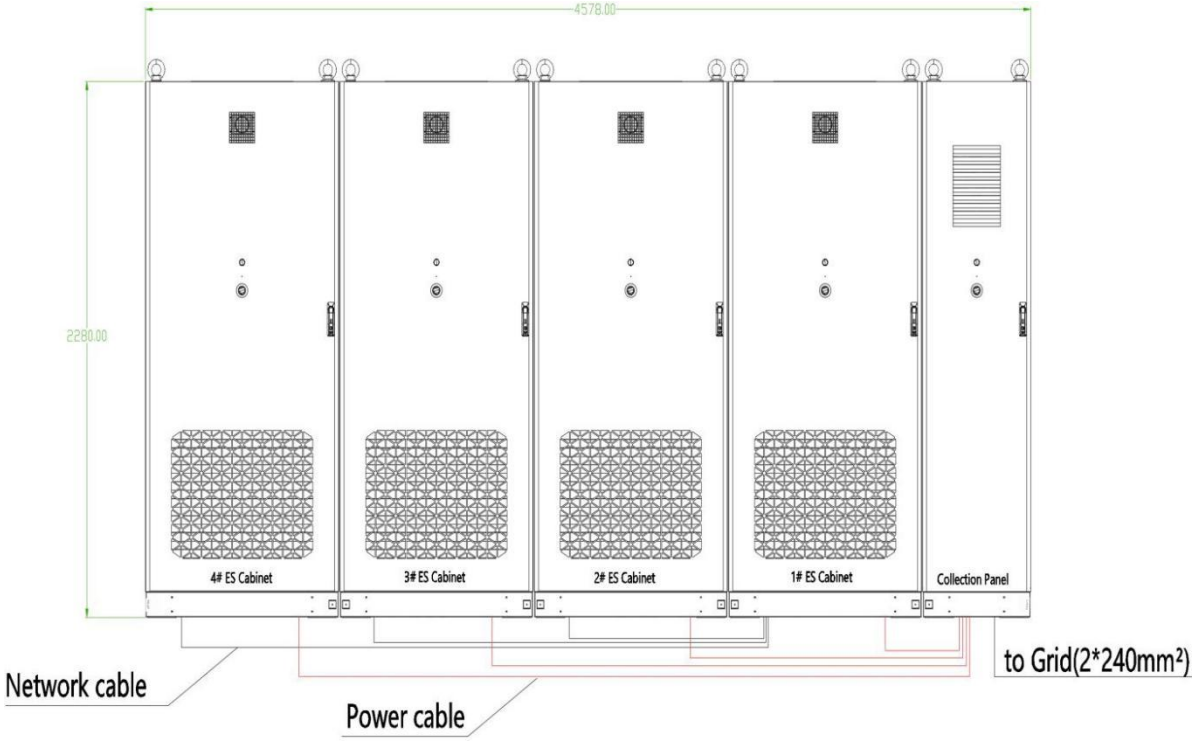


Figure 5- 12Multiple Energy Storage Cabinets Connection Diagram

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- Smoking and open flames are prohibited near the Energy Storage Cabinet.
- The site must be equipped with compliant fire-fighting equipment such as fire sand, carbon dioxide extinguishers, and water-based fire-fighting materials.
- Please use dedicated protective equipment and insulated tools to prevent electric shock injuries or short-circuit faults.

⚠ 注意

- When connecting the energy storage cabinet, ensure terminal connections are tight and cables are undamaged.
- All cable colors in the electrical connection diagrams in this chapter are for reference only. Cable selection must comply with local cable standards (yellow-green bi-color cables may only be used for protective grounding).

5.4 Commissioning

5.4.1 Pre-Power-On Inspection

Item No.	Inspection Items	Acceptance Criteria
1	Equipment Appearance	● The equipment appearance must be intact, without damage, rust, or paint peeling. If paint peeling occurs, repainting must be performed. ● Equipment labels are clearly visible; damaged labels must be replaced promptly.
2	Cable Appearance	● The cable protective sheath is intact without visible damage. ● The conduit and cable flexible hoses are intact.
3	Cable Connections	● Cable connection points conform to the design. ● Terminal fabrication meets standards; connections are secure and reliable. ● Both ends of each cable have clear and unambiguous labels, consistently oriented.
4	Cable Routing	● Routing complies with the principle of separating high- and low-voltage cables. ● Cable ends are cut cleanly with no exposed burrs or sharp edges. ● Appropriate slack is maintained at bends as required; cables must not be taut. ● Wiring is straight and smooth, with no cable crossings inside the cabinet.

5	Cabinet Grounding	The grounding conductor is reliably connected to the cabinet grounding terminal.
6	Sealing of Cable Passage Holes	The cable passage holes have been sealed.
7	Switch	All switches are in the off (open) position.

Table 5- 6Pre-Power-On Inspection Items

5.4.2 Power-On Operation Procedure

1. Pre-Power-On Inspection

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- Check for any leakage on the pack baseplate inside the battery compartment, leakage at the liquid cooling pipeline connections to the pack inlet/outlet, or leakage at the liquid cooling pipeline connections to the liquid cooling unit inlet/outlet. If leakage is detected at any of the above locations, please contact the manufacturer's after-sales service and do not proceed with the power-on operation.
- Please wear insulating gloves and use insulated tools to prevent electric shock or short circuit hazards.

注意

- The AC power input terminals (A, B, C, N, PE) must be properly connected and securely fastened.
- Before powering on, ensure that the power cables from the PACK to the High Voltage Box (B+, B-) are properly connected.
- Monitor the system continuously during the power-on process; if any abnormal conditions are detected, immediately power down the Energy Storage System, identify the cause, and only proceed with powering on after the issue is resolved.

- If the circuit breaker inside the Energy Storage System trips, first inspect the corresponding load side, confirm there is no short circuit or fault, and then perform the closing operation to prevent fault escalation and safety risks.

2. Power-On Operation Steps

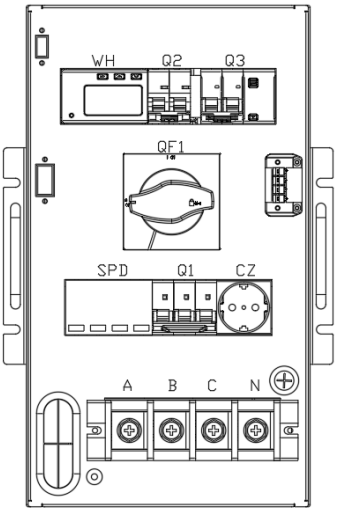


Figure 5- 13Distribution Box Diagram

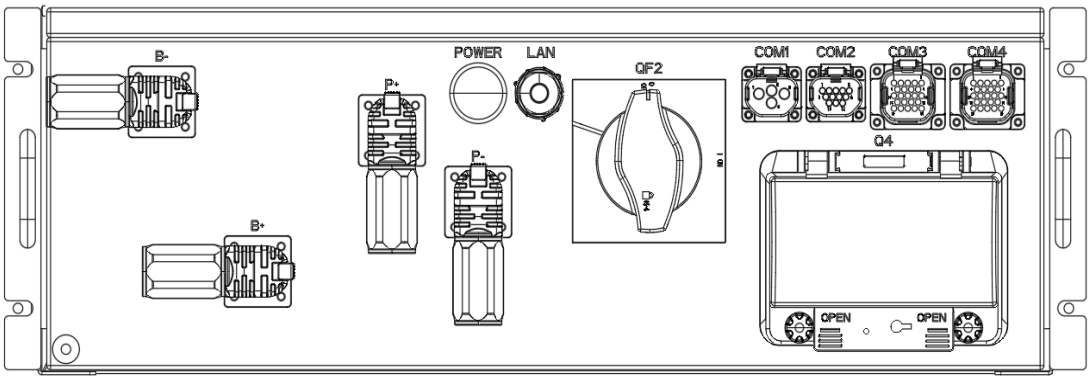


Figure 5- 14High Voltage Box Diagram

Step 1: Before the first power-on, parameter confirmation must be performed using the host computer:

1. Close the Q4 switch in the high voltage box and verify that the POWER indicator light is on; after confirmation, start the local host computer and read the BCS configuration information (specifically refer to Appendix 1, section 2.2.2: Parameter Configuration). Compare the retrieved information with the configuration table provided by our sales department to ensure consistency. If discrepancies are found, please contact our technical support.

2. Once the information is confirmed to be correct, customized information configuration (cabinet number, local communication) can be performed.

Step 2: Before closing the AC circuit breaker QF1 in the distribution box, use a multimeter set to resistance (ohm) mode to check that the three-phase lines A, B, and C at the distribution box input terminals are not incorrectly shorted to each other; verify that none of the three-phase lines A, B, or C are shorted to the ground or neutral lines; confirm that the phase sequence of A, B, and C matches the external wiring phase sequence; and ensure the ground and neutral lines are properly connected.

Step 3 Close the main circuit breaker and the lightning protection switch of the Combiner Cabinet (if applicable).

Step 4 Close the AC main circuit breaker QF1 in the High Voltage Box and the DC main circuit breaker QF2 in the Distribution Box; the power meter will activate and the display screen will illuminate. The PCS connection indicator will also light up (flashing or red at this stage).

Step 5 Sequentially close the miniature circuit breakers Q1, Q2, and Q3 in the Distribution Box.

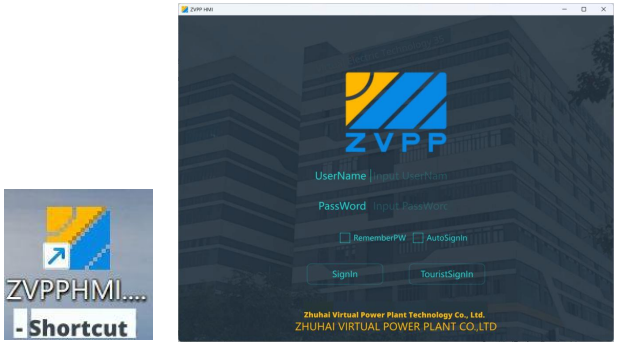
Step 6 Observe the PCS indicator light change from flashing green to steady green, indicating successful power-up.

5.5 Power-down Procedure

5.5.1 Standard Power-down Operation Procedure

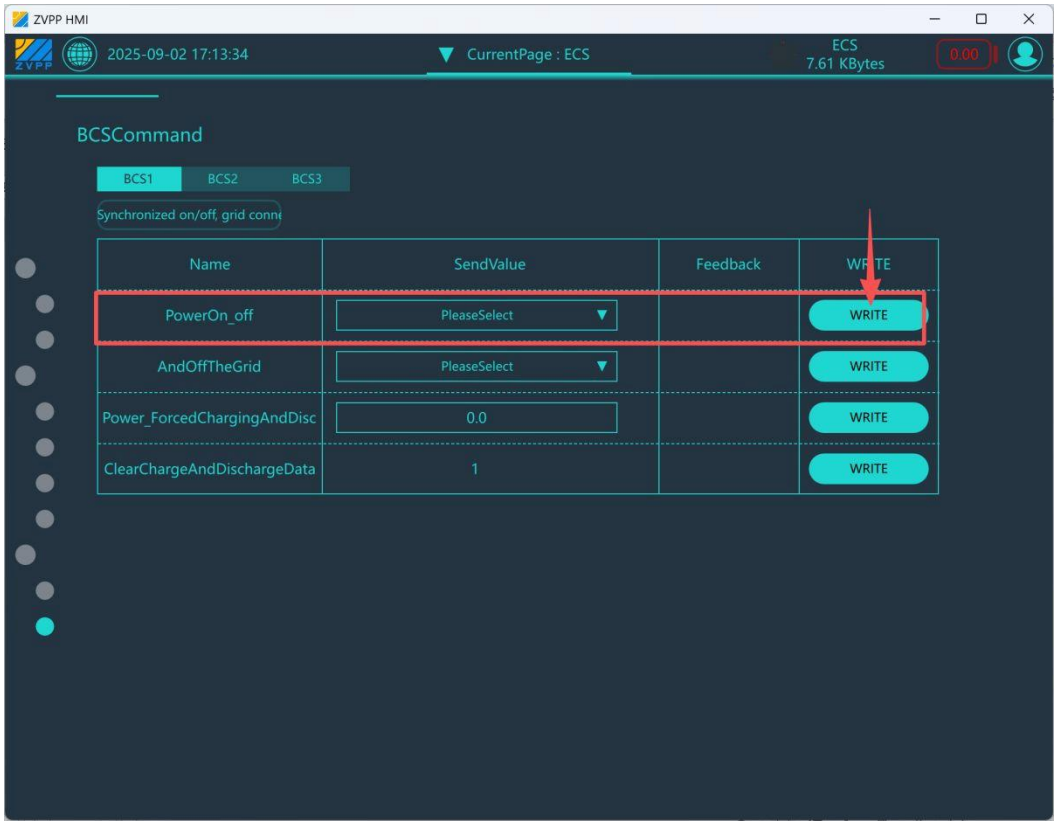
Operation Steps:

Step 1 Open the host computer software program and enter the username and password on the login screen to log in.

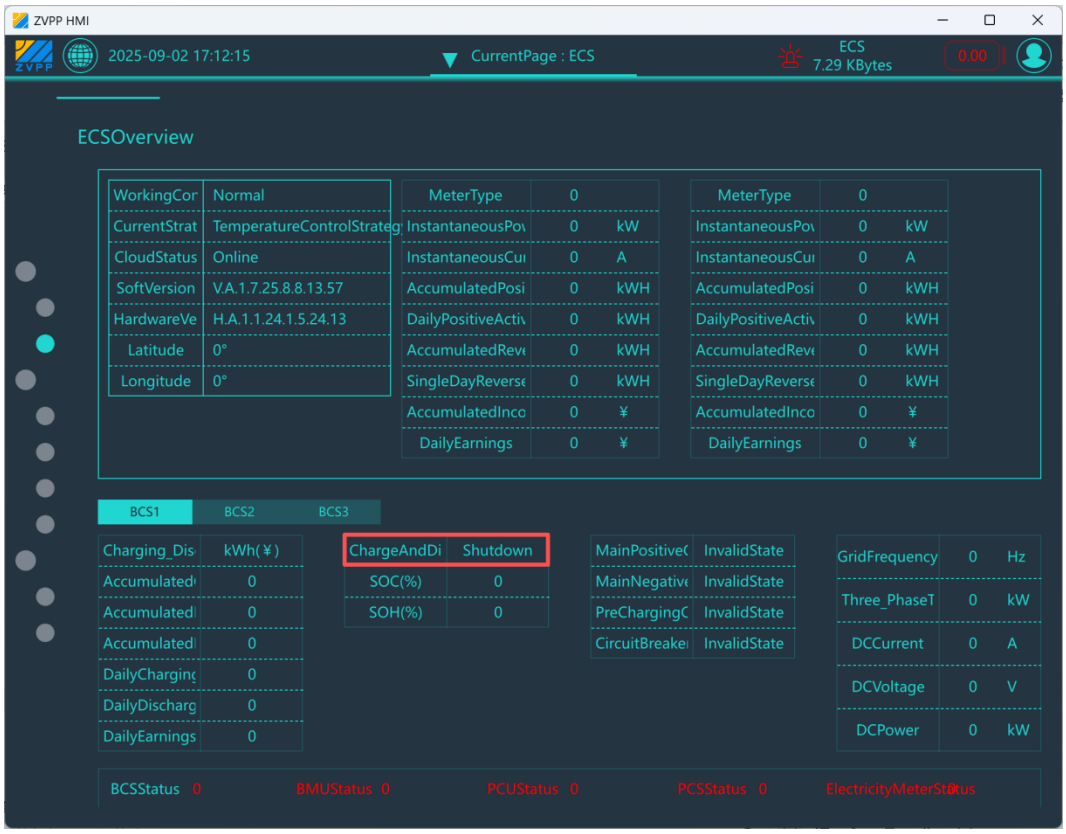


Step 2 When connected to the ECS, click the top navigation to open the dropdown menu, switch to the ECS equipment interface, move the mouse to the floating ball on the left, select "BCS Command" in the menu bar, choose "Power Down" in the dropdown, and click Write.

When connected to the BCS, click the top navigation to open the dropdown menu, switch to the PCS equipment interface under BCS, move the mouse to the floating ball on the left, select "Command" in the menu bar, choose "Power Down" in the dropdown, and click Write.



Step 3 On the ECS display interface, verify that the charge and discharge status of the corresponding equipment shows shutdown, confirming successful power-off execution.



Power-down Operation

Reference **5.4.3 Power-on** The power-down operation procedure is performed in the reverse order of the power-on sequence, that is, sequentially disconnect Q4 to Q1, then disconnect QF2 and QF1.

5.5.2 Emergency Power-Off Operation Procedure

In case of emergency, immediately press the emergency stop button. The AC circuit breaker QF1 and DC circuit breaker QF2 will trip and disconnect. After a 2-second delay, the DC miniature circuit breaker Q4 will trip and disconnect, completing the system's emergency power-down.

6 Host Computer Operation Instructions

See Appendix 1.

7. Operation and Maintenance Instructions

7.1 Operation and Maintenance Safety

During normal operation, scheduled maintenance, or emergency faults of the energy storage equipment, operation and maintenance personnel must perform work in compliance with safety regulations. Operators shall be familiar with the fault emergency handling procedures and proficient in the operation steps and methods. In the event of a fault, immediate organization of repair work is mandatory. If the fault cannot be resolved independently, please contact the manufacturer without delay.

7.2 Safety Inspection Management

Inspections are categorized into annual, quarterly, and monthly checks, requiring patrols and inspections of the functional zones within the equipment energy storage cabinet. Relevant personnel shall possess the capability to assess fault type, level, and severity. Upon discovery of abnormalities, reporting and handling must be conducted in accordance with the relevant procedures stipulated in the inspection management regulations.

7.3 Battery System Usage Requirements

SOC range for storing energy storage batteries: 20% to 50%. Avoid long-term storage of battery cells below 15% SOC. When the battery is left unused for an extended period, power-consuming devices must be promptly disconnected.

(1) Perform an inspection of the energy storage system every three months and accurately record the inspection.

(2) For systems left idle (not started for more than three consecutive months), before first use, at least one full charge is required to activate the battery system and restore battery performance to its optimal state.

7.4 Maintenance Tasks

Before personnel perform maintenance or repair work on the system, all switches within the system must be turned off. Refer to section 5.4.4 for the shutdown and power-off procedures. Only after confirming all switches are in the off position and the system is powered down may inspection and maintenance of the interior of the energy storage cabinet be carried out. Inspect the following items; if any do not meet the requirements, immediate correction is required.

Maintenance Cycle	Maintenance Type	Inspection Items	Testing Methods
Monthly Inspection	Energy Storage Cabinet Body	System Status	(1) Verify that no insects, rodents, or other debris have entered the energy storage cabinet; (2) Verify that there is no odor, condensation, or

			water accumulation inside the cabinet.
	Battery system	System Status	(1) Ensure no abnormal smoke, vibrations, or noises are present; (2) Confirm that the battery pack appearance is intact without damage, swelling, or deformation; (3) Confirm no condensation or leakage at the connections between the battery pack liquid cooling plate and piping.
	PCS	System Status	(1) Ensure installation and wiring connections are secure and free from looseness; (2) Confirm the appearance is intact without damage, swelling, or deformation.
	High Voltage Box	System Status	(1) Ensure installation and wiring connections are secure and free from looseness; (2) The appearance is intact without damage, swelling, deformation, or other abnormalities;
	Alarm Records	System Alarms and Fault Troubleshooting	System alarm information can be viewed and corresponding faults troubleshot through the host computer software; refer specifically to section 6.5 Fault Handling.
Quarterly Inspection	Fire Protection System	Composite Detector	(1) Verify cleanliness, ensuring it is free from dust, paint, or other contaminants; (2) Confirm installation and wiring are secure and free from looseness.
		Audible and Visual Alarm	(1) Inspect for dust accumulation and clean promptly; (2) Confirm installation and wiring are secure and free from looseness.
		Flame Detection Tube	(1) Inspect all joint connections to ensure no looseness; (2) The device appearance is intact, without damage, swelling, deformation, or other abnormalities.
	Electric Meter	Electrical and Fixed Connection	(1) The device appearance is intact, with no damage, swelling, deformation, or other abnormalities, and the displayed data is normal; (2) Confirm installation and wiring are secure and free from looseness.
	PCS	Electrical and Fixed	(1) The device appearance is intact, with no damage, swelling, deformation, or other

		Connection	abnormalities ; (2) Ensure that installation and wiring are secure, and wiring points are free from rust, dust accumulation, and condensation; (3) The cabinet grounding contact is reliable, with no looseness; (4) Inspect the heat dissipation filter for dust accumulation and any impact on heat dissipation; clean the filter promptly.
	Liquid Cooling Unit	Electrical and Fixed Connection	(1) The device appearance is intact, with no damage or deformation ; (2) Ensure that installation and wiring are secure; (3) The cabinet grounding contact is reliable, with no looseness; (4) Operation is free of abnormal noise and vibration; temperature remains within the set range. (5) The liquid cooling unit filter should be clean and intact; air vents must be free from obstructions. If dust accumulates at external air inlets or outlets, power off for at least one minute before removing dust and dirt with a brush or cloth. (6) Visually inspect that pipes show no damage, deformation, or corrosion; pipe fixings and connection joints must be secure with no leakage.
		Coolant Maintenance	If leakage is detected in the liquid cooling unit or if the coolant no longer meets the required standards, perform refill or replacement operations as follows. (1) Open the exhaust valve at the highest point of the pipeline connecting the unit to the client. (2) Use piping to connect the outlet of the refill pump to the chiller unit's refill port, and the inlet to the external storage tank (note: a filter device must be installed at the refill pump). (3) Power on and start the chiller unit, then activate the refill device to inject coolant. (4) Open the host computer and monitor the return water pressure; stop refilling when the

			pressure reaches 0.9 bar. (5) After refilling is complete, power off the unit, close the maintenance ball valve at the refill port, and then remove the refill pump.
	Battery system	Electrical and Fixed Connection	(1) The main and secondary circuit connections of the battery system are secure, with no looseness, corrosion, dust accumulation, or condensation; (2) Ensure the installation and wiring of the water intrusion detector inside the battery compartment are secure.
	High Voltage Box	Electrical and Fixed Connection	(1) The main and secondary circuit connections of the High Voltage Box are reliable, with no corrosion, dust accumulation, or condensation; (2) Ensure the installation is secure; (3) The cabinet grounding contact is firm, with no looseness.
	Dehumidifier	Electrical and Fixed Connection	(1) The device appearance is intact, with no damage or deformation ; (2) Ensure that installation and wiring are secure; (3) The display can normally show temperature and humidity data, without fault alarms.
Annual Inspection	Cabinet Body and Structural Components	Energy Storage Cabinet Section	(1) Inspect the air filter at the cabinet door air inlet and outlet; if dirt or blockage is detected, clean the filter promptly (unscrew the screws of the filter metal mesh cover, remove the air filter, wash it with clean water, and reinstall it once the filter is completely dry and free of visible water stains). (2) Check the cabinet body for any paint peeling; if found, repaint promptly to prevent rust. (3) Inspect inside the cabinet for any fallen screws and promptly remove any foreign objects. (4) Verify that the cabinet grounding connection is secure and without looseness.
		Combiner Cabinet Section	(1) Inspect the air filter at the cabinet door air inlet and outlet; if dirt or blockage is detected, clean the filter promptly (unscrew the screws of the filter metal mesh cover, remove the air

			filter, wash it with clean water, and reinstall it once the filter is completely dry and free of visible water stains). (2) Check the cabinet body for any paint peeling; if found, repaint promptly to prevent rust. (3) Inspect inside the cabinet for any fallen screws and promptly remove any foreign objects. (4) Verify that the cabinet grounding connection is secure and without looseness.
	Fire Protection Device	Air Pressure Inspection	(1) The fire suppression device requires an annual air pressure inspection. The standard shipment air pressure is 2.5 MPa. If the air pressure falls below 1.8 MPa, please contact the supplier for replacement.  (2) To prevent minor leakage of perfluorohexanone medium through the air pressure gauge, the air pressure gauge and the air storage tank are normally not connected. When checking the air pressure, use a wrench to turn the nut behind the air pressure gauge 90 degrees counterclockwise. After the inspection, retighten the nut by turning it 90 degrees clockwise with the wrench.

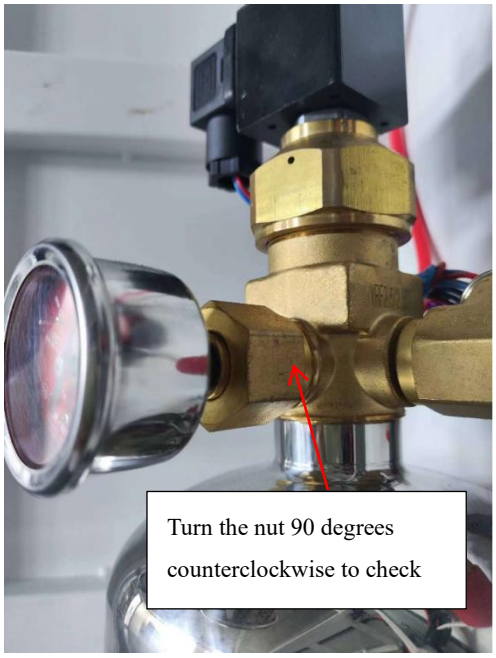
			 (3) Ensure that installation and wiring are secure and free from looseness.
	Electrical components	Component maintenance	1. Switch-type components: Verify that mechanical operation is normal; actuate the switch three times to confirm proper function. 2. Surge protector circuit (inspection intervals should be based on actual conditions; for instance, in high lightning areas, it is recommended to adjust the inspection cycle to once every six months): inspect for cracks, deformation, or other physical damage to the exterior; replace immediately if any defects are found.

Table 7- 1Maintenance task overview

The table presents only recommended routine maintenance intervals for the product. The actual maintenance intervals should be reasonably established according to the product's specific installation environment. Factors such as location and on-site environment will influence the equipment maintenance cycle. In environments with heavy sand or thick dust, it is essential to shorten the maintenance cycle and increase maintenance frequency.

7.5 Fault Handling

The energy storage system features comprehensive protection functions and alarm information. Upon occurrence of a fault, click the small indicator lamp at the upper right corner of the host computer (lit in red at that time). In the resulting drop-down menu, select the cabinet where the fault occurred. Based on the device fault prompts under the selected cabinet, locate the device. Detailed alarm information can be viewed under the alarm menu bar of that device. Users should follow the prompts in the table to conduct self-inspections, analyze the fault causes, and determine solutions. For faults that cannot be identified or resolved, please promptly contact the manufacturer's after-sales personnel.

Item No.	Fault/Status Feedback Name	Possible Cause	Corrective Action
1	Fire Protection Communication Fault	Communication anomaly between the fire detector and ECS	1) Verify whether the power supply line is normal and measure if the voltage at the power supply port meets the equipment's operational requirements.

			2) Verify whether the communication line is normal.
2	Electric Meter Communication Fault	Communication anomaly between the electric meter and ECS	Check whether the communication line is properly connected.
3	Water Cooling Unit Communication Fault	Communication anomaly between the water cooling unit and ECS	Check whether the communication line is properly connected.
4	Dehumidifier Communication Fault	Communication anomaly between the dehumidifier and ECS	Check whether the communication line is properly connected.
5	PCS Communication Fault	Communication anomaly between the PCS and ECS	Check whether the communication line is properly connected.
6	BMU communication failure	Communication abnormality between BUM and ECS	Check whether the communication line is properly connected.
7	Fire extinguisher cylinder valve status_triggered	Fire extinguisher cylinder valve damage or wiring issue	1) Check whether the fire extinguisher cylinder valve body is damaged 2) Check whether the wiring is properly connected
8	Battery compartment door status_open	Access control switch damaged or wiring issue	1) Check whether the access control switch body is damaged 2) Check whether the wiring is properly connected
9	Emergency stop signal	Emergency stop switch accidentally activated or wiring issue	1) Check whether the emergency stop switch body has been accidentally activated 2) Check whether the wiring is properly connected
10	Cabinet door indicator light	Suddenly extinguished or not lit	1) Check whether the indicator light body has water ingress or damage 2) Verify that the power supply line is functioning correctly and measure whether the voltage at the power supply port meets the equipment's operational requirements.

Table 7- 2Fault Overview Table

7.6 Emergency Handling

In the event of hazardous incidents on site, including but not limited to those listed below, immediately ensure the personal safety of personnel on site and contact the company's service engineers.

1. In the event of flooding:

Power down the system while ensuring personal safety.

If any part of the battery is submerged in water, do not touch the battery to avoid electric shock. Do not use batteries that have been submerged; contact the battery recycling company for disposal.

2. In the event of fire:

If a fire occurs, power down the system when it is safe to do so.

Use carbon dioxide, FM-200, or ABC dry powder fire extinguishers for fire suppression.

Firefighters must avoid contact with high-voltage components during fire suppression, as this may cause an electric shock hazard. Excessively high battery temperatures can lead to battery deformation, damage, and electrolyte leakage, releasing toxic gases. Respiratory protective equipment must be worn. Do not approach to prevent skin irritation and chemical burns.

3. In the event of coolant leakage:

If the system is in operation, power down the system after ensuring safety. Inspect potential system leak points, with emphasis on liquid cooling pipeline connections, bends in movable pipeline sections, joints of the top vent valve, and insertion points of bidirectional shut-off valves.

After troubleshooting, clean the interior of the system, replace the subcomponent where leakage occurs (PACK, PCS, Liquid Cooling Unit, or liquid cooling pipeline), then power it on again and verify whether the system is operating normally. If any abnormalities persist, please contact our company promptly for assistance.

4、When the audible and visual alarm is activated:

Immediately evacuate personnel, ensure personal safety, and promptly press the emergency stop button to cut off power to the energy storage cabinet.

8 Technical Support and Services

Our company has dedicated technical service personnel available before, during, and after sales to provide you with comprehensive technical support and services. For any product information, technical, or usage inquiries, please feel free to contact us at any time. You may reach us via our company website, email, fax, WeChat public account, or other channels. We will respond promptly upon receipt of your message.

All staff at ZVPP look forward to communicating and exchanging ideas with you!

Email: info@zvpp.ai

Address: No. 801-1, Building 2, No. 178 Dingxing Road, High-tech Zone, Zhuhai City

Appendix 1 Host Computer Software User Manual

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1. Installation and Startup

1.1 System Requirements

1.1.1 Hardware Configuration Requirements

Recommended Configuration

CPU	AMD Ryzen 7 7735H with Radeon Graphics (16CPUs),~3.2GHz
Memory	32768MB RAM
Operating System	Windows 10/11
Disk	4G
Graphics Card	No special requirements
Network Port	Gigabit Ethernet Port

Minimum Configuration

CPU	12th Gen Intel Core i5-12500(12 CPUs),~3.0GHz
Memory	16384MB RAM
Operating System	Windows 10/11
Disk	2G
Graphics Card	No special requirements
Network Port	Gigabit Ethernet Port

1.1.2 Network Configuration Requirements

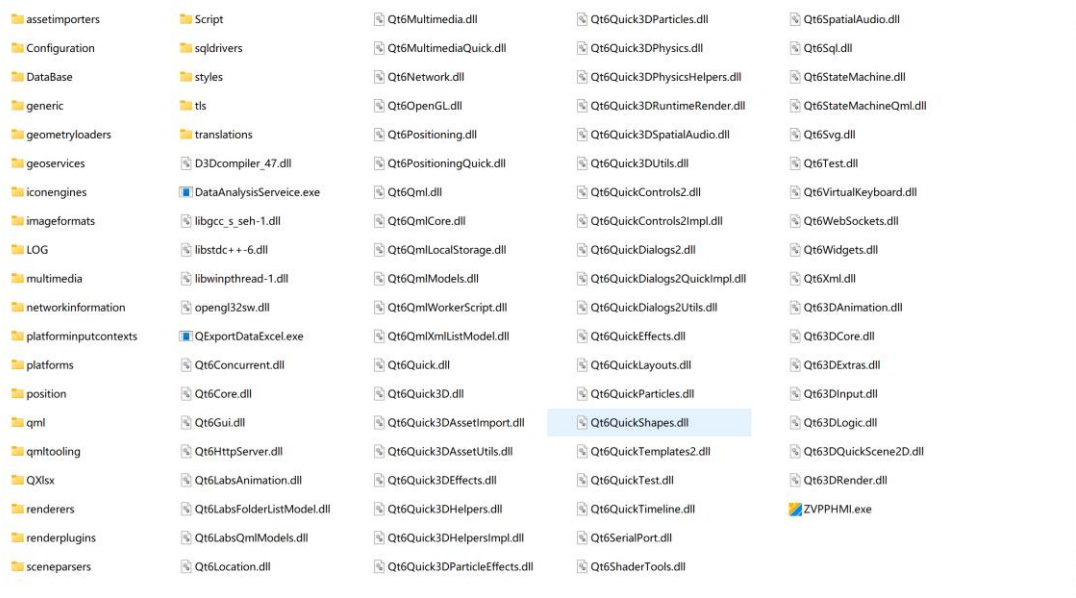
The host computer's IP addresses are fixed as 172.19.130.88 and 172.19.140.110. Before starting the host computer, ensure the IP addresses are fixed. This can be done in the Windows system by following these steps: Ethernet Properties — select Internet Protocol Version 4 (TCP/IPv4) — use the IP addresses shown below — Advanced — Add IP Address — OK.

1.2 Installation Steps

1.2.1 Software Dependencies

The host computer installation package is a portable compressed file that can be used directly after decompression.

After decompression, the contents appear as follows:



1.3 Startup

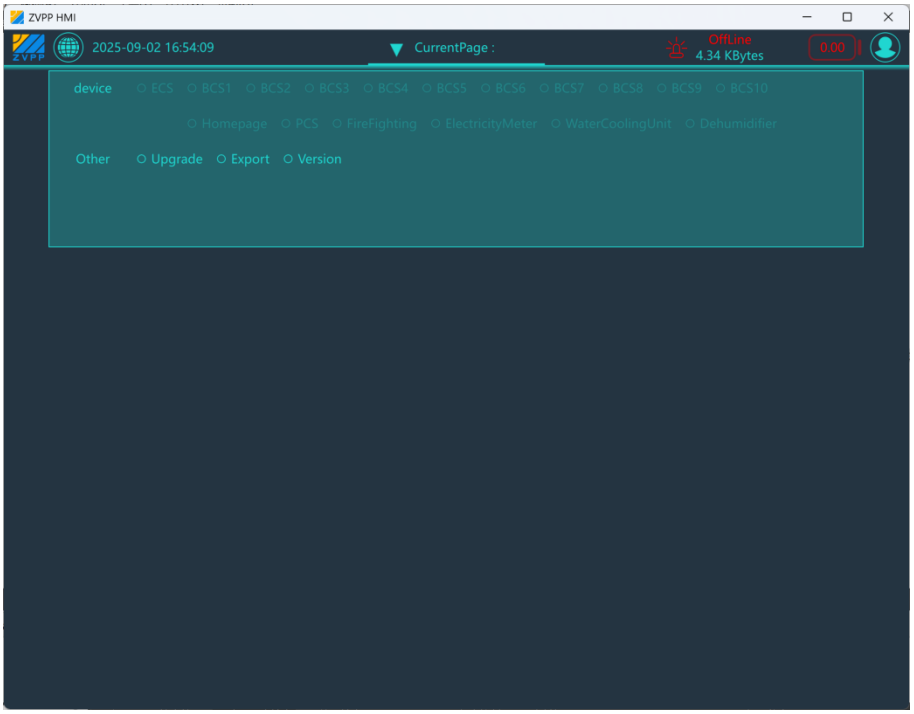
Double-click ZVPPHMI.exe directly to launch the host computer. For convenience, you may create a desktop shortcut.

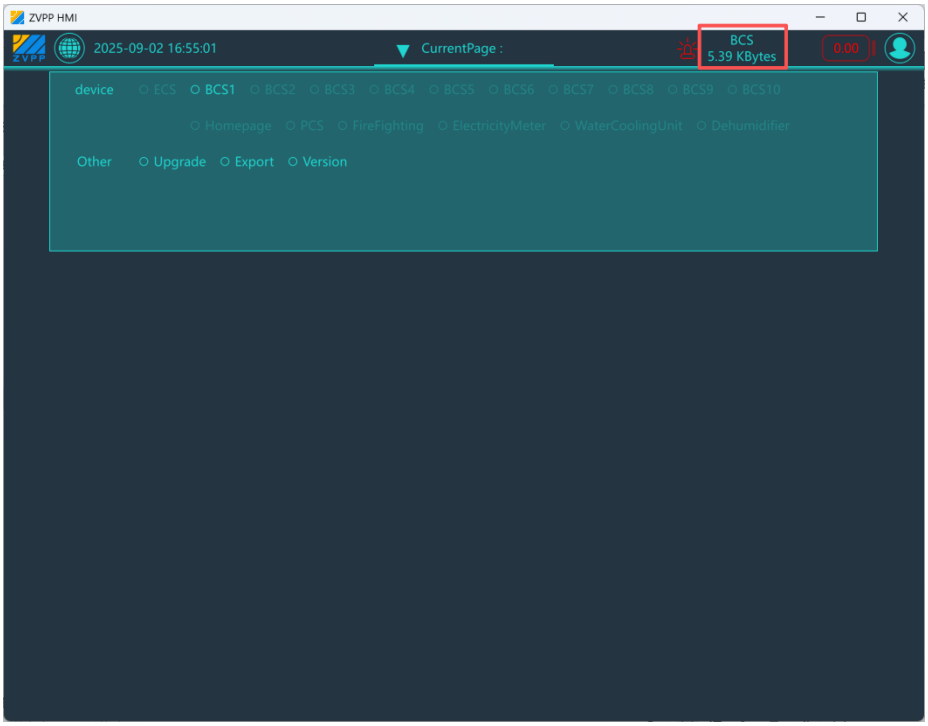
2. Basic Operation Guide

2.1 Login and Access Control

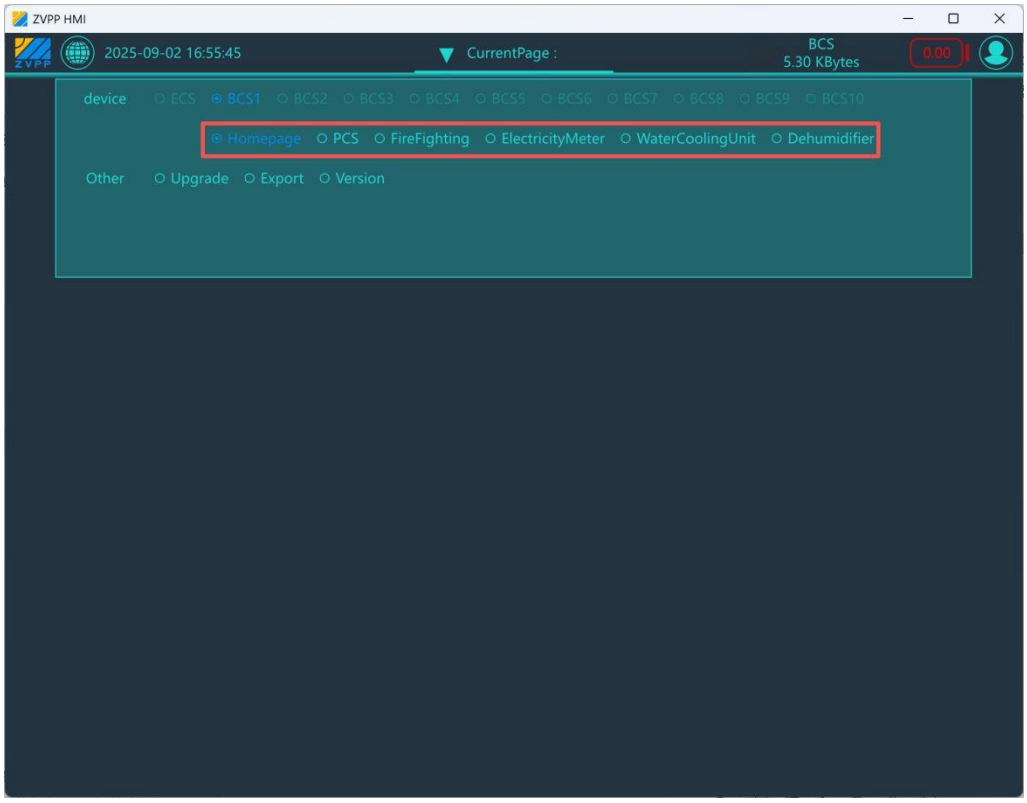
For account password inquiries, please consult after-sales service. If you do not wish to enter an account password, you may directly click Guest login. Guest login does not require an account password but only allows viewing information and prohibits any modifications.

After the Host Computer successfully logs in, if there is no BCS/ECS connection, Offline will be displayed in the upper right corner of the interface, and the real-time data flow below it will show 0. Devices in the drop-down menu that appears after clicking 'Current Page' cannot be selected.





If there is a BCS/ECS connection, it will be restored, allowing switching between BCS and ECS in the device selection. Selecting BCS enables further selection of devices under it, while selecting ECS directly navigates to the ECS interface.



Regarding access control, if Guest login is used, only information, version, and warnings are displayed.

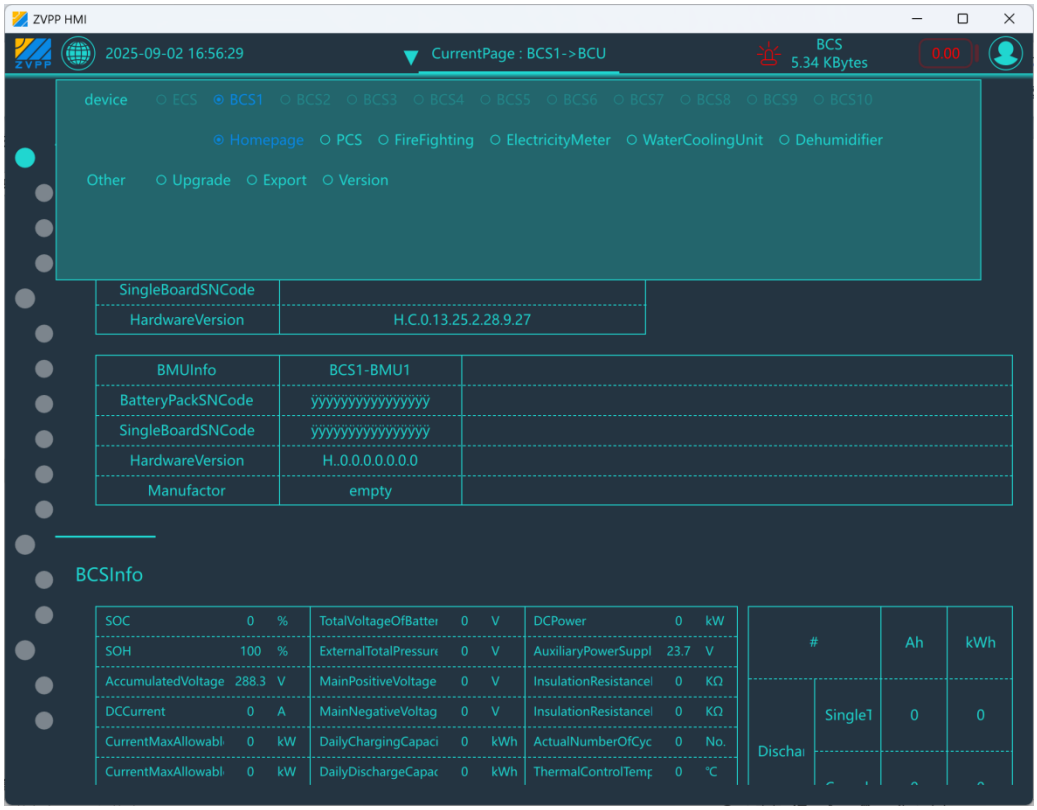
Additionally, the software's account management defaults to hierarchical management. Hierarchical management can restrict whether a specific item is displayed at a certain permission level, while Access Control allows for user customization.

For example, a user customizes two levels: one as Super Administrator and the other as General Administrator.

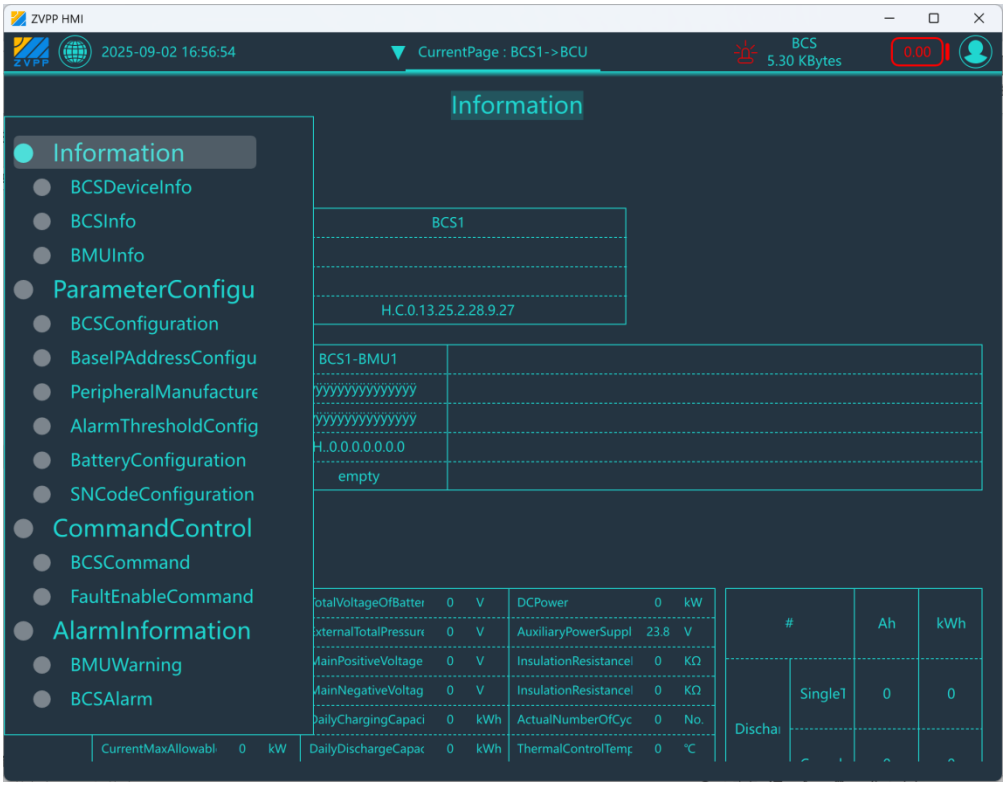
The Super Administrator can view all data, whereas the General Administrator sees less than the Super Administrator. For instance, it can be customized so that the General Administrator cannot view certain items, thereby preventing the General Administrator from viewing or modifying them.

2.2 Equipment Interface

After selecting equipment under ECS or BCS, you can navigate to the corresponding interface. The following example uses the BCU interface, that is, the 'Home' page. Once a device is selected from the dropdown menu at the top, it disappears. Clicking again on the centered text area at the top will bring it back.



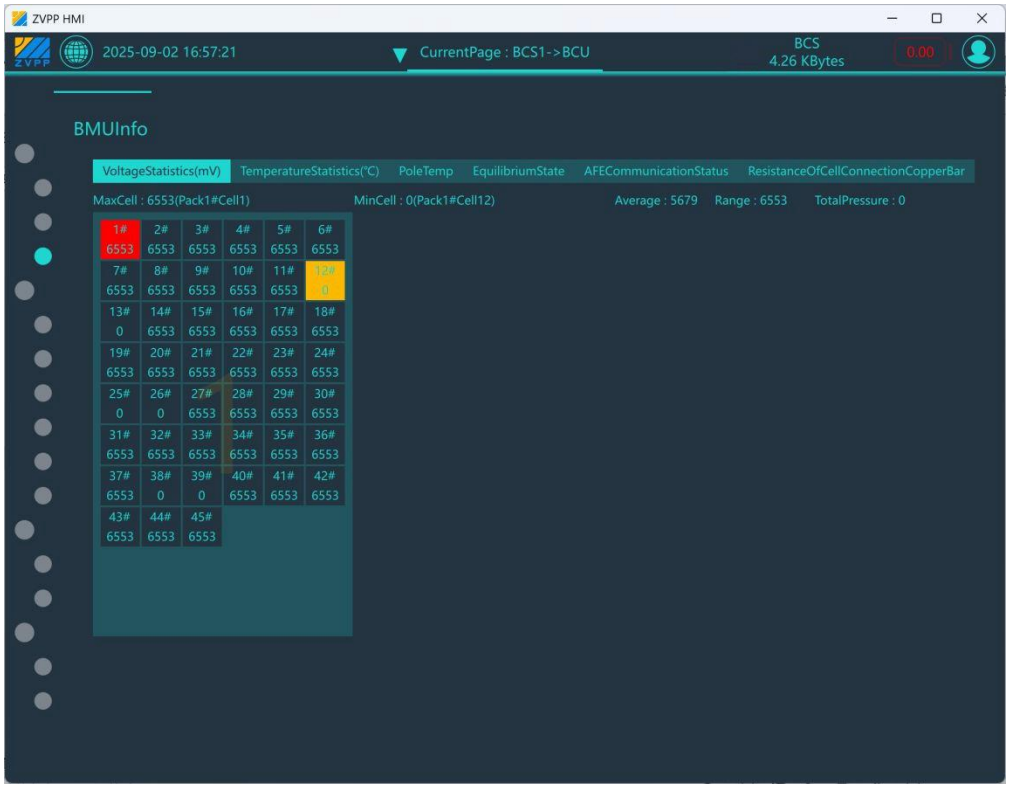
Hover the mouse over the floating ball on the left side to activate the navigation menu of the current interface.



The navigation menu is divided into four main sections: Information, Parameter Configuration, Command Control, and Alarm Information.

2.2.1 Information

Information refers to the real-time data display of the equipment. For example, BMU information: clicking the 'BMU Information' item in the menu bar will scroll to the BMU information section.

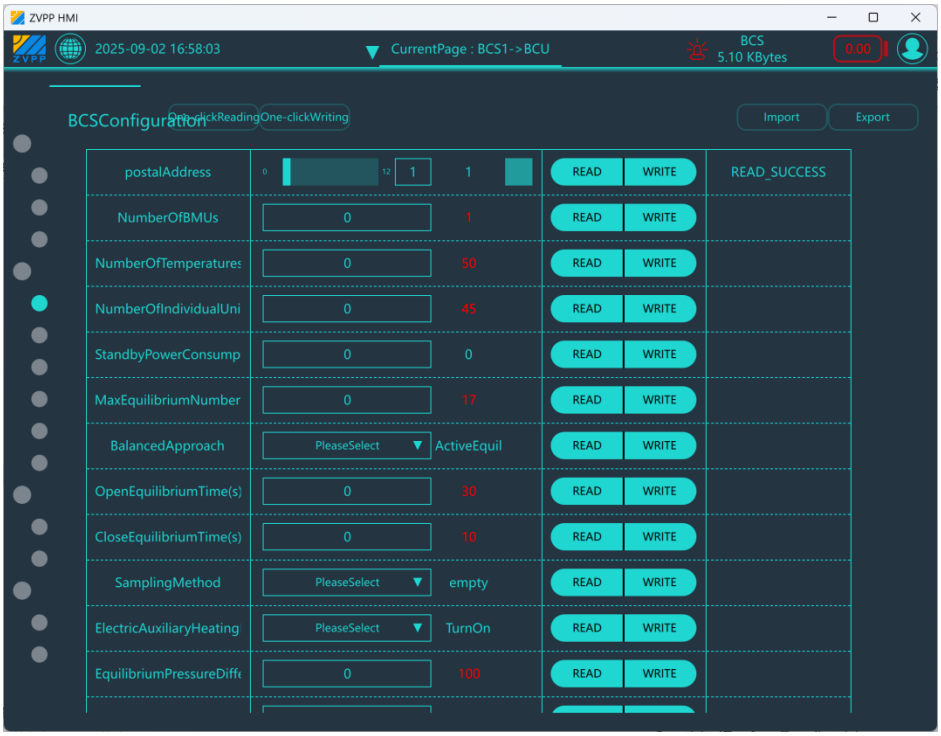


2.2.2 Parameter Configuration

Parameter Configuration refers to the configuration of the equipment's various parameters. Selecting the 'BCS Configuration' item in the menu bar will scroll to the BCS configuration section, where certain interfaces with numerous configuration items support auxiliary operations such as One-Key Read/Write and Import and Export.

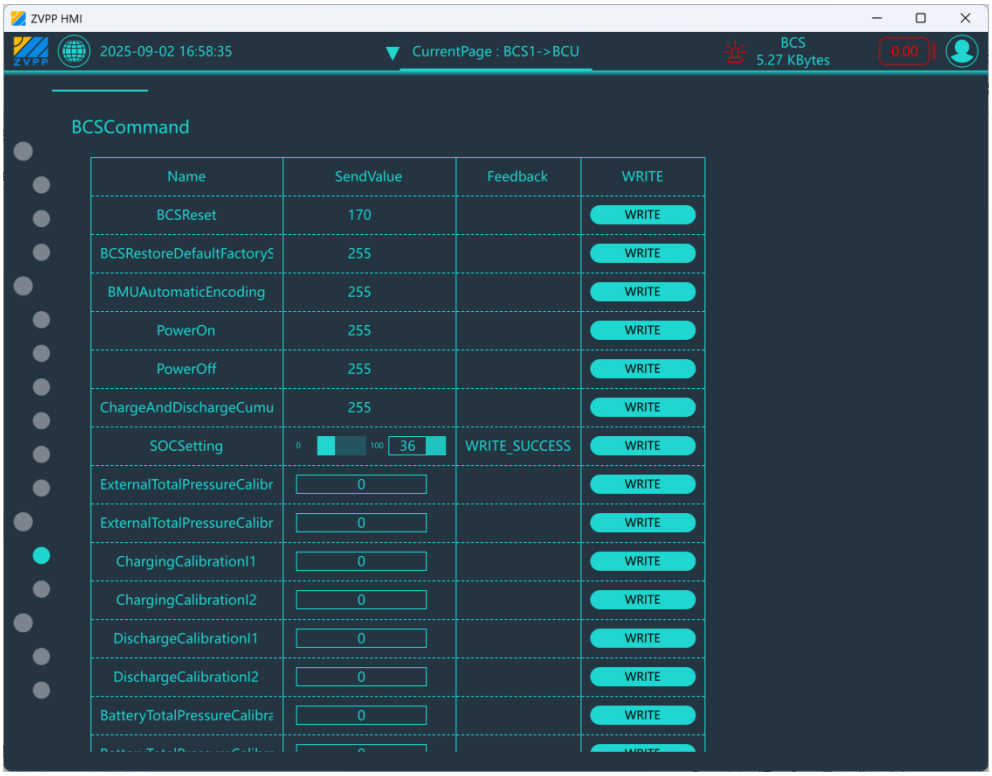
The configuration interface is divided into four columns: the first column shows the name of the configuration item; the second column displays the input and output of the configuration item; the third column provides read and write operation controls; and the fourth column shows the feedback results of the operations, such as displaying 'Read Successful' upon successful reading.

In the second column, the left side contains the input box: the input box automatically handles invalid values; for example, if a value exceeds limits, it will be automatically adjusted to the nearest boundary value. The centered text shows the lower computer value: if it differs from the input box value, it will be highlighted in red. The color block on the right indicates the interaction status: red for interaction failure, constant cyan for success, both fading out within three seconds after the interaction ends.



2.2.3 Command Control

The content in the Command Control interface is similar to the configuration interface; however, Command Control is unidirectional, so it lacks read functionality and does not display lower computer values, One-Key Read/Write, or Import and Export.



2.2.4 Alarm Information

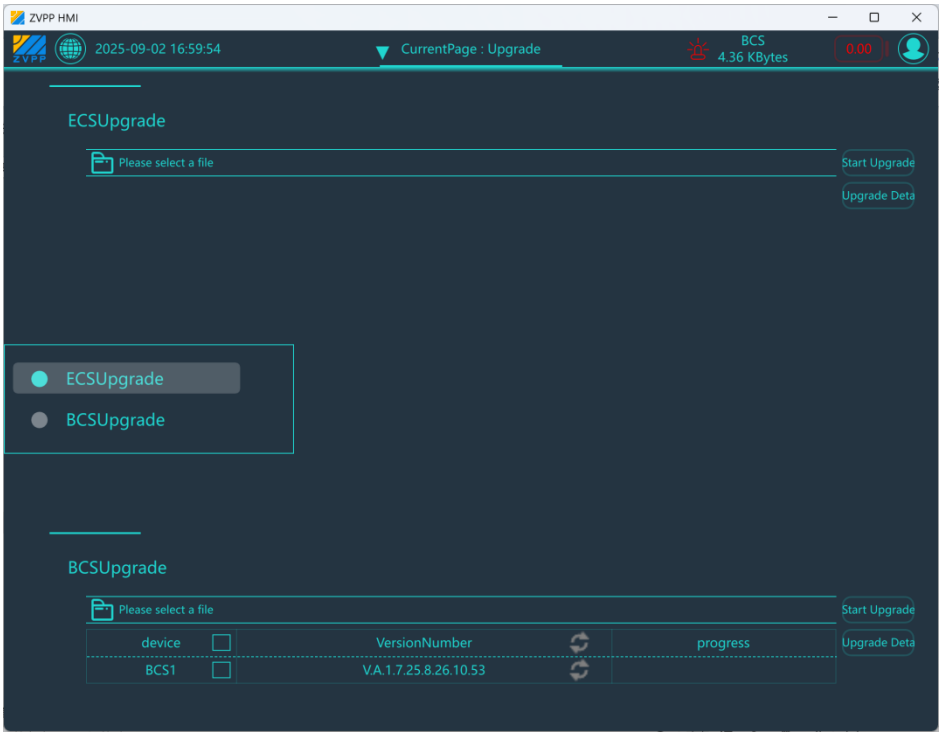
The Alarm Information section displays the detailed alarm information of the equipment.

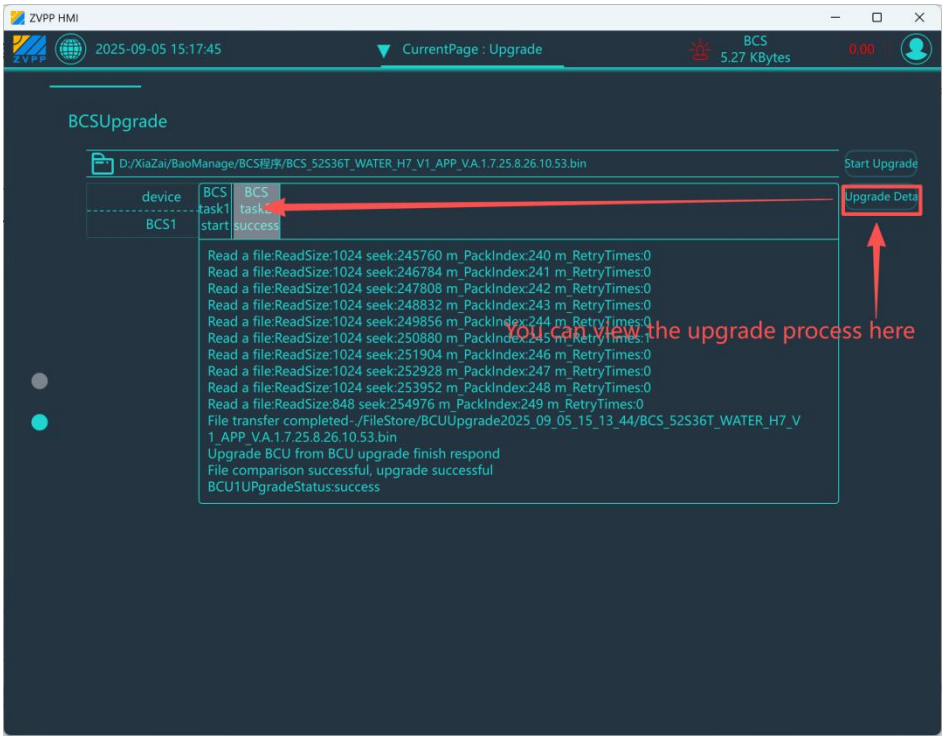
FaultName	AlarmLevel	TriggerValue	Pack1	Monomer1	Pack2	Monomer2
IndividualUndervoltageFau	SHUTDOWN	0	1	12	#	#
SingleUnitOvervoltageFaul	SHUTDOWN	6553	1	1	#	#
ExcessiveIndividualPressure	SHUTDOWN	6553	1	1	1	12
ChargeIndividualTemperatu	NOWARNING	0	0	0	#	#
IndividualTemperatureTooH	SHUTDOWN	125	1	1	#	#
ExcessiveTemperatureDiffe	SHUTDOWN	125	1	1	1	49
PACKVoltageUndervoltagel	NOWARNING	0	0	0	#	#
PACKVoltageOvervoltageFa	SHUTDOWN	288.3	1	0	#	#
PACKPressureDifferenceFau	NOWARNING	0	0	0	0	0
TotalUndervoltageFault	SHUTDOWN	0	#	#	#	#
TotalPressureOvervoltageFa	NOWARNING	0	#	#	#	#
ChargingOvercurrentFault	NOWARNING	0	#	#	#	#
DischargeOvercurrentFault	NOWARNING	0	#	#	#	#
PoleTemperatureTooHighFa	NOWARNING	0	0	0	#	#

2.3 Other Interfaces

2.3.1 Upgrade

All equipment upgrades are performed here. When connected to ECS, an ECS upgrade item will appear under ECS upgrades, and the upgrade items under BCS upgrades depend on the number of BCS units configured by ECS. When connected to BCS, no ECS upgrade items are shown under ECS upgrades, and only a single BCS upgrade item is displayed under BCS upgrades. Regardless of connection to ECS or BCS, the upgrade items under BMU upgrades are determined by the number of BMUs configured in BCS.



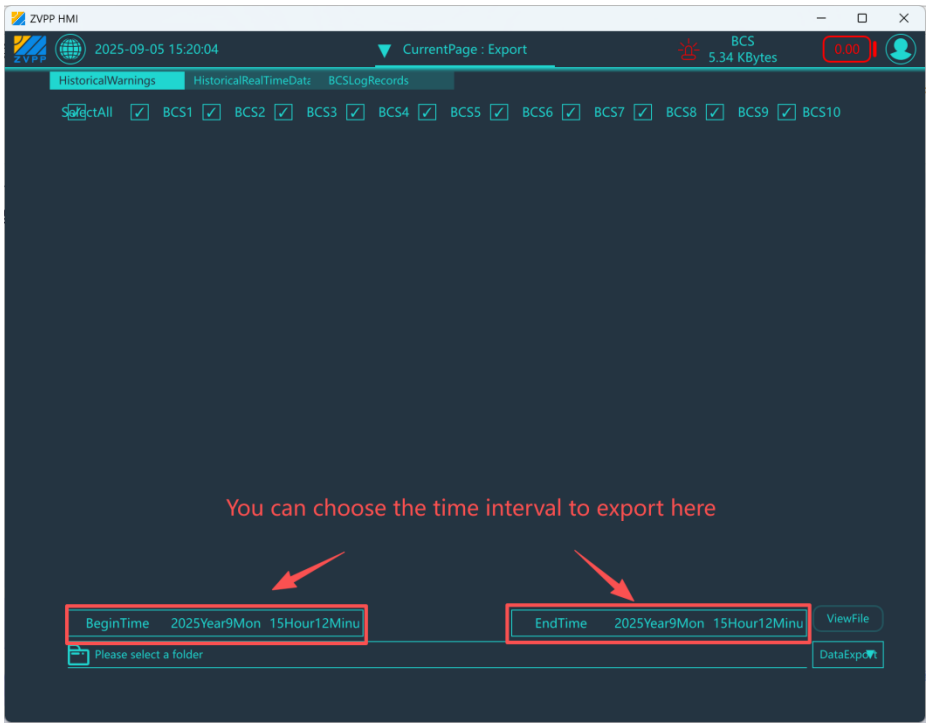


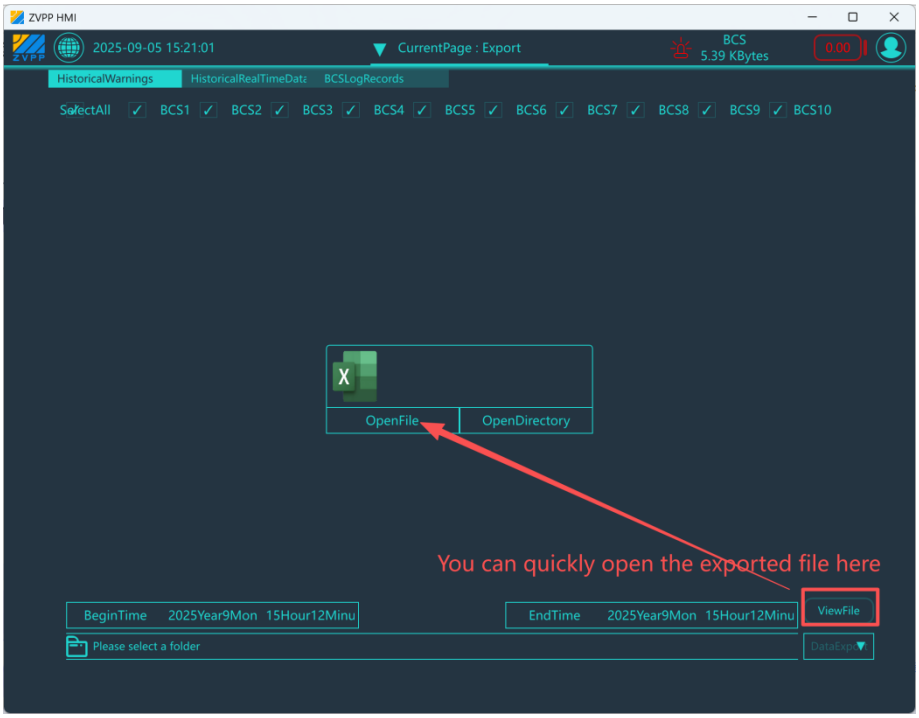
If the upgrade fails, please retain the logs and contact after-sales service.

2.3.2 Export

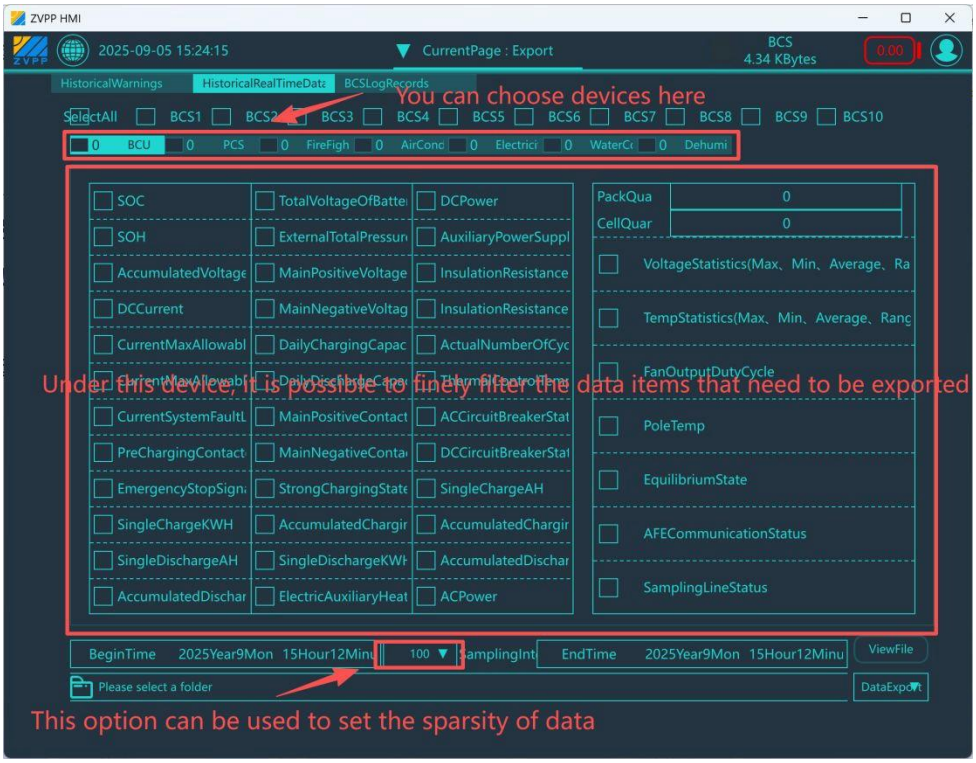
In the dropdown box at the bottom right corner, you can select to export either the current day's data or data within a chosen time range; the export will initiate immediately upon selection. If the SD card is not installed, the local device can store approximately one day of historical data.

Export of Historical Alarm Data:

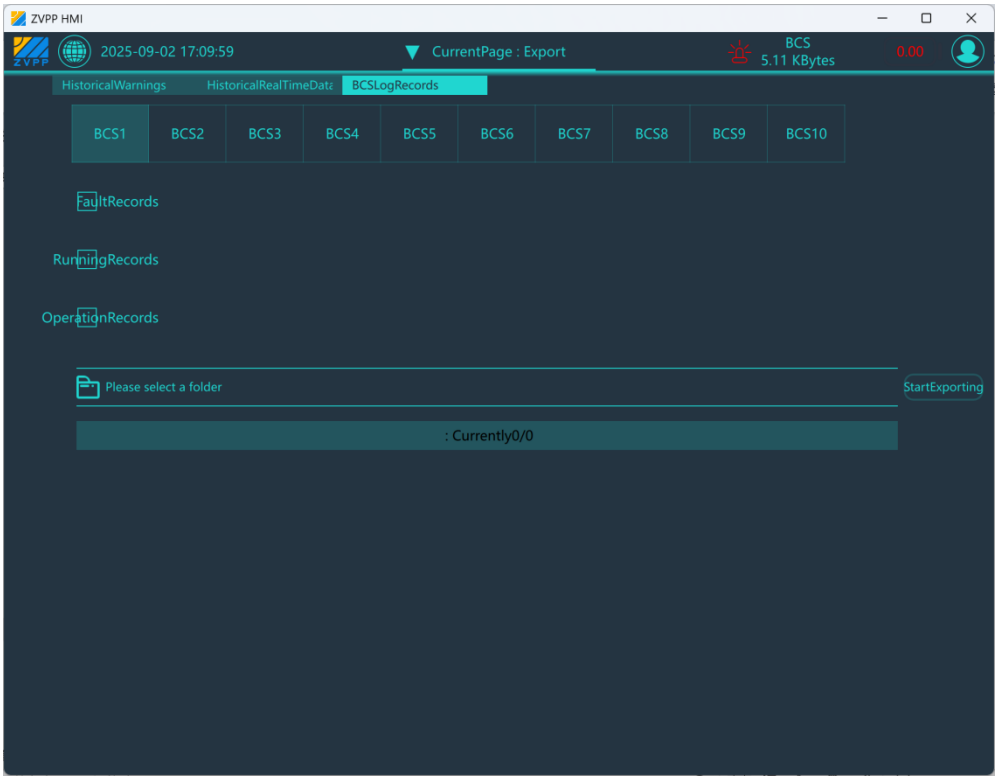




Export of Historical Real-time Data:



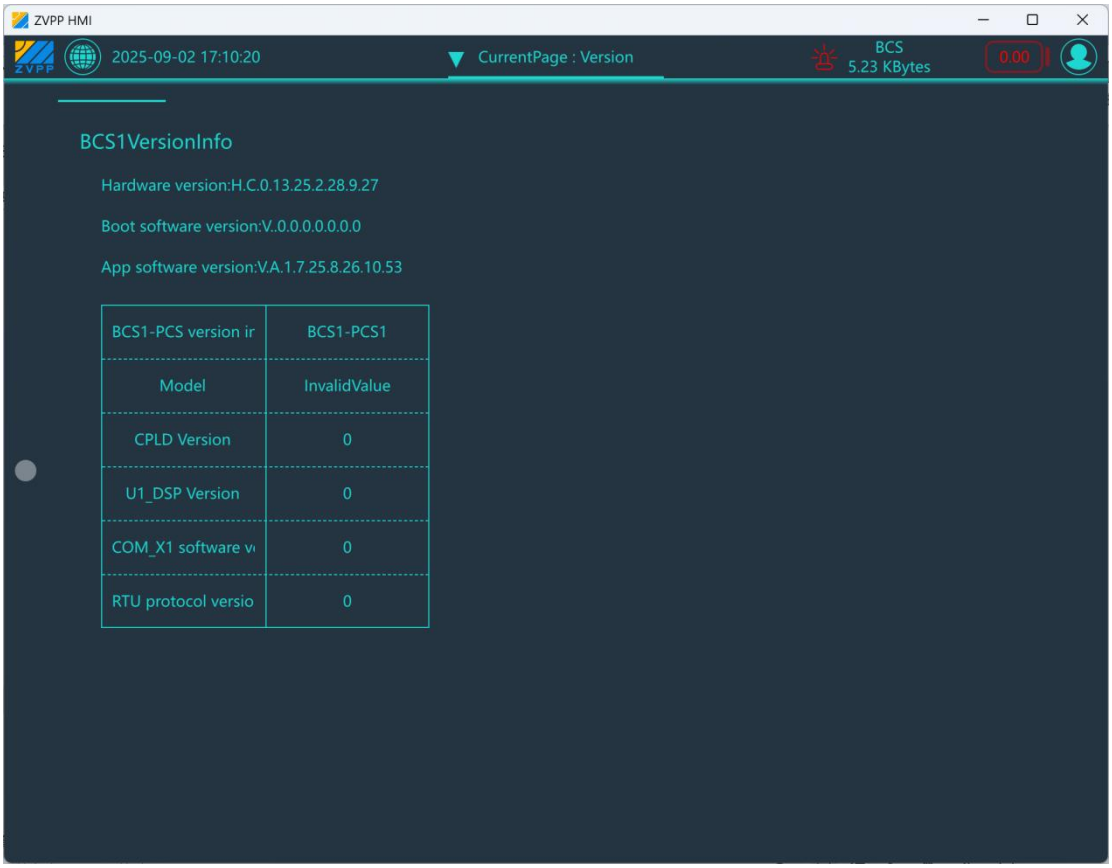
Export of BCS Logs:



2.3.3 Version

The version interface display is affected by the currently connected equipment: the ECS

displays the ECS version interface and the BCS version interfaces corresponding to the number of BCS units configured under it; the BCS displays only its own version interface, including the versions of all subordinate devices.



3. Troubleshooting and Maintenance

3.1 Frequently Asked Questions

Q1: After connecting the network cable and opening the host computer, no ECS/BCS connection is displayed, and devices cannot be selected from the dropdown menu.

A1: Please verify your IP configuration according to section 1.1.2, then use commands to check your IP address and attempt to ping the subordinate device. ECS default IP address: 172.19.130.200. BCS: 172.19.140.20X (X represents the BCS number; for example, if BCS1, the last digit of the IP address is 201)

Q2: The host computer does not respond when exporting certain historical data

A2: The export format is xls, and the process takes a longer time. If the quantity exported is considerable, it may take even longer. However, if there is no response for more than 5 to 10 minutes, please retain the logs and contact after-sales service. Additionally, you can check the LOG folder where all exported files are stored; the file extension is xls.

Q3: The exported historical data from the host computer is either too small or blank

A3: Retain the logs and contact after-sales service.

Q4: Why are the devices under BCS not visible when starting the host computer for the first time?

A4: Restart the Host Computer

3.2 System Maintenance and Updates

3.2.1 Viewing and Management of Maintenance Log

Operation logs are stored in the LOG folder, and operation scripts are stored in the Script folder, as shown: