SmartGen

MAKING CONTROL SMARTER

ESSL233-832-05C

LIQUID-COOLED ENERGY STORAGE CABINET

USER MANUAL

郑州众智科技股份有限公司

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Table 1 Software Version

Date	Version	Note
2024-08-21	1.0	Original release.

Table 2 Notation Clarification

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

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

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

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

Terminology:

PCS (Power Conversion System): Power conversion system, i.e., energy storage converter.

BMS (Battery Management System): Battery management system.

BCU (Battery Control Unit): Battery control unit.

BMU (Battery Management Unit): Battery management unit.

SOC (State of Charge): Charge status.

PACK: Battery pack.

CONTENT

1 PRECAUTIONS

1.1 PERSONNEL REQUIREMENT

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

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

1.2 ELECTRICAL SAFETY

⚠ DANGER

- Risk of electric shock may occur if you touch the power grid or the contacts, terminals, etc., that are connected to it inside the device!
- Voltage can be generated on either the battery side or the grid side, so always be careful to use a standard voltmeter to confirm that there is no voltage before touching it.
- Disconnect the power supply of the energy storage cabinet, and ensure that the device is completely unpowered before operation.

⚠ DANGER

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

⚠ CAUTION

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

NOTE

In order to prevent mal-operation or accidents caused by unrelated personnel approaching the energy storage cabinet, please obey the following precautions:

- Place eye-catching warning signs around the energy storage cabinet to prevent accidents caused

by mal-closing.
• Set up warning signs or safety warning tapes in the vicinity of the equipment.

1.3 BATTERY SAFETY

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

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

1.4 LIFTING & TRANSPORTATION

⚠ CAUTION

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

1.5 INSTALLATION & WIRING

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

1.6 OPERATION & MAINTENANCE

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

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

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

1.7 PRODUCT SCRAP

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

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

2 PRODUCT INFORMATION

2.1 PRODUCT INTRODUCTION

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

The cabinet can be used in various scenarios, including peak load shifting, green power utilization, demand management, backup power and others. It can realize grid operation and manual off-grid operation.

2.2 ELECTRICAL TOPOLOGY DIAGRAM OF ENERGY STORAGE CABINET

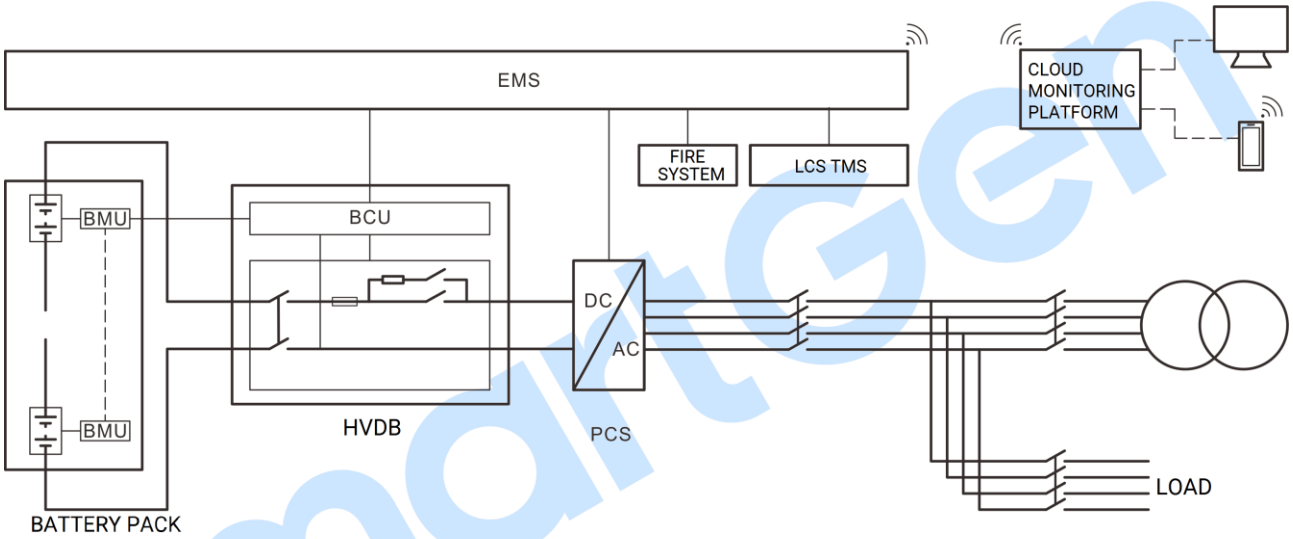


Fig.1 Topology Diagram

2.3 TECHNICAL PARAMETER

Table 3 Technical Parameters

Items		Parameters
Model		ESSL233-832-05C
Rated Capacity		232.96kWh
Rated Output Power		125kW
External Wiring Method		3P3W+PE
AC Grid Parameter	Rated Volt	AC230V/400V
	Volt Deviation	-15%~+15%
	Rated Grid Freq.	50Hz/60Hz
	PF Range	1(ahead)~1(behind)
AC Off-grid Parameter	Rated Volt	AC230V /400V
	Rated Freq.	50Hz/60Hz
	Unbalanced Load Capacity	Support 100% 3-phase unbalanced load
External Communication Port		RS485, ETHERNET, 4G
Cell Type		LFP3.2V/280Ah(25±2)°C

Items	Parameters
Liquid-cooled Battery Box Configuration	1P52S
Battery System Configuration	1P260S
Extinguishing Method	Cabinet-level + built-in PACK-level
Thermal Management System	Cooling, heating, self-check, communication
Working Temperature	-20°C~+50°C
Working Humidity	(5~95)%RH (no condensation)
Overall Dimensions	1000mmx1350mmx2270mm
Weight	2.9t
Protection Level	IP54
Working Altitude	≤2000m

2.4 APPEARANCE AND DIMENSION

Fig.2 Appearance of the Energy Storage Cabinet

Unit: mm

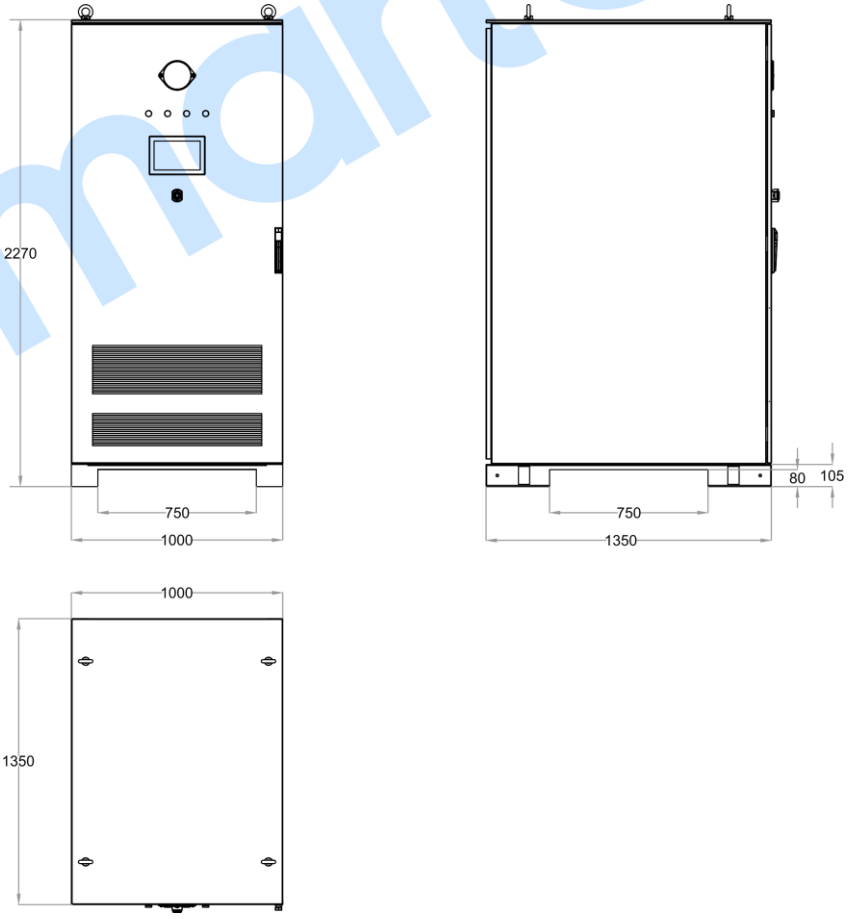


Fig.3 Overall Dimensions

2.5 MAIN EQUIPMENT

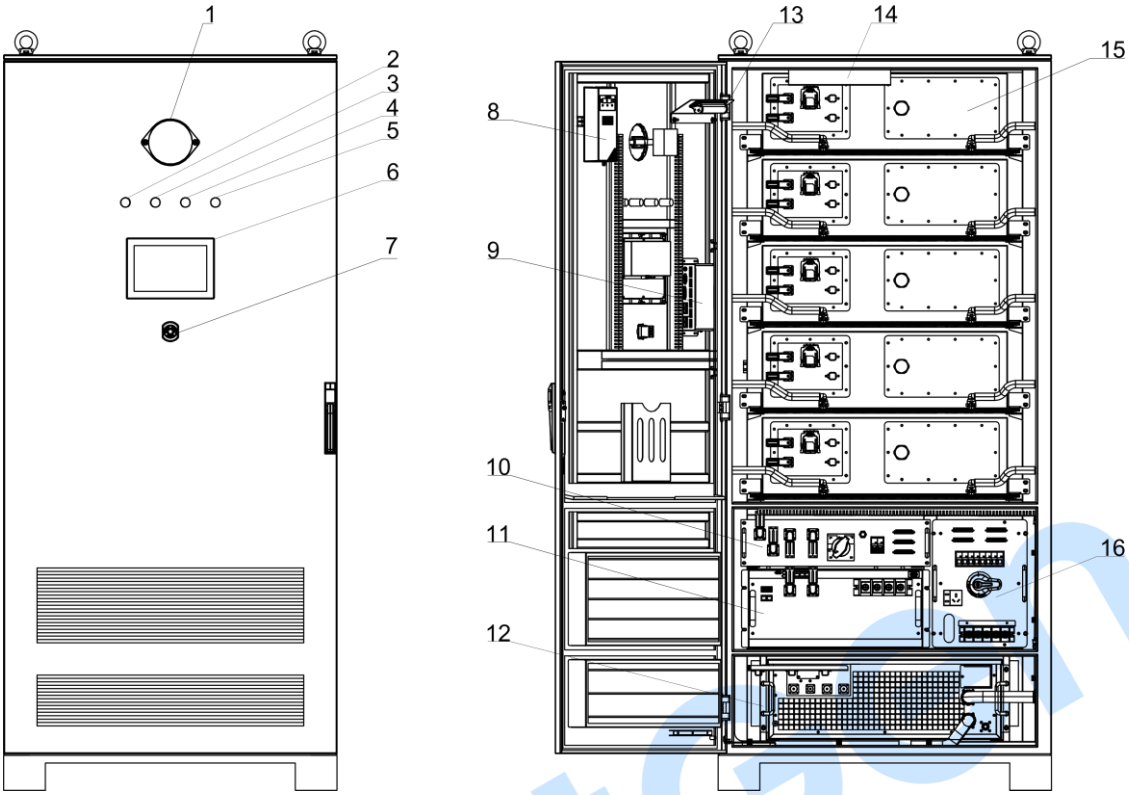


Fig.4 Main Equipment

Table 4 Main Equipment List

No.	Equipment	Function Description
1	Explosion-proof Valve of Electric Actuator	Rapid and directed release of internal gases and smoke.
2	Fire Buzzer	When the fire control system warns or alarms, the buzzer lights up and sounds at the same time.
3	Alarm Indicator (Red)	When the energy storage system fails, the alarm indicator lights up.
4	Running Indicator (Green)	When the energy storage system is operating normally, the running indicator lights up.
5	Power Indicator (Green)	When the auxiliary power supply is operating normally, the power indicator lights up.
6	EMS Display Screen	Read and display each energy data and status.
7	Emergency Stop Button	In case of emergency, press the emergency stop button to stop the energy storage system.
8	Intelligent Condensation Dehumidifier	Moisture-proof, anti-condensation.
9	EMS Controller	Data collection, management, and control.
10	High-voltage Box	The protection and control unit at the DC side.
11	PCS	Power conversion module.
12	LCS TMS	Conduct the start and stop of auto, cool, heat, self-cycle or standby according to EMS command.
13	Cabinet light	Cabinet lighting.

No.	Equipment	Function Description
14	Cabinet-level Fire Extinguishing Device	Filled with perfluorohexanone extinguishing agent.
15	LCS Battery Box	Battery pack, 5 in total.
16	Distribution Box	Control system of AC main circuit.

2.6 LCS BATTERY BOX

2.6.1 APPEARANCE

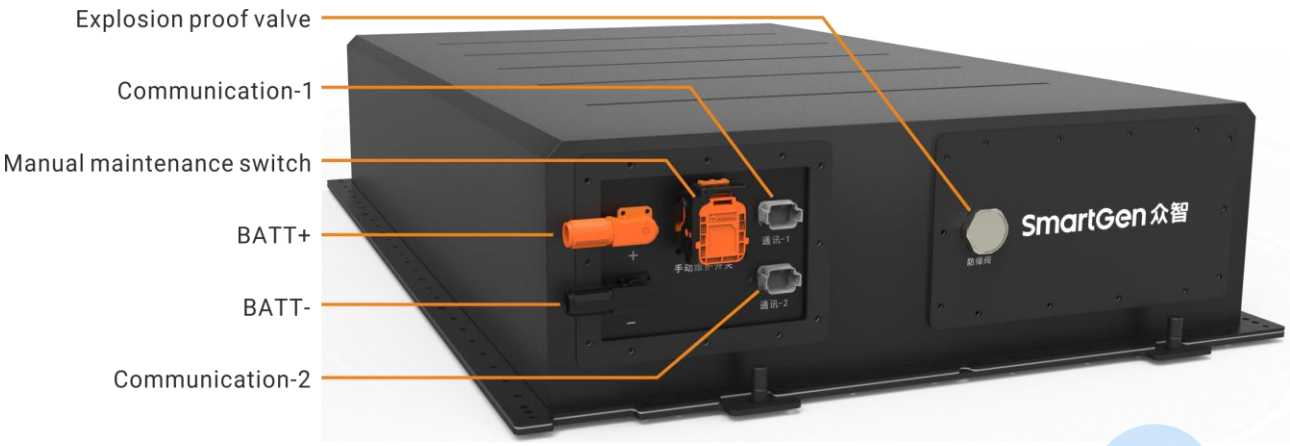


Fig.5 LCS Battery Box Appearance

2.6.2 TECHNICAL PARAMETER

Table 5 Technical Parameter

Item	Parameter
Model	BPL52-280
Cell Type	LFP
Cell Specification	3.2V/280Ah
Group Method	1P52S
Rated Energy	46.6kWh
Rated Voltage	DC166.4V
Working Voltage Range	DC145.6V~187.2V
Maximum Continuous Charge Rate	0.5C
Maximum Continuous Discharge Rate	0.5C
Cooling Method	Liquid-cooling
Built-in PACK-level Fire	Perfluorohexanone
Protection Level	IP67
Dimensions	808mmx1172mmx245mm
Weight	400kg

2.6.3 TERMINAL DEFINITION

Table 6 Communication 1 Terminal Definition

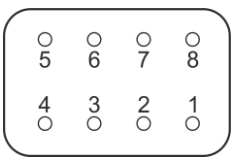
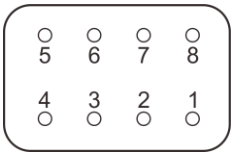
Figure	No.	Definition	Function
	1	VIN+	DC24V power supply positive pole.
	2	VIN -	DC24V power supply negative pole.
	3	CANH	Module communication port CANH.
	4	TR1	TR1 and TR2 are connected to 120Ω terminal match resistor. The battery pack at the end of the battery cluster is connected.
	5	TR2	

Figure	No.	Definition	Function
	6	NC	
	7	CANL	Module communication port CANL.
	8	BMU ID	ID auto-coding.

Table 7 Communication 2 Terminal Definition

Figure	No.	Definition	Function
	1	VIN+	DC24V power supply positive pole.
	2	VIN -	DC24V power supply negative pole.
	3	CANH	Module communication port CANH.
	4	NC	
	5	NC	
	6	NC	
	7	CANL	Module communication port CANL.
	8	BMU ID	ID auto-coding

2.7 HIGH-VOLTAGE CONTROL BOX

2.7.1 APPEARANCE

Fig.6 Appearance

2.7.2 TECHNICAL PARAMETER

Table 8 Technical Parameter

Item	Parameter
Model	HVB1000-250
Maximum Working Voltage	DC1000V
Maximum Working Current	250A
Auxiliary Power Supply	DC24V
Dimensions	566mmx840mmx140mm
Weight	29kg

2.7.3 TERMINAL DEFINITION

Table 9 J1 Terminal Definition

Figure	No.	Definition	Function
	1	DC24V+	DC24V power supply positive pole.
	2	DC24V-	DC24V power supply negative pole.
	3	DC24V+	DC24V power supply positive pole.
	4	DC24V-	DC24V power supply negative pole.
	5	CAN-1H	Module communication port CAN-1H.
	6	CAN-1L	Module communication port CAN-1L.
	7	ID-IN	/
	8	ID-OUT	ID auto-coding.
	9	NC	/

Table 10 J2 Terminal Definition

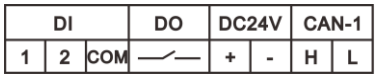
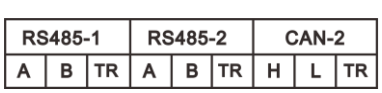
Figure	No.	Definition	Function
	1	DI-1	Emergency stop input, valid for DI-COM.
	2	DI-2	Aux. input 2, valid for DI-COM.
	3	DI-COM	Common end of aux. input port.
	4	DO-1	Passive normally open contact output, capacity 1A DC30V.
	5	DO-1	
	6	DC24V+	DC24V power supply positive pole.
	7	DC24V-	DC24V power supply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

Table 11 J3 Terminal Definition

Figure	No.	Definition	Function
	1	RS485-1A	Module communication port RS485-1A.
	2	RS485-1B	Module communication port RS485-1B.
	3	RS485-1TR	It is shorted with RS485-1A terminal for accessing 120Ω terminal impedance matching resistor. The factory product has been shorted.
	4	RS485-2A	Module communication port RS485-2A.
	5	RS485-2B	Module communication port RS485-2B.
	6	RS485-2TR	It is shorted with RS485-2A terminal for accessing 120Ω terminal impedance matching resistor. The factory product has been shorted.
	7	CAN-2H	Module communication port CAN-2H.
	8	CAN-2L	Module communication port CAN-2L.
	9	CAN-2TR	The communication port is shorted with CAN-2H, and the factory product has been shorted.

2.8 ENERGY MANAGEMENT SYSTEM (EMS)

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

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

2.9 PCS

The PCS can realize grid-connected charging and discharging and off-grid operation, which is equipped with protection of AC overcurrent, AC overvoltage, AC short, anti-island, DC reverse connection, etc.

Table 12 Technical Parameter

Item	Category	Parameter
DC Side Parameters	Working Voltage	DC650V~DC950V
	DC Maximum Current	203A
AC Grid-connected Parameters	Output Line System	3P4W
	Rated Power	125kW
	Rated Voltage	AC 230V/400V
	Voltage Deviation	-15%~+15%
	Max Current	200A
	Rated Grid Frequency	50Hz/60Hz
	Power Factor	0.99
	Power Factor Range	1(ahead)~1(behind)
	THDi	<2% (rated power)
	Charge/Discharge Conversion Time	≤100ms
	Overload Capacity	Long-term 110%
AC Off-grid Parameters	Output Line System	3P4W
	Rated Power	125kW
	Rated Voltage	AC 230V/400V
	Max Current	200A
	Rated Frequency	50Hz/60Hz
	AC Voltage Harmonic	<3% (linear load)
	Unbalanced Load Capacity	Support 100% 3-phase unbalanced load
Working Conditions	Working Temperature	-30°C ~+55°C (derating use above 45°C)
	Storage Temperature	-45°C ~+70°C
	Relative Humidity	5%RH~95%RH, no condensation
	Working Altitude	4000m (derating use above 2000m)
	Weight	65kg

2.10 FIRE CONTROL SYSTEM

2.10.1 GENERAL PRINCIPLE

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

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

2.10.2 FIRE EXTINGUISHING METHOD

- The cabinet-level fire adopts aerosol fire extinguishing system and is equipped with detector of combustible gas, temperature, smoke and thermal wire. When there is a fire, the aerosol is sprayed to control the fire.
- The built-in PACK-level fire adopts aerosol fire extinguishing system and is equipped with thermal wire detector. When thermal runaway occurs, the built-in PACK-level aerosol unit activates the fire extinguishing.
- When the fire module is active, the information is transmitted to BMS/EMS through the dry contact signal.

2.11 LCS THERMAL MANAGEMENT SYSTEM

It will conduct the start and stop of auto, cool, heat, self-cycle or standby mode according to EMS command.

Table 13 Technical Parameter

Item	Parameter
Rated Cool Capacity	5kW
Rated Heat Capacity	2kW
EER	≥2.2
Max Power Consumption	2.7kW
Working Current	12A
Refrigerant Type	R134a (Tetrafluoroethane)
Coolant	50% glycol solution

2.12 TRANSPORTATION AND STORAGE PRECAUTIONS

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

2.13 TRANSPORTATION METHOD

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

2.14 TRANSPORTATION REQUIREMENT

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

NOTE

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

⚠ CAUTION

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

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

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

2.15 STORAGE REQUIREMENT

- In order to prevent condensation inside the energy storage cabinet or being soaked by rainwater at the bottom of the house during the rainy season, the energy storage cabinet should be stored in a higher place.
- The base of the cabinet must be raised, and the specific height should be reasonably determined according to the geology, meteorology and other conditions on the site. At the same time, when the ambient temperature is too low, it should also provide heating for the internal equipment of the energy storage cabinet.
- Store the energy storage cabinet on a dry, flat, sturdy ground with sufficient carrying capacity and without any vegetation cover. The storage ground must be flat without water, and the flatness should not be greater than 5mm.
- Before storage, ensure that the door of the energy storage cabinet and the cabinet door of each equipment inside are locked.
- Storage temperature: -30°C~+60°C. Recommended storage temperature: -30°C~+25°C.
- It is not recommended to store batteries for a long time because there will be capacity decay. In addition, even if the battery is stored at the recommended optimal storage temperature, the irreversible capacity decay will occur due to the influence of the time, and the longer the storage time, the greater the irreversible attenuation.
- Relative humidity of storage: 5%RH~95%RH, no condensation.
- The air inlet and outlet of the energy storage cabinet should be effectively protected, and effective measures are taken to prevent rain, sand and dust from invading the inside of the cabinet.
- Regular inspections. Do it at least once every half month, check whether the cabinet and internal

equipment are intact.

- Before installing the energy storage cabinet for long-term storage (storage time of more than half a year), the cabinet door should be opened for visual inspection, and the outside of the cabinet should have no condensation. Make sure that the cabinet and internal equipment are in good condition. At the same time, it is necessary to check after powering on and starting. If necessary, it must be tested by a professional before installation.
- The battery box needs to be stored in a clean and dry place, and should not be exposed to the sun and rain. The storage location does not allow the presence of harmful gases, flammable, explosive products and corrosive chemicals, to avoid mechanical impact, heavy pressure and strong magnetic field, and to avoid direct sunlight.
- Pay attention to the surrounding harsh environment, such as sudden cold, sudden heat, collision, etc., to avoid damage to the battery box.
- Conduct regular inspections to check whether the packaging is intact to avoid insect bites, and replace them immediately if they are damaged.
- The box must not be tilted or turned upside down.
- Calculated from the date of delivery, the energy storage cabinet with a storage period of more than 6 months under the above conditions should be charged and discharged once to make the system SOC reach 30%~40%, and the SOC should be consistent after charging.
- Installation

⚠ DANGER

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

2.16 PRE-INSTALLATION INSPECTION

2.16.1 DELIVERABLE INSPECTION

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

2.16.2 DEVICE INSPECTION

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

⚠ DANGER

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

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

2.17 INSTALLATION ENVIRONMENT REQUIREMENT

2.17.1 SITE SELECTION REQUIREMENT

- When selecting the installation site, the characteristics of the climatic environment and geological conditions (such as stress wave emission and groundwater level) of the installation site should be fully considered.
- The surroundings are dry and well ventilated.
- Ensure that there are no trees around the installation location to prevent high winds from blowing

over branches or leaves and blocking the doors or air intakes of the integrated energy storage system.

- It should be kept away from areas where toxic and harmful gases are concentrated; Keep away from flammable, explosive, corrosive materials.
- To avoid noise, the equipment should be installed away from residential areas.

2.17.2 FOUNDATION REQUIREMENT

DANGER

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

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

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

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

Unit: mm

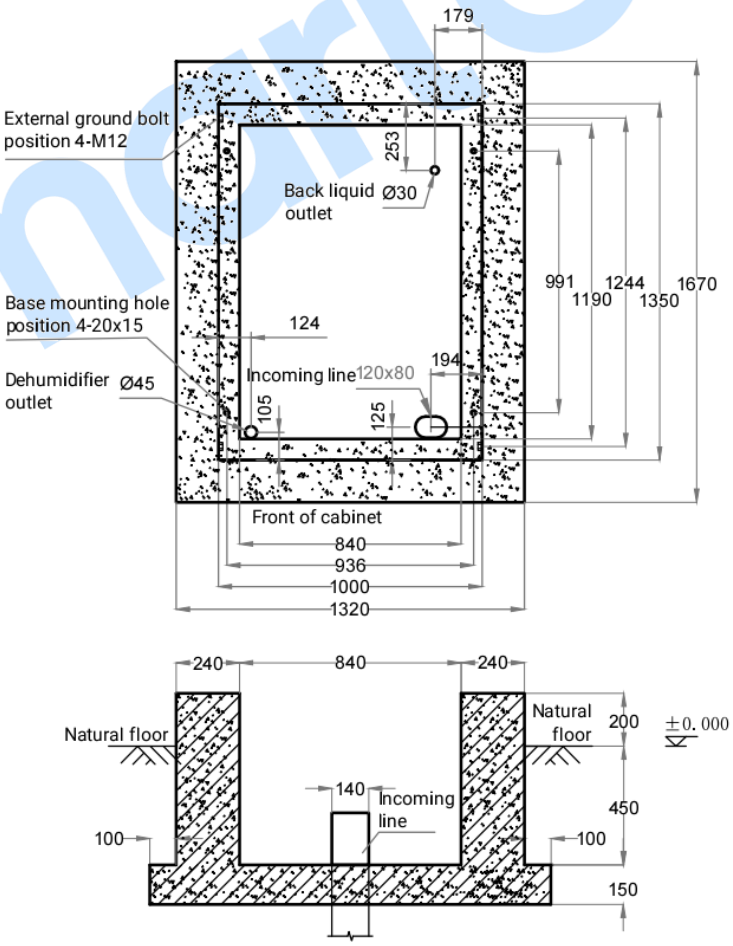


Fig.7 Reference Drawing of the Base Installation Size

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

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

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

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

2.17.3 INSTALLATION SPACE REQUIREMENT

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

Unit: mm

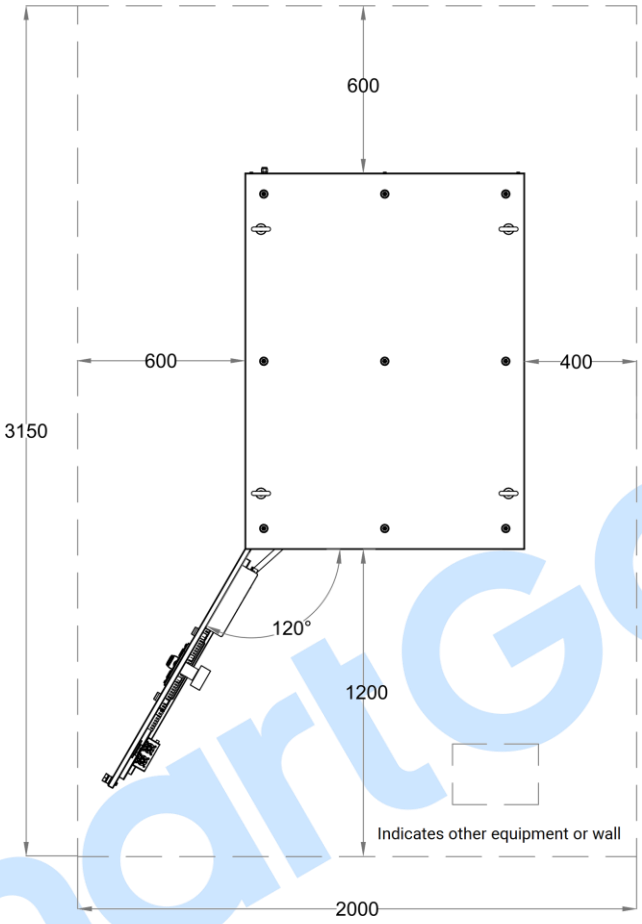


Fig.8 Reference Drawing of Installation Space Size

2.18 FORKLIFT TRANSPORTATION

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

The following requirements should be met if use forklift to transport:

- Forklifts should be equipped with sufficient load capacity.
- The length of the prongs should meet the requirements of the device.
- The transportation, movement and lowering of the energy storage cabinet should be slow and steady. It is advisable to make more attempts.
- Only place the energy storage cabinet in a stable place. The place should be well drained without any obstructions or bulges.

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

2.19 LIFTING AND TRANSPORTATION

2.19.1 PRECAUTIONS FOR LIFTING

⚠ DANGER

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

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

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

2.19.2 LIFITING OPERATION

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

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

2.19.3 FIXING

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

2.20 SAFETY PRECAUTION OF CONNECTION

⚠ DANGER

Danger! High voltage! Danger! Electric shock!
• It is strictly forbidden to touch the live part!

- Before installation, please make sure that both the AC and DC sides are de-energized.
- Do not place the device on flammable material surfaces.

⚠ DANGER

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

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

⚠ DANGER

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

⚠ DANGER

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

⚠ DANGER

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

NOTE

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

2.21 PREPARATION BEFORE WIRING

2.21.1 INSTALLATION TOOL PREPARATION

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

2.21.2 CABLE PREPARATION

The selected cable must meet the following conditions:

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

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

2.21.3 COPPER WIRE ACCESS

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

2.21.4 ALUMINUM WIRE ACCESS

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

2.21.5 CABLE ENTRY DESIGN

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

2.22 GROUND CONNECTION

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

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

- Grounding flat steel (recommended).
- Grounding cable. Use a copper grounding cable to reliably connect the grounding point with the cabinet grounding point. (with M12 bolts).

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

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

2.23 WIRING DIAGRAM BETWEEN BATTERY BOX

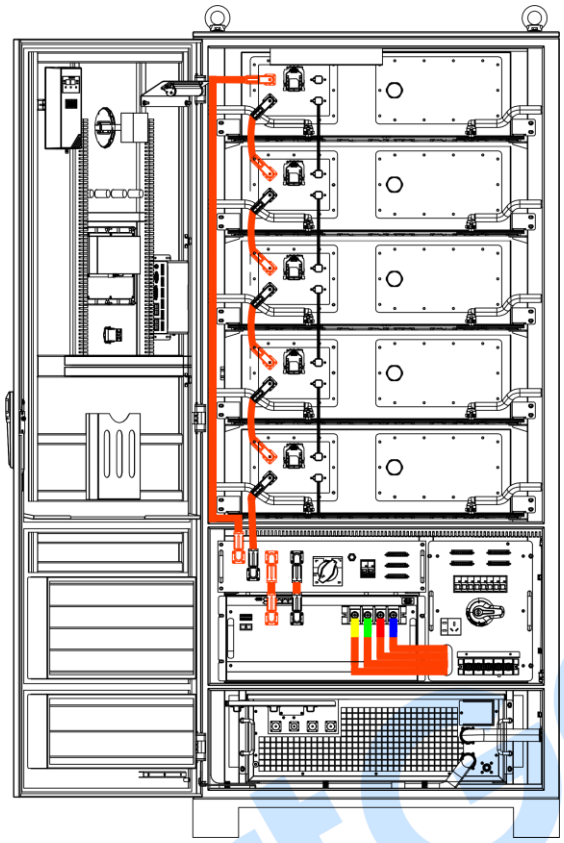


Fig.9 Power, Communication Line Connection Diagram Between Battery Box

2.24 CABLE CONNECTION

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

2.25 EXTERNAL WIRING TERMINAL DIAGRAM

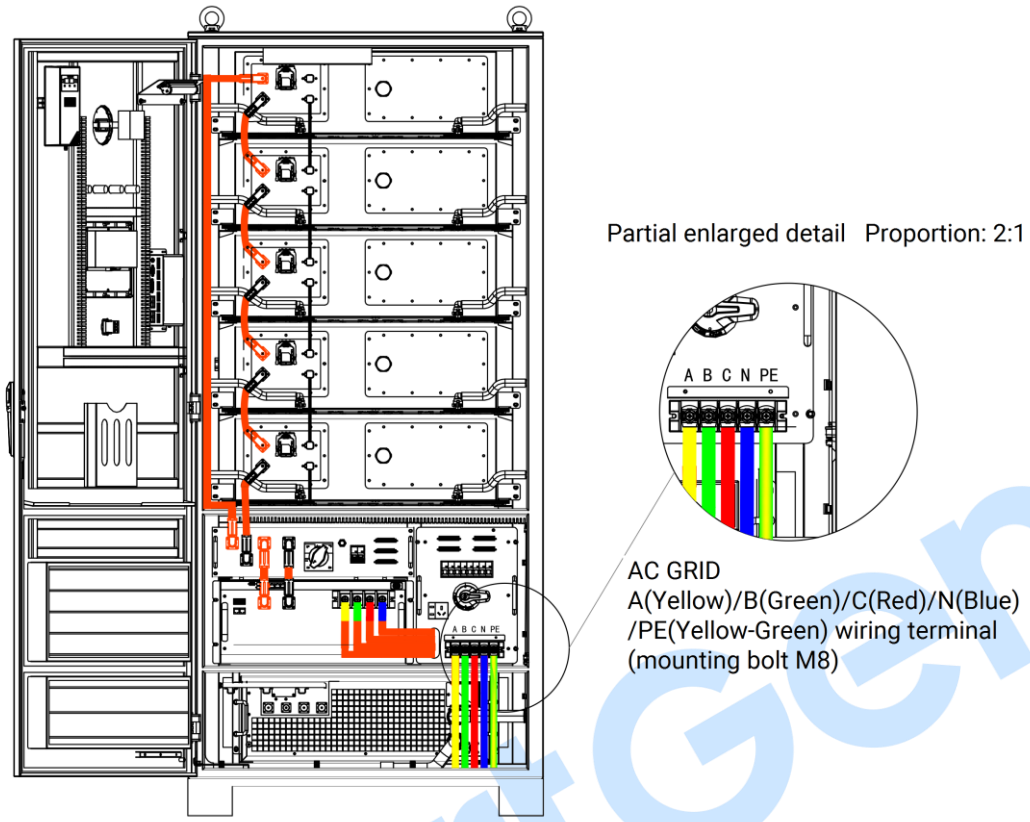


Fig.10 Wiring Terminal Diagram at AC Grid

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

Illustration (see fig.10):

- Use 70mm² cable for A/B/C/N line, and 35mm² cable for PE line.
- It is recommended to use 70-8 OT terminal.
- The recommended fixing torque of OT terminal is 6N•m.

2.26 OPERATION AFTER WIRING

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

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

⚠ DANGER
• Failure to seal properly can result in moisture entering the device. • Failure to seal properly can lead to rodent entry.

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

- Lock cabinet and box doors.

2.27 PRECAUTION

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

Incorrect use or operation may endanger the following:

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

NOTE

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

⚠ DANGER

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

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

3 COMMISSIONING

3.1 POWER-ON AND OPERATION

3.1.1 ILLUSTRATION

DANGER

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

DANGER

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

3.1.2 CHECK BEFORE POWERING ON

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

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

3.1.3 POWER-ON SWITCH OPERATION

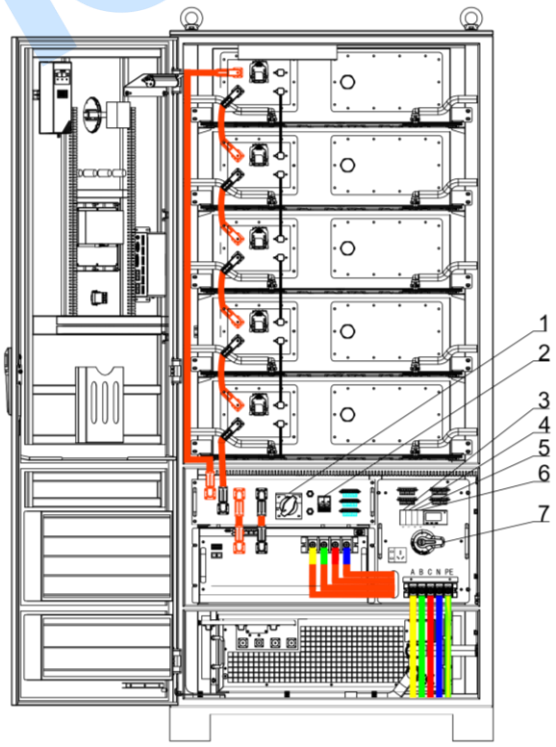


Fig.11 Operation Switch Position Diagram

Table 14 Technical Parameter

No.	Description
1	DC main circuit breaker
2	Auxiliary power DC24V switch of high-voltage box
3	Power switch of LCS thermal management unit
4	AC side switch of the power distribution system
5	Energy storage cabinet light switch
6	Power switch of fire protection system
7	AC main circuit breaker

Power-on switch operation procedures:

- Close DC main circuit breaker;
- Close the auxiliary power DC24V switch of high-voltage box;
- Close AC main circuit breaker;
- Close the power switch of liquid-cooled thermal management unit;
- Close the AC side switch of power distribution system power;
- Close the light switch of the energy storage cabinet;
- Close the power switch of fire control system;
- Control the EMS software to control the system to start.

Power-on ends.

3.1.4 START AND COMMISSIONING

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

Confirm whether BMS and PCS are running normally, energy meter is working normally.

Select corresponding control strategy by entering “System Strategy” of “Setting” page.

Select corresponding time template and price template by entering “Peak Load Shifting” page.

Return to homepage and press “Auto” button to enter auto running status.

3.2 POWER OFF AND SHUTDOWN

3.2.1 SCHEDULED SHUTDOWN

Power-off switch operation procedures:

- Control the EMS software to control the shutdown, (in special cases, press the emergency stop button outside the energy storage cabinet to stop).
- Disconnect the light switch of the energy storage cabinet;
- Disconnect the power switch of fire control system;
- Disconnect the AC side switch of power distribution system power;
- Disconnect the power switch of liquid-cooled thermal management unit;
- Disconnect AC main circuit breaker;
- Disconnect the auxiliary power DC24V switch of high-voltage box;
- Disconnect DC main circuit breaker.
- Check the power after the system shutdown.

3.2.2 UNSCHEDULED (EMERGENCY) SHUTDOWN

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

4 TROUBLESHOOTING

Table 15 Common Troubleshooting

No.	Fault Phenomenon	Cause of the Fault	Troubleshooting
1	Abnormal operation of energy storage system	• The distribution system is not powered on; • Partial circuit breaker is open; • Other reasons.	• Check whether the power indicator of the energy storage cabinet is illuminated; • Check whether the relevant circuit breaker is closed according to the operation procedures of the power-on switch; • If it is still abnormal, please contact the manufacturer for after-sales service; • It can re-run after troubleshooting.
2	System and single overvoltage shutdown protection	• The system and single voltage are higher than the protection value; • The battery sampling harness is broken or the sampling plug-in connection is unreliable; • The BMU is working abnormally; • Other reasons.	• Re-plug the BMU sampling and power supply plug; • If it is still abnormal, please contact the manufacturer for after-sales service.
3	System and single undervoltage shutdown protection	• The system and single voltage are lower than the protection value; • The battery sampling harness is broken or the sampling plug-in connection is unreliable; • The BMU is working abnormally; • Other reasons.	• Contact the manufacturer for processing.
4	Charge and discharge overtemperature shutdown protection	• The system temperature is higher than the protection value; • The battery sampling harness is broken or the sampling plug-in connection is unreliable; • The BMU is working abnormally; • Other reasons.	• Re-plug the BMU sampling and power supply plug; • Check whether the air conditioner is running normally, if not, please contact the manufacturer for after-sales service; • It can re-run after troubleshooting.

No.	Fault Phenomenon	Cause of the Fault	Troubleshooting
5	Charge and discharge undertemperature shutdown protection	• The system temperature is lower than the protection value; • The battery sampling harness is broken or the sampling plug-in connection is unreliable; • The BMU is working abnormally; • Other reasons.	• Re-plug the BMU sampling and power supply plug; • Check whether the air conditioner is running normally, if not, please contact the manufacturer for after-sales service; • It can re-run after troubleshooting.
6	Charge and discharge overcurrent shutdown protection	• The system charging and discharging current are higher than the protection value.	• Check whether the PCS end is normal, if not, please contact the manufacturer for after-sales service; • It can re-run after troubleshooting.
7	System insulation failure	• Insulation detection failure; • System leakage.	• Stop and contact the manufacturer for after-sales service. • It can re-run after troubleshooting.
8	BCU and BMU communication failure	• The BMS system is not powered on; • The corresponding CAN communication line is loose.	• Check whether the BMS is powered on normally; • Check whether the corresponding BCU and BMU communication plugin is loose; the wiring harness is damaged; • It can re-run after troubleshooting.
9	BMS and PCS communication failure	• The BMS system is not powered on; • The PCS system is not powered on; • The corresponding comm. line is loose.	• Check whether the entire energy storage system is powered on normally; • Check whether the PCS communication plugin is loose; the wiring harness is damaged; • It can re-run after troubleshooting.
10	LCS heating unit and EMS comm. failure	• The energy storage system is not powered on; • The corresponding comm. line is loose.	• It can re-run after troubleshooting.