All-in-one Liquid-cooled ESS Container ECO-E10FT1044LP-2 User Manual

Sunpal Power Co., Ltd.

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1. Overview

1.1. Main Content

This manual mainly introduces the product,transportation,installation,operation,maintenance and troubleshooting of the 1MWh integrated liquid-cooled energy storage container. Before using this product, please read this manual carefully and operate the energy storage system in accordance with the methods described in this manual;otherwise,equipment damage or personal injury may occur.

1.2. Target Readers

This manual is applicable to personnel engaged in the transportation,installation and other operations related to this product.The participating personnel must meet the following requirements:

- Proficiency in professional knowledge such as electric power,electronics and mechanical engineering,and strong ability to understand electrical schematic diagrams and structural drawings
- Understanding of products,basic knowledge,working principles and control logic of the energy storage industry
- Possession of professionally recognized electrician construction certificates and qualifications in the region where the product is used,and familiarity with the relevant laws and regulations of the region
- Having the ability to handle emergency incidents and deal with relevant incidents in accordance with the laws and regulations of the region where the product is used
- Proficiency in the terms and contents of this manual,with professional vocational skills and a high sense of responsibility
- This manual contains important information;please read it carefully before operating and maintaining the system

- Keep this manual together with other materials in the product components to ensure that operators and maintenance personnel can access them in a timely manner

1.3. Definition of Warning Symbols in the Manual

To ensure the personal and property safety of users when using this product and improve the efficiency of the product,relevant information is detailed in this manual,and relevant symbols are added for further explanation.

The"Danger","Warning","Caution"and"Notice"items in the manual do not represent all safety precautions that should be observed.You must also comply with relevant international,national or regional standards and industry practices.The Company shall not be liable for any damages caused by violation of safe operation requirements or violation of safety standards for the design,production and use of equipment.

The following symbols may appear in this document,with the meanings as follows:

Symbol	Description
	Used to warn of immediate dangerous situations that will result in death or serious personal injury if avoided.
	Used to warn of potential dangerous situations that may result in death or serious personal injury if avoided.
	Used to warn of potential dangerous situations that may result in moderate or minor personal injury if avoided.
	Used to convey equipment or environmental safety warning information that may result in equipment damage,data loss,reduced equipment performance or other unpredictable consequences if avoided."Notice"does not involve personal injury.

	Indicates additional information in the manual,emphasizing and supplementing the content,and may also provide tips or tricks for optimal product use to help you solve a problem or save your time
	This symbol indicates that the product contains high-voltage hazards inside,and touching it may cause electric shock hazards.
	This symbol indicates that there is a high-temperature hazard at this position of the product;please avoid contact to prevent personal injury.
	This symbol indicates that this position of the product is for protective earthing(PE),and the earthing wire needs to be connected firmly and reliably to ensure the safety of operators.
	This symbol indicates that this position of the product is prohibited from being opened;arbitrary opening involves major hazards.
	This symbol indicates that this position of the product is prohibited from being touched;arbitrary touching may cause equipment failure and involve significant hazards.
	This symbol indicates a risk of hearing damage;hearing protection must be worn when approaching operating equipment.
	This symbol indicates that the equipment must be discharged for ten minutes before operation.

1.4. Definition of Terms

Item	Definition
Cell	Battery cell
PACK	Liquid-cooled battery pack
High-Voltage Box	The high-voltage box is a high-voltage power circuit management unit specially designed for the energy storage system,and an intermediate unit connecting the battery cluster and the power conversion system(PCS)。
RACK	Battery cluster,a battery system composed of multiple battery PACKs and one high-voltage box
POC Cabinet	One type of central control and distribution cabinet， Composed of an auxiliary power supply part,and the AC circuit control section.Its function is to provide an AC power supply for the interior of the energy storage container;collect internal data and communicate with the outside;and connect the container to the external power grid.
STS Cabinet	One type of central control and distribution cabinet， Composed of an auxiliary power supply part,the STS module and the AC circuit control section，Its function is to provide an AC power supply for the interior of the energy storage container;collect internal data and communicate with the outside;and connect the container to the power grid,loads,photovoltaic systems,diesel generators,etc.
BMS	Battery Management System
BMU	Level 1 BMS:Slave control unit of the Battery Management System
BCU	Level 2 BMS:Main control unit of the Battery Management System
PCS	Power Conversion System
STS	Static Transfer Switch
UPS	Uninterruptible Power Supply

ESS	Energy Storage System
EMU	Local Energy Management System
EMS	Energy Management System
SOC	State of Charge of the battery

1.5. Difference Statement

Product Model Explanation:

Example Model:ECO-E10FT1044LP-2-S

- ECO—Product Code: Sunpal Power Product Series
- E—Product Type:E indicates All-in-one Energy Storage y System
- 10FT—Container Size:10ft Container
- 1044—Nominal Energy:1044 kWh
- L—Cooling Method:Liquid Cooling
- P—Cell Type:314Ah Lithium Iron Phosphate(LFP)Cell
- 2—Charging and discharging time:2-hour system
- S—Off-grid and grid-connected switching:S：Configure Static Transfer Switch；N：Only grid connection

Product Mode	Difference Description
ECO-E10FT1044LP-2-S	1044kWh integrated liquid-cooled energy storage container,Configure Static Transfer Switch
ECO-E10FT1044LP-2-N	1044kWh integrated liquid-cooled energy storage container,Only grid connection

2. Safety Instructions

2.1. Safety Notices

Please strictly comply with the various safety specifications in this product manual.To avoid personal injury and property damage that may occur during the use of this product,and to improve the service life and efficiency of the product,please read all safety specifications carefully.

The Company shall not be liable for any of the following situations or the consequences caused thereby:

- Equipment damage caused by force majeure such as earthquakes,floods,volcanic eruptions,mudslides,lightning strikes,fires,wars,armed conflicts,typhoons,hurricanes,tornadoes and extreme weather
- Operation outside the operating conditions specified in this manual
- Installation and use environment that does not comply with relevant international,national or regional standards
- Equipment installation and use by unqualified personnel
- Failure to operate in accordance with the operating instructions and safety warnings in the product and documents
- Unauthorized disassembly,modification of the product or modification of software code without authorization
- Damage caused by transportation by you or your entrusted third party
- Damage caused by storage conditions that do not meet the requirements of product documents
- Self-provided materials and tools that do not meet the requirements of local laws,regulations and relevant standards
- Damage caused by negligence,intent,gross negligence,improper operation by you or a third party or reasons not attributable to the Company

2.2. Operator Requirements

Operators must meet the following requirements:

- Only electricians with professional qualifications(including professionals and trained personnel)can operate and maintain this product,and complete professional electrician equipment must be provided
- Able to evaluate assigned tasks and identify potential dangerous events
- Able to rescue injured personnel in a timely manner
- Understanding of relevant maintenance standards for the product
- Compliance with local laws,regulations,ordinances and standards
- Personnel engaged in special scenarios such as electrical operations,working at heights and special equipment operations must have special operation qualifications required by the local country/region

Warning content is as follows:

	Live operation is strictly prohibited during installation.Prohibit live installation and removal of cables;electric arcs,electric sparks or fire and explosion may occur at the moment when cable cores contact conductors,which may lead to fire or personal injury.
	Improper and incorrect operation when the equipment is live may cause fire,electric shock or explosion,leading to personal injury or property damage.

	Wearing watches,bracelets,bangles,rings,necklaces and other easily conductive objects is strictly prohibited during operation to avoid electric shock and burns.
	Special insulated tools must be used during operation to avoid electric shock injury or short-circuit faults;the insulation and voltage withstand level must meet the requirements of local laws,regulations,standards and specifications.
	Special protective equipment must be used during operation,such as wearing protective clothing,insulated shoes,safety goggles,safety helmets,insulated gloves,etc.

2.2.1. Personal Protective Equipment(PPE)

According to the"Maximum Power Method"in NFPA 70E,the estimated DC arc flash incident energy at the maximum power point can be calculated,and then the hazard boundary can be determined.

PPE is determined by the incident energy,which is the temperature generated by the arc flash(unit:cal/cm^2)(usually at a distance of 18 inches),and this energy is less than 1 cal/cm^2.Therefore,the PPE requirement for battery rack operation is Category 1.

2.2.2. First Aid Measures

In the event of an electric shock accident,first aid and emergency measures must be taken quickly and in a standardized manner:

- Quickly disconnect the relevant DC/AC circuit breakers(such as battery cluster switches,PCS input/output switches,main control circuit breakers,etc.)
- If power cannot be cut off quickly,use insulated tools(such as dry wooden sticks,rubber gloves,insulated pliers)to separate the electric shock victim from the power supply
- Cover the electric burn wound with clean gauze or sterile dressings and send the victim to a hospital for treatment as soon as possible

2.3. Electrical Safety

Warning content is as follows:

	Before performing electrical connection,ensure that the equipment is undamaged;otherwise,electric shock or fire may occur.
	Improper and incorrect operation when the equipment is live may cause fire,electric shock or explosion,leading to personal injury or property damage.
	During operation,prevent foreign objects from entering the inside of the equipment;otherwise,it may cause equipment short-circuit faults or damage,load power supply derating or power failure,and personal injury.
	For equipment that needs to be earthed,the protective earthing wire must be installed first during installation;the protective earthing wire must be removed last when dismantling the equipment.
	No cables are allowed to pass through the air inlets and outlets of the equipment.

3. General Requirements

The following requirements must be met:

- Installation,operation and maintenance must be carried out in accordance with the step sequence in the manual;do not arbitrarily modify,add or alter the equipment,and do not arbitrarily change the installation sequence,etc.
- Permission from the power department of the country or region where it is located must be obtained before grid-connected operation
- Comply with power station safety specifications,such as implementing the operation ticket and work ticket system
- Install temporary fences or warning ropes in the operation area and hang"No Entry"signboards;non-staff are strictly prohibited from entering
- The equipment itself and its front and rear stage switches must be disconnected before installing and removing power cables
- If liquid is found to enter the inside of the equipment,turn off the power immediately and stop using it
- Before operating the equipment,carefully check that the tools used meet the requirements and register them;collect the tools according to the quantity after operation to prevent them from being left inside the equipment
- Before installing power cables,confirm that the cable label markings are correct and the cable terminals have been properly insulated
- After installation,ensure that all protective cases,insulating sleeves and other devices of

electrical components are in place to avoid electric shock risks

- If the equipment has multiple input channels,all input channels of the equipment should be disconnected,and the equipment can only be operated after it is completely powered off
- When maintaining the power consumption or power distribution equipment at the rear stage of the power supply equipment,the corresponding output switch of the power supply equipment must be disconnected
- During equipment maintenance,hang"Do Not Close"signboards on the upper and lower switches or circuit breakers and post warning signs to prevent accidental connection.The fault must be completely handled before powering on again
- When conducting fault diagnosis and troubleshooting,if power failure is required,the following safety measures must be completed:power failure→voltage testing→installation of earthing wires→hanging of signboards and installation of barriers
- Regularly check the fastening screws of the equipment connection terminals to confirm they are tightened and not loose
- If the cable is damaged,it must be replaced by professional personnel to avoid risks
- Deliberate alteration,damage or obscuring of the marks and nameplates on the equipment is strictly prohibited;replace marks that become unclear due to long-term use in a timely manner
- Do not clean the electrical components inside and outside the equipment with water,alcohol,oil or other solvents

3.1. Electrostatic Protection Requirements

Electrostatic accumulation may cause electric shock,fire,explosion,failure and damage of electronic devices,etc.The energy storage system contains circuit boards or other electrostatic sensitive components.To prevent or reduce the hazards of static electricity,electrostatic protection must be well done to further inhibit the generation of static electricity,accelerate the leakage of static electricity and perform electrostatic neutralization.Static electricity generated by the human body can damage electrostatic sensitive components on the circuit board.Its

prevention methods include but are not limited to:

- Before touching the equipment,holding circuit boards,modules with exposed circuit boards or special integrated circuit chips,etc.,comply with electrostatic protection specifications,wear anti-static overalls,and wear anti-static gloves or wrist straps,with the other end of the anti-static wrist strap well earthed
- During the replacement of components,keep all uninstalled equipment devices in packaging bags with anti-static shielding function,and place temporarily removed equipment devices on anti-static foam pads;disassembled circuit boards or modules must be packaged with anti-static packaging materials before storage or transportation
- Do not touch components,welding points,pins or exposed circuits with hands

3.2. Environmental Requirements

The following requirements must be met:

- The temperature and humidity environment for equipment storage should be appropriate;store in a clean,dry and well-ventilated area,and prevent dust and condensation
- It is strictly prohibited to install and operate the equipment beyond the range specified in the technical indicators,otherwise the equipment performance and safety will be affected
- It is strictly prohibited to install,use and operate outdoor equipment and cables(including but not limited to handling equipment,operating equipment and cables,plugging and unplugging signal interfaces connected to the outdoors,working at heights,outdoor installation,opening doors,etc.)in severe weather such as thunderstorms,rain,snow and winds above level 6
- It is strictly prohibited to install the equipment in an environment with dust,smoke,volatile gas,corrosive gas,infrared and other radiation,organic solvents or excessively high salt content
- It is strictly prohibited to install the equipment in an environment with metal conductive dust and magnetic conductive dust

- It is strictly prohibited to install the equipment in areas prone to breeding fungi,molds and other microorganisms
- It is strictly prohibited to install the equipment in areas with strong vibration,strong noise sources and strong electromagnetic field interference
- The site selection shall comply with the requirements of local laws,regulations and relevant standards
- The installation environment has a solid ground without soft soil,weak soil or other poor geology prone to subsidence;low-lying areas prone to water accumulation and snow accumulation are strictly prohibited,and the site horizontal plane shall be higher than the historical highest water level in the area
- It is strictly prohibited to install the equipment in positions that can be submerged by water
- If the equipment is installed in a place with lush vegetation,in addition to regular weeding,the ground under the equipment needs to be hardened,such as laying cement,gravel,etc.
- During installation,operation and maintenance,clean up water accumulation,ice and snow or other debris on the top first,then open the door to prevent debris from falling into the inside of the equipment
- When installing the equipment,ensure that the installation surface is firm and meets the load-bearing requirements of the equipment
- After installing the equipment,remove empty packaging materials in the equipment area,such as cartons,foam,plastic,cable ties,etc.

Warning content is as follows:

	It is strictly prohibited to place the equipment in an environment with flammable and explosive gases or smoke,and any operation in such an environment is prohibited.

	Storing flammable and explosive items in the equipment area is strictly prohibited.
	It is strictly prohibited to place the equipment close to heat sources or fire sources,such as fireworks,candles,heaters or other heating equipment;heating of the equipment may cause equipment damage or fire.
	The equipment should be installed in an area far away from liquids;it is strictly prohibited to install it under positions prone to condensed water such as water pipes and air outlets;it is strictly prohibited to install it under water leakage-prone positions such as air conditioning outlets,ventilation outlets and machine room outlet windows to prevent liquid from entering the inside of the equipment and causing equipment failure or short circuit.
	Do not block the ventilation outlets and heat dissipation system or cover with other items when the equipment is running to prevent high temperature from damaging the equipment or causing fire.

3.3. Battery Safety

Warning content is as follows:

	Short-circuiting the positive and negative poles of the battery is strictly prohibited,otherwise it will cause a battery short circuit.A battery short circuit will generate a large current instantaneously and release a lot of energy,causing battery leakage,smoke,release of flammable gas,thermal runaway,fire or explosion.To avoid battery short circuit,the battery is not allowed to be maintained live.
	Do not expose the battery to high-temperature environments or around heating equipment,such as high-temperature sunlight,fire sources,transformers,heaters,etc.Overheating of the battery may cause leakage,smoke,release of flammable gas,thermal runaway,fire or explosion.
	It is strictly prohibited for the battery to be subjected to mechanical vibration,drop,collision,puncture by hard objects and pressure impact,otherwise it may cause battery damage or fire.
	It is strictly prohibited to disassemble,modify or damage the battery(such as inserting foreign objects,external extrusion,immersion in water or other liquids)to avoid battery leakage,smoke,release of flammable gas,thermal runaway,fire or explosion.
	It is strictly prohibited for battery terminals to contact other metal objects,which may cause heating or electrolyte leakage.

	Using or replacing an incorrect battery model may cause fire and explosion hazards.Please use the specified battery model recommended by the manufacturer.
	Battery electrolyte is toxic and volatile.In case of electrolyte leakage or abnormal odor,avoid contact with the leaked liquid or gas.Non-professionals are not allowed to approach;please contact professional personnel immediately for treatment.Professional personnel should wear safety goggles,rubber gloves,gas masks,protective clothing,etc.,power off the equipment in a timely manner,take out the leaking battery,and contact technical engineers for treatment at the same time.
	The battery is a closed system and will not release any gas under normal operating conditions.In case of extreme abuse,such as fire,needle pricking,extrusion,lightning strike,overcharging or other harsh conditions that may lead to battery thermal runaway,the battery may be damaged or abnormal chemical reactions may occur inside the battery,resulting in electrolyte leakage or generation of gases such as CO and H2.The site must ensure that the flammable gas emission measures are normal to avoid combustion or equipment corrosion.
	Gases generated by battery combustion will irritate the eyes,skin and throat;please pay attention to protection.
	The battery should be installed in an area far away from liquids;it is strictly prohibited to install it under water leakage-prone positions such as air conditioning outlets,ventilation outlets,machine room outlet windows and water pipes to prevent liquid from entering the inside of the equipment and

	causing equipment failure or short circuit.
	Fire protection facilities such as fire sand and carbon dioxide fire extinguishers must be equipped in accordance with the requirements of construction standards and specifications during battery installation and commissioning.Before putting into operation,it must be ensured that fire protection facilities meeting the requirements of local laws,regulations and specifications are available.
	Before removing the battery packaging,ensure the integrity and non-damage of the outer packing box during storage and transshipment,place it correctly according to the marks on the packing box,strictly prohibit upside-down,side,vertical and inclined placement,and comply with the stacking requirements on the outer packing when stacking to avoid battery damage and scrapping caused by any impact or drop,etc.
	After removing the battery packaging,place it in the required direction,strictly prohibit upside-down,side,vertical,inclined and stacked placement to avoid battery damage and scrapping caused by any impact or drop,etc.
	Tighten the fastening screws of copper bars or cables according to the torque specified in the document,regularly check whether they are tightened,whether there is rust,corrosion or other foreign objects,and clean them up;otherwise,loose screw connection will lead to excessive connection voltage drop,and even a lot of heating will burn the battery when the current is large.
	The battery should be charged in a timely manner after discharge,otherwise the battery may be damaged due to over-discharge.

3.3.1. General Requirements

The following requirements must be met:

- Before the installation,operation and maintenance of the battery,read the instruction manual provided by the battery manufacturer and comply with the requirements of the battery manufacturer.The safety precautions in this manual are only for key reminders;for more safety precautions,please refer to the instruction manual provided by the battery manufacturer
- Use the battery within the specified temperature range.Charging is prohibited when the ambient temperature is lower than the lower limit of the operating temperature to avoid internal short circuit of the battery caused by low-temperature charging
- Before removing the battery packaging,check whether the packaging is intact;batteries with damaged packaging cannot be used,and if damaged,please immediately notify the carrier and manufacturer
- After removing the battery packaging,installation must be completed within 24 hours;if installation cannot be completed in a timely manner,the battery must be put back into the packaging and placed in an indoor,dry environment without corrosive gas;the energy storage system must be powered on within 24 hours after installation;the process from battery unpacking to energy storage system power-on must be completed within 72 hours;during later routine maintenance,the power-off time cannot exceed 24 hours
- Damaged batteries(drop,collision,swelling or shell dent,etc.)may cause leakage or release of flammable gas;do not use damaged batteries.In case of battery damage such as leakage and structural deformation,please immediately contact the installer or professional operation and maintenance personnel for removal and replacement.Do not store damaged batteries near other equipment or flammables;non-professionals are not allowed to approach damaged batteries
- Before battery operation,confirm that there is no irritating,burning or other odor around the battery
- Placing installation tools,metal parts and debris on the battery is strictly prohibited during battery installation.After installation,clean up the items on and around the battery in a

timely manner

- Do not install battery packs in rainy,snowy,foggy and other weather to avoid erosion of battery packs by water vapor and rainwater
- If the battery is accidentally wetted by water,stop installation immediately,transport it to a safe isolation point and arrange for scrapping treatment in a timely manner
- Before installing the battery pack,check that the shell of the battery pack is free of deformation or damage
- Determine whether the positive and negative terminals of the battery are accidentally earthed.If accidentally earthed,disconnect the battery terminals from the ground
- Do not perform welding,grinding and similar work around the battery to avoid fire and other hazards caused by electric sparks and electric arcs
- If the battery is not used for a long time,it needs to be stored and recharged in accordance with battery requirements
- It is prohibited to use equipment that does not meet the requirements of local laws,regulations and specifications for charging and discharging
- The battery circuit should remain disconnected during installation and maintenance
- Damaged batteries should be monitored during storage to confirm no signs of smoke,flame,electrolyte leakage or heating,etc.
- The surface temperature of the battery may be too high in case of battery failure;avoid contact to prevent scalding
- Do not stand,lean on or sit on the equipment

Warning content is as follows:

	To ensure the safety of battery use and the accuracy of battery management functions, please use the battery configured by the Company. The Company shall not be liable for any battery-related faults caused by the use of non-Company-configured batteries

3.3.2. Short-Circuit Protection

The following requirements must be met:

- When installing and maintaining the battery,wrap the exposed cable terminals on the battery with insulating tape
- Prevent foreign objects(such as conductive objects,screws,liquids,etc.)from entering the battery and causing short circuit

3.3.3. Leakage Handling

Electrolyte is corrosive,and contact may cause skin irritation and chemical burns.If contact with battery electrolyte occurs,take the following measures:

- Inhalation:Evacuate the contaminated area,inhale fresh air immediately,and seek medical help immediately
- Eye contact:Rinse the eyes with plenty of clean water for at least 15 minutes immediately,do not rub,and seek medical help immediately
- Skin contact:Wash the contact area with plenty of water and soap immediately,and seek medical help immediately
- Ingestion:Seek medical help immediately

4. Product Introduction

4.1. System Overview

- ECO-E10FT1044LP-2-S

This product(1MWh integrated liquid-cooled energy storage container ECO-E10FT1044LP-2-S)is a 1044kWh(nominal energy)liquid-cooled energy storage system,which consists of main components such as a container body,a battery system,a Power Conversion System，a central control and distribution cabinet（STS Cabinet）,a liquid-cooled system,a battery management system and a fire protection system.

This product includes one set of 10-foot container energy storage system with 4 battery clusters.Each battery cluster is composed of 5 Lithium Iron Phosphate(LFP)battery PACKs,managed by 1 BCU(Master Battery Management Unit).Each battery PACK is composed of 52 3.2V 314Ah cells connected in series,managed by 1 BMU(Slave Battery Management Unit).Every battery clusters are connected in parallel to 1 High Voltage Box.

Each battery cluster is connected to a 125kW PCS module through a 1 high-voltage box.Four PCS modules are independently connected to the AC bus in the STS cabinet.The AC bus of the STS cabinet simultaneously connects to the STS module,the load,photovoltaic power,diesel generator,and bypass interface circuit breaker.During normal operation,the STS cabinet is directly connected to the grid through the STS module and the AC main circuit breaker.The various components in the container are uniformly managed by the EMU(Local Energy Management System).The management and monitoring system is equipped with UPS,which can maintain the system monitoring operation for a certain period of time even when the grid power is interrupted or the system is disconnected and reconnected.

- ECO-E10FT1044LP-2-N

This product(1MWh integrated liquid-cooled energy storage container ECO-E10FT1044LP-2-N)is a 1044kWh(nominal energy)liquid-cooled energy storage system,which consists of main components such as a container body,a battery system,a Power Conversion System，a central control and distribution cabinet（POC Cabinet）,a liquid-cooled system,a battery management system and a fire protection system.

This product includes one set of 10-foot container energy storage system with 4 battery clusters.Each battery cluster is composed of 5 Lithium Iron Phosphate(LFP)battery

PACKs,managed by 1 BCU(Master Battery Management Unit).Each battery PACK is composed of 52 3.2V 314Ah cells connected in series,managed by 1 BMU(Slave Battery Management Unit).Every battery clusters are connected in parallel to 1 High Voltage Box.

Each battery cluster is connected to a 125kW PCS module through a 1 high-voltage box.Four PCS modules are independently connected to the AC bus in the STS cabinet.The AC bus of the STS cabinet simultaneously connects to the STS module,the load,photovoltaic power,diesel generator,and bypass interface circuit breaker.During normal operation,the STS cabinet is directly connected to the grid through the STS module and the AC main circuit breaker.The various components in the container are uniformly managed by the EMU(Local Energy Management System).The management and monitoring system is equipped with UPS,which can maintain the system monitoring operation for a certain period of time even when the grid power is interrupted or the system is disconnected and reconnected.

Figure 4-1 Appearance

4.1.1. Technical Parameters

4.1.2. Container Design Scheme

This 1MWh integrated liquid-cooled energy storage container product adopts an integrated design,integrating key equipment such as the energy storage battery system,battery management system,Power Conversion System， fire protection system and liquid-cooled system into a standard 10-foot high cube container for easy stacking.

The parameters of this liquid-cooled energy storage container product are as follows:

- ECO-E10FT1044LP-2-S

Item	Specification	Remarks
Grid Input/Output Port		
Max.AC Power	1000kW	
Max.AC Current	1444A	
Nominal AC Voltage	AC230/400Vac/3P+N+PE	
Nominal AC Frequency	50Hz/60Hz	
Integrated Battery System Parameters		
Battery Type	LFP 314Ah	
System Configuration Mode	4*(1P52S*5)	
Nominal Energy	1044.992kWh	100%DOD,0.5P,25±2°C
Rated Voltage	DC832V	
Voltage Range	DC728～936V	Cell voltage 2.8V～3.6V
Rated Charging Power	500kW	

Rated Discharging Power	500kW	
Energy Conversion Efficiency	≥88%	Excluding the auxiliary power consumption of the energy storage container itself
Output Port&PV Input Port&Genset Input Port		
Max.AC Power	500kW	
Max.AC Current	722A	
Nominal AC Voltage	400Vac/3P+N+PE	
Nominal AC Frequency	50Hz/60Hz	
General Parameters		
Operating Temperature	-25～55°C	
Relative Humidity	0～95%RH,No Condensation	
Operating Altitude	2000m	Below 4000m
Cooling Method	Active Liquid Cooling	50%ethylene glycol solution
Fire Protection Method	PACK&Cabin-Level Aerosol+Water Sprinkler	
IP Rating	IP55	
Corrosion Resistance Grade	C4-H	
Color	RAL 9003	

Dimensions	2991*2438*2591mm	W*D*H
Weight	Approx.14 t	
Communication Interface	Ethernet/RS485	

- ECO-E10FT1044LP-2-N

Item	Specification	Remarks
Grid Input/Output Port		
Max.AC Power	500kW	
Max.AC Current	722A	
Nominal AC Voltage	AC230/400Vac/3P+N+PE	
Nominal AC Frequency	50Hz/60Hz	
Integrated Battery System Parameters		
Battery Type	LFP 314Ah	
System Configuration Mode	4*(1P52S*5)	
Nominal Energy	1044.992kWh	100%DOD,0.5P,25±2°C
Rated Voltage	DC832V	
Voltage Range	DC728～936V	Cell voltage 2.8V～3.6V
Rated Charging Power	500kW	
Rated Discharging Power	500kW	

Energy Conversion Efficiency	≥88%	Excluding the auxiliary power consumption of the energy storage container itself
General Parameters		
Operating Temperature	-25～55°C	
Relative Humidity	0～95%RH,No Condensation	
Operating Altitude	2000m	Below 4000m
Cooling Method	Active Liquid Cooling	50%ethylene glycol solution
Fire Protection Method	PACK&Cabin-Level Aerosol+Water Sprinkler	
IP Rating	IP55	
Corrosion Resistance Grade	C4-H	
Color	RAL 9003	
Dimensions	2991*2438*2591mm	W*D*H
Weight	Approx.14t	
Communication Interface	Ethernet/RS485	

4.2. Primary Electrical Drawings of the Energy Storage System

The primary electrical design drawings of the 1MWh integrated liquid-cooled energy storage container product mainly include two parts:AC busbar connection and Auxiliary power distribution System.

4.2.1. Primary AC System Drawing

- ECO-E10FT1044LP-2-S

The single ECO-E10FT1044LP-2-S integrated liquid-cooled energy storage container product has 4 1P260S liquid-cooled battery packs independently connected to 4 PCS modules.The AC side of the PCS modules is connected to the AC bus through busbar convergence,and then it is connected to the external power grid through two 500kW STS modules.The interfaces for load,photovoltaic,diesel generator,etc.are connected to the AC bus through branch circuit breakers.

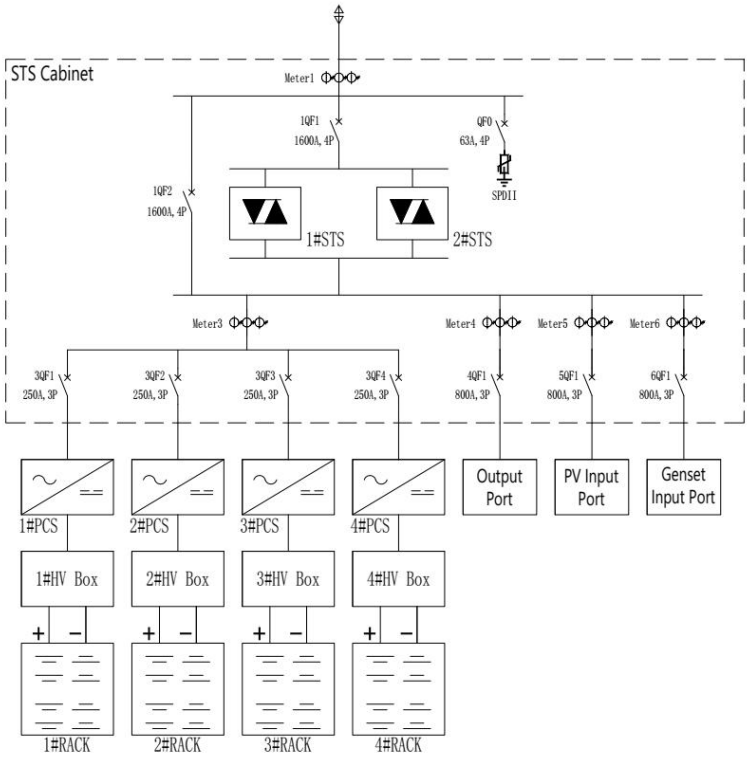


Figure 4-2 Schematic Diagram of AC Busbar Connection

- ECO-E10FT1044LP-2-N

In a single ECO-E10FT1044LP-2-N integrated liquid-cooled energy storage container product,4 1P260S liquid-cooled battery packs are independently connected to 4 PCS modules.The AC side of the PCS modules,after being connected through the AC bus,passes through the circuit breaker and is connected to the external power grid

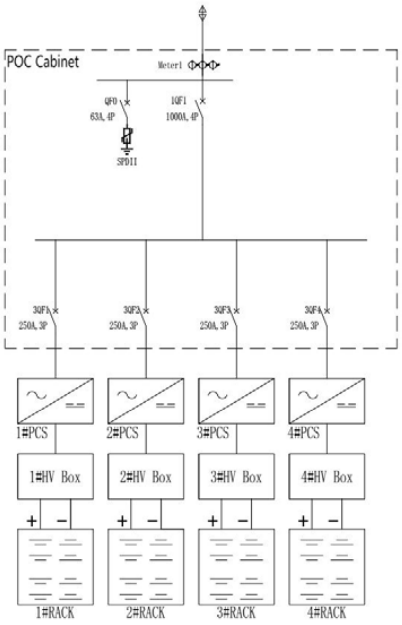


Figure 4-3 Schematic Diagram of AC Busbar Connection

4.2.2. Auxiliary power distribution System.

The auxiliary power supply in the system is divided into two parts:Auxiliary distribution panel and UPS power supply.

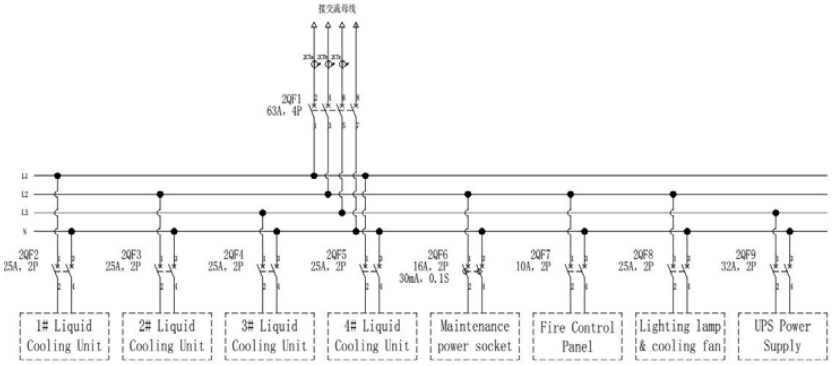


Figure 4-4 Schematic Diagram of Auxiliary distribution panel

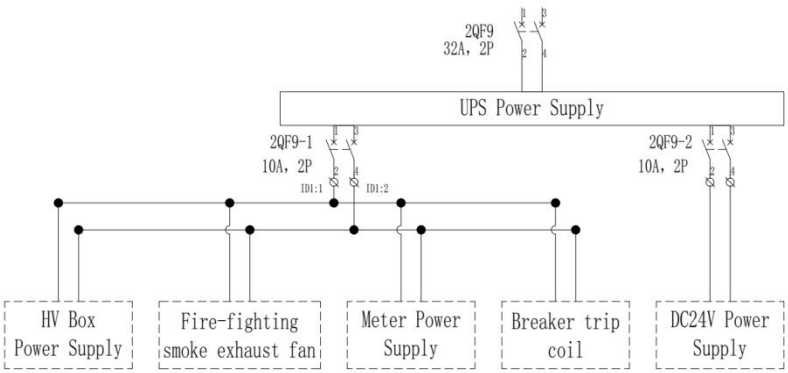


Figure 4-5 Schematic Diagram of UPS Power Supply

4.3. Exterior Design of the Energy Storage System

4.3.1. Container Design Scheme

The container structural design mainly includes the design of appearance,selection of steel structure,shell protection,container inlet and outlet lines,etc.,with the specific designs as follows:

- Container overall dimensions:10-foot standard Container,2991×2438×2591mm(10GP)
- The container has good anti-corrosion,fireproof,waterproof,dustproof(sandproof),shockproof,anti-ultraviolet and anti-theft functions to ensure that the container will not fail due to corrosion,fireproof,waterproof,dustproof,ultraviolet and other factors
- The container has fireproof function:the container shell structure,thermal insulation materials,internal and external decoration materials all use flame-retardant materials
- The overall protection grade of the container is IP55;the parts where the container door panel is connected to the outside are protected by sealing strips to prevent dust or rainwater from entering the container during outdoor sand or rainfall weather.Ensure no water accumulation,water seepage or water leakage on the top of the box body,no rainwater entering the side of the box body,and no water seepage at the bottom of the box body
- The container has dustproof(sandproof)function:standard ventilation filters that can be easily replaced are installed at the air inlets and outlets of the container and the air inlets of the equipment,and can effectively prevent dust from entering the container in case of strong wind and sand weather
- The container adopts a shockproof design:ensure that the mechanical strength of the container and its internal equipment meets the requirements under transportation and earthquake conditions,without deformation,functional abnormality,and non-operation after vibration
- The container has anti-ultraviolet function:ensure that the properties of the internal and external materials of the container will not deteriorate due to ultraviolet radiation,and will not absorb the heat of ultraviolet radiation

The appearance of this contain is as follow figure shows：

Front&back View

Side View

4.3.2. Ventilation Design Scheme

Adopt a layout mode of bottom air intake and top air exhaust,single intake and single exhaust,and double-side arrangement to avoid air flow short circuit and exhaust dead angles,ensure full replacement of gas in the cabin,and no accumulation of flammable gases.

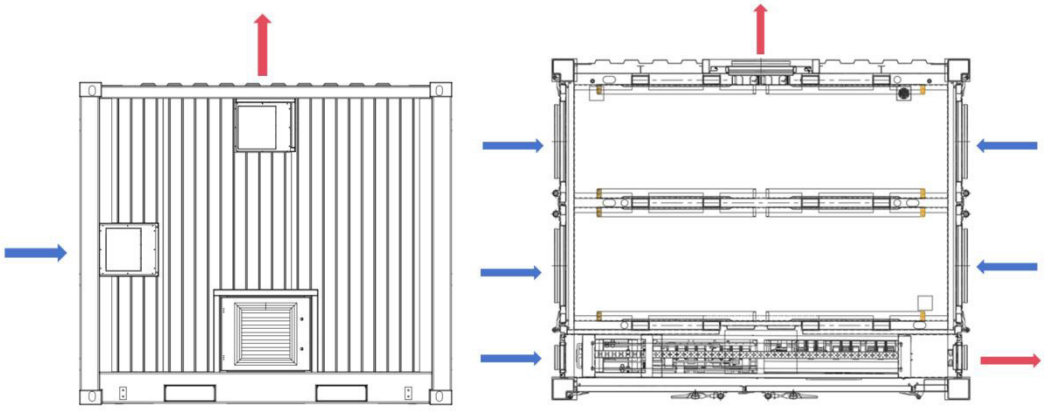


Figure4-6 Air Duct Schematic

4.4. Internal Design of the Energy Storage System

4.4.1. Composition of Internal Equipment

The 1MWh integrated liquid-cooled energy storage container product is composed of 4 battery packs,integrated and installed in one 10-foot container,including 4 battery clusters,4 Power Conversion System， a central control and distribution cabinet,4 liquid-cooled system and a fire protection system.,etc.

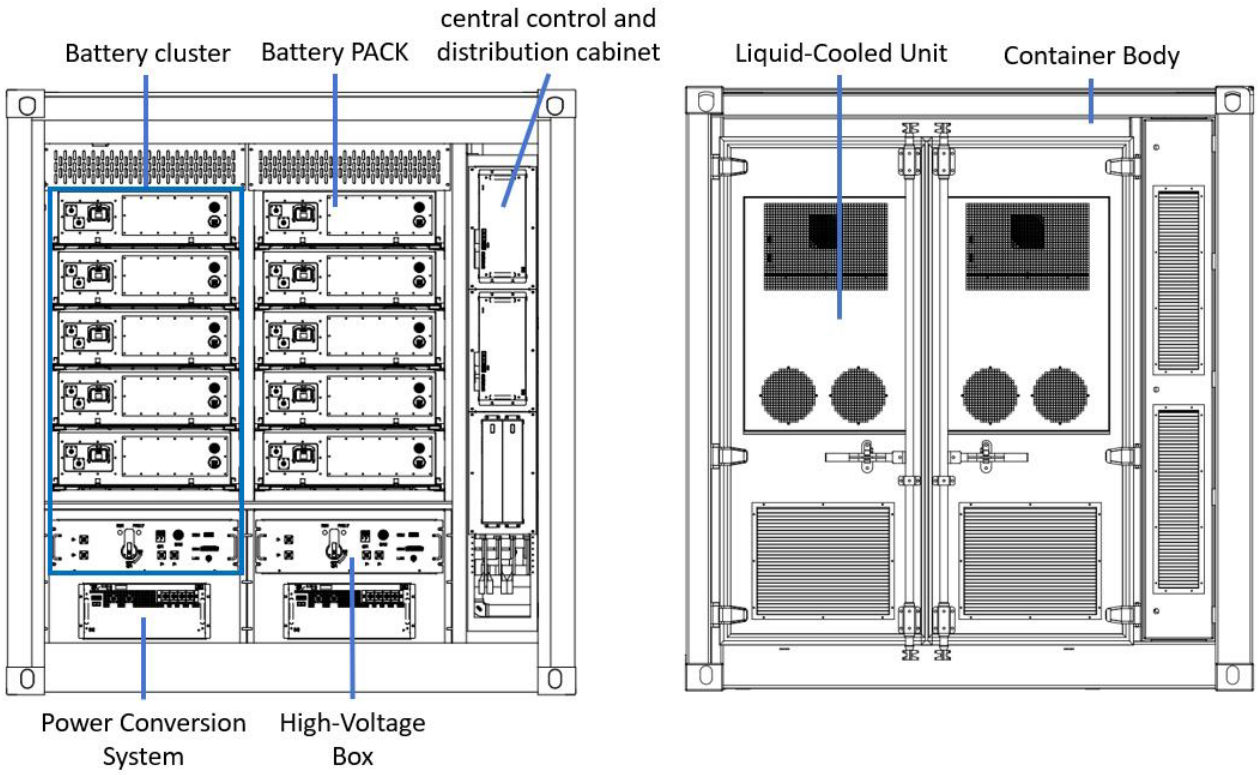


Figure 4-7 Internal Layout

The key component information is as follows:

- ECO-E10FT1044LP-2-S&N

Component	Quantity	Remarks
Battery Cells	1040	LFP 3.2V 314Ah
Battery PACKs	20	The series-parallel mode of a single battery PACK is 1P52S;in addition to cells,wire harnesses and structural parts,each battery PACK is also equipped with 1 slave control module ESBMM
High-Voltage Boxes	4	Mainly composed of master control module ESBCM,high and low voltage wire harnesses,connection terminals and structural parts
RACK	4	Battery cluster,a battery system composed of multiple battery PACKs and one high-voltage box
Central Control and Distribution Cabinet	1	Including key devices such as master control module ESCCU,EMS and backup power UPS,with main functions of AC busbar connection,auxiliary power distribution and local monitoring
Battery Management System	1	It is divided into four parts,each of which Including 5 slave control modules BMU and 1 master control modules BCU
Fire Protection System	1	Including 1 set of aerosol fire extinguishing system,1 set of explosion-proof exhaust system and 1 set of emergency water fire protection system
Thermal Management System	4	Including 5kW liquid-cooled unit,two-level liquid-cooled pipeline,cooling liquid,etc.
Container Body	1	2991×2438×2591mm(W×D×H)

4.5. Battery System

4.5.1. Battery Cells

This design scheme adopts the mainstream 314Ah Lithium Iron Phosphate(LFP)prismatic aluminum shell cells in the market.The parameter information of a single battery cell is as follows:

Item	Specification	Remarks
Nominal Capacity	314Ah	
Rated Voltage	DC3.2V	
Battery Energy	1004.8Wh	
Maximum Charging/Discharging Power	0.5P	
Operating Voltage Range	2.8V～3.6V	
Charging Operating Temperature Range	0～55℃	
Discharging Operating Temperature Range	-20～55℃	
Storage Temperature	-30～60℃	
Weight	5.6±0.3kg	
Dimensions	174.7*207.11*71.70 mm	W*D*H

4.5.2. Battery PACK

Figure 4-8 Battery Pack

According to the dimensions of the battery PACK and the selected cells,52 cells are used for each battery PACK.Each battery PACK is composed of 4 battery modules,and each module contains 13 battery cells connected in series,i.e.,1P13S*.The battery PACK is 1P52S.The parameter information of the battery PACK is as follows:

Name	Parameter	Remarks
Nominal Energy	52.24kWh	
Rated Voltage	DC166.4V	
Voltage Range	DC145.6～187.2V	Cell voltage 2.8V～3.6V
Number of Cells	52	
Cell Series-Parallel Mode	1 parallel,52 series	
Rated Charging Rate	0.5P	
Rated Discharging Rate	0.5P	
Product Dimensions	780*1140*245mm	W*D*H

Name	Parameter	Remarks
Communication Interface	CAN	
Fire Protection Method	Aerosol	
IP Rating	IP65	
Weight	Approx.352kg	

4.5.3. High-Voltage Box

Figure 4-9 High-voltage Box

The high-voltage box is a high-voltage power circuit management unit specially designed for the energy storage system,and an intermediate unit connecting the battery cluster and the power conversion system(PCS).The high-voltage box has the functions of battery cluster voltage and current collection,battery cluster circuit contactor control and protection,summarizing the data uploaded by the slave battery management unit BMU,and Realize functions such as information communication with the local management system(EMU)and the energy storage converter(PCS). The high-voltage control box contains circuit breakers,contactors,fuses,circulation control circuits,current sensors,master battery management unit BCU,switching power supplies and other components.The high-voltage control box has fully considered the electrical characteristics,heat dissipation performance,safety performance and operability and maintainability of each component in the design,with a reasonable spatial layout and the characteristics of compact structure,flexible configuration,safety and reliability.

The high-voltage box adopts a highly integrated design,The parameter information of the high-voltage box is as follows:

Item	Parameter	Remarks
Rated Operating Voltage	DC832V	Meets DC1000V voltage class
Rated Operating Current	250A	
Power Supply Input	AC220V	
Dimensions	800×800×225mm	W*D*H
Operating Temperature	-20～55°C	
Operating Humidity	≤95%RH,no condensation	
Communication Interface	CAN,LAN	
IP Rating	IP20	
Product Weight	45kg	

4.5.4. Battery Management System

The battery management system(BMS)of the 1MWh integrated liquid-cooled energy storage container product is a two-level architecture,consisting of the slave control module BMU and the master control module BCU.The slave control module BMU provides real-time monitoring functions for the voltage and temperature of a single string of batteries(individual cells),and is installed inside the battery PACK.The master control module BCU manages the battery clusters in the energy storage battery system and is installed inside the high-voltage control box of the battery cluster.

A total of 4 battery clusters(BAT RACK)are installed in the container.Each battery cluster(BAT RACK)is composed of 5 battery PACKs connected in series.Each battery is independently managed by 1 slave control module BMU,which is responsible for collecting and uploading all the information within the battery PACK,including 52 battery(individual cell)voltage information and 20 battery(individual cell)temperature information.The slave control module BMU communicates with the superior master

control module BCU using the standard CAN2.0 protocol.

Each battery cluster(BAT RACK)is equipped with 1 master control module BCU.The master control module BCU collects data through 485 communication with the liquid cooling unit(TMS)inside the liquid-cooled container and exchanges data with the EMU industrial control computer through LAN communication(Ethernet).The master control module BCU communicates with the internal PCS module using CAN communication and sets a one-way passive DO dry contact signal

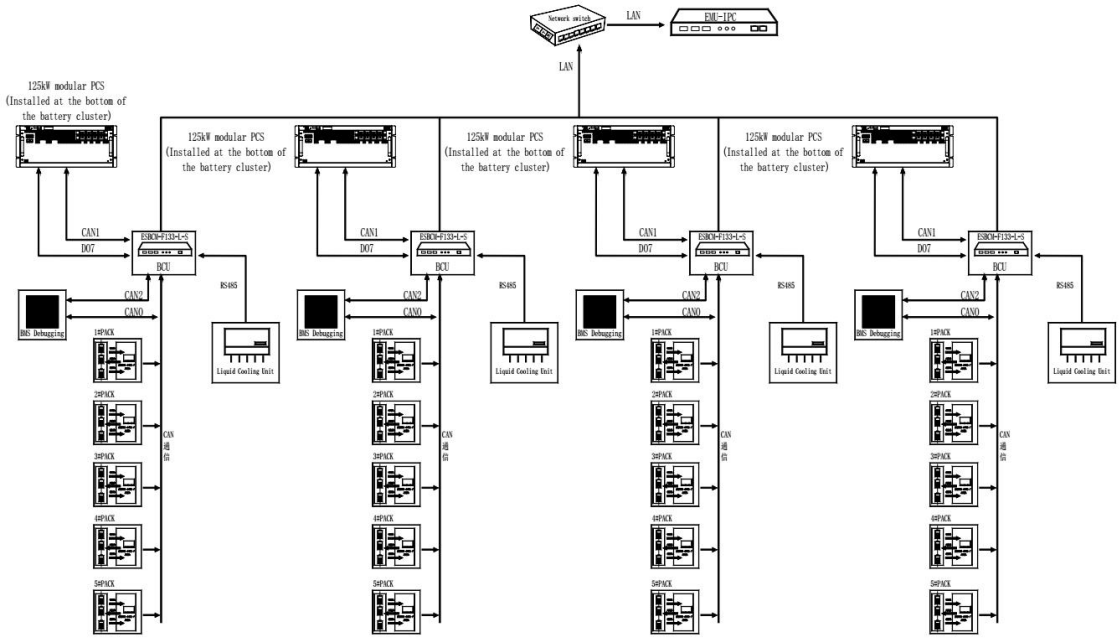


Figure 4-10 Communication Diagram

4.5.4.1. Slave Control Module-BMU

The BMU slave control module is a slave control module with integrated passive balancing function suitable for lithium battery management systems.The module provides real-time monitoring functions of single string battery(cell)voltage and temperature,and has thermal management and passive balancing capabilities at the same time.It can form a highly flexible battery management system with the master control module ESBCM through CAN communication.

Figure 4-11 BMU

Function Description:

- Supports voltage monitoring of 64 series of battery cells
- Supports temperature monitoring of 64 channels of NTC(10K)
- Supports passive balancing,adopting energy consumption balancing technology,which can discharge and balance multiple single battery cells in the battery pack at the same time with a balancing current of 100mA,and the balancing energy of single battery cells can be measured
- Supports low-power acquisition mode,and the latent current in low-power mode can be reduced to 50μA or lower
- Supports alarm functions such as power supply/cell voltage(overvoltage,undervoltage),temperature(overtemperature)and communication faults
- Supports balancing fault detection
- Supports detection function of disconnection of acquisition wire harnesses(voltage, temperature)

- Meets the application requirements of 1500V energy storage systems,complies with the functional safety and insulation voltage withstand requirements of standards such as UL 60950,IEC 60730-1:2013,GB/T 36276-2018 and IEC 62477-1:2012,and can be equipped with relevant certifications such as IEC 62619:2017 and UL 1973.

Technical Parameters:

Category	Item	Min	Typ	Max	Unit
Operating Environment	Operating Altitude	-	-	5000	m
	Relative Humidity	5	-	95	%
	Operating Temperature	-40	-	85	℃
	Storage Temperature	-40	-	85	℃
Operating Power Supply	Rated Voltage	9	24	32	Vdc
	Rated Power Consumption	-	-	0.8	W
Single String Battery(Cell)Voltage Acquisition	Acquisition Channel Number	32	-	64	Channel
	Acquisition Range	0	-	5	Vdc
	Acquisition Accuracy	-	±3	±5	mV
Single String Battery(Cell)Temperature Acquisition	Acquisition Channel Number	-	-	64	Channel
	Acquisition Range	-40	-	125	℃
	Acquisition Accuracy	-	±1	-	℃

Passive Balancing	Balancing Current	-	100	-	mA
DO	Channel Number	-	-	1	Channel
	Output Current	-	-	1	A
DI	Channel Number	-	-	2	Channel
	DIL	0	-	0.7	V
	DIH	9	-	32	Vdc
IO	Channel Number	-	-	2	Channel
	VIL	-	-	0.7	V
	VIH	3	-	5	V
CAN	Channel Number	-	-	1	Channel
	Communication Rate	125	500	1000	Kb/s

4.5.4.2. Master Control Module-BCU

The BCU master control module is a control and management module suitable for energy storage battery management systems.It is mainly responsible for battery cluster voltage and current collection,summarizing the voltage and temperature information of single cells within the cluster,calculating battery cluster states such as SOC/SOH,executing balance strategy judgment and battery fault diagnosis functions,and implementing local protection of battery clusters and relay control based on battery fault information.The ESBCM master control module is equipped with CAN communication interfaces to realize data communication with slave control modules ESBMM and the master control unit ESCCU.It has insulation collection function and state calculation functions such as single cell SOC/SOH,and is provided with redundant CAN

communication interfaces,RS485 communication interfaces and Ethernet communication interfaces for communication with external devices.

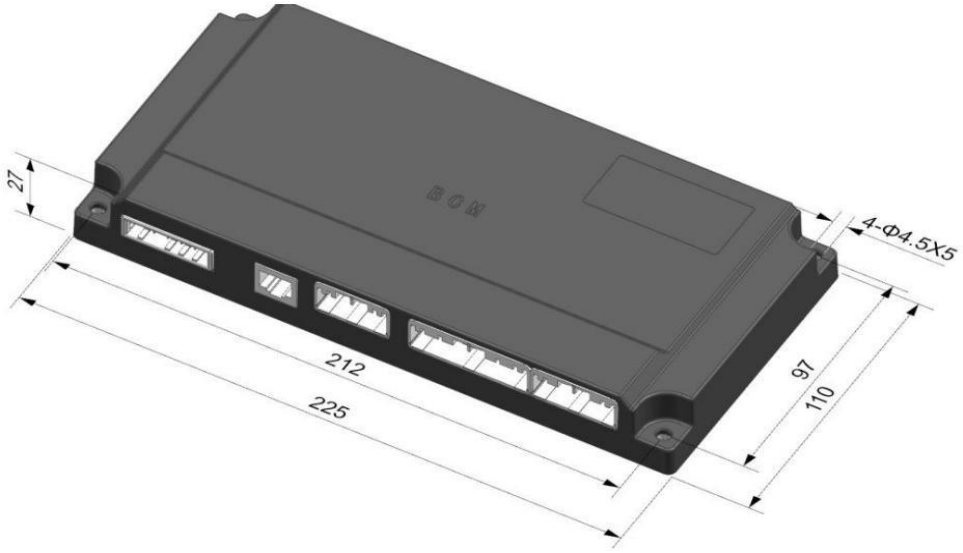


Figure 4-12 BCU

Functional Description

- Supports battery state data processing,summarizes real-time battery data information,and realizes the management and control of charging and discharging of battery packs/clusters after data processing.
- Supports pack terminal voltage detection,and realizes real-time detection of pack terminal voltage through isolated collection and processing of pack terminal voltage.
- Supports pack terminal current detection,and realizes real-time isolated current collection and processing via Hall sensors.
- Supports the insulation detection function of the battery system,which can be enabled or disabled according to system configuration requirements.
- Supports the estimation of SOC,SOH,SOE and SOP,and can realize the SOC and SOH estimation of single cells and battery packs.
- Supports fault detection function,including threshold alarm functions based on voltage,current,temperature,SOC,SOH,etc.,and circuit cut-off protection function for extreme alarm thresholds.
- Supports system expansion functions,including multi-channel active and passive node output,relay control and management,and effective isolation of strong and weak electricity to meet diverse safety control requirements.

- Supports CAN,RS485 and Ethernet communication functions to realize information interaction.
- Meets the application requirements of 1500V energy storage systems,complies with the functional safety and insulation withstanding voltage requirements of standards such as UL 60950,IEC 60730-1:2013,GB/T 36276-2018 and IEC 62477-1:2012,and can be equipped with relevant certifications such as IEC 62619:2017 and UL 1973.

Technical Parameters

Category	Item	Minimum	Typical	Maximum	Unit
Working Power Supply	Rated Voltage	9	24	32	Vdc
	Rated Power Consumption	-	-	3	W
5V Power Output	Rated Voltage	-	5	-	Vdc
	Output Current	-	-	300	mA
12V Power Output	Rated Voltage	-	12	-	Vdc
	Output Current	-	-	300	mA
Pack Terminal Voltage Collection	Collection Range	0	-	1500	Vdc
	Collection Accuracy	-	±0.1	±0.5	%FS
Pack Terminal Current	Collection Range	0	-	±500	A
Collection	Collection Accuracy	-	±0.1	±0.5	%
Temperature Collection	Number of Channels	-	-	4	Channel
	Collection Range	-40	-	125	℃
	Collection Accuracy	-	±1	-	℃

Insulation Resistance	Collection Range	0	-	10	MΩ
	Collection Accuracy	-	15	-	%
CAN	Number of Channels	-	-	1	Channel
	Communication Rate	125	500	1000	Kb/s
DO	Number of Channels	-	-	8	Channel
	Output Current	-	-	1	A
DI	Number of Channels	-	-	2	Channel
	DIL	0	-	0.7	V
	DIH	9	-	32	Vdc
CAN	Number of Channels	-	-	3	Channel
	Communication Rate	125	250	1000	Kb/s
LAN	Number of Channels	-	-	1	Channel
	Communication Rate	-	10/100	-	Mb/s
RS485	Number of Channels	-	-	1	Channel
	Communication Rate	1200	9600	115200	bps

4.6. Power Conversion System（PCS）

Figure 4-13 125kW PCS

PCS（Power Conversion System）is a device that enables bidirectional conversion of electrical energy.It converts direct current into alternating current and feeds it into the power grid or directly supplies it to alternating current loads;it also rectifies alternating current into direct current for charging batteries.The ECO-E10FT1044LP-2 model incorporates a total of four 125-kilowatt PCS modules.These devices are designed for easy maintenance from the front and feature built-in overvoltage and overload protection mechanisms,enabling safe and efficient energy conversion.

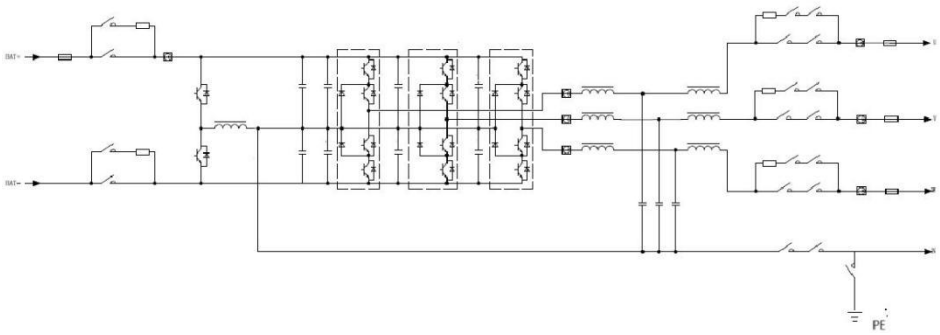


Figure 4-14 PCS Schematic Diagram

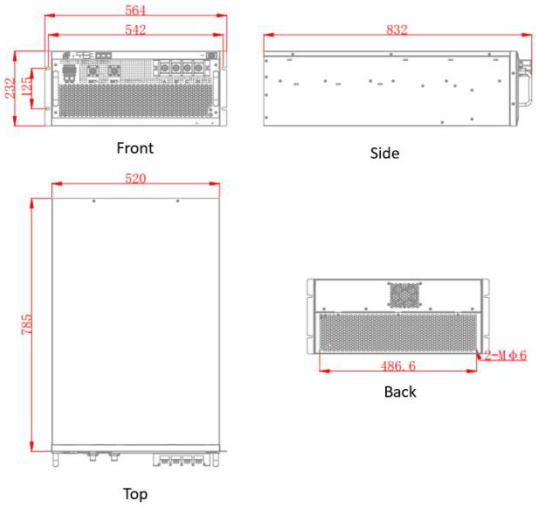


Figure 4-15 PCS Dimensional Drawing

Technical Parameters:

DC-side Parameters	
Maximum input current(A)	203
Voltage range(V)	615~950 (3W+PE)/650~950 (3W+N+PE)
AC-side Parameters	
Rated output power(kW)	125
Max.output power(kw)	138
Overload capacity	110%Long term@ambient temp≤35°C;120%@60s
AC wiring	3L+N+PE/3L+PE
Isolation	Non-Transformer
Power factor	0.99,-1to+1
Rated voltage(Vac)	AC400V/230V
Voltage range(Vac)	400V(-15%to+15%)
Rated grid frequency(Hz)	50/60
Protection Functions	
Short cireuit protection	Support
AC phase sequence protection	Support
Comm fault protection	Support
Anti-islanding protection	Support
DC over-voltage protection	Support
AC over-voltage protection	Support
Reverse Polarity protection	Support
Overheating protection	Support
LVRT	Fault-ride-through

General Parameters	
Dimensions(mm)	W52O*D785*H232
Max.Efficiency	98.5%
Weight(kg)	69
Cooling method	Air cooling
Ingress Protection	IP20
Communication protocol	RS485&Modbus-RTU for EMS;CAN for BMS
Operation Ambient Temperature	-25°C~55°C (>45°Cderating)
Relative humidity	O-95%RH(No condensing)
Attitude	400om(Derating above 200om)

4.7. Central Control and Distribution Cabinet

The 1MWh integrated liquid-cooled energy storage container uses different grid-tie cabinets depending on the product model.The grid-tie cabinet is independently installed within the container's electrical compartment,with the ECO-E10FT1044LP-2-S model equipped with an STS cabinet and the ECO-E10FT1044LP-2-N model equipped with a POC cabinet.

4.7.1. STS cabinet

The STS cabinet is primarily composed of four parts:AC busbar,grid-connection/disconnection switching,auxiliary power distribution,and the local monitoring system(EMU).It serves as a critical hub for connecting to the external power grid and equipment,performing seamless grid connection/disconnection operations,and ensuring stable system operation.

AC Busbar:The AC output sides of all PCS modules within the system are connected to branch circuit breakers inside the grid cabinet.Power is then aggregated via AC busbars before being connected externally.The AC busbar system includes a main switch and surge protectors.

The liquid-cooled energy storage container connects to the power grid through the grid cabinet,delivering output at AC 400V/50(60)Hz,supporting three-phase four-wire connection to low-voltage power networks.

Grid Connection/Disconnection Switching:The 500kW/1MWh liquid-cooled energy storage container is

equipped with two 500kW STS modules installed in the grid cabinet to enable seamless grid connection and disconnection.Additionally,it reserves circuit breakers for load,photovoltaic,and diesel generator branches for external connections.

Auxiliary Power Distribution:The auxiliary power supply within the system consists of two components:commercial power supply and UPS power supply.Commercial power mainly supplies the liquid cooling unit,maintenance sockets,lighting,and cooling fans.The UPS power supply provides electricity to devices that need continuous operation during grid transition or system power outages,including the BMS system,EMS system,environmental monitoring system,fire protection ventilation systems,electric meters,video surveillance,and other equipment.It also powers the opening and closing operations of system switches,providing control and protection functions.

The Local Monitoring System(EMU)mainly comprises an industrial computer,switch,4G router,and I/O module.The industrial computer acts as the control core,running control strategies.It communicates with the 4G module,I/O module,BMS system,and PCS modules via the switch.The I/O module controls digital input/output signals,while the 4G module exchanges data wirelessly with the cloud platform through an external 4G network.

Figure4-16 STS cabinet

4.7.1.1. Components

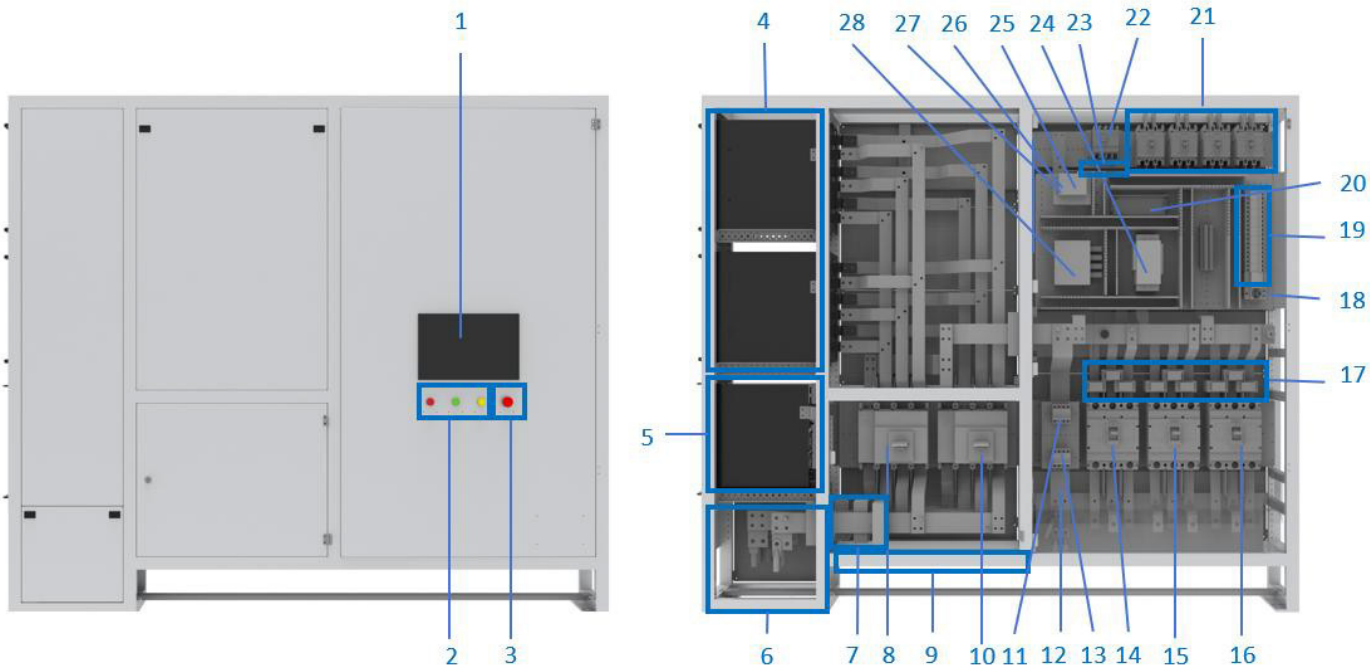


Figure 4-17 Components of POC Cabinet

No.	Item	Remarks
1	HMI Screen	
2	Operating Indicators	
3	Emergency Stop Button	Press to shutdown AC power
4	STS	Switching between off-grid andgrid-connected states
5	UPS	Use for control source
6	Copper busbar	Power grid connections
7	Meter CT1	For the whole system
8	1QF1	Main circuit breaker
9	Ground copper bar	For the ground connection
10	1QF2	Power grid bypass circuit breaker
11	QFO	Protective circuit breaker
12	Neutral conductor	

13	SPD	AC side Typell
14	4QF1	Output circuit breaker
15	5QF1	Connect to PV inverter
16	6QF1	Connect to diesel generator
17	Meter CT4~6	For the External
18	Maintenance power socket	
19	2QF2~2QF9	Internal circuit breaker
20	Switching Power Supply	
21	3QF1~3QF4	Energy storage system switch
22	2QF1	Distribution circuit breaker
23	Meter CT2	For auxiliary devices
24	1/O Module	
25	Serial Server	
26	4G Wireless Module	
27	Network Switch	
28	EMU IPC	

4.7.1.2. Indicator Lights

The indicator lights from left to tight are,in sequence

Indicator	Color	Status	Description
System Fault Indication	Red	On	System fault: 1) 1/O module fault:Level 2 fire alarm,fire sprinkler alarm,emergency stop pressed 2) Both Level 2 and Level 3 BMS Alarms 3) Fault Signals Reported by Equipment such as PCS,STS, Chillers,and Fire Alarm Control Panels
		Off	No fault

On-grid Running	Green	On	The STS module is in grid-connected operation mode
		Off	The system is not running or is in off-grid running mode.
Off-grid Running	Yellow	On	1) The STS module is operating in off-grid mode. 2) The 1QFiand2QF2 circuit-breaker is in the off position
		Off	The system is not running or is in on-grid running mode.

4.7.2. POC cabinet

The POC cabinet is primarily composed of three parts:AC busbar,auxiliary power distribution,and the local monitoring system(EMU),serving as a key hub that connects to the external power grid and ensures stable system operation.

AC Busbar:All AC output sides of the PCS modules within the system are connected to branch circuit breakers inside the grid-tie cabinet.The currents are then aggregated via AC busbars before being linked to the external network.The AC busbar system includes a main switch and surge protectors.

The liquid-cooled energy storage container connects to the power grid through the grid-tie cabinet,delivering output at AC 400V/50(60)Hz,supporting a three-phase four-wire connection for integration into low-voltage power networks.

Auxiliary Power Distribution:The auxiliary power supply in the system consists of two components—mains power and UPS power.Mains power mainly supplies the liquid cooling units,maintenance sockets,lighting fixtures,and cooling fans.UPS power provides backup electricity to critical equipment during grid disconnection or system power outages,including the BMS system,EMS system,environmental monitoring system,fire protection ventilation systems,electric meters,video surveillance,and other devices.It also supports the opening and closing operations of system switches,providing control and protection functions.

The Local Monitoring System(EMU)comprises four main components:an industrial computer,a switch,a 4G router,and I/O modules.The industrial computer serves as the control core,running control strategies.It communicates with the 4G module,I/O modules,BMS system,and PCS modules via the switch.The I/O module controls digital input/output signals,while the 4G module exchanges data

wirelessly with the cloud platform through an external 4G network.

Figure4-18 POC cabin

4.7.2.1. Components

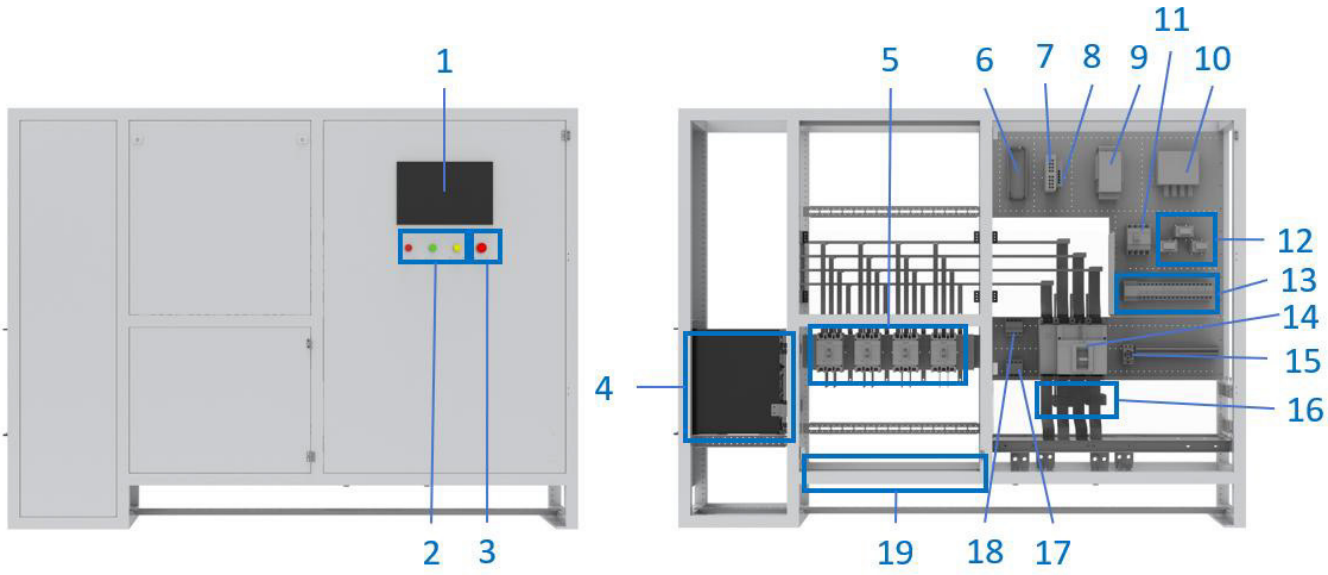


Figure 4-19 Components of POC Cabinet

No.	Item	Remarks
1	HMI Screen	
2	Operating Indicators	
3	Emergency Stop Button	Press to shutdown AC power

4	UPS	Use for control source
5	3QF1~3QF4	Energy storage system switch
6	Switching Power Supply	
7	Network Switch	
8	4G Wireless Module	
9	VO Module	
10	EMU IPC	
11	2QF1	Distribution circuit breaker
12	Meter CT2	For auxiliary devices
13	2QF2~2QF9	Internal circuit breaker
14	QF	Main circuit breaker
15	Maintenance power socket	
16	Meter CT1	For the whole system
17	SPD	AC side TypeII
18	QFO	protective circuit breaker
19	Ground copper bar	For the ground connection

4.7.2.2. Indicator Lights

The indicator lights from left to tight are,in sequence

Indicator	Color	Status	Description
System Fault Indication	Red	On	System fault: 1) 1/O module fault:Level 2 fire alarm,fire sprinkler alarm,emergency stop pressed 2) Both Level 2 and Level 3 BMS Alarms 3) Fault Signals Reported by Equipment such as PCS,Chillers,and Fire Alarm Control Panels
		Off	No fault

System Power Indicationr	White	On	The main AC breaker of the system is closing
		Off	The main AC breaker of the system is opening
System Operation Status Indication	Green	On	Any PCS module in the system is in an operational state.
		Off	All the PCS modules in the system are currently in a shutdown state.

4.7.3. Static Transfer Switch（STS）

STS is an automatic seamless switching system.When the source side that requires isolation protection fails,STS automatically disconnects,quickly isolating the faulty circuit and enabling PCS to switch to off-grid mode to supply power to the load.Different from traditional automatic transfer switch ATS,STS provides rapid load switching,ensuring uninterrupted operation of precision electronic equipment.The re-powering of the load is actually instantaneous(≤20ms),and can provide power assurance for various digital devices,control devices or other electrical equipment with extremely high requirements for power supply continuity.

4.7.3.1. operating principle

- Grid connection mode:

When STS is closed,the mains power is connected to the load and PCS through STS.Our company's STS is used in conjunction with PCS.After STS is closed,PCS switches to the"grid connection mode",and the system enters the grid connection operation state.

- Grid-connected to off-grid mode:

When the STS detects a power outage in the grid,it disconnects the STS and simultaneously transmits the grid information to the PCS.The PCS then switches to the off-grid mode and supplies power to the load.

- Off-grid mode:

At this point,the STS is disconnected,isolating the grid from the system.The STS continuously monitors the grid data to determine if the grid has resumed operation.

- Off-grid to On-grid Mode:

When the grid is restored,STS detects it and instructs PCS to perform phase locking.Once the phase locking is completed,STS is closed,and at the same time,PCS transitions from the off-grid mode to the on-grid mode.

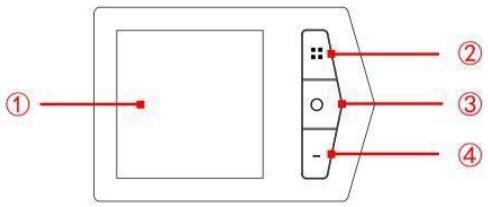
4.7.4. UPS

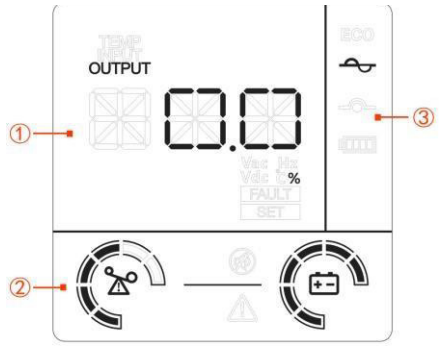
4.7.4.1. Basic Introduction to UPS

UPS(Uninterruptible Power Supply)is an uninterruptible power supply with an energy storage device,mainly used to provide uninterrupted power supply for some equipment with high requirements for power supply stability.

When the mains input is normal,the UPS stabilizes the mains voltage and supplies it to the load;at this time,the UPS acts as an AC voltage regulator and charges the internal battery at the same time.When the mains power is interrupted(accidental power failure),the UPS immediately converts the DC power of the battery into 220V AC power through the inverter and continues to supply it to the load,so that the load can maintain normal operation and the software and hardware of the load are protected from damage.UPS equipment can usually provide protection against overvoltage and undervoltage.

This product adopts KELONG YTR1103L-J,which can provide high-efficiency power protection.

Diagram	Description
	① Displays UPS working status,remaining battery capacity,fault alarm,etc. ② Short press to switch the display of output voltage,output frequency,input voltage,input frequency,battery voltage,internal temperature,output load percentage,fault information page,etc.;long press for 5s to enter the setting page,short press to select setting commands,long press to confirm command selection. ③ In the on state,long press for 1s to shut down the unit. ④ In the off state,long press for 1s to start the unit;in the on state and mains mode,long press for 3s toperform battery test;in battery mode,long press for 3s to mute the buzzer(cancel the mains abnormality alarm).

	① Displays UPS input,output,temperature,fault type,setting items,etc. ② Displays load capacity,battery capacity,UPS fault indication,buzzer mute,etc. ③ Displays UPS working status:mains inversion,bypass power supply,battery inversion,ECO.

4.8. Fire Protection System

The fire protection system of this product consists of one set of aerosol fire extinguishing system,one set of explosion-proof ventilation system and one set of emergency water fire protection system.

The aerosol fire extinguishing system is divided into two parts:PACK-level and cabin-level.
PACK-level:

Each battery PACK is equipped with a hot aerosol fire extinguishing device.The module adopts thermal wire detection inside;when the battery thermal runaway reaches a certain temperature,the thermal wire can detect the fire at the first time and activate the fire extinguishing device to achieve rapid fire extinguishing and prevent fire spread.

Cabin-level:

The cabin-level hot aerosol fire extinguishing system in the container uses point-type photoelectric smoke fire detectors and point-type heat fire detectors as fire detectors,and is equipped with fire sound and light alarms,manual release stations,emergency start/stop buttons,alarm bells,gas fire extinguishing controllers and cabin-level hot aerosol fire extinguishing devices to form an automatic fire protection system.
The explosion-proof ventilation system is composed of flammable gas detectors and air intake and exhaust components.When the battery cells in the prefabricated cabin experience thermal

runaway and generate flammable gas,the flammable gas detector installed in the cabin will detect that the flammable gas concentration reaches the alarm threshold,and then immediately link the air intake and exhaust components for ventilation to prevent the flammable gas from reaching the explosive concentration and causing an explosion when exposed to external energy.

The emergency water fire protection system is set as a final resort to manually connect emergency water for fire extinguishing in case the automatic fire protection system fails to

extinguish the fire effectively after a fire occurs in the electrochemical energy storage system.In this scheme,the emergency water system is equipped with a water fire protection pipe network inside the cabin and an interface outside the cabin.

Working Principle of the Fire Protection System

When either the smoke detector or the heat detector in the protected area reaches the alarm threshold,a first-level fire alarm is triggered and a fire signal is output,and the alarm bell outside the protected area will be activated immediately to alert personnel to respond;when both the smoke detector and the heat detector reach the alarm threshold,or the manual release station is pressed after personnel discover smoke or open fire,a second-level fire alarm is triggered and a fire signal is output,the alarm bell and sound and light alarm outside the protected area are activated,and a 30s pre-release phase is entered.After a 30s delay,the gas fire extinguishing controller sends a signal to the fire extinguishing device,the fire extinguishing device is activated to extinguish the fire,and a feedback signal is given.During the 30s delay,if the emergency stop button is pressed,the delay will reset to 30s and the gas release will be suspended.

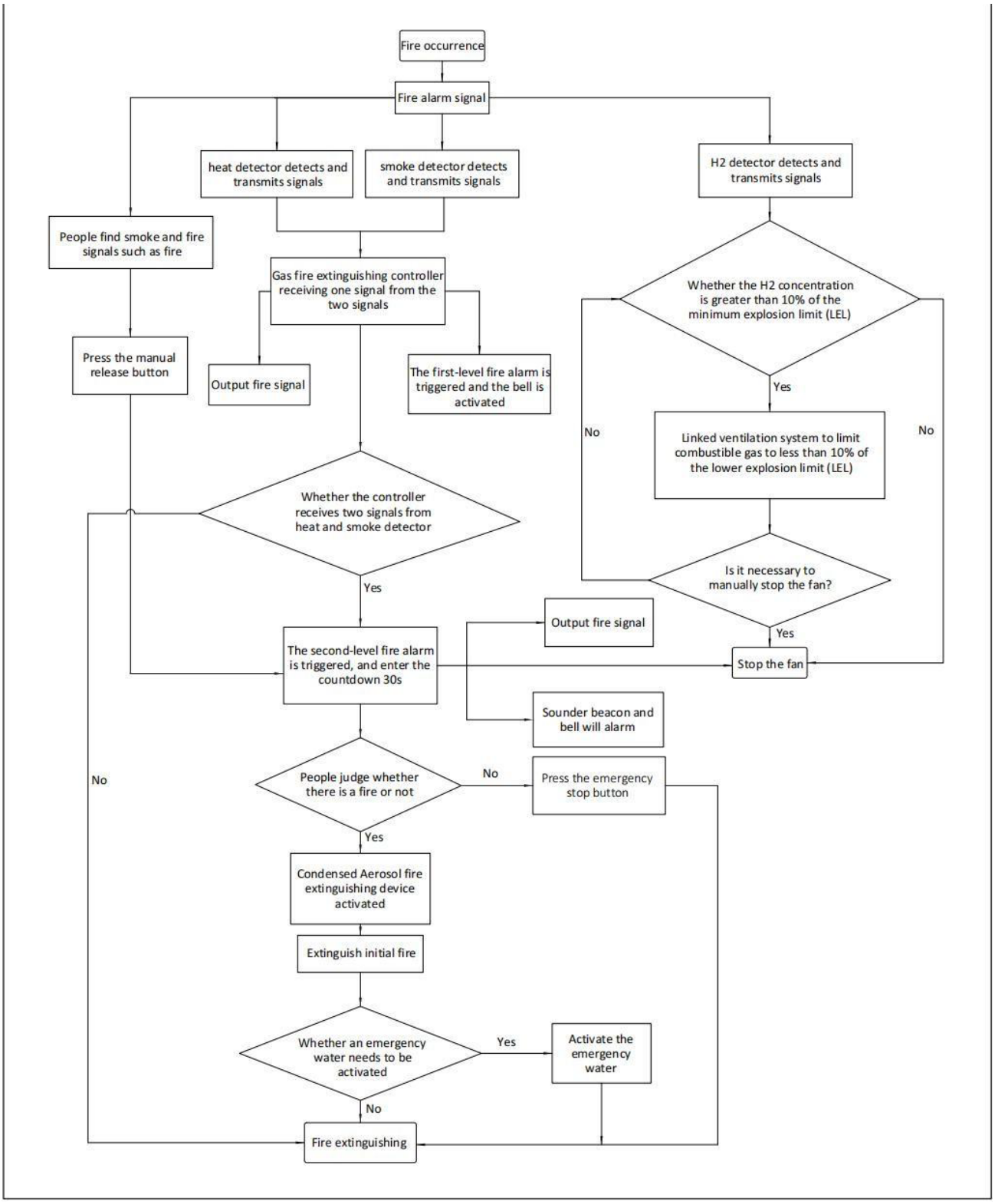


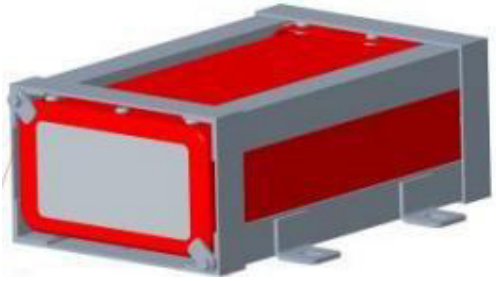
Figure 4-20 Logic Diagram of Fire Protection Diagram

Configuration of the Fire Protection System:

Name	Quantity	Model
Cabin-level hot aerosol fire extinguishing device	2sets	QRR0.75G-U01
Gas fire extinguishing device	1 set	K11031M2
Smoke detector	1 sets	55000-316
Heat detector	1 sets	55000-121
Detector base	2 sets	45681-200APO
Fire sound and light alarm	1 set	958CHL1000
Alarm bell	1 set	CBE6-RS-024-EN
Emergency stop button	1 set	K91000M10
Manual release station	1 set	K91110M08
Controller battery	1 sets	SSP12-7
Air intake fan	1 set	CNBF-350A
Air exhaust fan	1 set	CNF-350A
Fan start/stop button box	1 set	CJ-B2J-A36-42
Flammable gas detector	1 sets	Xgard Bright-H2
Water fire protection system	1 set	-

Technical Parameters of the Fire Protection System:

Smoke Detector 55000-316	Item	Technical Parameter
	Working Voltage	9-33Vdc
	Quiescent Current	30-50μA/24Vdc
	Alarm Voltage	6-28Vdc
	Alarm Current	52mA/24Vdc
	Alarm Threshold	0.15dB/m obscuration
Temperature Detector 55000-121	Item	Technical Parameter
	Working Voltage	9-33Vdc
	Quiescent Current	55μA/24Vdc
	Alarm Voltage	6-28Vdc
	Alarm Current	52mA/24Vdc
	Working Temperature	AIR:-20-50℃
Fire Sound and Light Alarm 958CHL1000	Item	Technical Parameter
	Working Voltage	9-30Vdc
	IP Rating	IP45
	Working Temperature	-20-70℃
	Sound Decibel	-10dB/-20dB

Alarm Bell CBE6-RS-024-EN	Item	Technical Parameter
	IP Rating	IP33
	Working Temperature	-25-70°C
	Sound Decibel	96dB
Emergency Stop Button K91000M10	Item	Technical Parameter
	IP Rating	IP30
	Working Temperature	-5-40°C
Manual Release Station K91110M08	Item	Technical Parameter
	IP Rating	IP30
	Working Voltage	21-30Vdc
	Quiescent Current	33μA/24Vdc
Aerosol Fire Extinguishing Device QRR0.75G-U01	Item	Technical Parameter
	Start Mode	Electric start
	Feedback Signal	Passive switch signal
	Protection Space	12.5m^3
	Discharge Time	15.50±5s
	Service Life	15 years

Flammable Gas Detector Xgard Bright-H2	Item	Technical Parameter
	Working Voltage	12-30Vdc
	Contact Capacity	1A@30Vdc
	Sensor Type	H2
	IP Rating	IP66
	Service Life	3-5 years
Air Intake Fan CNBF-350A	Item	Technical Parameter
	Working Voltage	220Vac
	Starting Current	1.4A±10%
	Rated Power	120W±10%
	Corrosion Resistance Grade	C5VH
Air Exhaust Fan CNF-350A	Item	Technical Parameter
	Working Voltage	220Vac
	Starting Current	1.4A±10%
	Rated Power	120W±10%
	Corrosion Resistance Grade	C5VH

4.9. Thermal Management System

The thermal management system of the battery cabin adopts a liquid cooling system,which consists of a liquid-cooled unit,liquid supply and return pipelines,and battery liquid cooling plates(part of the battery PACK cabinet).Meanwhile,it adopts a multi-mode and refined thermal management control logic to ensure the system temperature and temperature difference,and improve the system consistency and service life.

The liquid-cooled unit and the battery cabin adopt a completely independent structural layout to improve system safety.This design adopts a vertical liquid-cooled unit with AC power supply,which is suitable for applications where the batteries inside the energy storage container generate large heat and the internal equipment is sensitive to ambient temperature.The liquid-cooled unit adopts an integrated structure,integrating upper computer communication,alarm and other functions,with high reliability,simple and convenient installation,and no complex debugging required.The liquid-cooled unit is equipped with a variable frequency compressor and a variable frequency water pump to realize dual variable frequency regulation of the refrigeration system and the cooling liquid circulation system,achieving high energy efficiency during operation.

The liquid cooling pipeline adopts a two-level pipeline scheme;all pipelines are made of nylon hoses with thermal insulation,anti-condensation and exhaust functions.The internal flow channel of the battery liquid cooling plate is designed with a non-uniform flow channel through thermal flow simulation analysis under all working conditions to ensure uniform flow field distribution and no fluid dead zones.The system performs refined temperature zone control based on criteria such as temperature differences at all levels and intelligently switches operation modes to reduce auxiliary power consumption and improve system efficiency on the basis of ensuring the system temperature and temperature difference.

4.9.1. Liquid-Cooled Unit

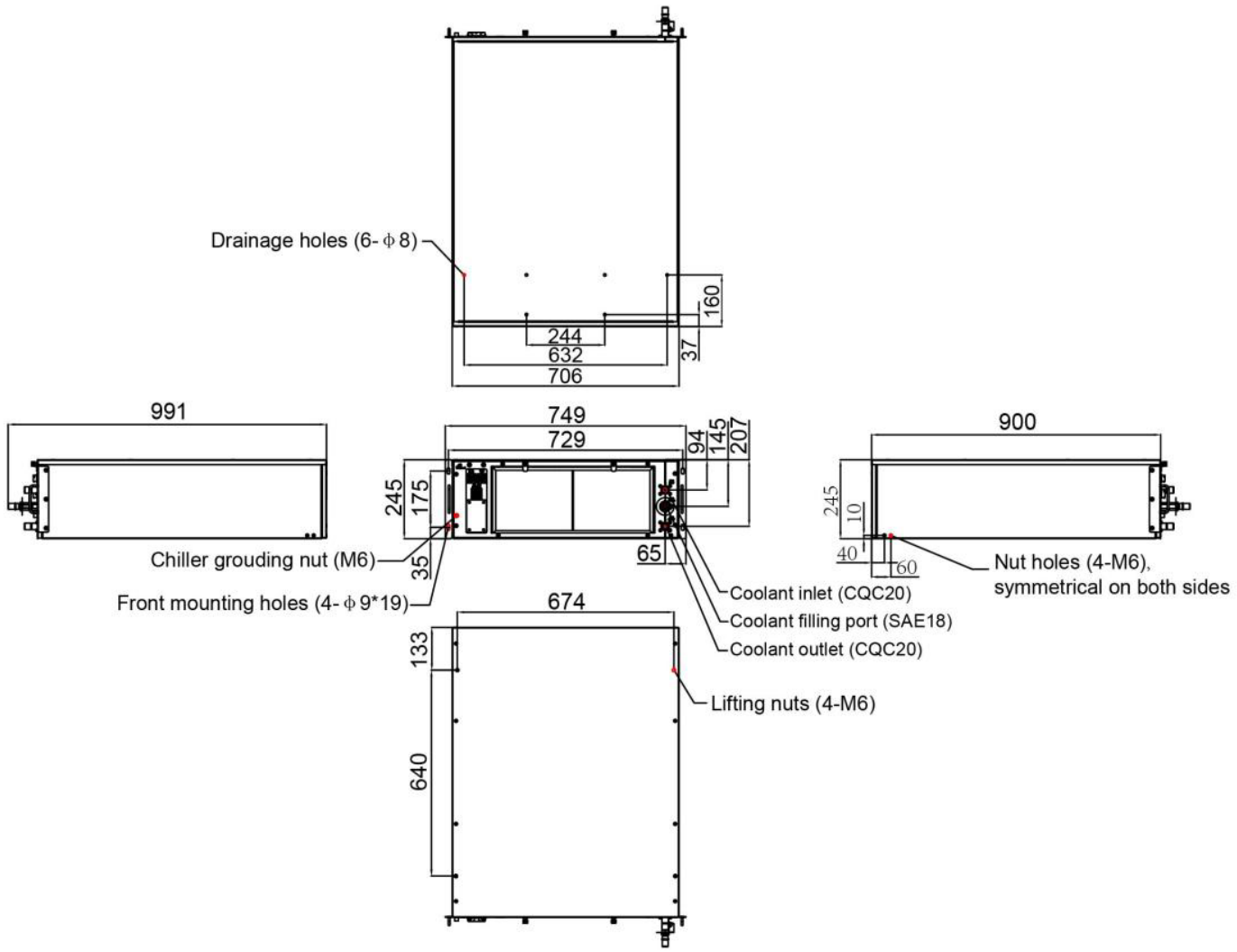


Figure 4-21 5kW Liquid-cooled Unit

The liquid-cooled unit is composed of a refrigeration cycle system and a cooling liquid circulation system,with the working process as follows:

1) The compressor starts when the outlet liquid temperature reaches the refrigeration set point to compress the gaseous refrigerant.The control system of the air-cooled chiller adjusts the rotation speed of the compressor motor according to the outlet liquid temperature or the demand issued by the upper computer to control the overall power and outlet liquid temperature of the unit.
2) The condenser condenses the high-temperature gaseous refrigerant into liquid,and the heat is discharged to the surrounding air through the condenser surface by the fan.
3) The electronic expansion valve throttles and reduces the pressure of the condensed refrigerant and injects it into the plate heat exchanger,where the refrigerant evaporates and absorbs the heat of the cooling liquid.
4) The circulating water pump delivers the cooling liquid to the plate heat exchanger for heat exchange with the refrigerant,and then transports the cooled cooling liquid into the container to cool the battery pack.

Technical Parameters

Name	Parameter	Remarks
Working Voltage	AC220V±10%,50/60Hz	-
Refrigerating Capacity	5kW	@W18/L35
Refrigerant	R513a	-
Coolant	50%ethylene glycol aqueous solution	-
Rated Circulation Flowrate	46.5@60kPa	L/min
Refrigeration Input Power	5kW	@W18/L45
Heating Capacity	2.5kW	Tu=10°C
Heating Input Power	2.5kW	Tu=10°C
Self-circulation Power	0.2kW	Water pump only in

		operation
IP Rating	IPX5	-
Corrosion Resistance Grade	C3-M	-
Dimensions	700*220*1000mm	WDH

4.9.2. Liquid Cooling Pipeline

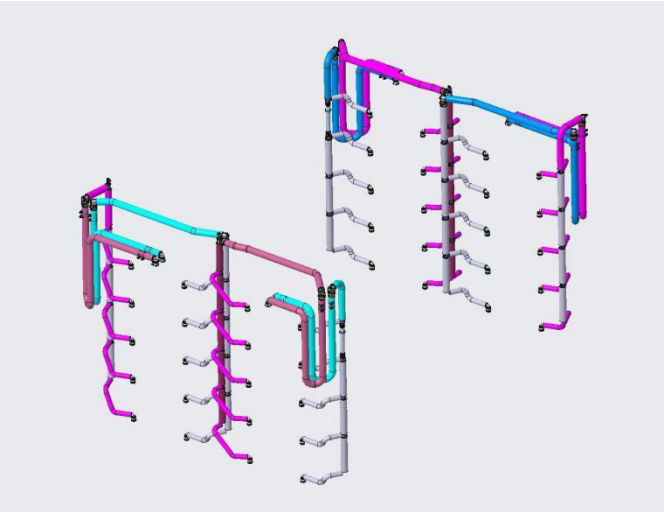


Figure 4-22 Liquid-cooled Pipeline

The liquid cooling pipeline adopts a right-in and left-out design,and is divided into two levels . the first-level pipeline is the cluster-level pipeline,and the second-level pipeline is the PACK-level pipeline.All pipelines are made of PA12 nylon hoses,connected by quick-plug joints using crimping technology,and flexibly connected by corrugated pipes between pipelines.The connection between the second-level pipeline and the battery PACK adopts a two-way shut-off valve design to ensure no cooling liquid leakage when the battery PACK is disassembled for maintenance.The two-level pipeline system distributes the cooling liquid in the container through different pipe diameters to ensure the battery temperature in the entire container is balanced and the temperature difference between batteries is controlled.

The liquid cooling pipeline system has an automatic exhaust function to discharge air in the liquid cooling system in a timely manner,reducing the impact of gas on heat exchange and the stability of the cooling liquid.The liquid cooling pipeline system is equipped with easily replaceable filters to ensure the cleanliness of the cooling medium.

The external pipeline components of the liquid cooling system are required to be thermally

insulated to prevent condensation.

4.9.3. Leakage Monitoring and Response

- Reducing Leakage Risks

1) Integrated design of the lower cabinet and the liquid cooling plate,with no joints or leakage points inside the battery PACK.
2) The first-level pipeline adopts nylon hoses that can effectively absorb assembly tolerances,and the sealing form is changed from stainless steel chuck to quick-plug form with lower leakage risk against vibration and impact.
3) The number of pipeline joints is minimized,and high-sealability pipe fittings and valves are adopted.
4) Pipeline joints,valves and other components are mainly arranged in the liquid-cooled unit cabin to reduce leakage risk points in the battery cabin.

- Leakage Monitoring and Alarm

1) A coupling criterion of pressure difference and liquid level is adopted to detect system leakage or blockage in advance.A flow meter can also be optionally equipped to further improve the sensitivity of leakage detection.
2) Alarms for liquid level changes and the number of automatic liquid replenishment times of the automatic liquid replenishment system are set to provide high early warning of system leakage.

- Leakage Response Scheme

1) After the system detects an abnormality,it estimates the leakage/blockage risk according to the leakage degree and stops the system operation in a timely manner to avoid the expansion of the abnormality.
2) Reliable leakage collection and discharge facilities are configured,which can not only reduce the spread of leaked cooling liquid,but also slow down the disorderly diffusion of flammable gases released by battery cell thermal runaway.

5. Equipment Operation

5.1. Hazards

5.1.1. Electric Shock Hazard

	Personnel will be exposed to a maximum voltage of 864 VDC from the battery pack of the liquid-cooled energy storage container. There is also the possibility of exposure to low-voltage and medium-voltage AC electricity. Arc flash and electric shock hazards are common at the ESS site. Sunpal encourages full compliance with the practices and procedures specified in NFPA 70E, including the use of personal protective equipment (PPE), to fully mitigate the hazards identified in site-specific arc flash studies. Emergency personnel should rely on standard operating procedures (SOPs) to respond to incidents occurring at power generation facilities.

5.1.2. Fire and Explosion Hazard

	The liquid-cooled energy storage container contains flammable fuels, ignition sources, and sufficient oxygen to cause fire spread. If not properly mitigated, fire and other extreme heat sources may cause cascading thermal runaway of batteries and release of combustible gases. If these combustible gases exist at a sufficient density, there is a risk of explosion. If there is a fire or other signs of thermal runaway in the liquid-cooled energy storage container or at the ESS site, it is recommended that first responders maintain a safe distance until entry into the ESS site is verified as safe in accordance with site-specific emergency response plans (ERPs) and SOPs.

5.1.3. Chemical Exposure Hazard

	The liquid-cooled energy storage container contains the following hazardous chemicals: LFP battery electrolyte. These chemicals may be harmful to both human health and the environment.

5.2. Operation Precautions

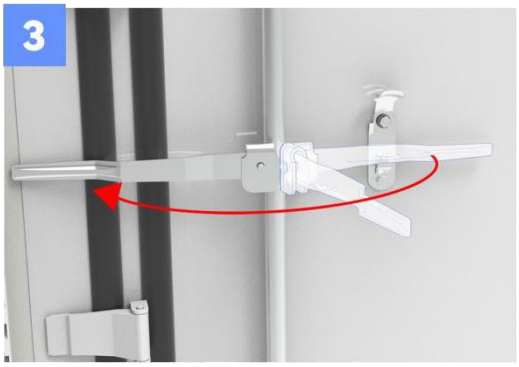
	The battery cannot be powered off. The following shutdown sequence can only isolate the battery and related hazardous voltages. Personnel must always exercise extreme caution and wear appropriate PPE.

	The complete ESS shutdown sequence will vary depending on the project-specific design. Always refer to site-specific schematics and manuals to ensure proper isolation of electrical equipment.
	All personnel operating the liquid-cooled energy storage container shall receive appropriate training and be qualified. Personnel shall read and understand all manuals and project documents and comply with the requirements and instructions contained therein.
	Prolonged shutdown of the thermal management and communication systems may result in equipment damage and failure to detect and communicate fault conditions.
	Disconnecting the BMS contactor under load may damage the BMS of the liquid-cooled energy storage container, and direct power-off may cause sticking of the main positive and main negative contactors. Use the emergency stop button only in emergency situations.
	Do not start the liquid-cooled energy storage container until the system has undergone comprehensive commissioning and inspection by Sunpal on-site technical personnel, or until all necessary regular maintenance has been performed.
	Do not modify or alter this user manual without the written permission of Elecnova.

	Be aware of the risk of hearing damage and wear hearing protection equipment.

5.3. Door Operation Method

5.3.1. Door Open



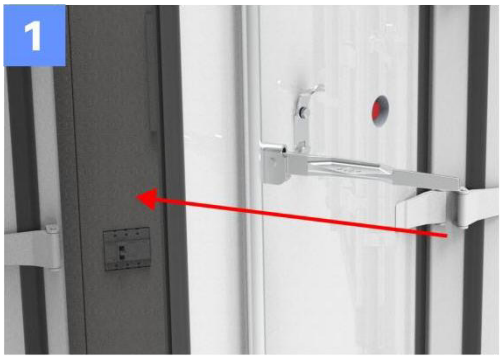
Step1:Locate the door lock shown as photo 1.

Step 2:Rotate the upper latch upward by 180°.

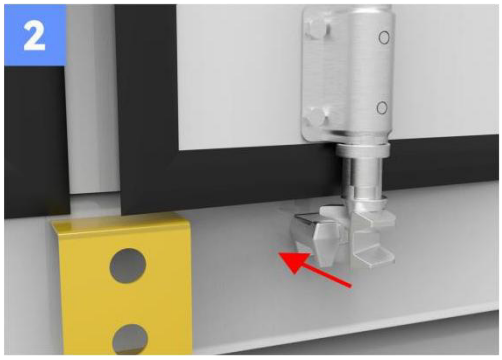
Step3:Rotate the door handle in the opposite direction by 180°,and you will feel the door pop open slightly.

Step4:Pull the door handle outward firmly,and the door will open accordingly

5.3.2. Door Close



Step 1:Push the cabinet door inward,but do not fully close it.



Step 2:Pay attention to the bottom of the cabinet door:the locking tooth at the lower end of the door rod must be inserted vertically into the latch at the bottom of the cabinet door

Step 3:Rotate the door handle until it is flush with the cabinet door,and then place it into the handle recess.

Step 4:Rotate the upper latch downward.

5.4. Connection and Power-On of Liquid-Cooled Container

5.4.1. Cable Connection

Please refer to the installation manual.

5.4.2. Inspection before Powering Up

ESS Container Unit Status Check

Inspection Items	Method	Requirement
Exterior of the Battery Container	Visual Inspection	No bumps,deformations or paint peeling
Container Door	Manual testing	There is no abnormality in opening and closing the door,no door gap,and the rubber sealing ring is well sealed
Container Door Lock	Manual testing	No malfunction
Cable appearance	Visual Inspection	The positive and negative cables are color-coded and clearly marked,and the insulation layer is not damaged
Code	Visual Inspection	The Container number,Rack number,Pack number,and high-voltage box are clearly and correctly marked
Nameplate	Visual Inspection,Tape Measurement	Whether Nameplate falls off or not,whether it is clear and correct
Warning signs	Visual Inspection,Tape Measurement	Clear and correct
LOGO	Visual Inspection,Tape Measurement	Clear and correct
Grounding identification	Visual Inspection	Clear and correct
Fire Signs	Visual Inspection	Clear and correct
High-voltage box serial number	Visual Inspection	Check if the serial number is correct

5.4.3. Overall Power-On Operation

	Before power-on, check that all circuit breakers are in the open state.

5.4.3.1. Switch Status Check

1. Check that the MSD of each PACK has been properly installed.
2. Check whether the DC circuit breaker on the high-voltage box panel is in the open position.
3. Check that the series power cables between each cluster of battery PACKs and between the battery PACKs and the high-voltage box are securely connected.
4. Check that the connection terminals of all communication and power supply cables are securely connected.
5. Check that the communication harnesses,power supply harnesses and power cables on the high-voltage box panel are correctly connected.
6. Check for any connection faults in the communication and power supply harnesses inside the integrated control cabinet.
7. Check that the UPS power unit and the battery are securely connected.

5.4.3.2. ECO-E10FT1044LP-2-S Power-On Operation

The power-on operation of the ECO-E10FT1044LP-2-S product is to start in the off-grid mode.

1. Start the UPS power battery mode operation according to the UPS power user manual. Close the 2QF9-1 and 2QF9-2 switches to complete the power-on of the internal control part.
2. Ensure that the PCS module inside the container is in a stopped state (with no indicator light on the PCS module). Sequentially close the QF1/QF2 switches of each high-voltage box. After the BMS is powered on, perform a self-check. The system status should indicate that the battery pack is normal. Then close the DC contactor and allow the battery pack to undergo charging and discharging operations. At this point, the indicator light of the high-voltage box will come on, and the PCS module will be powered on successfully.
3. Close the 3QF1～3QF4 circuit breakers, sequentially start the PCS module, and then close the 2QF1 switch to power on the auxiliary power system of the equipment.
4. Closing the 2QF9 switch will cause the UPS power supply to exit the battery mode and switch to

the mains power mode.

5. In sequence,close the following switches:
   a. Liquid cooling unit power supply switch 2QF2～2QF5
   b. Maintenance power socket power supply switch 2QF6
   c. Fire protection system power supply switch 2QF7
   d. Lighting lamp & cooling fan power supply switch 2QF8
6. After closing the QF0 switch (SPD protection switch) of the closed and connected cabinet, close the main switch 1QF1. After the mains power is connected to the container, the indicator lights on the left upper corner of the front panel of the STS module change from top to bottom. If the STS equipment is powered on normally, the POWER indicator light will light up and remain constantly on; if the STS equipment has a fault, the FAULT indicator light will show red, and the STS module will not be able to operate normally. Observe the PCS module. If a red light appears, check the phase sequence and voltage of the power supply of the STS cabinet to ensure they are normal

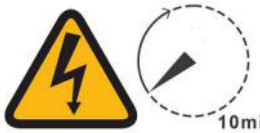
	When the system is disconnected from the grid, the FAULT indicator light of STS will remain constantly on. At this time, the fault is low grid voltage and low frequency, which is a normal alarm and does not require any handling. The RUN indicator light and the POWER indicator light will remain constantly off.
	When the power grid is connected to the system, the POWER indicator light of STS will remain constantly on. After the fault is automatically reset, the FAULT indicator light will remain off. Then, synchronization begins. The RUN light flashes. After the synchronization is completed, the equipment will be connected, and the RUN indicator light will remain constantly on.

7. Close the 4QF1 switch and connect the load.
8. Close the 5QF1 switch and connect the PV inverter.
9. Close the 6QF1 switch and connect the generator (a synchronizing device is required)

5.4.3.3. ECO-E10FT1044LP-2-N Power-On Operation

1. Close the QF0 switch of the POC cabinet (SPD protection switch)
2. Close the main switch 1QF1 of the closed container POC cabinet. After the mains power is connected to the container, the power-up process begins.
3. After normal connection to the mains power supply, close the 2QF1 switch of the POC cabinet to power on the auxiliary power system.
4. Close the 2QF9 switch to perform the UPS power supply self-check. After the self-check is completed, start the UPS power supply according to the UPS power supply user manual. Close the 2QF9-1 and 2QF9-2 switches to complete the internal power-on.
5. Ensure that the PCS module inside the container is in a shutdown state after power-on (confirm the PCS status through HMI or WEB). Sequentially close the QF1/QF2 switches of each high-voltage box. After the BMS is powered on, perform self-checks. If the system status is normal for the battery pack, close the DC contactor and allow for charging and discharging operations on the battery pack. At this point, the indicator lights of the high-voltage box will light up, and the main circuit of the container is powered on successfully.
6. Close the 3QF1 circuit breaker. Observe that the green indicator light of 1#PCS flashes and the cooling fan starts. If the red light appears on the PCS, check the phase sequence and voltage of the power supply in the POC cabinet to ensure they are normal. Once the 1#PCS module is normal, sequentially close the 3QF2～3QF4 circuit breakers and observe the status of 2～4#PCS modules.
7. In sequence,close the following switches:
   a. Liquid cooling unit power supply switch 2QF2～2QF5
   b. Maintenance power socket power supply switch 2QF6
   c. Fire protection system power supply switch 2QF7
   d. Lighting lamp & cooling fan power supply switch 2QF8

5.4.4. Overall Power-off Steps

	Before powering off the liquid-cooled energy storage container, ensure that the charge-discharge state is exited. It is strictly prohibited to cut off the power when it is live!!!
	The operation can only be performed after 10 minutes of discharge.

5.4.4.1. ECO-E10FT1044LP-2-S Power-off Operation

1. Confirm that the generator has stopped and disconnect the 6QF1 switch.
2. Confirm that the PV inverter has stopped operating and disconnect the 5QF1 switch.
3. Confirm that the electrical load has stopped operating and disconnect the 4QF1 switch.
4. After confirming that the PCS module is in a powered-off state, prioritize the disconnection of the QF2 switch on the high-voltage cabinet panel. The main circuit contactor in the high-voltage cabinet is disconnected, the green and red LED indicators on the high-voltage cabinet panel go out, the high-voltage cabinet is successfully powered down, and then disconnect the QF1 DC load switch on the high-voltage cabinet panel to ensure the disconnected state of the main circuit.
5. Disconnect the 3QF1～3QF4 circuit breakers, and the PCS module will be disconnected from the AC bus.
6. In sequence,disconnect the following switches:
   a. Liquid cooling unit power supply switch 2QF2～2QF5
   b. Maintenance power socket power supply switch 2QF6
   c. Fire protection system power supply switch 2QF7
   d. Lighting lamp & cooling fan power supply switch 2QF8
   e. UPS power supply output circuit power supply switch 2QF9-1and2QF9-2
   f. UPS power supply input circuit power supply switch 2QF9
7. Follow the operation instructions in the fire system user manual to shut down the fire control

panel.

8. Follow the UPS power supply user manual to turn off the UPS power supply.
9. Disconnect the 2QF1 switch, and cut off the power supply of the entire cabinet's electrical system. Then, immediately disconnect the 1QF1 main switch, and the container will be disconnected from the external power grid.

5.4.4.2. ECO-E10FT1044LP-2-N Power-off Operation

1. After confirming that the PCS module is in a powered-off state, prioritize the disconnection of the QF2 switch on the high-voltage cabinet panel. The main circuit contactor in the high-voltage cabinet is disconnected, the green and red LED indicators on the high-voltage cabinet panel go out, the high-voltage cabinet is successfully powered down, and then disconnect the QF1 DC load switch on the high-voltage cabinet panel to ensure the disconnected state of the main circuit.
2. Disconnect the 3QF1～3QF4 circuit breakers, and the PCS module will be disconnected from the AC bus.
3. In sequence,disconnect the following switches:
   a. Liquid cooling unit power supply switch 2QF2～2QF5
   b. Maintenance power socket power supply switch 2QF6
   c. Fire protection system power supply switch 2QF7
   d. Lighting lamp & cooling fan power supply switch 2QF8
   e. UPS power supply output circuit power supply switch 2QF9-1and2QF9-2
   f. UPS power supply input circuit power supply switch 2QF9
4. Follow the operation instructions in the fire system user manual to shut down the fire control panel.
5. Follow the UPS power supply user manual to turn off the UPS power supply.
6. Disconnect the 2QF1 switch, and cut off the power supply of the entire cabinet's electrical system. Then, immediately disconnect the 1QF1 main switch, and the container will be disconnected from the external power grid.

5.5. HMI Operation Instructions

5.5.1. HMI Function Overview

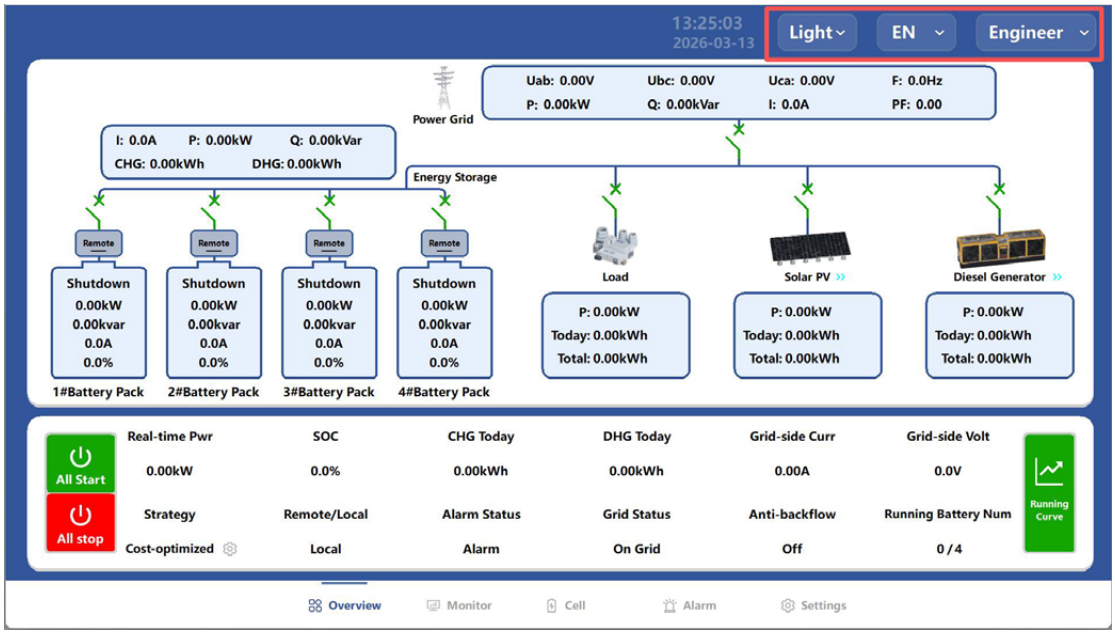
The HMI configuration screen serves as the core local control terminal for the energy storage system, enabling full-dimensional management of the system. It supports viewing device operation status, monitoring real-time operation data, analyzing historical data, and configuring operation strategy parameters. Meanwhile, it allows for convenient query of system alarm records, providing local visual control capabilities for the stable operation of the energy storage system.

5.5.2. HMI Basic Operations

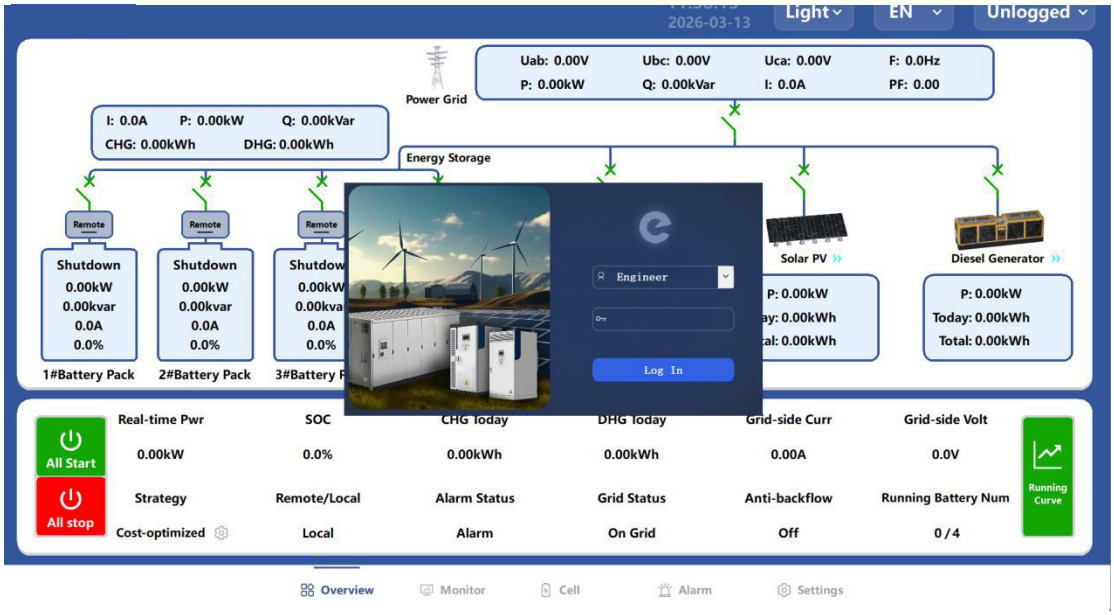
5.5.2.1. Account Login

The HMI configuration screen is equipped with two types of accounts: Engineer and Administrator, both of which have the authority to view and edit the system. In the unlogged state, only view operations are supported, with no editing authority. The exclusive authority of the Administrator account is to reset the password of the Engineer account.

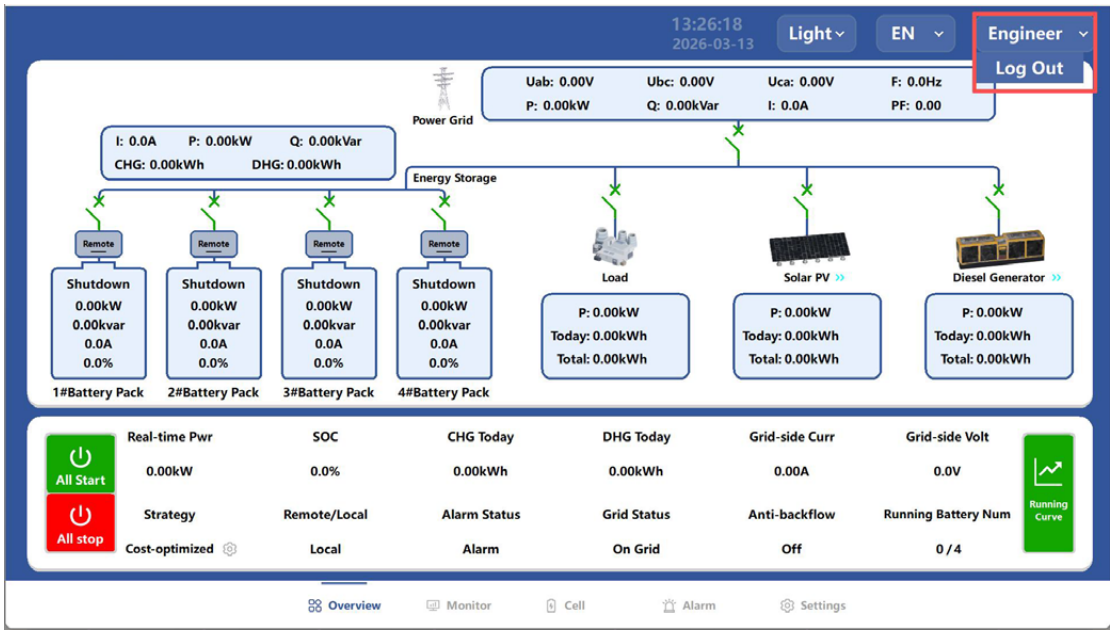
Opening the HMI defaults to the Overview interface, and the upper right corner of the interface is the entry for basic system operations.



Account Login Operation: Select the corresponding account type and enter the password correctly to complete the login; the system defaults to the Overview interface after login.

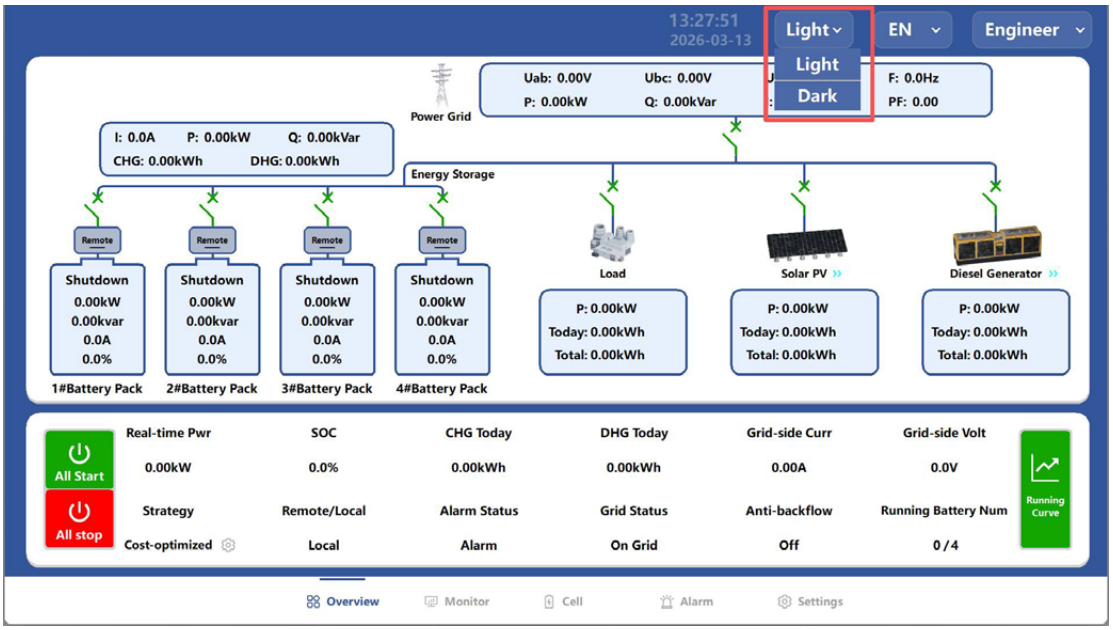


Logout Operation: Click the logged-in account name in the upper right corner of the interface, a "Logout" button will pop up, and click the button to complete the logout.



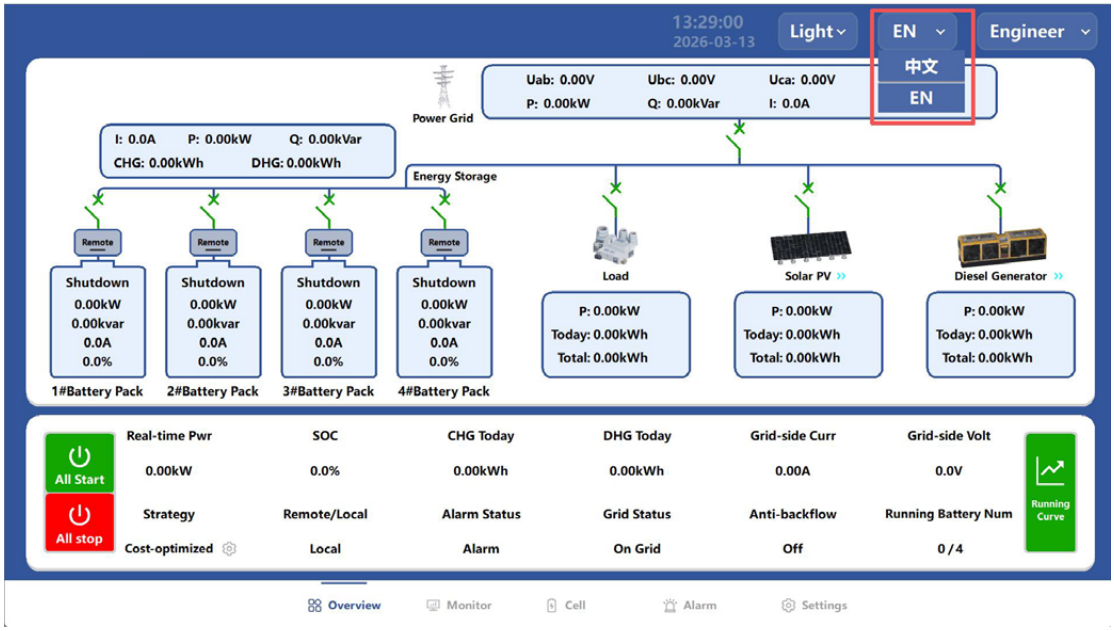
5.5.2.2. Display Mode Switch

The HMI configuration screen interface supports two display modes: Light and Dark. The one-click switch between the two modes can be completed at the corresponding setting entry of the interface according to usage scenarios and visual needs.



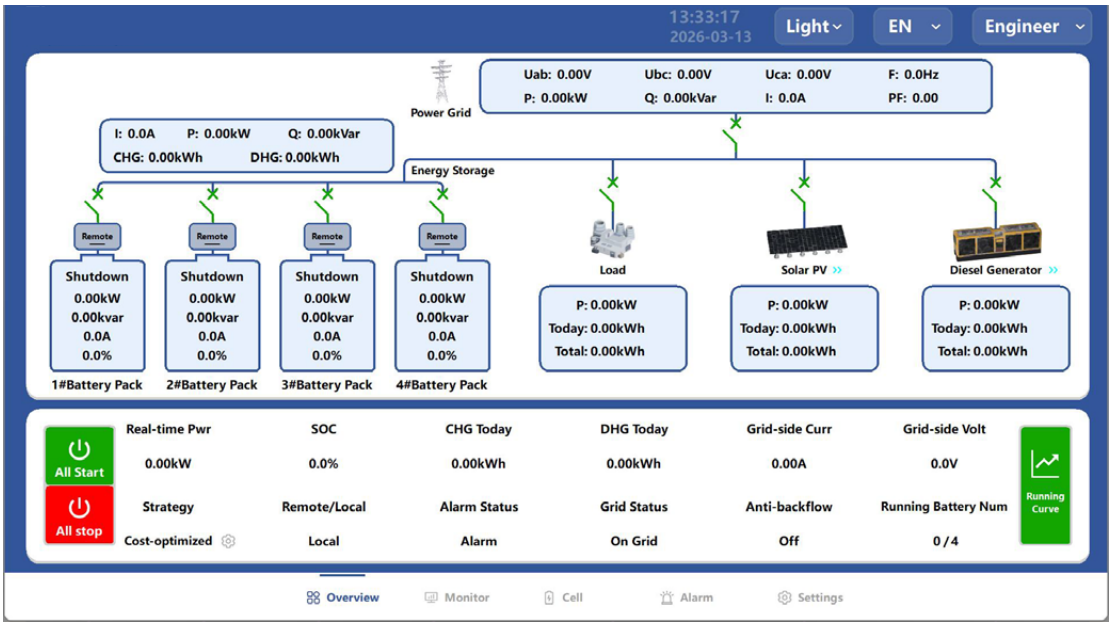
5.5.2.3. Language Switch

The HMI configuration screen currently supports dual-language display in Chinese and English to meet the language needs of different users, and the language can be quickly switched at the language setting entry of the interface.

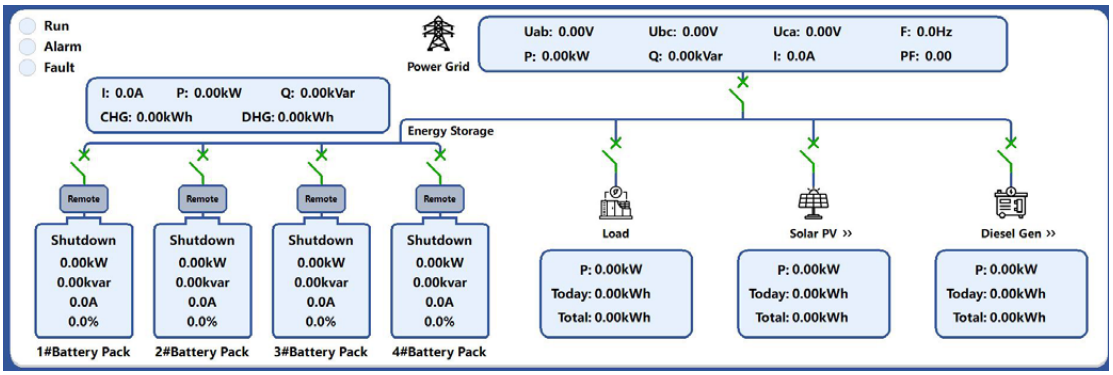


5.5.3. Overview

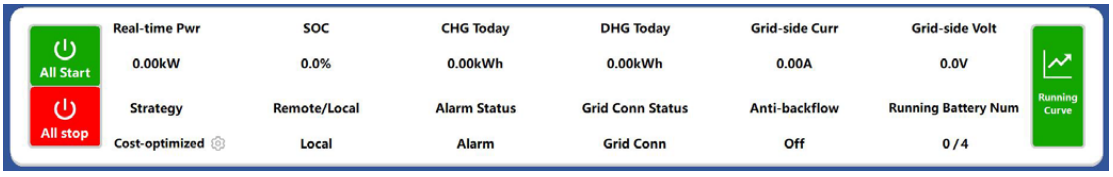
The Overview interface corely displays the overall operation data of the energy storage power station system, and provides functions such as device control, strategy configuration, and data curve viewing.



System Overall Topology Module：Intuitively display the real-time operation data of subsystems such as energy storage, power grid, load, photovoltaic, and diesel generator in the form of a topology map, enabling quick grasp of the basic overall operation status of the power station.



Data Monitoring Module：Display the core operation status of the energy storage power station, including operation strategy, anti-backflow function, total alarm status, remote/local status, and grid-connection status; it also supports one-click start/stop of all PCS devices and viewing of device operation curves, realizing core system status monitoring and quick operations.



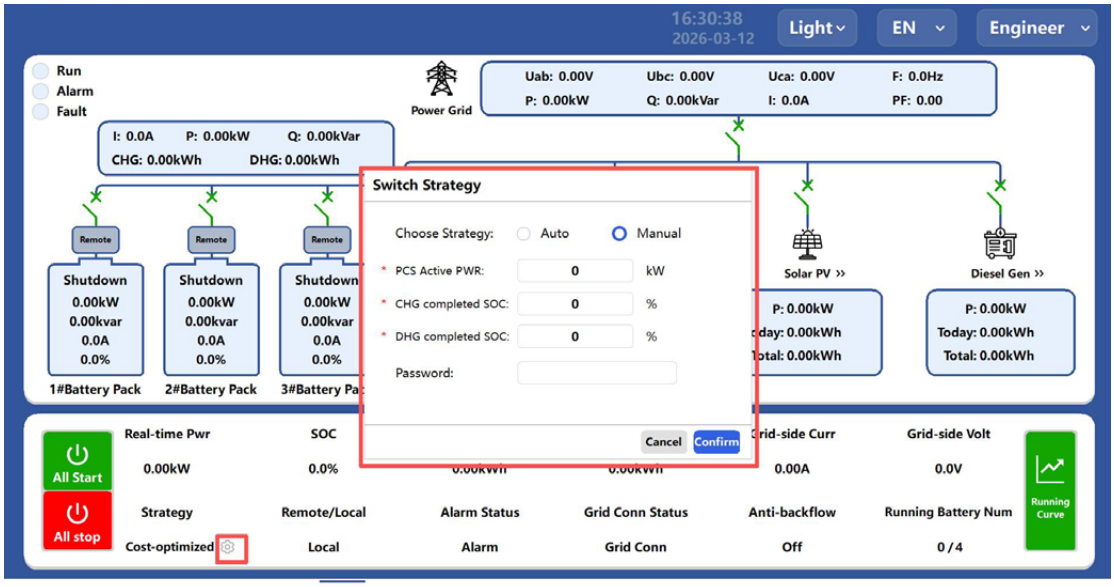
Total Alarm Status:When an abnormal alarm occurs on the device, the status is displayed as "Alarm"; when there is no abnormality in the device, the status is displayed as "Normal", which intuitively reflects the overall system alarm situation.

Remote/Local Status:When the status is "Local", the energy storage system executes the third-party EMS strategy; when the status is "Remote", the energy storage system executes the

Sunpal EMS strategy. The remote/local status can be switched through the ECO Energy Management Cloud Platform.

Grid-Connection Status:The "On Grid" status means the energy storage system operates in parallel with the public power grid; the "Off Grid" status means the energy storage system operates independently from the public power grid, clearly reflecting the system grid connection mode.

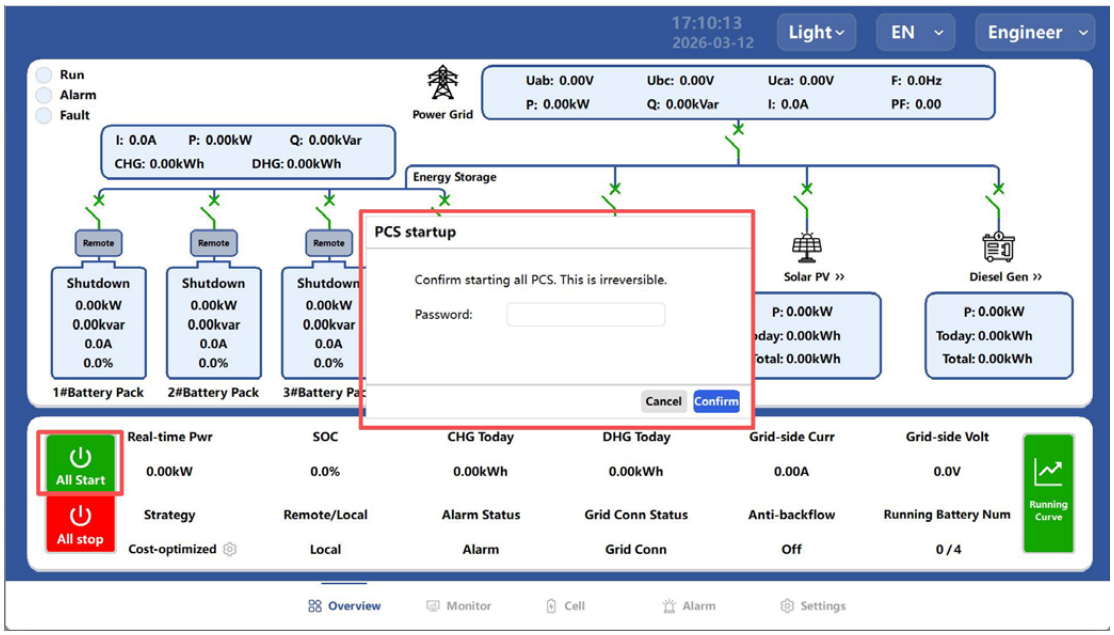
Operation Strategy:Display the strategy currently being executed by the EMS system of the energy storage power station, and support strategy setting and switching. When the Auto mode is selected, the system operates according to the strategy issued by the cloud platform; when the Manual mode is selected, the system operates according to the locally configured strategy.



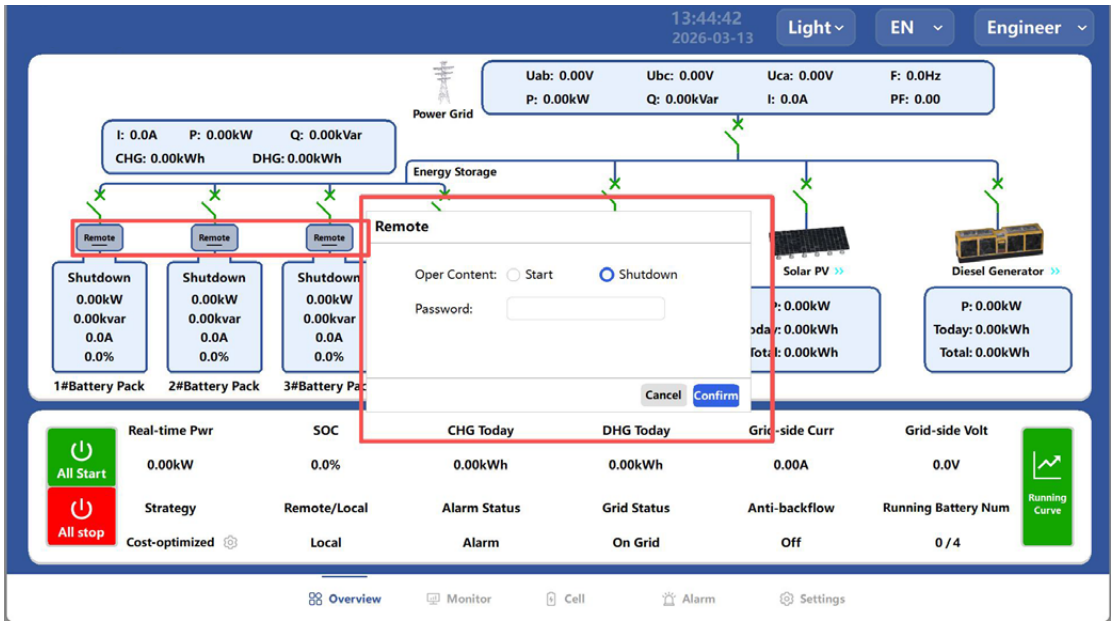
PCS Device Start/Stop:

1. One-click Start/Stop: Click the corresponding button to control all PCS devices to perform start/stop operations with one click. A password must be confirmed and entered before the operation, and the operation cannot be revoked after confirmation.
2. Single PCS Start/Stop: Click the "Remote Control" button of a single PCS device, select the start/stop operation, and enter the password for confirmation to complete the start/stop control of the single PCS device.

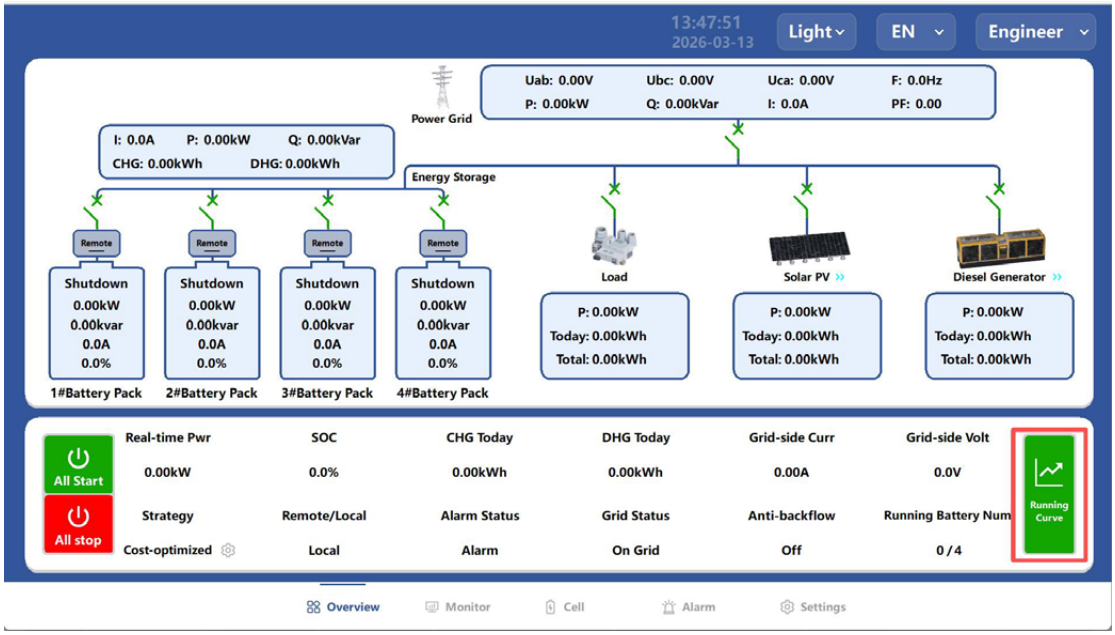
One-click Stop: Click the One-click Start and One-click Stop buttons to open the pop-up window.



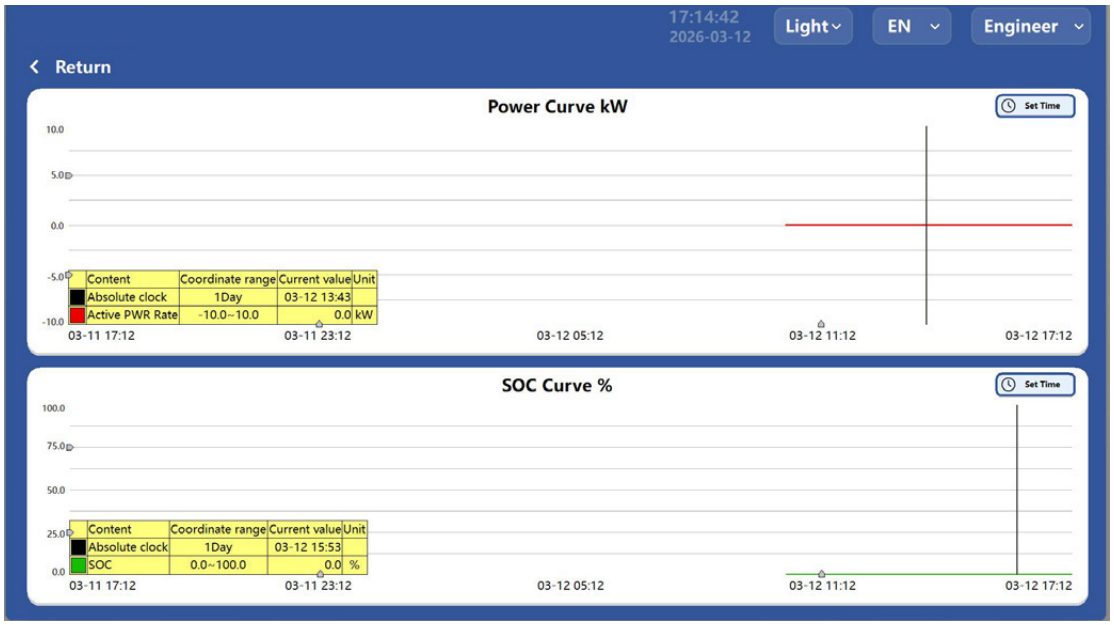
Single PCS Start/Stop: Click the remote control of a single PCS to control start and stop.



Operation Curves:Click the Operation Curve button to view the operation curve graphs of power parameters and battery SOC of the EMS system.



The curve display interface defaults to showing the latest one day of operation data, and historical operation data can be viewed by sliding the left and right cursors on the horizontal coordinate axis.

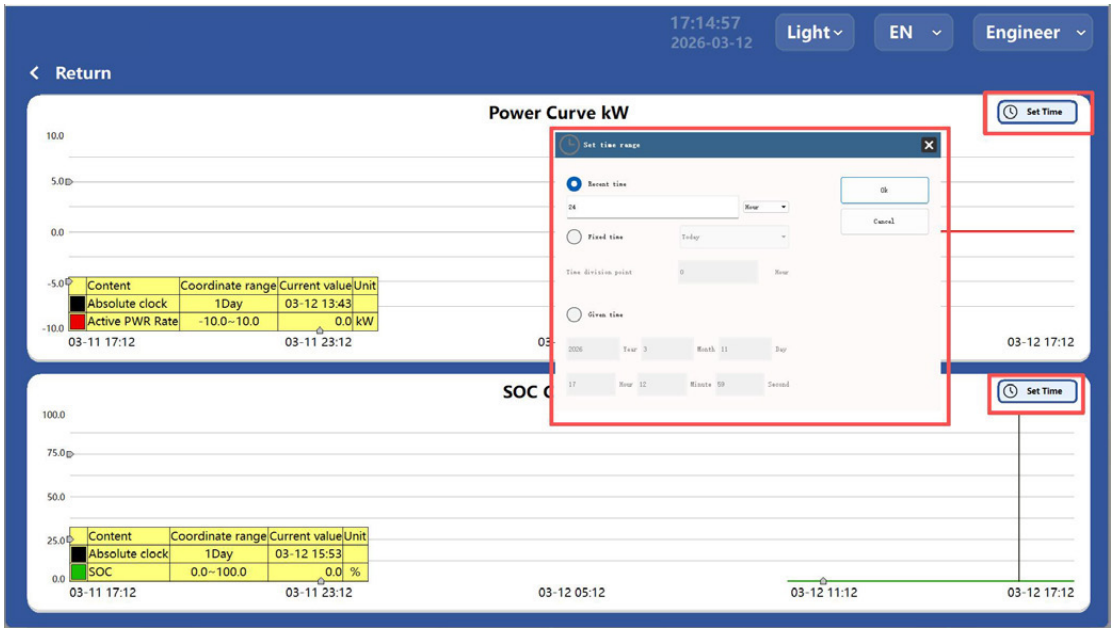


When viewing operation curves, the query time can be set as needed to view power and SOC curves. Click "Time Setting" to open the dialog box, and after setting the start time of the horizontal coordinate axis, the system displays the curve data for the subsequent 24 hours. Three time setting methods are supported:

Recent Time: Count back the set duration (e.g., 45 hours) from the current system time as the start time of the curve.

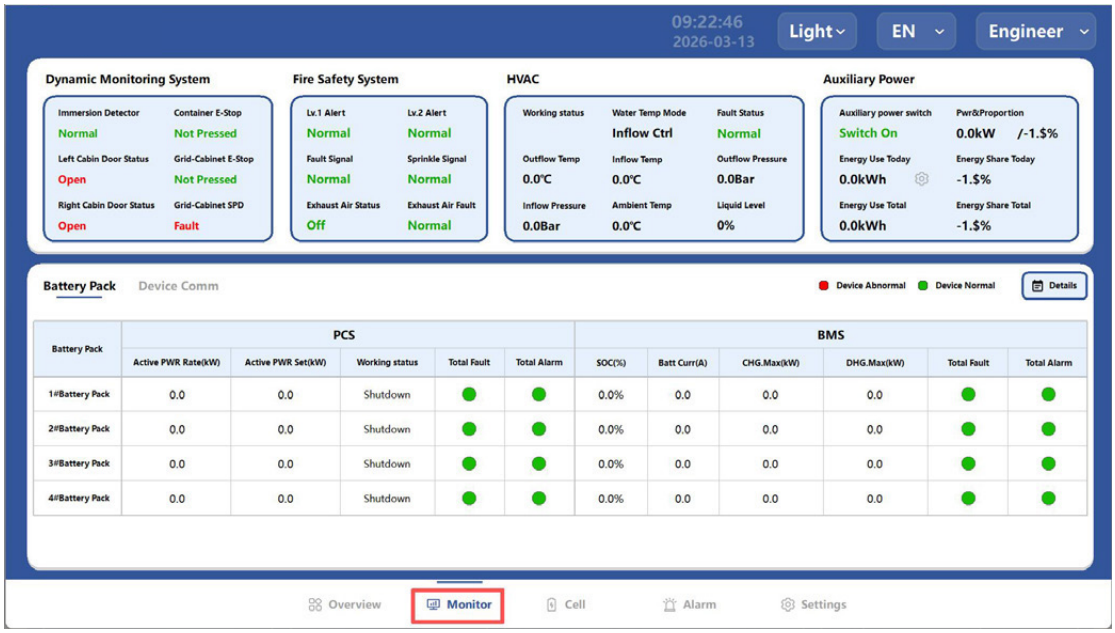
Fixed Time: Select an optional fixed time (e.g., the 4th of the current month), and take 0:00 of that time as the start time of the curve.

Specified Time: Manually fill in the specific year, month, day, hour, minute and second as the precise start time of the curve.

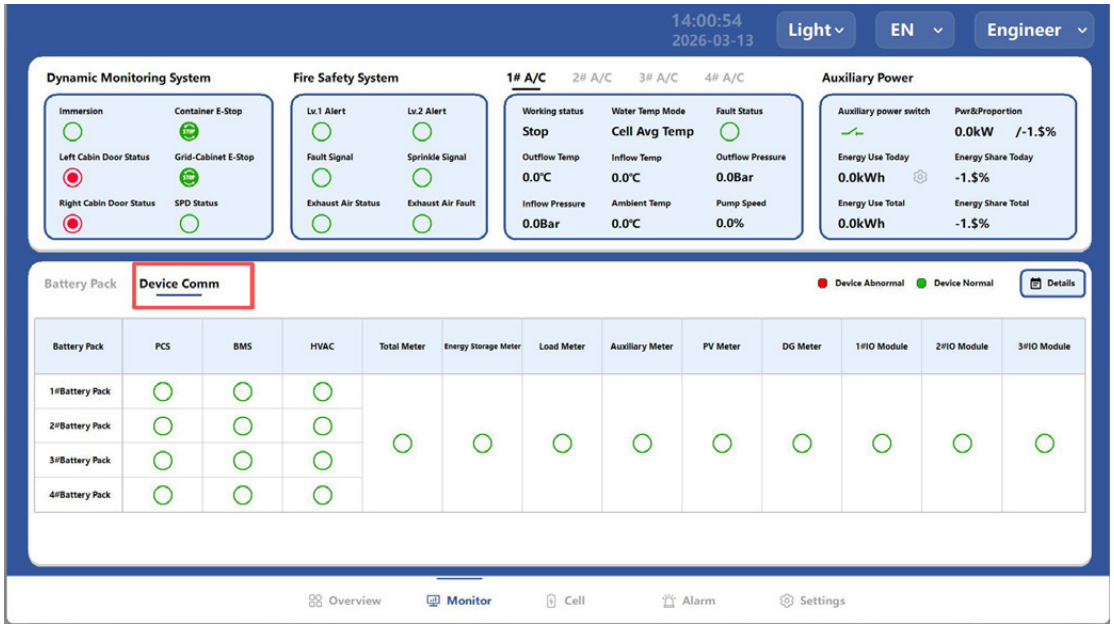


5.5.4. Monitoring

The Monitoring page can fully display the real-time operation data of the energy storage cabinet's dynamic monitoring system, fire safety system, air conditioning system, auxiliary power supply, PCS devices and BMS devices, and at the same time feed back the communication status of all devices. It also supports remote control operations on PCS and BMS devices. The core functions are as follows:



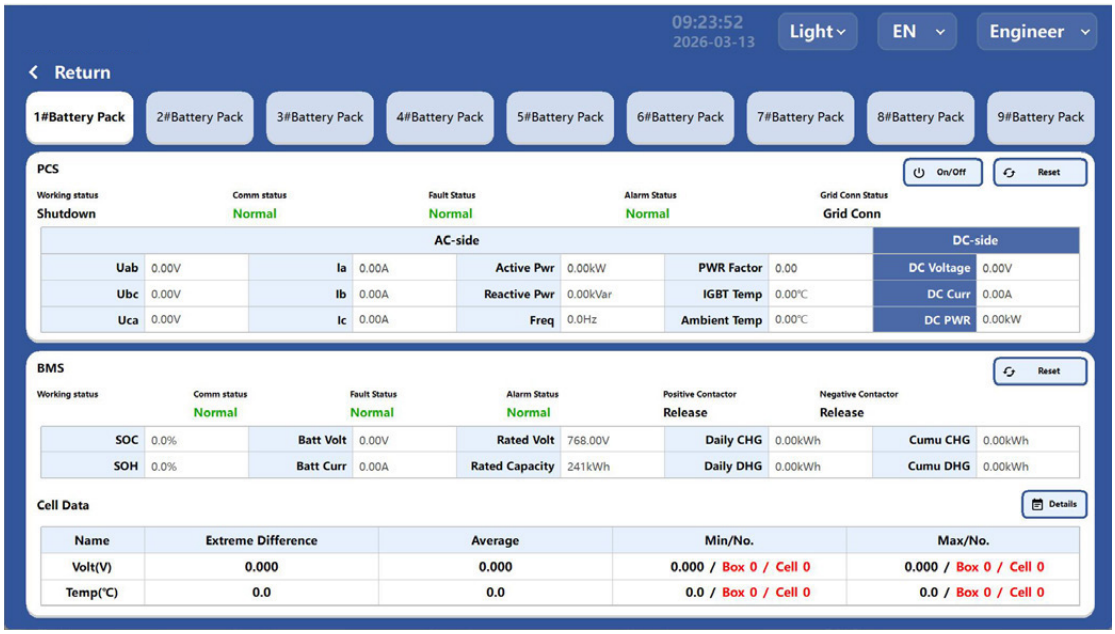
Device Communication:Click the Device Communication tab to view the current communication status of all devices in the system.



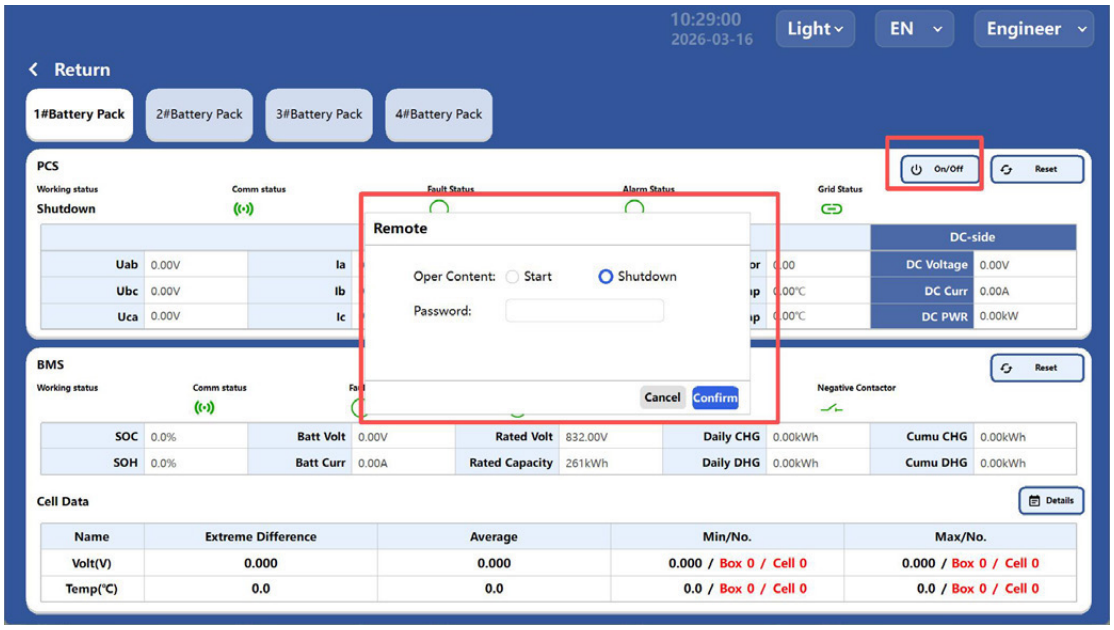
Click Details to enter the battery pack monitoring page, where you can switch battery packs to

view the operation parameters of each battery pack.

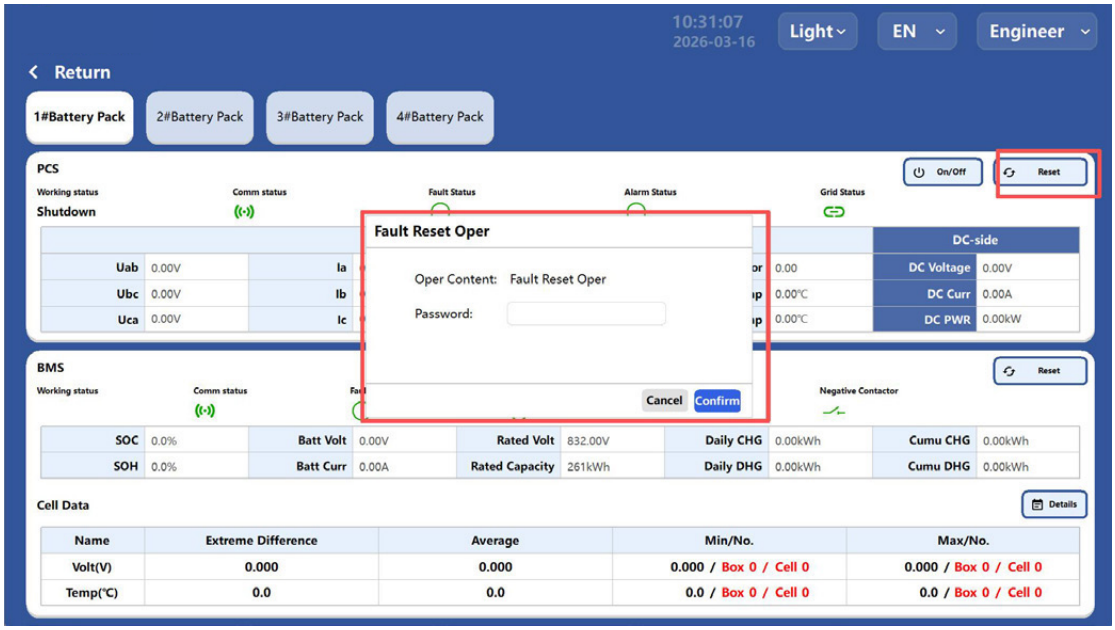
Battery Pack Details:In the battery pack details interface, you can view the operation of a single battery pack by switching the battery pack in the top menu bar. The battery pack interface allows viewing the operation status of a single battery pack, controlling PCS start/stop, and resetting PCS and BMS faults.



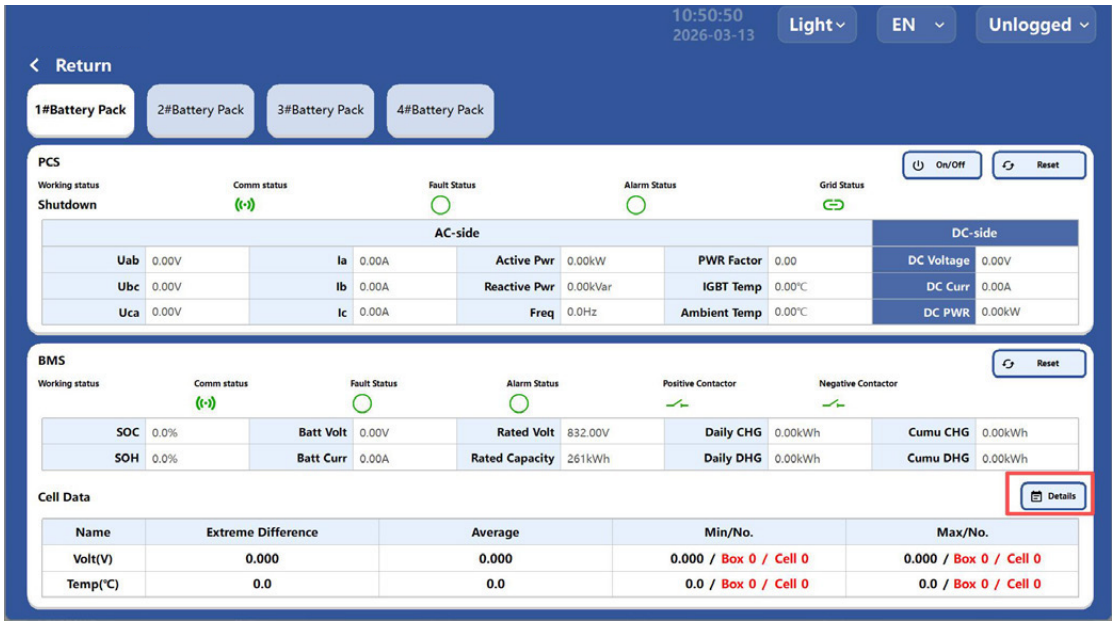
PCS Start/Stop Control:Realize the start and stop control operations of PCS devices.



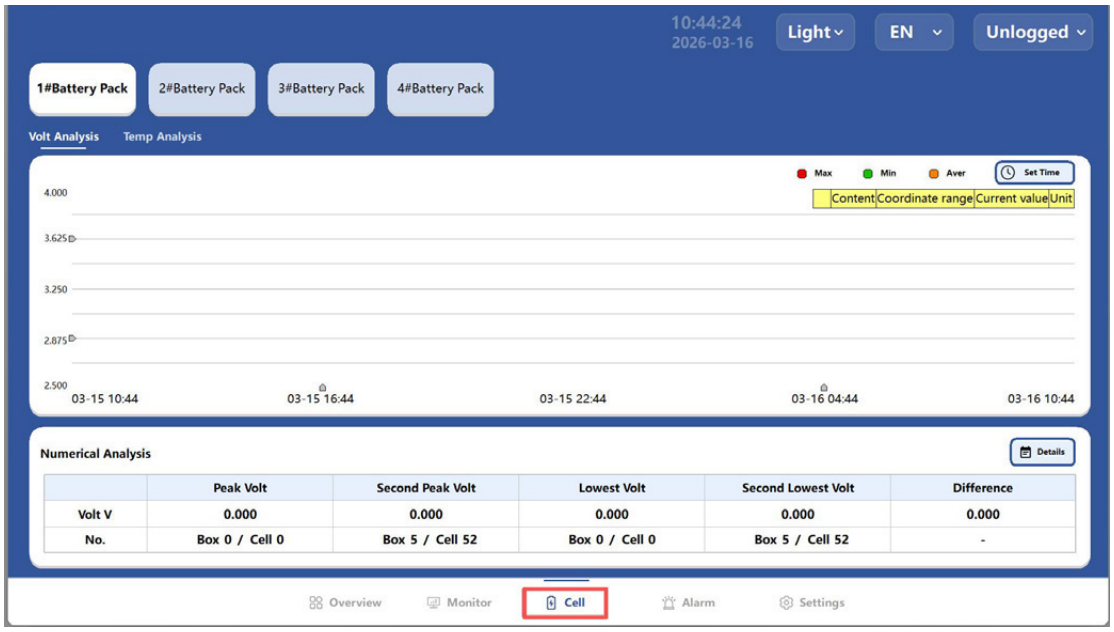
PCS Fault Reset:When a PCS device malfunctions, it is used to eliminate the device fault information and restore normal operation.



Cell Details:Click Details in the battery pack interface or select the "Cell" menu from the bottom menu bar to enter the cell analysis interface, where you can view the cell operation status and historical data.



Voltage Analysis:Click "Voltage Analysis" to display the real-time data curves of the maximum, minimum and average values of the cell voltage of the energy storage cabinet. Historical data can be viewed by dragging the coordinate cursors left and right; at the same time, the maximum, second maximum, minimum, second minimum voltage values and the corresponding cell numbers can be viewed to accurately grasp the cell voltage distribution.

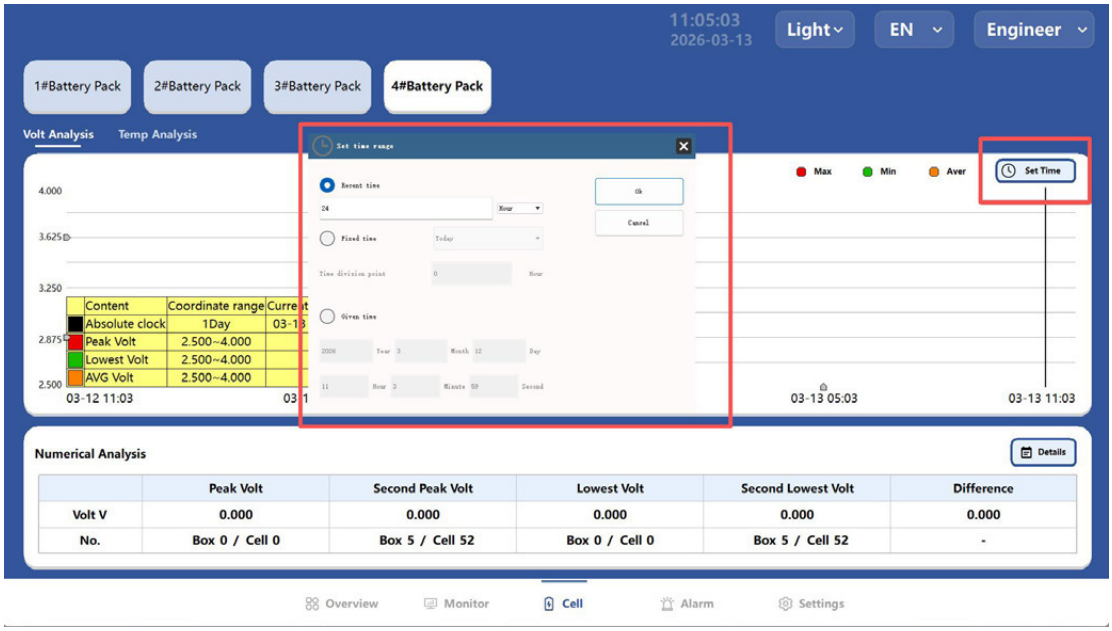


Click "Time Setting" to open the dialog box, and after setting the start time of the horizontal coordinate axis, the system displays the curve data for the subsequent 24 hours. Three time setting methods are supported:

Recent Time: Count back the set duration (e.g., 45 hours) from the current system time as the start time of the curve.

Fixed Time: Select an optional fixed time (e.g., the 4th of the current month), and take 0:00 of that time as the start time of the curve.

Specified Time: Manually fill in the specific year, month, day, hour, minute and second as the precise start time of the curve.

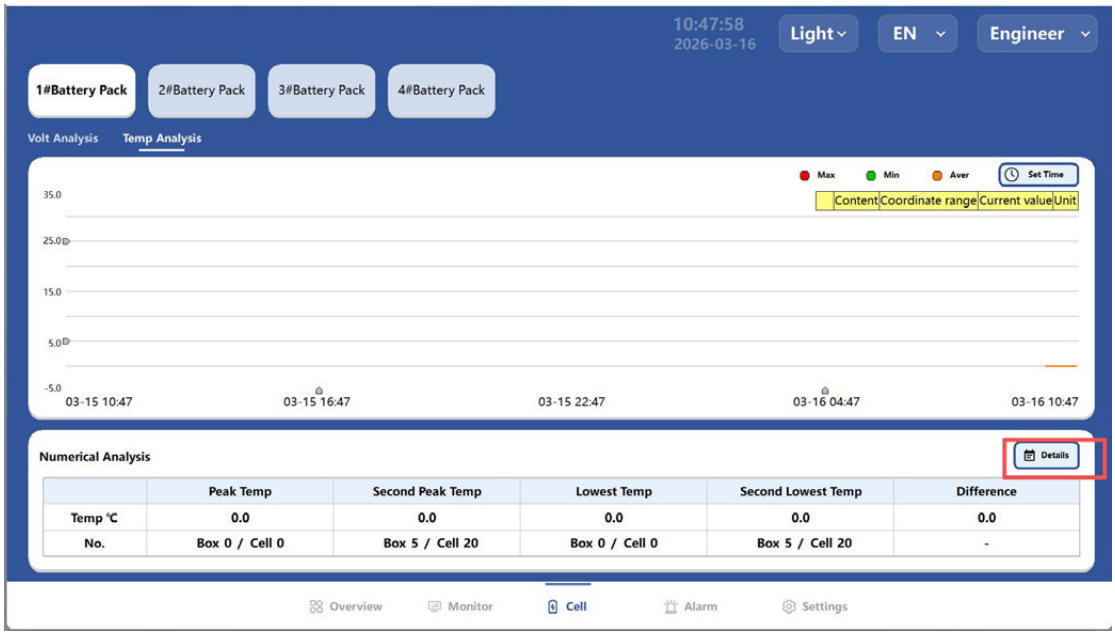


Temperature Analysis:Click "Temperature Analysis" to display the real-time data curves of the maximum, minimum and average values of the cell temperature of the energy storage cabinet. Historical data can be viewed by dragging the coordinate cursors; at the same time, the maximum, second maximum, minimum, second minimum temperature values and the corresponding cell numbers can be viewed to detect abnormal cell temperatures in a timely manner.

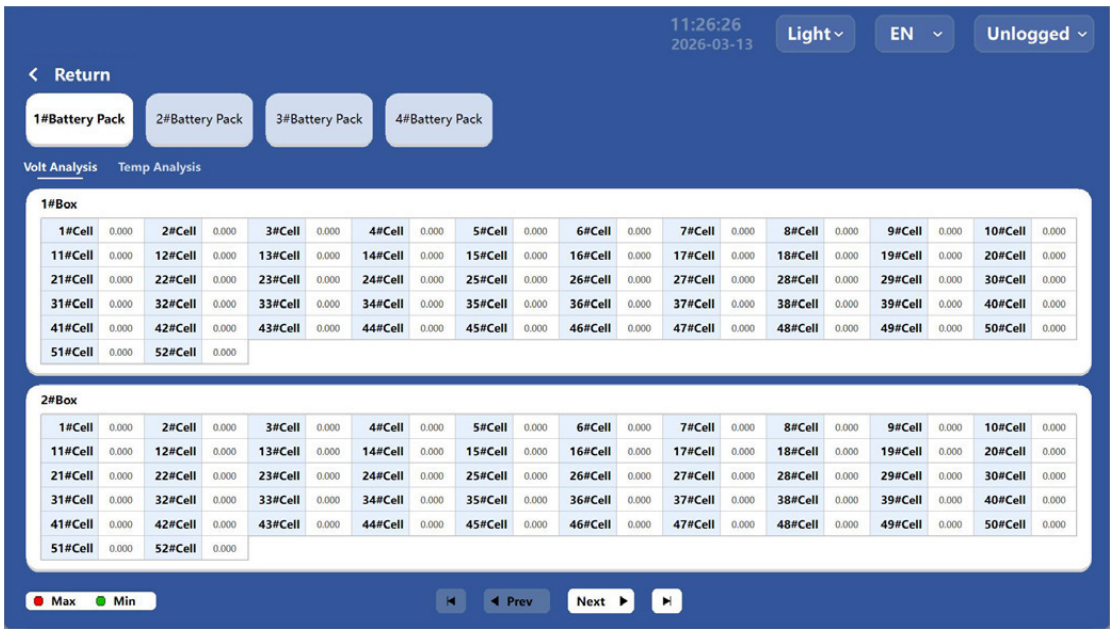
5.5.5. Cell

Display the real-time voltage and temperature data of each cell, in which the maximum cell voltage/temperature value is marked in red and the minimum value in green to intuitively distinguish abnormal cells.

Click Details in the numerical analysis bar to enter the cell data analysis interface.

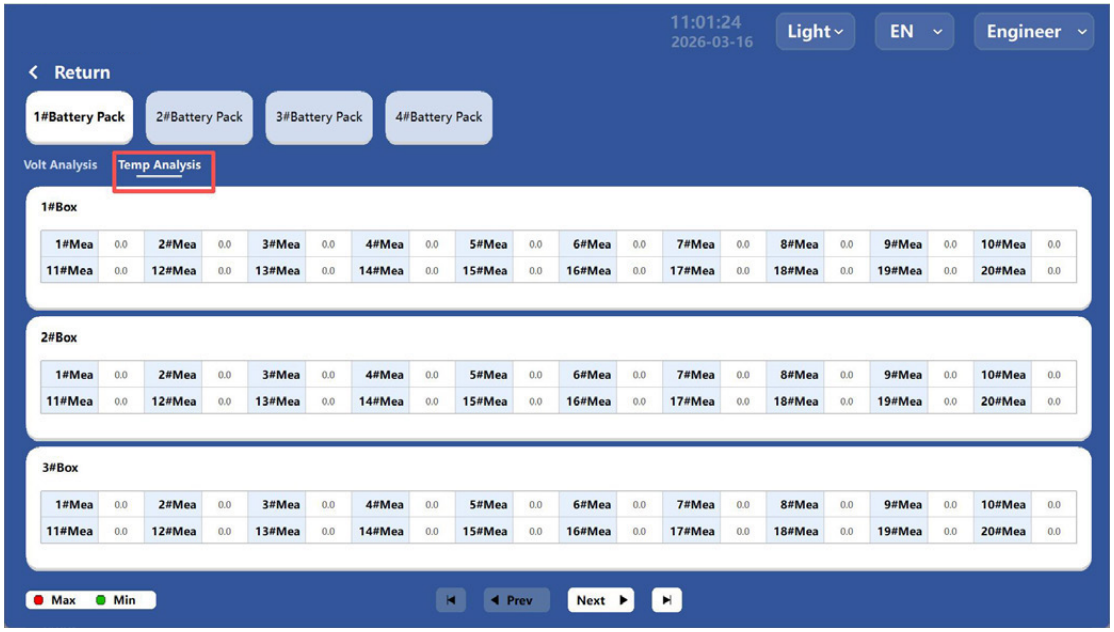


Voltage Analysis:Voltage Analysis displays the real-time voltage of each cell of the energy storage cabinet, with the maximum and minimum cell values distinguished in red and green respectively. It supports page up and page down to view cell data.



Temperature Analysis:Temperature Analysis displays the real-time temperature of each cell of the energy storage cabinet, with the maximum and minimum cell values distinguished in red and

green respectively. It supports page up and page down to view cell data.



5.5.6. Alarm

Click the "Alarm" in the bottom menu bar to enter the alarm management interface. The system centrally displays all abnormal alarm information of the energy storage system, which is divided into two modules: Real-time Alarm and Historical Alarm, realizing the full life cycle management of alarm information.

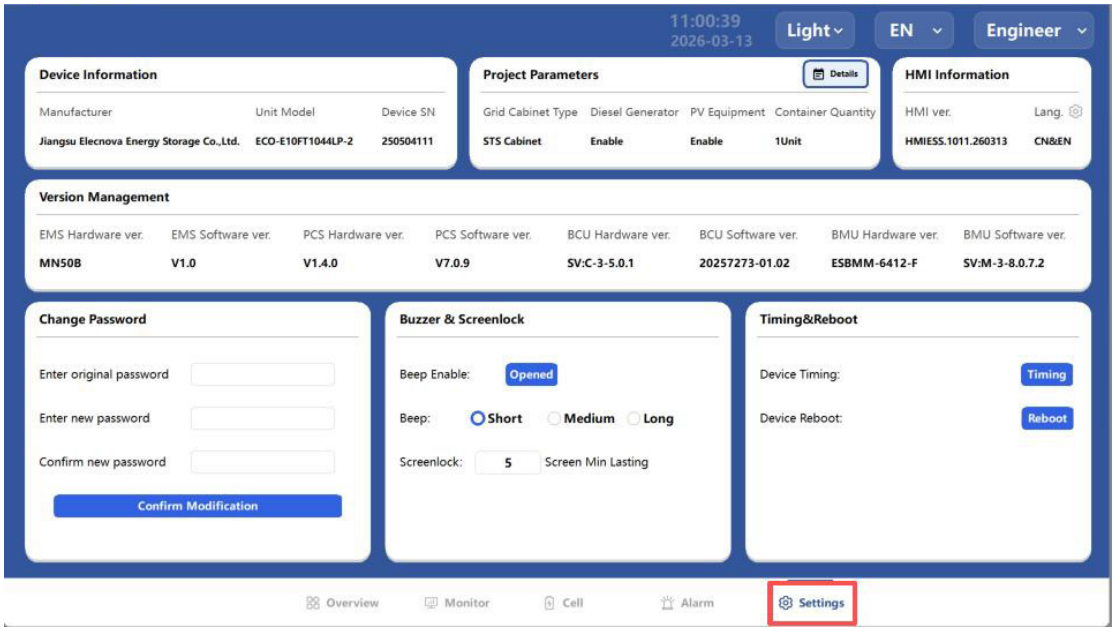
Real-time Alarm:Display the current abnormal alarm information of the energy storage system, including the date, time and specific alarm description of the alarm occurrence, and timely feed back the real-time abnormal status of the system.

Historical Alarm:Click "Historical Alarm" to switch to the corresponding module, which displays all

past alarm records of the energy storage system, including alarm number, occurrence date, time, alarm description and alarm end time; it also supports custom query time and clearing historical alarm records, facilitating the screening, viewing and management of historical alarm information.

5.5.7. Settings

Click the "Settings" in the bottom menu bar to enter the system setting interface, where you can view and configure project information, HMI parameters, version management, buzzer & screen saver, device information and warranty information, and also support operations such as device time synchronization and password modification. Note: All modification operations of setting parameters can only be performed after logging in to the account, and only view operations are supported in the unlogged state.



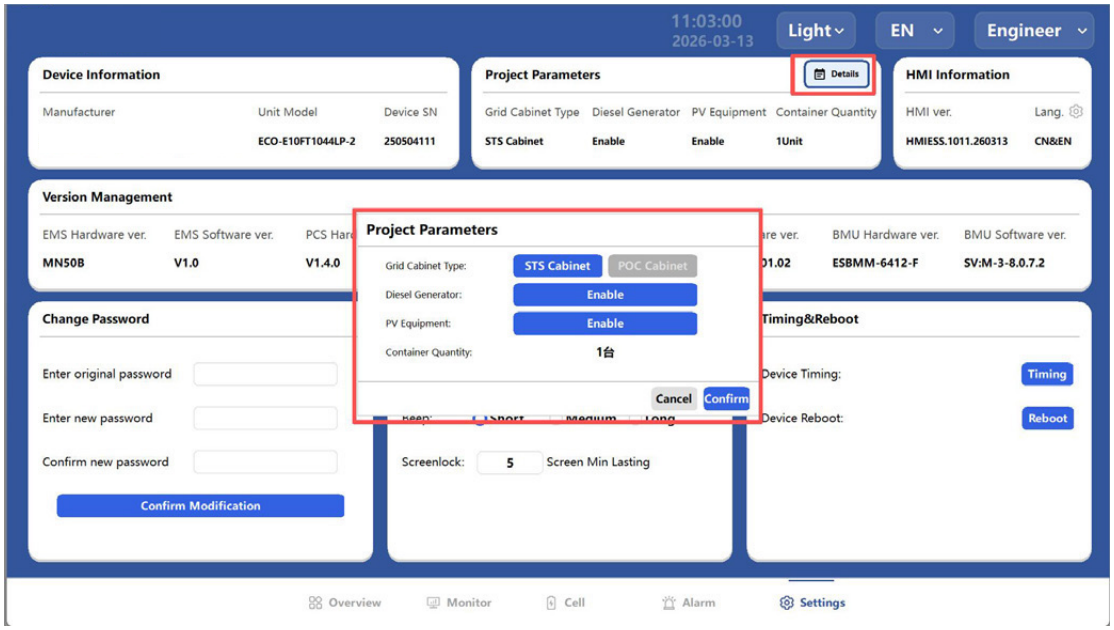
Project Settings:

Support setting parameters such as system structure and device model.

Grid Cabinet Type: Set different models of STS cabinet or POC cabinet (selected according to the on-site project structure).

Diesel Generator: Set whether there is a diesel generator in the system.

Photovoltaic Equipment: Set whether there is photovoltaic equipment in the system.



Device Information: Display the device manufacturer name and the model of the energy storage cabinet.

HMI Information: Display the version number of the HMI program and the supported languages.

Version Management: Support viewing and setting the hardware and software version numbers of the EMS system, PCS devices and BMS devices.

Password Modification: Modify the login account password.

Buzzer & Screen Saver: Set the buzzer alarm duration when an alarm occurs; if the HMI screen has no operation within the set time, the logged-in account will automatically log out and enter the screen saver interface.

Time Synchronization & Reboot: Click the Time Synchronization button to synchronize the time of the HMI screen with the time of the EMS all-in-one machine. Click the Reboot button to restart the HMI screen.

5.6. Operation Instructions for BMS Upper Computer

5.6.1. Preparations before Debugging of BMS Upper Computer

(1) According to the installation manual, find and connect the corresponding debugging port: During the debugging/testing of the battery system of the liquid-cooled energy storage container, connect the CAN card to the BMS debugging CAN interface of the ID3 terminal block of the grid-connected cabinet;

(2) Before applying low-voltage power, check whether the voltage of the power supply is within the normal system voltage range. For a 12V (24V) system, the power supply is generally required to be within the range of DC9–16V (DC22–32V);

(3) Before applying low-voltage power, check the wiring sequence of H and L of the CAN card. Use a multimeter to measure whether the resistance between CANH and CANL is approximately 60Ω after connecting the CAN card;

(4) Before applying low-voltage power, check the wiring sequence of the power supply V± again;

(5) Check and confirm the correspondence between the script ControlCAN.dll in the upper computer installation package and the CAN card model;

(6) Check the correspondence between the system configuration file EvbmaServer.ini and the CAN card model, and check the baud rate;

(7) Check whether the parameter configuration file EVBCM_Para_new.ini is consistent with the design parameters of the battery system.

①	Note: The software installation package of CAN only recognizes “ControlCAN.dll”. Depending on file size, 52k is applicable to ZLG CAN card, and 36k is applicable to CAN analyzer (CANalyst-II). CAN tools of different categories need suffix for switching.

②	The configuration file of project parameter corresponds to "Default Value" column in the configuration table of master-slave parameters on upper computer interface.
③	Configuration of Baud Rate
④	For types of CAN tools, the applicability of CAN tools except for the following 22 types needs to be confirmed with the manufacturer.
⑤	6 Common CAN Cards (Recommended by Manufacturer)

Note: The CAN software installation package only recognizes "ControlCAN.dll". There are differences in file size. The 52KB version is applicable to ZLG CAN cards, and the 36KB version (ControlCAN - Analyzer 36KB.dll) is applicable to CAN analyzers (CANalyst - II). Different types of CAN tools require suffix switching.

（8）List of 6 commonly used CAN cards:

(9) A computer using CAN software for the first time needs to install the CAN driver.

5.6.2. Data Viewing on Upper Computer

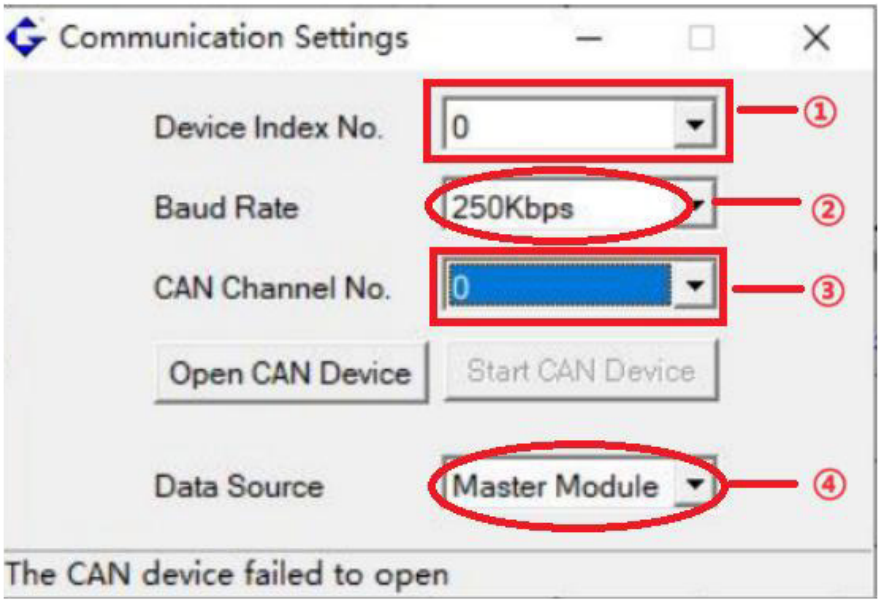
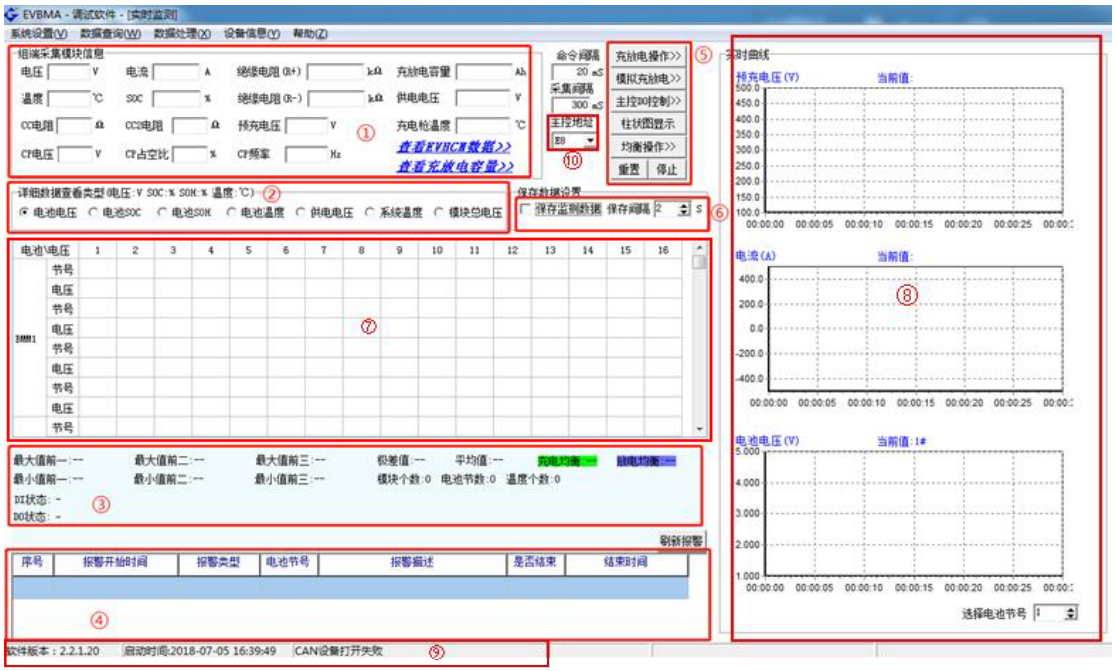


Figure 3-3 BMS Upper Computer Communication Settings Interface

①	The CAN card device number needs to be distinguished when multiple CAN cards are shared on one computer
②	System baud rate
③	CAN card channel configuration, 0 represents "channel 1", 1 represents "channel 2"
④	The "master control mode" is suitable for working conditions with master control, while the "slave control mode" is suitable for working conditions with only slave control



It can be seen from the above figure that the Battery Management System (BMS) is divided into 10 areas:

Area 1: Group - end data of the battery system;

Area 2: Category of single module data of the battery system;

Area 3: Data status of the battery system;

Area 4: Internal network alarm information of the battery system;

Area 5: Manual simulation operations of the battery system. The current system can simulate "DO Control"; "Reset" is the upper computer restart button;

Area 6: Data saving and saving interval;

Area 7: Detailed single - cell data of the battery system;

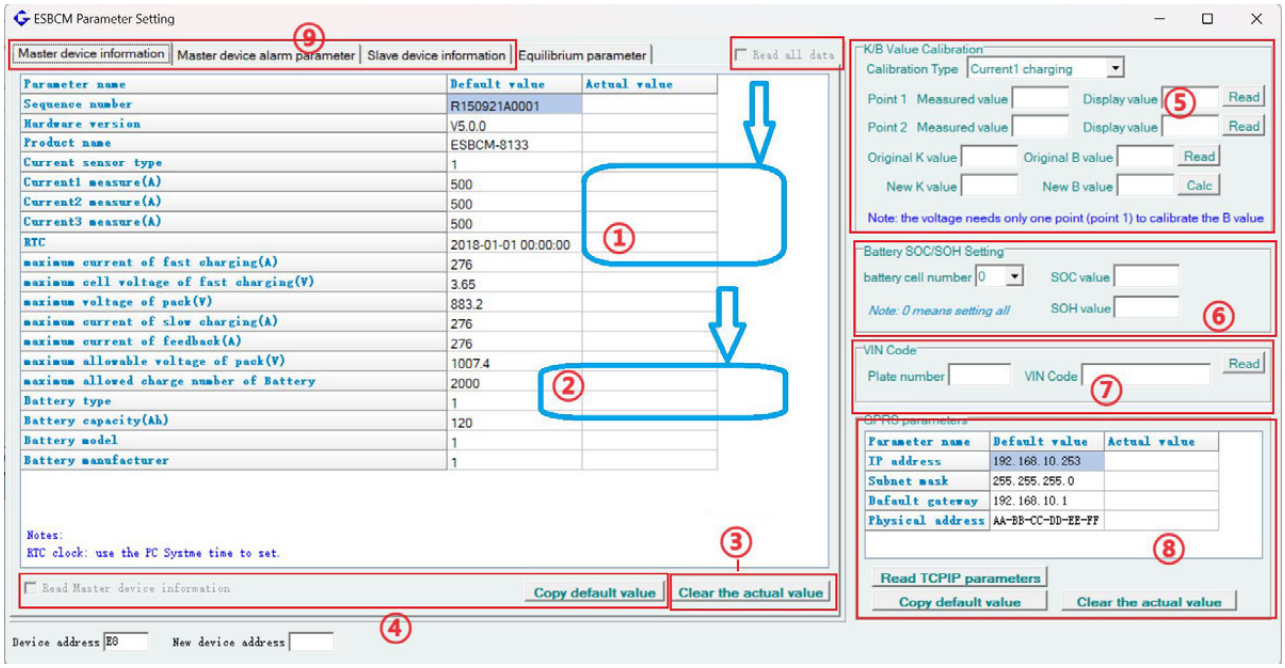
Area 8: Data curve of the battery system;

Area 9: Upper computer version, startup time and CAN card opening status;

Area 10: Master control station address. E8 corresponds to Master Control No. 1, followed by E8/9/A/B/C/D/E/F in sequence.

WARNING	*When manually simulating the closing of DO on the upper computer, it is necessary to confirm that the load end is in a no - load state and confirm the logical relationship. Unauthorized closing may lead to safety accidents and system damage.*
CAUTION	*Before opening the upper computer, confirm that other CAN software has been closed; otherwise, software errors may occur.*

5.6.3. Upper Computer Parameter Configuration Interface



①	To modify the parameters, you need to uncheck “Read All”; after the parameters are modified, you need to check “Read All” to inspect whether the actual values have be modified as necessary.
②	The “default value” corresponds to the parameter configuration table EVBCM.Para_new.ini in the host computer installation package; “Actual value "refers to

	the design parameters of the battery system
③	Refresh button
④	Read Device Information: Read the configuration parameters of current page, and uncheck corresponding option when modifying the parameters; Set All Parameters: Send the currently displayed parameters of all actual value columns to configuration table software for modification. Copy Default Value: Copy the data from "Default Value" column to "Actual Value" column.
⑤	Battery system current, voltage op amp coefficient: 1. "Read" is the current coefficient; 2. "Setting" is the modification factor.
⑥	SOC/SOH Manual Correction Window: 1. "Cell No. 0" represents all cells of battery system; 2. The other cell Nos represent the data of corresponding cell.
⑦	Vehicle Identification Number
⑧	GPRS Data Window

5.7. Operation Instructions for WEB Platform

Please refer to the User Manual of ECO - EMS - CLOUD Energy Management System WEB P*latform.*

5.8. Operation Instructions for Mobile APP

Please refer to the User Manual of ECO - EMS - CLOUD Energy Management System Mobile APP.

6. Maintenance Guide

6.1. Pre-Maintenance Instructions

The warning content is as follows:

	1.Do not open the battery container for maintenance in rainy,humid or windy weather.Our company shall not be liable for any losses incurred by noncompliance with this requirement. 2.Avoid opening the container door in high-humidity conditions such as rainy,snowy or heavy foggy weather.After closing the container door,confirm that the sealing strips around the door are free from curling.
	1.To reduce the risk of electric shock,do not perform any maintenance or inspection operations beyond the scope of this manual. 2.If necessary,please contact our after-sales technical support personnel for professional maintenance and inspection.
	1.In clear weather,it is recommended to open the container doors for equipment ventilation and dehumidification.

6.2. System Usage Requirements

6.2.1. Usage Requirements for System Normal Operation

1. Perform battery maintenance on the system once every twelve months to prevent battery damage.For the specific maintenance procedures,refer to Section 5.4.

2. Conduct a routine inspection of the system once every twelve months and keep a complete inspection record.The inspection items are as follows:

No.	Item	Inspection Method
1	Check if the fire suppression system is intact and within its valid period	Visual Inspection
2	Check if the air intake and exhaust systems are clogged	Visual Inspection
3	Check if the heat dissipation air duct of the liquid cooling unit is clogged	Visual Inspection
4	Check if the container appearance is deformed,rusted or damaged	Visual Inspection
5	Check if the fixing bolts of structural components are loose or missing	Visual Inspection
6	Check if the high and low voltage wiring harnesses are loose or damaged	Visual Inspection
7	Check if the MSD is intact and securely installed	Visual Inspection
8	Check if the liquid cooling pipelines are damaged	Visual Inspection
9	Check if the high-voltage connection parts have ablation	Visual Inspection
10	Check if there is any pungent odor in the electrical room	Olfactory Inspection
11	Check if the battery system data is complete	Check via the upper monitoring computer
Note:Any abnormalities detected during the routine inspection shall be reported promptly,and relevant personnel shall be contacted for arrangement of handling!		

6.2.2. Usage Requirements for Intermittent Operation System

The usage requirements are the same as those for the normal operation system.

6.2.3. Operating Requirements for Long-idle Systems

1. SOC range for energy storage battery storage:15-40%.Avoid long-term storage of battery cells at a SOC below 15%.Cut off power-consuming equipment in a timely manner when the battery system is not in use for an extended period.

2. Perform battery maintenance on the system every three months to prevent battery damage.

3. Prior to the first use,perform at least one full charge to activate the battery system and restore its performance to the optimal state.

Warning Notes as Follows:

	Prolonged idleness of the energy storage system will cause irreversible damage to the battery; regular maintenance is mandatory.

6.3. Maintenance Notes

Before conducting maintenance and overhaul work on the energy storage system,it is mandatory to first open the DC isolation switches on each high-voltage box and confirm that the DC isolation switches are in the OFF position and the AC auxiliary power switches are open.After the completion of maintenance and overhaul work,ensure that the DC isolation switches on each high-voltage box are in the ON position and the AC auxiliary power switches are closed.

6.4. Battery Maintenance

6.4.1. Long-term storage requirements

To ensure the long-term safe and reliable operation of the liquid-cooled energy storage system,please comply with the following requirements:

1.When the battery is to be stored for an extended period,it shall be charged to a SOC of 15-40%.

2.During long-term battery storage,it is recommended to discharge and recharge the battery every 3 months to ensure its SOC remains within the range of 15-40%at all times.It is also recommended to check the specific status of the battery in the system via the CCU every 3 months,with the maximum storage

period not exceeding 6 months.Prior to the final grid-connection and commissioning of the system,if the ambient temperature is below 10°C,the system must be activated first to adjust the battery temperature to normal operating temperature(25°C±3°C).After a standing time of no less than 10 hours,charge the battery cells to full capacity at a 0.2C rate,then perform charge and discharge operations on the product under actual operating conditions.

Warning Notes as Follows:

	Before performing battery maintenance operations, inspect and ensure a safe environment, system safety, and the absence of any alarms or faults.

6.4.2. Battery Maintenance Operation Methods

To ensure the long - term safe and reliable operation of your energy storage system, please read and follow the following usage instructions carefully:

Maintenance Operation Process:

Plan 1: Recommended for energy - saving when the battery system SOC is at a low level.

Discharge the battery system until it reaches the cut - off condition (average single - cell voltage < 3.1V or minimum voltage < 2.8V), then stop discharging and let it stand for 1 hour;

Perform automatic full charging on the battery system (maximum single - cell voltage > 3.6V). After charging is completed, let it stand for 1 hour;

(3) Discharge the battery system to 40% and stop.

Plan 2: Recommended for energy - saving when the battery system SOC is at a high level.

Perform automatic full charging on the battery system (maximum single - cell voltage > 3.6V). After charging is completed, let it stand for 1 hour;

Discharge the battery system until it reaches the cut - off condition (average single - cell voltage < 3.1V or minimum voltage < 2.8V), then stop discharging and let it stand for 1 hour;

Charge the battery system to 40% and stop.

6.5. Liquid-Cooling System Maintenance

6.5.1. Electrical System Maintenance

The maintenance information for the liquid-cooling electric control system is shown in the table below:

Item	Standard	Cycle	Method
Reliability of power and signal cables on the wiring panel	No loosening of electrical and signal cables	6 months	Visual inspection
	No aging,damage,abnormal heating or other abnormalities of electrical and signal cables	6 months	Visual inspection
	No dust on the wiring panel	6 months	Visual inspection
Normal operation of maintenance circuit breakers	Automatically disconnect in case of circuit anomalies(e.g.short circuit)	6 months	Visual inspection
	The above maintenance cycles are recommended values only and may be adjusted according to actual plans.		

6.5.2. Unit Exterior Maintenance

The maintenance information for the exterior of the liquid-cooled unit is shown in the table below:

Item	Standard	Cycle	Method
Unit Exterior	The unit shall be kept clean without dust or dirt.	6 months	Visual inspection
	The above maintenance cycles are recommended values only and may be adjusted according to actual plans.		

6.5.3. Fan Maintenance

The maintenance information for the fans of the liquid-cooling system is shown in the table below:

Item	Standard	Cycle	Method
Reliability of Fan Operation	No dust on the fan and no foreign matter blockage at the air inlet.	6 months	Visual inspection
	No damage to the fan blades and smooth fan rotation	6 months	Visual inspection
	The above maintenance cycles are recommended values only and may be adjusted according to actual plans.		

6.5.4. Condenser Maintenance

The maintenance information for the condenser of the liquid-cooling system is shown in the table below:

Item	Standard	Cycle	Method
Condenser Cleaning	No dust or foreign matter blockage in the condenser	6 months	Visual inspection
	The above maintenance cycles are recommended values only and may be adjusted according to actual plans.		

6.5.5. Cooling Medium Maintenance

The maintenance information for the cooling medium of the liquid-cooling system is shown in the table below:

Item	Standard	Cycle	Method
Cooling Medium	Concentration within the specified range,pH value and concentrations of all electrolytes meeting the requirements,free from scale,sediment and other contaminants.	6 months	Visual inspection
	The above maintenance intervals are for reference only and may be adjusted by the user according to the actual performance of the cooling fluid.The maintenance interval may be appropriately extended for cooling fluid with better stability.The operating procedures for replacing the cooling medium in the liquid-cooled unit are as follows: Turn off the power supply and wait for at least 10 minutes. Drain all the fluid from the cooling system through the drain port. 3.Refill with cooling fluid and check the pH value and electrolyte concentration of the cooling fluid.		
	Ethylene glycol is a substance that contaminates groundwater.The equipment operator must comply with the relevant national and local regulations and shall not discharge it arbitrarily.		

7. Troubleshooting of Energy Storage System

7.1. Troubleshooting Methods for Common Faults

The liquid - cooled energy storage container is equipped with a complete protection function. When an abnormal operation state is detected, the battery system will automatically take corresponding measures to timely ensure the safety of the energy storage system and its sub - components and ensure the reliable operation of the battery system cabinet.

The abnormal operation states of the liquid - cooled energy storage container system are divided into "Early Warning", "Minor Fault" and "Major Fault". Among them, the battery system does not take any action for "Early Warning"; "Minor Fault" indicates that there is a slight abnormality in the battery system cabinet; "Major Fault" indicates that there is a serious abnormality in the battery system cabinet. Users can view the fault details through the energy storage system display interface and contact our after - sales service in a timely manner.

7.2. Troubleshooting Methods for Emergency Faults

7.2.1. Fire

Step 1: Evacuate on - site personnel to a safe area, mark out a safe isolation zone, and call the police according to the on - site situation.

Step 2: If conditions permit, perform the following operations under the premise of ensuring personal safety:(1) If the wire harness smokes and catches fire, use a carbon dioxide or dry powder fire extinguisher to put out the fire.(2) If the energy storage battery catches fire, use a high - pressure water gun to put out the fire from a long distance.(3) If you accidentally inhale

thick smoke, move to a safe place as soon as possible and seek medical treatment.

7.2.2. Flooding

Step 1: Regardless of whether the system is powered on or not, urgently evacuate on - site personnel to a safe area and mark out a safe isolation zone.

Step 2: Notify the system supplier and conduct maintenance after the water recedes.

Step 3: Do not start the system until the system manufacturer provides the system safety determination result.

	If a fire is caused by abnormal charging or discharging, be sure to turn off the power supply first, and then perform fire - fighting operations!!!

8. Quality Assurance Statement

The quality assurance period shall be subject to the commercial contract. Within the quality assurance period, if any part of the product is damaged or fails to meet the various indicators specified in the contract due to poor manufacturing or improper design, Party B shall repair or

replace the parts for the purchaser free of charge, and even improve the equipment structure and supply goods free of charge, except for the following cases:

All kinds of faults caused by failure to use, maintain and repair the product correctly in accordance with the provisions of this manual.

Damage to the product caused by excessive water immersion, impact or other damages beyond its bearing capacity.

Unauthorized modification, addition, disassembly and adjustment of the battery system without the authorization of Elenova.

Damage to the battery system caused by the customer's unauthorized handling of the fault without the permission of Elenova when a fault occurs.

Quality problems caused by not using the genuine parts provided by our company.

Damage caused by using charging equipment that does not meet national standards or irregular charging operations.

Damages caused by force majeure such as earthquakes, typhoons, floods, chemical pollution, lightning strikes, hailstones, sediment, flying rocks, fires, political disasters, or man - made intentional damages, as well as secondary compensation caused by these damages. Both parties shall be exempted from liability for such damages.

9. Disclaimer

Statement on the expected use environment of the product, i.e., industrial environment:

Caution: The emission characteristics of the system make it suitable for use in industrial areas, which means a Class A electromagnetic environment. If it is used in a residential environment (where Class B is normally required), this equipment may not provide adequate protection for radio - frequency communication services. The user may need to take mitigation measures, such as relocating or reorienting the equipment.

Statement on risk clarification caused by power supply loss:

Caution: The mains power quality should be that of a specialized distribution network in an industrial environment. If the user of the system requires continued operation during or after power mains interruptions, it is recommended that the information storage parts of the system be powered from an uninterruptible power supply or a backup power source.

Disclaimer on keeping away from high - power radio frequency transmitters:

Caution: Some portable RF communication equipment, such as high - power walkie - talkies, may cause the degradation of electromagnetic performance. If the essential performance is lost or degraded due to electromagnetic disturbances, please keep the high - power transmitter far away from the system and call the customer service to solve the related problem.