WOLONG
Power your future

WL-ESS-110kW/235kWh-0.4kV

C&I ESS User Manual

Document Version 01
Release Date 2024-02-01

Zhejiang Wolong Energy Storage System Co., Ltd.

WOLONG
Power your future

Wolong Energy Storage

WL-ESS-110kW/235kWh-0.4kV All-in-one ESS User Manual
Version 1.0

Zhejiang Wolong Energy Storage System Co., Ltd.

Company Website: www.wolong.com.cn

Company Address: No. 1801, Renmin West Road, Shangyu District, Shaoxing City, Zhejiang Province

Preface

1 Overview

1.1 Applicable Models

This document applies to the following equipment models:

• WL-ESS-110kW/235kWh-0.4kV

The section introduces product model definitions used in this manual, as shown in Figure 1.1:

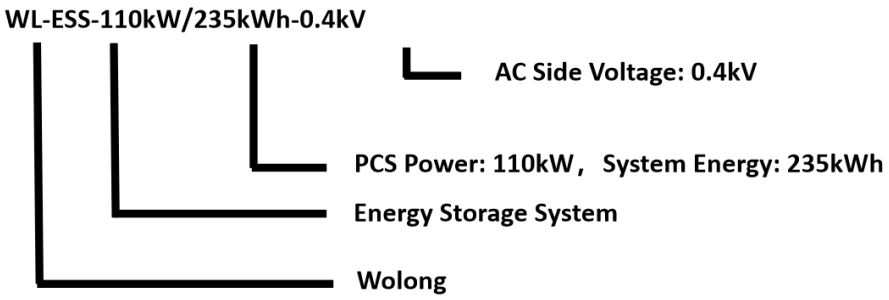


Figure 1.1 Product Model Definition

1.2 Target Audience

The content described in this document should only be operated by professionals. Professionals must have the following skills:

1) Understanding of how the product works and how to operate it.
2) Knowledge of how batteries work and how to operate them.
3) Trained and understand how to handle hazards and risks that may arise during the installation and use of electrical equipment.
4) Knowledge of the installation and commissioning of electrical equipment and devices.
5) Understanding of all applicable standard operating instructions.
6) Awareness and compliance with this manual and all safety information.

Symbol Conventions

The following symbols may appear in this document, and their meanings are as follows:

Symbol	Description
DANGER	Indicates a high-level risk hazard that could lead to death or serious injury if not avoided.
WARNING	Indicates a medium-level risk hazard that could lead to death or serious injury if not avoided.
CAUTION	Indicates a low-level risk hazard that could lead to minor or moderate injury if not avoided.
NOTICE	Used to convey equipment or environmental safety warning information. If not avoided, it could lead to equipment damage, data loss, reduced equipment performance, or other unpredictable results. “Notice” does not involve personal injury.

Symbol	Description
NOTE	Used to highlight important/key information, best practices, tips, etc. “Note” is not safety warning information and does not involve information about personal, equipment, or environmental harm.

WOLONG
Power your future

1 Precautions

Statement

Before transporting, storing, installing, operating, using, or maintaining the equipment, please read this manual first. Operate strictly according to the contents of the manual and follow all safety precautions identified on the equipment and in the manual.

In this manual, "equipment" refers to the products, software, components, spare parts, and/or services related to this manual; "the company" refers to the manufacturer (producer), seller, and/or service provider of the equipment. "You" refers to the entity transporting, storing, installing, operating, using, and/or maintaining the equipment.

The "danger," "warning," "caution," and "notice" items in this manual do not represent all the safety items that should be followed. You must also comply with relevant international, national, or regional standards, as well as industry practices. The company is not responsible for any liability caused by violating safety operation requirements or violating the standards of design, production, and safe use of equipment.

This equipment should be used in an environment that meets the design specifications. Otherwise, any equipment failure, abnormal equipment function, or component damage that may occur is not within the scope of the equipment quality assurance; the company is not liable for any personal injury or property damage that may occur.

All operations such as transportation, storage, installation, operation, use, and maintenance should comply with applicable laws, regulations, standards, and norms.

Reverse engineering, decompiling, disassembling, adapting, implanting, or other derivative operations on the equipment's software are prohibited. It is not permissible to study the internal implementation logic of the equipment, obtain the equipment software source code, infringe on intellectual property rights, or disclose any results of equipment software performance tests.

The company is not responsible for any of the following situations or their consequences:

- Equipment damage caused by earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or force majeure;
- Operation outside the usage conditions described in this manual;
- Installation and use environment not meeting relevant international, national, or regional standards;
- Installation and use by unqualified personnel;
- Operation not following the instructions and safety warnings in the product and documentation;
- Unauthorized disassembly, alteration of the product, or modification of software code;
- Damage caused by transportation by you or your appointed third party;
- Damage caused by storage conditions not meeting the requirements of the product documentation;
- Materials and tools provided by you not meeting local laws, regulations, and relevant standards;
- Damage caused by negligence, intent, gross negligence, improper operation, or reasons not attributable to the company or a third party.

1.1 Personal Safety

⚠ DANGER

It is strictly forbidden to operate with power during the installation process. Do not install or remove cables while they are live. When the cable cores come into contact with conductors, they can produce arcs, electrical sparks, or cause fires and explosions, leading to fires or personal injury.

⚠ DANGER

When the equipment is powered, non-standard or incorrect operation can lead to fires, electric shocks, or explosions, resulting in personal injury or property loss.

⚠ DANGER

During the operation, it is strictly forbidden to wear watches, bracelets, rings, necklaces, or other conductive objects to avoid electric shock injuries.

⚠ DANGER

During the operation, it is essential to use specialized insulated tools to prevent electric shock injuries or short-circuit faults. The insulation voltage resistance level must meet the local legal, standard, and normative requirements.

⚠ WARNING

During the operation, it is necessary to use specialized protective equipment, such as wearing protective clothing, insulated shoes, safety goggles, helmets, insulated gloves, etc.

General Requirements

- Do not disable equipment protection devices and ignore warnings, cautions, and preventive measures in the manual and on the equipment.
- During the operation of the equipment, if a fault is discovered that could cause personal injury or equipment damage, immediately stop the operation, report to the person in charge, and take effective protective measures.
- Do not power up the equipment until the installation is complete or confirmed by a professional.
- Avoid direct contact with energized equipment, using other conductors, or indirect contact through damp objects. Before touching any conductive surface or terminal, measure the voltage at the contact point to ensure there is no risk of electric shock.
- During the operation of the equipment, the exterior may be hot, posing a risk of burns. Do not touch.
- Do not touch the fan with fingers, parts, screws, tools, or circuit boards while it is running to avoid injury or equipment damage.
- In the event of a fire, evacuate the building or equipment area immediately and call the fire department. Under no circumstances should anyone re-enter the burning building or equipment area.

Personnel Requirements

- Personnel operating the equipment include professionals and trained individuals.

  - Professionals: Individuals familiar with the principles and structure of the equipment, who have training or experience in operating the equipment, and who understand the various potential sources of danger and their levels during the installation, operation, and maintenance of the equipment.

  - Trained personnel: Individuals who have undergone corresponding technical and safety training and have the necessary experience, who are aware of the dangers that a particular operation may pose to them and can take measures to minimize the risk to themselves or others.

- Personnel responsible for installing and maintaining the equipment must be strictly trained, know the correct operating methods, understand various safety precautions, and be familiar with the relevant standards of their country/region.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety devices and repair the equipment.
- Personnel working in special scenarios such as electrical operations, working at heights, or operating special equipment must have the special operation qualifications required by the local country/region.
- Medium voltage equipment operators must have a high-voltage electrician's license.
- Replacement of equipment or components (including software) must be carried out by authorized professionals.
- Apart from personnel operating the equipment, others should not approach the equipment.

1.2 Electrical Safety

⚠ DANGER

Before making electrical connections, ensure that the equipment is undamaged, as damage may cause electric shock or fire.

⚠ DANGER

Non-standard and incorrect operations may lead to accidents such as fires or electric shocks.

⚠ DANGER

During operation, it is necessary to prevent foreign objects from entering the interior of the equipment, as this may lead to equipment short circuit failures or damage, reduced power supply to the load or power loss, and personal injury.

⚠ WARNING

Equipment that requires grounding must have the protective earth wire installed first during installation, and it must be the last to be removed during disassembly.

⚠ CAUTION

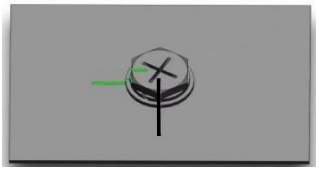
Cables are not allowed to pass through the equipment's air inlet and outlet.

General Requirements

- Installation, operation, and maintenance must be carried out in the order of steps described in the manual. Do not modify, add to, or change the equipment without authorization, and do not change the installation order arbitrarily.
- Permission from the power department of the country or region is required for grid-connected operation.
- Comply with the safety regulations of the power station, such as the implementation of operation ticket and work ticket systems.
- Install temporary fences or warning ropes in the work area and hang "No Entry" signs. Entry of non-working personnel is strictly prohibited.
- Before installing or removing power cables, disconnect the equipment itself and the switches at its upstream and downstream.
- If liquid enters the equipment, immediately turn off the power and do not continue to use it.
- Before operating the equipment, carefully check that the tools used meet the requirements and are recorded; collect them after the operation to prevent them from being left inside the equipment.
- Before installing power cables, ensure the cable tags are correctly labeled and the cable terminals have been properly insulated.
- When installing equipment, use a torque tool with the appropriate range to tighten screws. When using a

wrench, ensure it is not skewed, and the torque value error does not exceed the prescribed 10%.

- Use torque tools to fix bolts and perform a double check with black and green markings. The installer should apply a black mark after tightening the bolts; the inspector should apply a green mark after confirming the tightening (the marking line must cross the edge of the bolt).



- Ensure that all electrical component protective cases, insulation sleeves, and other devices are in place after installation to avoid the risk of electric shock.
- If the equipment has multiple inputs, disconnect all inputs to the equipment and only operate on the equipment after it has completely powered down.
- When maintaining electrical or distribution equipment downstream of the power supply equipment, disconnect the corresponding output switch of the power supply equipment.
- During equipment maintenance, hang a “Do Not Close” sign on the upstream and downstream switches or circuit breakers, and post warning signs to prevent accidental connection. The equipment must not be re-energized until all faults have been resolved.
- When performing fault diagnosis and troubleshooting, if power shutdown is necessary, the following safety measures must be completed: power off > verify de-energization > install grounding wires > hang signs and set up barriers.
- Regularly check the equipment's connection terminal screws to ensure they are tightened and not loose.
- If the cable is damaged, it must be replaced by a professional to avoid risks.
- It is strictly forbidden to tamper with, damage, or cover the labels and nameplates on the equipment. Replace labels that have become unclear due to long-term use in a timely manner.
- Do not use water, alcohol, or oil-based solvents to clean the internal and external electrical components of the equipment.

Grounding Requirements

- The equipment grounding impedance should meet local electrical standards.
- The equipment should be permanently connected to the protective ground. Before operating the equipment, check the electrical connections to ensure that the equipment is reliably grounded.
- Do not operate the equipment without the ground conductor installed.
- Do not damage the ground conductor.
- For equipment using three-prong sockets, ensure that the grounding terminal in the three-prong socket is connected to the protective ground.
- For equipment with large contact current, the protective grounding terminal of the equipment chassis must be grounded before connecting the input power, to prevent the contact current of the equipment from causing electric shock to the human body.

Wiring Requirements

- The selection, installation, and routing of cables must comply with local laws, regulations, and norms.
- During the installation of power cables, avoid looping or twisting. If the power cable is found to be too short, it must be replaced. Do not make joints or soldering points in the power cable.
- All cables must be securely connected, well insulated, and of the appropriate specifications.
- Cable trays and through-holes should have no sharp edges. Cable conduits or through-holes must be

protected to avoid damage to the cables by sharp edges or burrs.

- If cables enter the cabinet from the top, they should be bent in a U-shape outside the cabinet before entering.
- Cables of the same type should be bundled together, appearing straight, neat, and without damage to the outer sheath.
- Immediately seal the cable entry with sealing putty when wiring is completed or when leaving during the wiring process, to prevent moisture and small animals from entering.
- Buried cables need to be securely fixed using cable supports and clamps. In backfilled soil areas, ensure cables are closely aligned with the ground to prevent deformation or damage due to the force exerted during backfilling.
- When external conditions change (such as installation methods or environmental temperature), refer to IEC-60364-5-52 or local regulations and standards for cable selection verification, such as whether the current carrying capacity meets the requirements.
- Use of cables in high-temperature environments may cause insulation aging and damage. The distance between the cable and heat-generating devices or heat source areas should be at least 30mm.
- At low temperatures, severe impacts or vibrations can cause plastic sheaths of cables to become brittle and crack. To ensure construction safety, the following requirements must be followed:

  - All cables should be installed above 0°C. When handling cables, especially in low-temperature environments, handle them gently.
  - If the storage temperature of the cable is below 0°C, the cable must be stored in a room temperature environment for more than 24 hours before laying.

1.3 Environmental Requirements

DANGER

It is strictly forbidden to place equipment in environments with flammable or explosive gases or fumes, and no operations should be conducted in such environments.

DANGER

It is strictly forbidden to store flammable and explosive materials in the equipment area.

DANGER

It is strictly forbidden to place equipment near sources of heat or fire, such as fireworks, candles, heaters, or other heating devices, as the equipment may be damaged by heat or could cause a fire.

WARNING

Equipment should be installed away from liquids, strictly not under positions where condensation water is easily produced, such as water pipes, air outlets, etc.; it is also forbidden to install it under air conditioning vents, ventilation openings, computer room windows, and other places prone to water leakage to prevent liquids from entering the equipment and causing malfunctions or short circuits.

WARNING

When the equipment is running, do not block the ventilation ports, cooling systems, or cover them with other items to prevent damage from high temperatures or fire.

General Requirements

- The temperature and humidity environment for equipment storage should be suitable, placed in a clean, dry, and well-ventilated area, and protected from dust and condensation.
- It is strictly forbidden to install and operate the equipment beyond the range specified by the technical indicators, otherwise, it will affect the equipment's performance and safety.
- It is strictly forbidden to install, use, and operate outdoor equipment and cables in severe weather such as thunderstorms, rain, snow, and winds above level six (including but not limited to transporting equipment, operating equipment and cables, plugging and unplugging connections to outdoor signal interfaces, high-altitude operations, outdoor installations, opening doors, etc.).
- It is strictly forbidden to install the equipment in environments with dust, smoke, volatile gases, corrosive gases, infrared and other radiation, organic solvents, or high salt content.
- It is strictly forbidden to install the equipment in environments with metallic conductive dust or magnetic dust.
- It is strictly forbidden to install the equipment in areas prone to the growth of fungi, mold, and other microorganisms.

- It is strictly forbidden to install the equipment in areas with strong vibration, noise sources, and strong electromagnetic field interference.
- The site selection should comply with local laws, regulations, and relevant standard requirements.
- The installation environment ground should be solid, without rubber soil, weak soil, or other adverse geological conditions prone to sinking; it is strictly forbidden to choose low-lying areas prone to waterlogging or snow accumulation, and the site's horizontal plane should be higher than the historical highest water level of the area.
- It is strictly forbidden to install the equipment in a position where it can be submerged by water.
- If the equipment is installed in a place with lush vegetation, in addition to routine weeding, the ground below the equipment needs to be hardened, such as laying cement, gravel, etc.
- When installing, operating, and maintaining, it is necessary to clean the accumulated water, ice, snow, or other debris on top before opening the door to prevent debris from falling inside the equipment.
- When installing the equipment, please ensure that the installation surface is firm and meets the equipment's load-bearing requirements.
- All wiring holes must be sealed. Use sealing clay to seal the wired holes, and use the equipment's own covers to seal the unwired holes.
- After installing the equipment, the empty packaging materials in the equipment area, such as cardboard boxes, foam, plastic, cable ties, etc., should be cleared away.

1.4 Mechanical Safety

DANGER

For high-altitude operations, safety helmets, safety belts or waist ropes must be worn and attached to sturdy structural components. It is strictly forbidden to hang them on moving, unstable objects or sharp-edged metals to prevent hook slippage and falling accidents.

WARNING

Tools must be fully prepared and inspected and approved by a professional institution. It is prohibited to use tools with damages, failed inspections, or beyond their inspection validity period, ensuring tools are secure and not overloaded.

WARNING

Before installing equipment into a cabinet, first ensure that the cabinet has been firmly fixed to avoid tilting or collapsing due to an unstable center of gravity, which could cause injury to the installers or damage the equipment.

WARNING

When pulling equipment out of a cabinet, be careful of equipment that may be unstable or heavy inside the cabinet to avoid being crushed or injured.

WARNING

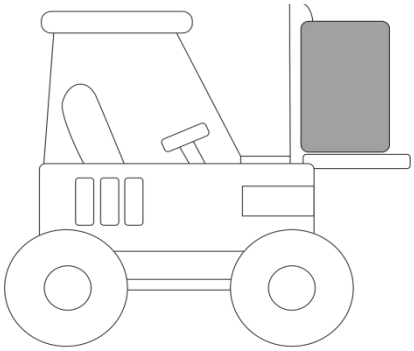
Drilling holes in equipment is strictly prohibited. Drilling can damage the equipment's seal, electromagnetic shielding performance, internal components, and cables. Metal filings generated from drilling can cause short circuits on circuit boards.

General Requirements

- Any paint scratches occurring during equipment transportation and installation must be repaired promptly, and the scratched area must not be exposed for an extended period.
- Arc welding, cutting, and similar operations on the equipment are prohibited without the company's assessment.
- Installing other equipment on top of this equipment without the company's assessment is prohibited.
- When working above the equipment, protective measures should be added to the top of the equipment to avoid damage.
- Use the correct tools and master the correct methods of using them.

WOLONG
Power your future

Safe Handling of Heavy Objects



>68kg
(>150lbs)

>40kg use machine

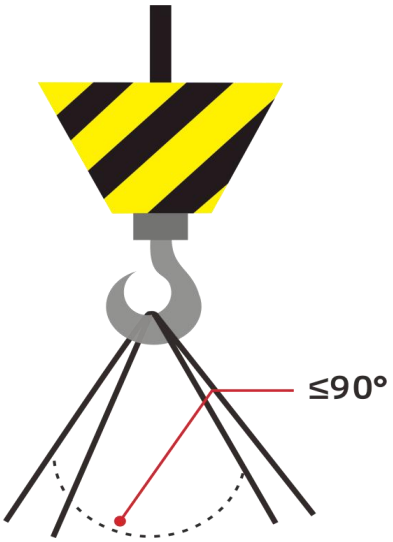
- When using a forklift for handling, the forklift must fork in the middle position to prevent tipping. Before moving, secure the equipment to the forklift with ropes; a dedicated person is needed to watch during movement.
- Transportation should choose sea transport or roads with good conditions, and rail and air transport are not supported. The transport process should minimize jolting and tilting.
- Operations conducted more than 2 meters above the ground are considered high-altitude operations, and a supervisor must be set for high-altitude work.
- Only those who have undergone relevant training and obtained the appropriate qualifications may work at high altitudes.
- High-altitude operations should be stopped in potentially dangerous situations, such as when steel pipe rainwater has not dried. After such conditions have passed, various work devices must be checked by the safety officer and relevant technical personnel, and work can resume only after safety is confirmed.
- A danger zone should be delineated at the high-altitude work site, with clear signs, and entry of unrelated personnel is strictly prohibited.
- Guardrails and signs should be set up at the edges and holes of high-altitude work areas to prevent accidental falls.
- The ground below high-altitude work areas should not have scaffolding, planks, or other miscellaneous objects piled up. Ground personnel should not stay or pass directly under high-altitude work areas.
- Carry the necessary operating instruments and tools to prevent tools from falling and causing equipment damage or personal injury.
- It is strictly prohibited for high-altitude workers to throw objects to the ground from a height, and it is also prohibited to throw objects from the ground to a height. Use slings, baskets, elevated cars, or cranes to transfer objects.
- Try to avoid simultaneous operations on upper and lower levels. If unavoidable, special protective sheds or other protective measures must be set up between the upper and lower levels, and tools and materials should not be piled up on the upper level.
- When dismantling scaffolding upon completion of work, it should be done layer by layer from top to bottom. Simultaneous dismantling of upper and lower layers is strictly prohibited. When dismantling a part, prevent other parts from collapsing.
- High-altitude workers must strictly follow high-altitude safety regulations during operations. The company is not responsible for accidents caused by violations of high-altitude safety regulations.
- It is strictly forbidden to joke around or rest in high-altitude work areas.

Ladder Safety

- When working at heights where electrical hazards are possible, wooden ladders or insulated ladders should be used.
- For high-altitude operations, prefer to use platform ladders with protective railings, and the use of straight ladders is prohibited.
- Before using a ladder, ensure that the ladder is intact and undamaged, and that the ladder's load-bearing capacity meets the requirements. Overloading is strictly forbidden.
- The ladder must be placed on a stable surface, and someone must hold the ladder during operation.
- When climbing a ladder, maintain a stable body posture and ensure that the body's center of gravity does not deviate from the edge of the ladder frame to reduce risk and ensure safety.
- When using an A-frame ladder, the rope must be securely fastened.

Hoisting Safety

- Personnel conducting hoisting operations must undergo relevant training and be qualified before starting work.
- A temporary warning sign or fence should be erected in the hoisting area for isolation.
- The foundation for hoisting operations must meet the load-bearing requirements of the crane work.
- Before hoisting, ensure that the hoisting tools are firmly fixed to a load-bearing structure or wall.
- During hoisting, it is strictly forbidden to walk under the boom or the hoisted object.
- During hoisting, dragging of steel wire ropes or lifting gear is prohibited, as is striking with hard objects.
- During the hoisting process, ensure that the angle between the two cables does not exceed 90 degrees.
-



Forklift Movement (Preferred)

- Using a forklift to transport energy storage outdoor cabinets is the standard method of movement. During transportation, the center of gravity of the outdoor cabinet should be between the two forks of the forklift, with pre-insertion to ensure that it does not tilt after being lifted. As shown in the diagram, the length of the forklift forks must not be less than 2.1m, and the pallet truck's load capacity needs to be >5000kg.
- In the process of lifting, lowering, and moving the energy storage outdoor cabinet with a forklift, it is necessary to ensure slow and stable movement, and the outdoor cabinet must be placed on a solid, level ground.
- Throughout the process of operating the forklift, strict adherence to forklift safety operation standards is required. Due to the large size of the energy storage outdoor cabinet, which may obstruct the driver's view, assistance from auxiliary personnel is needed.

Forklift Diagram

Drilling Safety

- Obtain consent from the client and contractor before drilling.
- Wear safety goggles and protective gloves when drilling.
- Avoid drilling into pre-embedded pipes or lines to prevent short circuits or other dangers.
- Provide shielding protection for the equipment during drilling to prevent debris from falling inside the equipment, and clean up debris promptly after drilling.

1.5 Equipment Safety

1.5.1 WL-ESS-110kW/235kWh-0.4kV Energy Storage System Safety

⚠ DANGER

When the system is in operation, do not open the cabinet door.

⚠ DANGER

When there is a fault in the energy storage system, avoid standing at the cabinet door (including the range within which the door opens).

⚠CAUTION

In the event of a fire alarm (sound and light alarm), evacuate the scene immediately.

⚠ DANGER

The energy storage system must be equipped with protective measures such as fences and walls, and safety warning signs should be erected for isolation to prevent unauthorized personnel from entering during the operation of the equipment, thereby avoiding personal injury or property damage.

- The installation layout of the energy storage system must meet the fire protection distances or fire wall requirements specified by local standards, including but not limited to the specifications required by the "NFPA 855 Standard for the Installation of Stationary Energy Storage Systems."
- The energy storage system should undergo regular fire inspections, at least once a month.
- When performing live inspections of the system, pay attention to the danger signs on the equipment and avoid standing at the cabinet door.
- After replacing power components or changing wiring in the energy storage system, it is necessary to manually initiate a wiring check to avoid abnormal system operation.
- It is recommended that users have their own camera devices to record the detailed process of installation, operation, and maintenance of the equipment.

1.5.2 Battery Safety

⚠ DANGER

It is strictly forbidden to short-circuit the positive and negative terminals of the battery, as this can cause a short circuit. A short-circuited battery can instantly produce a large current and release a large amount of energy, leading to battery leakage, smoking, release of flammable gases, thermal runaway, fire, or explosion. To avoid short-circuiting, batteries should not be maintained while charged.

⚠ DANGER

Do not expose the battery to high-temperature environments or near heating devices, such as under intense sunlight, near a fire source, transformers, heaters, etc. Overheating of the battery may lead to leakage, smoking, release of flammable gases, thermal runaway, fire, or explosion.

⚠ DANGER

It is strictly forbidden for the battery to be subjected to mechanical vibrations, falls, impacts, puncture by hard objects, or pressure shocks, as this may cause battery damage or fire.

⚠ DANGER

It is strictly forbidden to disassemble, modify, or damage the battery (such as inserting foreign objects, external compression, immersion in water or other liquids) to prevent battery leakage, smoking, release of flammable gases, thermal runaway, fire, or explosion.

⚠ DANGER

Avoid contact of battery terminals with other metal objects, which may cause heating or electrolyte leakage.

⚠ DANGER

Do not disassemble the battery pack or replace the cells.

⚠ DANGER

Battery electrolyte is toxic and volatile. In case of electrolyte leakage or abnormal odor, avoid contact with the leaked liquid or gas. Non-professionals should not approach and should immediately contact professionals. Professionals should wear safety goggles, rubber gloves, gas masks, protective clothing, etc., promptly power down the equipment, remove the leaking battery, and contact a technical engineer for handling.

WOLONG
Power your future

⚠ DANGER

The battery is a sealed system, and under normal operation, there should be no gas release. However, in extreme abuse conditions, such as exposure to fire, puncture, compression, lightning strike, overcharging, or other conditions that may cause thermal runaway, the battery may be damaged or undergo abnormal chemical reactions, leading to electrolyte leakage or production of gases like CO, H2, etc. Ensure measures for flammable gas emission are in place on-site to prevent combustion or corrosion of equipment.

⚠ DANGER

Gases produced by battery combustion can irritate the eyes, skin, and throat, so protective measures are important.

⚠ WARNING

When installing and testing the energy storage system, fire-fighting facilities such as fire sand, CO2 fire extinguishers, etc., must be equipped according to construction standards and regulations. Before commencing operations, ensure that fire-fighting facilities that meet local laws and regulations are in place.

⚠ WARNING

Before unpacking the energy storage system, during storage and transport, ensure the outer packaging box is intact and undamaged, placed correctly according to the markings on the box. Strictly avoid inversion, sideways, standing, tilting placement, and stacking in accordance with the requirements on the outer packaging to avoid any impact or falls that could damage and render the battery unusable.

⚠ WARNING

After unpacking the energy storage system, place it in the required direction, strictly avoiding inversion, sideways, standing, tilting, and stacking to prevent any impact or falls that could damage and render the battery unusable.

⚠ WARNING

Tighten the busbars or cable fastening screws according to the torque specified in the text, regularly check if they are tightened, and if there are any signs of rust, corrosion, or other foreign matter, and clean them. Otherwise, loose screws can lead to excessive connection voltage drop, and even significant heating at high currents, destroying the battery.

⚠ WARNING

After discharging the energy storage system, the battery should be charged promptly, as failure to do so may result in battery damage due to over-discharge.

WOLONG
Power your future

⚠WARNING

The environmental temperature and humidity for battery storage and operation in the energy storage system must meet the product specification requirements (refer to the product introduction chapter -- system parameters).

General Requirements

NOTICE

To ensure the safety of battery use and the accuracy of battery management functions, please use batteries configured by our company. If battery-related faults occur due to the use of batteries not configured by our company, our company is not responsible.

- Before the installation, operation, and maintenance of the energy storage system, please read the manufacturer's manual and comply with the manufacturer's requirements. The safety precautions in this manual are only highlights; for more safety precautions, please refer to the manufacturer's manual.
- Please use the energy storage system within the specified temperature range. Do not charge when the environmental temperature is below the lower limit of the working temperature to avoid internal short circuits due to low-temperature charging.
- Before unpacking the energy storage system, check whether the packaging is intact. Do not use energy storage systems with damaged packaging; if damaged, immediately notify the transporter and manufacturer.
- After packaging the energy storage system, installation must be completed within 12 hours. If it is not possible to install immediately, the energy storage system should be repackaged and stored in an indoor, dry, and non-corrosive gas environment; after installation, the energy storage system must be powered on within 72 hours. During routine maintenance, the power-off time should not exceed 72 hours.
- Damaged batteries in the energy storage system (such as drops, impacts, swelling, or dents in the shell) may cause leakage or release of flammable gases. Do not use damaged batteries. If the battery shows leakage, structural deformation, or other damage, immediately contact the installer or professional maintenance personnel for removal and replacement. Do not store damaged batteries near other equipment or flammable materials, and non-professionals should not approach damaged batteries.
- Before operating the energy storage system, ensure there are no stimulating, burning smells around the energy storage system.
- Do not install the energy storage system in rainy, snowy, or foggy weather to prevent moisture or rainwater corrosion.
- If the energy storage system accidentally gets wet, dry it and perform insulation treatment before installation.
- Before installing the energy storage system, check for any abnormalities. Abnormalities in the energy storage system include any of the following phenomena:
  - Obvious deformation or damage to the energy storage system's outer shell.
  - The positive and negative terminals of the battery are accidentally grounded. If accidentally grounded, disconnect the battery terminals from the ground.
- Do not perform welding, grinding, or similar work around the energy storage system to avoid generating electric sparks or arcs that could cause fire hazards.
- If the energy storage system is not used for a long time, it needs to be stored and charged as required.

- Do not use equipment that does not meet local laws, regulations, and standard requirements for charging and discharging.
- During installation and maintenance, the battery circuit should be kept disconnected.
- During storage, monitor damaged batteries to ensure there are no signs of smoke, flames, electrolyte leakage, or heating.
- In case of battery failure, the surface temperature may be too high; avoid contact to prevent burns.
- Do not stand or lean on, or sit on top of the equipment.
- Do not disassemble the battery pack of the energy storage system.

Short Circuit Protection

- When installing or maintaining the battery, use insulating tape to wrap the exposed cable terminals on the battery.
- Avoid foreign objects (such as conductive objects, screws, liquids, etc.) entering the battery and causing a short circuit.

Leakage Handling

NOTICE

Electrolyte spillage can pose potential hazards to equipment. Spilled electrolyte can corrode metal objects and circuit boards, causing damage.

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

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

Recycling and Disposal

- Dispose of waste batteries according to local laws and regulations, and do not treat batteries as household waste. Improper disposal of batteries may cause environmental pollution or explosions.
- If the battery leaks or is damaged, contact technical support or a battery recycling company for disposal.
- When the battery exceeds its service life and becomes unusable, contact a battery recycling company for disposal.
- Avoid exposing waste batteries to high temperatures or direct sunlight.
- Avoid exposing waste batteries to high humidity or corrosive environments.
- Do not reuse faulty batteries and contact a battery recycling company for disposal as soon as possible to avoid environmental pollution.

WOLONG
Power your future

Disclaimer

Our company is not responsible for damage or other consequences to the batteries provided by our company caused by the following reasons:

- Damage to batteries caused by earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or force majeure.
- Direct damage to batteries due to the operational environment or external electrical parameters failing to meet normal operating requirements, including but not limited to actual operating temperatures being too high or too low, unstable power grid conditions, frequent power outages, etc.
- Battery damage, drops, leaks, ruptures, etc., caused by improper operation or failure to connect the battery as required.
- Damage caused by failure to power on the battery promptly after installation and system connection due to your reasons.
- Damage to the battery due to your failure to promptly accept delivery.
- Incorrect setting of battery operation management parameters by you.
- Mixing batteries provided by our company with other batteries, leading to accelerated capacity degradation, including but not limited to mixing with batteries of other brands or different rated capacities.
- Frequent over-discharging of batteries due to your improper maintenance, on-site capacity expansion, or long-term inability to fully charge.
- Failure to properly maintain the battery according to the operation manual of the accompanying equipment, including but not limited to failure to regularly check whether the battery terminal screws are tightened.
- Damage to batteries caused by improper storage (such as storing in damp or rain-prone environments) due to your reasons.
- Capacity loss or irreversible damage to the battery caused by your failure to charge the battery promptly, leading to overextended storage.
- Damage to the battery caused by you or a third party, including but not limited to unauthorized relocation, installation of the battery without our company's requirements.
- Changes in the battery usage scenario without informing our company.
- Connecting additional loads to the battery by yourself.
- The battery has exceeded the maximum storage period.
- The battery has exceeded the warranty period. Batteries beyond the warranty period may pose safety risks and are not recommended for continued use.

2 Unpacking and Acceptance

NOTICE

- To avoid tipping over the equipment, please secure the box containing the equipment to the forklift with ropes before moving. Care should be taken when moving the equipment as impacts or drops could cause damage.
- Once the equipment is set down, carefully unpack it to avoid scratching the equipment. The equipment should remain stable during the unpacking process.
- After opening the packaging, please check if the fastening components and detachable parts are loose. If loose, immediately notify the transporter and manufacturer.
- Before unpacking the energy storage system, check whether the packaging is intact. Do not use energy storage systems with damaged packaging; if damaged, immediately notify the transporter and manufacturer.
- If the installation environment is poor, after unpacking, take dust-proof and condensation-proof measures (such as using dust covers, plastic film, or cloth covering) to prevent internal condensation or dust corrosion in the battery.
- For a complete list of all product components, refer to the "Product Acceptance Checklist."

3 Product Introduction

3.1 System Overview

The WL-ESS-110kW/235kWh-0.4kV product is an outdoor cabinet-type energy storage system that integrates an energy storage inverter, battery system, energy management module, temperature control system, fire-fighting system, AC auxiliary power distribution, lighting, and display and control. It is primarily used in the industrial and commercial sectors for direct low-voltage AC 400V grid connection or grid connection through transformer step-up to 10kV. It can achieve load balancing and peak-valley filling, energy cost management, grid support, and stabilization.

3.2 Product Appearance

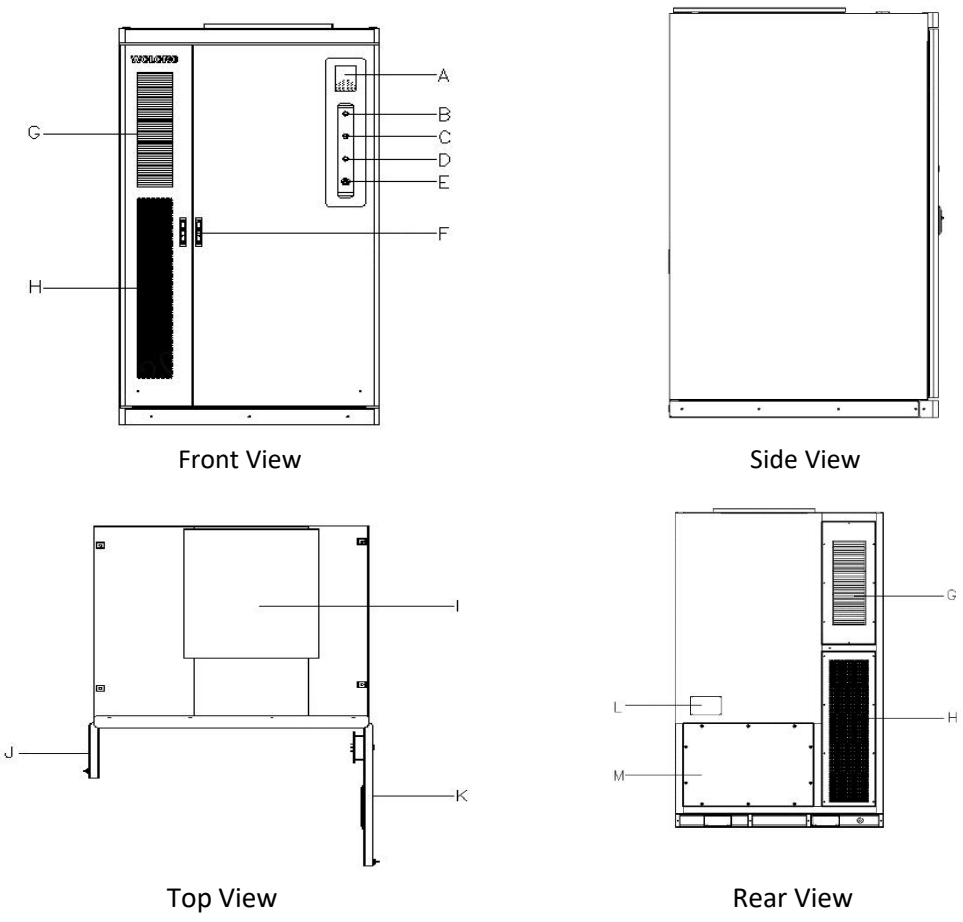


Figure 3-1 Product Appearance

Code	Name
A	Audio-Visual Alarm
B	Power Indicator
C	Operation Indicator
D	Fault Indicator
E	Emergency Stop Button
F	Cabinet Door Lock
G	PCS Cooling Louver
H	Liquid Cooling Machine Radiator Window
I	Explosion-Proof Valve
J	Cabinet Door
K/L	Nameplate
M	External Access Cover Plate

Note:

1. The power indicator lights up to indicate that the system control power is normal.
2. The operation indicator lights up to indicate that the system is charging or discharging.
3. The fault indicator lights up to indicate a system fault and that the system is in shutdown mode.

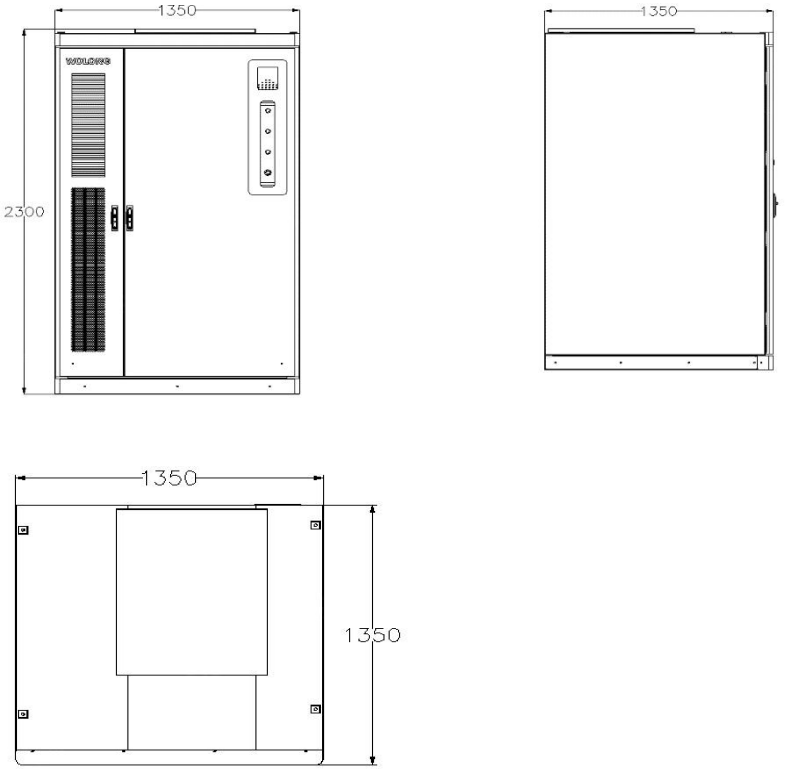


Figure 3-2 Cabinet Dimensions

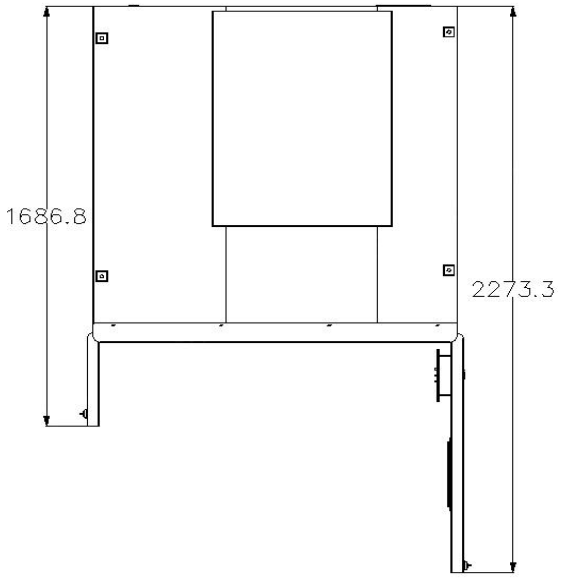
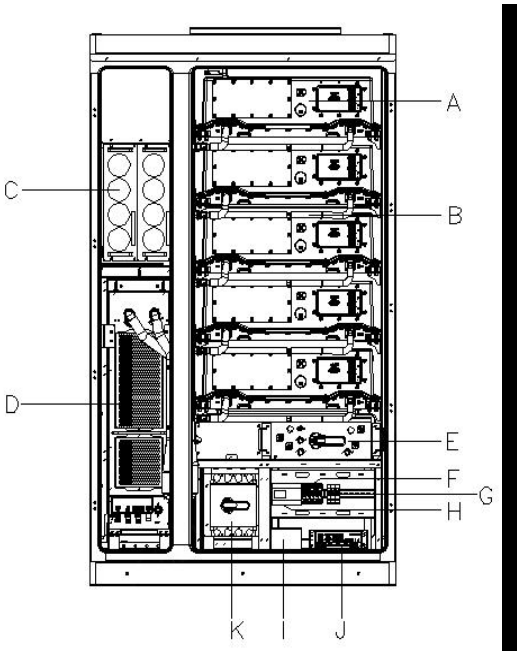
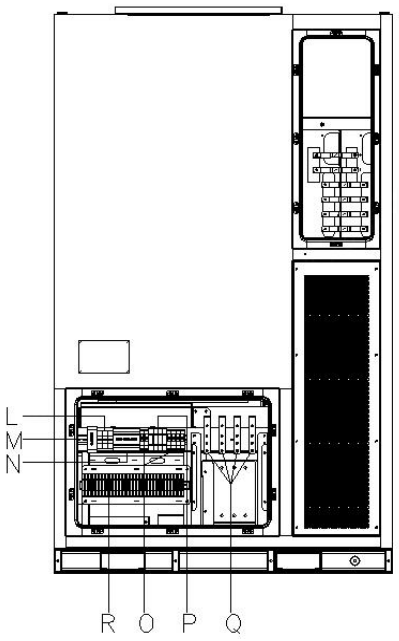


Figure 3-3 Cabinet Top View with Door Open Dimensions

3.3 Component Layout



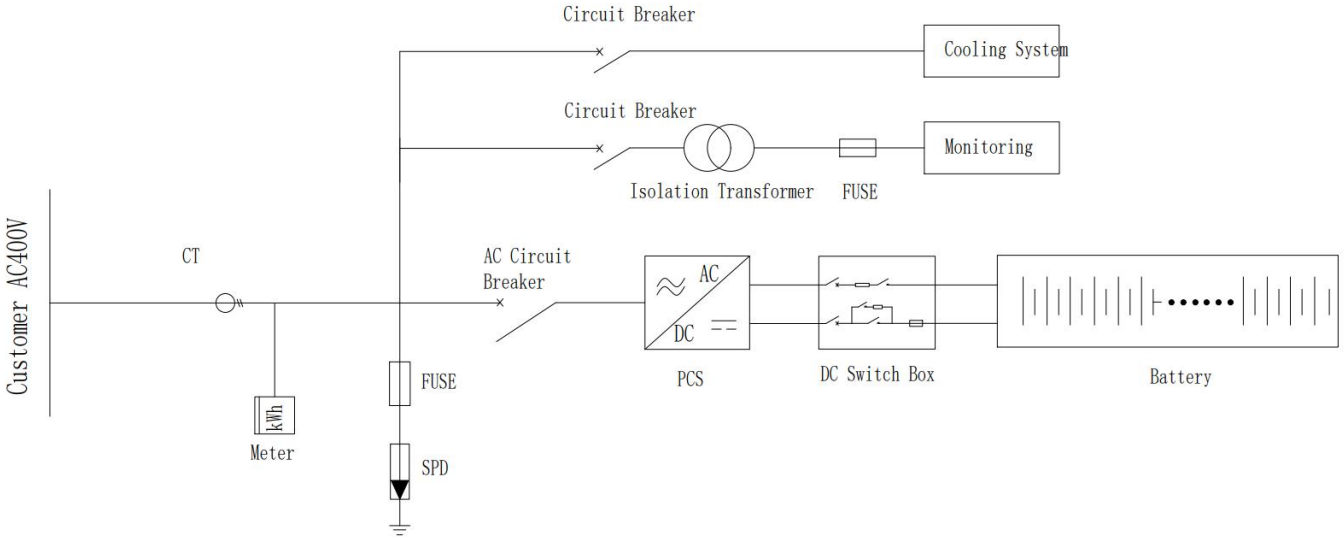
Front Door Open View



Rear Door Open View

Code	Name
A	Battery pack
B	Liquid Cooling Pipes
C	PCS Module
D	Liquid Cooling Machine
E	DC Switch Box
F	Circuit Breaker
G	Fuse
H	Energy Meter
I	Isolation Transformer
J	Energy Management Unit
K	AC Circuit Breaker
L	Intermediate Relay
M	Water Immersion Transmitter
N	Switching Power Supply
O	Fuse
P	Surge Protector
Q	Incoming Line Busbar
R	Terminal Strip

3.4 Electrical Principles

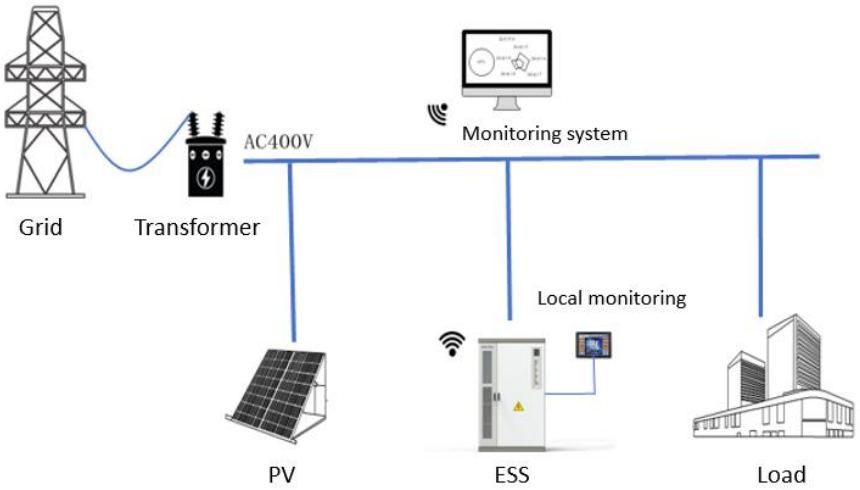


WOLONG
Power your future

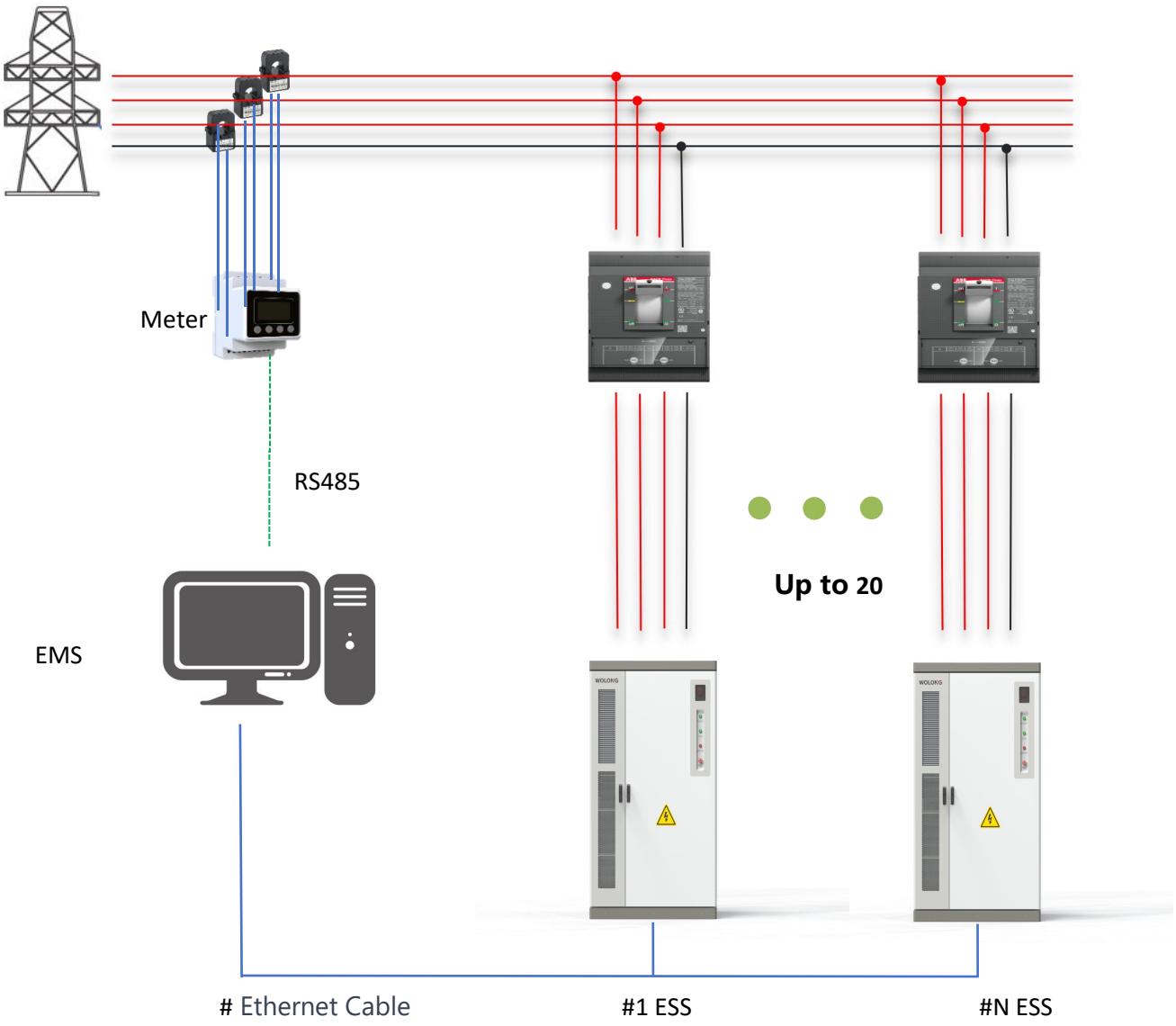
3.5 System Parameters

System Model	WL-ESS-110kW/235kWh-0.4kV
AC Parameters	
Rated Power	110kW
Wiring Method	3P+N+PE
AC Overload Capacity	121kW
Rated Voltage	400（±10%）Vac
Rated Frequency	50/60（-5~+5）Hz
Max.THD of current	≤3%（at nominal power）
Power Factor	-1~+1
Battery Parameters	
Cell Type	LFP 306Ah
System Configuration	1P240S
Rated Voltage	768V
Voltage Range	672~864V
Energy Level	235.008kWh
General Parameters	
Noise	＜75dB
IP Level	IP55
Operating Ambient Temperature	-20~50℃
Storage Ambient Temperature	-30~60℃
Cooling Method	Liquid cooling (Battery) + Air cooling (PCS)
Permissible Humidity	0~95%（non-condensing）
Cabinet Dimensions (W×D×H)	1350mmX1350mmX2300 mm
Permissible Altitude	2000m
Cabinet Weight	3.0t
Max. System Efficiency	90%
Communication Parameters	
Communication Interface	RS485，Ethernet
Communication Protocol	Modbus RTU/TCP

3.6 Application Scenarios



3.7 Multiple Machine Parallel Connection Diagram



4 Transportation Requirements

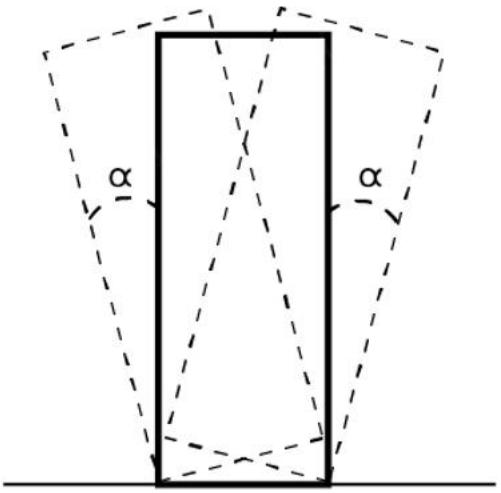
DANGER

Rough handling is prohibited, as it may cause battery short circuit, damage (leakage, rupture, etc.), fire, or explosion.

WARNING

When handling, transport in the required direction. Do not invert, tilt, drop, mechanically impact, or immerse in water. Transportation with the battery charged is forbidden. If it's necessary to transport or move the cabinet, the machine must be shut down and the power circuit disconnected first.

- When transporting heavy objects, use a forklift or crane and be prepared for the load to avoid being crushed or hit by heavy objects.
- When moving or lifting equipment, support the bottom edge of the equipment.
- When using a forklift, the forks must be positioned in the middle to prevent tipping. Before moving, secure the equipment to the forklift with ropes; during movement, one person should direct and another should supervise.
- The cabinet's tilt angle should meet the illustrated requirements, with a tilt angle $\alpha \leq 10°$.



- Certified through UN38.3 (UN38.3: Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria) and SN/T0370.2-2009 "Inspection Procedures for Export Dangerous Goods Packaging Part 2: Performance Testing", this product is classified as Class 9 Dangerous Goods.

- The transportation service provider must have qualifications for transporting dangerous goods and must not use open trucks.
- Direct delivery to the site is possible, meeting the requirements of transportation by truck, ship, etc.
- Comply with international regulations for the transport of dangerous goods, fulfilling the regulatory requirements of the transportation's origin, transit, and destination countries.
- During transportation, choose sea transport or roads with good conditions; rail and air transport are not supported. Minimize jolts and tilting during transport.
- Sea transport must comply with the "International Maritime Dangerous Goods Code" (IMDG Code).
- Land transport must comply with ADR or JT/T617 transportation requirements.
- Before transportation, check that the packaging is intact and undamaged, and there are no phenomena such as odor, leakage, smoking, or fire; otherwise, transportation is prohibited.
- The transport packaging must be sturdy. Care should be taken during loading and unloading, and moisture-proof measures should be taken.
- Handle with care to avoid bumps and pay attention to personal safety.
- Unless otherwise specified, dangerous goods must not be mixed with goods containing food, medicine, animal feed, or their additives in the same vehicle or container.
- Unless otherwise specified, when dangerous goods packages are loaded with ordinary goods in the same vehicle or container, one of the following isolation methods should be adopted:
  - Use isolation material of the same height as the package.
  - Maintain a minimum gap of 0.8m around.
- Before transporting faulty products (leakage, swelling, water ingress, etc.), insulate the positive and negative terminals, place them in an insulated explosion-proof box as soon as possible after packaging, and record the information on the outer box, including site name, address, time, phenomena, etc.
- When transporting faulty products away from the site, avoid flammable material storage areas, residential areas, or other places where people gather, such as public transportation or elevators.

WOLONG
Power your future

5 Storage Requirements

General Requirements

NOTE

- During storage of the industrial and commercial integrated energy storage cabinet, relevant proofs complying with product storage requirements, such as temperature log data, humidity log data, and storage environment record photos, should be preserved.
- It is not recommended to store the industrial and commercial integrated energy storage cabinet for an extended period. Long-term storage of lithium-ion batteries can lead to capacity loss; after 6 months of storage at the recommended temperature, the general irreversible capacity loss is 2% to 6%.
- The industrial and commercial integrated energy storage cabinet should be stored in a clean, dry place, protected from dust and moisture. It must not be exposed to rainwater or standing water on the ground.
- The environmental air must not contain corrosive or flammable gases.
- Do not store in a tilted or inverted position.
- If the storage time of the industrial and commercial integrated energy storage cabinet is 6 months or more, it must be inspected and tested by professionals before use.

5.1 Energy Storage System Storage

- Do not remove packaging when stored for a long time.
- Do not stack during storage.
- Ensure the storage surface is level.
- Keep the cabinet doors closed.
- Storage environment temperature: -30℃ to +60℃, relative humidity: 5%RH to 95%RH.

Storage Requirements

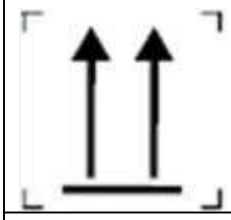
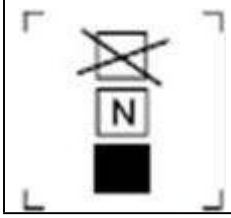
WARNING

- Store the industrial and commercial integrated energy storage cabinet indoors, away from direct sunlight or rain, in a dry, well-ventilated area. The surrounding environment should be clean, free of organic solvents, corrosive, flammable gases, metallic conductive dust, etc., and kept away from heat sources and fires.
- If the battery is faulty (leaking, failure, water ingress, etc.), it must be promptly transferred to a hazardous goods warehouse for separate storage, at least 3m away from nearby combustible materials, and disposed of as soon as possible.
- When storing the industrial and commercial integrated energy storage cabinet, place it correctly according to the markings on the packaging box. Do not store it upside down, sideways, tilted, or stacked in a manner inconsistent with the packaging requirements.

⚠CAUTION

Store batteries separately, avoiding mixing with other equipment, and do not stack. The site must have fire-fighting facilities that meet requirements, such as fire sand, extinguishers, etc.

Table 5-1 Packaging Diagram Explanation

Diagram	Explanation
	Upward Arrow: Indicates that the package should be stored or transported upright.
	Fragile Item Symbol: Indicates that the package contains fragile items, and should be handled with care during transportation.
	Rain Sensitive Symbol: Indicates that the package should not be exposed to rain.
	Stacking Limit Symbol: The "N" in the diagram indicates the maximum number of layers of the same package that can be stacked, as per the actual diagram.

- In principle, long-term storage of batteries is not recommended; they should be used promptly.
- Storage environment requirements:
  - Temperature: -30℃ to +60℃ (recommended 20℃ to 30℃).
  - Relative humidity: 5% RH to 95% RH (recommended around 45% RH).
  - Dry, ventilated, clean.
  - Avoid contact with corrosive organic solvents, gases, etc.
  - Avoid direct sunlight.
  - The distance from heat sources should be no less than 3 meters.
- Disconnect from external connections during storage; if the panel has an indicator light, it should be off.
- The storage time starts from the last charge/discharge date. After the battery is recharged, update the recharge

label with the most recent charge date (recommended to record as year-month-day) and the next charge date (next charge date = most recent charge date + recharge cycle).

- The total storage and transportation time of the industrial and commercial integrated energy storage cabinet should not exceed 6 months (counting from the date of shipment). If it exceeds 6 months, maintenance as per the user manual is required, with at least 50% SOC recharge. Failure to recharge as required may affect the battery's performance and lifespan.
- Storage time is calculated from the most recent charge date of the industrial and commercial integrated energy storage cabinet. The time is recalculated after the battery is recharged and found to be qualified.
- Report promptly if battery storage exceeds the period.
- Batteries that are deformed, damaged, or leaking should be scrapped immediately, regardless of storage time.
- Recharge every 6 months during storage, with a maximum of 3 recharges allowed. If the maximum number is exceeded, it's recommended to scrap the battery.
- Do not remove the outer packaging during long-term storage. If the battery needs to be recharged, it must be done by professionals as required, and the packaging must be restored after recharging.
- The administrator should compile storage data monthly and report regularly. Arrangements for recharging should be made promptly for long-term storage.

⚠CAUTION

- Recharging operations must be performed by professionally trained personnel, wearing insulating gloves and using specialized insulating tools.
- During the recharging process, someone must be present to observe and handle any abnormalities promptly.
- If the battery swells or smokes during recharging, stop charging immediately and dispose of it.

6 Mechanical Installation

⚠WARNING

Throughout the entire process of mechanical installation, it is mandatory to strictly adhere to the relevant standards and requirements of the project's location.

6.1 Pre-Installation Check

6.1.1 Check Delivered Items

Check against the packing list to ensure all delivered items are complete.

6.1.2 Check Equipment

- Inspect whether the actual received cabinet matches the ordered model.
- Check the product and internal equipment to ensure there are no damages.
  If any issues or doubts are found, please contact the transporter or our company immediately.

⚠WARNING

Only complete and undamaged equipment can be installed! Before installation, please ensure:

- The cabinet itself is intact and undamaged.
- All equipment inside the cabinet is intact and undamaged.

6.2 Installation Environment Requirements

6.2.1 Site Selection Requirements

- When choosing the installation site, consider the climatic environment and geological conditions (such as stress wave emissions, groundwater levels) of the site.
- The surrounding environment should be dry and well-ventilated.
- Ensure no trees are around the installation site to prevent branches or leaves from blocking the doors or air inlets of the energy storage integrated system during strong winds.
- It should be far from areas concentrated with toxic or harmful gases; away from flammable, explosive, corrosive items.
- To avoid noise, the equipment installation location should be away from residential areas

6.2.2 Foundation Requirements

WARNING

The equipment is heavy, so a detailed inspection of the installation site's conditions (mainly geological and environmental climate conditions) must be conducted before building the foundation. Only then can the design and construction of the foundation begin.

An unreasonable foundation construction plan can cause difficulties or trouble in placing the equipment, opening and closing doors, and later operation. Therefore, the installation foundation must be designed and built in advance according to certain standards to meet the requirements for mechanical support, cable routing, and later maintenance. The following requirements must be met when building the foundation:

- The bottom of the foundation pit must be compacted and leveled.
- The foundation should be built according to the foundation plan provided by Wolong Energy Storage, or a plan confirmed by us, with a surface tolerance requirement of ±5mm.
- The foundation must provide effective load-bearing support for the equipment.
- Elevate the cabinet to prevent rainwater erosion of the cabinet base and interior. It is recommended that the foundation be raised about 300mm above the level ground of the installation site.
- Combine with local geological conditions to build appropriate drainage measures.
- Build a cement foundation with sufficient cross-sectional area and height. The height of the foundation should be determined by the constructor based on the site's geology.
- Consider cable routing when building the foundation.

The excavated soil during foundation construction should be cleared immediately to avoid affecting subsequent equipment hoisting and transportation.

NOTE

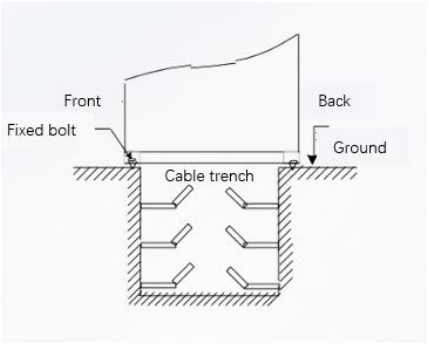
The energy storage integrated cabinet uses a bottom inlet and outlet wiring method. To facilitate installation and maintenance, it is recommended that all external connecting cables are routed through a cable trench.

The energy storage integrated cabinet installation foundation should have a pre-set concrete cable trench underneath, or a steel bracket installed on the foundation to elevate the installation surface, with cables laid in the overhead space. If a cable trench is pre-set, it can be fixed with anchor bolts or channel steel. If using a steel bracket, the equipment can be directly installed and fixed on the bracket.

Cable trenches are usually designed and constructed by the constructor according to relevant standards, taking into account the weight and space occupied by the required cables.

The recommended foundation and cable trench style are shown in the diagram.The cross-section of the

trench is shown in Figure 6-1, and the user can determine the number of cable support brackets as needed.



1. A maintenance platform is built around the foundation for convenience in later maintenance.
2. According to the position and size of the cable entrances and exits on the cabinet, enough space should be reserved for AC/DC side cable troughs during foundation construction, and cable conduits should be embedded in advance.
3. Determine the specification and number of shot pipes based on the cable model and the number of inlet and outlet cables.
4. Temporarily seal both ends of all pre-embedded pipes to prevent impurities from entering; otherwise, later wiring will be inconvenient.
5. After connecting all cables, seal the cable entrances, exits, and joints with fire-resistant mud or other suitable materials to prevent rodents from entering.

> Embed grounding units according to the relevant standards of the project's country/region.

6.2.3 Installation Space Requirements

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

> **Note**
>
> The following distance requirements are for the distance between cabinets, not between foundations.

Single Unit

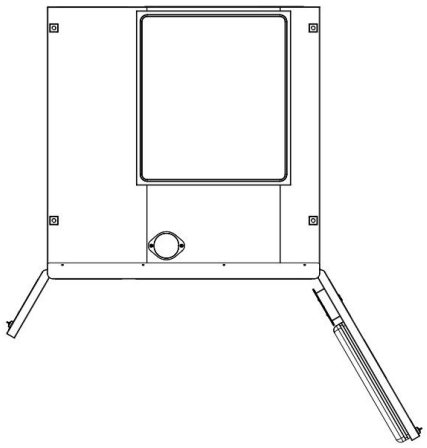


Figure 6-2 Recommended Installation Space for Single BESS Unit

If the rear side of the ESS is a movable frame, the minimum distance at the rear can be reduced to 150mm.

Multi-Unit

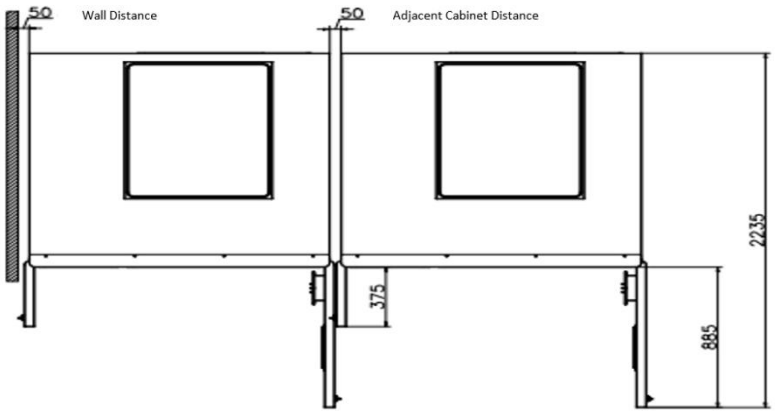


Figure 6-3 Recommended Installation Space for Multiple Units

*The illustration is for reference only. The actual product should be the standard.

6.3 Forklift Transportation

WARNING

- Move the product through the standard fork entry at the bottom.
- Under no circumstances should the equipment be moved by inserting the forks into any position other than the designated fork holes.

Before delivery, the product' s fork holes are exposed. It is recommended to seal the fork holes with the provided cover plates after installation at the site.

If the installation site is level, the product can be moved using a forklift. The bottom of the product is equipped with special fork holes for forklift transportation. Move the product through the fork holes on the front.

If using a forklift transportation method, the following requirements should be met:

- The forklift should be equipped with sufficient load-bearing capacity.
- The length of the forks should meet the requirements of the equipment.
- The forks should be inserted into the fork-shaped holes at the bottom of the equipment (for the location of the fork-shaped holes, please refer to the figure below). The depth of the forks inserted should be the depth of the pile number.
- The transportation, movement, and placement of the product should be slow and stable. It is advised to attempt transportation.
- The product can only be placed in a stable area. This area should be well-drained, free of obstacles or bulges.

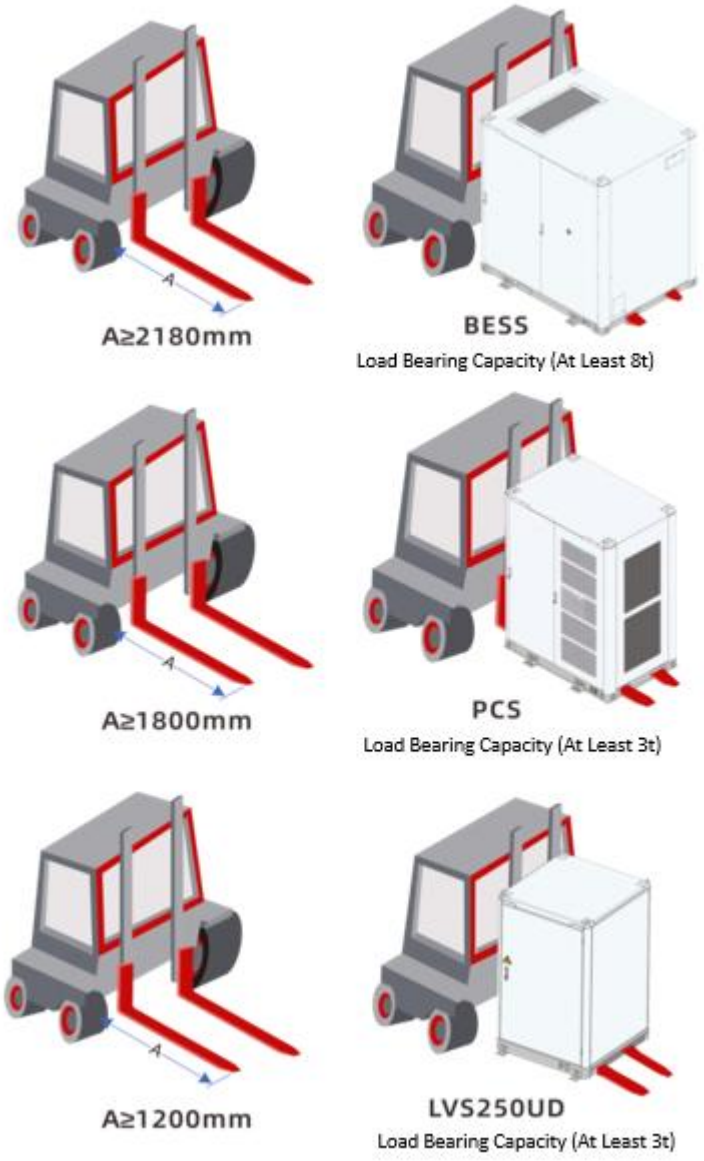


Figure 6-4 Forklift Transportation

6.4 Hoisting Transportation

6.4.1 Hoisting Precautions

⚠WARNING

- Throughout the entire process of hoisting the equipment, it is necessary to strictly follow the safety operation procedures of the crane.
- It is strictly forbidden for personnel to stand within a 5m to 10m range of the operation area. This is especially important under the lifting arm and under the hoisted or moved machinery to avoid accidents and casualties.
- If adverse weather conditions occur, such as heavy rain, dense fog, or strong wind, hoisting work should be stopped.

The following requirements must be met when hoisting the equipment:

A. Ensure site safety during lifting.

B. There must be professional personnel directing the entire operation on-site during the hoisting and installation.

C. The strength of the slings used must be sufficient to support the weight of the equipment.

D. Ensure all sling connections are safe and reliable and that the lengths of the slings connected to the angle pieces are equal.

E. The length of the slings can be appropriately adjusted according to actual site requirements.

F. The equipment must be kept stable and not tilted throughout the entire hoisting process.

G. Please implement the hoisting operation from the top of the BESS.

H. Take all necessary auxiliary measures to ensure the safe and smooth hoisting of the equipment.

The diagram below illustrates the crane operation during the hoisting process. In the diagram, the inner dotted circle represents the working range of the crane. When the crane is in operation, it is strictly forbidden for anyone to stand within the outer solid circle.

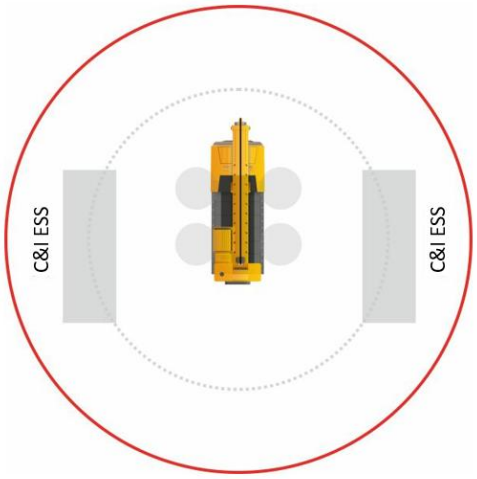


Figure 6-5 Illustration of Crane Operation

6.4.2 Hoisting Operation

During the process of hoisting the equipment, each operation should be conducted as follows:

- The equipment should be lifted vertically. There should be no dragging on the ground or on the top of the lower cabinets during lifting, and the cabinet should not be pushed or dragged on any surface.
- After the equipment is lifted 300mm off the support surface, pause to check the connection between the lifting gear and the equipment. Only after confirming that the connection is secure, continue with the hoisting.
- Once in place, the equipment should be gently lowered and landed smoothly. It is strictly forbidden to place the equipment outside the vertical drop by swinging the lifting gear.
- The ground where the equipment is placed should be firm, flat, well-drained, and free of obstacles or protrusions.

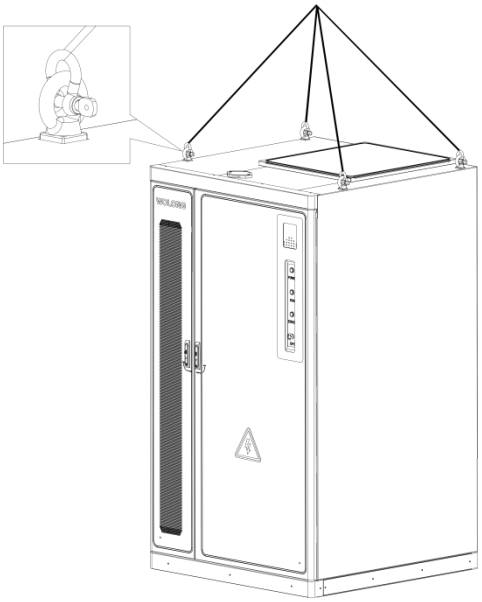


Figure 6-6 ESS Hoisting Illustration

*This diagram is for reference only. Please refer to the actual product received.

Shackle	Specifications
Model	Bow-shaped US standard G209 model 11/4(in) shackle (to be replaced)
Load	Above 12t

Note
● Do not hoist from the bottom of the cabinet ● When hoisting, please place the lifting rope in the middle of the top corner piece to prevent the rope from wearing the surface of the cabinet

6.5 Fixed Installation

External Cable Laying

If the energy storage integrated cabinet is to be permanently fixed to the foundation, before finally securing the equipment, ensure that the cable trench laying and the cable through-hole openings meet the installation requirements of the energy storage integrated cabinet.

After transporting the outdoor cabinet to the installation location, proceed with fixation. Choose welding fixation according to actual needs.

Welding Fixation Method

Weld the bottom of the cabinet to the foundation. After completion, apply anti-corrosion treatment to the welding area. Install expansion screws for fixation. The fixation of the energy storage integrated cabinet needs to be completed as follows:

1. Use appropriate tools to transport the energy storage integrated cabinet to the installation location and align it with the foundation.
2. Use welding to fix the energy storage integrated cabinet to the foundation.
3. Install the base baffle of the energy storage integrated cabinet to complete its fixed installation.

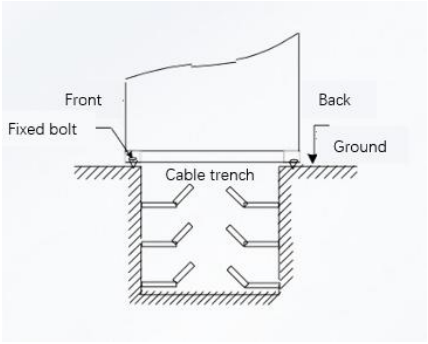


Figure 6-9 Energy Storage Cabinet Fixation Method

7 Installing Cables

DANGER

During the battery installation process, pay attention to the positive and negative terminals. It is strictly forbidden to short-circuit the positive and negative terminals of a single battery or battery pack, as this can cause a battery short circuit.

DANGER

Smoking or using open flames near the batteries is prohibited. The site must have fire-fighting facilities that meet requirements, such as fire sand, carbon dioxide fire extinguishers, etc. Please use specialized protective gear and insulated tools to avoid electric shock injuries or short-circuit faults.

WARNING

Tighten the busbars or cable fastening screws according to the torque specified in the text, and regularly check if they are tightened, and if there are any signs of rust, corrosion, or other foreign matter, and clean them. Otherwise, a loose screw connection will lead to excessive connection voltage drop, and even significant heating at high currents, which can burn out the battery.

CAUTION

When connecting and securing the battery, ensure the terminals are firmly inserted, the plug's self-locking mechanism is locked, and the cables are undamaged. Do not connect two or more cables at the positive and negative power interfaces of the battery. When making cables, be sure to keep away from the equipment to prevent cable debris from accidentally entering the equipment, causing sparks and resulting in personal injury and equipment damage.

NOTE

All electrical connection diagrams involving cables in this chapter are for reference only. The selection of cables should comply with local cable standards (yellow-green two-color wires can only be used for protective grounding).

7.1 Installing Cables

7.1.1 Preparing Cables

NOTE

- The selection of cable diameter should comply with local cable standards. Factors affecting cable selection include rated current, cable type, laying method, environmental temperature, and maximum expected line loss.
- Either Ethernet communication or 485 communication can be chosen, depending on the actual situation.

Table 7.1 Cable Reference Table

Name	Type	Conductor Cross-sectional Area Range	Outer Diameter	Terminal	Source
Equipment Protective Ground Wire	Single-core Outdoor Copper Core Wire	≥70mm2	-	M12 OT/DT Terminal	User-supplied
External Power Supply AC Line (External Power Supply Scenario)	4-core (A, B, C, N) Outdoor Copper Core Cable	70mm2	15.20mm (±0.40mm)	40mm depth cold-pressed terminal, 70㎡ OT/DT terminal	User-supplied
Ethernet Cable	CAT6E Outdoor Shielded Flame Retardant Ethernet Cable	-	≤9mm	Shielded RJ45 Connector	User-supplied
Shielded Twisted Pair	UL2464_20AWG*1P+AB_Flame Retardant	-	≤10mm	Tube-type Insulated Terminal Crimp 0.5mm² Tinned Copper Flame Retardant	User-supplied

7.2 Installing Grid Power Supply AC Line

Prerequisites

The AC cable has been pre-embedded

Safety Precautions

⚠WARNING

Accidental contact with live terminals can lead to fatal electric shock

- Ensure that the energy storage inverter's AC/DC switch is in the off position, ensuring that the terminal is not live.
- When connecting to the grid, it must be permitted by the relevant departments and comply with all safety directives related to the grid.

⚠WARNING

When connecting to the AC grid, disconnect the upstream AC side circuit breaker to ensure that the contact terminals are voltage-free.

- Connection to the grid is only allowed with the approval of the public power grid and in compliance with all relevant safety instructions.
- The AC output is not grounded inside the equipment.
- The DC and AC circuits are isolated from the casing. If the national electrical standards require it, the installer will need to perform the system connection.

Operating Steps

Step 1: Run the AC cable through the bottom cable entry hole and connect it to the corresponding terminal hole on the copper busbar inside the cabinet.----End

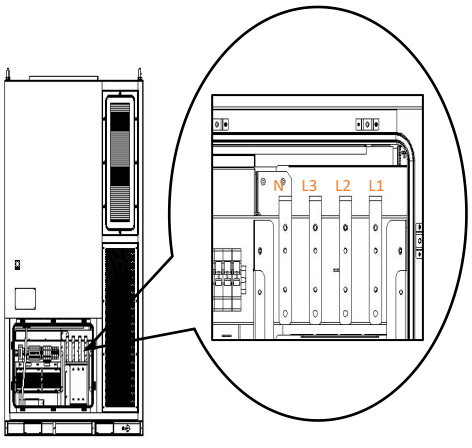


Figure 7-1 Connecting AC Line

7.3 Installing Communication Lines

7.3.1 EMS Industrial Control Machine Communication Line

Step 1: Connect the communication line to the "LAN" port or 485 interface of the industrial computer, and wire according to the diagram.

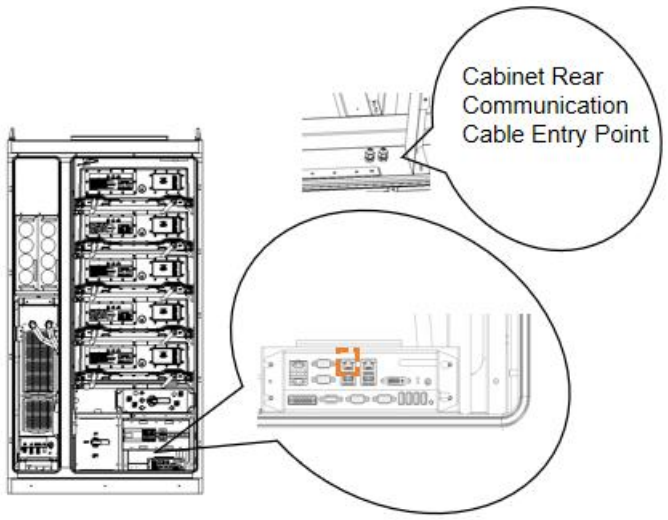


Figure 7-2 Connecting LAN or 485 Communication Cable

Step 2: Bundle the cables.
----End

7.4 Installing Grounding Wire

Grounding Method

Use a grounding cable fixed to the ground point. Please refer to "Cabinet Appearance" for the location of the grounding point.

Grounding Cable

Use a 70mm2 ~ 95mm2 copper grounding cable, reliably connecting the grounding point to the cabinet's grounding point.

Crimp DT terminal, for specific steps please refer to "Preparing Cables". Use an M12 bolt to fix the DT terminal to the terminal hole, with a tightening torque of 34~40N·m.

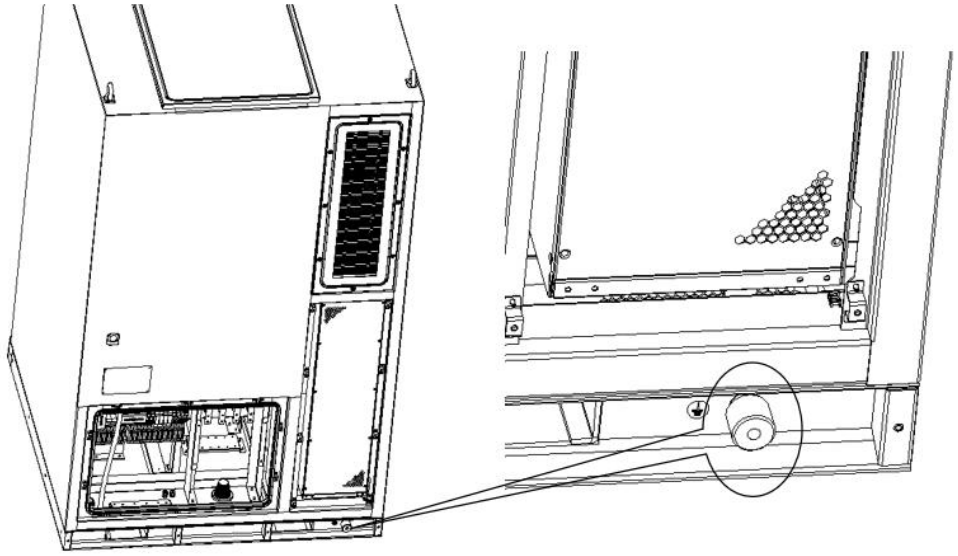


Figure 7-3 Installing grounding wire

Please install external grounding in accordance with the actual situation of the project site, and follow the instructions of the power station staff. After completing the grounding connection, measure the grounding resistance, which should not exceed 4Ω.

Note
The grounding method must comply with the standards and regulatory requirements of the installation location. The specific grounding resistance value must follow the national/local standards and regulations.

7.5 Installing Inter-Pack Series Cables

Precautions

Strict adherence to all safety instructions in this manual is mandatory at all times. To avoid potential personal injury, property damage during installation or operation, and to effectively extend the product's lifespan, please read all safety instructions carefully. Incorrect usage or mishandling may endanger:

- The life and personal safety of the operator or third parties.
- The energy storage battery system or other properties belonging to the operator or third parties.

Note
The safety precautions in this manual cannot encompass all the standards to be followed and should be adapted to the actual situation on-site. Wolong Energy Storage will not be responsible for any loss caused by not following the safety precautions in the manual.

⚠WARNING

- When installing equipment with hazardous voltages, please comply with relevant standards and local installation safety guidelines.
- Adhere to regulations concerning the correct use of tools and personal protective equipment.
- All connections must be made under clear guidance; any form of guesswork and vague attempts are strictly prohibited.
- Use tools with an insulating protective layer.

Cable Connection

Tools preparation as shown in the figure below:

Figure 7-4 Installation Tools

Step 1: Before connecting inter-pack cables, wear insulating shoes and gloves. Before connecting inter-pack

power cables, disconnect the high voltage box circuit breaker.

> The positive terminal of the aviation plug should be inserted into the positive base, and the negative terminal into the negative base. Positive is orange, and negative is black. A "click" sound indicates that the aviation plug is properly inserted.

Step 2: Connect the power cables between Packs. Except for the connection between the negative terminal of pack 2 and the positive terminal of pack 3, the positive and negative terminals of other Packs have already been installed on the battery rack. Only need to connect the negative terminal of PACK2 in series to the positive terminal of PACK3. Install as shown in the figure below.

----End

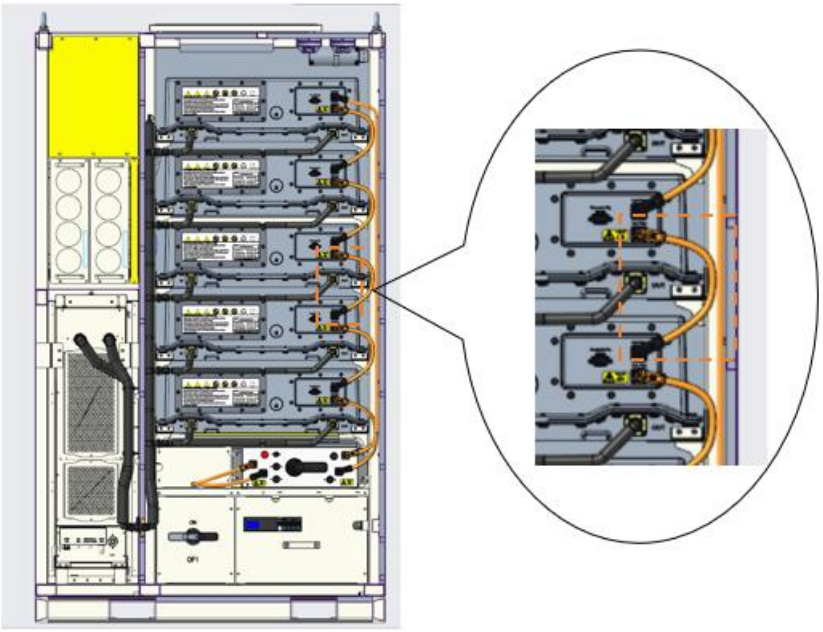


Figure 7-5 PACK Cable Installation

Note
When connecting power cables between Packs, ensure that the high voltage box circuit breaker is in the disconnected state.

7.6 Installing the Antenna

The antenna can be installed only after the industrial and commercial energy storage cabinet is in place and fixed. The lead wire for the antenna from the industrial control machine to the cabinet has already been installed; you only need to install the part of the antenna outside the cabinet and tighten it securely.

Install as shown in the figure for the desired effect.

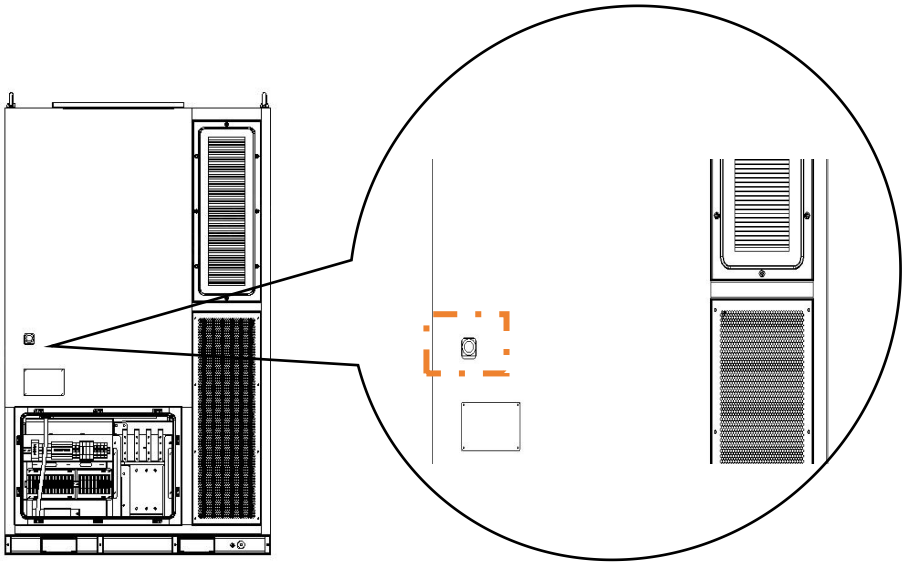


Figure 7-6 Antenna Installation

7.7 Sealing the Cable Entry Holes

After the cable installation is complete, use sealing clay to seal the cable entry holes. The sealing point is as shown in the figure.

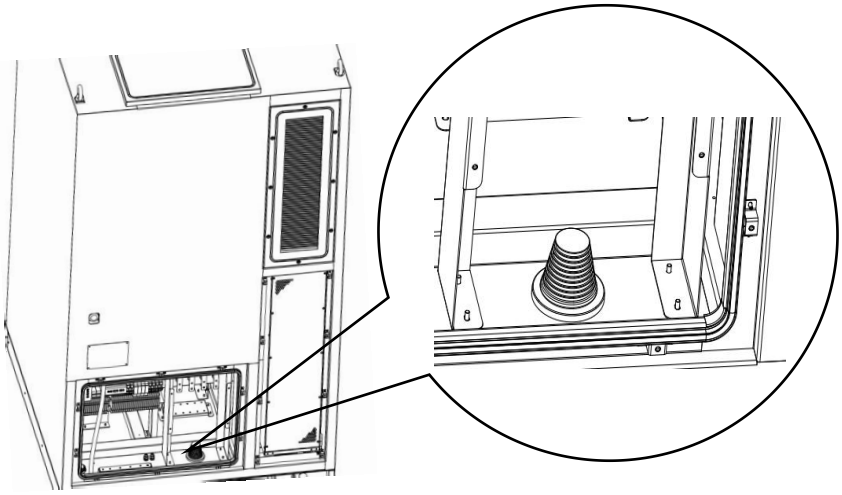


Figure 7-7 Sealing the Wiring Hole

8 EMU Monitoring Operation Introduction

8.1 Homepage

The main interface can visualize the basic data of the energy storage unit, including AC and DC voltage, current, power and other real-time information.EMU has five main functions, namely, Event Record, Historical Data, Real-Rime Data, Local Control and Setting Center, which are all reflected in the main interface. The following section describes these five functions in detail.

Figure 8-1 Homepage interface

Real-Time Function

The Real-Time Data interface can display the real-time information of BMS, PCS, cooling system and power meter. When click BMS it can jump to the interface of BMS data.

The Real-Time Data interface can show the real-time data of BMS, PCS, cooling system and meter. When the user clicks on the BMS section, the interface will automatically jump to the BMS data interface, which provides more detailed of the battery status information. This is designed for efficient system management and monitoring, ensuring that users have quick access to critical operational data.

Figure 8-2 Real-Time Data interface

In the BMS data interface, users can monitor the battery's current state of charge (SOC) and state of health (SOH) in real time. In addition, the interface also shows the current temperature and voltage of each battery module in detail, thus providing users with a comprehensive battery performance analysis. This design ensures that users can grasp the detailed operating status of the battery in real time for effective battery management and maintenance.

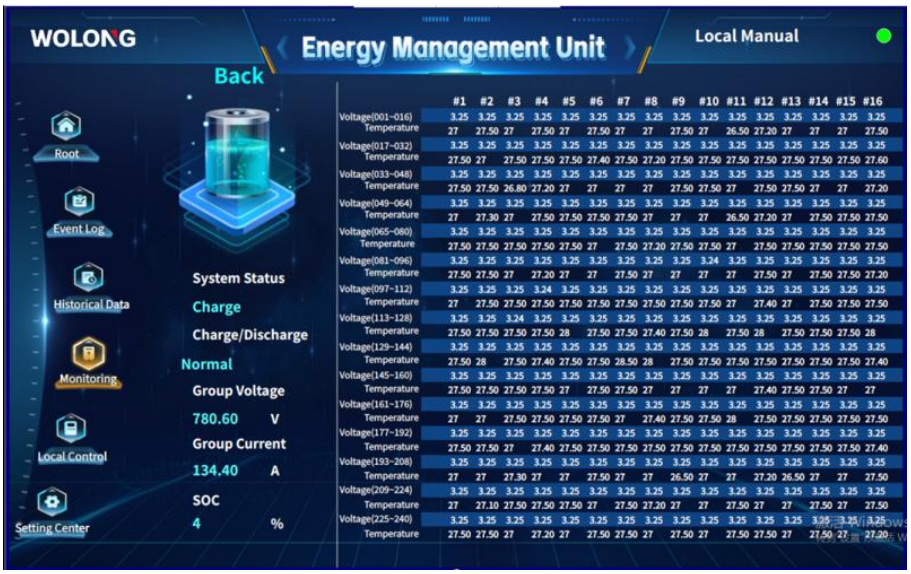


Figure 8-3 BMS interface

Historical Data Function

The Historical Data provides a capability to view the history of data points for each device. Users can retrieve historical data by setting the time interval and selecting specific equipment names and data point names. The interface also supports presenting this data in the form of graphical curves, making it easy for users to perform detailed data analysis and trend observation, thus providing a more comprehensive understanding of

the historical performance of the equipment.

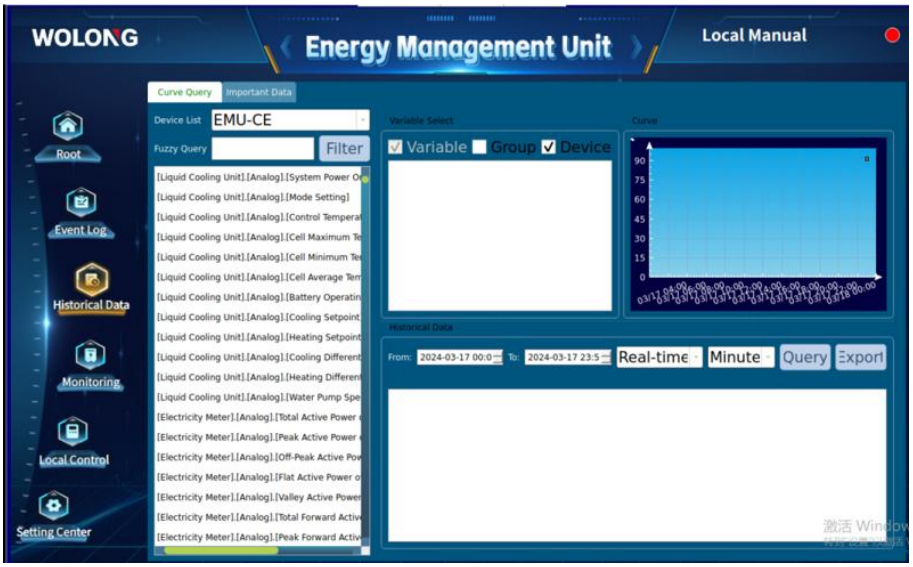


Figure 8-4 Historical Data Interface(BMS: Temp)

Event Record Function

The Event Record screen displays the current alarm, event and protection logs and allows the user to filter and review the history. This feature allows the user to effectively track the historical performance and safety events of the system, providing important data to support system maintenance and management.

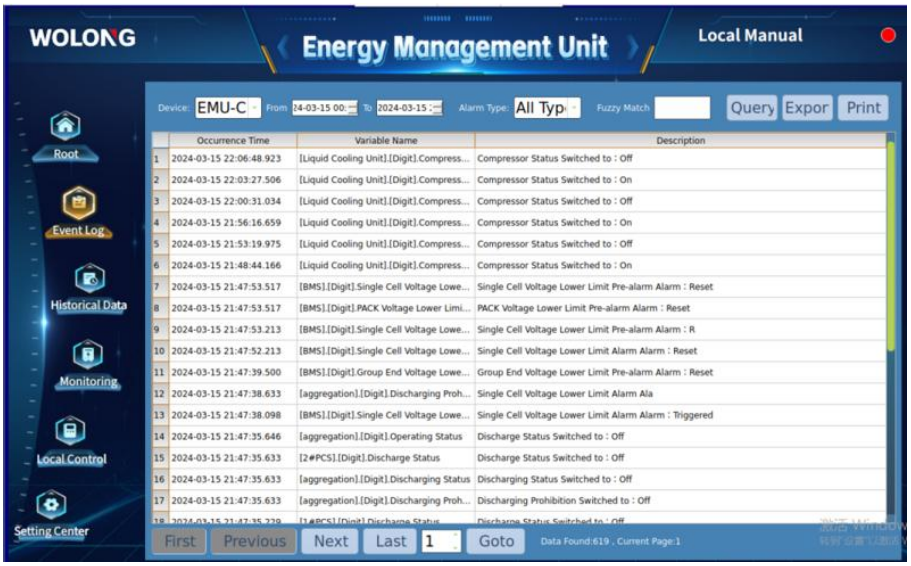


Figure 8-5 Event Record Interface

Local Control Function

The local control interface is the interface for manually operating the energy storage unit for charging and discharging when the control mode is in manual control. Through this interface, users can directly start and stop the energy storage unit and set the power, when the power is set to a negative value indicates the charging state, and a positive value indicates the discharging state. The status display area on the right side of the interface allows the user to quickly understand the current operating status of the device and the charging and discharging power.

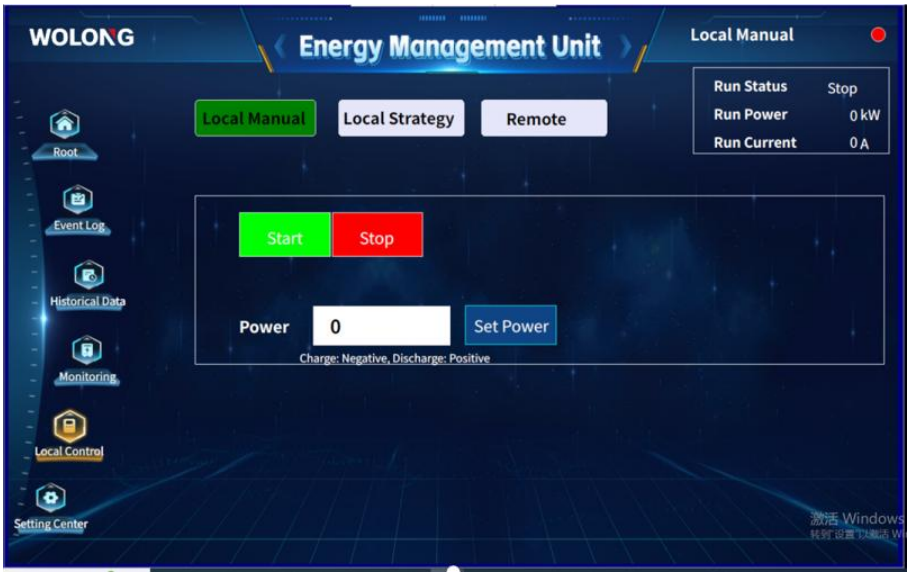


Figure 8-6 Local Control Interface

Local Control

Control Mode:

It can choose whether to use remote control, local strategy and manual control.

Local strategy requires selecting pre-set custom strategies on the strategy selection page

Custom strategies are set by setting fixed times for charging and discharging, and the corresponding charging and discharging power, clicking the confirm button saves the strategy settings;

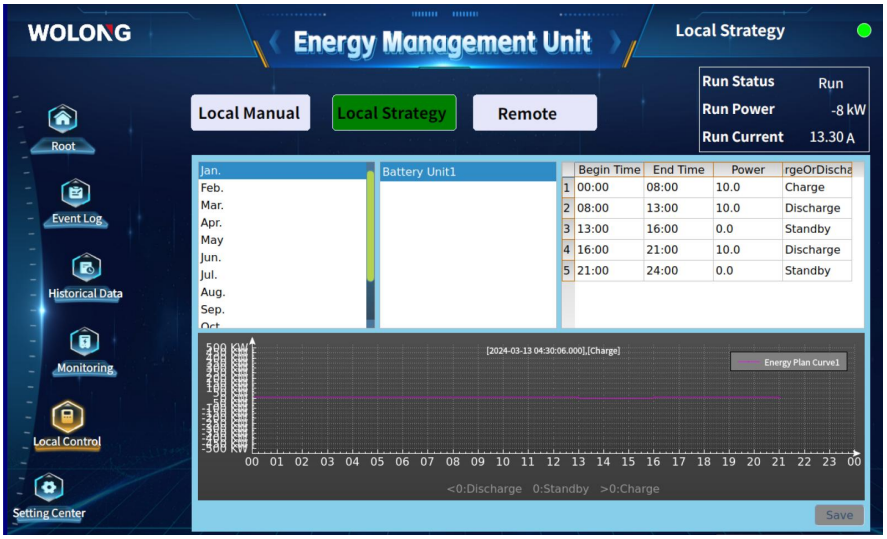


Figure 8-7 local strategy Interface

Manual control is mainly used in cases where it is necessary to manually set the PCS operating power during testing;

Specific operation method: First select manual control and confirm that the manual status indicator in the top right corner of the interface turns green before proceeding to set the power, then click

execute to run;

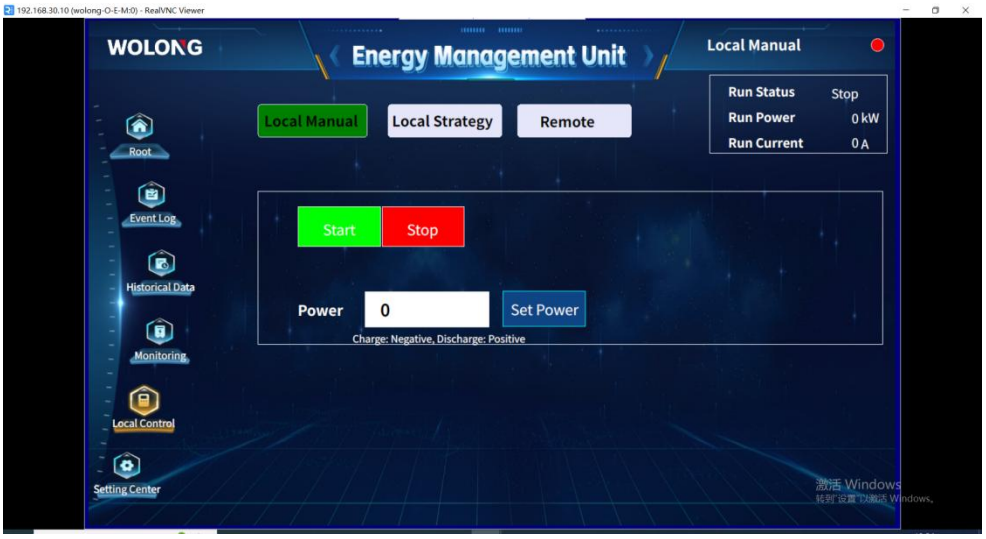


Figure 8-8 Local Control (Control Method)

Setting Center

The setting center includes protection preview and protection settings, totaling 2 modules;

Protection preview allows viewing the settings of protection parameters;

Protection settings are for setting protection parameters, and the settings can be viewed on the protection preview page after completion.

Figure 8-9 Settings Center (Protection settings)

9 Powering On and Powering Off

9.1 Powering On for Operation

⚠WARNING

The energy storage equipment can only be put into operation after confirmation by professional personnel and with the permission of the local power department.

⚠WARNING

For energy storage equipment that has been shut down for a long period, a comprehensive and detailed inspection of the equipment must be carried out before powering on. Only after ensuring that all indicators meet the requirements can the equipment be powered on.

9.1.1 Pre-Power On Checks

Before powering on, please carefully check the following items to ensure accuracy.

- Check that communication lines, power lines, and power cables are connected correctly.
- Ensure that the protective covers inside the equipment are securely installed.
- Ensure that the emergency stop button is in the released position.
- Check to make sure there is no grounding fault.
- Use a multimeter to verify that the AC and DC side voltages meet the startup conditions and that there is no risk of overvoltage.
- Check to ensure no tools or parts are left inside the equipment.
- Ensure all air inlets and outlets are free of foreign objects or blockages.

9.1.2 WL-ESS-110kW/235kWh-0.4kV Main Electrical Diagram and Battery Cabinet Structure Diagram

The structural diagram of the battery cabinet and the main electrical diagram of the WL-ESS-110kW/235kWh-0.4kV can be referred to in Sections 3.3 Component Layout and 3.4 Electrical Principle, respectively.

9.1.3 Powering On Steps

Step 1: Preparation for powering on.

1) Check the power and communication connections between the battery PACK and PCS module.
2) Check if the liquid cooling pipeline between the liquid cooling machine and the battery PACK is connected normally and if there is any leakage.
3) Check if the power line of the liquid cooling machine is connected properly.
4) In the battery cabinet: Check that the AC side molded case switch QF1 is in the “OFF” position, and the cabinet emergency stop is reset.
5) In the battery cabinet: Check that the high voltage box DC load switch handle is in the “OFF” position, and the cabinet emergency stop is reset.

Step 2: Powering on the battery cabinet. (Manual control)

1) Measure the voltage at the lower end of the input power side molded case switch QF1 to ensure it is normal.
2) Close the auxiliary control power switch QF2, including the control circuit, EMU screen power, high voltage box, industrial control machine, firefighting equipment, and other devices; the power-up is completed.
3) Close the liquid cooling unit power switch QF3; the liquid cooling unit power-up is completed.
4) Close the high-voltage box DC molded case switch QF (DC main circuit power supply), completing the powering up of the DC main power supply;
5) Close the AC molded case switch QF1 switch (AC main circuit power supply), completing the powering up of the main AC power supply;

Step 3: WL-ESS-110kW/235kWh-0.4kV power-on check is completed, ready for startup operation. Click to enter the EMU software control system human-machine interface.

Step 4: Click the EMU interface “Local Control”, select the control mode, click manual control and execute, the manual control icon in the top right corner of the interface turns green.

Step 5: Click “Manual Control,” enter the PCS operating power “10KW” in the power input box and execute.

Step 6: Click the green “Start” button and execute, the energy storage system starts operating.

Step 7: Click “Main Interface” and “Real-Time Data” interface to observe if the AC and DC side voltage, current, power, and other data are normal during energy storage operation.

----End

----Continue from Step 1

Step 2: Powering on the battery cabinet. (Local strategy control)

1) Measure the voltage at the lower end of the input power side molded case switch QF1 to ensure it is normal.
2) Close the auxiliary control power switch QF2, including the control circuit, EMU screen power, high voltage box, industrial control machine, firefighting equipment, and other devices; the power-up is completed.
3) Close the liquid cooling unit power switch QF3; the liquid cooling unit power-up is completed.
4) Close the DC molded case switch QF in the high voltage box (DC main circuit power supply), completing the powering up of the DC main power supply.
5) Close the AC molded case switch QF1 (AC main circuit power supply), completing the powering up of the main AC power supply.

Step 3: WL-ESS-110kW/235kWh-0.4kV power-on check is completed, ready for startup operation. Click to enter the EMU software control system human-machine interface.

Step 4: Click the EMU interface “Local Control”, select local strategy and execute, click to enter “Strategy Selection,” set timed strategies, enter charging and discharging time periods and power.

Step 5: The WL-ESS-110kW/235kWh-0.4kV energy storage system starts executing the planned strategy.

Step 6: After starting the planned strategy, click on the "Main Interface" and "Real-Time Data" interface to observe whether the voltage, current, power, and other data on the AC and DC sides of the energy storage operation are normal.

----End

----Continue from Step 1

Step 2: Powering on the battery cabinet. (Remote control)

1) Measure the voltage at the lower end of the input power side molded case switch QF1 to ensure it is normal.
2) Close the auxiliary control power switch QF2, including the control circuit, EMU screen power, high voltage box, industrial control machine, firefighting equipment, and other devices; the power-up is completed.
3) Close the liquid cooling unit power switch QF3; the liquid cooling unit power-up is completed.
4) Close the DC molded case switch QF in the high voltage box (DC main circuit power supply), completing the powering up of the DC main power supply.
5) Close the AC molded case switch QF1 (AC main circuit power supply), completing the powering up of the main AC power supply.

Step 3: WL-ESS-110kW/235kWh-0.4kV power-on check is completed, ready for startup operation. Click to enter the EMU software control system human-machine interface.

Step 4: Click the EMU interface “Local Control”, click remote control and execute.

Step 5: Energy storage control for start, stop, and charging/discharging strategies, power, and time are handed over to remote backend control.

Step 6: Click “Main Interface” and “Real-Time Data” interface to observe if the AC and DC side voltage, current, power, and other data are normal during energy storage operation.

----End

9.2 Powering Off for Shutdown

9.2.1 Planned Shutdown (Manual Control)

Step 1: Preparation for powering off: Click to enter the EMU software control system human-machine interface (for emergency shutdown, press the cabinet emergency stop button).

Step 2: Click the EMU interface “Local Control”, select control mode, confirm manual control and execute, the manual control icon in the top right corner of the interface turns green.

Step 3: Click “Manual Control,” enter “0KW” in the PCS operating power input box and execute.

Step 4: Click the red “Stop” button and execute, the WL-ESS-110kW/235kWh-0.4kV industrial and commercial energy storage integrated cabinet shuts down.

Step 5: Click “Main Interface” and “Real-Time Data” interface to observe if the AC and DC side voltage, current, power, and other data are in shutdown state.

Step 6: Powering off the battery cabinet.

Disconnect the AC equipment power switch QF1 (AC main circuit power supply), turn the AC molded case switch QF1 to "OFF";

Disconnect the DC equipment power switch QF (DC main circuit power supply), turn the DC molded case switch QF to "OFF";

Disconnect the AC auxiliary power switch QF2 (control circuit);

Disconnect the liquid cooling machine power switch QF3 (liquid cooling machine power circuit).

9.2.2 Planned Shutdown (Local Strategy Control)

Step 1: Preparation for powering off: Click to enter the EMU software control system human-machine interface (for emergency shutdown, press the cabinet emergency stop button).

Step 2: Click the EMU interface “Local Control”, select control mode, confirm local strategy and execute, the local strategy icon in the top right corner of the interface turns green.

Step 3: Click “Local Control Strategy”, enter “0KW” in the PCS operating power input box and execute.

Step 4: The WL-ESS-110kW/235kWh-0.4kV shuts down.

Step 5: Click “Main Interface” and “Real-Time Data” interface to observe if the AC and DC side voltage, current, power, and other data are in shutdown state.

Step 6: Powering off the battery cabinet.

1) Disconnect the AC equipment power switch QF1 (AC main circuit power supply), and turn the AC molded case switch QF1 to "OFF";
2) Disconnect the DC equipment power switch QF (DC main circuit power supply), and turn the DC molded case switch QF to "OFF";
3) Disconnect the AC auxiliary power switch QF2 (control circuit);
4) Disconnect the liquid cooling machine power switch QF3 (liquid cooling machine power circuit).

9.2.3 Planned Shutdown (Remote Control)

Step 1: Preparation for powering off: Click to enter the EMU software control system human-machine interface (for emergency shutdown, press the cabinet emergency stop button).

Step 2: Click the EMU interface “Local Control”, select remote control and execute, the remote control icon in the top right corner of the interface turns green.

Step 3: Click “Remote Control,” enter “0KW” in the remote backend power input box and execute.

Step 4: Click the “Stop” button and execute, the WL-ESS-110kW/235kWh-0.4kV industrial and commercial energy storage integrated cabinet shuts down.

Step 5: Click “Main Interface” and “Real-Time Data” interface to observe if the AC and DC side voltage, current, power, and other data are in shutdown state.

Step 6: Powering off the battery cabinet.

1) Disconnect the AC equipment power switch QF1 (AC main circuit power supply) and turn the AC molded case switch QF1 to "OFF";
2) Disconnect the DC equipment power switch QF (DC main circuit power supply) and turn the DC molded case switch QF to "OFF";
3) Disconnect the AC auxiliary power switch QF2 (control circuit);
4) Disconnect the liquid cooling machine power switch QF3 (liquid cooling machine power circuit);

* Note: Wait for 5 minutes before opening the door for maintenance.

9.2.4 Unplanned (Emergency) Shutdown

1. In case of an emergency, press the emergency button to stop the machine.
2. In case of a fire emergency, contact local firefighting professionals.

9.3 Trial Operation Steps

9.3.1 Manual Control Trial Operation

Step 1: Follow the power-on steps 9.1.3 for the WL-ESS-110kW/235kWh-0.4kV industrial and commercial energy storage integrated cabinet for a pre-trial run check.

Step 2: Click the EMU interface “Local Control”, select the control mode, click manual control and execute, the manual control icon in the top right corner of the interface turns green.

Step 3: Click “Manual Control,” enter “10KW” in the PCS operating power input box and execute.

Step 4: Click the green “Start” button and execute, the energy storage system begins operation.

Step 5: Input the rated power, and the PCS operating power gradually increases from "10KW" to operate at the rated power.

Step 6: Conduct a full charge-discharge cycle, click “Main Interface” and “Real-Time Data” interface to observe if the AC and DC side voltage, battery rack and PCS voltage, current, temperature are normal during operation.

9.3.2 Remote Control Trial Operation

Step 1: Follow the power-on steps 9.1.3 for the WL-ESS-110kW/235kWh-0.4kV industrial and commercial energy storage integrated cabinet for a pre-trial run check.

Step 2: Click to enter the EMU software control system human-machine interface.

Step 3: Click the EMU interface “Local Control”, click the remote control and execute, set timed strategies, enter charging and discharging time periods and power.

Step 4: The remote backend controls the WL-ESS-110kW/235kWh-0.4kV industrial and commercial energy storage integrated cabinet to start, stop, and set charging/discharging strategies.

Step 5: The remote backend observes if the current, voltage, temperature, power, and other data are normal during energy storage operation.

10 Troubleshooting

10.1 Safety Precautions

⚠WARNING

Risk of electric shock due to high voltage

Under fault conditions, the product may have high voltage. Touching live parts of the equipment can be dangerous or fatal and may cause severe injury.

Follow all safety information when operating the product.

Wear appropriate personal protective equipment when maintaining the product.

If the problem cannot be resolved through this document, please contact the manufacturer.

10.2 Exporting Device Operation Data

When it's necessary to send logs to the manufacturer for analysis, the device operation records need to be downloaded.

1. Log into the control interface on the webpage using a password.
2. Select “History” > “Data Record” > choose the respective device and the operating data for the corresponding month > “Package Excel”. Once the download is complete, save the record file in the browser.

10.3 Common Fault Descriptions

The table below shows faults caused by incorrect parameter settings. Users can reset parameters according to the instructions in the appendix, and then the fault can be automatically resolved.

⚠CAUTION

Alarm Categories:

Fault: Shutdown;

Warning: Alarm without shutdown;

Alarm Clearing Method:

Automatic: The alarm clears automatically once the cause of the alarm disappears.

Manual: After the cause of the alarm disappears, a manual alarm clearing command needs to be sent.

Power off: After the alarm disappears, the power needs to be turned off and restarted.

Table 10-1 Common Faults Table

Fault Name	A.C.+CM	Cause
AC Bus Overvoltage	A.C	AC bus voltage higher than overvoltage protection setting
AC Bus Undervoltage	A.C.	AC bus voltage lower than undervoltage protection setting
AC Bus Overfrequency	A.C.	AC bus frequency higher than overfrequency protection setting
AC Bus Underfrequency	A.C.	AC bus frequency lower than underfrequency protection setting
AC Overvoltage	A.C.	Current grid voltage higher than overvoltage protection setting
Grid Undervoltage	A.C.	Current grid voltage lower than undervoltage protection setting
Grid Overfrequency	A.C.	Current grid frequency higher than overfrequency protection setting
Grid Underfrequency	A.C.	Current grid frequency lower than underfrequency protection setting
DC Input Overvoltage	A.C.	Device's current DC voltage higher than the upper limit of DC voltage
DC Input Undervoltage	A.C.	Device's current DC voltage lower than the lower limit of DC voltage or DC voltage not connected
DC Bus Overvoltage	A.C.	During module operation, voltage on DC bus capacitors too high
DC Bus Undervoltage	A.C.	During module operation, voltage on DC bus capacitors too low
Parameter Mismatch	A.C.	Parameters set in <DC Parameters> are unreasonable

10.4 Detailed Fault Troubleshootin

For detailed fault troubleshooting, please consult our technical personnel.

10.4.1 Overview

Common faults and handling methods of the device are as follows. If the problem still cannot be resolved or if there are still doubts with the help of this manual, please contact the company. At the same time, provide the following information for faster and better service:

Device serial number, production date, and software version information;

Information about external devices connected to this device, including manufacturer, model, configuration, etc.;

Fault information and brief description;

Photos of the fault site (if site conditions permit).

⚠WARNING

The grounding cable must be properly grounded during fault handling, otherwise, it may pose a fatal electric shock risk to the operator.

10.4.2 Troubleshooting Methods

Fault Name	Fault Type	Suggested Action
PCS Fault	Fault	Check if there is a fault in the PCS system modules, and resolve the PCS fault according to the PCS manual.
PCS Unit Fault	Fault	Check for fault information in the PCS subunits and handle the PCS alarm information specifically. Resolve the PCS fault according to the PCS manual.
PCS Unit Alarm	Alarm	Investigate alarms in PCS subunits and address PCS alarm information specifically. Resolve the PCS alarm according to the PCS manual.
System Leakage Current Fault	Fault	Investigate the leakage current situation in the PCS cabinet and resolve the fault according to the PCS manual.
Liquid Cooling Unit Fault	Fault	Check the fault information displayed on the EMU human-machine interface. Determine if there are faults in all liquid cooling units and resolve them according to the maintenance manual.
Upper Machine Communication Fault	Fault	Check if the upper machine is on the same local network as the EMU. Check the communication lines between the upper machine and all EMUs are connected properly. Check if the upper machine's configured IP address matches the actual device.
PCS and EMU Communication Fault	Fault	Check if the communication method between PCS and EMU is consistent with the diagram. Check if the communication line between PCS and EMU is connected properly.
Liquid Cooling Unit and EMU Communication Fault	Fault	Check if the communication method between the liquid cooling unit and EMU is consistent with the diagram. Check if the communication line between the liquid cooling unit and EMU is connected properly.
Battery Rack and EMU Communication Fault	Fault	Check the CAN communication between the pack and the high-voltage box, and the 485 communication between the high-voltage box and EMU is consistent with the diagram; check if the communication address of the high-voltage box is set correctly and corresponds with the EMU program. Check if the CAN communication between the pack and the high-voltage box, and the communication line between the high-voltage box and EMU are connected properly.
Energy Meter and EMU Communication Fault	Fault	Check if the communication method between the energy meter and EMU is consistent with the diagram, whether the communication address of the energy meter is set correctly, and corresponds with the EMU program. Check if the communication line between the energy meter and EMU is connected properly.
Dry Contact Fault and Alarm	Fault/Alarm	Check the EMU human-machine interface for alarms or fault list, find the corresponding dry contact status through the diagram, and determine if a real emergency stop, water intrusion, lightning protection, access control, smoke detection, fire action has occurred; If no actual event has occurred and the fault or alarm still exists, check whether the node feedback signal line is loose or the EMU input end collection fault, and if the node feedback information is abnormal.
System Battery Rack Alarm	Alarm	Check if the primary wiring of the system battery rack is normal. Check if the communication line wiring of the system battery rack is normal. Check the EMU human-machine interface to see if the battery rack

		group-end voltage shows overvoltage and undervoltage, group-end temperature shows over-temperature or low-temperature alarm, and if the high-voltage box battery rack alarm parameters are set normally. Check if there are anomalies in the packs within the system battery rack.
System Battery Rack Protection	Protection	Check if the primary wiring of the system battery rack is normal. Check if the communication line wiring of the system battery rack is normal. Check the EMU human-machine interface to see if the battery rack group-end voltage shows overvoltage and undervoltage, group-end temperature shows over-temperature or low-temperature protection, and if the high-voltage box battery rack protection parameters are set normally. Check if there are anomalies in the packs within the system battery rack.
System Battery Pack Alarm	Alarm	Check if the primary wiring of the system battery pack is normal. Check if the communication line wiring of the system battery cluster is normal. Check the EMU human-machine interface to see if the battery pack's cell voltage shows overvoltage and undervoltage, cell temperature shows over-temperature or low-temperature alarm, and if the high-voltage box battery cluster protection parameters are set normally. Check if there are anomalies in the packs within the system battery cluster.
System Battery Rack Protection	Protection	Check if the primary wiring of the system battery pack is normal. Check if the communication line wiring of the system battery cluster is normal. Check the EMU human-machine interface to see if the battery pack's cell voltage shows overvoltage and undervoltage, cell temperature shows over-temperature or low-temperature protection, and if the high-voltage box battery cluster protection parameters are set normally. Check if there are anomalies in the packs within the system battery cluster.

11 TroubleshootingMaintenance Guidelines

11.1 Precautions Before Maintenance

⚠WARNING

- Ensure to disconnect the power supply before performing internal maintenance on the equipment to prevent accidental contact.
- Do not open the battery outdoor cabinet for maintenance during rainy, humid, or windy weather. Wolong is not responsible for any damage caused by maintenance under these conditions.
- Avoid opening the cabinet door during rain, snow, or foggy weather with high humidity, and ensure the sealing strips around the door are not curled after closing the door.
- Follow the instructions provided in the product manual for operation. Failure to do so may result in product failure.

⚠WARNING

To minimize the risk of electric shock, do not perform any maintenance or repair operations beyond those specified in this manual.

On clear weather days, it is advisable to open the cabinet door for ventilation and dehumidification.

11.2 Safety Precautions

General Safety Rules

⚠WARNING

- Only qualified and authorized personnel should perform maintenance or other operations on the equipment.
- Do not leave screws, washers, or other metal objects inside the equipment as this may damage the equipment.

⚠WARNING

- After the equipment is turned off, wait for at least 5 minutes before operating on it.

Five Safety Rules

When performing maintenance or repair operations on the equipment, ensure the safety of the operators by adhering to the following five safety rules:

1. Disconnect all external connections to the equipment, as well as the connection to the internal power supply of the equipment.
2. Ensure that the equipment cannot be accidentally powered back on.
3. Use a multimeter to verify that the part of the equipment to be repaired is completely de-energized.
4. Implement necessary grounding connections.
5. Use insulating material to cover any potentially energized parts of the operation area.

11.3 Cabinet Maintenance Item List and Cycle

11.3.1 Maintenance Work (Biennially)

Item List	Inspection Method
System Status and Cleanliness	Check the following items and correct immediately if they do not meet the requirements: • Check for damage or deformation of the outdoor cabinet and internal equipment. • Monitor for abnormal noise during operation of internal equipment. • Check if the temperature inside the outdoor cabinet is too high. • Verify if the humidity and dust level inside the outdoor cabinet are within normal ranges. Clean if necessary. • Ensure the intake and exhaust vents of the outdoor cabinet are not blocked.
Warning Signs	Check if warning signs and labels are clearly visible and undamaged. Replace if necessary.
Cable Shielding Grounding	Inspect if the cable shielding layer and insulating sleeve are in good contact; check if the grounding copper bar is securely fixed.
Lightning Protection and Fuses	Verify if lightning protection devices and fuses are properly secured.
Corrosion	Examine the interior of the outdoor cabinet for any signs of oxidation or corrosion.

11.3.2 Annual Maintenance Work

Item List	Inspection Method
Exterior of Cabinet	Check the following items and correct immediately if they do not meet the requirements: • Examine the top of the outdoor cabinet for flammable materials. • Inspect the welding points between the outdoor cabinet and the steel base for firmness and rust. • Check for damage, paint peeling, or oxidation on the outdoor cabinet casing. • Ensure the door locks and other mechanisms open smoothly. • Verify if the sealing strips are well-fixed.
Interior of Cabinet	Check for foreign objects, dust, dirt, and condensation inside the energy storage integrated system.
Inlet and Outlet Vents	Check the temperature and dust on the radiator. If necessary, clean the cooling modules using a vacuum cleaner.
Wiring and Cable Layout	Start inspection after the energy storage integrated system is completely powered down. Correct any non-compliance immediately. • Ensure cable layout is organized and free from potential short circuits. Correct any irregularities immediately. • Check all the inlet and outlet holes of the outdoor cabinet for proper sealing. • Inspect the interior of the outdoor cabinet for water ingress. • Verify the power cable connections for looseness, retighten according to the previously specified torque. • Examine power cables and control cables for damage, especially for cuts on the surface where they contact metal. • Check if the insulating tape on the electrical cable terminals is intact.
Grounding and Equipotential Connection	• Verify the grounding connections are correct, and ground resistance must not exceed 4Ω. • Check the internal equipotential connections of the energy storage integrated system.
Fans	• Monitor the operation of fans. • Check for blockages in the fans. • Examine for abnormal noises during fan operation.
Screws	Inspect for any screws that may have come loose inside the outdoor cabinet.

11.3.3 Maintenance Work (Every Six Months to One Year)

Item List	Inspection Method
Safety Functions	Test the emergency stop button's stopping function. Simulate a shutdown. Replace any warning signs or other equipment labels if they are blurred or damaged.

Item List	Inspection Method
Internal Component Inspection	Check circuit boards and components for cleanliness. Inspect the temperature and dust on the radiator. If necessary, clean the cooling modules using a vacuum cleaner. Replace the air filter if necessary. Note! Ventilation at the air intake must be checked. Otherwise, modules may fail due to overheating if not effectively cooled.
Component Maintenance	Regularly inspect (every six months) all metal components for rust. Annually inspect contactors (auxiliary switches and microswitches) to ensure good mechanical operation. Check operational parameters (especially voltage and insulation).

12 Guidelines Emergency Handling

In the event of hazardous incidents at the site, including but not limited to those listed below, ensure the safety of personnel on site first and foremost, and then contact our service engineers.

In case of battery fall or strong impact:

- If there are obvious signs of damage, smoke, or fire, immediately evacuate personnel, report to the authorities, and contact professionals to handle the situation safely, including using firefighting equipment if necessary.
- If there is no visible deformation or damage and no signs of smoke or fire, proceed as follows, ensuring safety first:
- In storage areas: Evacuate personnel, and have professionals use mechanical tools to transport the battery to an open and safe area. Contact our service engineers and monitor the battery temperature within a range of room temperature ±10℃ for 1 hour before handling.
- At the site of the WL-ESS-110kW/235kWh-0.4kV Commercial and Industrial Energy Storage Integrated Cabinet: Evacuate personnel, close the doors of the energy storage cabinet, have professionals transport the battery to an open and safe area, contact our service engineers, and leave it for 1 hour before handling.

In case of flooding:

- Power down the system, ensuring personal safety first.
- If any part of the battery is submerged, do not touch the battery to avoid electric shock.
- Do not use batteries that have been submerged. Contact a battery recycling company for disposal.

In case of fire:

If a fire occurs, power down the system while ensuring safety. Use carbon dioxide, FM-200, or ABC dry chemical fire extinguishers for firefighting. Firefighters should avoid contact with high-voltage components to prevent the risk of electric shock. High battery temperatures can cause deformation, damage, electrolyte leakage, and release of toxic gases. Wear respiratory protection equipment, avoid close proximity to avoid skin irritation and chemical burns.

When the Audio and Visual Alarm is Activated:

- If the equipment's alarm light flashes or buzzer sounds:
- Do not approach.
- Do not open the cabinet.
- Immediately leave the area.
- Remotely cut off the power supply, ensuring your own safety.

When Exhaust Activation Occurs:

- On-site Personal Protection: Prohibit personnel from facing the exhaust outlet directly.
- Post-disaster Product Maintenance: Contact our service engineer for assessment.

In Case of Fire Suppression Agent Release or Fire:

- **Recommendations for on-site operation and maintenance personnel:**

1. In the event of a fire, evacuate the building or equipment area and press the fire alarm bell. Immediately call the fire department, providing them with relevant product information, including but not limited to: battery pack type, capacity of the WL-ESS-110kW/235kWh-0.4kV Commercial and Industrial Energy Storage Integrated Cabinet, battery pack distribution, etc.

2.Under no circumstances should you re-enter a burning building or equipment area, nor open the doors of the WL-ESS-110kW/235kWh-0.4kV Commercial and Industrial Energy Storage Integrated Cabinet. Isolate and guard the site, preventing unauthorized persons from approaching.

3.After calling the fire department, remotely power down the system (e.g., smart box-type substations, smart energy storage controllers, auxiliary power equipment, combiner box power supply) while ensuring personal safety.

4.Once professional firefighters arrive, provide them with relevant product information, as mentioned above. After the fire is extinguished and confirmed by professional firefighters, have it handled by professionals in accordance with local regulations. Do not open the WL-ESS-110kW/235kWh-0.4kV Commercial and Industrial Energy Storage Integrated Cabinet yourself.

5.Post-disaster Product Maintenance: Contact our service engineer for assessment.

- **Recommendations for Firefighting Professionals:**

1.Refer to the information provided by the operation and maintenance personnel, including but not limited to: battery pack type, storage system capacity, battery pack distribution, user manual, etc.

2.Do not open the doors of the energy storage system until it is certain that the interior of the WL-ESS-110kW/235kWh-0.4kV Commercial and Industrial Energy Storage Integrated Cabinet is safe.

3.Follow local firefighting regulations for extinguishing operations.