PowerHill (143kWh-215kWh)

User Manual

V_7.0 Date 2025/08/19

Notice

This manual contains important safety instructions, installation, electrical connections, commissioning, maintenance, and troubleshooting of the equipment.

Save the manual!

This manual must be stored carefully and be available at all times.

Copyright Declaration

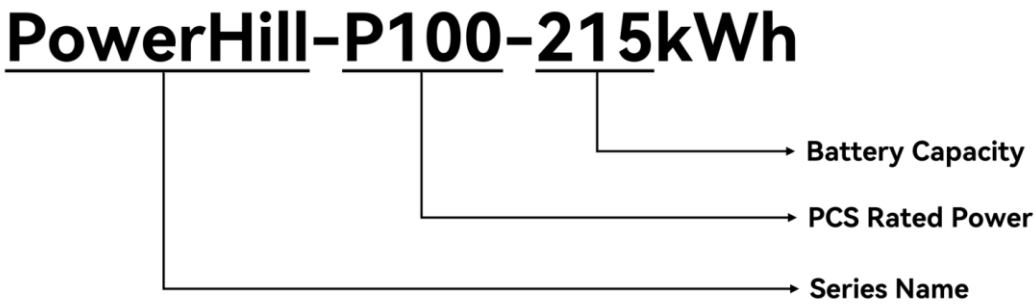
Content

About This Manual

Overview

Please read the product manual carefully before installation, operation, or maintenance of the PowerHill. This manual contains important safety instructions and installation instructions that must be followed during installation and maintenance of the equipment.

Designation explanation of the PowerHill:



No.	Meaning	Description
1	Series Name	PowerHill: Battery energy storage system
2	PCS Rated Power	P30: System power is 30kW P60: System power is 60kW P100: System power is 100kW
3	Battery Capacity	215kWh: Nominal capacity is 215kWh 179kWh: Nominal capacity is 179kWh 161kWh: Nominal capacity is 161kWh 143kWh: Nominal capacity is 143kWh

Intended Audience

This manual is intended for technical professionals for installation, commissioning and maintenance of the C&I ESS. The technical personnel have to be familiar with the product, local standards, and electric systems.

Symbol Conventions

The following types of safety instructions and general information appear in this document as described below:

Symbol	Description
	'Danger' indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
	'Warning' indicates a hazard with a medium level of risk that, if not avoided, will result in death or serious injury.
	'Caution' indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.
NOTICE NOTICE!	'Notice' indicates a situation that, if not avoided, could result in equipment or property damage.
	'Note' provides tips that are valuable for the optimal operation of the product.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 01 (2024-07-01)

This issue is used for first application.

Issue 02 (2024-11-26)

Added HMI Human-Computer Interaction

Issue 03 (2025-3-10)

- Added description of communication protocol in chapter 2.6
- Updated description of Space Requirements in chapter 5.2.
- Updated description of communication line installation in chapter 8.3
- Added torque requirement in chapter 8.4
- Added check items in the cabinet in chapter 9.12
- Added description of Remote / Local knobs and Start / Stop buttons operation in chapter 10.1
- Updated description of HMI Human-Computer Interaction in chapter 11

Issue 04 (2025-5-28)

Updated Technical parameters of MPPT in chapter 2.4.3.3

Issue 05 (2025-6-30)

Updated Technical parameters of MPPT in chapter 2.4.3.3 and Technical data in chapter 13

Issue 06 (2025-7-24)

Added description and figure of applicable grid types for PowerHill in Chapter 8.2

Issue 07 (2025-8-19)

Updated Figure 2-38 in chapter 2.6.2, and stacker and forklift maintenance space requirements in chapter 5.2

1 Safety Information

1.1 Statement

Before transporting, storing, installing, operating, using, and/or maintaining the equipment, read this document, strictly follow the instructions provided herein, and follow all the safety instructions on the equipment and in this document. In this document, "equipment" refers to the products, software, components, spare parts, and/or services related to this document; "the Company" refers to the manufacturer (producer), seller, and/or service provider of the equipment; "you" refers to the entity that transports, stores, installs, operates, uses, and/or maintains the equipment.

The Danger, Warning, Caution, and Notice statements described in this document do not cover all the safety precautions. You also need to comply with relevant international, national, or regional standards and industry practices. The Company shall not be liable for any consequences that may arise due to violations of safety requirements or safety standards concerning the design, production, and usage of the equipment.

The equipment shall be used in an environment that meets the design specifications. Otherwise, the equipment may be faulty, malfunctioning, or damaged, which is not covered under the warranty. The Company shall not be liable for any property loss, personal injury, or even death caused thereby.

Comply with applicable laws, regulations, standards, and specifications during transportation, storage, installation, operation, use, and maintenance.

Do not perform reverse engineering, decompilation, disassembly, adaptation, implantation, or other derivative operations on the equipment software. Do not study the internal implementation logic of the equipment, obtain the source code of the equipment software, violate intellectual property rights, or disclose any of the performance test results of the equipment software.

The Company shall not be liable for any of the following circumstances or their consequences:

- The equipment is damaged due to force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions.
- The equipment is operated beyond the conditions specified in this document.
- The equipment is installed or used in environments that do not comply with international, national, or regional standards.
- The equipment is installed or used by unqualified personnel.
- Fail to follow the operation instructions and safety precautions on the product and in the document.
- Remove or modify the product or modify the software code without authorization.
- You or a third party authorized by you cause the equipment damage during transportation.
- The equipment is damaged due to storage conditions that do not meet the requirements specified in the product document.
- You fail to prepare materials and tools that comply with local laws, regulations, and related standards.
- The equipment is damaged due to your or a third party's negligence, intentional breach, gross negligence, or improper operations, or other reasons not related to the Company.

1.1.1 Personal Safety

 DANGER!	Ensure that power is off during installation. Do not install or remove a cable with power on. Transient contact between the core of the cable and the conductor will cause electric arcs, sparks, fire, or explosion, which may result in personal injury.
 DANGER!	Non-standard and improper operations on the energized equipment may cause fire, electric shocks, or explosion, resulting in property damage, personal injury, or even death.
 DANGER!	Before operations, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces to prevent electric shocks.

 DANGER!	During operations, use dedicated insulated tools to prevent electric shocks or short circuits. The dielectric withstanding voltage level must comply with local laws, regulations, standards, and specifications.
 WARNING!	During operations, wear personal protective equipment such as protective clothing, insulated shoes, goggles, safety helmets, and insulated gloves.

1.1.2 General Requirements

- Do not stop protective devices. Pay attention to the warnings, cautions, and related precautionary measures in this document and on the equipment.
- If there is a likelihood of personal injury or equipment damage during operations, immediately stop, report the case to the supervisor, and take feasible protective measures.
- Do not power on the equipment before it is installed or confirmed by professionals.
- Do not touch the power supply equipment directly or with conductors such as damp objects. Before touching any conductor surface or terminal, measure the voltage at the contact point to ensure that there is no risk of electric shock.
- Do not touch operating equipment because the enclosure is hot.
- Do not touch a running fan with your hands, components, screws, tools, or boards. Otherwise, personal injury or equipment damage may occur.
- In the case of a fire, immediately leave the building or the equipment area and activate the fire alarm or call emergency services. Do not enter the affected building or equipment area under any circumstances.

1.1.3 Personnel Requirements

- Only professionals and trained personnel are allowed to operate the equipment.

  – Professionals: personnel who are familiar with the working principles and structure of the equipment, trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation, operation, maintenance.

  – Trained personnel: personnel who are trained in technology and safety, have required experience, are aware of possible hazards on themselves in certain

operations, and are able to take protective measures to minimize the hazards on themselves and other people.

- Personnel who plan to install or maintain the equipment must receive adequate training, be able to correctly perform all operations, and understand all necessary safety precautions and local relevant standards.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment.
- Personnel who will perform special tasks such as electrical operations, working at heights, and operations of special equipment must possess the required local qualifications.
- Only certified high-voltage electricians are allowed to operate medium voltage equipment.
- Only authorized professionals are allowed to replace the equipment or components (including software).
- Only personnel who need to work on the equipment are allowed to access the equipment.

1.2 Electrical Safety

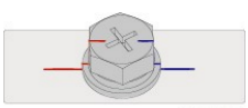
 DANGER!	Before connecting cables, ensure that the equipment is intact. Otherwise, electric shocks or fire may occur.
 DANGER!	Non-standard and improper operations may result in fire or electric shocks.
 DANGER!	Prevent foreign matter from entering the equipment during operations. Otherwise, equipment short-circuits or damage, load power derating, power failure, or personal injury may occur.
 WARNING!	For the equipment that needs to be grounded, install the ground cable first when installing the equipment and remove the ground cable last when removing the equipment.

CAUTION!	Do not route cables near the air intake or exhaust vents of the equipment.

1.2.1 General Requirements

- Follow the procedures described in the document for installation, operation, and maintenance. Do not reconstruct or alter the equipment, add components, or change the installation sequence without permission.
- Obtain approval from the national or local electric utility company before connecting the equipment to the grid.
- Observe the power plant safety regulations, such as the operation and work ticket mechanisms.
- Install temporary fences or warning ropes and hang "No Entry" signs around the operation area to keep unauthorized personnel away from the area.
- Before installing or removing power cables, turn off the switches of the equipment and its upstream and downstream switches.
- If any liquid is detected inside the equipment, disconnect the power supply immediately and do not use the equipment.
- Before performing operations on the equipment, check that all tools meet the requirements and record the tools. After the operations are complete, collect all of the tools to prevent them from being left inside the equipment.
- Before installing power cables, check that cable labels are correct and cable terminals are insulated.
- When installing the equipment, use a torque tool of a proper measurement range to tighten the screws. When using a wrench to tighten the screws, ensure that the wrench does not tilt and the torque error does not exceed 10% of the specified value.
- Ensure that bolts are tightened with a torque tool and marked in red and blue after double-check. Installation personnel mark tightened bolts in blue. Quality inspection personnel confirm that the bolts are tightened and then mark them in red, as shown in Figure 1-1. (The marks must cross the edges of the bolts.)

Figure 1-1 Bolts tightening marks



- After the installation is complete, ensure that protective cases, insulation tubes, and other necessary items for all electrical components are in position to avoid electric shocks.
- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.
- Before maintaining a downstream electrical or power distribution device, turn off the output switch on the power supply equipment.
- During equipment maintenance, attach "Do not switch on" labels near the upstream and downstream switches or circuit breakers as well as warning signs to prevent accidental connection. The equipment can be powered on only after troubleshooting is complete.
- If fault diagnosis and troubleshooting need to be performed after power-off, take the following safety measures: Disconnect the power supply. Check whether the equipment is live. Install a ground cable. Hang warning signs and set up fences.
- Check equipment connections periodically, ensuring that all screws are securely tightened.
- Only qualified professionals can replace a damaged cable.
- Do not scrawl, damage, or block any labels or nameplates on the equipment. Promptly replace labels that have worn out.
- Do not use solvents such as water, alcohol, or oil to clean electrical components inside or outside of the equipment.

1.2.2 Grounding Requirements

- Ensure that the grounding impedance of the equipment complies with local electrical standards.
- Ensure that the equipment is connected permanently to the protective ground. Before operating the equipment, check its electrical connection to ensure that it is reliably grounded.
- Do not work on the equipment in the absence of a properly installed ground conductor.
- Do not damage the ground conductor.
- For the equipment that uses a three-pin socket, ensure that the ground terminal in the socket is connected to the protective ground point.
- If high touch current may occur on the equipment, ground the protective ground terminal on the equipment enclosure before connecting the power supply; otherwise, electric shock as a result of touch current may occur.

1.2.3 Cabling Requirements

- When selecting, installing, and routing cables, follow local safety regulations and rules.
- When routing power cables, ensure that there is no coiling or twisting. Do not join or weld power cables. If necessary, use a longer cable.
- Ensure that all cables are properly connected and insulated, and meet specifications.
- Ensure that the slots and holes for routing cables are free from sharp edges, and that the positions where cables are routed through pipes or cable holes are equipped with cushion materials to prevent the cables from being damaged by sharp edges or burrs.
- If a cable is routed into the cabinet from the top, bend the cable in a U shape outside the cabinet and then route it into the cabinet.
- Ensure that cables of the same type are bound together neatly and straight and that the cable sheath is intact. When routing cables of different types, ensure that they are at least 30 mm away from each other.
- When cable connection is completed or paused for a short period of time, seal the cable holes with sealing putty immediately to prevent small animals or moisture from entering.
- Secure buried cables using cable supports and cable clips. Ensure that the cables in the backfill area are in close contact with the ground to prevent cable deformation or damage during backfilling.
- If the external conditions (such as the cable layout or ambient temperature) change, verify the cable usage in accordance with the IEC-60364-5-52 or local laws and regulations. For example, check that the current-carrying capacity meets requirements.
- When routing cables, reserve at least 30 mm clearance between the cables and heat-generating components or areas. This prevents deterioration or damage to the cable insulation layer.
- When the temperature is low, violent impact or vibration may damage the plastic cable sheathing. To ensure safety, comply with the following requirements:

  – Cables can be laid or installed only when the temperature is higher than 0℃. Handle cables with caution, especially at a low temperature.

  – Cables stored at below 0℃ must be stored at room temperature for more than 24 hours before they are laid out.

- It is forbidden to directly push the cable from the car and other non-standard operations, to avoid the damage of the cable performance decline, affecting the current load and temperature rise.

1.3 Environment Requirements

 DANGER!	Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.
 DANGER!	Do not store any flammable or explosive materials in the equipment area.
 DANGER!	Do not place the equipment near heat sources or fire sources, such as smoke, candles, heaters, or other heating devices. Overheat may damage the equipment or cause a fire.
 WARNING!	Install the equipment in an area far away from liquids. Do not install it under areas prone to condensation, such as under water pipes and air exhaust vents, or areas prone to water leakage, such as air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that no liquid enters the equipment to prevent faults or short circuits.
 WARNING!	To prevent damage or fire due to high temperature, ensure that the ventilation vents or heat dissipation systems are not obstructed or covered by other objects while the equipment is running.

1.3.1 General Requirements

- Ensure that the equipment is stored in a clean, dry, and well-ventilated area with proper temperature and humidity and is protected from dust and condensation.
- Keep the installation and operating environments of the equipment within the allowed ranges. Otherwise, its performance and safety will be compromised.

- Do not install, use, or operate outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, inserting connectors to or removing connectors from signal ports connected to outdoor facilities, working at heights, performing outdoor installation, and opening doors) in harsh weather conditions such as lightning, rain, snow, and level 6 or stronger wind.
- Do not install the equipment in an environment with dust, smoke, volatile or corrosive gases, infrared and other radiations, organic solvents, or salty air.
- Do not install the equipment in an environment with conductive metal or magnetic dust.
- Do not install the equipment in an area conducive to the growth of microorganisms such as fungus or mildew.
- Do not install the equipment in an area with strong vibration, noise, or electromagnetic interference.
- Ensure that the site complies with local laws, regulations, and related standards.
- Ensure that the ground in the installation environment is solid, free from spongy or soft soil, and not prone to subsidence. The site must not be located in a low-lying land prone to water or snow accumulation, and the horizontal level of the site must be above the highest water level of that area in history.
- Do not install the equipment in a position that may be submerged in water.
- If the equipment is installed in a place with abundant vegetation, in addition to routine weeding, harden the ground underneath the equipment using cement or gravel.
- Before opening doors during the installation, operation, and maintenance of the equipment, clean up any water, ice, snow, or other foreign objects on the top of the equipment to prevent foreign objects from falling into the equipment.
- When installing the equipment, ensure that the installation surface is solid enough to bear the weight of the equipment.
- All cable holes must be sealed. Seal the used cable holes with sealing putty. Seal the unused cable holes with the caps delivered with the equipment.
- After installing the equipment, remove the packing materials such as cartons, foam, plastics, and cable ties from the equipment area.

1.4 Mechanical Safety

 DANGER!	When working at heights, wear a safety helmet and safety harness or waist belt and fasten it to a solid structure. Do not mount it on an insecure moveable object or metal object with sharp edges. Make sure that the hooks will not slide off.
 WARNING!	Ensure that all necessary tools are ready and inspected by a professional organization. Do not use tools that have signs of scratches or fail to pass the inspection or whose inspection validity period has expired. Ensure that the tools are secure and not overloaded.
 WARNING!	Before installing equipment in a cabinet, ensure that the cabinet is securely fastened with a balanced centre of gravity. Otherwise, tipping or falling cabinets may cause bodily injury and equipment damage.
 WARNING!	When pulling equipment out of a cabinet, be aware of unstable or heavy objects in the cabinet to prevent injury.
 WARNING!	Do not drill holes into the equipment. Doing so may affect the sealing performance and electromagnetic containment of the equipment and damage components or cables inside. Metal shavings from drilling may short-circuit boards inside the equipment.

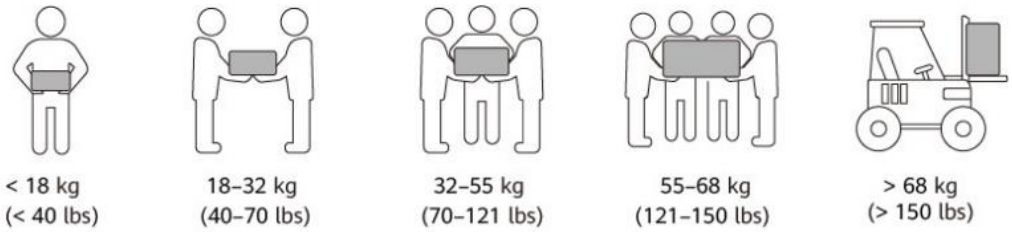
1.4.1 General Requirements

- Repaint any paint scratches caused during equipment transportation or installation in a timely manner. Equipment with scratches must not be exposed for an extended period of time.
- Do not perform operations such as arc welding and cutting on the equipment without evaluation by the Company.
- Do not install other devices on the top of the equipment without evaluation by the Company.
- When performing operations over the top of the equipment, take measures to protect the equipment against damage.
- Use correct tools and operate them in the correct way.

1.4.2 Moving Heavy Objects Safety

- Be cautious to prevent injury when moving heavy objects, follow instructions in Figure 1-2.

Figure 1-2 Moving Heavy Objects Instructions



- If multiple persons need to move a heavy object together, determine the manpower and work division with consideration of height and other conditions to ensure that the weight is equally distributed.
- If two persons or more move a heavy object together, ensure that the object is lifted and landed simultaneously and moved at a uniform pace under the supervision of one person.
- Wear personal protective gears such as protective gloves and shoes when manually moving the equipment.
- To move an object by hand, approach to the object, squat down, and then lift the object gently and stably by the force of the legs instead of your back. Do not lift it suddenly or turn your body around.
- Move or lift the equipment by holding its handles or lower edges. Do not hold the handles of modules that are installed in the equipment.
- Do not quickly lift a heavy object above your waist. Place the object on a workbench that is half-waist high or any other appropriate place, adjust the positions of your palms, and then lift it.
- Move a heavy object stably with balanced force at an even and low speed. Put down the object stably and slowly to prevent any collision or drop from scratching the surface of the equipment or damaging the components and cables.
- When moving a heavy object, be aware of the workbench, slope, staircase, and slippery places. When moving a heavy object through a door, ensure that the door is wide enough to move the object and avoid bumping or injury.

- When transferring a heavy object, move your feet instead of turning your waist around. When lifting and transferring a heavy object, ensure that your feet point to the target direction of movement.
- When transporting the equipment using a pallet truck or forklift, ensure that the tynes are properly positioned so that the equipment does not topple. Before moving the equipment, secure it to the pallet truck or forklift using ropes. When moving the equipment, assign dedicated personnel to take care of it.
- Choose sea or roads in good conditions for transportation. Do not transport the equipment by railway or air. Avoid tilt or jolt during transportation.
- When moving and transporting an air conditioner, keep it upright and do not place it horizontally or upside down. If the package of the air conditioner is damaged or the tilt indicator on the package changes color, contact the Company's service engineers.

1.4.3 Work-at-height Safety

- Any operations performed 2 m or higher above the ground shall be supervised properly.
- Only trained and qualified personnel are allowed to work at heights.
- Do not work at heights when steel pipes are wet or other risky situations exist. After the preceding conditions no longer exist, the safety owner and relevant technical personnel need to check the involved equipment. Operators can begin working only after safety is confirmed.
- Set a restricted area and prominent signs for working at heights to warn away irrelevant personnel.
- Set guard rails and warning signs at the edges and openings of the area involving working at heights to prevent falls.
- Do not pile up scaffolding, springboards, or other objects on the ground under the area involving working at heights. Do not allow people to stay or pass under the area involving working at heights.
- Carry operation machines and tools properly to prevent equipment damage or personal injury caused by falling objects.
- Personnel involving working at heights are not allowed to throw objects from the height to the ground, or vice versa. Objects shall be transported by slings, hanging baskets, aerial work platforms, or cranes.
- Do not perform operations on the upper and lower layers at the same time. If unavoidable, install a dedicated protective shelter between the upper and lower layers or take other protective measures. Do not pile up tools or materials on the upper layer.

- Dismantle the scaffolding from top down after finishing the job. Do not dismantle the upper and lower layers at the same time. When removing a part, ensure that other parts will not collapse.
- Ensure that personnel working at heights strictly comply with the safety regulations. The Company is not responsible for any accident caused by violation of the safety regulations on working at heights.
- Behave cautiously when working at heights. Do not rest at heights.

1.4.4 Ladder Use Safety

- Use wooden or insulated ladders when you need to perform live-line working at heights.
- Platform ladders with protective rails are preferred. Do not use single ladders.
- Before using a ladder, check that it is intact and confirm its load bearing capacity. Do not overload it.
- Ensure that the ladder is securely positioned and held firm, as shown in Figure 1-3.

Figure 1-3 Ladder Holding Example

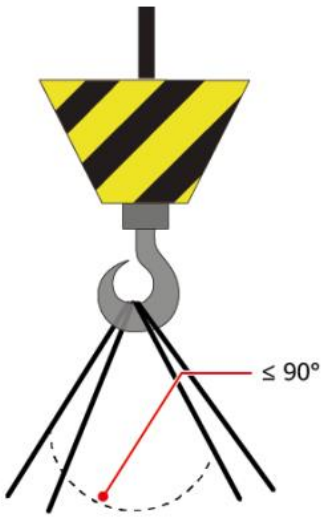
- When climbing up the ladder, keep your body stable and your center of gravity between the side rails, and do not overreach to the sides.
- When a step ladder is used, ensure that the pull ropes are secured.

1.4.5 Hoisting Safety

- Only trained and qualified personnel are allowed to perform hoisting operations.
- The hoisting area is to be isolated by erecting temporary warning signs or fences.

- Ensure that the foundation where hoisting is performed on meets the load bearing requirements.
- Before hoisting objects, ensure that hoisting tools are firmly secured onto a fixed object or wall that meets the load-bearing requirements.
- During hoisting, it is strictly prohibited to stand or walk under the crane or hoisted object.
- Do not drag steel ropes and hoisting tools or bump the hoisted objects against hard objects during hoisting.
- Ensure that the angle between two hoisting ropes is no more than 90 degrees, as shown in figure 1-4.

Figure 1-4 Requirement of Angle Between Two Hoisting Ropes



1.4.6 Drilling Safety

- Obtain consent from the client and contractor before drilling.
- Wear protective equipment such as safety goggles and protective gloves when drilling holes.
- To avoid short circuits or other risks, do not drill holes into buried pipes or cables.
- When drilling holes, the equipment should be shielded and protected to prevent debris from falling into the equipment, and debris should be cleaned up in time after drilling.

1.5 Equipment Safety

1.5.1 Energy Storage System Safety

	Do not open the cabinet door when the system is running.
	When the energy storage system is faulty, DO NOT stand at the cabinet door (including the open range of the cabinet door).
	The energy storage system is an enclosed system and will not release any gases under normal operations. If the energy storage system is improperly treated, for example, burnt, struck by lightning, overcharged, or subject to other adverse conditions that may cause battery thermal runaway, the system may be damaged or an abnormal chemical reaction may occur inside the battery, resulting in electrolyte leakage or production of gases such as CO and H2. To prevent fire or device corrosion, ensure that flammable gas is properly exhausted.
	Before unpacking, storage, and transportation, ensure that the packing cases are intact and the energy storage system are correctly placed according to the labels on the packing cases.
	Install the energy storage system in a dry area. Do not install it under areas prone to water leakage, such as air conditioner vents, ventilation vents, feeder windows of the equipment room, or water pipes. Ensure that no liquid enters the equipment to prevent faults or short circuits.

 WARNING!	Before installing and commissioning the energy storage system, prepare firefighting facilities, such as fire sand and carbon dioxide fire extinguishers, according to construction standards and regulations. Before putting into operation, ensure that firefighting facilities that comply with local laws and regulations are installed.
 WARNING!	Tighten the screws on copper bars or cables to the torque specified in this document. Periodically confirm whether the screws are tightened, check for rust, corrosion, or other foreign objects, and clean them up if any. Loose screw connections will result in excessive voltage drops and batteries may catch fire when the current is high.
 WARNING!	After the energy storage system is discharged, the system should be charged in time, otherwise the battery inside the system may be damaged due to over discharge.
 CAUTION!	Once the fire horn and light alarm is triggered, evacuate from the site immediately.
NOTICE NOTICE!	Take protection and isolation measures for the energy storage system, such as installing fences, walls, and safety warning signs to prevent personal injury or property damage caused by unauthorized access during operations.

- When installing the energy storage system, comply with the fire separation distance or fire wall requirements specified in local standards, including but not limited to GB 51048-2014 Design Code for Electrochemical Energy Storage Station and NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.
- The energy storage system should be inspected for fire protection on a regular basis, not less than once a month.
- When inspecting the system with power on, pay attention to the hazard warning signs on the equipment and DO NOT stand at the cabinet door.
- It is recommended that you prepare camera devices to record the detailed process of installation, operation and maintenance of the equipment.

1.5.2 Battery Safety

	Do not connect the positive and negative poles of a battery together. Otherwise, the battery may be short-circuited. Battery short circuits can generate high instantaneous current and releases a large amount of energy, which may cause battery leakage, smoke, flammable gas release, thermal runaway, fire, or explosion. To avoid battery short circuits, do not maintain batteries with power on.
	Do not expose batteries at high temperatures or around heat sources, such as fire sources, transformers, and heaters. Battery overheating may cause leakage, smoke, flammable gas release, thermal runaway, fire, or explosion.
	The battery is strictly prohibited from fall, collision, hard object puncture and pressure impact, otherwise it may lead to battery damage or fire.
	To avoid leakage, smoke, flammable gas release, thermal runaway, fire, or explosion, do not disassemble, alter, or damage batteries, for example, insert foreign objects into batteries, squeeze batteries, or immerse batteries in water or other liquids.
	It is strictly prohibited to touch the battery terminals with other metal objects, which may cause heat generation or electrolyte leakage.
	There is a risk of fire or explosion if the model of the battery in use or used for replacement is incorrect. Use a battery of the model recommended by the manufacturer.
	Battery electrolyte is toxic and volatile. Do not get contact with leaked liquids or inhale gases in the case of battery leakage or odor. In such cases, stay away from the battery and contact professionals immediately. Professionals must wear safety goggles, rubber gloves, gas masks, and protective clothing, power off the equipment, remove the battery, and contact technical engineers.
	Gases from burning batteries can irritate eyes, skin and throat. Take protective measures promptly.

1.5.2.1 Statement

The Company shall not be liable for any battery damage, personal injury, death, property loss, and/or other consequences caused by the following reasons:

- Force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions
- The battery warranty period has expired. You are advised not to use a battery whose warranty period has expired, as this poses safety risks.
- Actions that do not follow instructions in the user manual or direct advice from the Company, including but not limited to the following scenarios:

  – The onsite equipment operating environment or external power parameters do not meet the environment requirements for normal operation, for example, the actual operating temperature of batteries is too high or too low, or the power grid is unstable and experiences outages frequently.

  – Batteries are dropped or incorrectly operated or connected.

  – Batteries are over discharged due to delayed acceptance or power-on after battery installation.

  – Battery running parameters are incorrectly set.

  – Different types of batteries, for example, batteries of different brands or rated capacities, are used together without prior approval from the Company.

  – Batteries are frequently overdischarged due to improper battery maintenance or operation.

  – Battery use scenarios are changed without prior approval from the Company.

  – Battery maintenance is not performed according to the instructions in the user manual, for example, failing to check battery terminals regularly.

  – Batteries are not transported, stored, or charged according to the instructions in the user manual.

  – Instructions from the Company are not followed during battery relocation or reinstallation.

1.5.2.2 General Requirements

NOTICE NOTICE!	To ensure battery safety and battery management accuracy, use batteries provided by the Company. The Company is not responsible for any faults of batteries not provided by it.

- Before installing, operating, and maintaining batteries, read the battery manufacturer's instructions and comply with their requirements. The safety precautions specified in this document are highly important and require special attention. For additional safety precautions, see the instructions provided by the battery manufacturer.

- Do not use a damaged battery (such as damage caused when a battery is dropped, bumped, bulged, or dented on the enclosure), because the damage may cause electrolyte leakage or flammable gas release. In the case of electrolyte leakage or structural deformation, contact the installer or professional O&M personnel immediately to remove or replace the battery. Do not store the damaged battery near other devices or flammable materials and keep it away from non-professionals.
- Before battery operation, make sure there are no irritating, burning or other scorched smell around the battery.
- It is strictly prohibited to place installation tools, metal parts and sundries on the battery during installation. After the installation is completed, clean up the items on and around the battery in a timely manner.
- Prohibit the installation of the battery pack in rain, snow, fog and other weather to avoid the battery pack being eroded by moisture and rain.
- If the battery is accidentally drenched in water, it is prohibited to continue installation. Transport it to a safe isolation point and promptly scrap it for disposal.
- Check whether the positive and negative battery terminals are grounded unexpectedly. If so, disconnect the battery terminals from the ground.
- Do not perform welding or grinding work around batteries to prevent fire caused by electric sparks or arcs.
- If batteries are left unused for a long period of time, store and charge them according to the battery requirements.
- Prohibit the use of equipment for charging and discharging that does not meet the requirements of local laws, regulations and codes.
- Keep the battery circuit disconnected during installation and maintenance.
- Monitor damaged batteries during storage for signs of smoke, flame, electrolyte leakage, or heat.
- If a battery is faulty, its surface temperature may be high. Do not touch the battery to avoid scalds.
- Do not stand on, lean on, or sit on the top of the equipment.
- In backup power scenarios, do not use the batteries for the following situations:

  – Medical devices substantially important to human life

  – Control equipment such as trains and elevators, as this may cause personal injury

  – Computer systems of social and public importance– Locations near medical devices

  – Other devices similar to those described above

1.5.2.3 Short Circuit Protection

- When installing and maintaining the battery, you need to wrap the exposed cable terminals on the battery with insulation tape.
- Avoid foreign bodies (such as conductive objects, screws, liquids, etc.) from entering the battery and causing a short circuit.

1.5.2.4 Leakage Handling

NOTICE NOTICE!	Electrolyte leakage may damage the equipment. It will corrode metal parts and boards, and ultimately damage the boards.

The electrolyte is corrosive and can cause skin irritation and chemical burns. If you come into direct contact with the battery electrolyte, take the following measures:

- Inhalation: Evacuate from contaminated areas, get fresh air immediately, and seek immediate medical attention.
- Eye contact: Immediately flush eyes with plenty of water for at least 15 minutes, do not rub, and seek immediate medical help.
- Skin contact: Wash the affected areas immediately with soap and water and seek immediate medical attention.
- Intake: Seek immediate medical help.

1.5.2.5 Recycling

- Please dispose of used batteries in accordance with local laws and regulations, and do not dispose of batteries as household waste. Improper disposal of batteries may lead to environmental pollution or explosion.
- If a battery leaks or is damaged, contact technical support or a battery recycling company for disposal.
- When the batteries are out of service life, 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 use faulty batteries and must be reported to a battery recycling company for disposal as soon as possible to avoid environmental pollution.

2 Product Description

2.1 Model Description

This article mainly covers the following product models:

PowerHill-P100-215kWh

Figure 2-1 Model identification (example)

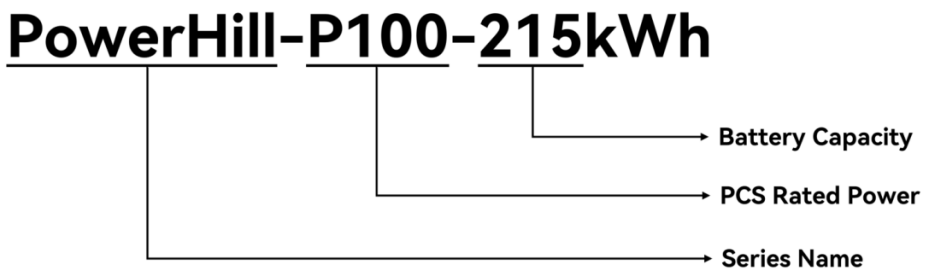


Table 2-1 Model identification

No.	Meaning	Description
1	Series Name	PowerHill: Battery energy storage system
2	PCS Rated Power	P30: System power is 30kW P60: System power is 60kW P100: System power is 100kW
3	Battery Capacity	215K: Nominal capacity is 215kWh

2.2 Product Introduction

PowerHill is an integrated outdoor battery energy storage cabinet including battery, BMS, PCS, MPPT (optional), auxiliary power system, fire protection system, air conditioning system and grounding system, which meets the requirements of outdoor installation.

2.3 Appearance Introduction

NOTE!	The schematic diagrams in this document are all based on 215kWh model as examples, and the actual model structure shall prevail.

Figure 2-2 Appearance and dimensions of 215kWh model

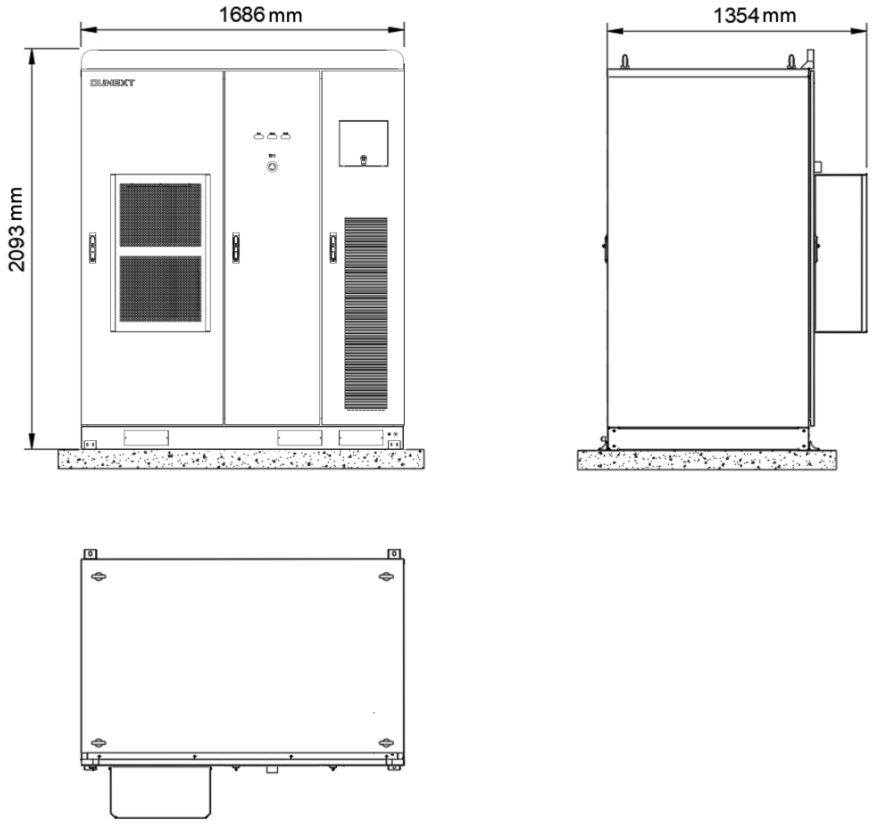
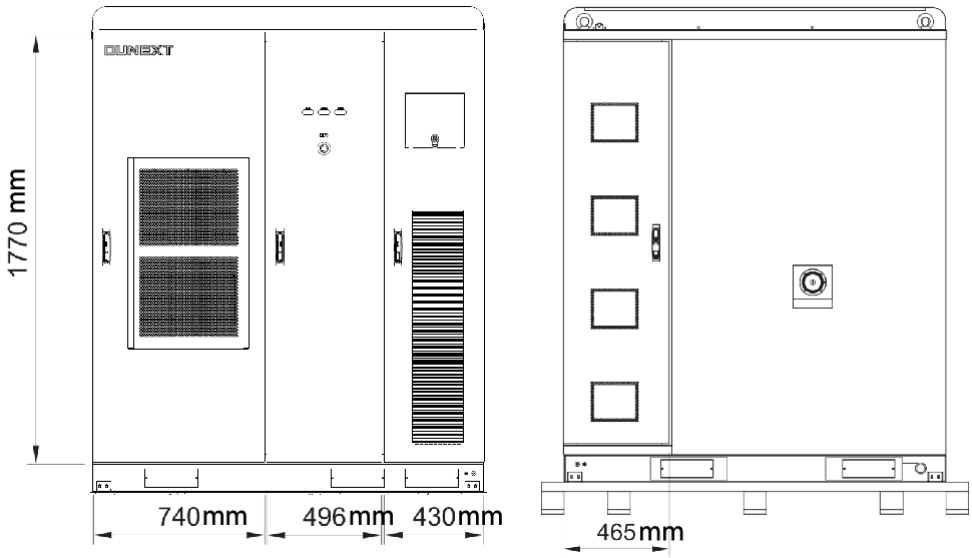


Figure 2-3 Appearance and dimensions of doors for 215kWh model



NOTE!	The site foundation must be designed by professional technical personnel such as those from a design institute. The technical personnel can refer to the foundation drawings of the Company. Contact the product manager of the Company to obtain the drawings.

2.4 Components Introduction

Figure 2-4 Introduction of 215 kWh model components (door closed)

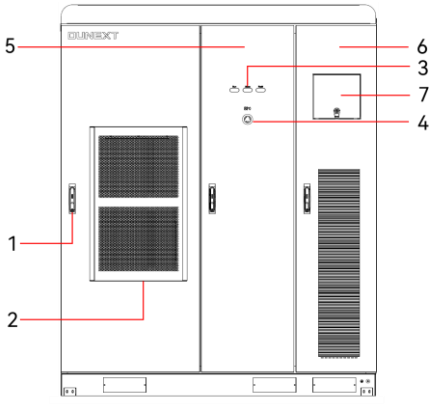
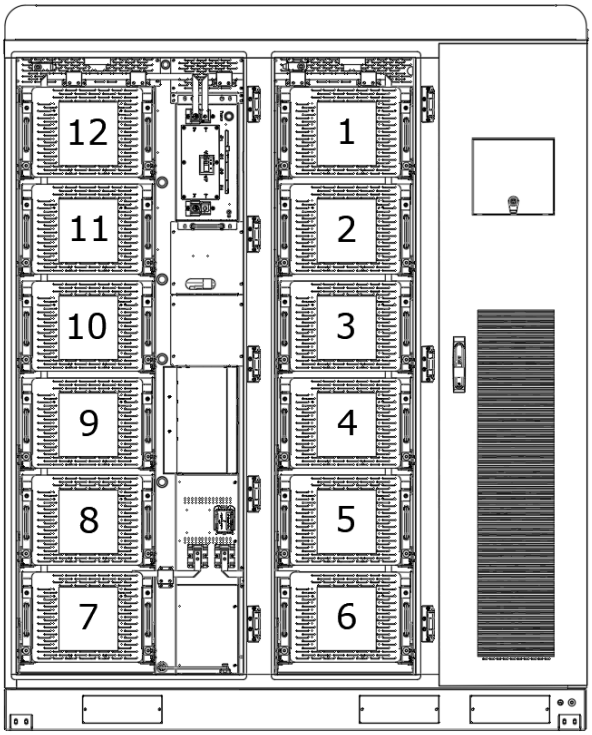


Table 2-2 Components introduction

No.	Item	Description
1	Door lock	Lock the cabinet door and need a specific key to open.
2	Air conditioner	Air conditioner on the cabinet door to adjust the temperature in the cabinet.
3	System status indicator light	The green light is always on to indicate operating normally, flashing to indicate standby. The yellow light is always on to indicate that there is an alarm in the system which does not affect the system operation. The red light is always on to indicate that there is a fault in the system and the system will stop to operate.
4	Emergency power-off switch	For system emergency stops.
5	Battery compartment door	Battery compartment maintenance door
6	Electrical compartment door	Electrical compartment maintenance door
7	HMI	The HMI system is a human-machine interaction system that allows users to view system operating status, modes, power settings, and issue configuration commands through the display screen. It also provides features for real-time fault monitoring and viewing historical faults.

Figure 2-5 Structure design of battery module of 215 kWh model



(1) Battery pack 1 (2) Battery pack 2 (3) Battery pack 3

(4) Battery pack 4 (5) Battery pack 5 (6) Battery pack 6

(7) Battery pack 7 (8) Battery pack 8 (9) Battery pack 9

(10) Battery pack 10 (11) Battery pack 11 (12) Battery pack 12

Figure 2-6 Components introduction (front door opened)

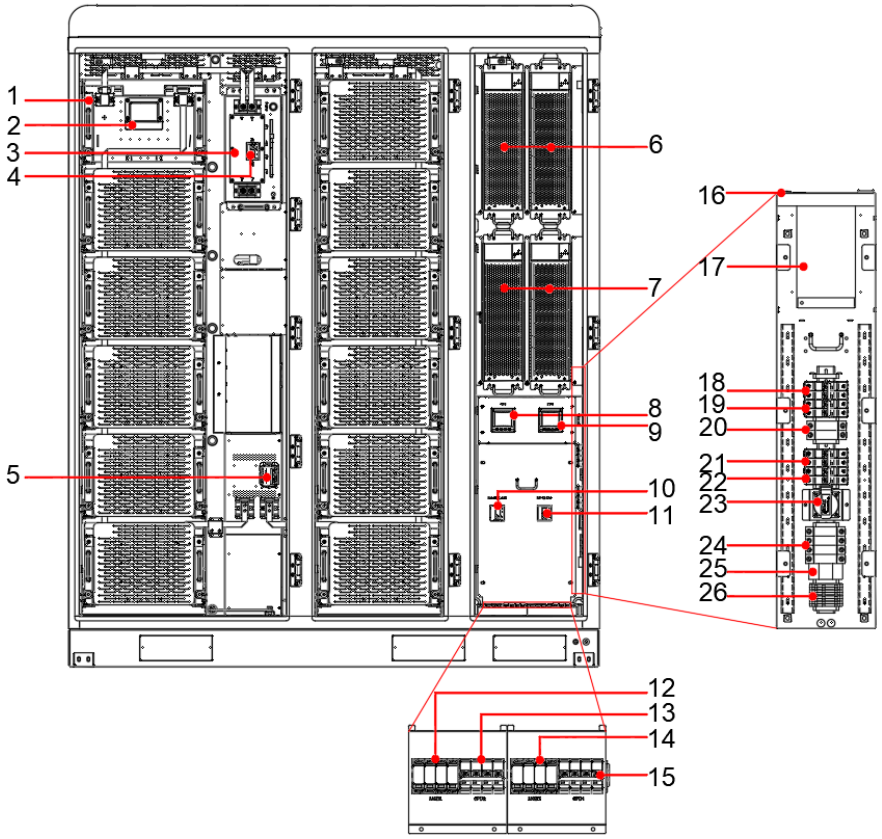


Table 2-3 Components introduction (front door opened)

No.	Item	Description
1	Battery module	For power storage
2	BMM	Battery data acquisition module
3	High voltage control box	BMS, monitoring the battery status in real time
4	DC circuit breaker	Battery high-voltage breaker, over-current protection device
5	Maintenance switch	Intermediate break of battery cluster
6	MPPT	For PV connection
7	PCS	For the AC/DC conversion
8	Meter	Current data acquisition in Grid side

9	Meter	Current data acquisition in Load side
10	Load side circuit breaker	Load distribution switch
11	AC circuit breaker	Main switch for AC power distribution
12	Load SPD switch	Backup protection switch for surge protection
13	Load SPD	Surge protection
14	AC SPD switch	Backup protection switch for surge protection
15	AC SPD	Surge protection
16	Black Start activation button (optional)	For system secondary black start
17	DC Power Switch	24V DC power supply
18	AC micro circuit breaker MCB 1	AC 220V power distribution main switch
19	AC micro circuit breaker MCB 2	AC distribution switch
20	Fuse	Short circuit protection device
21	AC micro circuit breaker MCB 3	Air conditioner distribution switch
22	DC micro circuit breaker MCB 4	24V DC power distribution switch
23	Socket	Socket for commissioning
24	Fuse	Short circuit protection device
25	Intermediate relay	Control device
26	Terminal board	Terminal board for cable connection

Figure 2-7 Components introduction (front door opened)

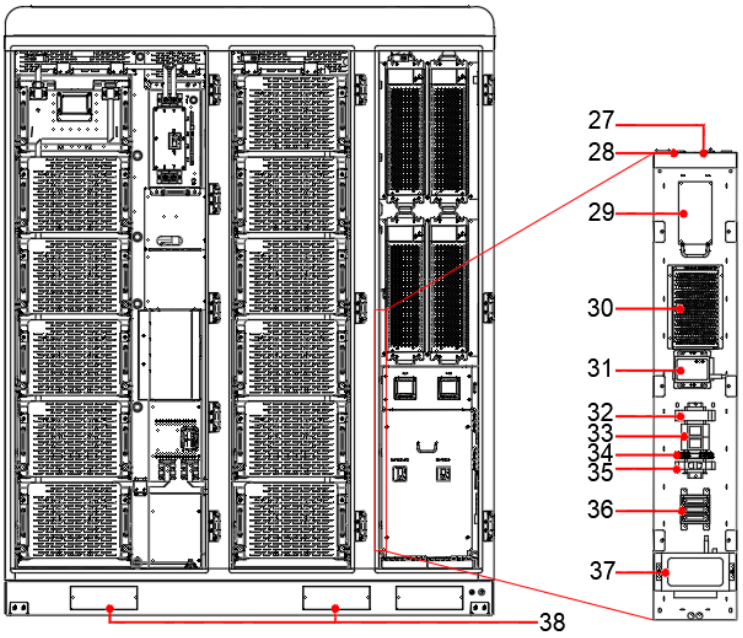


Table 2-4 Components introduction (front door opened)

No.	Item	Description
27	Mode switching knob	Mode switch between remote mode and local mode
28	System start and stop button	System start and stop button in local mode
29	Printed circuit board	Printed circuit board for cable connection
30	DC Power Switch	12V DC power supply
31	485 to TCP module	Communication switch
32	Water immersion sensor	Water detection
33	Intermediate relay	Control device

34	Signal SPD	External RS485 signal surge protection device
35	Network outlet SPD	External network port surge protection device
36	RS485 communication interface	External RS485 communication interface
37	IO controller	Acquisition control device
38	Forklift hole	For cabinet handling

Figure 2-8 Components introduction (back door opened)

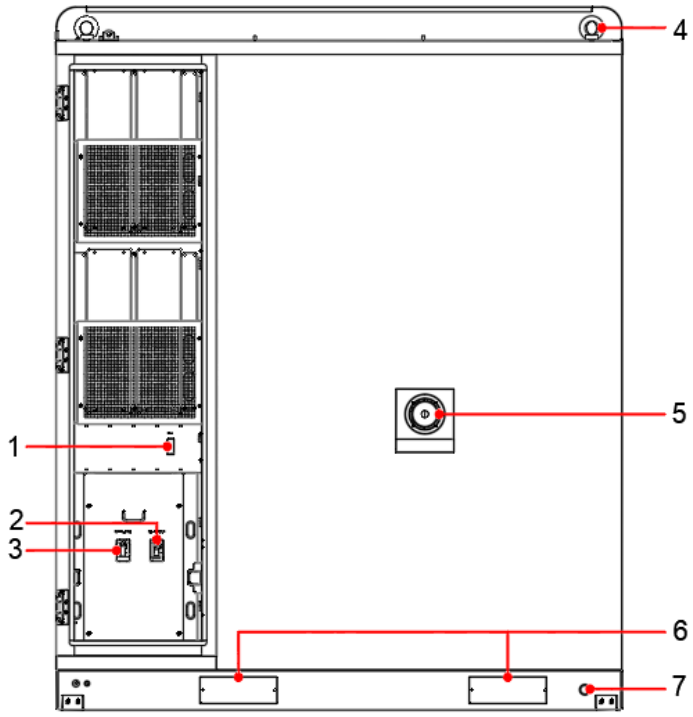


Table 2-5 Components introduction (back door opened)

No.	Item	Description
1	PV power switch fuse	Optional, for protecting the PV power switch
2	Circuit breaker for PV1 input	MPPT1 Protection switch

3	Circuit breaker for PV1 input	MPPT2 Protection switch
4	Hanging ring	4 pcs, for cabinet lifting
5	Water firefighting connection	For filling cabinet with water to extinguish fires
6	Forklift hole	For cabinet handling
7	Water firefighting drain valve	For drain away water

Figure 2-9 Components introduction (back door opened)

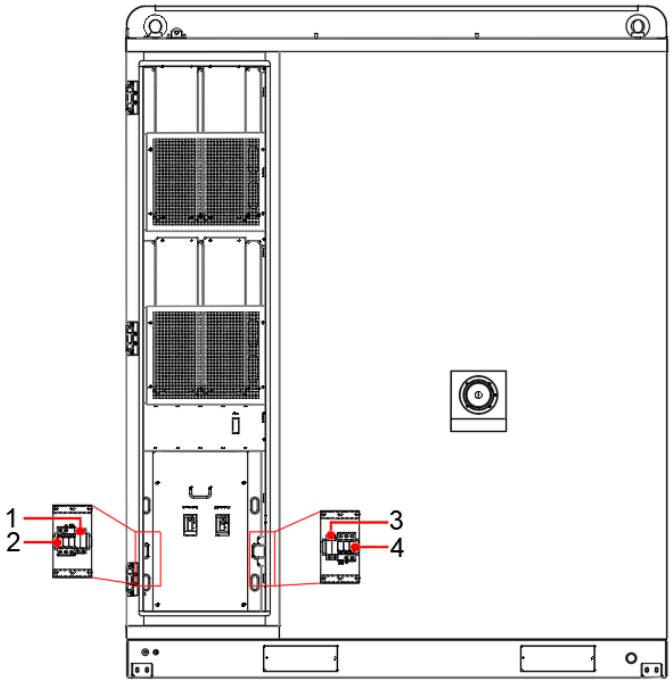


Table 2-6 Components introduction (back door opened)

No.	Item	Description
1	Fuse	Backup protection for PV surge protection device
2	PV SPD	Protect the PV side circuits, corresponding to MPPT2
3	Fuse	Backup protection for PV surge protection device
4	PV SPD	Protect the PV side circuits, corresponding to MPPT1

2.4.1 Battery Pack

Figure 2-10 Appearance of the battery pack

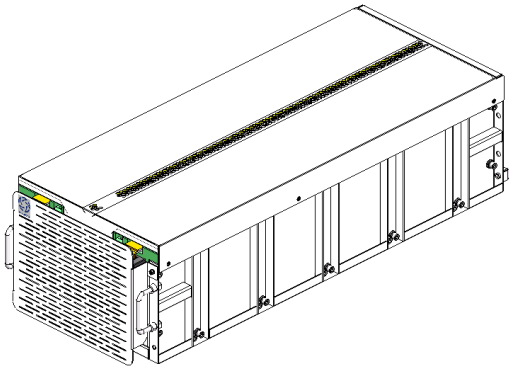


Table 2-7 Technical parameters of the battery pack

Technical specifications	Parameters
Rated voltage	64V
Rated capacity	280Ah / 17920Wh
Dimensions (W*D*H)	378*985*260mm
Weight	150kg
Configuration	1P20S
Standard charging current	140A
Standard discharging current	140A
End of charge voltage	3.6V/Cell
End of discharge voltage	2.8V/Cell
Operating ambient temperature	Charge: 0℃ ~ + 60℃; Discharge: -30℃ ~ + 60℃
Storage temperature	Short-term storage: -20℃ ~ +45℃ (<1month, SOC: 20%~60%) Long-term storage: 0℃~ +35℃ (<1year, SOC: 30%~60%)
Storage humidity	5% to 95%
Long-term storage	6 months normal temperature power supply:

Technical specifications	Parameters
requirements	charge and discharge once, and then recharge to 25% SOC

2.4.2 High Voltage Control Box

Figure 2-11 Appearance of the High Voltage Control Box

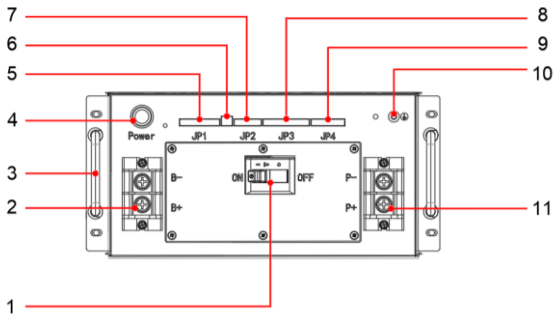


Table 2-8 Introduction of the High Voltage Control Box

No.	Item	Description
1	DC circuit breaker	DC circuit breaking and protection
2	B+/B- terminal blocks	Total positive and negative port of the battery cluster
3	Handle	To pull the control box out of the battery cabinet
4	Running indicator light	Display the power supply status of the control box
5	JP1	RS485, CAN communication interface
6	Dial switch	Used to adjust the matching resistance of RS485 and CAN communication bus
7	JP2	BMM communication bus
8	JP3	24V DC power supply, indicator light, fire protection solenoid valve control
9	JP4	Control of maintenance switch and intermediate contactors, input of emergency stop signal

No.	Item	Description
10	Ground hole	Grounding point of the high voltage control box
11	P +/P- terminal blocks	PCS DC side connection port

Table 2-9 Technical parameters of the High Voltage Control Box

Technical specifications	Parameters
Rated voltage	DC 1000V
Rated current	150A
Input power	DC 24V
Dimensions (W*D*H)	388*478*350 mm
IP Protection	IP20
Operating temperature	-20 ~ 55℃
Altitude	≤2000m

2.4.3 Power module

2.4.3.1 PCS

PCS can control the charging and discharge process of lithium battery, carry out AC/DC conversion, and directly supply power to the AC load in the case of having no Grid. PCS is composed of DC/AC bi-directional converter, control unit, etc. The PCS controller receives the control command through communication and controls the converter to charge or discharge the battery to adjust the active power and reactive power of the Grid.

Figure 2-12 Appearance (front side, without dust cover)

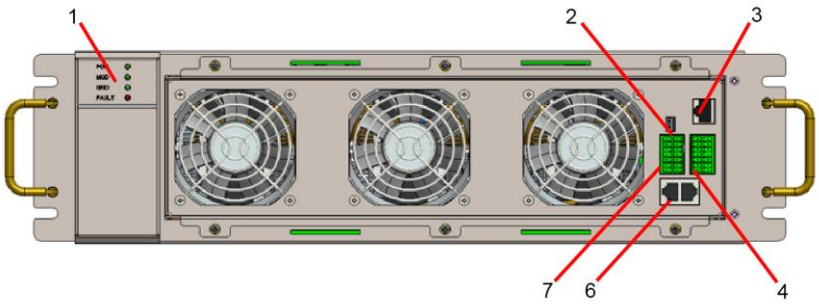


Figure 2-13 Appearance (front side, with dust cover)

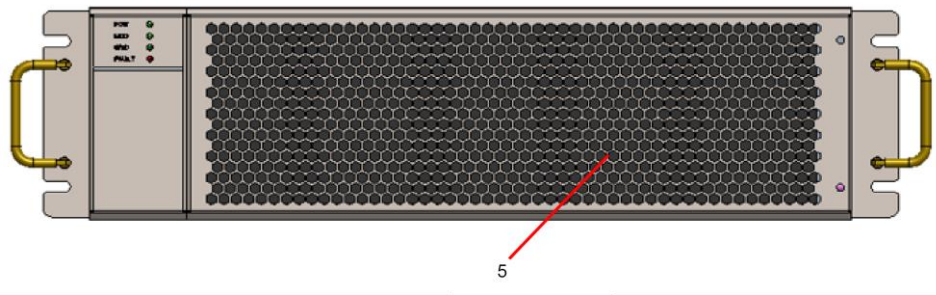
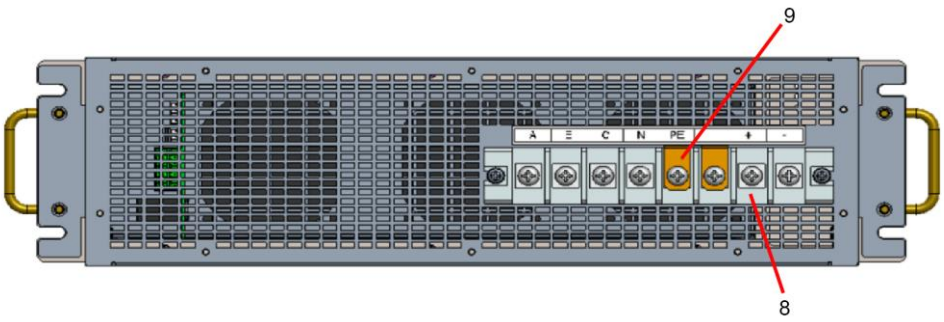


Figure 2-14 Appearance (back side)



(1) The LED status indicator light
(2) Communication resistance dial switch
(3) The RJ 45 communication interface
(4) BMS and other communication interfaces
(5) Dust cover
(6) Parallel communication interface
(7) Module communication and DI/DO signal interface
(8) Input and output terminals
(9) PE, short-circuit metal sheet

Table 2-10 Technical parameters of PCS

Model		**PCS 30kW**	**PCS 60kW**
DC parameter	Max. voltage [Vd.c.]	1000	1000
	Rated voltage [Vd.c.]	800	800
	Battery voltage range [Vd.c.]	680 ~ 1000	680 ~ 1000
	Maximum charge and discharge current [Ad.c.]	44	88
AC input	Max. input apparent power [kVA]	30	60

parameter	Maximum input active power [kW]	30	60
	Rated input voltage [Va.c.]	230/400, 3P+N+PE	230/400, 3P+N+PE
	Max. continuous input current [Aa.c.]	43	86
	Rated input frequency [Hz]	50	50
AC out parameter	Rated output voltage [Va.c.]	230/400, 3P+N+PE	230/400, 3P+N+PE
	Rated output frequency [Hz]	50	50
	Max. continuous output current [Aa.c.]	43	86
	Maximum continuous output active power [kW]	30	60
	Max. continuous output apparent power [kVA]	30	60
	Unbalanced load	100%	100%
	Overload capacity	1.1, 1min; 1.2, 5s	1.1, 1min; 1.2, 5s
	Power factor	0.8 un ~ 0.8 ov	0.8 un ~ 0.8 ov
General	Operating temperature range [℃]	-30 ~ +60 (> 45℃ drop)	-30 ~ +60 (> 45℃ drop)
	Protection grade	IP20	IP20
	Operating altitude range [m]	3000	3000
	Maximum efficiency	98.5%	98.5%
	AC / DC startup function	Yes	Yes
	Dimensions (W*D*H) [mm]	436*550*130	436*550*130
	Weight [kg]	25	28
Communication	BMS communication interface	CAN、RS485	CAN、RS485
	EMS communication interface	Ethernet, RS485	Ethernet, RS485
	EMS communicating protocol	Modbus TCP/RTU	Modbus TCP/RTU
	General IO	3 DI, 2 DO	3 DI, 2 DO

2.4.3.2 DC/DC

DC/DC module is a device used for DC/DC voltage conversion. Its main function is to

convert the DC voltage of the input power supply into the required output voltage to meet the requirements of the power supply voltage of the equipment.

When the number of battery modules is less than 12, the DC/DC modules will be pre-installed at the factory.

Figure 2-15 Appearance (front side, without dust cover)

Figure 2-16 Appearance (front side, with dust cover)

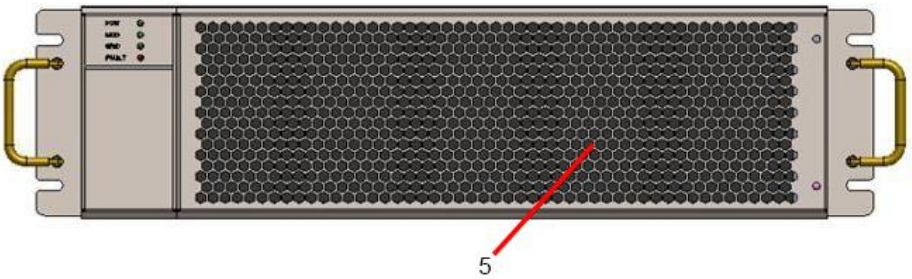


Figure 2-17 Appearance (30kW DC/DC back side)

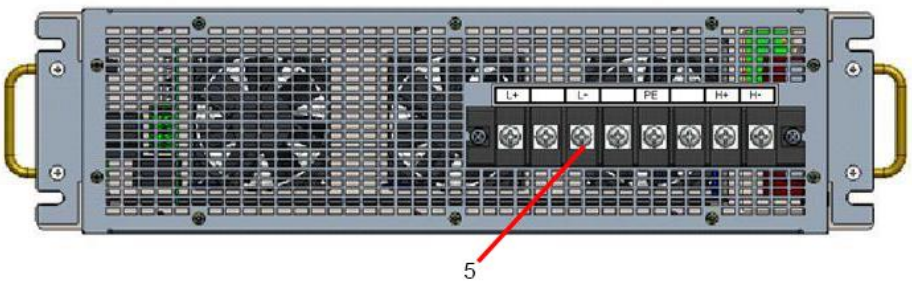
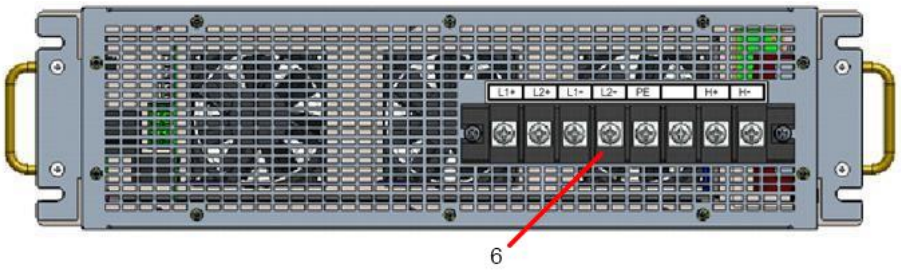


Figure 2-18 Appearance (60kW DC/DC back side)



(1) The LED status indicator light

(2) Communication resistance dial switch

(3) Module communication and DI/DO signal interface

(4) Parallel communication interface

(5) Dust cover

(6) Input/output wiring terminals

Table 2-11 Technical parameters of DC/DC

Model		**DC/DC 30kW**	**DC/DC 60kW**
Low voltage side interface	Maximum voltage [Vd.c.]	900	900
	Rated voltage [Vd.c.]	350	350
	Battery voltage range [Vd.c.]	200 ~ 900	200 ~ 900
	Maximum charge and discharge power [kW]	30	60
	Maximum charge and discharge current [Ad.c.]	100	200
	Maximum voltage [Vd.c.]	1000	1000
High voltage side interface	Rated voltage [Vd.c.]	800	800
	Voltage range [Vd.c.]	350 ~ 1000	350 ~ 1000
	Maximum continuous current [Ad.c.]	50	100
	Maximum continuous power [kW]	30	60
	Operating temperature range [℃]	-30 ~ +60 (>45℃ drop)	-30 ~ +60 (>45℃ drop)
General	Protection grade	IP20	IP20

	Operating altitude range [m]	3000	3000
	Maximum efficiency	98.5%	98.5%
	High voltage/low voltage start function	Yes	Yes
	Dimensions (W*D* H) [mm]	436*550*130	436*550*130
	Weight [kg]	25	28

2.4.3.3 MPPT (Optional)

MPPT is used for PV connecting.

Figure 2-19 Appearance (front side, without dust cover)

Figure 2-20 Appearance (front side, with dust cover)

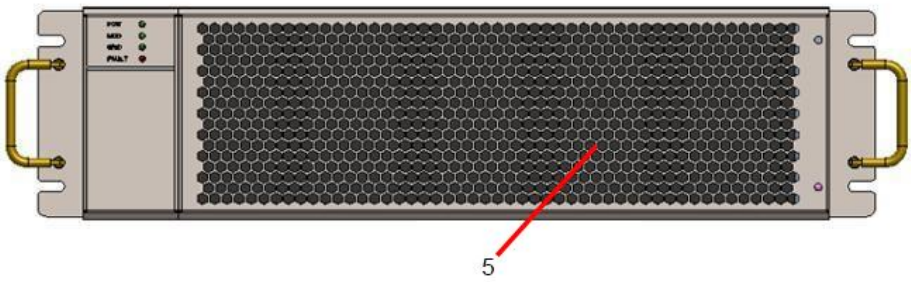


Figure 2-21 Appearance (30kW MPPT back side)

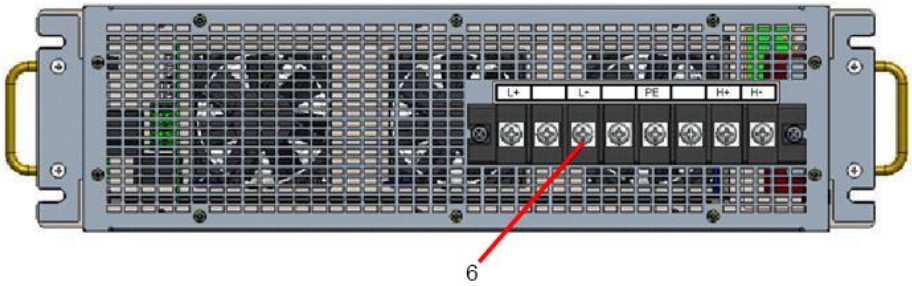
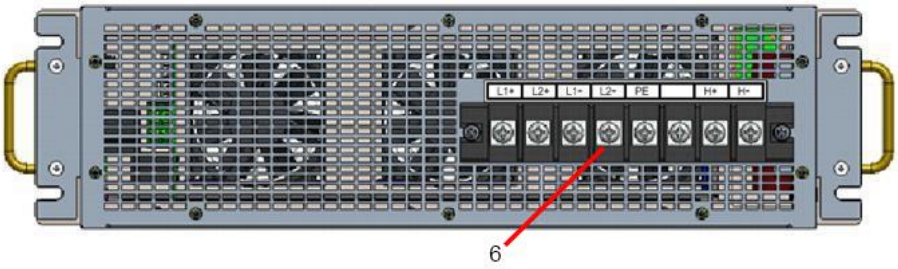


Figure 2-22 Appearance (60kW MPPT back side)



(1) The LED status indicator light

(2) Communication resistance dial switch

(3) Module communication and DI/DO signal interface

(4) Parallel communication interface

(5) Dust cover

(6) Input/output wiring terminals

Table 2-12 Technical parameters of MPPT

Model		**MPPT30A**	**MPPT60A**
Low voltage side	Max. PV input voltage range [V]	● 200 ~ 750 (For PowerHill P30-143kWh, PowerHill P30-179kWh, PowerHill P60-143kWh, PowerHill P60-161kWh, PowerHill P60-179kWh) ● 200 ~ 650 (For PowerHill P60-215kWh, PowerHill P100-215kWh)	
	Max. input power [kW]	30	60
	MPPT number	1	1
	MPPT input number	1	1

Model		MPPT30A	MPPT60A
	Max. input current [Ad.c.]	100	200
High voltage side	Max. voltage [Vd.c.]	1000	1000
	Rated voltage [Vd.c.]	800	800
	Voltage range [Vd.c.]	350 ~ 1000	350 ~ 1000
	Max. continuous current [Ad.c.]	50	100
	Max. continuous power [kW]	30	60
General	Operating temperature range [℃]	-30 ~ +60 (>45℃ drop)	-30 ~ +60 (>45℃ drop)
	IP Protection	IP20	IP20
	Operating altitude [m]	3000	3000
	Max. efficiency	98.5%	98.5%
	High voltage / low voltage start function	Yes	Yes
	Dimensions (W*D*H) [mm]	436*550*130	436*550*130
	Weight [kg]	25	28

2.4.4 Air conditioner

The air conditioner is used to adjust the temperature in the battery compartment so that the battery operates under appropriate temperature conditions.

Figure 2-23 Appearance of Air conditioner

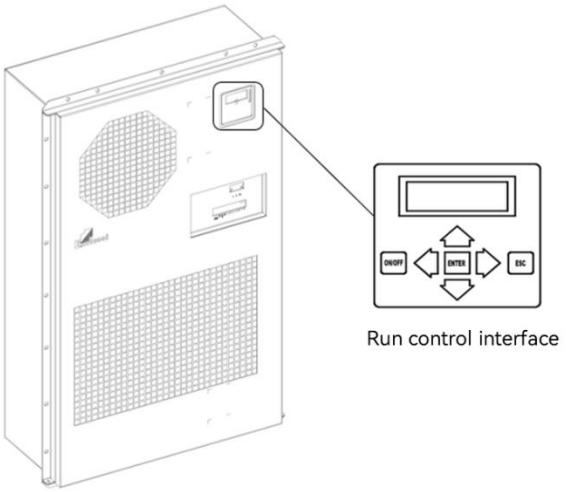


Table 2-13 Technical Parameters of air conditioner

Technical specifications	Value
Overall dimensions (H* W*D) (mm)	746×446×300
Dimensions with flange (H* W*D) (mm)	783×483×300
Weight (kg)	48
Mounting method	Door outfit
Application	Outdoor
Operating temperature range	-40℃ ~ +55℃
Noise level (indoor) (dB)	65
Protection degree	IP55
Refrigerant	R134a
RoHS compliant	Yes
Cooling capacity@L35/L35 (W)	3000
Heating capacity (W)	1000
Power consumption @L35/L35 (W)	1240
Current @L35/L35 (A)	5.7
Internal airflow	850

Technical specifications	Value
Maximum operating current (A)	9.8
Power supply range (V,Hz)	220±15%,50/60
Rated operating voltage - controller (V,Hz)	220, 50/60
Rated operating voltage - cooling / heating system (V,Hz)	220, 50/60

2.4.5 Fire Suppression System

Figure 2-24 Position of fire suppression system of 215 kWh model

(1) Smoke sensor

(2) Combustible gas detector

(3) Perluorohexone fire extinguishing device

The fire protection system will be activated and gas will be released under the following conditions:

(A battery cabinet is equipped with a set of detection circuit including two smoke detectors and a combustible gas detector.)

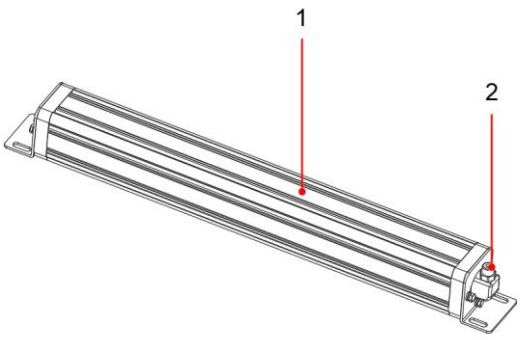
- When only one smoke detector is activated, the system will send out the fault information and stop the operation.

- When two smoke detectors are activated together or one smoke detector is activated and the cell temperature is greater than 60℃,
- The BESS system will immediately stop operation and the fire extinguishing device will be powered to release the extinguishant to suppress the fire.
- When the combustible gas concentration is above a certain value, the system will send out the fault information and stop the operation.

2.4.5.1 Non-pressure storage gas fire extinguishing device

- The cabinet is built-in non-pressure storage type fire extinguishing device.
- The extinguishant is perfluorohexanone which features high insulation, environment friendly, and quick fire extinguishing and cooling.
- Working Principles
- Non-pressure storage type fire extinguishing device adopts electric start mode.
- When the fire alarm signal is detected by the fire detection system in the protection area, the alarm signal is transmitted to the fire alarm control system through the electrical wiring, and the fire alarm control system sends out an activation signal based on the fire alarm signal through internal processing. Non-pressure storage fire extinguishing system receives the start signal and ignites the electric initiator inside the system, which in turn ignites the driving agent inside the system and generates a large amount of gas, the pressure inside the driving chamber rises and pushes the piston inside the system to move to the outlet end, when the pressure rises to the rupture disc bursting value at the front end of the system, the rupture disc bursts open, and the fire extinguishing agent is released through the nozzle to the inside of the protective area, so as to achieve the function of rapidly cooling down and extinguishing the fire.

Figure 2-25 Non-storage perfluorohexanone fire extinguishing device



(1) Fire extinguishing device tank

(2) Nozzle release kit

Table 2-14 Technical parameters of non-pressure perfluorohexanone fire extinguishing device

Technical Specifications	Value
Storage pressure (at 20℃)	0 bar
Startup method	Electric startup
Start the voltage / current	DC12~24V/1.2A
Startup time	≤1s
Extinguishant release time	6s≤t≤10s
Working temperature	-40℃~60℃
Alarming method	Dry contact signal feedback
Dimensions	596mm(width)x75mm(height)x75(depth)

2.4.5.2 Smoke Detector

The smoke detector is used to detect the smoke concentrations in the environment.

Figure 2-26 Appearance of the smoke detector

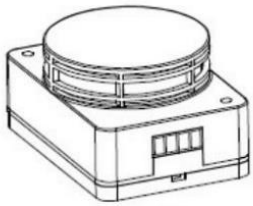


Table 2-15 Indicator description of the smoke detector

Name	Color	Status	Description
Indicator	Red	Steady on	The detector enters the alarm state.

Name	Color	Status	Description
		Blinking every 6 seconds	The detector enters the monitored state.
		Blinking twice every 6 seconds	The detector enters a fault state.

Table 2-16 Technical specifications of the smoke detector

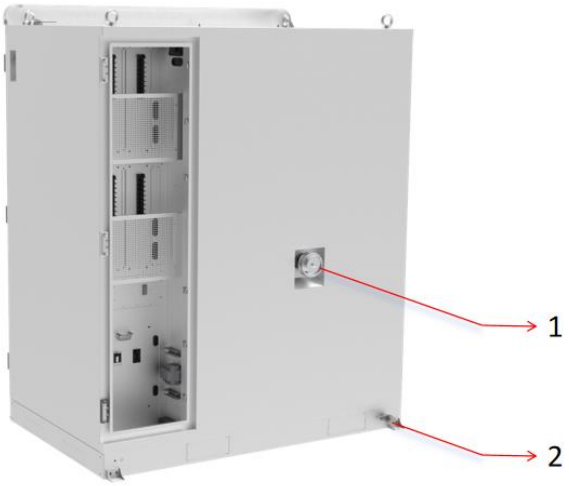
Technical Specifications	Smoke Detector
Operating voltage	12V（9V DC ~ 30V DC)
Quiescent current	< 5mA
Alarm current	< 35mA
Output mode	Relay output
Operating temperature	-10°C ~ +65°C
Ambient humidity	<95% RH (no condensing)

2.4.5.3 Fire-fighting water connection

NOTE!

- Water supply is not available in non-emergency situations.
- Fire-fighting water connection joints should be operated by skilled personnel.
- The drainage valve should be opened after fire-fighting water connection.
- It is recommended that the infrastructure to install fire-fighting water connection pipes behind the cabinet.
- When the battery compartment catches fire, the water will be injected into the battery compartment through the fire-fighting water connection to extinguish the fire.

Figure 2-27 Appearance of fire-fighting water connection of 215 kWh model



(1) Fire-fighting water connection

(2) Drainage valve

2.4.6 EMS (Optional)

EMS box is used for data information display, storage and operation control of energy storage system. It is a lightweight on-site control and energy management system, which is mainly used for the application scenarios of battery energy storage equipment. Through the application of the system, it can achieve the role of on-site multi-storage equipment power distribution, multi-energy (loads, photovoltaic, wind power, generators, etc.) complementary monitoring and energy management. For more details, please refer to the EMS User Manual.

Figure 2-28 Appearance of the EMS

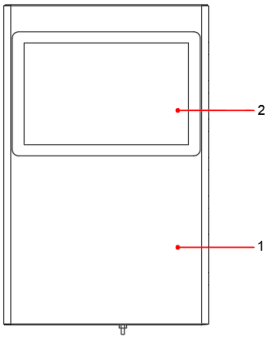


Table 2-17 Introduction of the appearance of the EMS

No.	Module Description	Explanation
1	EMS chest	Box
2	Indicator	Displays the EMS interface information

Table 2-18 Technical parameters of the EMS

Technical Specifications	Description
Controlling function	Peak shaving, Backup mode, Smooth PV output
User interface	Display interface, Ethernet
Communication Interface	1 Road Ethernet
communicating protocol	Ethernet: Modbus TCP
Power input	DC12V
Operating ambient temperature	-20 ~ 55℃
Height	≤2000m
Relative ambient humidity	5 ~ 95%
Ingress Protection	IP21
Dimension(W*H*D)	320mm*500mm*60mm
Weight	9.3kg
Installation Method	Indoor, hanging

2.4.7 ACHub (Optional)

ACHub busbar is an intelligent AC power distribution cabinet for current convergence and centralized control of multiple energy storage cabinets. For more detailed information, please refer to the AChub User Manual.

Figure 2-29 Appearance of ACHub

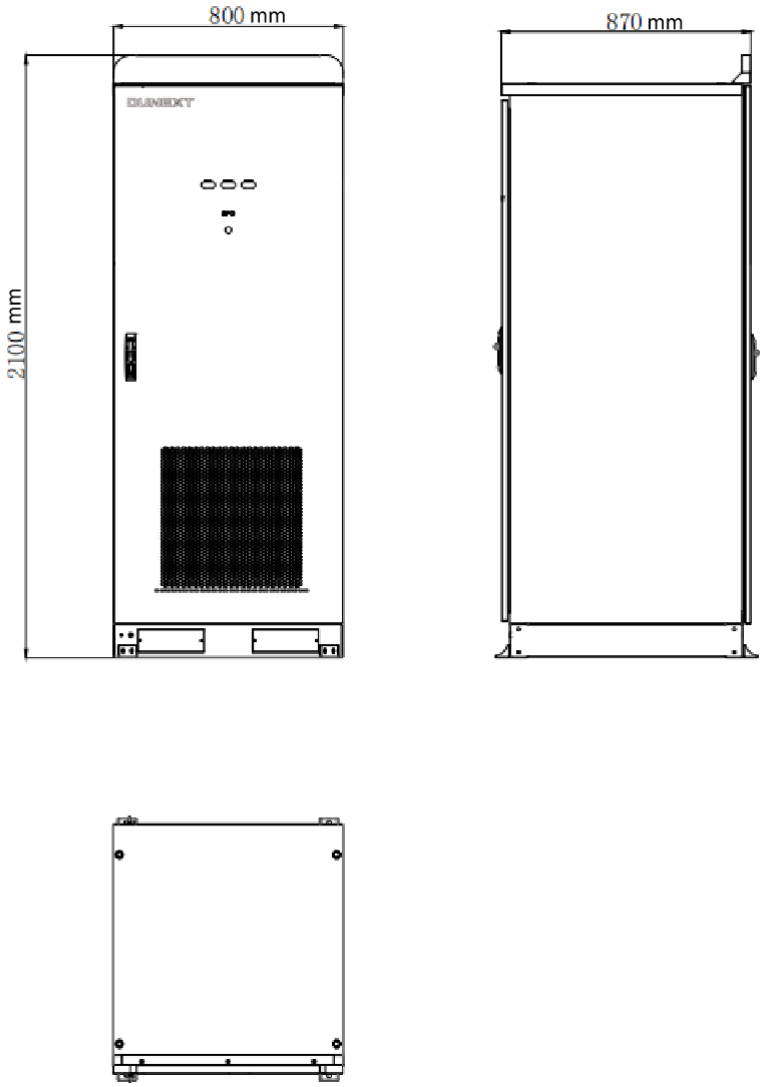


Table 2-19 Technical parameters of ACHub

Model	ACHub-6/1	ACHub-4/1	ACHub-2/1
AC Side			
Grid Type	3P4W		
Charge and Discharge Power (KW)	600	400	240
ESS Cabinet Interface	6	4	2
Single-interface Rated Power (KW)	100		

Model	ACHub-6/1	ACHub-4/1	ACHub-2/1
Single-interface Rated Current (A)	144A		
Rated Grid Voltage (V)	400		
Frequency (Hz)	50/60		
Rated Current (A)	866	577	346
General Parameters			
Dimensions (W*H*D) (mm)	800*2100*870		
Maximum Weight (KG)	400		
Ingress Protection	IP54		
Cooling Method	Fan cooling		
Anti-corrosion Grade	C3		
Relative Humidity	0-95% (no condensation)		
Operating Temperature: *(℃)	-20 ~ 50		
Working Altitude * * (m)	< 2000		
Noise (dB)	≤75		
Seismic Intensity Rating	8 Degrees (IEC60980)		
Lightning Protection	Support		
Earth Leakage Protection	Support		
Communication Interface	RS485, Ethernet		
Communication Protocol	Modbus RTU, Modbus TCP/IP		

2.4.8 PCC On/off Grid Switching Cabinet (Optional)

PCC On/off Grid Switching Cabinet is used to control the on/off-grid switching of energy storage cabinet. For more detailed information, please refer to the PCC On/Off Grid Switching Cabinet User Manual.

Figure 2-30 Appearance of PCC On-off Grid Switching Cabinet

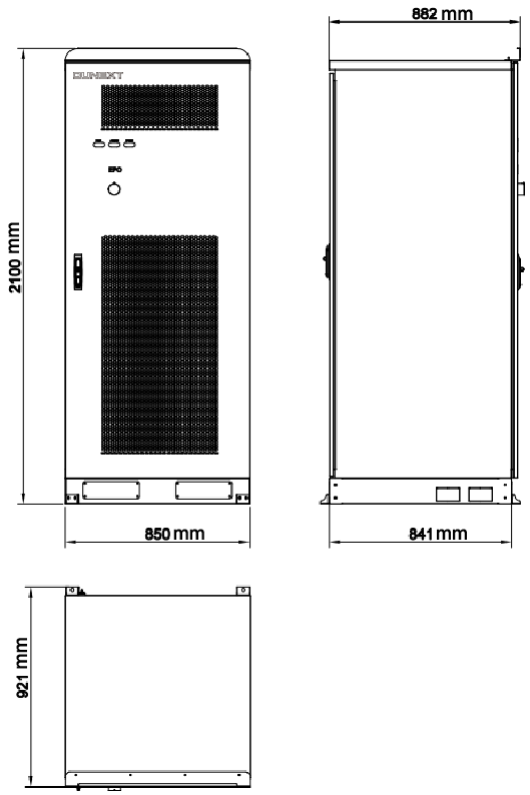


Table 2-20 Technical Parameters of PCC On/off Grid Switching Cabinet

Parameter model	PCC-75	PCC-125	PCC-250	PCC-375
Basic Parameters				
Rated Power	75kVA	125kVA	250kVA	375kVA
Mode of Connection	3P4W+PE			
Rated Voltage	AC400V			
Voltage Range	AC400V±15%			
Rated Frequency	50/60Hz			
Frequency Range	50/60(±2.5) Hz			
Long-term Overload Capability	110%			
Off-grid to On-grid Automatic Switching	5~27ms	30~80ms	33~120ms	33~120ms

Parameter model	PCC-75	PCC-125	PCC-250	PCC-375
Time				
On-grid to Off-grid Automatic Switching Time	≤20ms			
Rated Output Current	86A	172A	344A	516A
Maximum Current	100A	200A	400A	600A
Maximal Efficiency	99%			
Automatic Protection	Grid-side over-voltage, Under-voltage, Over-frequency, Under-frequency, Over-temperature, Emergency stop and Output overload protection			
General Parameters				
Isolation Transformer	Yes			
Ingress Protection	IP54, support for outdoor			
Cooling Method	Forced Air Cooling			
Anti-corrosion Grade	C3			
Operating Temperature	-20℃ ~ 50℃			
Relative Humidity	0~95% (no condensation)			
Operating Altitude	< 2000m			
Noise	≤75dB			
Dimensions (W * D * H)	850mm*900mm*2100mm		1100mm*900mm*2100mm	
Maximum Weight	1000kg		1200kg	
Number of Grid Inputs	1			
Number of PCS Inputs	1			
Number of Load Inputs	1			
Communication Interface	1 RS485,1 CAN			
Communication Protocol	Modbus-RTU、CAN2.0B			

2.5 Operating Principle

2.5.1 Circuit Diagram

Figure 2-31 Circuit Diagram (100kW PCS model)

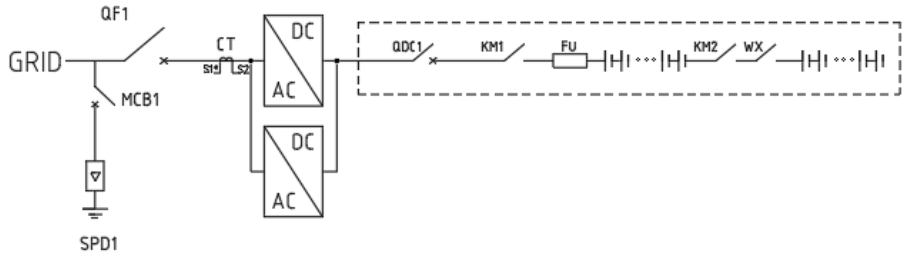


Figure 2-32 Circuit Diagram (100kW PCS model with 100kW MPPT)

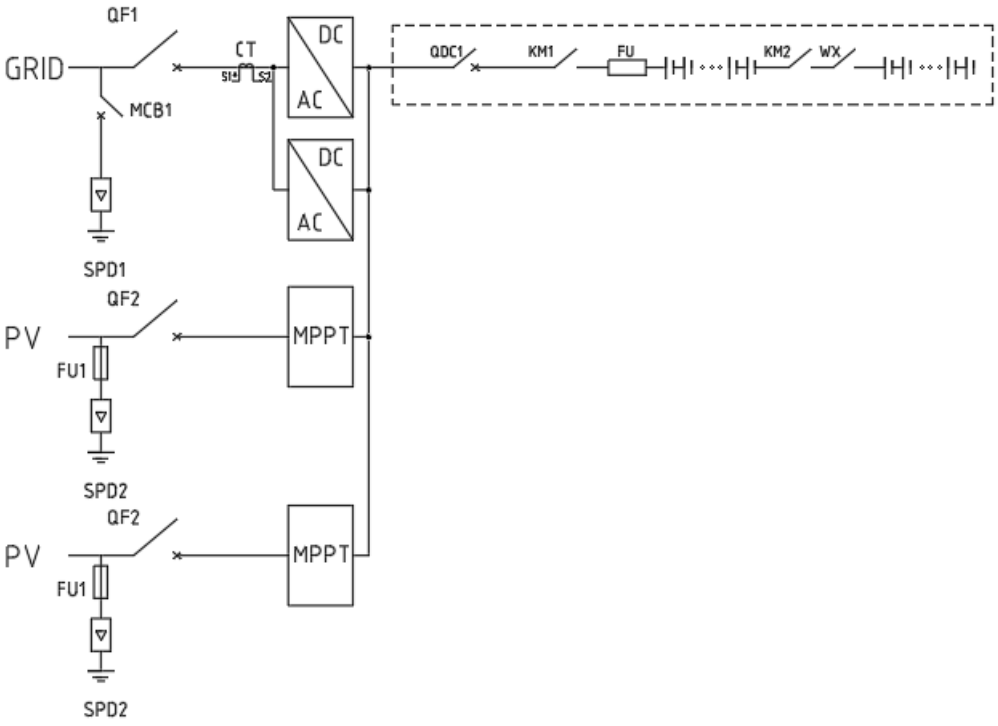


Figure 2-33 Circuit Diagram (50kW PCS model with 50kW DC/DC)

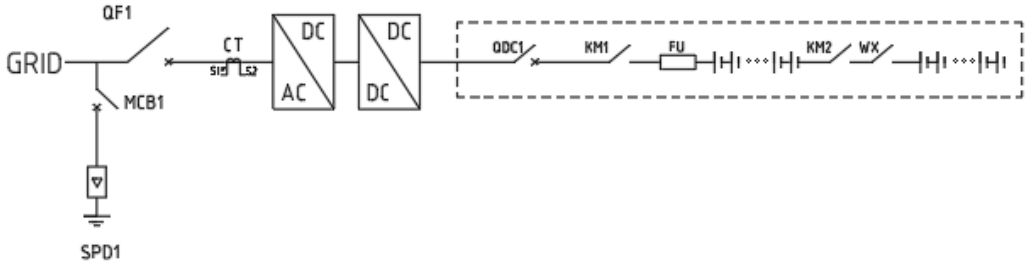
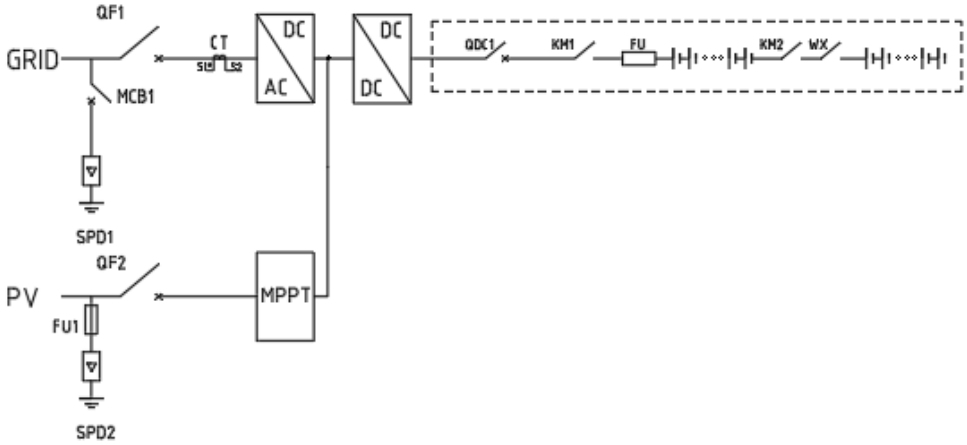


Figure 2-34 Circuit Diagram (50kW PCS model with 50kW DC/DC, 50kW MPPT)



2.5.2 PowerHill Status

The PowerHill has three states: Operation, Shutdown and Fault.

Table 2-21 Description of the PowerHill status

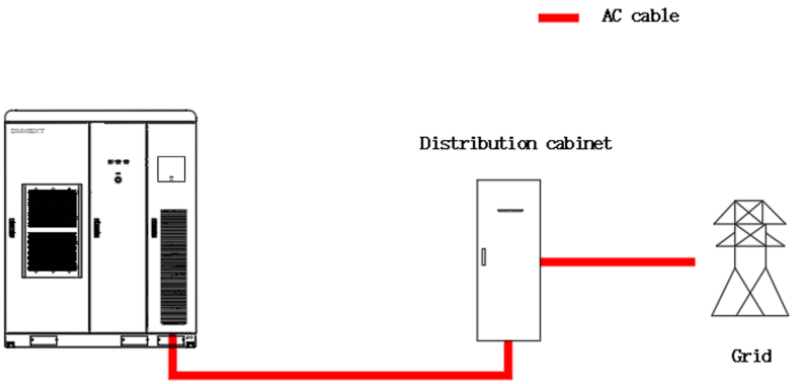
Device status	Explanation
Operation	Battery is charging or discharging.
Shutdown	The energy storage system will stop charging and discharging.
Fault	If the system failure or battery pack failure is detected, it will enter a fault state.

2.6 Networking Application

NOTE!	Power distribution cabinet and cable are supposed to be supplied by clients.

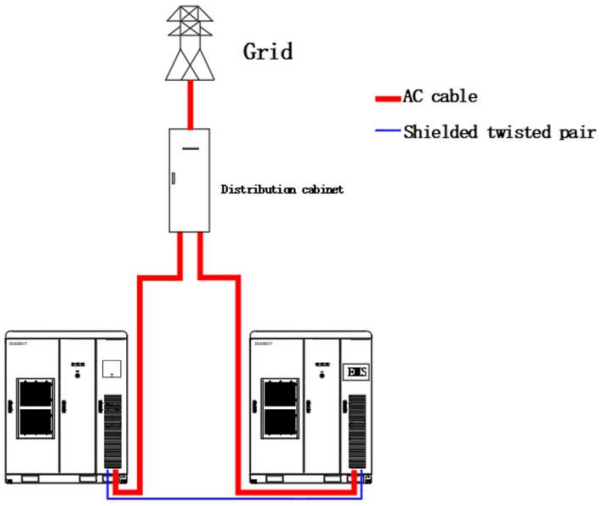
2.6.1 On-grid Scenario

Figure 2-35 Typical Electrical Connection Diagram



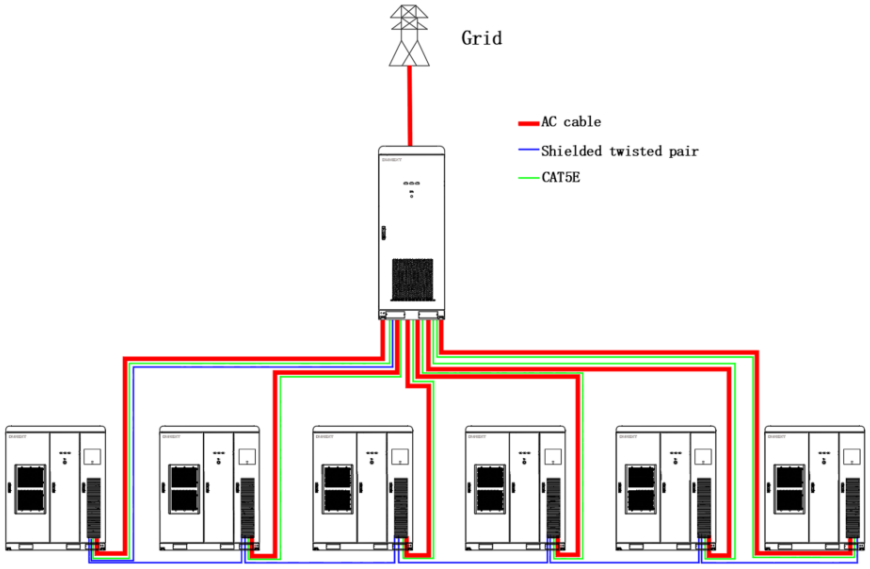
For BESS with data acquisition and control requirements, refer to the communication protocol EMS Modbus Protocol.

Figure 2-36 Electrical Diagram for Multiple Cabinets Connect in Parallel



For BESS with data acquisition and control requirements, refer to the communication protocol EMS Modbus Protocol.

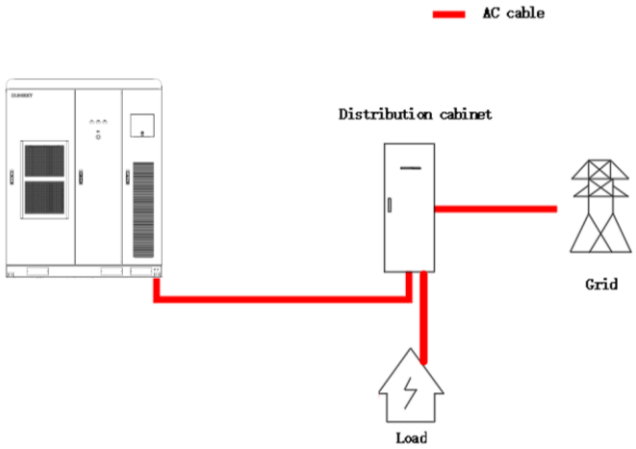
Figure 2-37 Electrical Diagram for Multiple Cabinets Connect in Parallel by using ACHub



For systems with data acquisition and control requirements, data acquisition and system control can be achieved through the ACHub external interface, refer to the communication protocol ACHub Modbus Protocol.

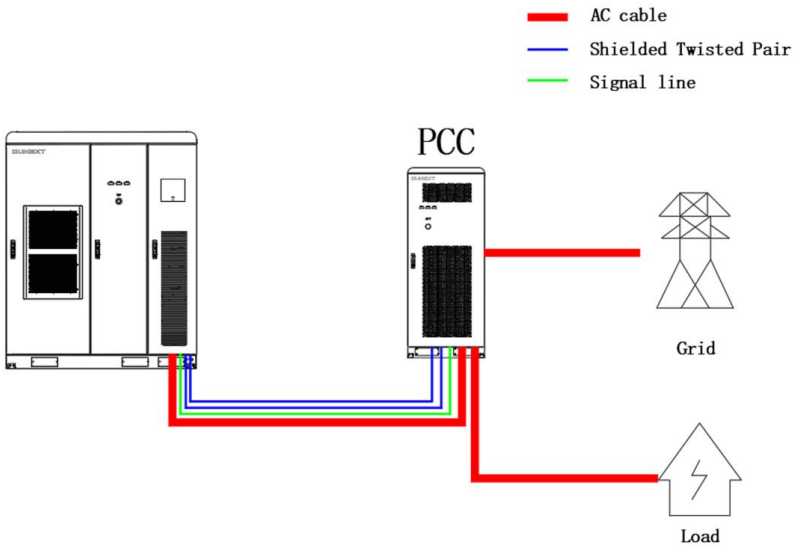
2.6.2 Micro-grid Scenario

Figure 2-38 Electrical Connection Diagram of Manual On and Off-grid Switching



For BESS with data acquisition and control requirements, refer to the communication protocol EMS Modbus Protocol.

Figure 2-39 Electrical Connection Diagram of Automatic On and Off-grid Switching with PCC



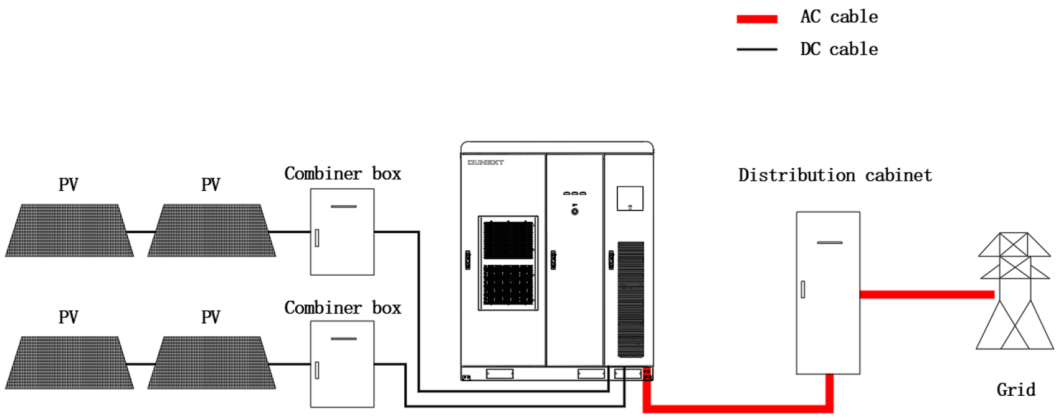
For BESS with data acquisition and control requirements, refer to the communication protocol EMS Modbus Protocol.

2.6.3 Solar PV + Storage Scenario

Explanation

- BESS can access up to 2 channels of PV, single channel can be selected 30kW, 60kW, the maximum power of two channels is 120kW.
- Maximum open-circuit voltage of external PV is 650V for 215kWh model; maximum open-circuit voltage of external PV is 750V for 143~197kWh models.

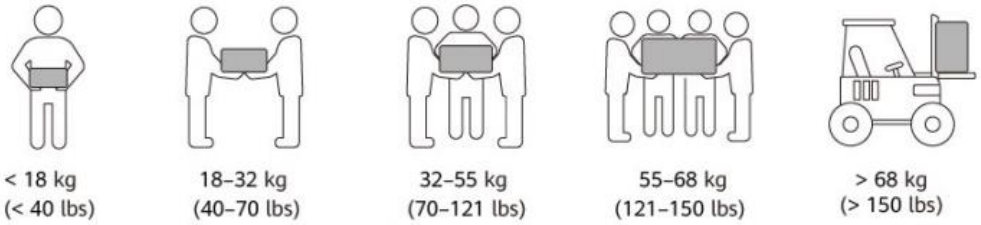
Figure 2-40 Electrical Connection Diagram of Solar PV + Storage Scenario



For BESS with data acquisition and control requirements, refer to the communication protocol EMS Modbus Protocol.

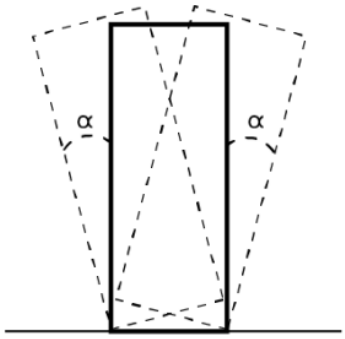
3 Transportation Requirements

- Be cautious to prevent injury when moving heavy objects.



- If multiple persons need to move a heavy object together, determine the manpower and work division with consideration of height and other conditions to ensure that the weight is equally distributed.
- If two persons or more move a heavy object together, ensure that the object is lifted and landed simultaneously and moved at a uniform pace under the supervision of one person.
- Wear personal protective gears such as protective gloves and shoes when manually moving the equipment.
- To move an object by hand, approach to the object, squat down, and then lift the object gently and stably by the force of the legs instead of your back. Do not lift it suddenly or turn your body around.
- Move or lift the equipment by holding its handles or lower edges. Do not hold the handles of modules that are installed in the equipment.

- Do not quickly lift a heavy object above your waist. Place the object on a workbench that is half-waist high or any other appropriate place, adjust the positions of your palms, and then lift it.
- Move a heavy object stably with balanced force at an even and low speed. Put down the object stably and slowly to prevent any collision or drop from scratching the surface of the equipment or damaging the components and cables.
- When moving a heavy object, be aware of the workbench, slope, staircase, and slippery places. When moving a heavy object through a door, ensure that the door is wide enough to move the object and avoid bumping or injury.
- When transferring a heavy object, move your feet instead of turning your waist around. When lifting and transferring a heavy object, ensure that your feet point to the target direction of movement.
- When transporting the equipment using a pallet truck or forklift, ensure that the tynes are properly positioned so that the equipment does not topple.
- Before moving the equipment, secure it to the pallet truck or forklift using ropes. When moving the equipment, assign dedicated personnel to take care of it.
- Ensure that tilt angle of the cabinet meets the requirements shown in the figure. The tilt angle α of a cabinet with packaging must be less than or equal to 15°. After the cabinet is unpacked, its tilt angle α must be less than or equal to 10°.



- When moving and transporting an air conditioner, keep it upright and do not place it horizontally or upside down. If the package of the air conditioner is damaged or the tilt indicator on the package changes color, contact the Company's service engineers.

Transportation requirements

 DANGER!	Load or unload batteries with caution. Otherwise, the batteries may be short-circuited or damaged (such as leakage and crack), catch fire, or explode.
 WARNING!	Do not move a battery by holding its terminals, bolts, or cables. Otherwise, the battery may be damaged. Keep batteries in the correct direction during transportation. They must not be placed upside down or tilted, and must be protected against falling down, mechanical impact, rains, snows, and falling into water during transportation. Batteries must be transported separately. Do not transport a cabinet with batteries installed. If the cabinet needs to be transported or moved, remove the batteries first.

- According to the UN Recommendations on the Transport of Dangerous Goods: Model Regulations (also referred to as TDG or UN Orange Book), batteries belong to class 9 dangerous goods and shall pass the related tests required in Part III Subsection 38.3 of the UN Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria.
- Transportation and storage service providers must have the qualifications for dangerous goods operations required by local laws, regulations, and standards. Rigid box trucks shall be used for transportation and pickup trucks are prohibited.
- Batteries are delivered to the site directly and the road or sea transportation requirements shall be met.
- Comply with the latest international and national rules on the transportation and storage of dangerous goods, including but not limited to the International Maritime Dangerous Goods Code (IMDG Code), Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), and China's transportation industry standards (JT/T 617) Regulations concerning road transportation of dangerous goods, as well as the requirements of the transportation regulatory authorities in the countries of departure, route, and destination. Before transportation and storage, properly pack, label, and mark products according to the local laws, regulations, and standards, and complete related product and packaging tests.
- Choose sea or roads in good conditions for transportation. Do not transport the equipment by railway or air. Avoid tilt or jolt during transportation.

- Before transportation, ensure that the battery packaging, labels, and markings are intact and there is no abnormal smell, leakage, smoke, or fire. Otherwise, the batteries must not be transported.
- The packing case must be solid and strong. Handle the packages with care and take moisture-proof measures during loading, transportation, and unloading. Do not place the packages on one side or upside down. Bind the packages securely to avoid displacement. Ensure that the dangerous goods labels are visible.
- Exercise caution when moving batteries to prevent bumping and ensure 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.
- If the local laws, regulations, and standards allow the mixed transportation of specified different dangerous goods and that of dangerous goods and common goods, the dangerous goods shall be isolated according to the local laws, regulations, and standards. If there is no specific local requirement, refer to the following requirements for isolation when dangerous goods and common goods are in the same vehicle or container:

  – Use a spacer that is as high as the packages.

  – Keep a distance of at least 0.8 m around.
- Before transporting a faulty battery (with scorch, leakage, bulge, or water intrusion), insulate its positive and negative terminals, pack it, and place it in an insulated explosion-proof box as soon as possible. Record information such as the site name, address, time, and fault symptom on the box.
- When transporting faulty batteries, avoid approaching flammable material storage areas, residential areas, or other densely populated places, such as mass transit facilities or elevators.

4 Storage Requirements

4.1 Storage and Recharging of the ESS

- It is prohibited to remove the packaging when storing for a long period of time.
- Store (long-term or temporary) on a level floor.
- Close the cabinet door tightly.
- Storage environmental requirements:

  -Ambient temperature: short-term storage -20℃~+60℃ (<1 month)

  - Long-term storage 0℃~35℃ (<1 year) (Recommended 0℃~35℃, long-term storage beyond 40℃ may affect the performance and service life of the battery).

  - Relative humidity: 5% RH ~ 95% RH (recommended around 45% RH).

  - Dry, ventilated, and clean. The product must be protected against dust, rain and water.

  - Avoid contact with corrosive organic solvents, gases and other substances.

  - The distance from the heat source should not be less than two meters.
- If the system is not used for a long time, turn off the system, otherwise it may lead to over-discharge of the battery.

- If the system is not used for a long time, it is necessary to inspect the system regularly, such as the system appearance, battery power, UPS power, etc.
- If the system is not used for a long time, please charge the system equipment every 6 months to keep the battery SOC above 50%.
- Storage period of the energy storage system should be less than 2 years.
- Battery storage exceeds the expiration date, should be reported in time.
- If the battery is deformed, broken or leaking, it will be scrapped directly without considering the storage time.

4.2 Recharging Operation Instructions

- Connect the system to the power grid, if there is no power grid, use diesel engine, photovoltaic and other power generating equipment (need to contact with the supplier to confirm), and use the EMS control system to carry out small power charging until the SOC is more than 30%.
- If there is a UPS function, you need to connect the system to the grid periodically (three months), open the secondary distribution circuit breaker of the system, at this time, the UPS switching power supply will charge the small battery, the charging time is 2 hours.

5 Site Requirements

5.1 Site Selection Requirements

NOTICE NOTICE!	The ESS site selection and fire safety must comply with local laws and regulations. Reference standards include but are not limited to the NFPA855 Standard for the Installation of Stationary Energy Storage Systems.

5.1.1 General Requirements

- The installation level should be above the highest historical water level in the area and at least 300mm above ground level, and the installation location should not be in a low-lying area.
- The energy storage system or energy storage power station must be set up in an environment with no risk of ignition or explosion.
- The site has convenient transportation conditions and reliable fire suppression system equipment.

 NOTE!	• The installation, commissioning and operation phases of the energy storage system should satisfy the principle of fire-fighting first: the number of gaseous fire extinguishers configured near each unit should be ≥2, such as Heptafluoropropane, Perfluorohexanone and Carbon Dioxide.

	• Please reserve water fire extinguishing system interface for the energy storage system site. • Meet the necessary site area in the near future, and should leave room for expansion according to the needs of the whole life cycle. • The energy storage system should be installed at a location greater than 30m from third-party wireless communication facilities. • Select a well-ventilated site. • Site location should avoid scenarios that are not recommended by industry standards and regulations, including but not limited to the following lots, areas, and places: • - Areas with strong vibration, strong noise sources and strong electromagnetic field interference. • - Sites that produce or have dust, fumes, noxious gases, corrosive gases, etc. • - Places where corrosive, flammable and explosive substances are produced or stored. • - Places with existing underground facilities. • - Places with poor geology such as rubberized soil, weak soil, etc., and ground that is prone to water accumulation and subsidence. • - Underneath cisterns, water features, and water intake houses. • If it is unavoidable to set up in a place where water may accumulate, water-blocking and drainage facilities or measures to raise the ground level should be installed. • Cable trenches should not be used as drainage paths, and cable routing openings (e.g., holes where cables run through partition walls and floor slabs) should be sealed with fire-resistant blocking. • Earthquake faults and seismic zones with an intensity of defense higher than 9 degrees. • Lots with mudslides, landslides, quicksand, caves and other direct hazards. • Within the boundary of mining trap (misalignment) area.

	• Within the blasting hazard areas. • Areas that may be flooded if a dam or dike breaks. • Important sanitary protection areas for water supply sources. • Historical relics and monuments protection zones. • Personnel-intensive places, high-rise buildings, and underground buildings. • Intersections of urban arterial roads and busy traffic sections.

5.1.2 Site selection for flood prevention and flood control requirements

- Large electrochemical energy storage system (power ≥100MW) station area site design elevation should be higher than the flood water level with a frequency of 1% or the highest historical waterlogging level.
- The design elevation of the station area for small and medium-sized electrochemical energy storage systems (power <100MW) shall be higher than the flood level with a frequency of 2% or the highest historical flood level.
- When the site design elevation of the station area cannot meet the above requirements, another site should be selected, or different flood prevention and flood control measures should be taken for different situations.
- For energy storage stations along rivers, streams, lakes and seas that are affected by wind and waves, the elevation of the flood prevention facilities should take into account a wind and wave height with a frequency of 2% and a safety over-height of 0.5m.
- When there is a large catchment of water at the periphery of the base that converges into or crosses the base, it is appropriate to set up side ditches or drainage (interception) ditches to carry out surface drainage in an organized manner.

5.1.3 Outdoor Requirements

General requirements for the siting of outdoor energy storage systems are as follows:

- The energy storage system or energy storage plant installation site and the surrounding 3m area shall be free of vegetation and flammable plants to prevent wildfires caused by high summer temperatures from causing fires in the energy storage system. (Exemption: single specimens of trees, shrubs, or cultivated ground cover that do not readily constitute a passing fire, such as green grass, ivy, succulents, or similar plants used as ground cover, shall be exempt.)
- The safe distance between the energy storage system and the building shall comply with local fire codes or standards.

Energy storage systems located outdoors shall be separated from boundaries, public roads, buildings, flammable materials, hazardous materials, high stockpiles, parking spaces, and other hazards not related to the grid infrastructure by a minimum of 10 feet (3.048m).

The distance between the energy storage system and the production building can be reduced to 0.914m when one of the following conditions is met, while space requirements for equipment transportation, installation, and maintenance need to be considered.

The energy storage system has a 1h fire-resistant independent firewall, and the length and height of the firewall should exceed the outer contour of the energy storage system by 1.5m each.

The walls in the vicinity of the energy storage system are provided with non-combustible exterior walls with no openings or combustible exterior finishes, and the exterior walls have a 2h fire resistance rating in accordance with ASTM E119 or UL 263.

The distance between the exhaust of the energy storage system and heating, ventilation, and air conditioning intakes, windows, doors, loading platforms, and sources of ignition of other buildings or facilities should be >4.6m.

The energy storage system will be corroded if it is installed in salt-affected or polluted areas, do not install the energy storage system in salt-affected or polluted

areas. The energy storage system can be used in the following or better environments:

Outdoor environments greater than 10km from the coast. The use of the energy storage system is not recommended when the distance from the coast is 2km to 10km (if it is necessary to use it, please confirm with your dealer or our engineers). Outdoor deployment is not allowed when the distance from the coast is less than 2km, and indoor deployment should be performed according to indoor requirements.

Distance from heavy pollution sources such as smelters, coal mines, thermal power plants, etc. is more than 5000m.

Distance to medium pollution sources such as chemical, rubber, electroplating, etc. is greater than 3000m.

The distance from light pollution sources such as food, leather, heating boilers, slaughterhouses, centralized garbage dumps, sewage treatment stations, etc. is greater than 500m to 1000m.

When the safety spacing of the selected site cannot meet the requirements of the relevant standards, it is recommended to select a new site.

 NOTE!	When the safety spacing of the selected site cannot meet the requirements of the relevant standards, it is recommended to select a new site.

Anti-trespassing fence:

It is recommended that the area of energy storage equipment be isolated and protected by solid walls or fences with door locks, and the height of the fences should be >2.2 meters, and the firewall can replace part or all of the fence, which can be considered by the designer.

5.1.4 Indoor requirements

The fire safety of the independent dedicated building/structure for energy storage system shall meet the requirements of local laws and regulations, with reference standards including but not limited to NFPA855 or GB50016, GB51048, and the following requirements:

- Stand-alone buildings/structures dedicated to energy storage should be equipped, and the walls of the buildings/structures should meet the requirements of 2h fire protection, and the maximum total capacity of lithium batteries stored in a single fire protection unit should be 600kWh, and the requirements of buildings/structures dedicated to energy storage should be fulfilled.
- The building/structure should be equipped with the following:

  - The building/structure may only be used for the operation of energy storage equipment.

  - Access to the rooms and areas containing the ESS is restricted to persons operating, maintaining, servicing, testing and repairing the ESS and other energy systems.

  - No other occupation types shall be included in the construction / structure.
- Stand-alone energy storage dedicated buildings/structures should be no less than 3.0m away from the following places: municipal red lines, combustible warehouses, hazardous materials, high stacking warehouses, electric power infrastructures, public roads, buildings, parking spaces.
- The layout of the building/structure dedicated to independent energy storage should comply with local fire laws, regulations and specifications, such as various production scenarios, safe distance and placement of buildings and materials.
- No combustible materials should be stored in the building/structure dedicated to independent energy storage, and the distance between combustible materials and the battery room should not be less than 3 meters.
- The building/structure dedicated to independent energy storage should be equipped with fire extinguishers, such as halothane fire extinguishers, sevoflurane fire extinguishers, perfluorohexanone fire extinguishers, carbon dioxide fire extinguishers or dry powder fire extinguishers, and the number of fire extinguishers for each fire protection unit shall not be less than two, and they shall be inspected and replaced on a regular basis.

- Buildings/structures dedicated to independent energy storage shall be equipped with room-level smoke detectors, with the number of each type of sensor not less than 2, and the automatic fire alarm system is on.
- Stand-alone energy storage buildings/structures shall be equipped with independent ventilation equipment, which shall be linked with the fire alarm system, and the ventilation capacity shall ensure that the concentration of combustible gases is less than 25% LFL, and the ventilation rate of the mechanical exhaust shall be not less than 1 ft3 / min / ft2 (5.1 L / sec / m2).
- Special buildings / structures for independent energy storage shall be equipped with room-level combustible gas detection device, and rooms with ESS shall be protected by an approved continuous gas detection system meeting the following conditions:

  - The gas detection system shall be designed to activate the mechanical exhaust ventilation system when combustible gas levels detected in the room exceed 25% of the LFL.

  -The mechanical exhaust ventilation system shall remain on until the detected combustible gas is less than 25% of the LFL.

  -The gas detection system shall have a minimum of 2 hours of power backup capability.

  -The monitoring center shall signal a fault in the event of a gas detection system failure.
- Stand-alone energy storage dedicated buildings/structures should be equipped with fire extinguishing facilities such as water spray or water sprinkler, and the water supply time should be more than 2h under the premise that the water storage capacity meets the design water flow rate, and the surrounding water sources should have the ability to supply water for a continuous period of 12h to cope with the risk of rekindling again or spreading of fire after extinguishing the fire of the batteries; the minimum density of the sprinkler system should be designed to be 0.3 gpm / ft2 (12.2 mm / min) or 2500 ft2 (12.2 ft2 / min) for the whole area of the room. min) of the entire room area or 2500 ft2 (230 m2) of the design area, whichever is less.

- Stand-alone buildings/structures dedicated to energy storage should be equipped with pressure relief and explosion-proof devices or pressure relief channels of equivalent area (e.g. glass windows, electromagnetic locking doors, etc.), with reference to the requirements of the NFPA 68 standard. If side pressure relief is used, protective fences or protective fences need to be installed on the outside of the relief channels, with a distance of not less than 3 meters from the pressure relief wall surface of the fence or fences.
- The ambient temperature inside the building where the ESS is placed should be less than 55° when the ESS is in operation.
- Flammability is prohibited on the top side of the ESS cabinet. Flammable materials are prohibited above the top of the ESS cabinet.
- Maintenance space requirements:

  -Access doors meet the access space requirements for forklift installation of the ESS.

  -The interior area of the building meets the space requirements for ESS maintenance and forklift operation.
- Exit and access settings:

  -The above installation requirements need to meet the requirements of the local fire department for approval, and water sprinkler, smoke detection, combustible gas detection, and explosion-proofing requirements can be exempted under the premise of meeting the fire department's approval; however, the mechanical ventilation and exhaust, the top explosion relief space, and the space for heat dissipation and maintenance should still meet the requirements.

  -When an ESS dedicated building is located more than 100 feet (30.5 meters) from buildings, build-able lot lines, public rights-of-way, stored combustible materials, hazardous materials, high-pile stockpiles, and other exposed hazards not associated with the grid infrastructure, exemptions shall be allowed, subject to local fire department approval, from fire protection and suppression systems, ESS specifications and isolation requirements, and water supply systems.
- Indoor applications shall comply with the requirements of GB51048 and GB50016 standard specifications. Among them:

- The partition wall around the special building / structure for independent energy storage should be a firewall with a fire resistance limit of no less than 4.00h, and the fire resistance limit of the top and bottom floor should not be less than 2.00h.

  -The partition wall around the building/structure dedicated to independent energy storage shall be a fire wall with fire resistance limit of not less than 4.00h, and the fire resistance limit of the top and bottom floor slabs shall not be less than 2.00h.

  -The safety distance between the building/structure dedicated to independent energy storage and the production building of category A should be ≥12m, the safety distance from the production building of category B should be ≥10m, the safety distance from the production building of category C, D and E with fire-resistance level 1 or 2 should be ≥10m, and the safety distance from the production building of fire-resistance level 3 should be ≥12m.

  -Stand-alone energy storage dedicated buildings/structures should be equipped with pressure relief and explosion-proof devices or equivalent area of pressure relief channels (such as glass windows, electromagnetic locking doors, etc.), with reference to the requirements of GB50016 standard. If side pressure relief is adopted, protective fences or protective fences need to be set up on the outside of the pressure relief channels, and the fences or fences should be not less than 12 meters away from the surface of the pressure relief wall.

- Requirements for offshore indoor applications:

  -When the energy storage system is less than 500m away from the coast, special protective buildings/structures must be added and air-conditioners must be installed so that the energy storage system is in an indoor environment with controllable temperature and humidity, and the indoor environment must reach the C4 grade or better grade of the ISO12944/ISO9223 standard, and the siting requirements for the indoor application mentioned above should be met.

  -Outdoor air-conditioning and mechanical ventilation equipment need to consider anti-salt spray measures, inlet and outlet air inlet and outlet are required to add anti-salt spray filters or use anti-salt spray type air-conditioning/ventilation equipment, and carry out regular maintenance and replacement of filters.

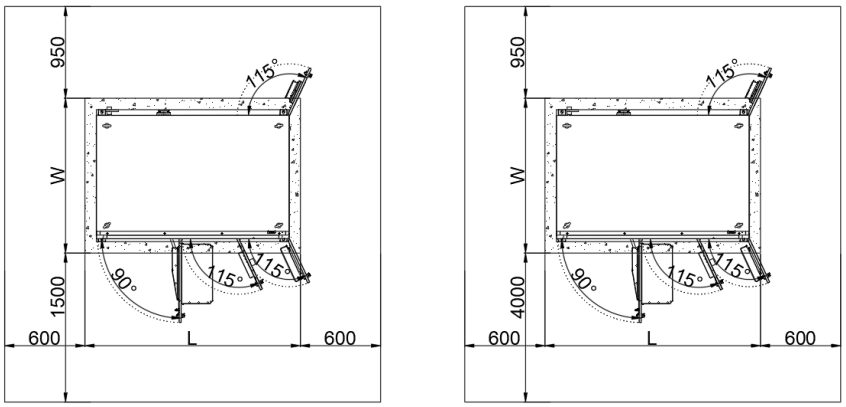
5.2 Space Requirements

NOTICE	The following figure shows the minimum space requirements for installation and operation and maintenance. The space requirements for equipment must also meet the site selection requirements (see Site Selection Requirements).

Figure 5-1 Space Requirements for 215 kWh model (Unit: mm)

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear

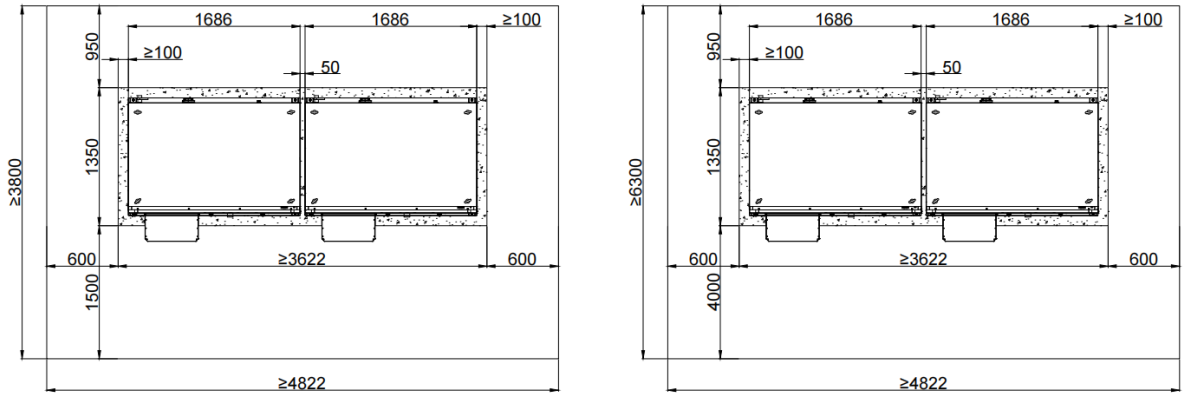


Category	Parameter
Minimum Hardening Area	L≥1886mm，W≥1350mm

Figure 5-2 Space Requirements for 2 Sets of 215kWh models (Unit: mm)

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

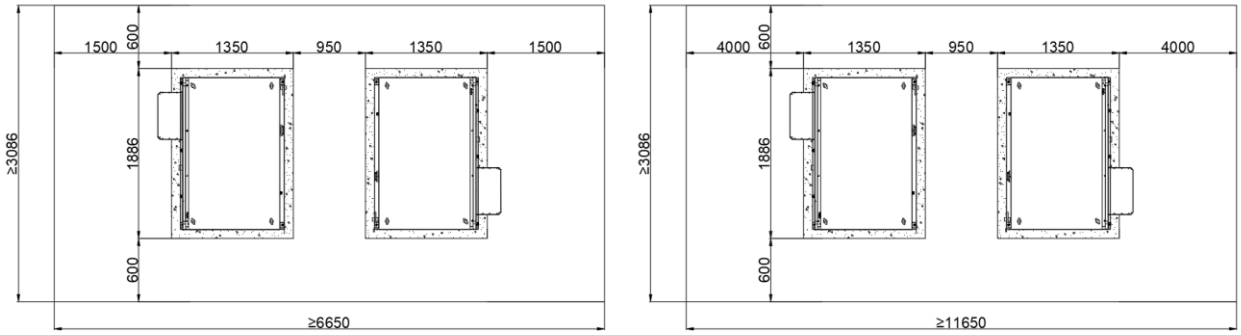
Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear



Back-to-back installation

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear



Face-to-face installation

Stacker maintenance space (Left figure): 2500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear

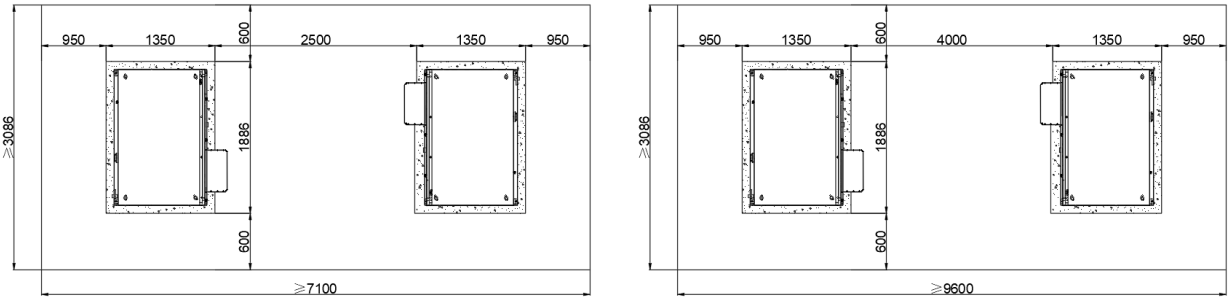


Figure 5-3 Space Requirements for 3 Sets of 215kWh models + ACHub (Unit: mm)

Side-by-side installation

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear

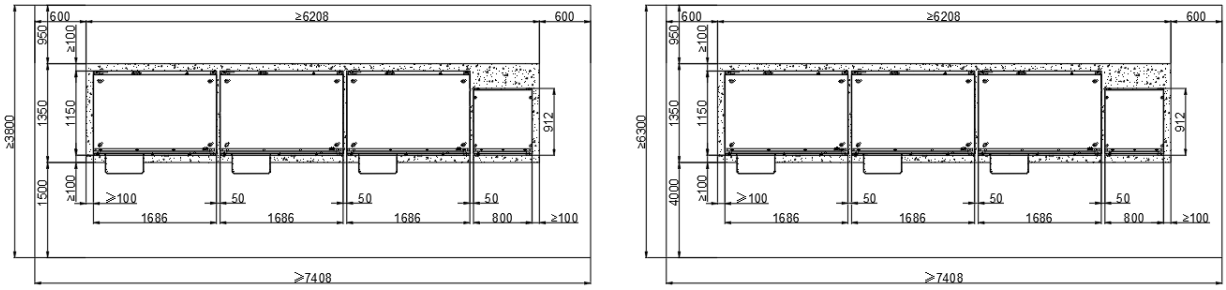
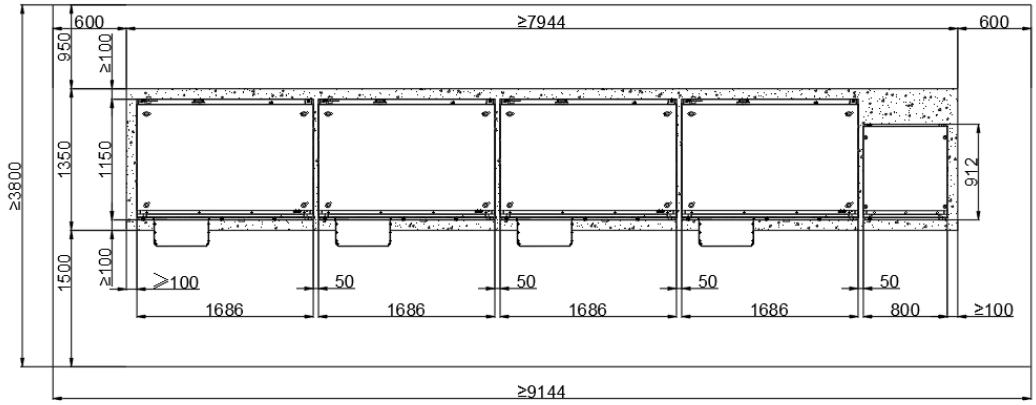


Figure 5-4 Space Requirements for 4 Sets of 215kWh models + ACHub (Unit: mm)

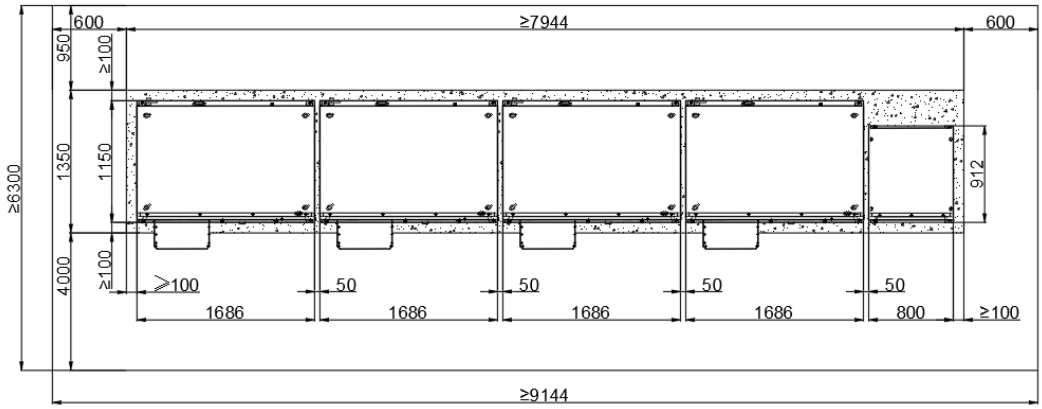
Side-by-side installation

Stacker maintenance space: 1500mm in the front, 950mm in the rear



Side-by-side installation

Forklift maintenance space: 4000mm in the front, 950mm in the rear



Back-to-back installation

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear

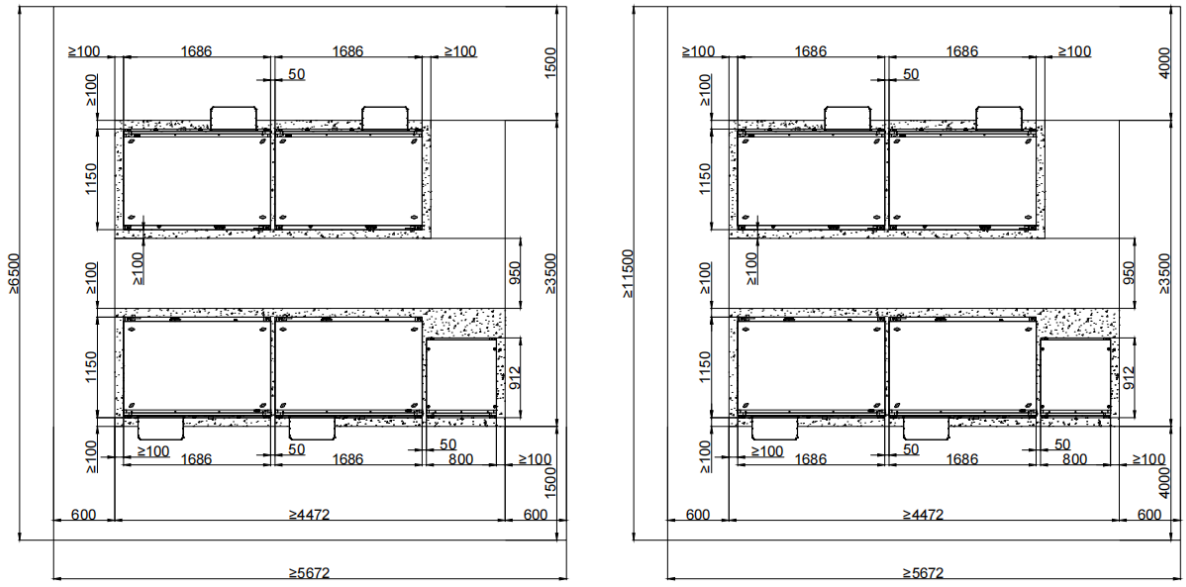
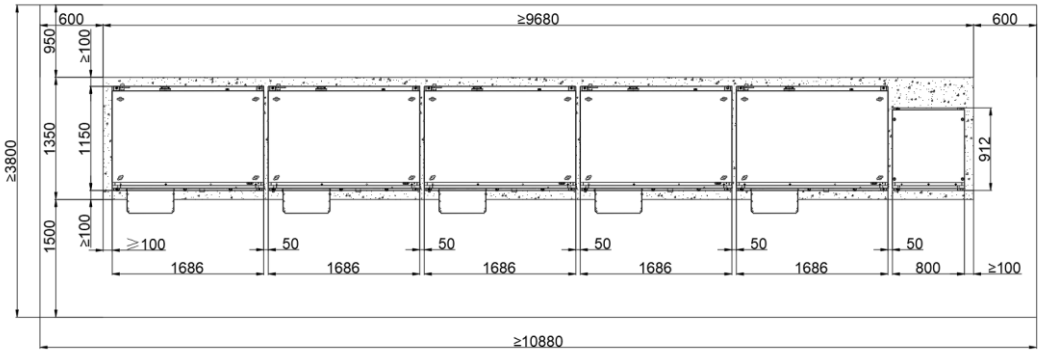


Figure 5-5 Space Requirements for 5 Sets of 215kWh models + ACHub (Unit: mm)

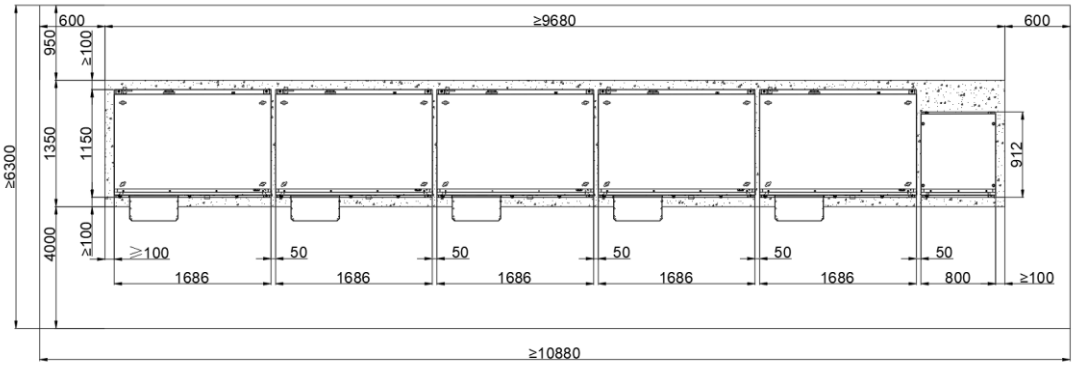
Side-by-side installation

Stacker maintenance space: 1500mm in the front, 950mm in the rear



Side-by-side installation

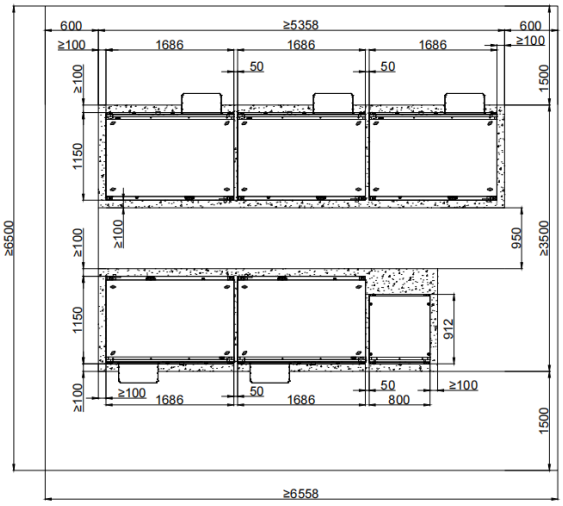
Forklift maintenance space: 4000mm in the front, 950mm in the rear



Back-to-back installation

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear



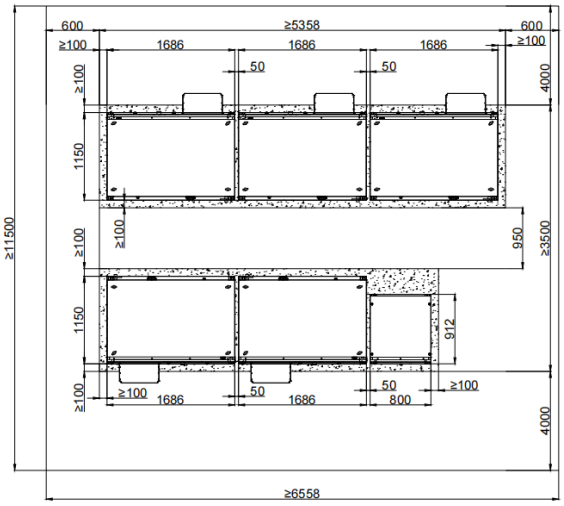
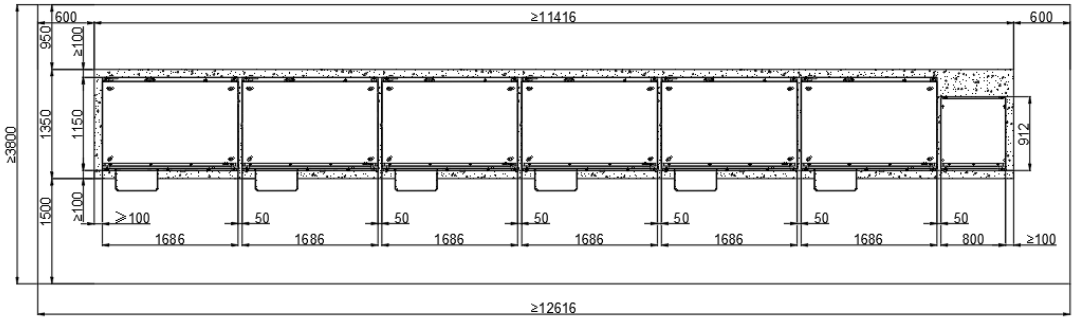


Figure 5-6 Space Requirements for 6 Sets of 215kWh models + ACHub (Unit: mm)

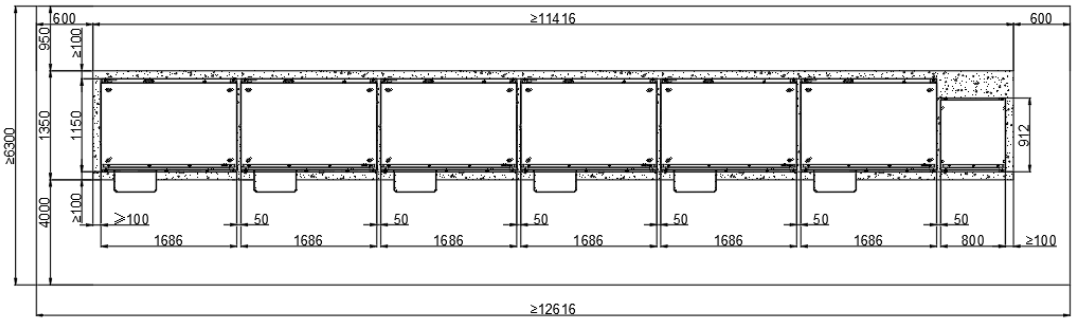
Side-by-side installation

Stacker maintenance space: 1500mm in the front, 950mm in the rear



Side-by-side installation

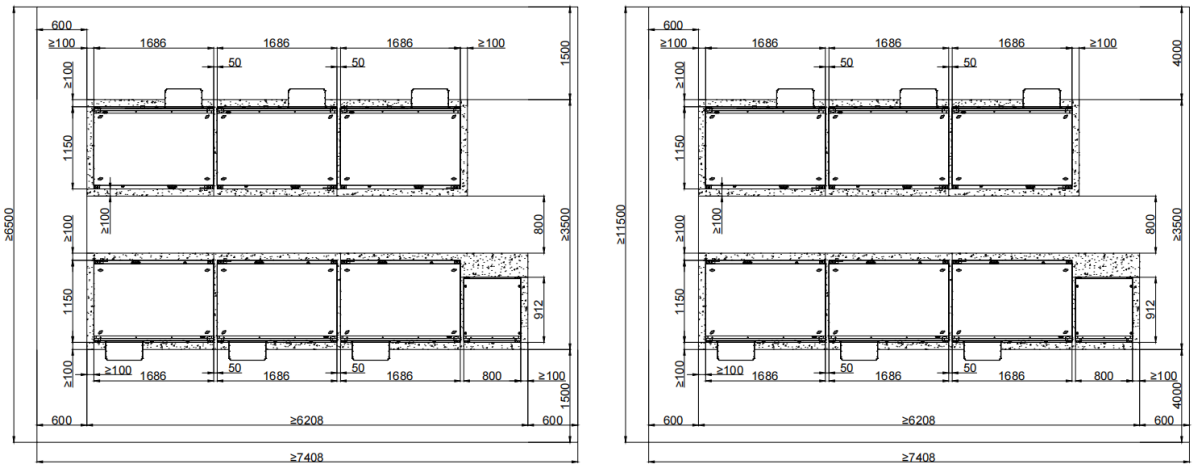
Forklift maintenance space: 4000mm in the front, 950mm in the rear



Back-to-back installation

Stacker maintenance space (Left figure): 1500mm in the front, 950mm in the rear

Forklift maintenance space (Right figure): 4000mm in the front, 950mm in the rear

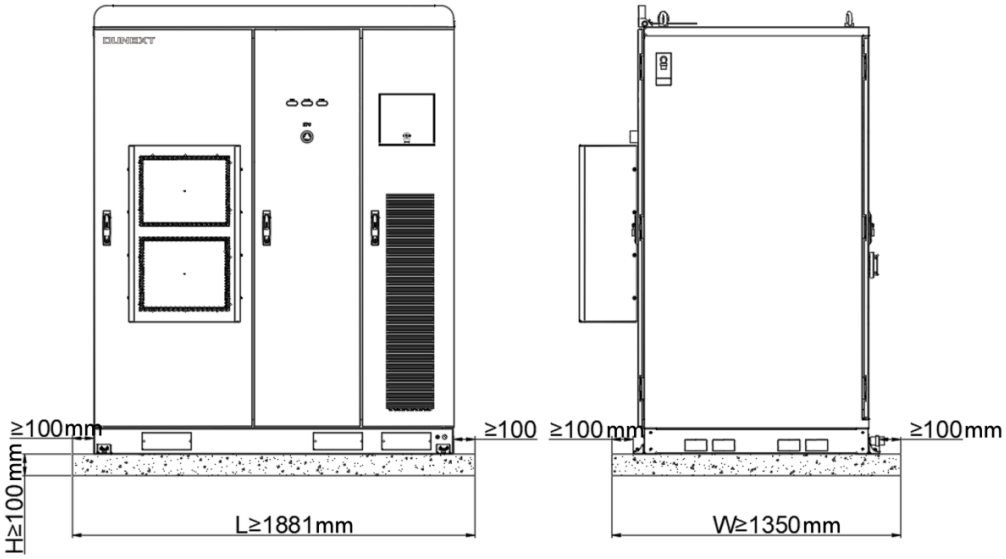


5.3 Foundation Requirements

Requirements of the foundation design scheme:

- The energy storage system must be installed on concrete or other non-combustible surfaces, and must ensure that the installation plane is level, firm, and flat, with sufficient bearing capacity, and depressions or tilts are prohibited.
- Equipment foundations are configured according to the total weight of the equipment, and need to be reviewed when the load-bearing capacity of the foundation is not satisfied.
- The bottom of the pit of the equipment foundation must be compacted and filled.
- Equipment foundations should not be disturbed by soaking water after excavation, and should continue to be excavated and refilled if disturbed by soaking water.
- The leveling error of the contact surface between the equipment foundation and the cabinet is ≤3mm.
- The foundation must be higher than the highest water level in local history and at least 100mm above the horizontal ground.

- Drainage facilities shall be constructed in accordance with the local geology and municipal drainage requirements to ensure that no water accumulates at the foundation of the equipment.
- The foundation should be constructed to meet the local historical maximum rainfall drainage requirements, and the discharged water should be disposed of in accordance with local laws and regulations.
- When constructing the equipment foundation, consider the cable outlet of the energy storage system, and reserve a trench or a hole for the cable.
- The holes reserved for the equipment foundation and the inlet holes at the bottom of the equipment should be blocked.
- The foundation drawing cannot be regarded as the final construction drawing and is for reference only, please contact our product manager for details. Users should review the foundation design parameters of the energy storage system according to the installation environment, ground bearing capacity, geological conditions and seismic requirements of the project site.



NOTE!	L indicates the width of the mounting surface of a single cabinet, W indicates the depth of the mounting surface of a single cabinet, the site can be prepared in advance of the steel shims, the cabinet mounting base levelling.

Category	Parameter
Minimum Hardening Area	L≥1881mm，W≥1350mm
Installation Foundation Height	H ≥ 100 mm (above the highest historical flood level)
Install Foundation Loading Capacity	Loading Capacity > 2.5 T / ㎡
Service Life of the Foundation	≥ 20 years
Leveling of the Foundation	3mm/㎡

6 Unpacking and Acceptance

Prerequisites

- To prevent the equipment from tipping over, secure the box containing the equipment to the forklift with a rope before moving. Be careful when moving the equipment, as impact or dropping may cause damage to the equipment.
- Once the equipment has been placed down, remove the packaging carefully to avoid scratching the equipment. Keep the equipment stable during unpacking.
- After unpacking, check whether the fastening components and removable parts are loose, and notify the transporter and manufacturer immediately if they are loose.
- If the installation environment is poor, please do a proper anti-dust and anti-condensation treatment (e.g. use dust cover, plastic film or textile cover) after unpacking to avoid corrosion and failure of the battery by condensation or accumulation of dust inside the battery.
- Check whether the appearance of the equipment is intact, no damage, no corrosion and no paint falling off. Notify the transporter and manufacturer of any paint loss or damage.
- Check whether the label of the equipment is clearly visible, if the label is damaged please notify the manufacturer

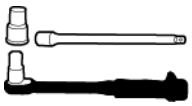
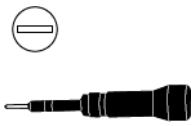
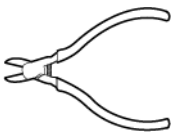
7 Installation Equipment

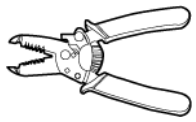
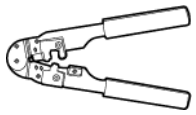
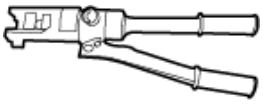
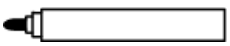
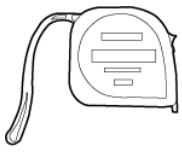
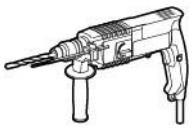
7.1 Preparation Before Installation

7.1.1 Preparing Tools

NOTE!	• The tools shown in the picture are for reference only, please refer to the physical object. • Due to the different site conditions, this tool list cannot completely list a few tools that may be used, site installers and users please prepare the unlisted tools according to the actual situation.

Table 7-1 Installation Tool

			
Phillips Insulated Torque Screwdriver	Insulated Torque Socket Wrench (Including extension bar) • Socket specifications: 7mm~19mm • Socket depth ≥32mm • Sleeve interface and	Slotted Insulated Torque Screwdriver	Diagonal Nose Pliers

	torque • Matching with torque wrench • Torque range: 1.2N-m~45N-m		
 Wire Strippers Pliers	 Wire Cutting Pliers	 Rubber Hammer	 Knife
 Crystal Head Crimping Pliers	 Hydraulic Pliers	 Multi-meter DC Voltage Range ≥1500V DC	 Marking Pen
 Steel Tape Measure	 Horizontal Ruler	 Vacuum Cleaner	 Impact Drill

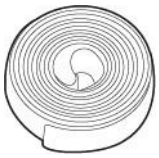
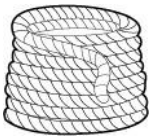
 Impact Drill Φ16mm	 Heat Shrink Tubing	 Hot Air Gun	 Wire Tie
 Insulation Ladder	 Crane	 Lanyard Rope Rope length≥1845mm×4	 Electric Forklift
 Manual Forklift	-	-	-

Figure 7-2. Personal Protection Tools

 Insulated Gloves	 Protective Gloves	 Goggles	 Dust Mask
 Insulated Shoes	 Reflective Undershirt	 Safety Helmet	 Safety Belt

7.1.2 Inspection Before Installation

Checking The Package

Before unpacking the outer packaging of the PowerHill, check the package for visible damage such as holes, cracks, or other signs of possible internal damage, and verify the PowerHill model number. If there are any package anomalies or if the PowerHill model number does not match, do not unpack it and contact your dealer as soon as possible.

WARNING!	When removing the outer packaging, please take precautions for overhead operation.

Inspection Of Delivery Parts

After unpacking the device, please check that the delivery parts are complete and that there is no visible external damage. If any items are missing or there is any damage, please contact your dealer.

 NOTE!	For the number of delivery parts dispatched with the box, please refer to the Packing List inside the package. Please keep the key properly after use. After opening the package, please check the delivery parts and quantity of the package according to the Packing List, if there are any missing parts, please contact your dealer as soon as possible.

7.2 PowerHill Installation

Forklift Requirements

- Use a forklift for cabinet installation as per actual needs.
- Recommended fork blade length 1400mm~1600mm, width 80mm~160mm, thickness 25mm~80mm.

Lifting Requirements

- Before lifting, make sure that the crane and rope meet the load-bearing requirements.
- Do not drag on the cabinet when installing and removing the lifting PowerHill to prevent scratching the cabinet.

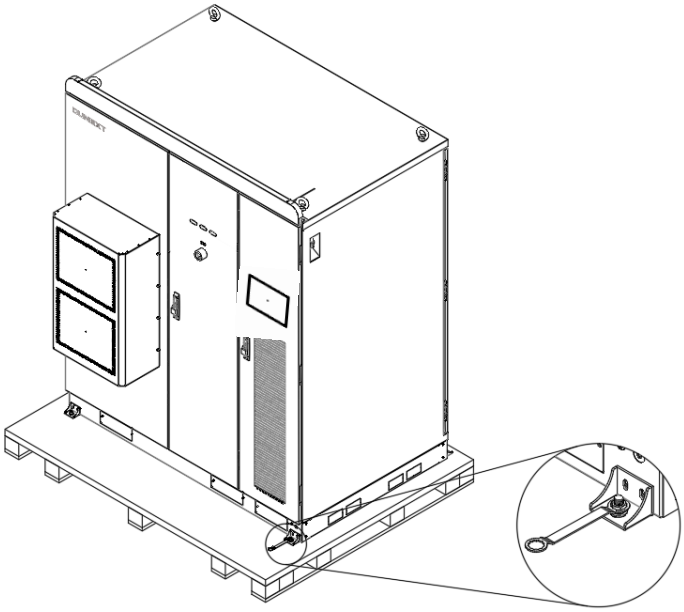
Lifting Process	Matters
Before lifting	The weight of the PowerHill cabinet is 2.5t. Coose the proper crane according to the onsite installation environment. If the working conditions of the site don't meet the requirements, it is necessary to get professional personnel to carry out assessment.
	The personnel who carry out the lifting operation should be trained and qualified before they are allowed to work.
	Lifting tools need to be inspected and used only when they are complete.
	Ensure that the lifting tools are firmly fixed to load-bearing fixtures or walls.
	For outdoor use, it is recommended to lift the PowerHill under clear weather and no wind.
	Confirm that the crane and cable meet the

	requirements before lifting.
	The door of the PowerHill is fully closed and locked.
	Ensure that the steel cable is securely and reliably connected.
	A left-to-right or right-to-left lifting sequence is recommended to ensure smooth lifting.
During the hoisting process	Strictly prohibit unrelated personnel from entering the lifting area, and strictly prohibit standing people under the boom.
	Ensure that the crane position is appropriate, not long distance lifting.
	Keep smooth, the diagonal inclination of the cabinet is ≤5°.
	Ensure that the angle between the two cables is ≤60°.
	Lift the PowerHill gently, the cabinet should be dropped slowly and smoothly to avoid impacting the internal PowerHill.
	Avoid impacting the internal PowerHill.
	When the cabinet is in contact with the base, withdraw the lifting cable after the base is evenly loaded.
	It is forbidden to drag the wire rope and spreader, and forbidden to collide the PowerHill.

Install PowerHill

Step 1 Remove the bottom floor adapter expansion bolts from the PowerHill as shown in the illustration, and using a #19 plum wrench, remove the four set screws on the bottom to separate the cabinet from the wood bracket.

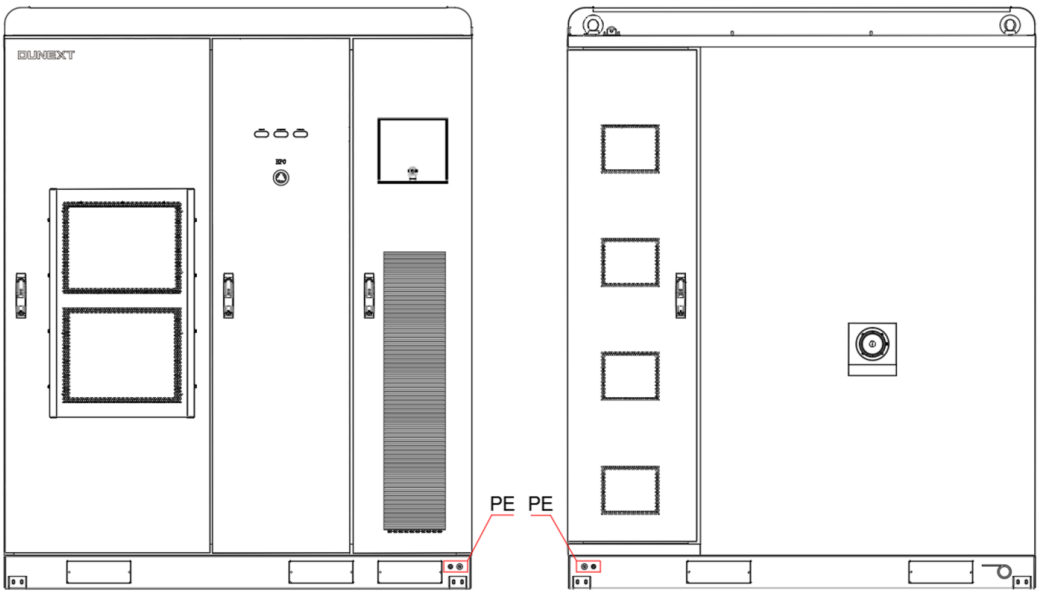
Figure 7-1 Remove the Expansion Bolts



Step 2 Open the electrical cabinet door and remove the packing list and spare parts.

Step 3 Remove the forklift flaps at the bottom of the cabinet (if forklift transportation is required, the forklift flaps do not need to be removed when using a crane for transportation).

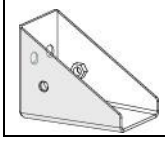
Figure 7-2 Remove the Forklift Flap



Step 4 After closing the cabinet door, move the PowerHill to the designated location using a forklift or with a crane.

NOTE!	If a forklift cannot be used for the moving route (e.g., if there is a slope in the ground), use a crane to move the PowerHill.

Table 7-2 List of Installation Parts

Ground adapter, Expansion bolts	
	

Prerequisites

When using a forklift to move the PowerHill, please tie down and fix it according to the actual situation to ensure that there is no risk of the PowerHill tipping over.

Figure 7-3 Using a Forklift

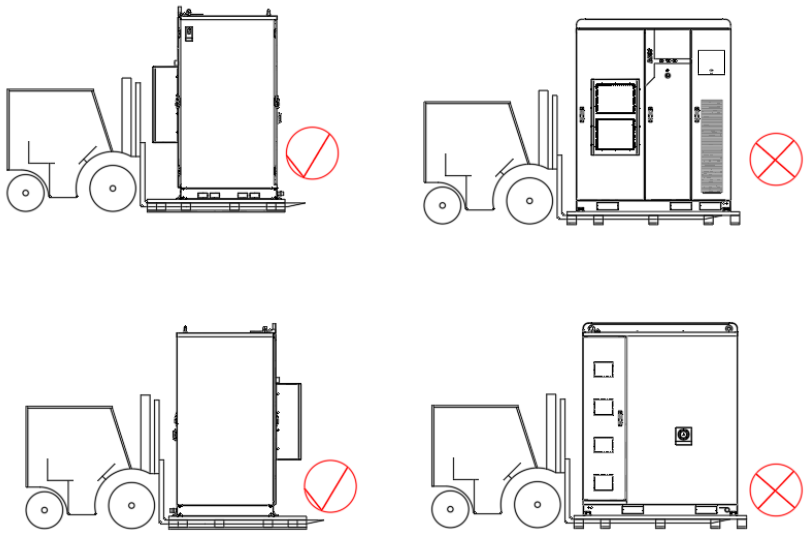
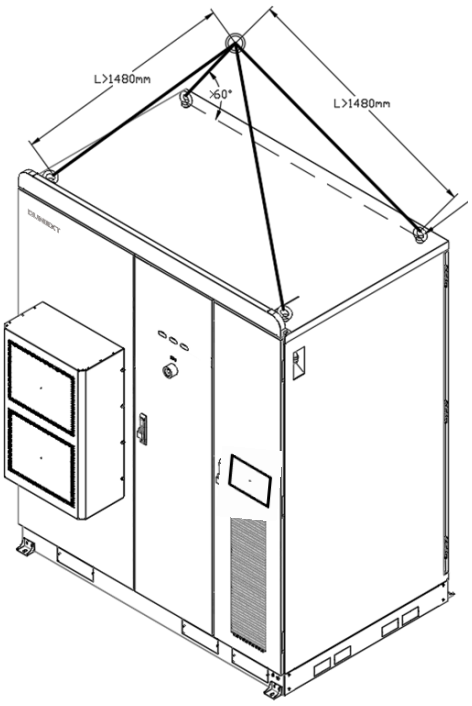
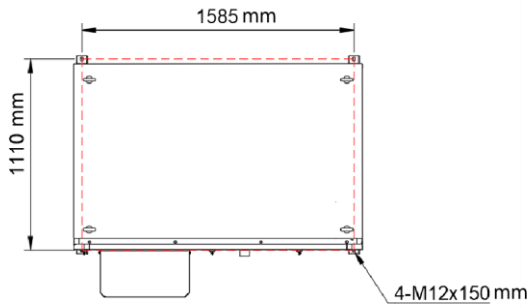


Figure 7-4 Using a crane



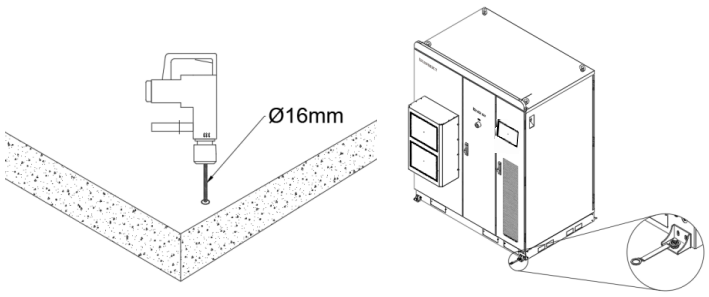
Step 5 Fix the PowerHill. You need to use an impact drill to drill holes in the foundation according to the installation size; after drilling, you need to use a hammer to fix the expansion bolts, and then use a wrench to tighten the expansion bolts.

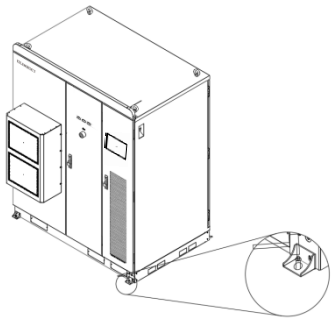
Figure 7-5 Installation Dimensions Diagram



NOTE!	• When the PowerHill is not stable, the gasket can be used before fixing. • According to the spacing of the fixing holes of the cabinet, use the impact drill to open the fixing holes with a diameter of 16mm and a depth of 170mm on the foundation; • After placing the cabinet, put M12x150mm expansion screws into the fixing holes on the foundation; • Tighten the four expansion screws in turn with a plum wrench/torque wrench and make a secondary confirmation.

Figure 7-6 Fixing the PowerHill





Step 6 Install the forklift stopper on the bottom of the PowerHill.

8 Cables Installation

 DANGER!	● It is forbidden to smoke or use open flames in the vicinity of the battery. ● Firefighting facilities that meet the requirements, such as fire sand, carbon dioxide, fire extinguishers, etc., must be available at the site. ● Please use special protective gears and special insulated tools to avoid electric shock injury or short roadblocks.
 WARNING!	Tighten the fastening screws of the copper rows or cables according to the torque specified in the text, and regularly check whether they are tightened, whether there are rust, corrosion or other foreign materials, and dispose of them cleanly, otherwise, the screws are falsely connected which will lead to excessive voltage drop of the connection, and even burn the battery with a large amount of heat generation in the case of high current.
 CAUTION!	When making cables, be sure to keep them away from the PowerHill to avoid cable debris from accidentally entering the PowerHill, causing fire and personal injury and PowerHill damage.
 NOTE!	The cable colors involved in all electrical connection schematics in this section are for reference only, and cable selection should be in accordance with local cable standards (yellow and green bicolored wires may only be used for protective grounding).

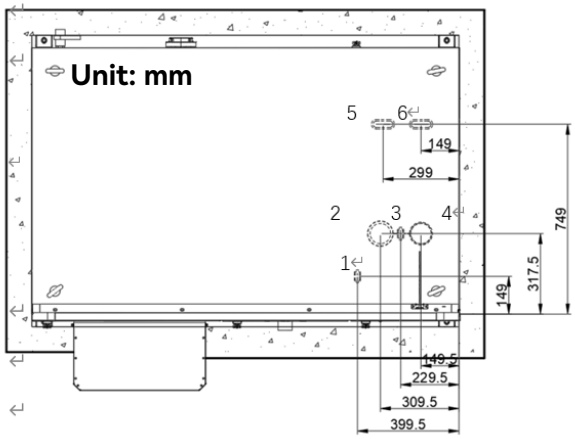
8.1 Cable Preparation

 NOTE!	Cable gauge should be selected in accordance with local cable standards. Factors affecting cable selection are: current rating, cable type, laying method, ambient temperature and maximum expected line loss.

Product Model	Rated Current (A)	Cable Type	Cable Material	Cross-section Area (mm^2)	Remarks
PowerHill-P100-215kWh	144	Live Cable	Copper	50	/
			Alminium	70	/
		Neutral/ Ground	Copper	25	If there are big single-phase loads, and the three-phase load imbalance are huge, it is recommended that the cross-section area of the Neutral Cable be the same as that of the Live cable.
			Alminium	35	
		RS485	Shielded Twisted Pair Cable	1.5	Characteristic Impedance: 120Ω
		Network cable	CAT 5E outdoor shielded network cable (internal resistance ≤ 1.5 Ω/10 m), and shielded RJ45 connector	/	/
PowerHill-P60-215kWh	87	Live Cable	Copper	25	/
			Alminium	35	/
		Neutral/Ground	Copper	25	If there are big single-phase loads, and the three-phase load imbalance are
			Alminium	25	

Product Model	Rated Current (A)	Cable Type	Cable Material	Cross-section Area (mm^2)	Remarks
					huge, it is recommended that the cross-section area of the Neutral Cable be the same as that of the Live cable.
		RS485	Shielded Twisted Pair Cable	1.5	Characteristic Impedance: 120Ω
		Network cable	CAT 5E outdoor shielded network cable (internal resistance ≤ 1.5 Ω/10 m), and shielded RJ45 connector	/	/

Figure 8-1 The location of the wire inlet hole is at the bottom of the electrical cabinet



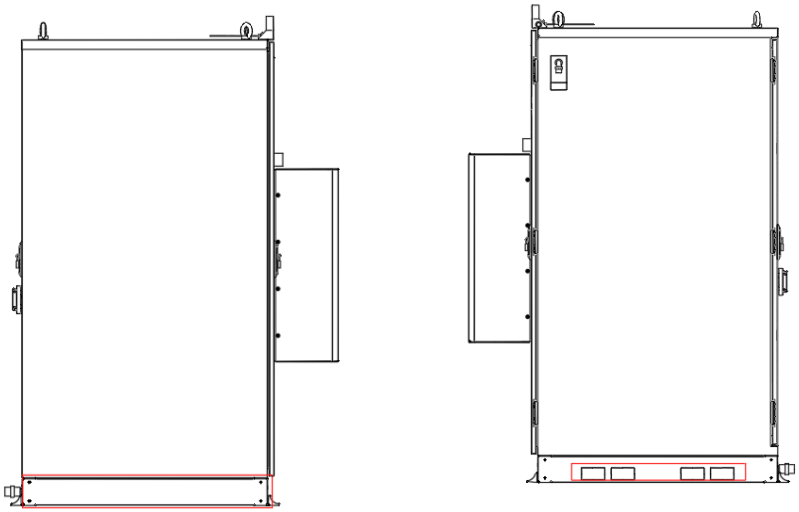
Top View

(1) 485 Communication cable hole (2) Load cable hole (3) Ground cable hole

(4) Grid cable hole (5) PV1 cable hole (6) PV2 cable hole

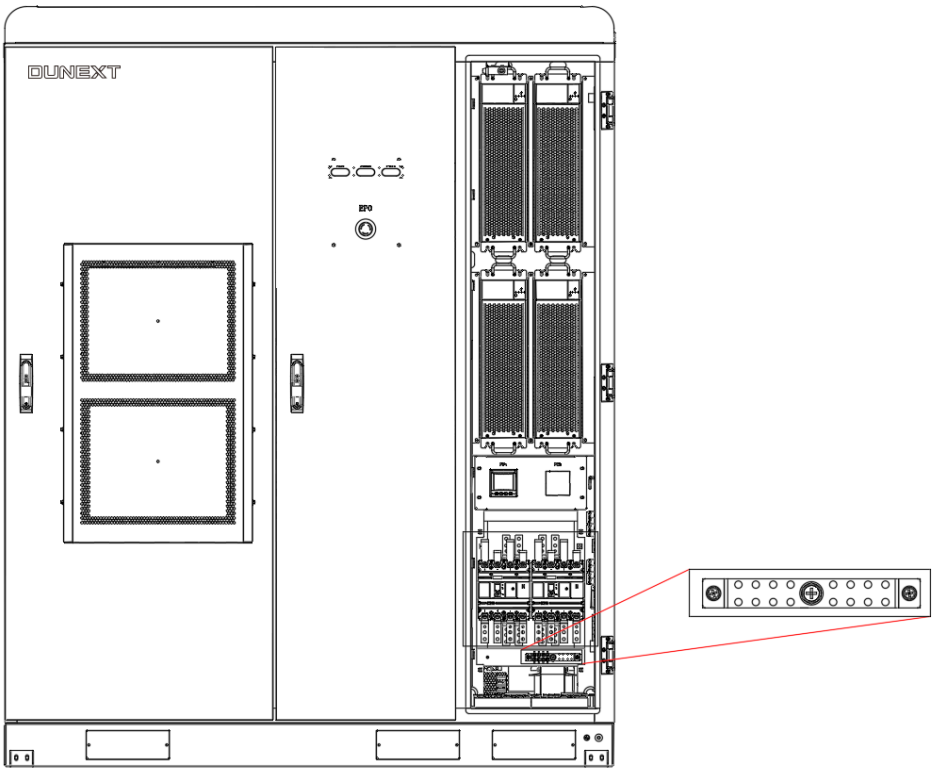
- It is recommended to feed wires from the bottom of the cabinet by cable trenching.
- The bottom side of the cabinet has removable flaps that can be removed for threading.

Figure 8-2 Cable Trunking



8.2 Ground Cable Installation

Figure 8-3 Internal Position of The Energy Storage Cabinet



- The system connection is 3P4W+PE, the applicable grid types for the PowerHill are TN-S, TN-C, TN-C-S and TT.

Figure 8-4 Applicable grid types

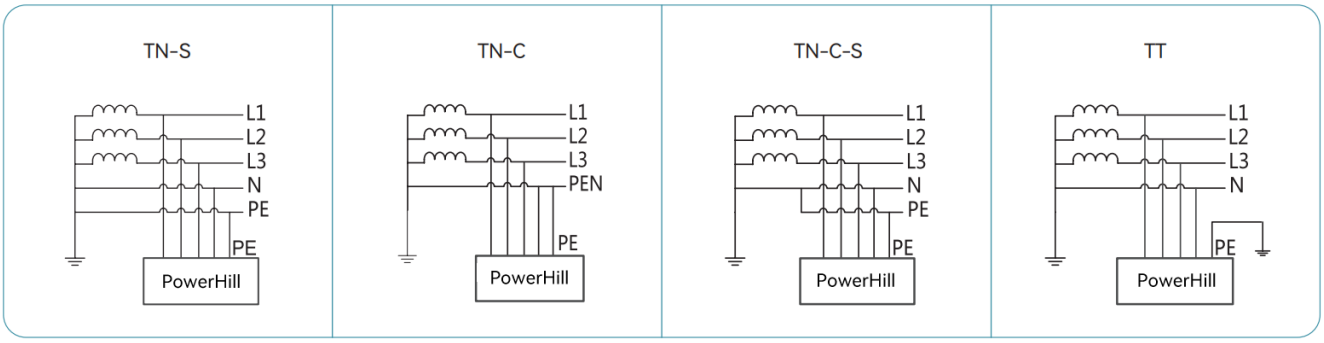
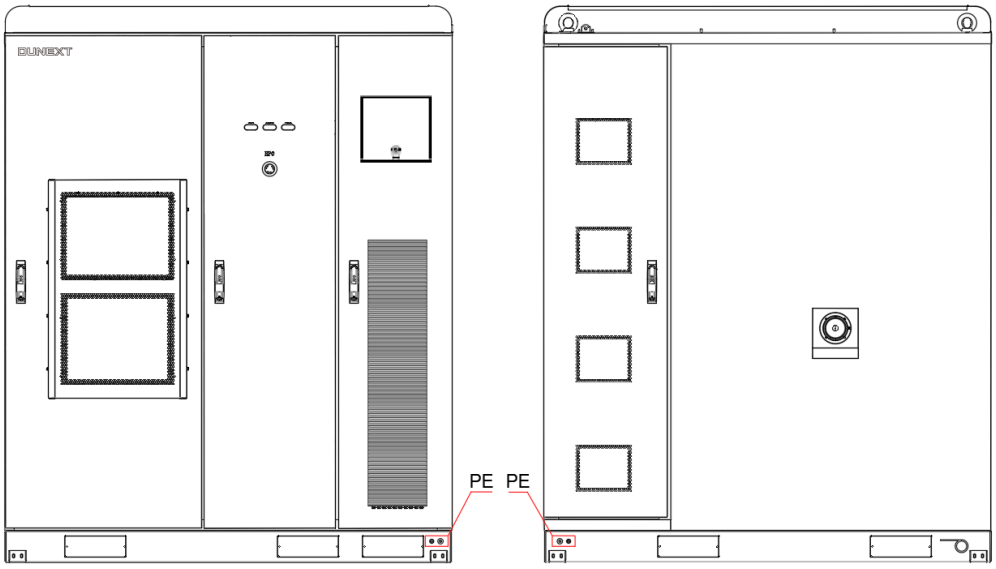


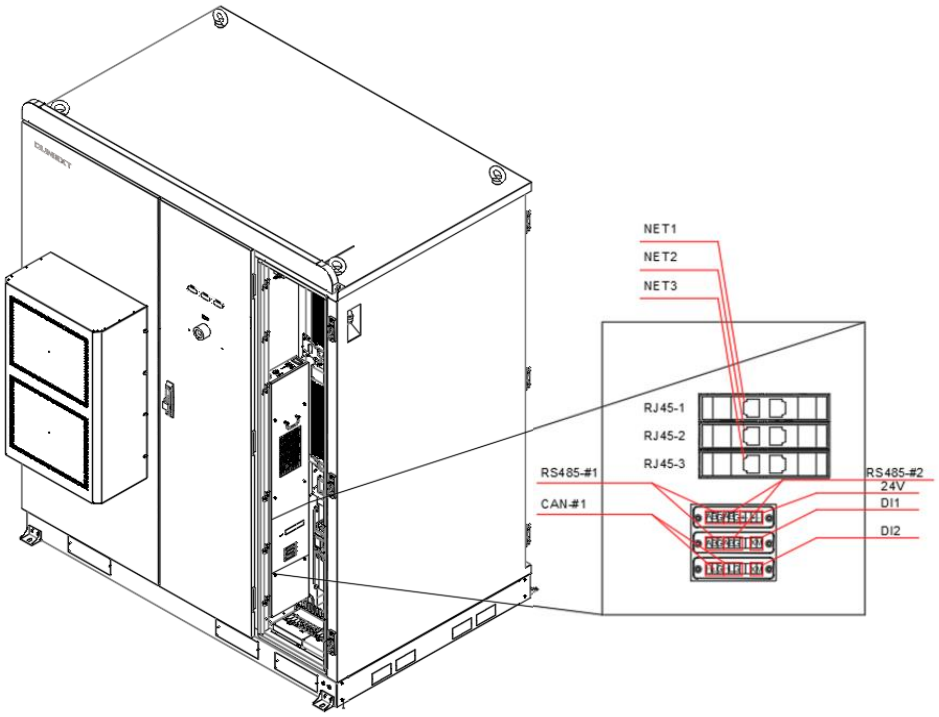
Figure 8-5 Location of external casing of PowerHill cabinet



- The front and back of the system enclosure are designed with grounding connection points, and a grounding point should be selected for grounding according to the actual site installation environment.
- In the power distribution system, the PowerHill system should be repeatedly grounded with a grounding impedance of 4Ω.

8.3 (Optional) Communication Cable Installation

Figure 8-6 Location of the external communication interface



Position	Wiring Terminal	Cable Recommendation	Remarks
NET1	RJ45	Network cable	External interface (for customer scheduling, FM RJ45 interface, data reading interface; FM, scheduling applications with RS485 interface 2 optional wiring)
NET2	RJ45	Network cable	Network cable External interface (data readout interface)
NET3	RJ45	Network cable	IOT network interface
RS485#1	E0510	Shielded twisted pair cable 2x0.5mm²	485 external interface 1 (for customer scheduling, FM RS485 interface, FM, scheduling applications and RJ45 interface 2 optional wiring)
RS485#2	E0510	Shielded twisted pair cable 2x0.5mm²	485 external interface 2 (for communication with PCC off-grid cabinet)

Position	Wiring Terminal	Cable Recommendation	Remarks
CAN-1#	E0510	Shielded twisted pair cable 2x0.5mm²	CAN external interface (for communication with PCC off-grid cabinet)
DI1	E1008	UL1015-18AWG	External emergency I/O interface
DI2	E1008	UL1015-18AWG	PCS off-grid signaling interface (for communication with PCC off-grid cabinet)
24V	E1008	UL1015-18AWG	External 24V power supply interface, a total of 2 circuits, from left to right respectively+、-、+、-

EMS and PowerHill communication mode:

EMS communicates with PowerHill through RS485, when one EMS needs to control more than one PowerHill, it is necessary to connect EMS with more than one PowerHill for communication.

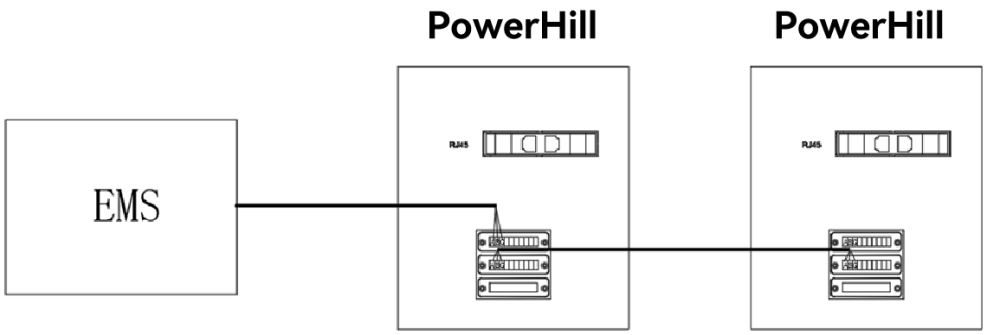
When an EMS needs to control more than one PowerHill, it is necessary to connect EMS with more than one PowerHill, at this time, the external 485 communication interface of each PowerHill should be connected to the 485 interface of EMS.

8.3.1 EMS Configuration Methods for 2 PowerHills

Wiring method:

PowerHill and EMS communication adopts hand-in-hand communication method, EMS and the RS485#1 of the first PowerHill are connected by signal line, and then connected from the RS485#1 of the first PowerHill to the RS485#1 of the second PowerHill.

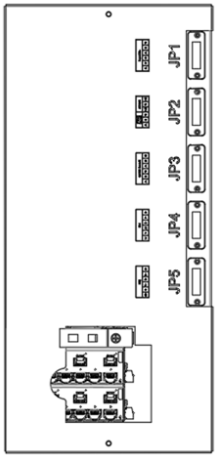
RS485 wiring:



Wiring Terminal of One Side	Wiring Terminal of the Other Side
PowerHill 1 RS485-1# Terminal Block II	PowerHill 2 RS485-1# Terminal Block I
EMS RS485	PowerHill 1 RS485-1# Terminal Block I

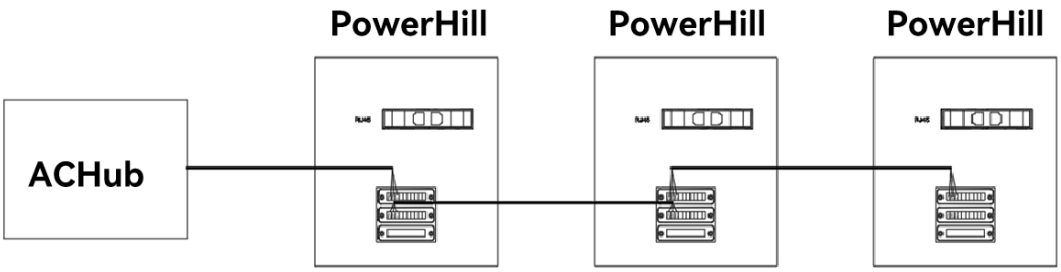
8.3.2 ACHub Configuration for multiple PowerHills

ACHub communication interface:



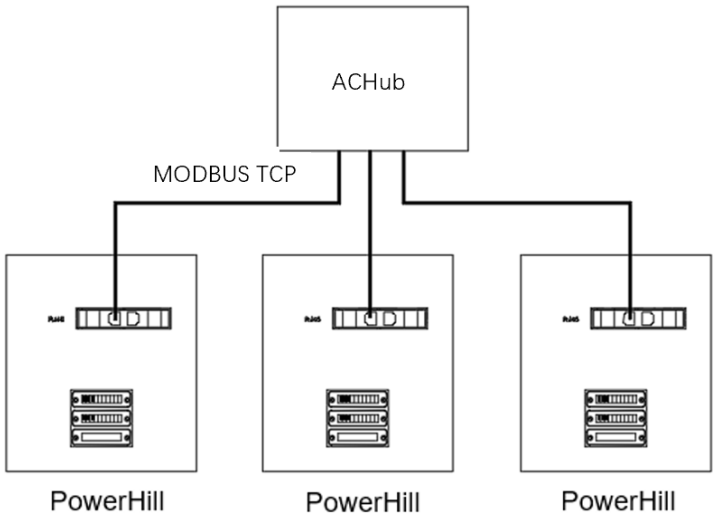
No.	Name	Function
1	JP1	RS485 communication, ACHub RS485 communication is connected to this interface
2	JP2	RS485 communication, reserved RS485 communication
3	JP3	RS485 communication, reserved RS485 communication
4	JP4	External emergency IO interface
5	JP5	External emergency IO interface
6	Network Port Lightning Protector	Reserve the EMS networking interface
7	Switch	Energy storage cabinet data reading interface, energy storage cabinet network cable connected to the switch

RS485 wiring:



MODBUS TCP wiring:

Figure 8-7 ACHub external communication interface location



Cable Label	Wiring Terminal
485 Communication	
PowerHill 1 RS485-1# Terminal Block II	PowerHill 2 RS485-1# Terminal Block I
PowerHill 2 RS485-1# Terminal Block II	PowerHill 3 RS485-1# Terminal Block I
PowerHill 1 RS485-1# Terminal Block I	ACHub JP1
Customer EMS	ACHub JP1
MODBUS TCP Communication	
PowerHill 1 RJ45	ACHub Switch 1

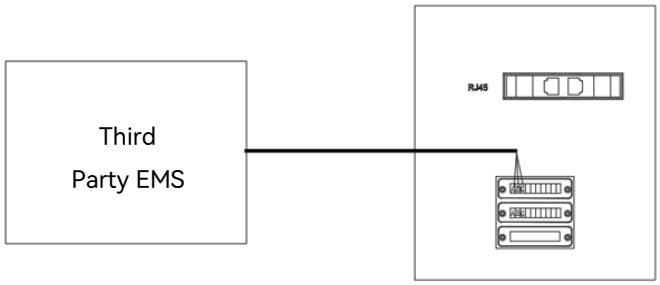
Cable Label	Wiring Terminal
PowerHill 2 RJ45	ACHub Switch 2
PowerHill 6RJ45	ACHub Switch 6
Customer EMS	ACHub Switch NEXT1

8.3.3 PowerHill scheduled by customer EMS

A Single PowerHill is scheduled by the customer's EMS:

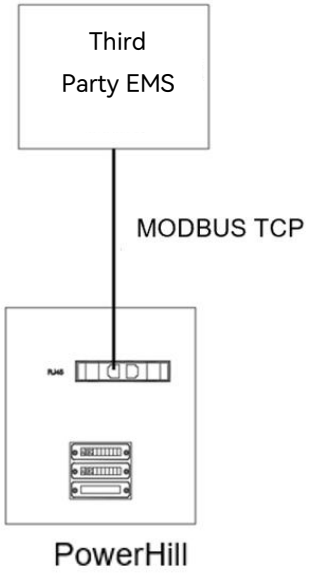
RS485 Wiring:

Figure 8-8 EMS 485 Communication cable connection



MODBUS TCP wiring:

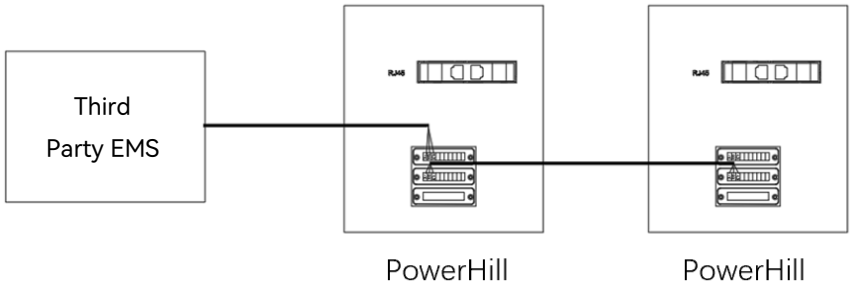
Figure 8-9 EMS MODBUS TCP communication cable connection



When two PowerHill are scheduled by the customer EMS:

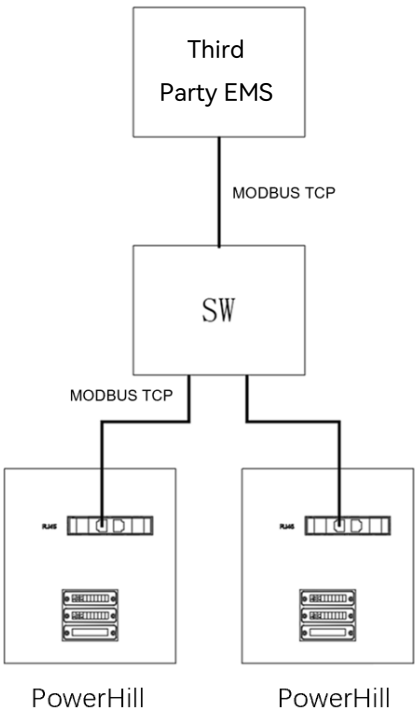
RS485 wiring:

Figure 8-10 EMS 485 Communication cable connection



TCP / IP wiring:

Figure 8-11 EMS TCP communication cable connection



NOTE!	Switches are provided by the customer.

8.3.4 (Optional For Off-grid) PCS Communication Cable Installation

If there is an off-grid application, the PCS also needs to be connected for parallel communication, and the following steps are for off-grid parallel communication connection:

Remove the PCS front cover plate

Figure 8-12 Remove the dust cover screws

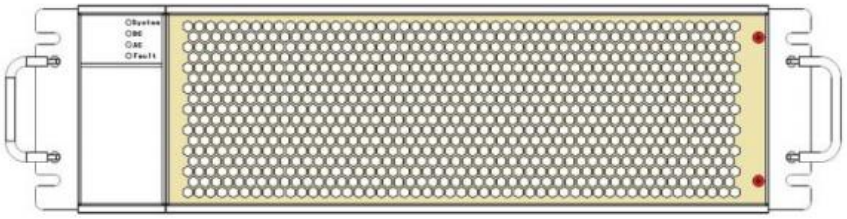


Figure 8-13 Slide the dust cover plate to the right

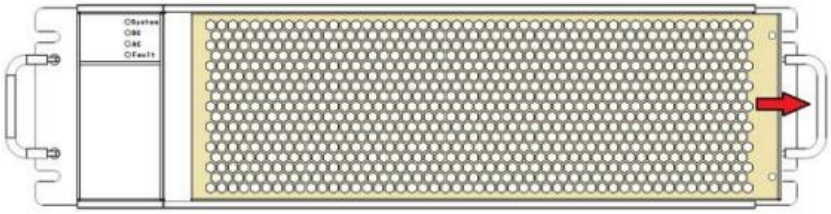
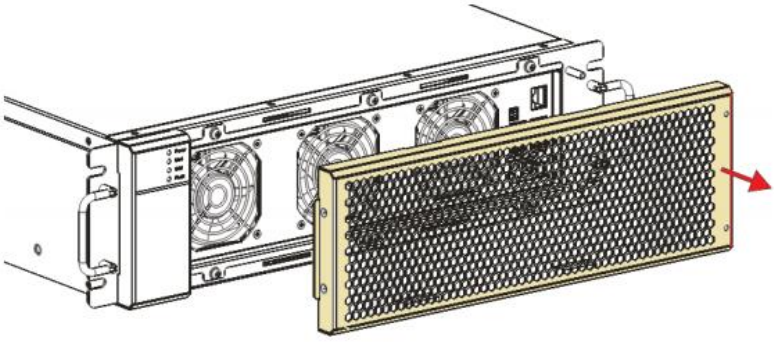


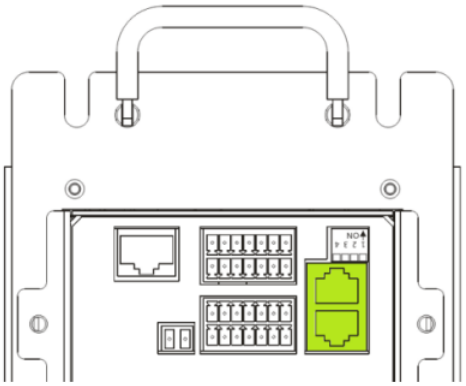
Figure 8-14 Slide the dust cover plate to the right



Connect the communication cable

The green mark in the following Figure is the parallel communication interface after removing the cover plate:

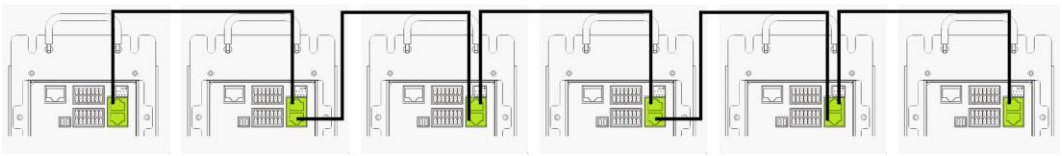
Figure 8-15 Parallel communication interface



Connect the PCSs that need to be paralleled hand in hand with a CAT5e shielded network cable (the PCSs in the PowerHill cabinet have already been paralleled at the time of shipment), as shown in the Figure below:

NOTE!	The number of off-grid parallel cannot exceed 3units, and the distance of the network cable does not exceed 5 meters.

Figure 8-16 Connection Types

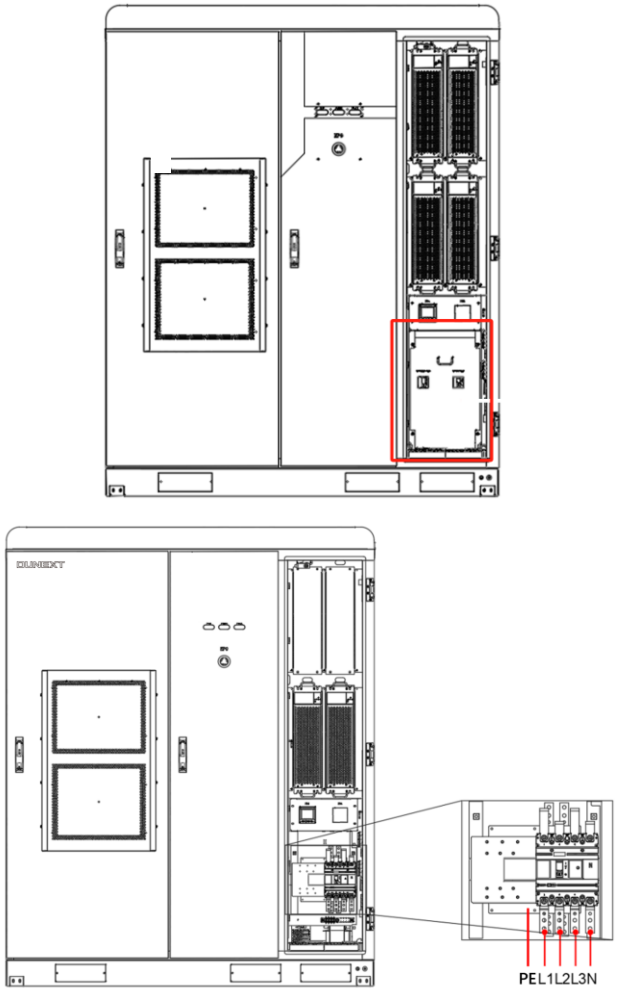


8.4 Power Cable Installation

8.4.1 AC Cable Installation

Step 1: Remove front circuit breaker enclosure.

Figure 8-17 Phase sequence diagram of lower circuit breaker



Step 2: Cut the inlet hole rubber sheath to allow the cable to pass through the rubber sheath.

CAUTION!	The rubber sheath is to protect the cable insulation from abrasion by the inlet hole sheet metal; Do not lose the rubber sheath.

Step 3: Install the ground wire to the ground row inside the cabinet.

Step 4: Install the AC power cable to the copper row below the circuit breaker, the torque requirement is 10N·m.

CAUTION!	• Wring needs to be done in strict accordance with the phase sequence markings on the copper row at the lower end of the circuit breaker. • For grid-connect and manual grid-connect applications, only connect to the right AC circuit breaker MCCB1. • For automatic grid-connection and off-grid application the right AC circuit breaker MCCB1 is connected to the grid and the left load circuit breaker MCCB2 is connected to the load.

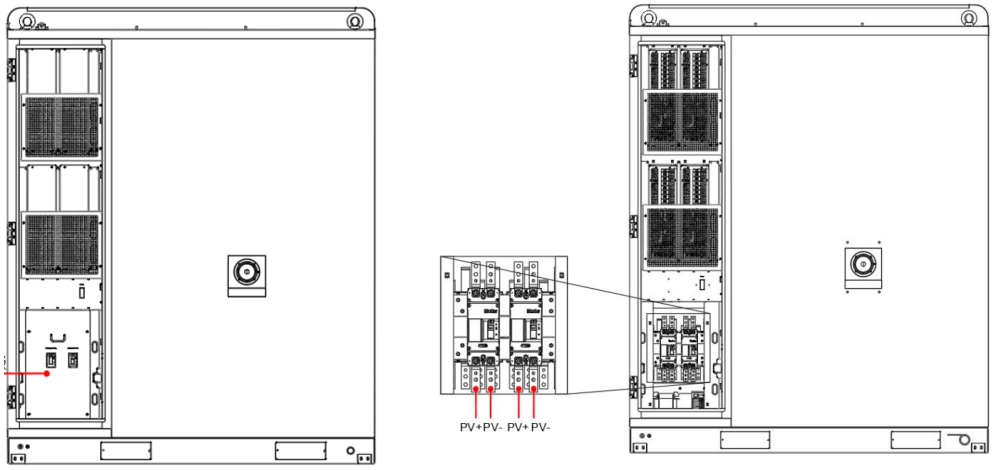
Step 5: Perform a torque check on the wiring, the torque requirement is 10N·m.

Step 6: Install the circuit breaker cover plate.

8.4.2 (Optional for MPPT Using) PV Cables Installation

Step 1: Remove the back circuit breaker sealing plate.

Figure 8-18 PV Circuit Breaker Lower Terminal Wiring Copper Row Polarity Diagram



Step 2: Cut the inlet hole rubber sheath to allow the cable to pass through the rubber sheath.

 **CAUTION!**	The rubber sheath is to protect the cable insulation from abrasion by the inlet hole sheet metal; Do not lose the rubber sheath.

Step 3: Install the ground wire to the cabinet ground row.

Step 4: Install the DC power cable to the lower copper row of the PV breaker, the torque requirement is 10N·m.

 **CAUTION!**	Wiring needs to be done in strict accordance with the polarity markings on the copper row at the lower end of the breaker.

Step 5: Perform a torque check on the wiring, the torque requirement is 10N·m.

Step 6: Install the circuit breaker cover plate.

9 PowerHill Power-On & Power-Off

9.1 Check Before Power-On

9.1.1 Standard inspection

No.	Check Items	Acceptance Criteria
1	PowerHill appearance	● The appearance of the PowerHill is intact and free from damage, rust and paint loss. If there is any paint falling off, please carry out the operation of replacing the paint. ● PowerHill labels are clearly visible, damaged labels should be replaced promptly.
2	Cable appearance	● The cable protection layer is well wrapped without visible damage. ● Cable hoses are in good condition.
3	Cable connection	● The cable connection position is the same as the design. ● The terminals are made in accordance with specifications, and the connections are firm and reliable. ● The labels on both ends of each cable are clear and the labels are oriented in the same direction.
4	Cable wiring	● Alignment meets the principle of separation of strong and weak power. ● The cables are neat and beautiful. ● Cable joints should be neatly cut and no spikes should be exposed. ● Leaving a margin at the turning point as required, and not pulling it tight. ● Straight and smooth wiring, no crossover of cables in the cabinet.
5	Battery pack copper	● No deformation of copper rows and no breakage of dip molding.

6	AC Switch	● The external AC switch of the power distribution cabinet is OFF. ● The energy storage cabinet AC switch is OFF.

9.1.2 Installation and inspection of the PowerHill

Cabinet inspection

No.	Check items	Acceptance Criteria
1	Installation	● Installation complies with the design drawings. ● Cabinet body level, each cabinet door can be opened normally.
2	Surface	The surface of the cabinet is free of cracks, dents and scratches. If there is any paint falling off, please carry out the refinishing operation.
3	Grounding	Each cabinet has at least two grounding points, and grounded firmly, lap resistance ≤ 0.1Ω.
4	Accessories	The installation quantity and location of the external accessories meet the design requirements.
5	Characteristic	Correct, clear and complete identification.

Cabinet internal inspection

No.	Check items	Acceptance Criteria
1	Circuit Breaker	The circuit breaker is in the open position.
2	Copper Array	There is no obvious deformation of the copper row, and no debris on the copper row.
3	Wire and Cable	Cable mounting bolts have been tightened, and there is no looseness in cable pulling.
4	Cross Hole Plugging	The blocking of cable crossing holes has been completed.
5	Battery Pack	There is no damage to the appearance of each battery pack.
6	Foreign Objects	Remove all foreign objects inside the cabinet, such as tools, installation residual materials, etc.
7	Distribution Area Blocking	No cracks, dents, scratches, splits, or looseness in the appearance of the power distribution area baffle.
8	Lightning Protector	Lightning protector status indication is green.
9	Subcomponents	The appearance of each subcomponent is free of damage.

10	Cabinet Grounding	The grounding conductor is reliably connected to the cabinet grounding terminal board or copper row.
11	Device identification	Each device has a complete identification.
12	Interface identification	The interface of the power grid and the communication interface are complete and clear.

9.2 Power-On and Power-Off Operations

 DANGER!	Please wear insulated gloves and use insulated tools to avoid electric shock injury or short circuit failure.
 CAUTION!	• During the power-up process, you should observe while powering up, and immediately power off the battery when you find abnormalities, and identify the causes and solve them before continuing to power on. • Storing the battery in a low battery state may result in over-discharge damage to the battery, so please replenish the battery in time.

Prerequisites

When the PowerHill is not in operation for six months or more after assembly, the PowerHill needs to be inspected and tested by a professional before it is put into operation.

Power-On Operation Steps

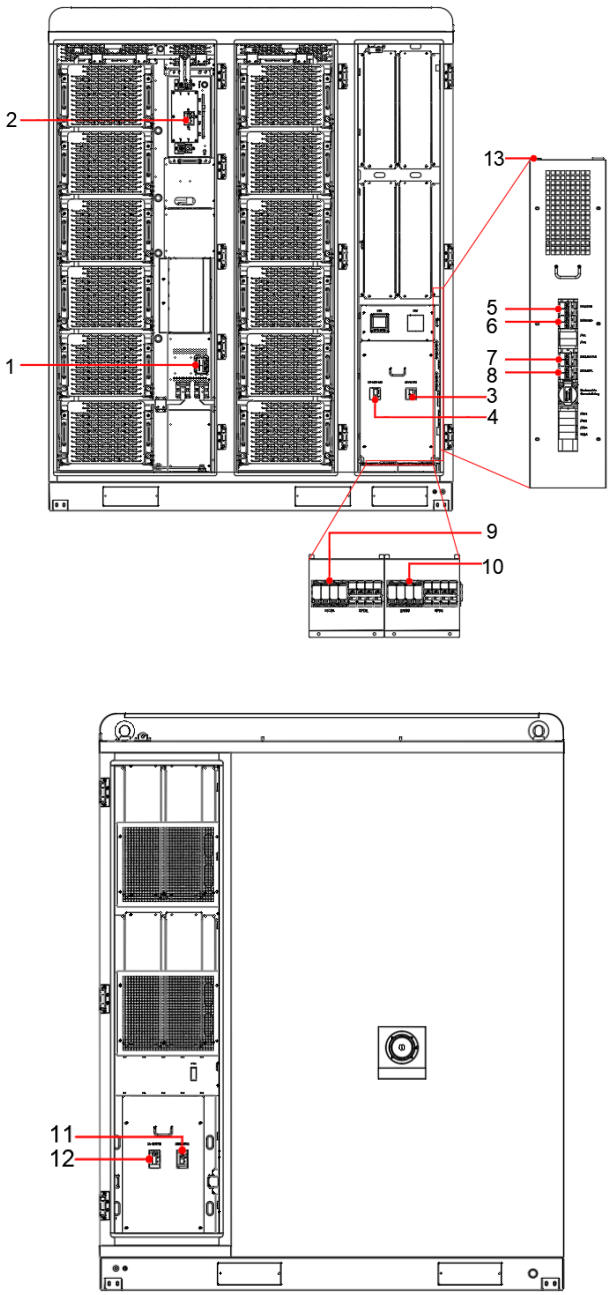


Figure 9-1 Switch position

No.	Name	Function
1	-	Maintenance switch
2	-	DC Circuit Breaker
3	MCCB1	AC circuit breaker

4	MCCB2	Load Circuit Breaker MCCB2 (Optional for off-grid type)
5	MCB1	Power distribution switch
6	MCB2	Distribution switch
7	MCB3	Air conditioner switch
8	MCB4	Control power switch
9	MCB6	Load arrester switch
10	MCB5	AC Surge Protector Switch
11	MCCB3	PV Circuit Breaker (Optional for MPPT Using)
12	MCCB4	PV Circuit Breaker (Optional for MPPT Using)
13	-	Black start activation button (Optional for off-grid type)

Step 1: Connect the Maintenance switch (No.1)

Step 2: Turn on the DC switch in the control box (No.2)

Step 3: Turn on surge protector switch MCB5 (No.10)

Step 4: Open surge protector switch MCB6 (optional) (No.9)

Step 5: Open AC circuit breaker MCCB1 (No.3)

Step 6: Open load circuit breaker MCCB2 (optional) (No.4)

Step 7: Open the PV circuit breaker (optional, if a PV string is connected) (No. 11, 12)

Step 8: Switch on the PowerHill distribution system

1. Open the distribution switch MCB1 (No.5)
2. Open the distribution switch MCB2 (No.6)
3. Turn on the air conditioning switch MCB3 (No.7)
4. Turn on control power switch MCB4 (No.8)
5. **(Optional)** Press the switching power supply black start activation button (if off-grid activation of the secondary system is required) (No.13).

After the steps are performed in sequence, the grid is energized, the AC circuit is started, and the PowerHill High Voltage Control Box indicator is checked to see if it is lit. If the status of PowerHill is normal, then the operation indicator light flashes,

the fault indicator light and warning indicator light does not light; then enter the standby mode, please wait for receiving external commands.

Power-off operation steps

The PowerHill power-off process operates as follows:

Step 1: Switching off the PowerHill Distribution System

1. turn off the control power switch MCB4 (No.8)
2. turn off the air conditioning switch MCB3 (No.7)
3. Turn off power distribution switch MCB2 (No.6)
4. Turn off power distribution switch MCB1 (No.5)

Step 2: Turn off the PV circuit breaker (optional, if a PV string is connected) (No.11, 12)

Step 3: Close load circuit breaker MCCB2 (No.4)

Step 4: Turn off the AC circuit breaker MCCB1 (No.3)

Step 5: Turn off the DC circuit breaker in the control box (as shown in Figure 5-1, No.2)

Step 6: Disconnect the maintenance switch (No.1, as shown in Figure 5-1)

After operating in sequence according to the steps, the air conditioner and the high-pressure control box stop running, and the indicator light of the PowerHill high-pressure control box goes out.

PowerHill maintenance requires disconnecting the maintenance switch, PowerHill shutdown for five minutes before you can carry out maintenance checks and other operations on the PowerHill.

10 System Commissioning

Prerequisites

- All the PowerHill at the site has completed the PowerHill arrival tuning and testing.
- The system has been successfully powered up and the alarms have been eliminated.
- The site has the testing PowerHill that can be used for the opening.

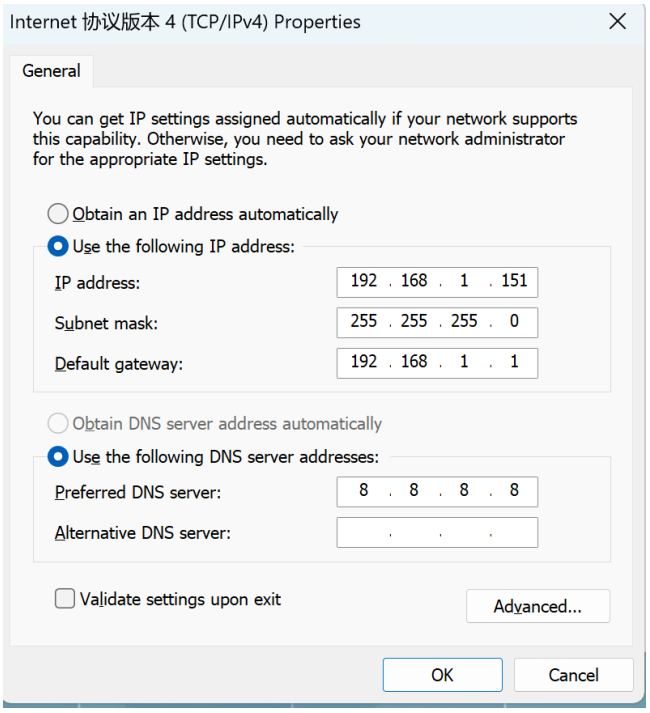
10.1 Local Startup

The device is in the power-on state, check whether the device status, etc. is in the running indicator blinking state, if so, continue the following operation; if the product has alarms or faults, enter the EMS interface, click on [Fault Alarm Information Page], take a picture of the fault information, and contact the distributor of the product to apply for after-sales service.

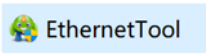
- After there is no fault information, you can start the system directly through EMS, the specific operation of EMS can refer to the EMS user manual.
- If there is no EMS, you can communicate with the PowerHill through external communication devices to control the system and read the system information according to the communication protocol.
- BESS is equipped with Remote / Local knobs and Start / Stop buttons. By turning the remote / local knob to the local position and pressing the start / stop button, the system will start when the button lights up, and the system will shut down when the button lights up again.

10.2 IP Address Setting

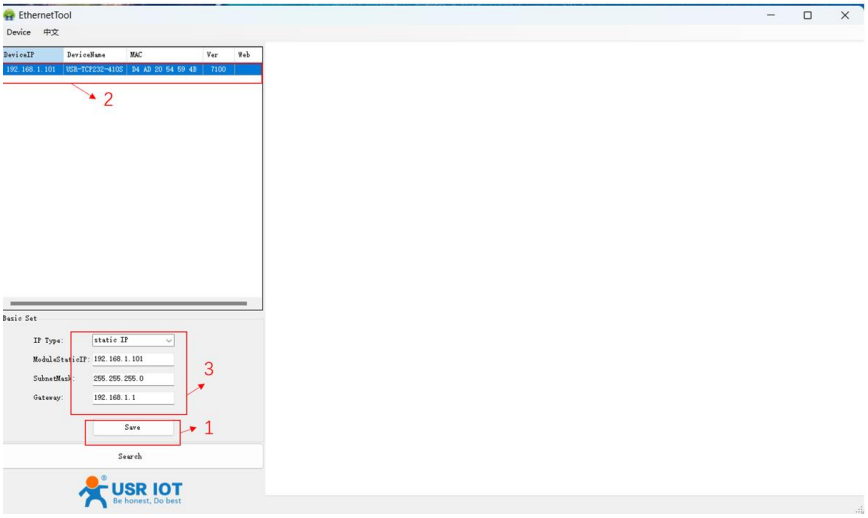
For cable connection methods, please refer to chapter 8,3. The device is in the power-on state, make sure the mode switching knob of the electrical cabinet is in the "Remote" state, one end of the cable is connected to the RJ45 of the electrical cabinet, and the other end is connected to the computer. Default IP address 192.168.1.100, the computer needs to be set up with the default IP address of the same network segment, as follows:



1. Double-click on EthernetTool (Ask Dunext to get this tool)



2. Click on Search - double click on the IP address - change the IP address



10.3 Scheduling Instructions

Data reading and scheduling according to the product protocol, the main functions are start, stop, charging, discharging, etc.; detailed scheduling protocol is provided separately.

After the system start/stop command input exceeds the limit, the system will not execute any action or modify the wrong command.

After the system power input exceeds the limit, the system will actively modify the command to the maximum charging and discharging power.

- System full and discharge stop is judged according to the voltage of a single battery, the maximum voltage of 3.55V is judged as full, and the minimum voltage of 2.8V is judged as discharge; when the system is full, continuing to issue the charging power will not be executed, and only the discharging power; when the system is discharged, continuing to issue the discharging power will not be executed, and only the charging power will be executed; the reversed power will make the change of the SOC after being full or discharged and it will Restriction is automatically restored.
- If the system level filling and emptying protection fails, the BMS level filling and emptying protection will be activated, and after the activation, it needs to be manually restored.
- The system SOC is a reference value, calculated according to the battery configuration and current value, but the battery capacity and current value have errors and are not accurate, so it is not recommended to use the SOC as a judgment condition for filling and emptying for system scheduling.
- Multiple TCP connections cannot exist at the same time, because the bottom is 485 communication, and multiple connections will lead to communication conflicts.
- Multiple threads cannot request data at the same time for a single TCP connection.
- The recommended interval time for each frame is 100ms or more.

Table 10-1 Communication Protocol Attachment

Address	Address (HEX)	Read and write attributes	Name	Data attribute	Coefficient	Unit	Meaning
100	0x0064	RO	Working status	U16	N/A	N/A	1 shutdown 2 operation

							3 fault
101	0x0065	RO	Working Mode	U16	N/A	N/A	1: P / Q 2: offgrid 3: on/off gird
102	0x0066	RO	Control Mode	U16	N/A	N/A	1 on-site 0 remote
103	0x0067	RO	Start-stop button status	U16	N/A	N/A	1 start 2 stops
104	0x0068	RO	Allow discharge active power limit	U16	0.1	kW	
105	0x0069	RO	Allow charging active power limit value	U16	0.1	kW	
106	0x006A	RO	System grid voltage	U16	0.1	V	
107	0x006B	RO	System grid active power	I16	0.1	kW	
108	0x006C	RO	Load Voltage	U16	0.1	V	
109	0x006D	RO	Load active power	I16	0.1	kW	
110	0x006E	RO	Total MPPT power	I16	0.1	kW	
300	0x012C	WR	System Mode Control	U16	1	N/A	1: P / Q 2: offline 3: parallel offline
301	0x012D	WR	System State Control	U16	1	N/A	2: Stop 6: Run
302	0x012E	WR	Active Power Control	I16	0.1	kW	Negative numbers represent charging

11 HMI Human-Computer Interaction

NOTE!	The screenshot of the interface in this article is for reference only, subject to the actual situation.

11.1 Function Introduction

HMI system is a set of human-machine interaction system mainly for outdoor energy storage cabinet products, which can view system operation status, mode, power and other configuration instructions through the page, real-time fault and historical fault viewing functions; applied to energy storage products, it can operate and view the state of energy storage system, with simplicity.

Figure 11-1 Home page of local HMI system

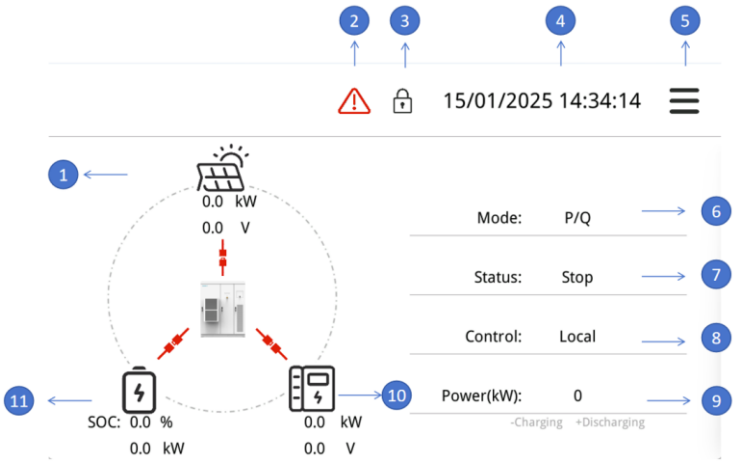
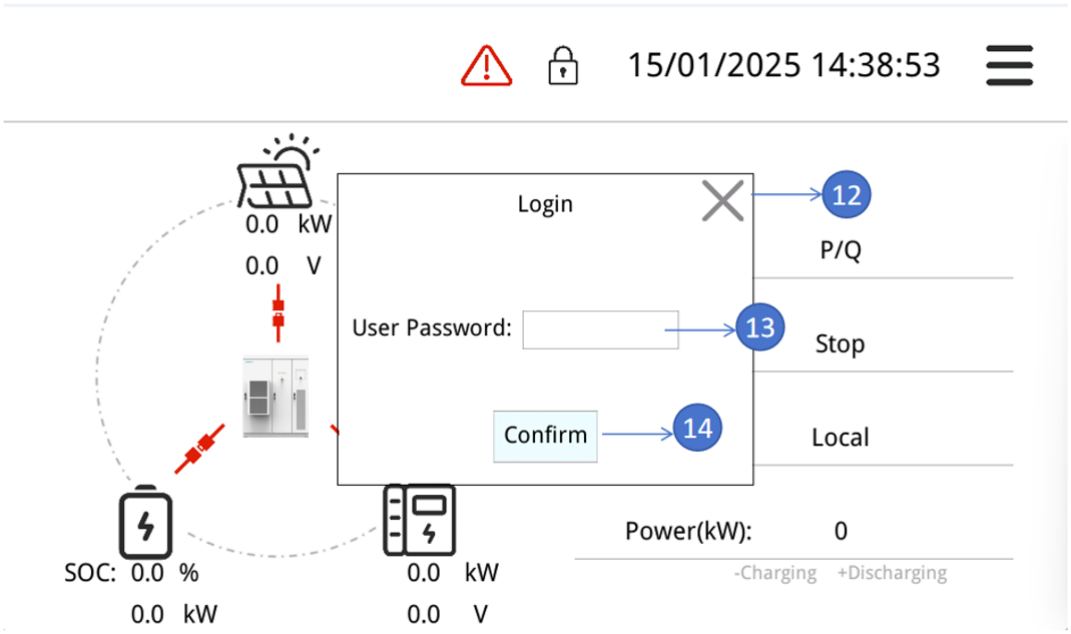


Figure 11-2 Local HMI login pop-up window

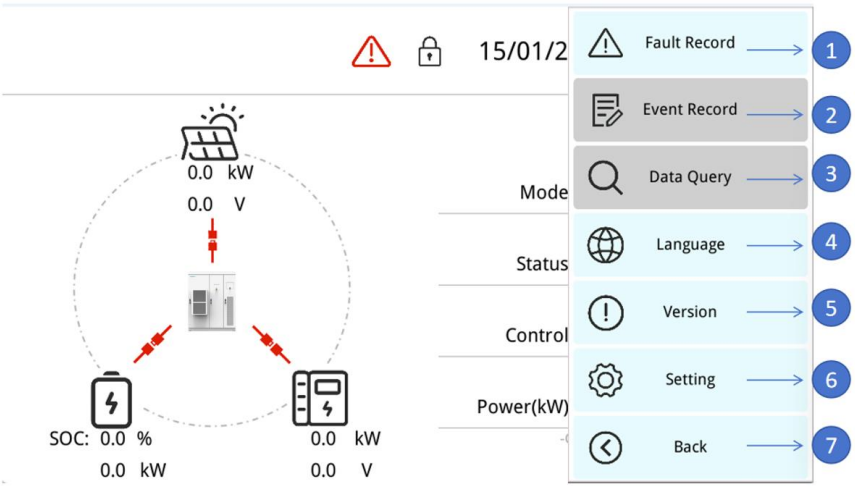


No.	Name	Function	Remarks
1	Photovoltaic information switch button	Click the icon to jump to the PV information page	
2	System fault alarm message button	Click the button to jump to the system fault alarm information page	
3	System information page button	Click the button to open the unlock pop-up window	
4	Time setting button	Press and hold to set system time	
5	Function selection button	Click the button to open the function selection page	
6	Mode switching button	Click on the button to select Switch System Mode	See operating instructions for details
7	Status switch button	Click the button to select the switch system status	See operating instructions for details
8	Control switch button	Click the button to select the switch system control	See operating instructions for details
9	Power button	Click the button to send system power	See operating instructions for details
10	PCS information page Button	Click the button to jump to the PCS information page	

No.	Name	Function	Remarks
11	Battery information page Button	Click the button to jump to the battery information page	
12	Back to home button	Click the button to jump to the system home page	
13	Password input button	Click the button to enter the system control password	See operating instructions for details
14	Password confirmation button	Click the button to confirm the system control password input	

1. Click the icon "5" on the main page to open the function selection list, and you can select to enter other information such as fault alarm information page, system setting page, version query page, etc.

Figure 11-3 Local HMI function list page

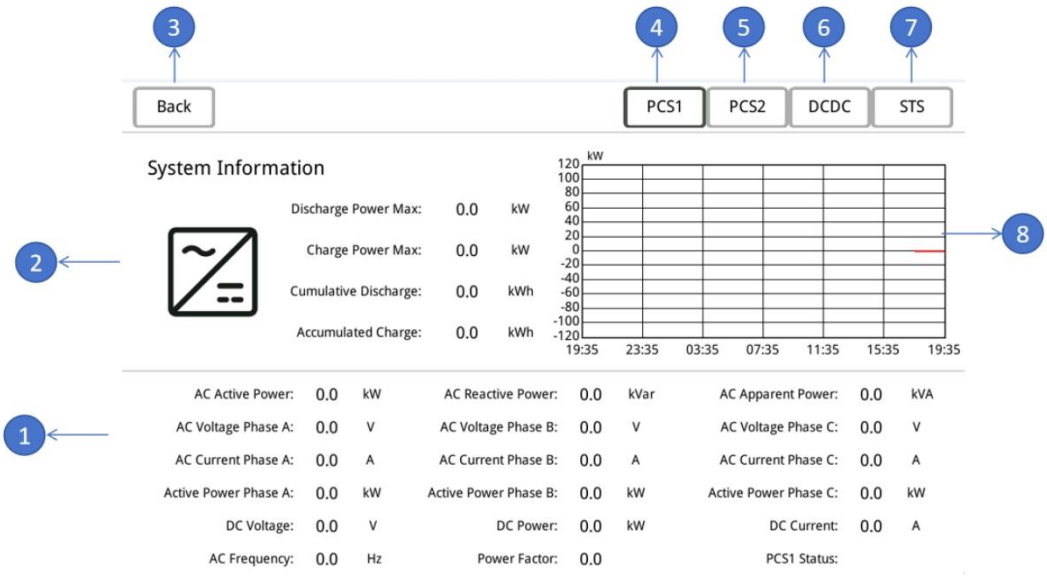


No.	Name	Function	Remarks
1	Fault alarm message page button	Click the button to jump to the system fault alarm information page	
2	Event log button	Click the button to jump to the system event log page (function not developed, temporarily unable to enter)	
3	Data query button	Click the button to jump to the system data query page (the function has not been developed and cannot be entered temporarily)	
4	Language switch button	Click the button to switch the language displayed on the Select System page	
5	Version query button	Click the button to jump to the system version information page	
6	System settings	Click the button to jump to the system settings page	

No.	Name	Function	Remarks
	button		
7	Back to Home button	Click the button to jump to the system home page	

2. Select and click the icon "11" on the main page to enter the PCS information page, and you can view the detailed operation parameter information of a single PCS.

Figure 11-4 PCS information page of local HMI system



No.	Name	Function	Remarks
1	Individual PCS data presentation	Show PCS detailed data	
2	System summary information display	Display system cumulative charge and discharge capacity, allowable charge and discharge capacity	
3	Home button	Click the button to jump to the system home page	
4	PCS1 information page button	Click the button to go to PCS1 information page	
5	PCS2 information page button	Click the button to go to PCS2 information page	
6	DCDC information page button	Click the button to go to the DCDC information page	
7	STS information page button	Click the button to jump to STS information page	
8	System operating power display	Display system grid active power curve	

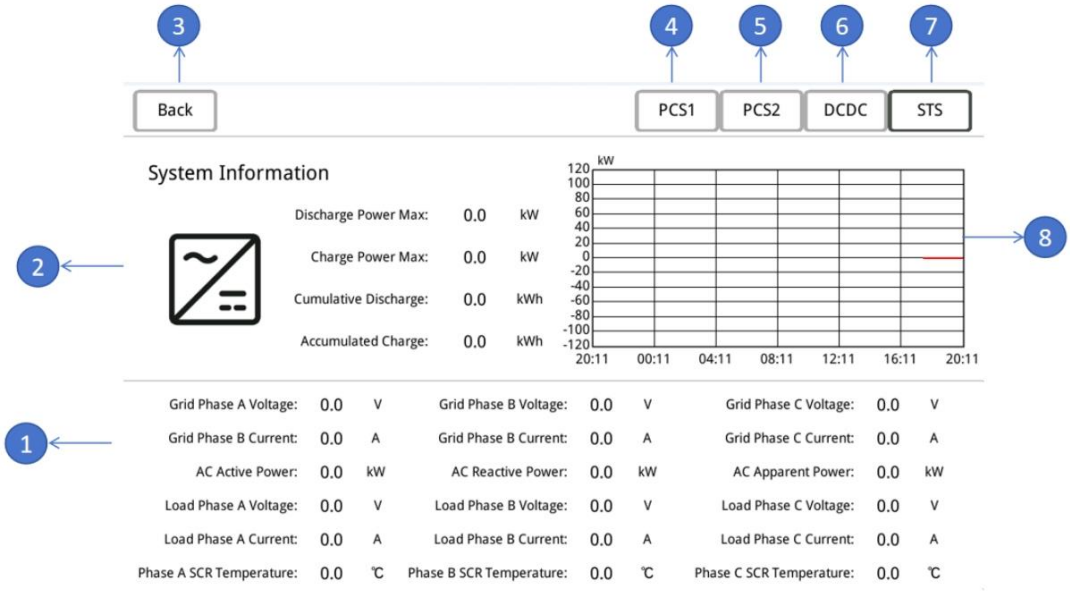
3. Select and click the icon "6" on the PCS page to enter the DCDC information page, and you can view the detailed operation parameter information of a single DCDC.

Figure 11-5 DCDC information page of local HMI system

No.	Name	Function	Remarks
1	DCDC data presentation	Show DCDC detailed data	
2	System summary information display	Display system cumulative charge and discharge capacity, allowable charge and discharge capacity	
3	Home button	Click the button to jump to the system home page	
4	PCS1 information page button	Click the button to go to PCS1 information page	
5	PCS2 information page button	Click the button to go to PCS2 information page	
6	DCDC information page button	Click the button to go to the DCDC information page	
7	STS information page button	Click the button to jump to STS information page	
8	System operating power display	Display system grid active power curve	

4. Select and click the icon "7" on the PCS page to enter the STS information page, and you can view the detailed operation parameter information of a single STS.

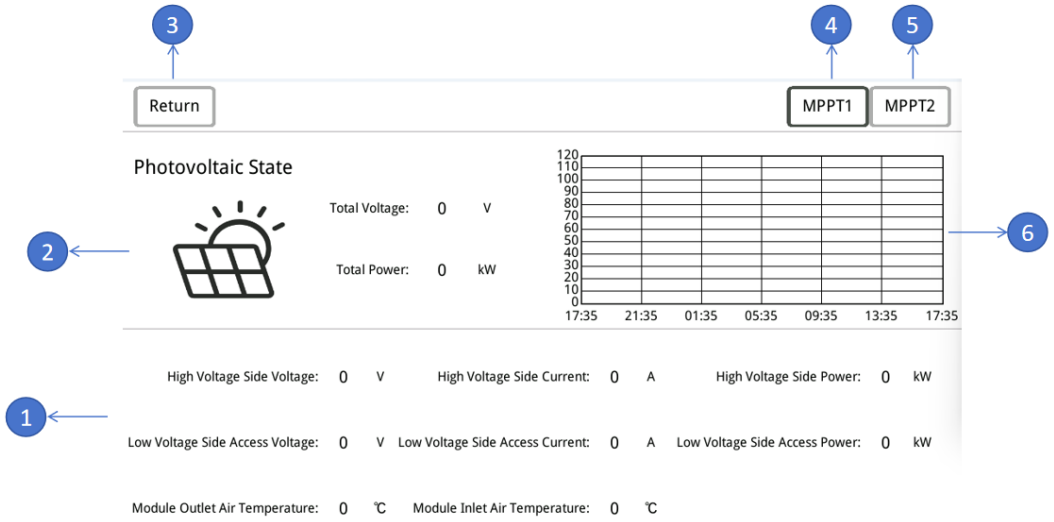
Figure 11-6 STS information page of local HMI system



No.	Name	Function	Remarks
1	STS data presentation	Show STS detailed data	
2	System summary information display	Display system cumulative charge and discharge capacity, allowable charge and discharge capacity	
3	Home button	Click the button to jump to the system home page	
4	PCS1 information page button	Click the button to go to PCS1 information page	
5	PCS2 information page button	Click the button to go to PCS2 information page	
6	DCDC information page button	Click the button to go to the DCDC information page	
7	STS Information Page Button	Click the button to jump to STS information page	
8	System operating power display	Display system grid active power curve	

5. Select and click the icon "1" on the main page to enter the MPPT information page, and you can view the detailed operation parameter information of a single MPPT.

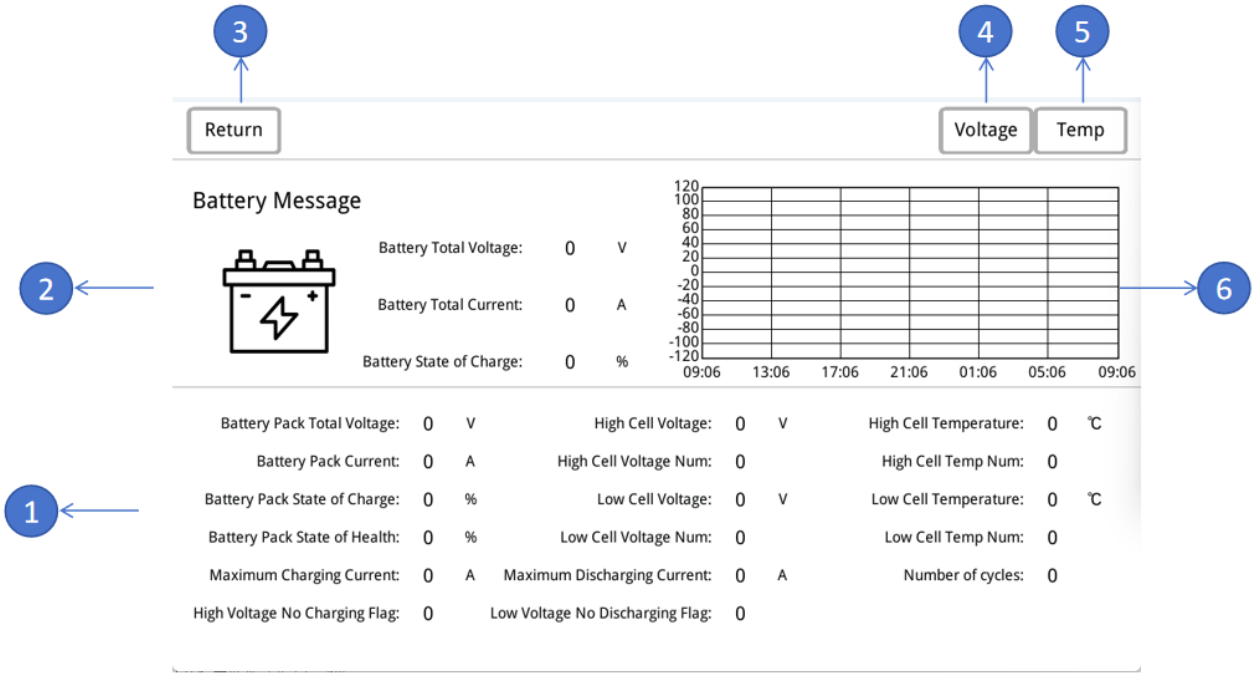
Figure 11-7 MPPT Information Page of Local HMI System



No.	Name	Function
1	Single MPPT data presentation	Display individual MPPT data in real time
2	Summary MPPT data presentation	Display aggregated MPPT data in real time
3	Home button	Click the button to jump to the system home page
4	MPPT1 information page button	Click the button to jump to MPPT1 information page
5	MPPT2 information page button	Click the button to jump to MPPT2 information page
6	Summary MPPT power curve display	Real-time display of MPPT total power curve

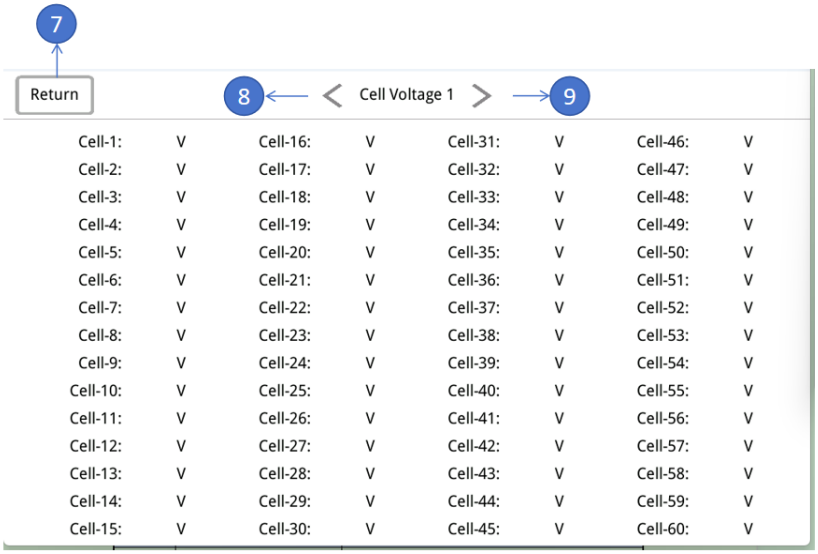
6. Click the icon "12" on the main page of 2.1 to enter the system battery information page, and you can view the current battery operation status information of the system, as well as the voltage and temperature of each single cell.

Figure 11-8 Local HMI system battery information page



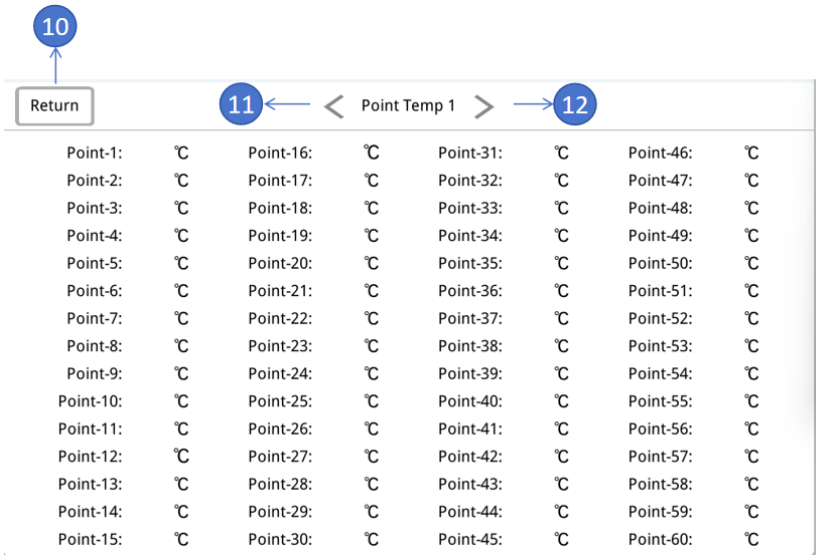
Click the "4" button to enter the battery cell voltage information page to view the voltage value of each cell.

Figure 11-9 Voltage page of local HMI single cell



Click the "5" button to enter the battery cell temperature information page to view the temperature value of each cell.

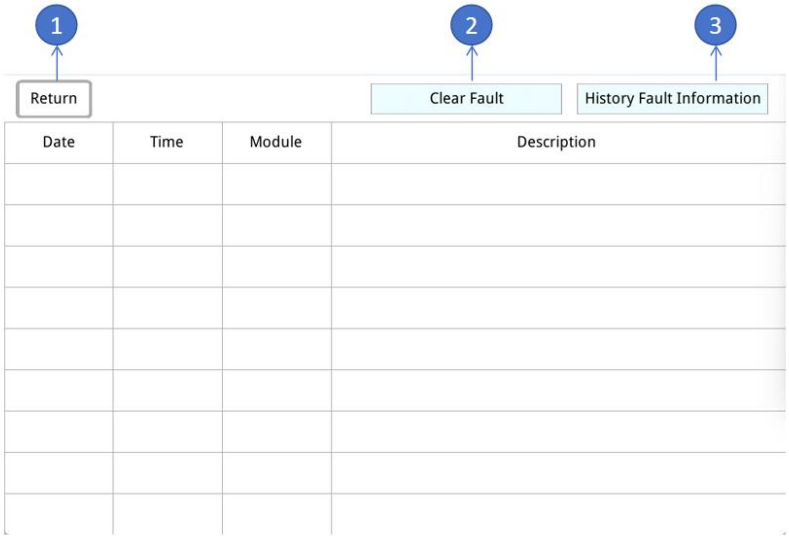
Figure 11-10 Temperature page of local HMI single cell



No.	Name	Function
1	Battery information data display	Click the button to switch the language displayed on the Select System page
2	Battery summary information display	Click the button to jump to the system home page
3	Home button	Click the button to jump to the system home page
4	Single section voltage information page button	Click the button to jump to the single section voltage information page
5	Single section temperature information page button	Click the button to jump to the temperature information page of a single section
6	Battery DC power curve display	Display battery DC power curve
7	Battery information page button	Click the button to jump to the battery information page
8	Single-section voltage page change button	Click the button to jump to the previous page of single section voltage information
9	Single-section voltage page change button	Click the button to jump to the next page of single section voltage information
10	Battery information page button	Click the button to jump to the battery information page
11	Single section temperature page change button	Click the button to jump to the previous page of temperature information in a single section
12	Single section temperature page change button	Click the button to jump to the next page of temperature information in a single section

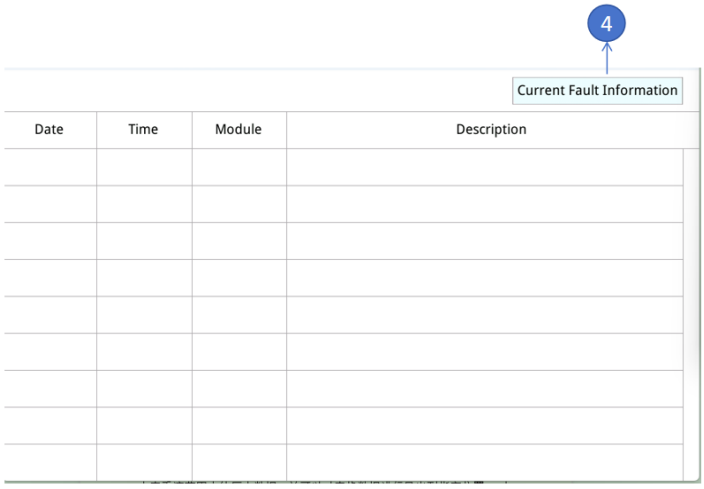
7. Fault alarm information page: click "1" button in function selection list to enter system fault alarm information page, and view current fault alarm information of system.

Figure 11-11 Local HMI current fault alarm information page



Click "History Fault Information" to enter the History Fault Alarm page.

Figure 11-12 local HMI system history fault alarm information page

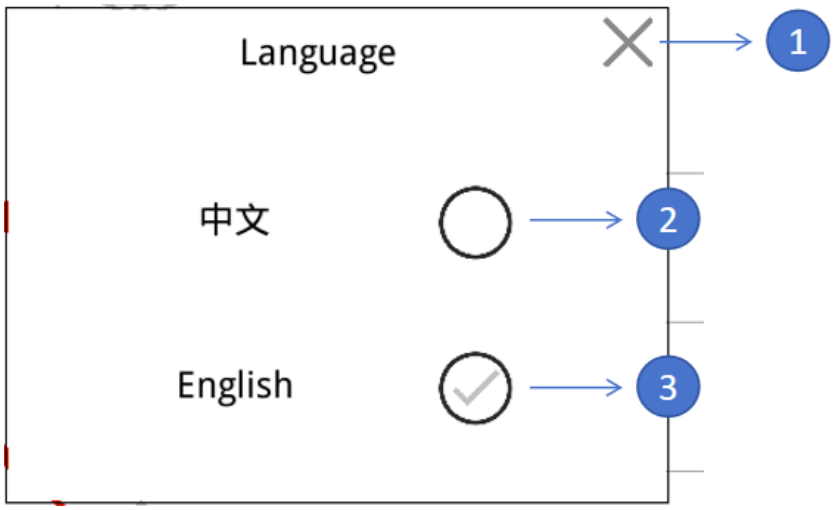


No.	Name	Function
1	Home button	Click the button to jump to the system home page
2	Clear fault button	Click the button to clear the current fault alarm message

No.	Name	Function
3	Historical fault alarm page button	Click the button to jump to the historical fault alarm page
4	Current fault alarm page button	Click the button to jump to the current fault alarm page

8. Click the button "4" in the function selection list. Open the language switch pop-up window.

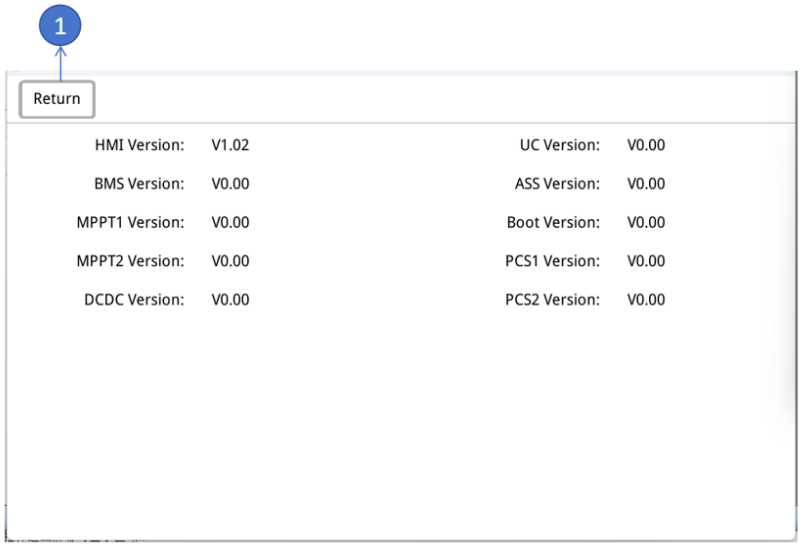
Figure 11-13 Local HMI system language switching page



No.	Name	Function
1	Close pop-up button	Click the button to close the language selection pop-up
2	Chinese select button	Click the button to switch the system language to Chinese
3	English select button	Click the button to switch the system language to English

9. Click the "5" button in the function selection list to enter the system version information page, where you can view the version information of all current modules in the system.

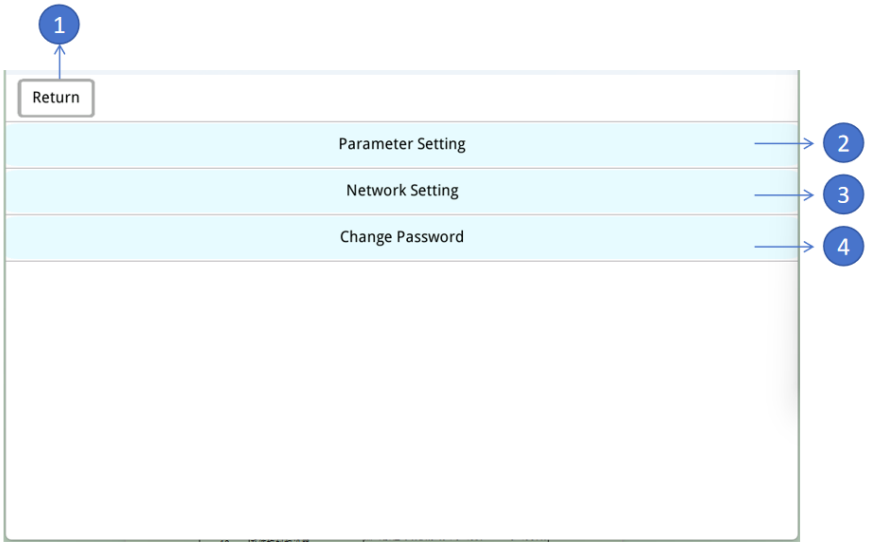
Figure 11-14 Local HMI system version information page



No.	Name	Function
1	Function selection button	Click the button to jump to the function selection

10. Click the button "6" in the function selection list to enter the system settings page.

Figure 11-15 Local HMI system settings page

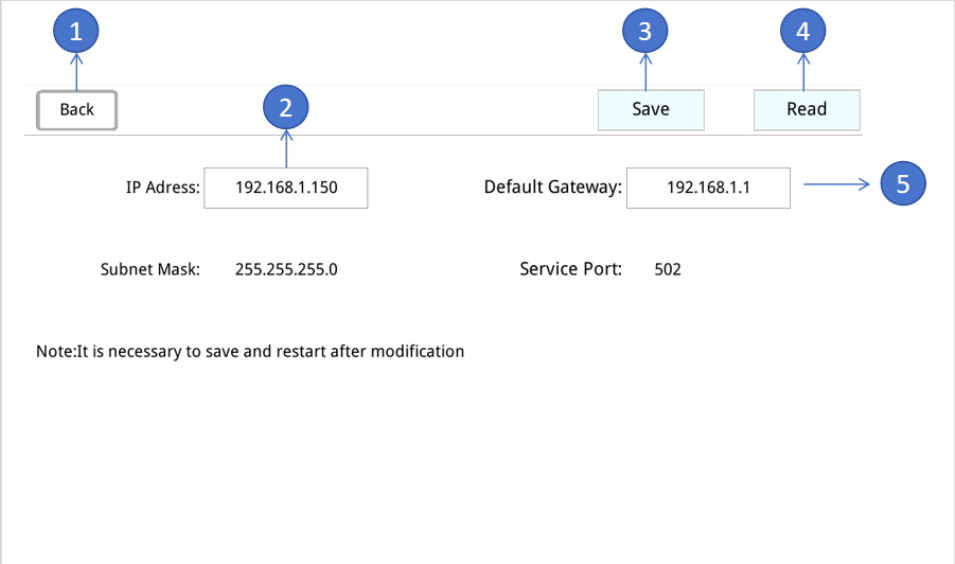


No.	Name	Function	Remarks
1	Home button	Click the button to jump to the system home page	
2	Parameter set button	Click the button to enter the password to jump to the parameter setting page	
3	Network settings button	Click the button to go to the network settings page	

4	Change password button	Click the button to open the Change Password pop-up window	See operating instructions for details

11. Click the "4" button on the system settings page to open the password modification pop-up window, which can modify the password unlocked on the main page.

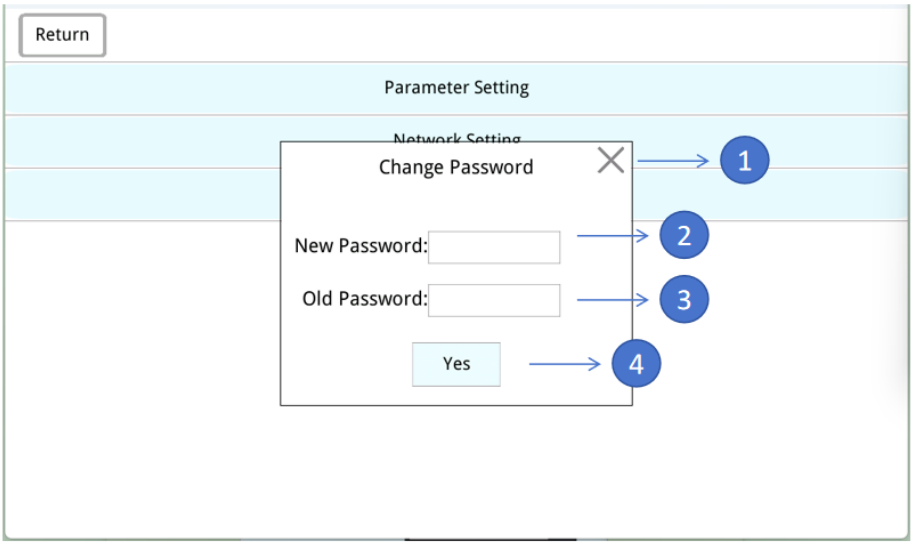
Figure 11-16 Local HMI network information page



No.	Name	Function	Remarks
1	System settings button	Click the button to jump to the system settings page	
2	IP settings button	Click the button to change IP address	See operating instructions for details
3	Save button	Click the button to save IP address settings	
4	Read button	Click the button to read the current IP address settings	
5	Getway settings button	Click the button to change Getway	See operating instructions for details

12. Click the "4" button on the system settings page to open the password modification pop-up window, which can modify the password unlocked on the main page.

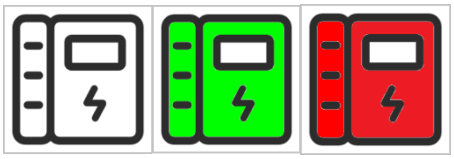
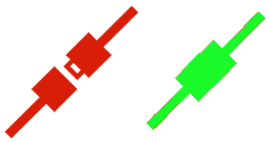
Figure 11-17 Modify password page for local HMI system



No.	Name	Function
1	System settings button	Click the button to jump to the system settings page
2	New password input button	Click the button to enter the new password
3	Old password input button	Click the button to enter the old password, forget the old password can enter" 000000" to set a new password
4	Confirmation button	Click the button to confirm the new password settings

Icon Indicates

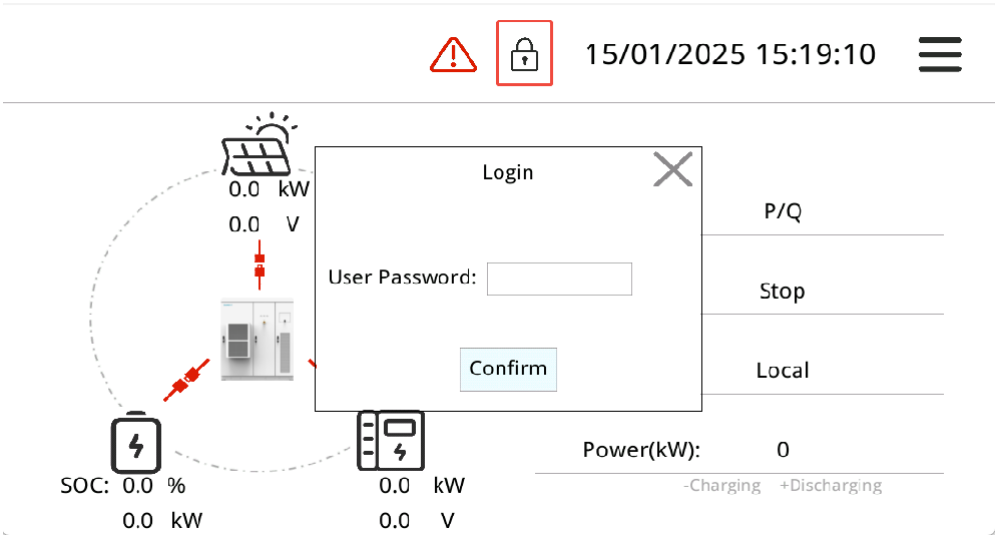
No.	Icon	Meaning
1		Grid icon (non-clickable)
2		Load icon (non-clickable)

No.	Icon	Meaning
3		Photovoltaic icon (click to jump to PV data display page)
4		Battery icon (click to jump to battery data display page)
5		System icon (click to jump to system data display page) Three icon colors represent system shutdown, operation and fault status respectively
6		Circuit breaker icon (non-clickable) Circuit breaker display icon between system and other modules, color represents disconnection and connection status between system and other modules
7		Control lock icon (clickable) to unlock or lock system controls
8		Power Delivery Icon (click Power Delivery)
9		Power Delivery Icon (click Power Delivery)
10		Fault icon (click to jump to fault alarm display page)

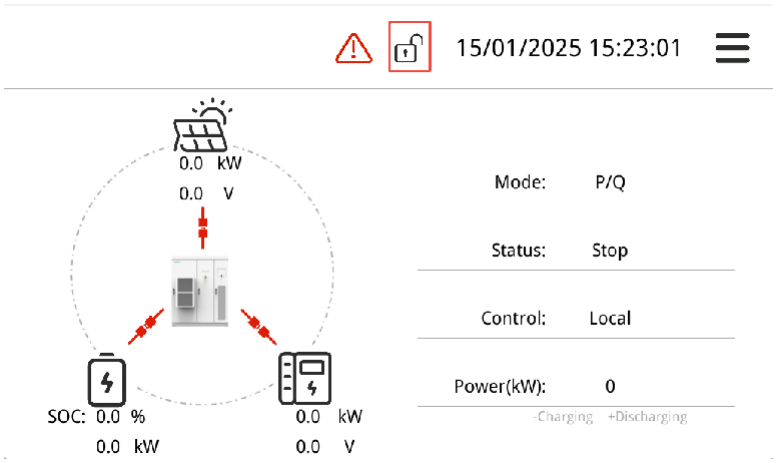
11.2 Operating Instructions

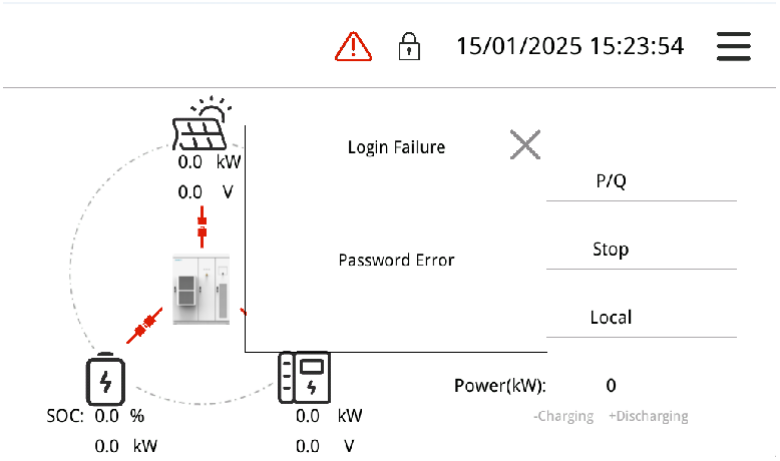
Control Unlocking

Step 1: Click the lock icon button on the main page to pop up the login interface as shown in the figure:



Step 2: Enter the login password (initial password 888), and click OK button. After successful login, as shown in the figure, if login fails, a failure prompt will be displayed.





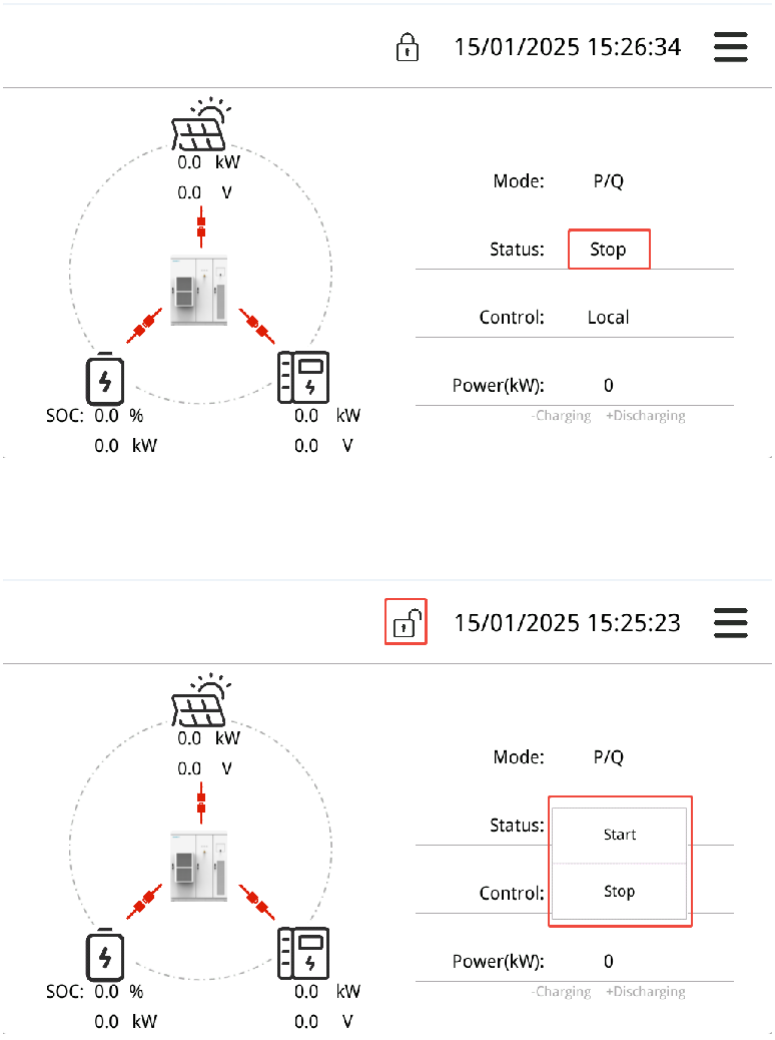
NOTE!	If the screen is not clicked within 5 minutes, the system will automatically lock, and the user can also click the unlock icon button to lock in advance.

System Start and Stop

Prerequisites:

1. Control unlocked.
2. Control is local.

Step 1: Click System Status to pop up the status selection menu as shown in the figure:



Step 2: Click Start or Stop.

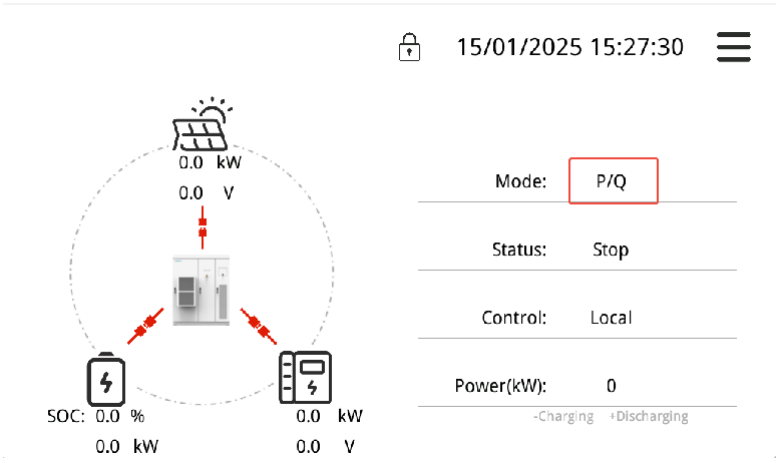
NOTE!	It takes 1-2 minutes for the system to start, and there is a progress bar prompt below.

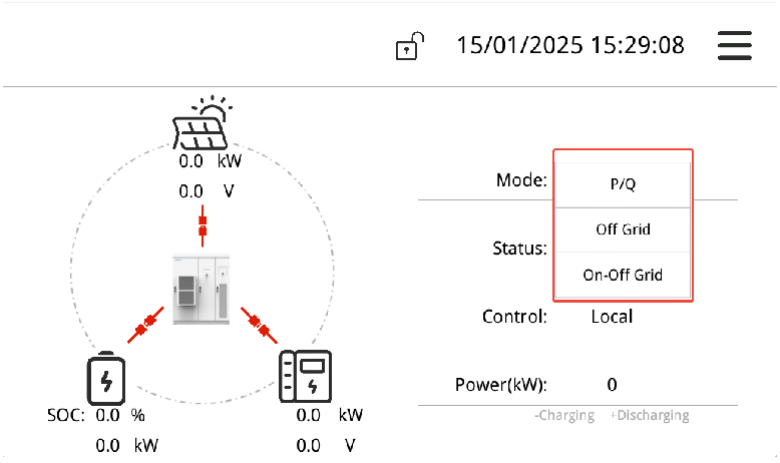
System Mode Switching

Prerequisites:

1. Control unlocked.
2. Control is local.

Step 1: Click System Mode to pop up the Mode Selection Menu as shown in the figure:





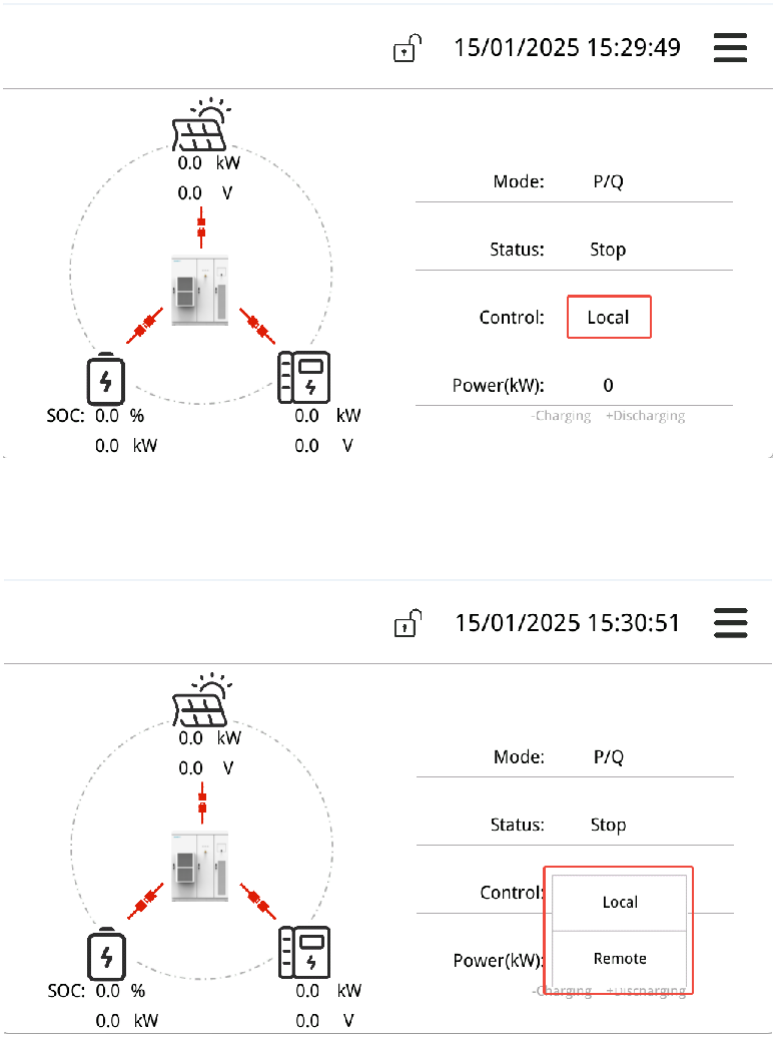
Step 2: Click Mode Selection.

System Control Handover

Prerequisites:

1. Control unlocked.

Step 1: Click on the system control position to pop up the control right selection menu as shown in the figure:



Step 2: Click Local or Remote.

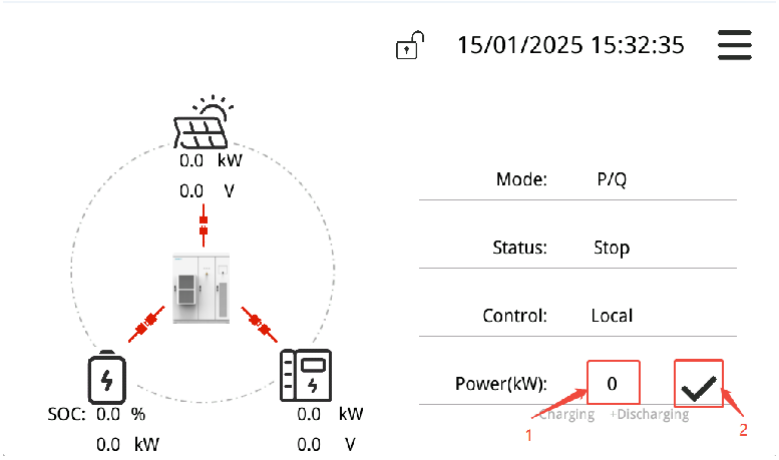
System Power Delivery

Prerequisites:

1. Control unlocked.
2. Control is local.
3. System is up.

Step 1: Click on the value to enter the power.

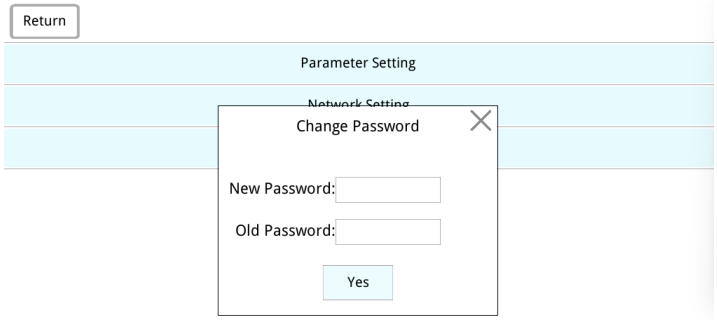
Step 2: Click the Send button, as shown in the figure:

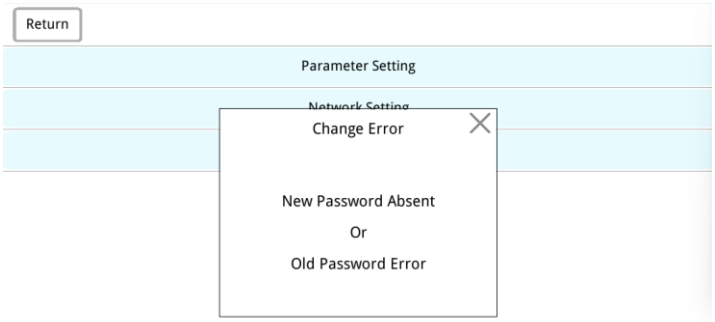


Control Password Modification

Step 1: Click the password modification button to open the password modification pop-up window.

Step 2: Enter the new password and the old password respectively, and then click the OK button. If the modification is successful, the password modification pop-up window will automatically close. If the modification fails, the failure prompt will be displayed, as shown in the figure:



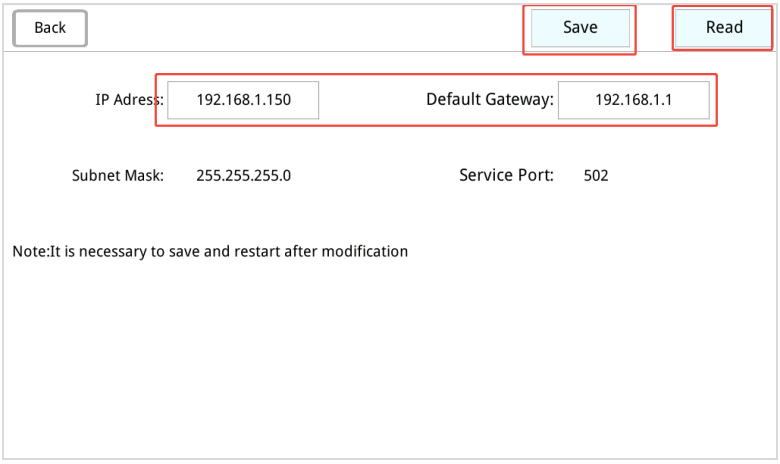


IP Modification

Step 1: After entering the network settings page, click the IP modification button or Getaway modification button to change the required IP or Getaway.

Step 2: Click the Save button to save the settings.

Step 3:(Optional) Click the Read button to see if the save is successful, as shown in the figure:



NOTE!	After IP modification, the equipment needs to be restarted to take effect.

12 Operation & Maintenance & Troubleshooting

12.1 Monthly operation & maintenance requirements

Inspection item	Inspection contents	Period (recommendation)
Battery system operation and maintenance requirements		Once a month
Battery Holder	Check the battery frame for deformation and abnormality.	
Sealing Strip	Check the seals for detachment and damage.	
Leak Check	Check the edge of the cabinet door for water stains.	
Battery Module	Check the battery for pack rise, liquid leakage, and irritating gas.	
Cables/Copper Bar	Check the battery power cables/copper rows and communication harnesses for breakage or disconnection.	
Battery Poles	Check the battery poles for burnt-on phenomenon.	
Torque marking	A red torque mark indicates a solid connection.	
Cable Connection Terminal/Copper Bar Connection	For cable connection terminals, check the front of the terminals to make sure they are not damaged or loose.	
DC Circuit Breaker	Check that the DC main circuit breaker opens and closes properly.	
Air conditioning system operation and maintenance requirements		

Running sound	Whether the air conditioner is running normally, with no abnormal noise.	
drainage outlet	Whether there is deformation and dirty blockage of the drain.	
Electrical warehouse operation and maintenance requirements		
Air inlet and outlet	Check whether the air inlet and outlet are clogged and whether the filter cotton needs to be cleaned.	
Sealing Strip	Check whether the sealing strip has fallen off or damaged.	
Meter	Check whether the power meter lights up and whether the data is normal.	
Module Indicator	Check whether the indicator lights of the switching power supply module, IO controller module and flooding transmitter module are on.	
Leakage check	Check whether the indicator light of the switching power supply module, IO controller module, and water immersion transmitter module is on.	
Module power connection cable	Check if the system status indicator is on.	
Dust Screen Dust Removal	1) Make sure the unit is turned off and disconnected from the power source. 2) Pull up the tabs that secure the dust screen to the unit. 3) Carefully pull out the dust screen to prevent damage to other parts inside the unit. 4) Clean the removed dust screen by using a dry soft brush or a vacuum cleaner to remove any dust or foreign matter. 5) Reinstall the cleaned dust screen and tighten it according to the appropriate installation sequence.	
Torque marking	A red torque mark indicates a firm connection.	
Cable Connection Terminal	For cable connection terminals, check the front of the terminals to ensure that the terminals are not damaged or loose.	
AC Circuit Breaker	The AC main circuit breaker can be opened and closed normally.	

12.2 Annual Operation and Maintenance Requirements (One year)

Inspection item	Inspection contents	Period (recommendation)
Battery system operation and maintenance requirements		Once a year
Threading Port	The rubber sheath of the feedthrough is checked to ensure that the rubber sheath is not detached from the feedthrough to prevent the cable from coming into direct contact with the cabinet sheet metal.	
Battery poles	Check whether the torque marking of battery poles exists, if not, it should be reinforced according to the torque standard.	
Cabinet Appearance	Appearance inspection, paint repair on the location of paint loss.	
Air conditioning system operation and maintenance requirements		
Power supply line	Check that the power supply incoming wires are tight.	
Miniature Circuit Breaker	Check that the miniature circuit breaker is in proper condition.	
Condenser	Check condenser cleanliness and clean condenser with compressed air.	
Water Leakage Check	Check for water stains in fixed locations inside the air conditioner.	
Fire protection system operation and maintenance requirements		
Smoke Sensor	Check if the run light is on	
Combustible Gas Detector	Check that the run light is on	
Electrical warehouse operation and maintenance requirements		
Powerline	Remove the front sealing plate and check the power line connection to the molded case circuit breaker	
Module torque	position for burnt-on phenomenon.	
Dusting inside the electrical silo	Check the torque at the power connection line of each module, which needs to be reinforced according to the torque	
Inlet	The power connection wires of each module are checked for torque and need to be	

	reinforced according to the torque standard.	

12.3 Annual O & M Requirements (Two years)

Inspection item	Inspection contents	Period (recommendation)
Electrical warehouse operation and maintenance requirements		Every two years
Replacement of Dust Screen Filter Foam	Replacement of electrical silo dust screen filters	

12.4 Annual O & M Requirements (Five years)

Inspection item	Inspection contents	Operation and maintenance time (recommended)
Battery system operation and maintenance requirements		Focused inspections after five years to replace end-of-life, damaged devices
High Voltage Box Indicator	Indicator lamp life is 5 years, damage recommended replacement	
System Status Indicator	Indicator lamp life is 5 years, damage requires replacement	
Fire protection system operation and maintenance requirements		
Perfluorohexanone fire extinguishing PowerHill	The service life of fire extinguishing device is 5~8 years, need to be replaced when it expires	
Combustible gas detector	Combustible gas detectors have a service life of 5~8 years and need to be replaced upon expiration.	
Electrical warehouse operation and maintenance requirements		
Switching Power Supply	Operation indicator does not light up, no output voltage needs to be replaced.	
L-Shape Cable Glands	Check whether the waterproof connector is brittle and damaged, the damage needs to be replaced in time.	
Sealant Strip	Check whether the sealing tape is peeled off, broken, whether the cabinet is waterlogged, the damage needs to be replaced in time.	

12.5 Annual O & M Requirements (Eight years)

Inspection item	Inspection contents	Operation and maintenance time (recommended)
Fire protection system operation and maintenance requirements		Focused inspections after eight years to replace end-of-life, damaged devices
Smoke Sensor	Replacement Devices	
Electrical warehouse operation and maintenance requirements		
IO Controller	Replacement is required if the run indicator does not light up and the system reports an interruption in communication with the IO controller.	
RS485 to TCP Module	Replacement is required if the run indicator does not light up and the communication is interrupted.	

12.6 Annual O & M Requirements (Ten years)

Inspection item	Inspection contents	Operation and maintenance time (recommended)
Electrical warehouse operation and maintenance requirements		Focused inspection after 10 years
Power conversion module	Operation indicator does not light up and needs to be replaced when communication is interrupted	

12.7 Energy Storage Cabinet Troubleshooting

12.7.1 Troubleshooting Steps:

1. Status Record: After a fault occurs, before operating any switches, immediately record the fault information on the local web server, the status of the indicators and the position of each switch.

2. Fault type identification: After recording all the instructions, refer to the fault information description table to analyze the cause of the fault.

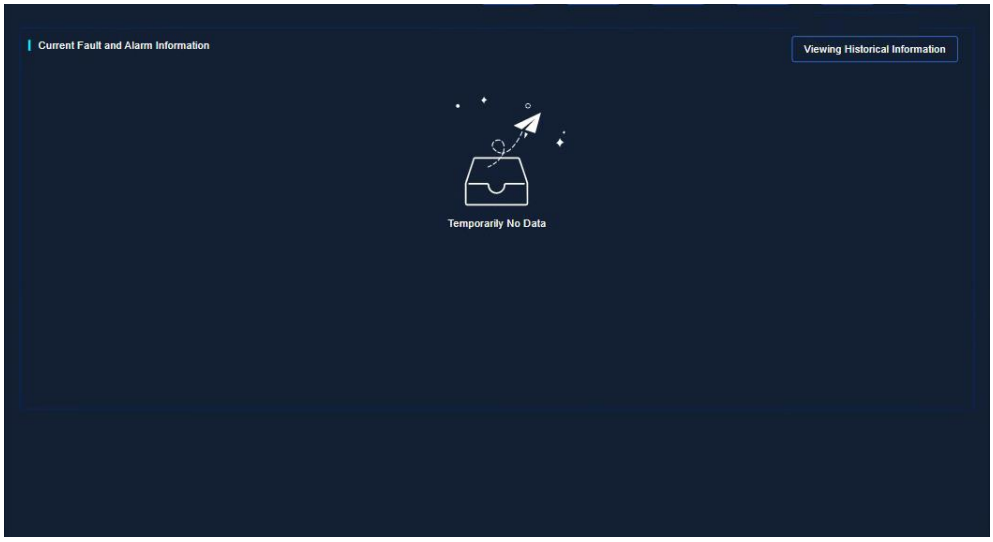
3. If you cannot identify the type of fault, please contact the supplier or technical support engineer.

4. Failure records: After the fault type identification, the results will be sent to the supplier or technical engineer, the user feedback is extremely important to the maintenance work.

5. On-site Repair: After identifying the cause of the failure, if you need to replace the broken parts, you can contact the supplier or technical support engineer, and ask the other party to provide guidance documents for replacing the parts or remote guidance.

12.7.2 Fault logging and analysis

1. View fault logs via local web server



2. Common Troubleshooting

No.	Fault phenomenon	Processing method
1	IO controller communication interruption	Check IO controller communication harness
2	Battery cell voltage high voltage fault	Notify the manufacturer
3	Differential cell voltage fault	Notify the manufacturer
4	BMM communication failure	Check BMM communication harness
5	High temperature of air inlet and outlet	Check the air inlet and outlet for blockage
6	Grid phase sequence alarm	Check for correct wiring sequence on the grid side
7	Electricity becomes low	Calibrate SOC

13 Technical Data

Model	PowerHill P30-143kWh	PowerHill P30-179kWh	PowerHill P60-143kWh	PowerHill P60-161kWh	PowerHill P60-179kWh	PowerHill P60-215kWh	PowerHill P100-215kWh
Battery							
Cell Type	LiFePO4-280Ah						
Pack Configuration	1P20S						
Battery Capacity [kWh]	143.36	179.2	143.36	161.2	179.2	215.04	215.04
AC Output							
Connection Type	3P4W						
Charging / Discharging Power [kW]	30		60				100
Rated Grid Voltage [V]	220 / 380; 230 / 400						
Frequency [Hz]	50 / 60						
Rated AC Output Current [A]	43		86				144
Adjustable Power Factor Range	0.8 Leading ... 0.8 Lagging						

Model	PowerHill P30-143kWh	PowerHill P30-179kWh	PowerHill P60-143kWh	PowerHill P60-161kWh	PowerHill P60-179kWh	PowerHill P60-215kWh	PowerHill P100-215kWh
Output THDi [@Rated Output]	≤ 3%						
Backup Output (Off Grid)							
Connection Type	3P4W						
Rated Output Power [kW]	30		60				100
Rated Output Voltage [V]	220 / 380; 230 / 400						
Output Frequency [Hz]	50 / 60						
Rated Current [A]	43		86				144
Frequency Accuracy [Hz]	0.2						
General Parameters							
Dimensions [W * H * D] [mm]	1686 * 2093 * 1354						
Weight [kg]	2500						
Display	HMI						
Degree of Protection	IP55 (Battery Cabinet), IP54 (Electrical Cabinet)						
Cooling	Battery Cabinet (Air Conditioner)						
Fire Suppression System	Combustible Gas Detection + Novec1230 + Water Fire Protection						
Anti-Corrosion Grade	C3						
Relative Humidity	0 ~ 95% (Non - Condensing)						
Operating Temperature [℃]	-20 ~ 50						

Model	PowerHill P30-143kWh	PowerHill P30-179kWh	PowerHill P60-143kWh	PowerHill P60-161kWh	PowerHill P60-179kWh	PowerHill P60-215kWh	PowerHill P100-215kWh
Altitude [m] [1]	< 2000						
Noise Level [dB]	≤ 75						
Communication Interface	RS485, Ethernet						
Communication Protocol	Modbus RTU, Modbus TCP / IP						
PV Side Parameters (Optional)							
Max. PV Input Power [kW]	30		60				60 / 120
Max. PV Input Voltage Range [V]	200 ~ 750					200 ~ 650	
Number of MPPTs	1		1				1 / 2
Number of PV Inputs	1		1				1 / 2
Max. Input Current [A]	100		200				200 / 400
Certifications & Standards							
System	CE (IEC 61000, IEC 62477), IEC 62109, IEC 62619, UN 3480, CEI 0-21, CEI 0-16, VDE 2510						
Converter	G99, VDE 4105, EN50549, CE (IEC61000, IEC62477), IEC62109, NC RfG, VDE4110						
PACK	UN38.3						
Cell	IEC62619, UL1973, UL1642, UL9540A						
[1] The system will be derated when the ambient temperature exceeds 45℃. [2] The system will be derated when the altitude is above 2000m.							

A Crimp OT / T terminal

OT / DT terminal requirements

- Use a copper terminal block when using copper core cables.
- Use copper terminals when using copper-clad aluminum cables.
- When aluminum alloy cables are used, use copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition spacers

Prerequisites

- It is strictly prohibited to connect the aluminum terminal block directly to the terminal block, otherwise it will cause galvanic corrosion and affect the reliability of cable connection.
- When using copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition spacers, the requirements of IEC61238-1 must be met.
- When using copper and aluminum transition spacers, the outer contour of the spacer should be not less than the outer contour of the OT/DT terminal, please pay attention to the front and back to ensure that the aluminum side of the spacer is in contact with the aluminum terminals, and the copper side is in contact with the terminal block. It is recommended that the shims and terminals be purchased from the same manufacturer

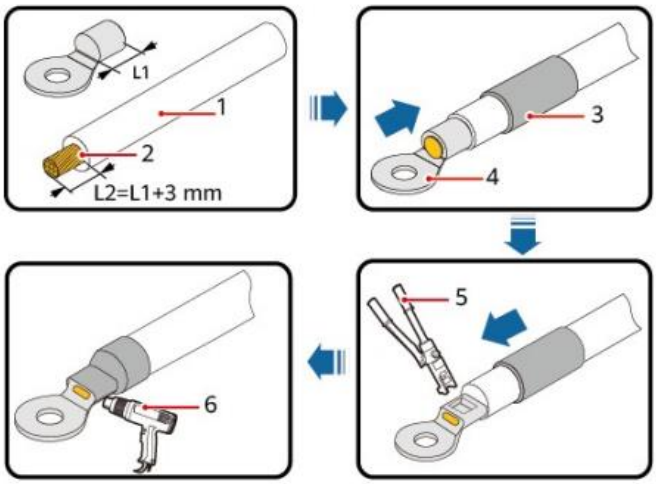
Crimp in with the OT / DT terminals

Prerequisites

- Do not scratch the wire core when stripping the wire.

- The cavity formed by crimping the conductor of the OT/DT terminal should completely enclose the core and the core should be tightly bonded to the OT/DT terminal without loosening.
- The crimp area can be wrapped with heat shrink tubing or insulating tape. Heat shrink tubing is introduced as an example.
- When using the heat gun, take care to protect the PowerHill from being baked.

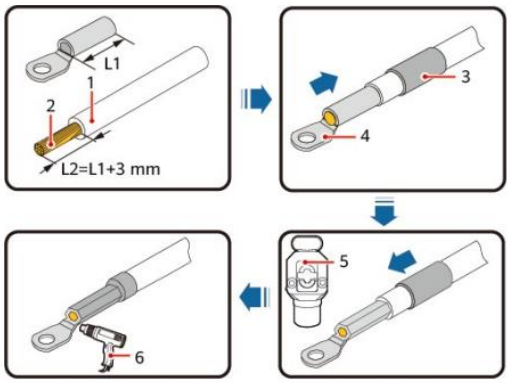
Figure A-1 Crimp OT terminal



(1) Cable (2) Wire core (3) Heat-shrinkable sleeve

(4) The OT terminal (5) Hydraulic clamp (6) Hot wind gun

Figure A-2 Crimp DT terminal



(1) Cable (2) Wire core (3) Heat-shrinkable sleeve

(4) The DT terminal (5) Hydraulic clamp (6) Hot wind gun

B How to reapply the paint

Prerequisites

- Repainting is strictly prohibited in bad weather, such as rain, snow, wind, sandstorm, etc., when the outdoor area is uncovered.
- The appearance of the PowerHill should be kept in good condition, if there is any paint falling off, it needs to be repainted immediately.

 NOTE!	Visually inspect the degree of paint damage to the PowerHill, prepare the appropriate tools and materials, the amount of materials according to the paint repair situation on-site assessment.

Table B-1 Description of painting

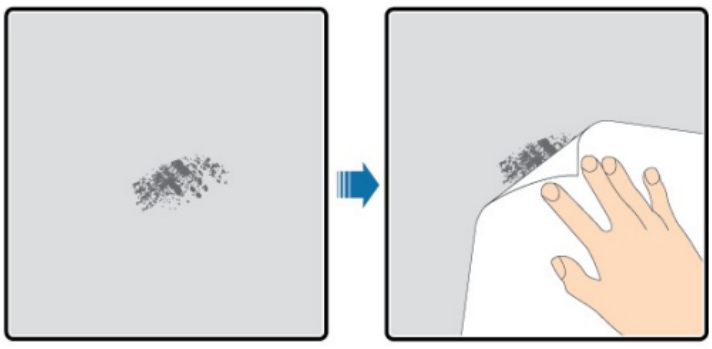
Degree of paint damage	Tools and materials	Procedure	Instruction
Light scratches (without exposing the steel substrate)	Hand spray paint or lacquer, brush (for small areas), fine sandpaper, anhydrous ethanol, cotton cloth, spray gun (for large areas).	Operate according to step 1 + step 2 + step 4 + step 5.	1. Small amount of scratches and small surface stains, rust is recommended to use hand spray paint or brush paint. 2. A large number of
Stains and rust that cannot be wiped away			

Deep scratches (primer damage, exposed steel substrate)	Hand spray or paint, zinc-rich primer, brush (for small areas), fine sandpaper, anhydrous ethanol, cotton cloth, spray gun (for large areas).	Operate as step 1 + step 2 + step 3 + step 4 + step 5.	scratches and large stains, rust need to use a paint spray gun for paint spraying. 3. The paint film should be as thin and even as possible, do not make the paint film in the form of liquid droplets, and keep the surface smooth. 4. After leaving the surface to be repainted for about 30 minutes, subsequent operations can be carried out.
Broken logos and designs	Provide logo size and color code for damaged logos and graphics, and look for a local spray painting supplier to develop a repair plan and execute the repair according to the logo size, color and damage.		
Impact craters	If the impact area is ≤100mm2 and the depth is less than 3mm, use unsaturated polyester resin putty (Poly-Putty base) (Atomic Gray) to fill in the area, and then follow the operation of deep scratch refinishing. If the impact area is >100mm2 or the depth is more than 3mm, you need to find a local supplier to give you an individual repair plan according to the situation.		

Operating steps

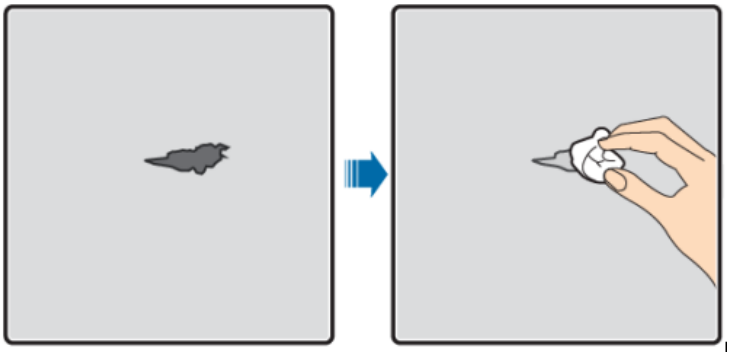
Step 1 Lightly sand the damaged area with fine sandpaper to remove dirt or rust.

Figure B-1 Polish the coating damage with fine sandpaper



Step 2 Moisten a cotton cloth with anhydrous ethanol and wipe the sanded area or area to be repaired to remove surface dirt and dust, then dry with a clean cotton cloth.

Figure B-2 Treat coating breaks with anhydrous ethanol



Step 3 Repair the zinc-rich primer with a brush or spray gun for coating breaks.

Prerequisites

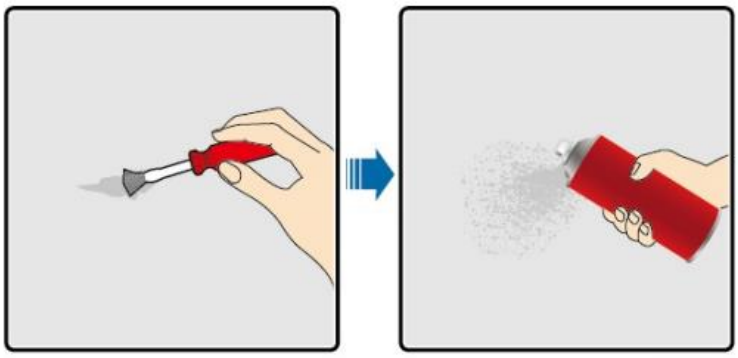
- If the area to be repaired is exposed to the substrate, an epoxy zinc-rich primer must be applied until the paint dries without exposing the substrate, and then an acrylic topcoat must be applied.
- Choose an epoxy zinc-rich primer or an acrylic topcoat of the corresponding color according to the surface coating color of the PowerHill

Step 4 According to the degree of paint damage, choose one of the methods of self-painting, brushing, or spraying with a spray gun to evenly touch up the damaged areas of the coating until the traces of the damaged coating are not exposed.

Prerequisites

- Pay attention that the paint film should be as thin and even as possible, the paint film should not be in the form of liquid droplets, and the surface should be kept smooth.
- For the case of different colors of the PowerHill pattern, cover the other color parts with tape and white paper before refinishing to avoid the pollution of other color parts during the refinishing operation of this color.

Figure B-3 Repainting of damaged PowerHill coatings



Step 5 After painting, leave it for about 30min, then observe whether the patched area meets the requirements.

NOTE!

- Repainted areas should be consistent with the color of the surrounding area, measured using a colorimeter with a color difference ΔE ≤ 3. If a colorimeter is unavailable, verify that there are no visible edges between the repainted area and its surrounding area. The paint should also be free of bumps, scratches, flakes or cracks.
- If the paint is sprayed, it is recommended that 3 coats be applied before observing whether the requirements are met; if not, repeat the spraying until the requirements are met.

Table B-2 Painting requirements for PowerHill

Paint Requirements	Specific requirements
Primer thickness	60 micron
Topcoat thickness	120 micron
Primer type	Epoxy zinc-rich paint
Topcoat type	Acrylic top coat
Topcoat color	RAL9003

C Emergency handling

When a dangerous accident occurs at the site, including but not limited to those listed below, please ensure the personal safety of the site personnel at the first time and contact our service engineers.

If the battery is dropped or strongly impacted

- If there is an obvious odor, breakage, smoke, fire, etc., immediately evacuate the personnel, call the police in time, contact a professional, and the professional will use fire fighting facilities to extinguish the fire and other treatments under the condition of ensuring safety.
- When there is no obvious deformation or damage in appearance and no obvious odor, smoke or fire, operate under the premise of ensuring safety:

Depot: Evacuate the personnel, transfer the battery to an open and safe place by professional personnel using mechanical tools, and contact our service engineers to deal with the battery after it has been left to stand for 1h and the temperature of the battery is monitored to be within the range of room temperature ±10℃.

- PowerHill site: evacuate people, close the door of the PowerHill, transfer the battery to an open and safe place by specialized personnel using mechanical tools, and contact our service engineers for 1h of static treatment.

When flooding occurs

- Power off the system under the premise of ensuring personal safety.
- If any part of the battery is flooded, do not touch the battery to avoid electric shock.

- Do not use flooded batteries and contact a battery recycling company for disposal.

In case of fire

	• If a fire occurs, de-energize the system to ensure safety. • Extinguish the fire with carbon dioxide, FM-200 or ABC dry powder extinguishers. • Firefighters need to avoid contact with high-voltage components in extinguishing a fire, as this may result in a risk of electric shock. • High battery temperatures can lead to deformation, damage and electrolyte overflow and leakage of toxic gases, respiratory protection should be worn and keep away to avoid skin irritation and chemical burns.

In the event of an extinguishing agent eruption or fire

- Recommendations for on-site O&M personnel:

  a.In case of fire, evacuate the building or PowerHill area and press the fire alarm, immediately call the fire alarm telephone, notify professional firefighters, and provide them with relevant product information, including but not limited to: type of battery pack, capacity of the PowerHill, and location distribution of the battery pack.

  b. In any case, it is forbidden to re-enter the burning building or PowerHill area, and to open the door of the PowerHill. The scene is isolated and guarded, and the approach of unrelated personnel is prohibited.

  c. After calling the fire alarm, remotely power off the system under the condition of ensuring your own safety (e.g. intelligent box-type substation, intelligent energy storage controller, auxiliary power supply PowerHill, convergence box power supply, etc.).

  d. Upon the arrival of professional firefighters, provide them with relevant product information, including but not limited to: type of battery pack, capacity of the PowerHill, location distribution of the battery pack, and user manuals.

  e.After the professional firefighters confirm that the fire is extinguished, it will be handled by the professionals in accordance with local regulations, and it is prohibited to open the door of the PowerHill privately.

  f.Post-disaster product maintenance: Contact our service engineers for evaluation.

- Recommendations for fire protection professionals:

  For product information, please refer to the information provided by the operation and maintenance personnel, including but not limited to: battery pack type, capacity of the PowerHill, location distribution of the battery packs, and user manuals.

  Opening the PowerHill door is prohibited until the interior of the PowerHill can be secured.

  Please follow local fire codes for fire suppression operations.

D How to recycle the used batteries

Prerequisites

- We do not recycle batteries, so customers need to contact local recycling organizations to dispose of the batteries themselves.
- If there is no local recycling organization, we suggest customers to contact the nearest national recycling organization for disposal.

Step 1 Contact the nearest recycling organization.

Step 2 The recycling organization assesses the cost of recycling.

Step 3 The recycling organization carries out recycling, of which there are two types of recycling methods.

- Up-coming recycling: Recycling organizations can up-come and recycle Li-ion batteries, but the price needs to be assessed depending on the actual situation such as distance/transportation costs.
- Centralized recycling: The customer places all the recycled lithium batteries in a centralized place, and the recycling organization comes to the house for centralized processing.

 NOTE!	Transportation costs, etc. incurred for recycling are to be provided by the customer.

Step 4 The recycling company handles the recycling at its sole discretion. The recycling company handles the recycled lithium batteries at its sole discretion, and the customer does not need to be involved any further.

E Abbreviation

Abbreviation	Meaning
PowerHill	Battery PowerHill
BMS	Battery management system
EMS	energy management system
SOC	State of charge
SOH	State of health
AC	Alternating current
DC	Direct current
PCS	PowerHill inverter
DOD	Depth of Discharge
MPPT	Maximum power point tracking

DUNEXT

Innovate for a Green Future

Dunext Technology Suzhou Co., Ltd.

service@dunext.com

www.dunext.com