

# Battery Energy Solar System **PowerX**

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## Product Manual

## Notice

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute the warranty of any kind, express or implied.

### **ATTENTION – IMPORTANT SAFETY INSTRUCTIONS**

This manual contains important safety instructions that must be followed during the installation and maintenance of the equipment.


### **ATTENTION – SAVE THESE INSTRUCTIONS**


Keep this document in a safe place near the inverter for easy access during installation, operation and maintenance.

The installer must read this document in its entirety and scrupulously follow the instructions given in it before installing this equipment, since MA Solar Italy cannot be held responsible for damage caused to people and/or things, or the equipment, if the conditions described below are not observed.

The purpose of this document is to support the qualified technician, who has received training and/or has demonstrated skills and knowledge in construction, to install, operate and maintain the inverter. This manual covers the inverter only, and NO other equipment (photovoltaic modules, external disconnects, etc) to which it is connected.

Warranty requirements are included in the Terms and Conditions of sale included with the battery energy storage system order.

 **NOTICE** – Any changes made to the product or to the installation conditions that hasn't been approved by MA Solar Italy will void the warranty.

 **NOTICE** – All pictures and illustrations shown in this user manual are indicatives and must be intended as support for installation instruction only. Actual product may vary due to product enhancement. Specifications subject to change without notice. The latest version of this document is available on the Fimer website.

The products are designed to be connected and communicate information and data via a network interface. It is the user's sole responsibility to provide and continuously ensure a secure connection between the product and the user's network or any other network (as the case may be). The user shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. MA Solar Italy and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information. The data, examples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties.

All persons responsible for applying the equipment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. In particular, any risks in applications where a system failure and/or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsibility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks. This document has been carefully checked by MA Solar Italy but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commitments, in no event shall MA Solar Italy be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.

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About This Document

Purpose

This document describes the battery energy storage system (also referred to as product, device, or battery) in terms of its overview, application scenarios, installation, commissioning, system maintenance, and technical specifications. The system consists of a power control module and battery expansion modules.






Intended Audience

This document is intended for:

- Sales engineers
- System engineers
- Technical support engineers
- End users

Symbols and signs

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
 NOTICE	Indicates warning information about device or environment security which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
 NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

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

Issue 01 (2024-06-30)

This issue is the first official release.

# 1. Safety Information

## 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.
- You fail to follow the operation instructions and safety precautions on the product and in the document.
- You 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 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.
- ⚠ **DANGER** – During operations, wear personal protective equipment such as protective clothing, insulated shoes, goggles, safety helmets, and insulated gloves.

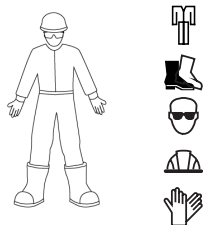


Figure 1.1. Personal protective equipment

## 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.
- 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.

## 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 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.

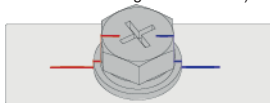
## 1.2 Electrical Safety

- ⚠ 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.

### 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. (The marks must cross the edges of the bolts.)



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- 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.
- Do not open equipment panels.
- 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.

### Grounding

- 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.

### Cabling Requirements

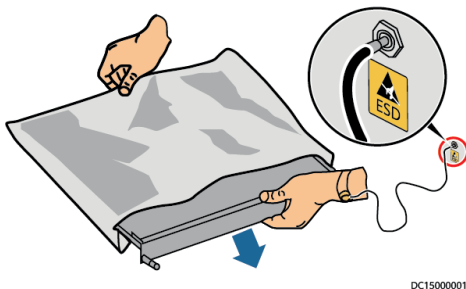
- When selecting, installing, and routing cables, follow local safety regulations and rules.
- When routing power cables, ensure that there is no coiling or twisting. Do not join or weld power cables. If necessary, use a longer cable.
- Ensure that all cables are properly connected and insulated, and 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.

- 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 away from each other without entanglement and overlapping.
- 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°C. Handle cables with caution, especially at a low temperature.
  - Cables stored at below 0°C must be stored at room temperature for more than 24 hours before they are laid out.
- Do not perform any improper operations, for example, dropping cables directly from a vehicle. Otherwise, the cable performance may deteriorate due to cable damage, which affects the current-carrying capacity and temperature rise.

## ESD

**NOTICE** – The static electricity generated by human bodies may damage the electrostatic-sensitive components on boards, for example, the large-scale integrated (LSI) circuits.

- When touching the equipment and handling boards, modules with exposed circuit boards, or application-specific integrated circuits (ASICs), observe ESD protection regulations and wear ESD clothing and ESD gloves or a well-grounded ESD wrist strap.



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Figure 1.2 Wearing an ESD wrist strap

- When holding a board or a module with exposed circuit boards, hold its edge without touching any components. Do not touch the components with bare hands.
- Package boards or modules with ESD packaging materials before storing or transporting them.

## 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.

### General Requirements

- The installation and usage environment must meet relevant international, national, and local standards for lithium batteries, and are in accordance with the local laws and regulations. The user is obliged to protect the ESS against fire or other hazards.
- Keep the ESS out of the reach of children and away from daily working or living areas, including but not limited to the following areas: studio, bedroom, lounge, living room, music room, kitchen, study, game room, home theater, sunroom, toilet, bathroom, laundry, and attic.
- When installing the ESS in a garage, keep it clear of the drive path. It is recommended that the ESS be mounted on the wall higher than the bumper to prevent collision.
- Do not install the ESS in places that are enclosed, unventilated, without proper fire fighting facilities, or difficult for firefighters to access. Do not place flammable or explosive materials around the ESS. It is recommended that the ESS be mounted on a wall to avoid contact with water.
- Install the ESS in a sheltered place or install an awning over it to avoid direct sunlight or rain.
- For areas prone to natural disasters such as floods, debris flows, earthquakes, and typhoons, take corresponding precautions for installation.
- Do not install the ESS in an easily accessible position because the temperature of the enclosure and heat sink is high when the ESS is running.
- Do not install the ESS on a moving object, such as ship, train, or car.
- 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 direct sunlight, 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.
- Do not install the equipment outdoors in salt-affected areas because it may be corroded. A salt-affected area refers to the region within 500 m of the coast or prone to sea breeze. Regions prone to sea breeze vary with weather conditions (such as typhoons and monsoons) or terrains (such as dams and hills).
- Before installation, operation, and maintenance, clean up any water, ice, snow, or other foreign objects on the top of the equipment.
- When installing the equipment, ensure that the installation surface is solid enough to bear the weight of the equipment.
- After installing the equipment, remove the packing materials such as cartons, foam, plastics, and cable ties from the equipment area.

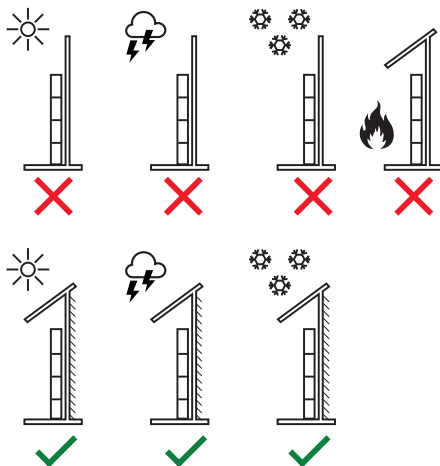


Figure 1.3. Installation environment

**NOTE** – The operation and service life of the ESS depend on the operating temperature. Install the ESS at a temperature equal to the ambient temperature or in a better environment.

**NOTE** – The operating temperature of the ESS ranges from  $-20^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ . If the ESS is installed in a cold environment, the built-in thermal control system starts to heat the batteries to achieve better performance. The heating process consumes rechargeable power, which reduces the system energy efficiency in cold weather.

**NOTE** – If the ESS is stored in a cold environment (for example,  $0^{\circ}\text{C}$ ) before installation, the ESS needs some time (< 2 hours) to heat up before it can be charged. You are advised to place the ESS in a warm place before installation to facilitate commissioning.

**NOTE** – If the ambient temperature of the ESS is higher than  $+45^{\circ}\text{C}$  or lower than  $-10^{\circ}\text{C}$ , the battery charge and discharge power will be derated.

## 1.4 Mechanical Safety

**FORBIDDEN** – 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.

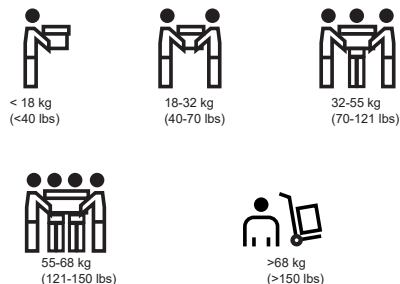
**WARNING** – Do not drill holes into the equipment. Doing so may affect the sealing performance and electromagnetic containment of the equipment and damage components or cables inside. Metal shavings from drilling may short-circuit boards inside the equipment.

### 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.

### 1.4.1 Moving Heavy Objects

- 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.
- 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.

### Working at Heights

- 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.

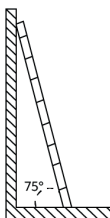
### Using Ladders

- Use wooden or insulated ladders when you need to perform live-line working at heights.
- Platform ladders with protective rails are preferred. Single ladders are not recommended.
- 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.



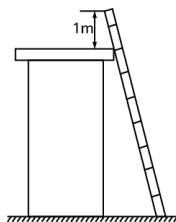
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- When climbing up the ladder, keep your body stable and your center of gravity between the side rails, and do not overreach to the sides.
- When a step ladder is used, ensure that the pull ropes are secured.
- If a single ladder is used, the recommended angle for the ladder against the floor is 75 degrees, as shown in the following figure. A square can be used to measure the angle.



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- If a single ladder is used, ensure that the wider end of the ladder is at the bottom, and take protective measures to prevent the ladder from sliding.
- If a single ladder is used, do not climb higher than the fourth rung of the ladder from the top.
- If you use a single ladder to climb up to a platform, ensure that the ladder is at least 1 m higher than the platform.



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### Drilling Holes

Obtain consent from the customer and contractor before drilling holes.

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, protect the equipment from shavings. After drilling, clean up any shavings.

## 1.5 Battery Safety

- ⚠ **DANGER** – 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.
- ⚠ **DANGER** – Do not expose batteries at high temperatures or around heat sources, such as scorching sunlight, fire sources, transformers, and heaters. Battery overheating may cause leakage, smoke, flammable gas release, thermal runaway, fire, or explosion.
- ⚠ **DANGER** – Protect batteries from mechanical vibration, falling, collision, punctures, and strong impact. Otherwise, the batteries may be damaged or catch fire.
- ⚠ **DANGER** – 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.
- ⚠ **DANGER** – Do not touch battery terminals with other metal objects, which may cause heat or electrolyte leakage.
- ⚠ **DANGER** – 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.
- ⚠ **DANGER** – 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.
- ⚠ **DANGER** – A battery is an enclosed system and will not release any gases under normal operations. If a battery is improperly treated, for example, burnt, needle-pricked, squeezed, struck by lightning, overcharged, or subject to other adverse conditions that may cause battery thermal runaway, the battery 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 H<sub>2</sub>. To prevent fire or device corrosion, ensure that flammable gas is properly exhausted.
- ⚠ **DANGER** – The gas generated by a burning battery may irritate your eyes, skin, and throat. Take protective measures promptly.
- ⚠ **WARNING** – Install batteries in a dry area. Do not install them 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 unpacking, storage, and transportation, ensure that the packing cases are intact and the batteries are correctly placed according to the labels on the packing cases. Do not place a battery upside down or vertically, lay it on one side, or tilt it. Stack the batteries according to the stacking requirements on the packing cases. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.
- ⚠ **WARNING** – After unpacking batteries, place them in the required direction. Do not place a battery upside down or vertically, lay it on one side, tilt it, or stack it. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.
- ⚠ **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 batteries are discharged, charge them in time to avoid damage due to overdischarge.

### 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 overdischarged 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.
  - 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.
- The battery warranty period has expired. You are advised not to use a battery whose warranty period has expired, as this poses safety risks.

### General Requirements

- 📌 **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.
- Use batteries within the specified temperature range. When the ambient temperature of the batteries is lower than the allowed range, do not charge the batteries to prevent internal short circuits caused during low-temperature charging.
- Before unpacking batteries, check whether the packaging is intact. Do not use batteries with damaged packaging. If any damage is found, notify the carrier and manufacturer immediately.
- Power on batteries within 24 hours after unpacking. If the batteries cannot be powered on in time, put them in the original packaging and place them in a dry indoor environment without corrosive gases. During later maintenance, ensure that the power-off time



does not exceed 24 hours.

- 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 working on a battery, ensure that there is no irritant or scorched smell around the battery.
- When installing batteries, do not place installation tools, metal parts, or sundries on the batteries. After the installation is complete, clean up the objects on the batteries and the surrounding area.
- If batteries are exposed to water accidentally, do not install them. Instead, transport the batteries to a safe isolation point and dispose of them in a timely manner.
- Before installing a battery pack, check that its enclosure is not deformed or damaged.
- 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.
- Do not charge or discharge batteries by using a device that does not comply with local laws and regulations.
- Keep the battery loop 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

### Short-Circuit Protection

- When installing and maintaining batteries, wrap the exposed cable terminals on the batteries with insulation tape.
- Avoid foreign objects (such as conductive objects, screws, and liquids) from entering a battery, as this may cause short circuits.

### Recycling

- Dispose of waste batteries in accordance with local laws and regulations. Do not dispose of batteries as household waste. Improper disposal of batteries may result in environmental pollution or an explosion.
- If a battery leaks or is damaged, contact technical support or a battery recycling company for disposal.
- If batteries are out of service life, contact a battery recycling company for disposal.
- Do not expose waste batteries to high temperatures or direct sunlight.
- Do not place waste batteries in environments with high humidity or corrosive substances.
- Do not use faulty batteries. Contact a battery recycling company to scrap them as soon as possible to avoid environmental pollution.



## 2. Product Introduction

### 2.1 Overview

The battery energy storage system (BESS) consists of a charger and battery expansion modules. It can store and release electric energy based on the requirements of the inverter management system. The input and output ports of the BESS are high-voltage direct current (HVDC) ports.

- **Charge:** The power control module connects to the battery terminals (BAT+ and BAT-) of the inverter. Under the control of the inverter, the BESS is charged to store surplus PV energy.
- **Discharge:** When the PV energy is insufficient for the loads, the system controls the BESS to supply power to the loads through the inverter.

#### BESS Capacity Description

The BESS supports power and capacity expansion. Two battery energy storage system can be connected in parallel. One charger supports a maximum of three battery expansion modules.

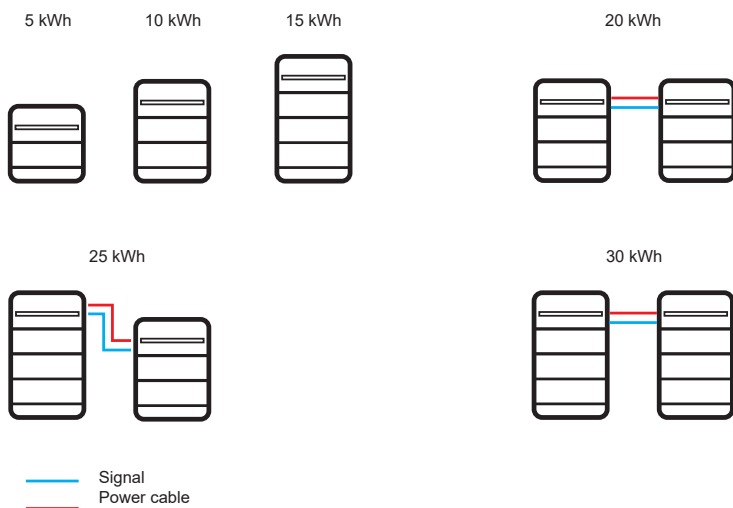


Figure 2.1. BESS capacity description

## 2.2 Appearance

### BESS

This section describes the appearance of the entire BESS.

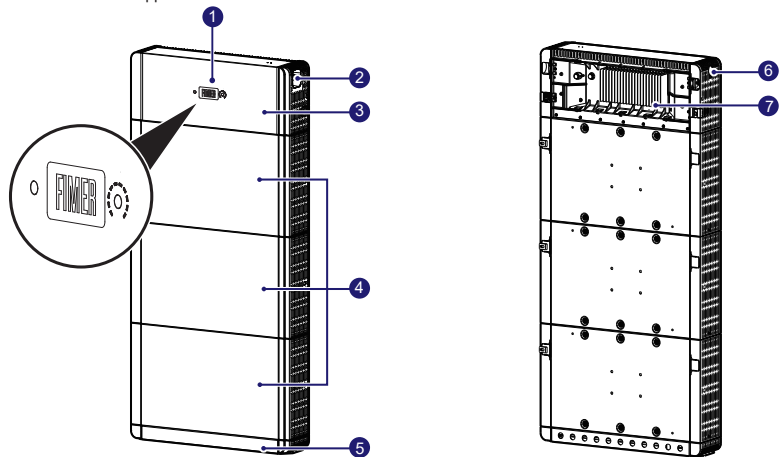


Figure 2.2. BESS appearance

- |                               |                           |                        |
|-------------------------------|---------------------------|------------------------|
| (1) LED indicators            | (2) DC switch (DC SWITCH) | (3) Charger            |
| (4) Battery expansion modules | (5) Mounting base         | (6) Black start switch |
| (7) Heat sink                 |                           |                        |

### Charger

The power of the charger is 5 kW.

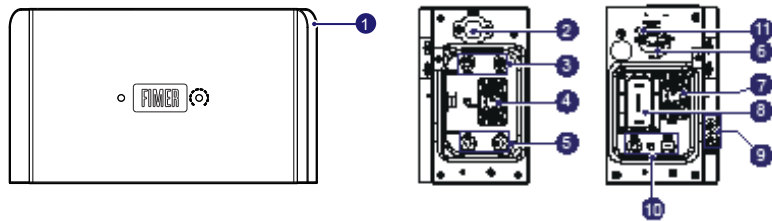


Figure 2.3. Power control module

- |                                    |  |                                   |
|------------------------------------|--|-----------------------------------|
| (1) Charger                        | (2) Black start switch                   | (3) Battery terminals (BAT+/BAT-) |
| (4) COM port (COM)                 | (5) Battery cascading terminals (B+/B-)  | (6) DC switch (DC SWITCH)         |
| (7) COM port (COM)                 | (8) Fuse                                 | (9) Ground points                 |
| (10) Battery terminals (BAT-/BAT+) | (11) DC switch locking screw hole (M4) a |                                   |

**NOTE** – A: (Optional) Remove the protective cap and install the locking screw that secures the DC SWITCH to prevent misoperations.

Battery Expansion Module

The standard capacity of a battery expansion module is 5 kWh.

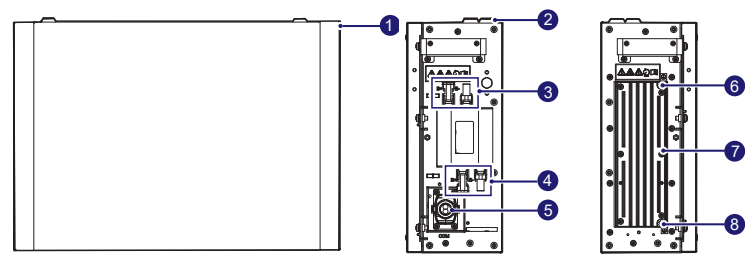


Figure 2.4. Battery expansion module

(1) Battery expansion module	(2) Bosses for alignment	(3) Battery cascading terminals (B+/B–)
(4) Battery cascading terminals (B+/B–)	(5) COM port (COM)	(6) Ground point
(7) Heat sink	(8) Ground point	

2.3 Label Description






Component	Name	Meaning
 <div><b>WARNING</b> Never touch the enclosure of an operating battery.</div>	Burn warning	Do not touch the BESS, as the enclosure is hot when the BESS is running.
 <div><b>DANGER</b> Start maintaining the battery at least 5 minutes after the battery disconnects from all external power supplies.</div>	Delayed discharge	High voltage exists after the BESS is powered on. Residual voltage still exists after the BESS is powered off. It takes 5 minutes for the BESS to discharge to the safe voltage.
 <div><b>DANGER</b> Only certified professionals are allowed to install and maintain the battery. High touch current, earth connection essential before connecting supply.</div>	Operation	<ul style="list-style-type: none"><li>• High voltage exists after the BESS is powered on. Only qualified and trained electrical technicians are allowed to install and operate the BESS.</li><li>• Ground the BESS before powering it on.</li></ul>
 <div><b>CAUTION</b> Read instructions carefully before performing any operation on the battery.</div>	Refer to documentation	Reminds operators to refer to the documentation provided with the BESS.
	Grounding	Indicates the position for connecting the PE cable.

Table 2.1. Enclosure label description

The labels are for reference only.

Nameplate

The nameplate contains the trademark, product model, important technical specifications, compliance symbols, company name, and place of origin.

2.4 Features

Multi-Scenario and Multi-Working Mode

- Supports multiple working modes such as grid-tied, grid-tied and off-grid, pure off-grid multi-scenario, self-consumption, and full fed to the grid modes.
- Allows users to query the total discharge capacity in the product life cycle in real time.

Intelligent and Simple Operation

- Works with the inverter, supports plug-and-play, and integrates the mobile phone app and management system.

Easy Installation and Replacement

- Standard battery DC terminals are used for system connection.
- Modular design is adopted for batteries.
- The installation or replacement can be performed by two persons.

Flexible Scalability

The battery supports power expansion, battery capacity expansion, and hybrid use of old and new batteries.

Intelligent O&M

- The factory defaults meet the requirements of target markets and the battery can be started by pressing only one button and supports black startup.
- The LED indicator shows the status. You can also use the mobile phone app to perform local and remote operations.
- The cloud data management system is used to manage the battery anytime and anywhere.

Low Investment

- Only common installation tools are required.
- The battery features high efficiency and power density, which saves installation space.
- The battery features easy O&M.

2.5 Working Modes

The BESS converts high-voltage DC power generated by PV strings to low-voltage DC through the DC-DC converter and stores the low-voltage DC power in the battery expansion modules. The BESS also converts low-voltage DC power from the battery expansion modules to high-voltage DC power, which is then converted to AC power through the inverter.

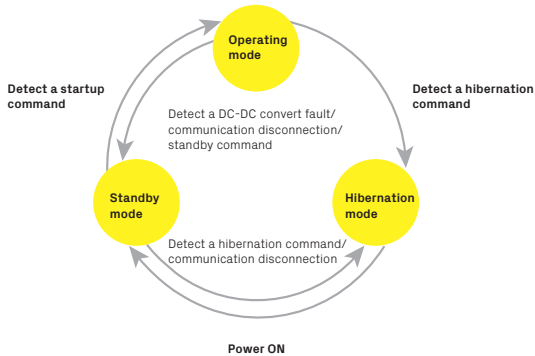
Working Modes

The BESS works in hibernation, standby, or operating mode.

Table 2.2. working modes

Working Mode	Description
Hibernation mode	The internal auxiliary power source and DC-DC converter of the BESS do not work.
Standby mode	The auxiliary power source inside the BESS works, and the DC-DC converter does not work.
Operating mode	The internal auxiliary power source of the BESS works, and the DC-DC converter charges or discharges.

Table 2.3. Working modes



## 3. Transportation and Storage

### 3.1 Handling 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.
- 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.

**⚠ 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.

**⚠ WARNING** – Before unpacking, storage, and transportation, ensure that the packing cases are intact and the batteries are correctly placed according to the labels on the packing cases. Do not place a battery upside down or vertically, lay it on one side, or tilt it. Stack the batteries according to the stacking requirements on the packing cases. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.

- 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.
- 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.
- 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.
- 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, and sharp objects are not allowed 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.
- Store batteries in a separate area away from heat sources. Protect batteries from moisture, water, and rain. Stack batteries according to the labels on the packing case. Do not stack batteries more than the allowed stacking layers. Do not place batteries on one side or upside down.
- 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.

- Ensure that batteries are delivered based on the “first in, first out” rule.
- Ensure that the storage duration starts from the latest charge time marked on the battery packing case and that the latest charge time is updated after every charge.

## 3.2 Storage Requirements

**⚠ WARNING** – Ensure that batteries are stored in a dry, clean, and ventilated indoor environment that is free from sources of strong infrared or other radiations, organic solvents, corrosive gases, and conductive metal dust. Do not expose batteries to direct sunlight or rain and keep them far away from sources of heat and ignition.

**⚠ WARNING** – If a battery is faulty (with scorch, leakage, bulge, or water intrusion), move it to a dangerous goods warehouse for separate storage. The distance between the battery and any combustible materials must be at least 3 m. The battery must be scrapped as soon as possible.
















**⚠ WARNING** – Place batteries correctly according to the signs on the packing case during storage. Do not place batteries upside down, lay them on one side, or tilt them. Stack batteries in accordance with the stacking requirements on the packing cases.

**⚠ WARNING** – Store batteries in a separate place. Do not store batteries together with other devices. Do not stack batteries too high. If a large number of batteries are stored onsite, it is recommended that the site be equipped with qualified fire fighting facilities, such as fire sand and fire extinguishers.

**⚠ CAUTION** – It is recommended that batteries be used soon after being deployed onsite. Batteries that have been stored for an extended period shall be charged periodically. Otherwise, they may be damaged.

- The storage environment must comply with local regulations and standards.
- The storage environment must be clean and dry. The product must be protected against rain and water.
- The air must not contain corrosive or flammable gases.
- The storage environment requirements are as follows:
  - Ambient temperature: -10–55°C; recommended storage temperature: 20–30°C
  - Relative humidity: 5% to 80%
- If a battery has been stored for longer than the allowed period, it must be checked and tested by professionals before use.
- Proof that the product is stored according to the requirements must be available, such as temperature and humidity log data, storage environment photos, and inspection reports.

## 4. System Installation

-  **DANGER** – Note the polarities when installing batteries. Do not connect the positive and negative poles of a battery or battery string together. Otherwise, the battery may be short-circuited.
-  **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** – When installing batteries, do not place installation tools, metal parts, or sundries on the batteries. After the installation is complete, clean up the objects on the batteries and the surrounding area.
-  **WARNING** – After unpacking batteries, place them in the required direction. Do not place a battery upside down or vertically, lay it on one side, tilt it, or stack it. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.
-  **CAUTION** – Slowly push or move battery packs to prevent damage and collision.
-  **CAUTION** – To prevent battery packs from falling off, start the pallet truck or forklift after confirming that battery packs are securely bound.
-  **CAUTION** – When moving batteries, do not remove protective components such as protective covers or waterproof caps from battery terminals.
-  **CAUTION** – Exercise caution when moving batteries to prevent bumping and ensure personal safety.
-  **CAUTION** – Install and secure batteries horizontally from the bottom up and from left to right to prevent falling over due to imbalance.
-  **CAUTION** – When connecting batteries, ensure that the spring washer on the screw is leveled, that the protruding part of the terminal on the cable faces outwards, and that the cable is intact.
-  **CAUTION** – Install and secure batteries horizontally from the bottom up and from left to right to prevent falling over due to imbalance.
-  **CAUTION** – Ensure that the power circuit breaker is OFF before installing batteries.
-  **CAUTION** – Keep the battery loop disconnected during installation and maintenance.
-  **NOTICE** – 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.
-  **NOTICE** – Before installing a battery pack, check that its enclosure is not deformed or damaged.

### 4.1 Checking Before the Installation

#### Checking the Outer Packing

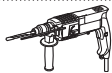

























- Before unpacking the battery, check the outer packing for damage, such as holes and cracks, and check the battery model. If any damage is found or the battery model is not what you requested, do not unpack the product and contact your dealer as soon as possible.

#### Checking Deliverables

- After unpacking the battery, check that the deliverables are intact and complete, and free from any obvious damage. If any item is missing or damaged, contact your dealer.

-  **NOTE** – For details about the number of deliverables delivered with the battery, see the Packing List in the packing case.

## 4.2 Preparing Tools and Instruments

Type	Tools and Instruments		
Installation			
	Hammer drill (with a drill bit of 8 mm)		Disassembly and Assembly Tool (model: PV-MS-HZ open-end wrench)
	Torque socket wrench		Cable tie
	Torque wrench		Vacuum cleaner
	Diagonal pliers		Multimeter (DC voltage measurement range $\geq 600$ V DC)
	Wire strippers		Marker
	Torque screwdriver		Steel measuring tape
	Rubber mallet		Level
	Utility knife		Hydraulic pliers
	Cable cutter		Heat-shrink tubing
	Crimping tool (model: PV-CZM-22100/19100)		Heat gun
	Cord end terminal crimper		
Personal protective equipment (PPE)			
	Insulated gloves		
	Protective gloves		
	Dust mask		
	Safety boots		
	Safety goggles		



### 4.3 Determining the Installation Position

#### Installation Angle Requirement

The BESS can be installed on a floor or wall. The installation angle requirement is as follows:

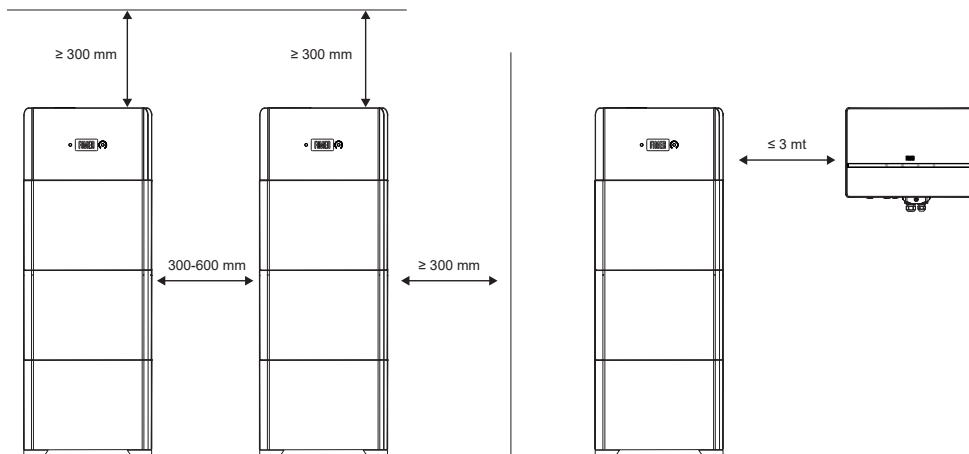
- Do not install the BESS at forward tilted, back tilted, side tilted, horizontal, or upside down positions.

#### Installation Position Requirements

Install the BESS on a solid brick-concrete structure or concrete wall or floor. If other types of walls and floors are used, they must be made of fire-retardant materials and meet the load-bearing requirements of the equipment.

#### Installation Clearance Requirements

- During installation, ensure that there is no other equipment (except related equipment and awnings) or flammable or explosive materials around the BESS. Reserve sufficient clearances for heat dissipation and safety isolation.
- When mounting the BESS on a wall, do not place any objects under the BESS.



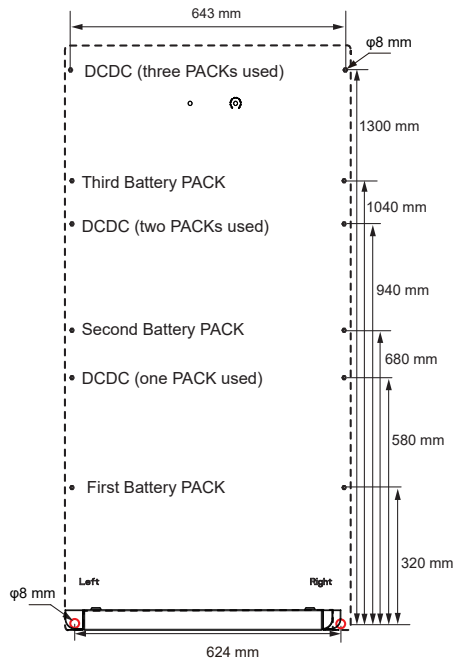
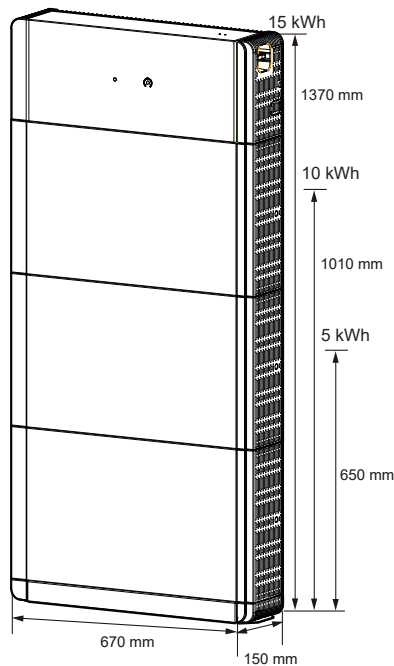
4.4 Device Installation

4.4.1 Floor-Mounted Installation

Installation Precautions

Shows the dimensions of floor-mounting holes for the BESS.

Figure 4.1. Floor-mounted installation dimensions



Procedure

Step 1

Align the floor support with the wall surface and keep the support 10 mm to 15 mm away from the wall surface. Level the hole positions using a level, and mark the hole positions for installing the floor support using a marker. Align the marking-off template with the surface of the floor mounting kit, determine the drilling positions on the wall for securing the power control module, and mark the positions using a marker.

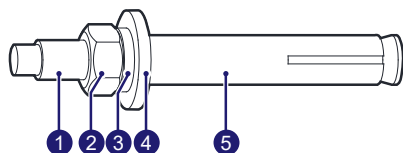
Step 2

Install the floor support.

**⚠ DANGER –** Avoid drilling holes into the water pipes or power cables buried in the wall.

**📖 NOTE –** Use the M6x60 expansion bolts delivered with the product to secure the floor support. If the length or quantity of the M6x60 expansion bolts cannot meet the installation requirements, prepare M6 stainless steel expansion bolts by yourself. The expansion bolts delivered with the product are used for solid brick-concrete walls and concrete floors. If other types of walls and floors are used, ensure that the load-bearing capacity requirements (the weight of one battery expansion module is 50 kg) are met and appropriate bolts are selected.

Figure 4.2. M6 expansion bolt structure



- (1) Bolt                      (2) Nut                      (3) Spring washer  
 (4) Flat washer          (5) Expansion sleeve

**NOTICE** – To prevent dust inhalation or contact with eyes, wear safety goggles and an anti-dust mask when drilling holes.

**NOTICE** – Wipe away any dust in or around the holes and measure the hole distances. If the holes are inaccurately positioned, drill holes again.

**NOTICE** – Level the head of the expansion sleeve with the concrete wall or floor after removing the nut, spring washer, and flat washer. Otherwise, the mounting kit will not be securely installed on the wall or ground.

**NOTICE** – Loosen the nut, spring washer, and flat washer of the expansion bolt at the bottom.

1

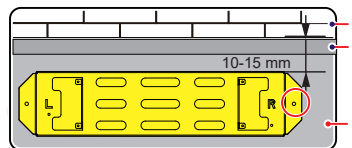
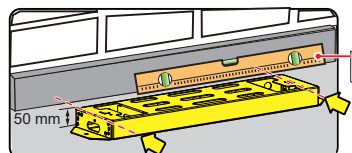
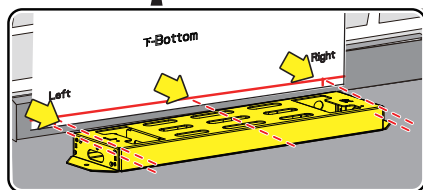
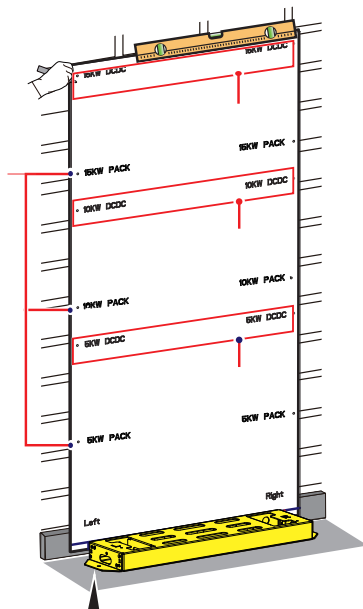
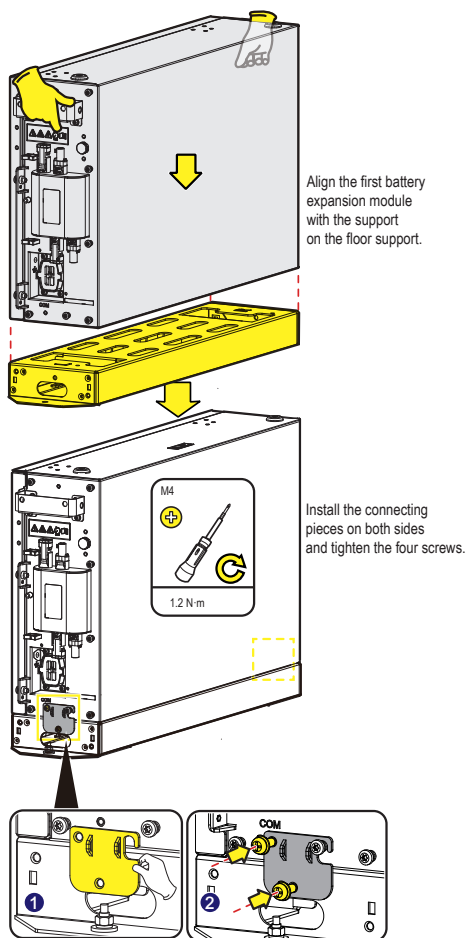
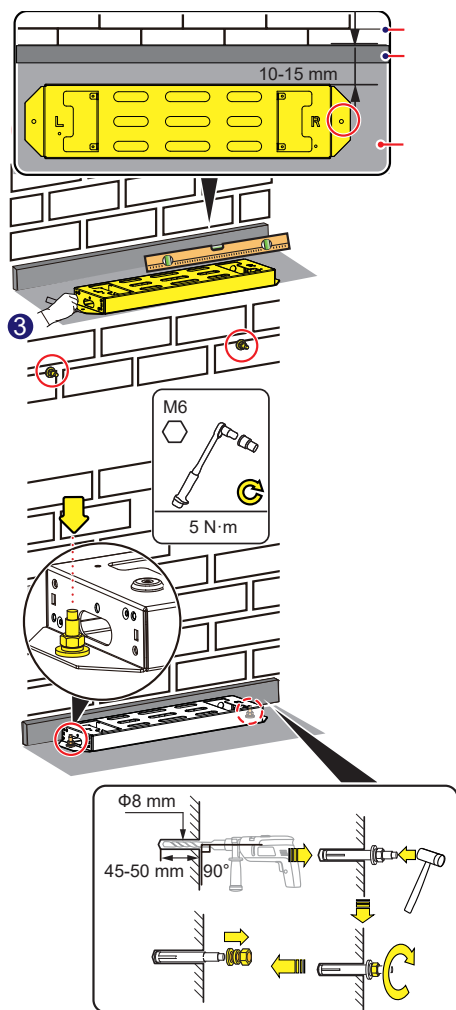


Figure 4.3. Installing expansion bolts

2





### Step 3

Place the first battery expansion module on the floor support, install the connecting pieces on both sides, and tighten the four screws. Install the remaining battery expansion modules and power control module from bottom to top.

**⚠ WARNING** – After installing a module, install and tighten the connecting pieces and screws on the left and right sides of the module, and then install the next module.

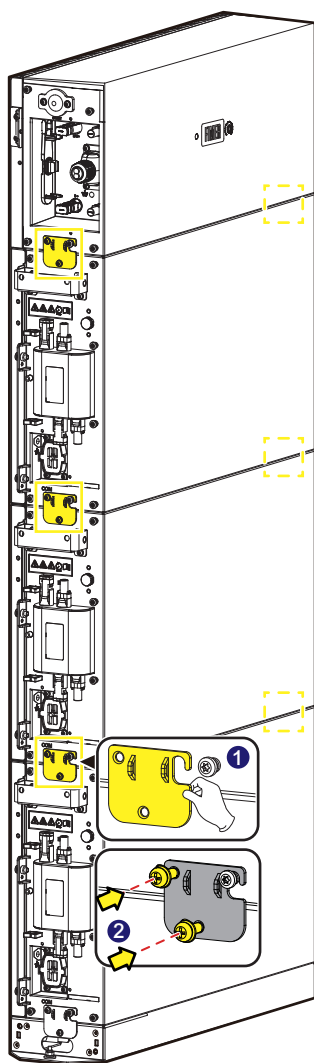


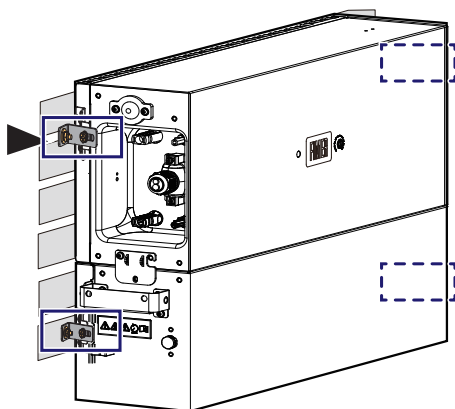
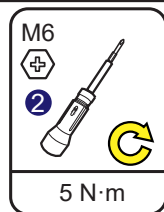
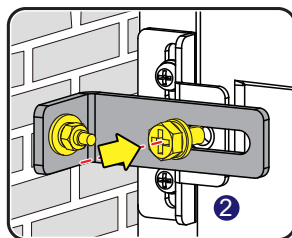
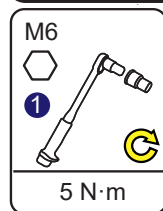
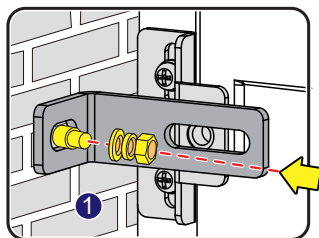
Figure 4.4. Installing the battery expansion modules and power control module

#### Step 4

Secure the power control module to the wall.

**⚠ WARNING –** The power control module (DCDC) must be secured on a wall. If the device is installed in an earthquake-prone area or a place prone to vibration, you are advised to mark mounting holes for battery expansion modules, drill holes, and install expansion bolts in step 2.

Figure 4.5. Fixing the power control module

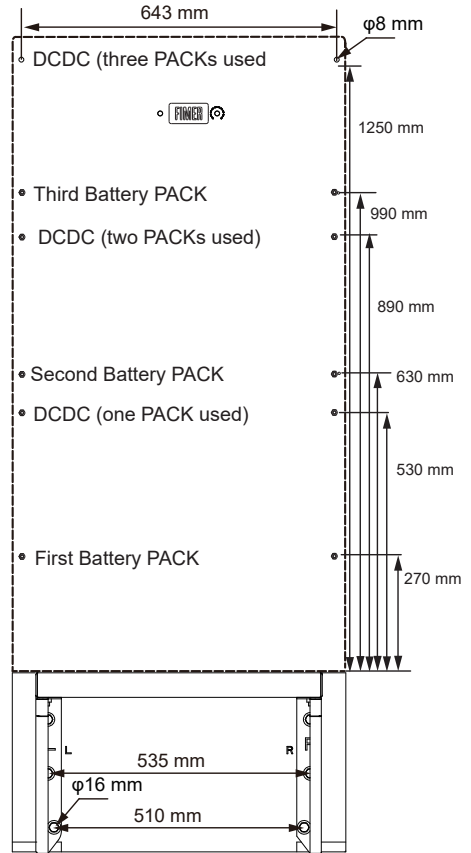
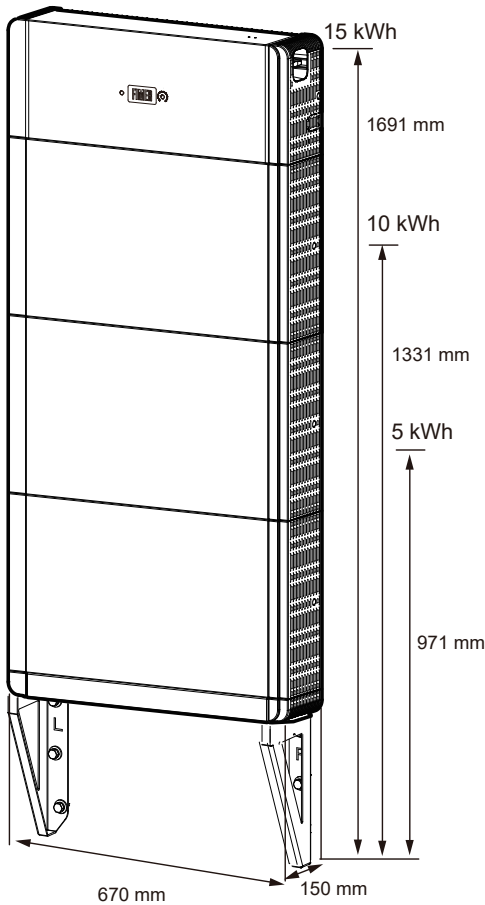


### 4.4.2 Wall-Mounted Installation

#### Installation Precautions

shows the dimensions of wall-mounting holes for the BESS.

Figure 4.6. Wall-mounted installation dimensions



#### Procedure

##### Step 1

Determine the positions for drilling holes using the marking-off template. Level the positions of mounting holes using a level, and mark the positions with a marker.

##### Step 2

Install the mounting bracket.

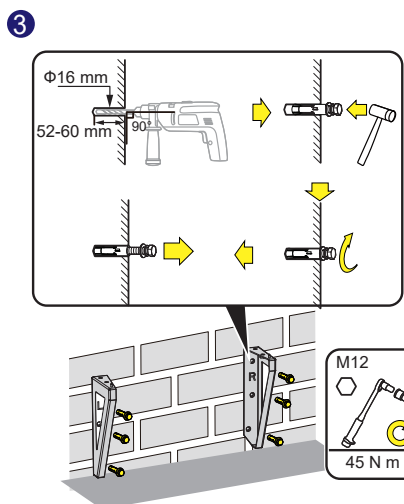
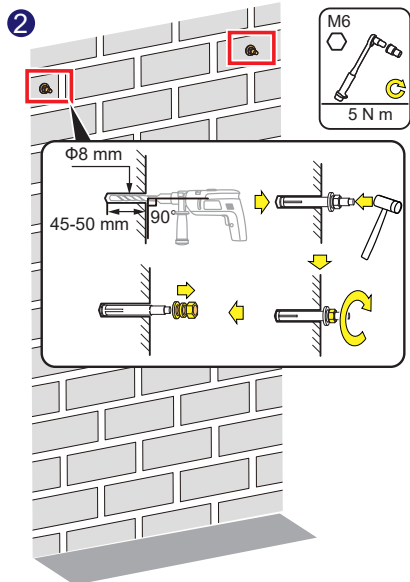
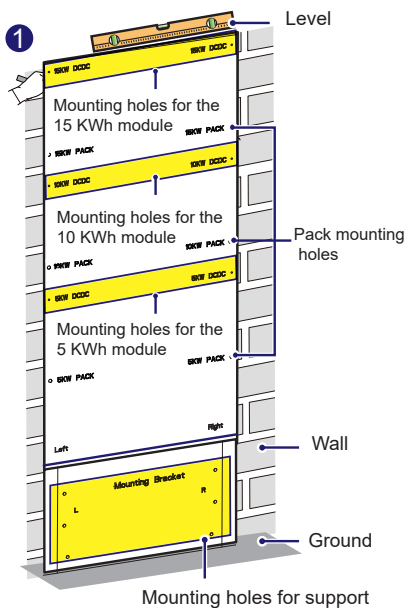
**⚠ DANGER** – Avoid drilling holes into the water pipes or power cables buried in the wall.

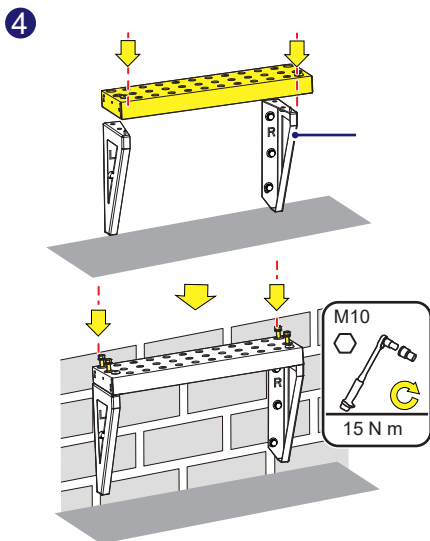
**📖 NOTE** – Use the M6x60 expansion bolts delivered with the product to secure the wall-mounting support. If the length or quantity of the M6x60 expansion bolts cannot meet the installation requirements, prepare M6 stainless steel expansion bolts by yourself. The expansion bolts delivered with the product are used for solid brick-concrete walls and concrete floors. If other types of walls and floors are used, ensure that the load-bearing capacity requirements (the weight of one battery expansion module is 50 kg) are met and appropriate bolts are selected.

**NOTE** – Use the M12x60 expansion bolts delivered with the product to secure the wall-mounting support. If the length or quantity of the expansion bolts cannot meet the installation requirements, prepare M12 stainless steel expansion bolts by yourself.

**NOTE** – M6x60 expansion bolts delivered with the product are used to fix the power control module. If the length and quantity of the bolts do not meet installation requirements, prepare M6 stainless steel expansion bolts by yourself.

Figure 4.7. Wall-mounted installation





### Step 3

Place the first battery expansion module on the wall-mounting support, install the left and right connective pieces, and install the second battery expansion module, third battery expansion module, and power control module from bottom to top.

**⚠ WARNING** – After installing a module, install and tighten the connecting pieces and screws on the left and right sides of the module, and then install the next module.

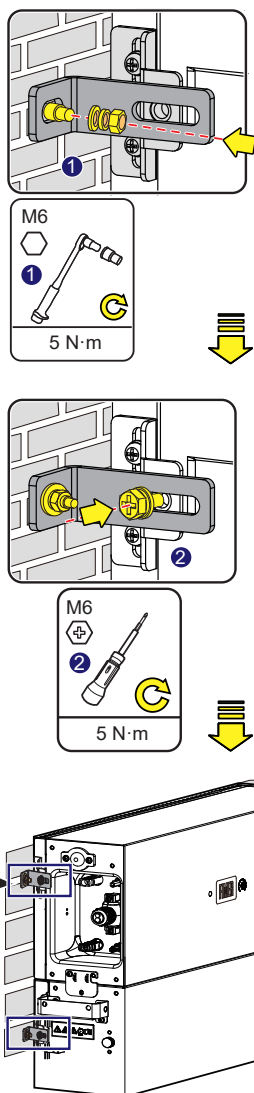
### Step 4

Secure the power control module and battery expansion modules to the wall.

**⚠ WARNING** – The power control module and battery expansion modules must be fixed on the wall to prevent the BESS from falling down.

**⚠ WARNING** – Figure 4-8 Fixing the power control module

Figure 4.8.Fixing the power control module





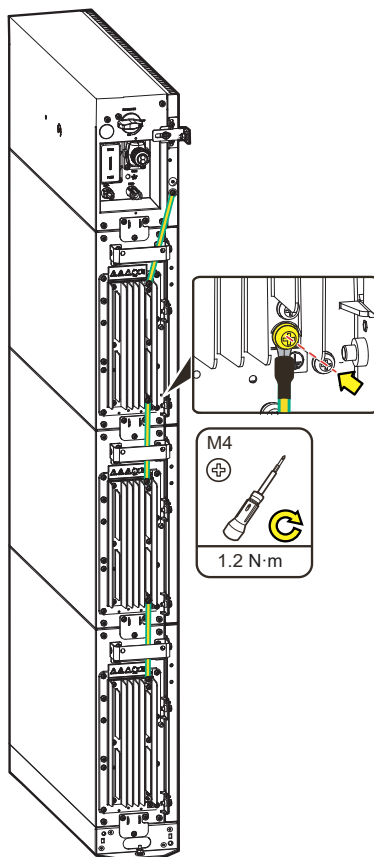
## 5. Electrical Connection

- ⚠ **DANGER** – Before connecting cables, ensure that the DC SWITCH on the BESS and all switches connected to the BESS are OFF. Otherwise, the high voltage of the BESS may result in electric shocks.
- ⚠ **DANGER** – Note the polarities when installing batteries. Do not connect the positive and negative poles of a battery or battery string together. Otherwise, the battery may be short-circuited.
- ⚠ **DANGER** – Do not smoke or have an open flame around batteries.
- ⚠ **DANGER** – Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.
- ⚠ **WARNING** – Equipment damage caused by incorrect cable connections is not covered by the product warranty.
- ⚠ **WARNING** – Only certified electricians are allowed to connect cables.
- ⚠ **WARNING** – Operation personnel must wear proper PPE when connecting cables.
- ⚠ **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** – When installing batteries, do not place installation tools, metal parts, or sundries on the batteries. After the installation is complete, clean up the objects on the batteries and the surrounding area.
- ⚠ **CAUTION** – Do not connect two or more cables to the positive or negative power port of a battery in parallel.
- ⚠ **CAUTION** – Stay away from the equipment when preparing cables to prevent cable scraps from entering the equipment. Cable scraps may cause sparks and result in personal injury and equipment damage.
- 📖 **NOTE** – The cable colors shown in the electrical connection diagrams provided in this chapter are for reference only. Select cables in accordance with local cable specifications (green-and-yellow cables are only used for PE).

### Step 1

Connect the PE cable to the battery power control modules and battery expansion modules.

Figure 5.1. Connecting the internal PE cable



### 5.1 Internal Electrical Connections of the Battery

- 📖 **NOTE** – Internal cables are delivered with the battery. For details, see the Packing List in the packing case.

#### 5.1.1 Installing an Internal PE Cable

##### Precautions

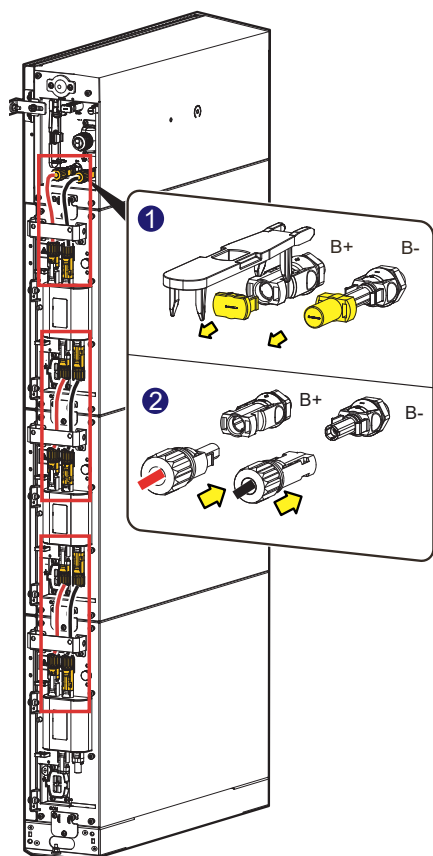
- ⚠ **DANGER** – Ensure that the PE cable is securely connected. Otherwise, electric shocks may occur.
- 📖 **NOTE** – It is recommended that silica gel or paint be used around the ground terminal after the PE cable is connected.

### 5.1.2 Installing Internal DC Terminals

#### Step 1

Insert the positive and negative connectors delivered with the device into the positive and negative battery cascading terminals (B+ and B-).

Figure 5.2. Internal DC power cable connection



**NOTE** – The DC terminals between the power control module and the battery expansion modules use the DC connection cable (Amphenol terminal) delivered with the battery.

**NOTICE** – After the positive and negative connectors snap into place, pull the DC input power cables back to ensure that they are connected securely.

### 5.1.3 Connecting Internal Signal Cables

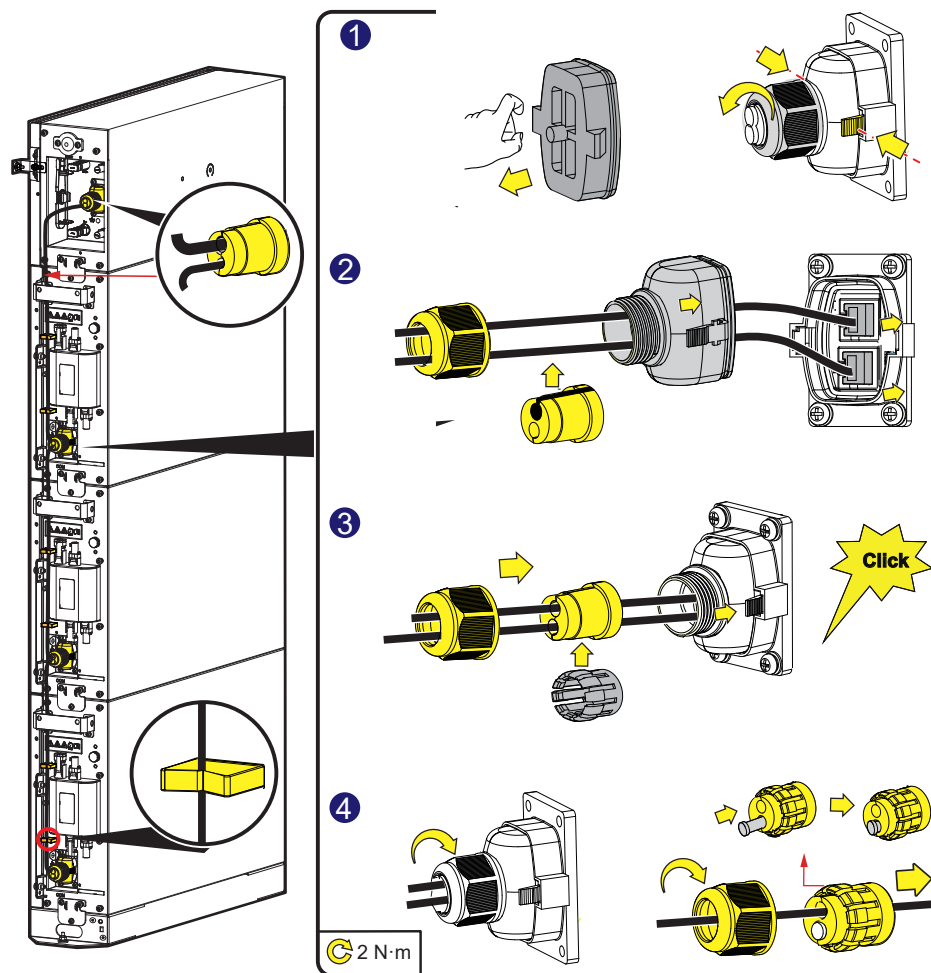
#### Connecting Signal Cables Between the Power Control Module and Battery Expansion Modules

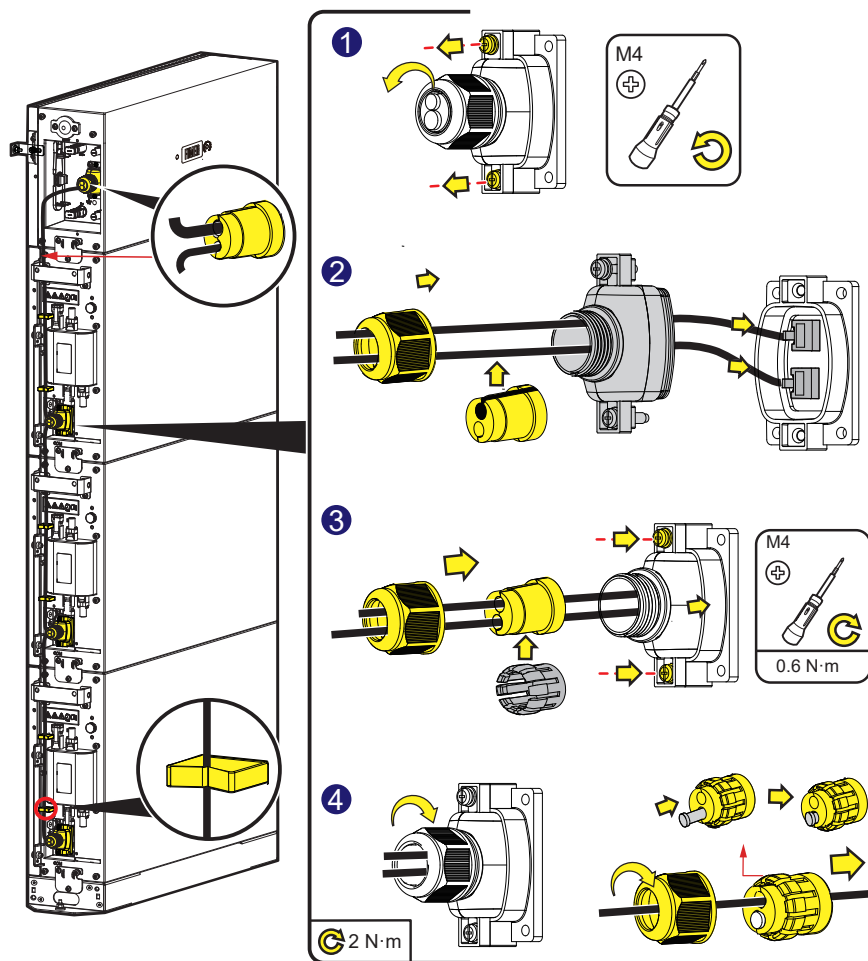
**NOTE** – The protective housings of the communications terminals delivered with the device can be fastened with snap-fits or screws based on the actual diagram.

**NOTE** – Connect the communications terminals of the power control module and battery expansion modules in sequence and secure them using cable clips. Install signal cables with a diameter of 5 mm and corresponding rubber plugs as described in this section. Do not use signal cables with a diameter of 7 mm. Do not install a cable with a diameter of 5 mm into a rubber plug with the 7 mm opening, which is intended for cables connected to an inverter or cascaded batteries.

Figure 5.4. Securing with screws

Figure 5.3. Securing with snap-fits





**NOTE** – When a communications terminal is connected to a single network cable, a waterproof rubber plug must be installed. Do not install a 5 mm cable in the rubber plug with the 7 mm opening

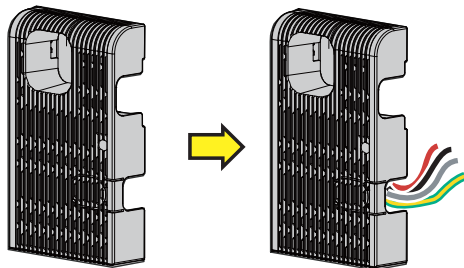
**NOTE** – After inserting the terminal housing into the COM port, shake the housing leftward and rightward and try to pull it back to ensure that it is securely installed. Tighten the nut (ensure that the rubber plug is tightly compressed). Otherwise, the waterproof performance will be affected.

## 5.2 External Electrical Connections of the Battery

### Routing Cables Out of the Cable Hole

Cut a cable hole based on the cabling mode, and route external cables through the cable hole.

Figure 5.5. Routing cables out of the cable hole



**NOTICE** – Before connecting external cables, route the cables through the cable hole to avoid disconnecting after installation.

### 5.2.1 Installing a PE Cable

#### Precautions

**DANGER** – Ensure that the PE cable is securely connected. Otherwise, electric shocks may occur.

**NOTE** – It is recommended that silica gel or paint be used around the ground terminal after the PE cable is connected.

#### Procedure

##### Step 1

Crimp an OT terminal.

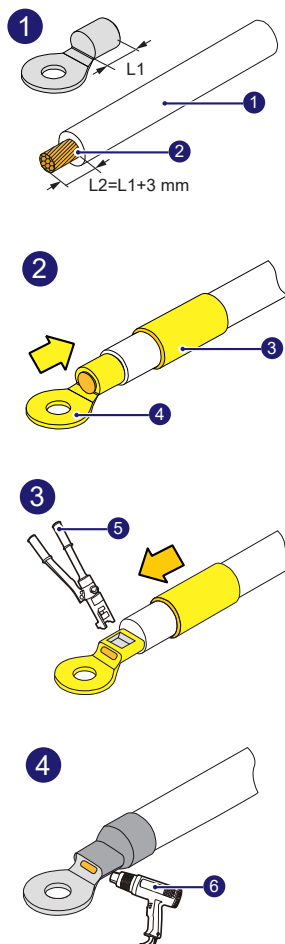
**NOTICE** – Avoid scratching the core wire when stripping a cable.

**NOTICE** – The cavity formed after the conductor crimp strip of the OT terminal is crimped must wrap the core wires completely. The core wires must contact the OT terminal closely.

**NOTICE** – Wrap the wire crimping area with heat shrink tubing or insulation tape. The heat shrink tubing is used as an example.

**NOTICE** – When using a heat gun, protect the equipment from being scorched.

Figure 5.6. Crimping an OT terminal

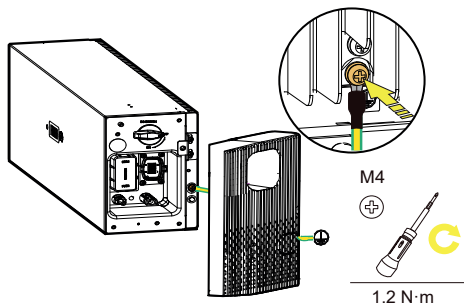


(A) Core wire (B) Insulation layer (C) Heat shrink tubing  
(D) Heat gun (E) Hydraulic pliers

##### Step 2

Connect the ground point of the power control module to the external ground point.

Figure 5.7. Grounding the PE cable



**NOTE** – Apply silicone grease or paint around the ground terminal after the PE cable is connected.

## 5.2.2 Installing DC Input Power Cables

### Connect DC input power cables to the inverter

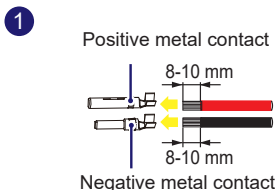
Insert the positive and negative battery connectors (Staubli) into the corresponding DC input terminals (BAT+ and BAT–).

**NOTE** – The DC input terminals (BAT+ and BAT–) on the left and right sides of the battery are the same.

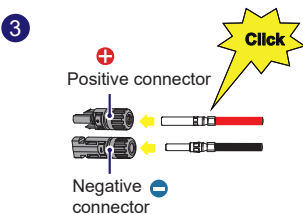
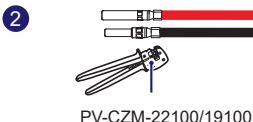
#### Step 1

Assemble DC connectors.

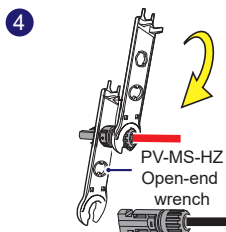
Figure 5.8. Assembling DC connectors



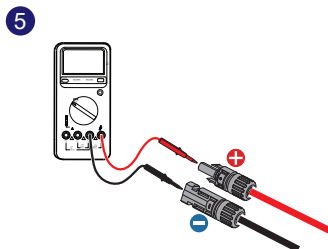
Ensure that the cable cannot be pulled out after being crimped.



Use the wrench shown in the figure to tighten the locking nut. When the wrench slips during the tightening, the locking nut has been tightened.



Use a multimeter set to the DC position to measure the DC voltage.



**CAUTION** – Use the Staubli MC4 positive and negative metal terminals and DC connectors delivered with the product. Using other positive and negative metal terminals and DC connectors may result in serious consequences, such as cable overheating, burning, and module damage. The resulting device damage is not covered by the product warranty.

**NOTICE** – Keep the DC input BAT+ cable and BAT– cable close to each other.

**NOTICE** – Cables with high rigidity, such as armored cables, are not recommended as DC input power cables to avoid cable folding.

**NOTICE** – Before assembling DC connectors, label the cable polarities correctly to ensure correct cable connections.

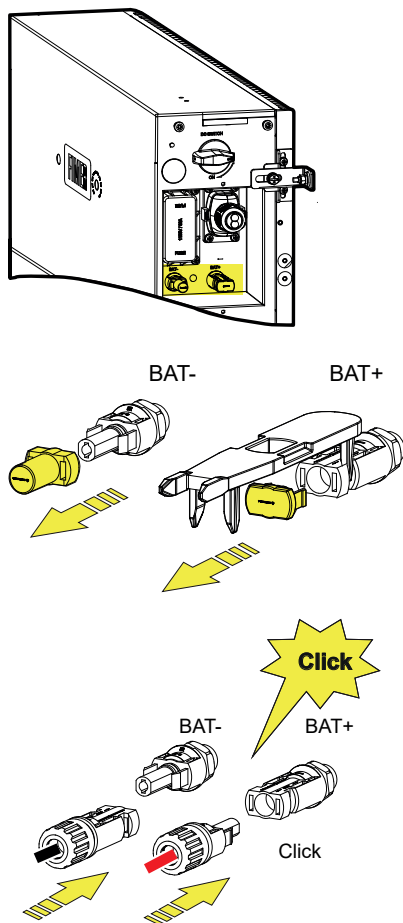
**NOTICE** – After crimping the positive and negative metal terminals, pull the DC input power cables back to ensure that they are connected securely.

**NOTICE** – Insert the crimped metal terminals of the positive and negative power cables into the appropriate positive and negative connectors. Then pull back the DC input power cables to ensure that they are connected securely.

#### Step 2

Insert the positive and negative connectors into the battery terminals (BAT+ and BAT–) on the switch and connect the other end to the cascaded battery.

Figure 5.9. Connecting battery cables



### 5.2.3 Installing a Signal Cable

Connecting the Signal Cable between the Power Control Module and the Inverter

**NOTICE** – When laying out a signal cable, separate it from power cables and keep it away from strong interference sources to prevent communication interruption.

The COM port definitions on both sides of the power control module are the same. It is recommended that the COM port on the right side be connected to the inverter and the COM port on the left side be connected to the cascaded battery.

Figure 5.10. Signal cable ports

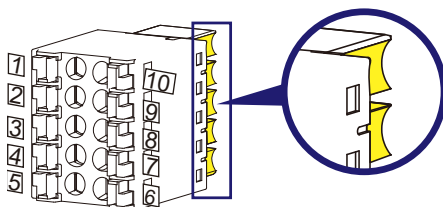


Table 5.1. COM port definition

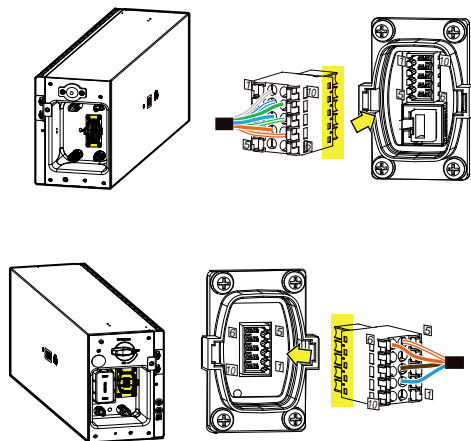
No.	Label	Definition	Description
1	PE	Shield layer grounding	Shield layer grounding
2	Enable–	Enable signal GND	Connects to the enable signal GND of the inverter.
3	Enable+	Enable signal+	Connects to the positive enable signal of the inverter.
4	485A	RS485A, RS485 differential signal+	Connects to the RS485 signal port+ of the inverter or the cascaded battery.
6	485B	RS485B, RS485 differential signal–	Connects to the RS485 signal port– of the inverter or the cascaded battery.
8	CANL	Extended CAN bus port	Used for signal cable cascading in battery cascading scenarios.
9	CANH	Extended CAN bus port	Used for signal cable cascading in battery cascading scenarios.
10	PE	Shield layer grounding	Shield layer grounding

#### Terminals

**NOTE** – Identify the signal terminal pins according to the following figures, and connect cables according to Table 5-1. When you insert the communications terminal of the power control module, the silk screens on the two sides of the communications port are different. Insert the communications terminal according to the following figures.

**NOTE** – The communications terminals connected to the inverter need to be connected to RS485+/RS485–, Enable+/Enable–.

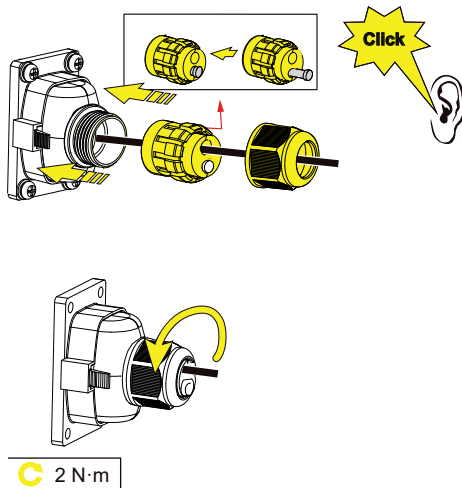
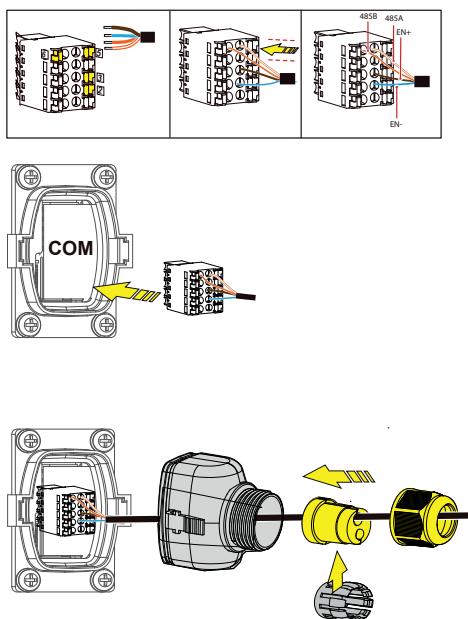
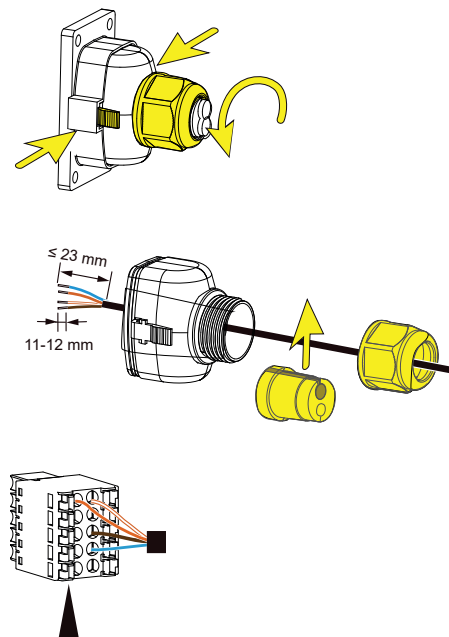
Figure 5.11. Inserting the terminal



## Connecting a Signal Cable

**Connecting a Signal Cable**  
Prepare signal cable terminals for connecting to the inverter.

Figure 5.12. Connecting inverter terminals





### 5.3 (Optional) Cascading Batteries

#### Connecting Cascading DC Input Power Cables (Cascading)

Connect the DC input terminals (BAT+ and BAT-) between the power control module by referring to 5.2.2 Installing DC Input Power Cables.

#### Terminals

**NOTE** – Identify the signal terminal pins according to the following figures, and connect cables according to Table 5-1. When you insert the communications terminal of the power control module, the silk screens on the two sides of the communications port are different. Insert the communications terminal according to the following figures.

**NOTE** – The communications terminals connected to the cascaded batteries need to be connected to RS485+/RS485-, Enable+/Enable-, CANH/CANL, and PE.

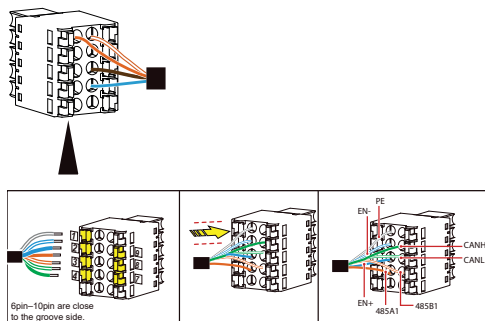
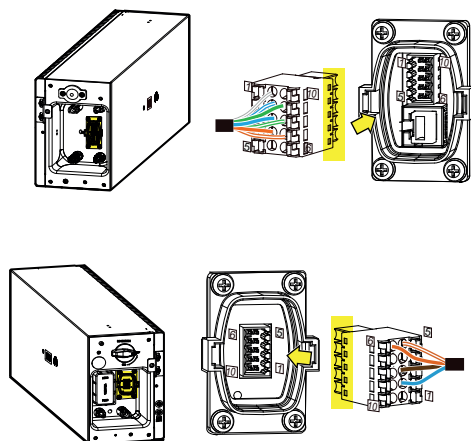


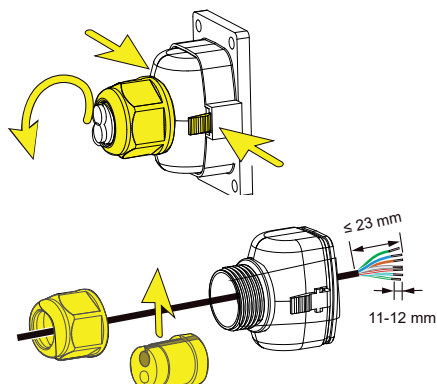
Figure 5.13. Inserting the terminal



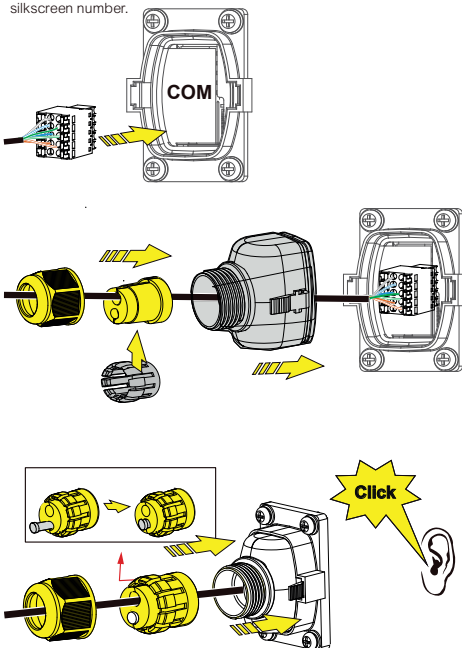
#### Connecting a Signal Cable (Cascading)

Prepare a signal cable terminal for connecting the power control module.

Figure 5.14. Cascading communication terminal



Insert the terminals according to the silkscreen number.

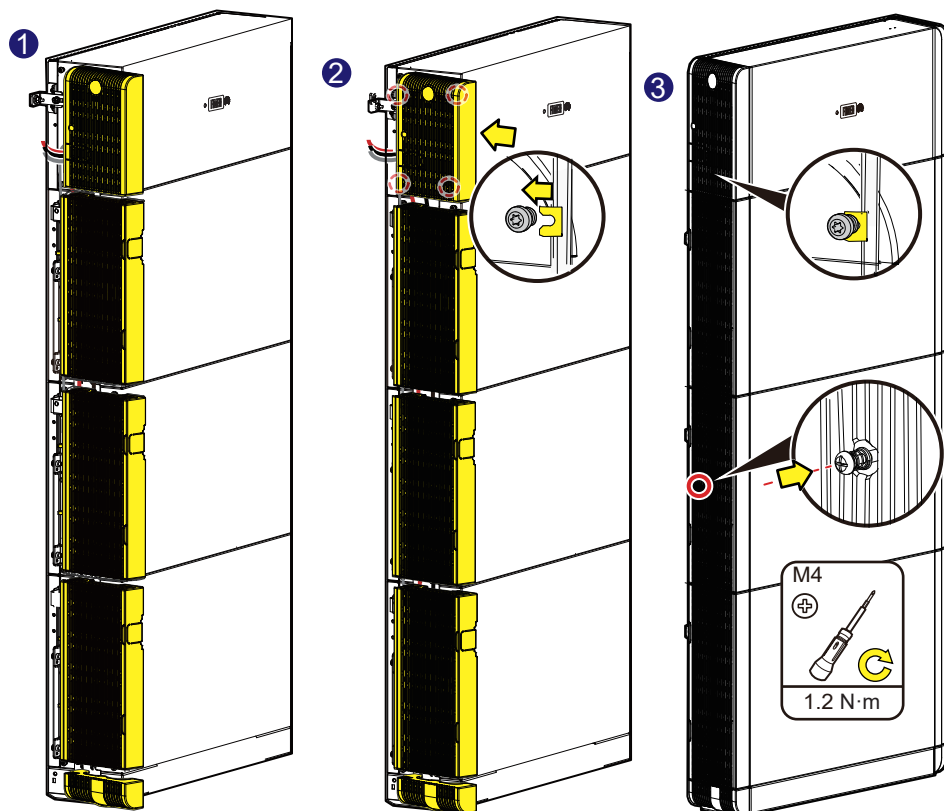


2 N·m

## 5.4 Installing the Cover

After electrical connections are complete, check that cables are correctly and securely connected, install the external protective cover, and secure it using screws.

Figure 5.15. Installing the cover



## 6. System Maintenance

- ⚠ **DANGER** – Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.
- ⚠ **DANGER** – Do not smoke or have an open flame around batteries.
- ⚠ **DANGER** – Do not use wet cloth to clean exposed copper bars or other conductive parts.
- ⚠ **DANGER** – Do not use water or any solvent to clean batteries.
- ⚠ **WARNING** – Do not maintain batteries with power on. To power off the batteries before performing operations such as checking and tightening screw torques, explain the risks to the customer, obtain the customer's written consent, and take effective preventive measures.
- ⚠ **WARNING** – After batteries are discharged, charge them in time to avoid damage due to overdischarge.
- ⚠ **WARNING** – Before moving or reconnecting the equipment, disconnect the mains and batteries and wait for five minutes until the equipment powers off. Before maintaining the equipment, check that no hazardous voltages remain in the DC bus or components to be maintained by using a multimeter.
- ⚠ **CAUTION** – Do not connect two or more cables to the positive or negative power port of a battery in parallel.
- ⚠ **CAUTION** – Stay away from the equipment when preparing cables to prevent cable scraps from entering the equipment. Cable scraps may cause sparks and result in personal injury and equipment damage.

### 6.1 System Power-Off

#### Precautions

- ⚠ **WARNING** – After the system powers off, the remaining electricity and heat may still cause electric shocks and body burns. Therefore, wear protective gloves 5 minutes after the system is powered off before performing any operation on the battery. You can maintain the battery only when all indicators on the battery are off.
- ⚠ **WARNING** – When the BESS is running, you can only turn off the DC switch of the battery, but cannot power off the BESS completely. In this case, you cannot maintain the battery.

#### Powering Off the System

- Step 1 Turn off the AC switch between the inverter and the power grid.
- Step 2 Turn off the DC switch at the bottom of the inverter.
- Step 3 Turn off the DC switch between the PV string and the inverter if there is any.
- Step 4 Turn off the DC switch on the battery.

### 6.2 Routine Maintenance

To ensure that the battery can operate properly for a long term, you are advised to perform routine maintenance on it as described in this chapter.

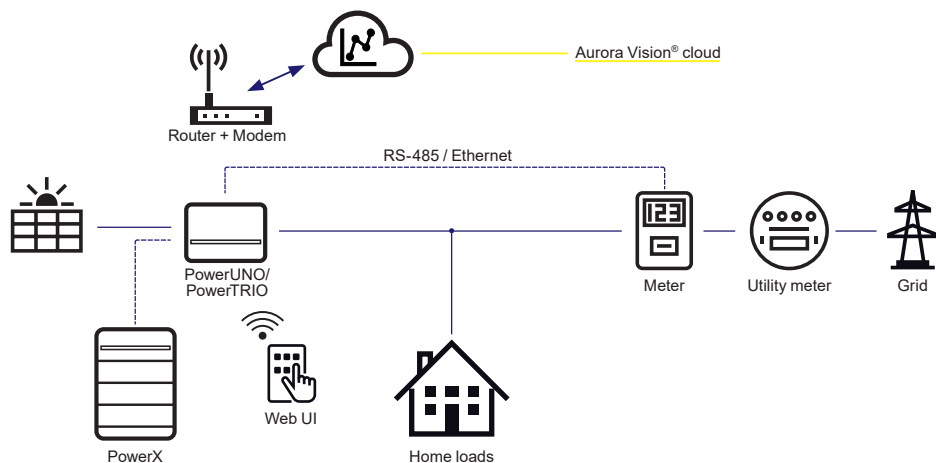
- ⚠ **CAUTION** – Before cleaning the system, connecting cables, and ensuring the grounding reliability, power off the system.

Table 6.1. Maintenance checklist

Check Item	Check Method	Maintenance Interval
System cleanliness	Check periodically that the heat sinks are free from obstacles and dust.	Once every 6 to 12 months
System running status	Check that the battery is not damaged or deformed.	Once every 6 months
	Check that the battery does not generate abnormal sound when it is in operation.	
	Check that the battery parameters are correctly set when the battery is running.	
	Check that cables are secured.	
Electrical Connection	Check that cables are intact, and that in particular, the parts touching the metallic surface are not scratched. Check that unused DC input terminals, battery terminals, and COM ports are locked by watertight caps.	The first inspection is 6 months after the initial commissioning. From then on, the interval can be 6 to 12 months.
Grounding reliability	Check that ground cables are securely connected.	The first inspection is 6 months after the initial commissioning. From then on, the interval can be 6 to 12 months.

## 6.3 Battery Storage and Recharge

**⚠ ATTENTION** – After the device has been stored for a long time, recharge the batteries by using an inverter or a power control module.



### Battery Acceptance Inspection

A battery recharge label must be put on the battery packing case. The recharge label should contain the latest charge time and the next recharge time.

### Battery Storage Requirements

1. Place batteries according to the signs on the packing case during storage. Do not put batteries upside down or sidelong.
2. Stack battery packing cases by complying with the stacking requirements on the external package.
3. Handle batteries with caution to avoid damage.
4. The storage environment requirements are as follows:
  - Ambient temperature:  $-10^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ ; recommended storage temperature:  $20^{\circ}\text{C}$ – $30^{\circ}\text{C}$
  - Relative humidity: 5%–80% RH
  - Place batteries in a dry and clean place with proper ventilation.
  - Place batteries in a place that is away from corrosive organic solvents and gases.
  - Keep batteries away from direct sunlight.
  - Keep batteries at least 2 meters away from heat sources.
5. The batteries in storage must be disconnected from external devices. The indicators (if any) on the batteries must be off.
6. AC mains input voltage requirements on the charging facilities: single-phase voltage: 220 V/230 V/240 V,  $\pm 10\%$ ; three-phase voltage: 380 V/400 V,  $\pm 10\%$ .
7. The warehouse keeper shall collect battery storage information every month and periodically report the battery inventory information to the planning department. The batteries that have been stored for nearly 15 months (at  $-10^{\circ}\text{C}$  to  $+25^{\circ}\text{C}$ ), 9 months (at  $25^{\circ}\text{C}$ – $35^{\circ}\text{C}$ ), or 6 months (at  $35^{\circ}\text{C}$ – $55^{\circ}\text{C}$ ) shall be charged in a timely manner.
8. Batteries shall be delivered based on the “first in, first out” rule.
9. After the battery production test is complete and before the batteries are stored, the batteries must be recharged to at least 50% of the SOC.

### Conditions for Judging Overdue Storage

Do not store batteries for extended periods of time. The deep discharge during storage may damage batteries. The batteries should be handled according to the following requirements.

Table 6.2. Lithium battery recharge interval

Required Storage Temperature	Actual Storage Temperature	Recharge Interval	Remarks
-10°C < T ≤ +55°C	T ≤ -10°C	Not allowed	Not reaching the time for recharge: Use the batteries as soon as possible.
	-10°C < T ≤ +25°C	15 months	Reaching the time for recharge: Recharge the batteries.
	25°C < T ≤ 35°C	9 months	The total storage duration should not exceed the warranty period.
	35°C < T ≤ 55°C	6 months	
	T > 55°C	Not allowed	

1. Dispose of deformed, damaged, or leaking batteries directly irrespective of how long they have been stored.

2. The storage duration starts from the latest charge time labeled on the battery package. If a battery is qualified after recharge, update the latest charge time and the next recharge time (next recharge time = latest charge time + recharge interval) on the label.

3. Batteries can be charged for a maximum of three times during storage. Dispose of batteries if the maximum charge times are exceeded.

4. If a lithium battery is stored for extended periods of time, capacity loss may occur. After a lithium battery is stored for 12 months at the recommended storage temperature, the irreversible capacity loss rate is 3%–10%. If customers perform the discharge test according to the specifications, they may fail to pass the test if the storage capacity of the battery is not 100% of the rated capacity.

### Inspection Before Recharge

- Before recharging a battery, you need to check its appearance. Recharge the battery if it is qualified or dispose of it if not.
- The battery is qualified if it is free from the following symptoms:
  - Deformation
  - Shell damage
  - Leakage

## 6.4 Recharge Requirements for Batteries in Low SOC


After batteries are powered off, static power consumption and self-discharge loss may occur in internal modules. Therefore, charge batteries in a timely manner and do not store batteries in low SOC. Otherwise, the batteries may be damaged due to overdischarge and battery expansion modules need to be replaced.


Storing the batteries in low SOC may occur in the following scenarios:

- The DC SWITCH on the power control module is OFF.
- The power cables or signal cables are not connected.
- The batteries cannot be charged due to a system fault after discharge.
- The batteries cannot be charged due to incorrect configurations in the system.
- The batteries cannot be charged due to no PV input and long-term mains failure.

Regardless of scenarios, the batteries must be charged within the longest interval corresponding to the SOC when the batteries are powered off. If the batteries are not charged within the specified interval, they may be damaged due to overdischarge.

Power-Off SOC Before Storage	Maximum Charge Interval
SOC ≥ 5%	30 days
0% ≤ SOC < 5%	7 days

 **NOTE** – When the battery SOC decreases to 0%, charge the batteries within seven days. Permanent battery faults caused by delayed charge due to customer reasons are not covered by the product warranty.

 **NOTE** – When the battery SOC is low due to self-discharge loss or extended periods of storage without being charged, the system forcibly charges the batteries to prevent damage from overdischarge. Additionally, in situations where the PV power is insufficient, the system will draw power from the grid regardless of the Charge from AC threshold.

## 6.5 Battery Health Check

- To ensure safe and reliable operation of the BESS, the system checks the state of health (SOH) of batteries. If the SOH decreases to the minimum threshold, the BESS stops working and reports an alarm to avoid safety risks. During battery operation, if the SOH calculation conditions are met, the SOH is checked naturally. If the SOH calculation conditions are not met, the forced check is required.
- Natural check: During normal operation, when batteries are fully charged and then discharge to about 5% to 10% SOC and the batteries are not charged during the discharge, the SOH is checked during this process naturally.
- For example, in the maximum self-consumption mode, when the PV power is greater than the load power, the batteries are fully charged to 100% SOC by the surplus PV power. When the PV power is insufficient, the batteries discharge to 5% SOC. The SOH is checked during this process naturally.
- Forced check: The forced check is performed one year after the last SOH check during normal operation or one month after the last SOH check near the end of the battery service life.

### Impact of Battery Health Check

- Natural check: Natural checks are performed during normal operation and do not affect the operating status of the BESS.
- In different phases of **Battery Health Check**, the status is displayed as **Detection Request (Requesting calibration)**, **Detecting... (Calibrating...)**, **Pending (Idle)**, or **Detection ends (Calibration completed)**.

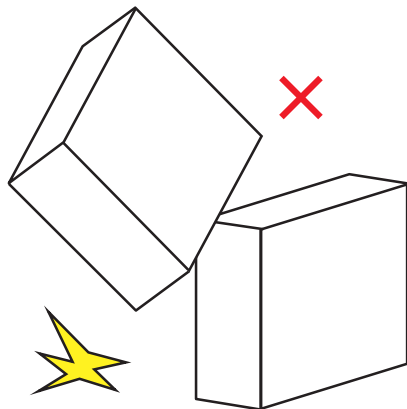
## 7. Emergency Handling

If an accident (including but not limited to the following) occurs on the site, ensure the safety of onsite personnel first and contact the Company's service engineers.

### Battery Falling or Strong Impact

**⚠ DANGER –** If a battery is dropped or violently impacted during installation, it may become faulty and must not be used. Using a faulty battery will cause safety risks such as cell leakage and electric shock.

- If a battery has obvious damage or abnormal odor, smoke, or fire occurs, evacuate the personnel immediately, call emergency services, and contact the professionals. The professionals shall use fire extinguishing facilities to extinguish the fire under safety protection.
- If the appearance is not deformed or damaged, and there is no obvious abnormal odor, smoke, or fire, contact the professionals to transfer the battery to an open and safe place, or contact a recycling company for disposal.



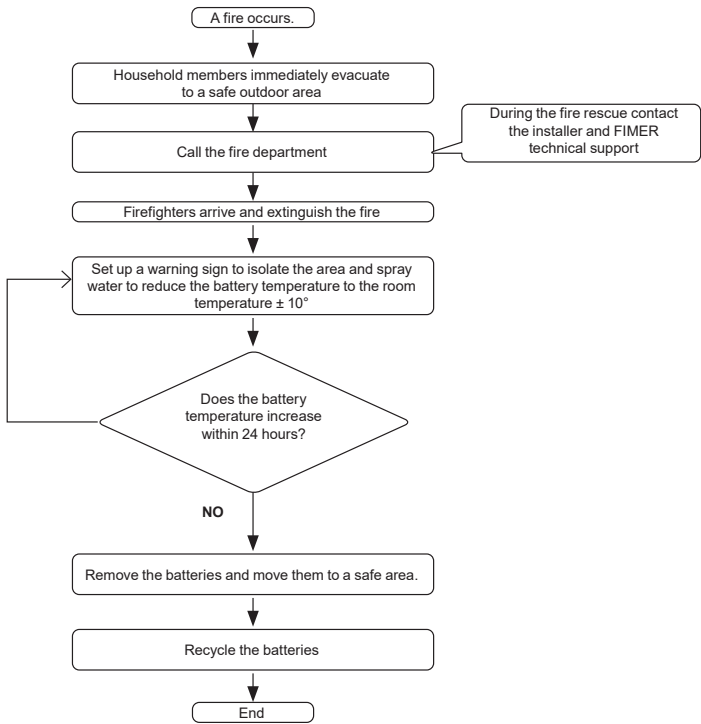
### Flood

- Power off the system if it is safe to do so.
- If any part of the batteries is submerged in water, do not touch the batteries to avoid electric shock.
- Do not use batteries that have been soaked in water. Contact a battery recycling company for disposal.

Smoke or Fire

- ⚠ **DANGER** – In case of smoke or fire, if there is a large amount of smoke in the battery storage room, do not open the door to prevent explosion risks and toxic gas inhalation.
- ⚠ **DANGER** – If a lithium battery catches fire, flammable and toxic gases will be released. Therefore, during the extinguishing process, all firefighters must wear a full set of protective suite, including flame retardant/fireproof clothing, air-purifying respirator or breathing apparatus, firefighter helmet and mask, and insulated shoes.
- ⚠ **DANGER** – A lithium battery fire may last for several hours. After it is extinguished, the fire may be reignited by the heat generated from residual ingredients due to internal cell damage. After an open flame is extinguished, continue spraying water to cool the batteries. Wait until the battery temperature drops to the room temperature  $\pm 10^{\circ}\text{C}$  and monitor for 24 hours to ensure that there is no sign of temperature rise before removing the batteries. Move the removed batteries to a safe place (an open and safe outdoor place is recommended), and then place the batteries in the fire sand box or salt water.

If a BESS emits smoke or catches fire, household members should not dispose of the BESS by themselves. Follow the processes in the flowchart below.



- The detailed description is as follows:
1. If batteries emit smoke or catch fires, notify all household members to evacuate immediately.
  2. After evacuating to a safe outdoor area (20 m away is recommended), call the fire department immediately. While waiting for the fire rescue, contact the installer and technical support.
  3. Firefighters arrive at the site and extinguish the fire.
  4. After the fire is extinguished, set up a warning sign to isolate the area and spray water to reduce the battery temperature to the room temperature  $\pm 10^{\circ}\text{C}$ . (You can use an infrared thermometer or thermal imager.)
  5. Observe the batteries for 24 hours and ensure that there is no sign of temperature rise before removing the batteries. (Only professionals are allowed to remove the batteries.)
  6. After removing the batteries, move them to a safe place (an open and safe outdoor place is recommended), place them in the fire sand box or salt water. These operations must be performed by professionals who must take insulation measures, such as wearing insulated gloves, insulated shoes, and personal protective equipment (PPE).
  7. After the battery fire is extinguished, if there is no potential risk onsite, the battery must be handled and recycled by professionals in accordance with local laws and regulations.



## Electric Shock

**⚠ DANGER** – Before the injured person is separated from the source of electricity, onsite paramedic personnel are not allowed to touch the injured person with their hands to avoid electric shocks.

**⚠ WARNING** – Even if the AC circuit breaker of an inverter is turned off, PV modules and the DC side of the inverter are still energized in the daytime.

For household members, if an electric shock occurs related to a PV device, you are advised to follow the following steps:

1. Turn off the AC circuit breaker of the inverter.
2. Wear dedicated insulated shoes and insulated gloves, and use insulated tools to separate the injured person from the source of electricity. If no professional equipment is available, you can step on a dry wooden stool or hold insulated tools (such as a long dry wooden stick) to separate the injured person from the source of electricity while ensuring your safety.
3. If the injury is serious, call the emergency medical service immediately. Let the injured person lie flat and monitor the person's consciousness, breathing, and heartbeat changes. Personnel who have first aid qualifications or have received first aid training can perform first aid such as artificial respiration and cardiopulmonary resuscitation based on the situation of the injury onsite until the paramedic personnel arrive to send the injured person to the hospital.
4. Install warning objects and barricades around the electric shock site to prevent other personnel from getting electric shocks.
5. Notify distributors and installers to dispatch professional O&M personnel to rectify the fault.

## Conclusion and Follow-Up Procedure

- After a battery fire is extinguished and there is no potential risk onsite, professionals handle and recycle the batteries after wearing insulated gloves, insulated shoes, and other PPE in accordance with local laws and regulations. After an accident occurs, the manufacturer can identify the damage to the device and replace the device according to the corresponding procedure to restore the BESS.
- After a battery fire is extinguished, the fire extinguishing water may pollute the surrounding soil and water source. In this case, notify the related environmental protection department for evaluation and handling.
- If you have any questions about residential inverters and BESSs, contact the device distributor and installer. You can also contact us through the local service hotline on official website.

## Battery Leakage

**⚠ DANGER** – The leaked electrolyte is a colorless viscous liquid that may evaporate rapidly and is flammable, turning into white salt residues. The electrolyte has a pungent smell and is corrosive, irritating to eyes and skin. Avoid contact with it.

**⚠ DANGER** – When handling chemical leakage incidents, professional maintenance personnel and firefighters must wear necessary protective equipment such as air-purifying respirator and other PPE.

For household members, if battery leakage occurs, you are advised to follow the following steps:

1. Stop the BESS immediately and set the battery switch to OFF. Turn off the AC circuit breaker of the inverter and set the inverter DC switch to OFF.
2. Indoor installation scenario: Indoor personnel should quickly evacuate, open the doors, windows, and ventilation devices of the room, and turn off indoor fire sources during the evacuation. Outdoor installation scenario: Notify outdoor personnel to stay away from the site and set up a warning sign to isolate the area.
3. After evacuating to a safe area, notify professional maintenance personnel or firefighters to handle the emergency.

Avoid contact with electrolytes or released gases. In the case of contact, take the following measures:

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

# 8. Technical Specifications

## 8.1 PowerX-5kWh

Technical Specifications	PowerX-5kWh
Rated charge and discharge power	5 kW
Nominal voltage (single-phase system)	450 V
Operating voltage (single-phase system)	350–560 V
Nominal voltage (three-phase system)	600 V
Operating voltage (three-phase system)	600–980 V
Dimensions (H x W x D)	240 mm x 670 mm x 150 mm
Weight	12 kg
Cooling mode	Natural convection
IP rating	IP66
Communications	RS485 and CAN (for cascading)
Operating temperature	–25°C to +55°C
Operating humidity	5%–95% RH
Maximum operating altitude	4000 m

## 8.2 PowerX-5KW-BATT

Technical Specifications	PowerX-5KW-BATT
Nominal available capacity	5 kWh
Battery cell type	Lithium-iron phosphate (LiFePO4)
Dimensions (H x W x D)	360 mm x 670 mm x 150 mm
Weight	50 kg
Cooling mode	Natural convection
IP rating	IP66
Operating temperature	–20°C to +55°C
Maximum operating altitude	4000 m

Note a: 5 kWh is the initial capacity (designed) of the battery module. The actual capacity is affected by the external environment (such as temperature, transportation, and storage).

## 9. FAQs

### 9.1 How Do I Replace a Fuse?

Prerequisite for replacement: If the inverter is faulty, the fuse is likely to be damaged. In this case, check whether the fuse is damaged. If yes, replace the fuse.

#### Step 1

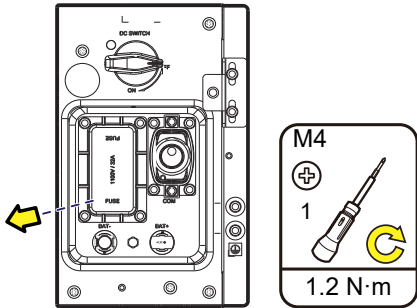
Power off the system. For details, see 6.1 System Power-Off.

**⚠ WARNING** – After the system powers off, the remaining electricity and heat may still cause electric shocks and burns. Therefore, wait for 5 minutes after the system is powered off, wear protective gloves, and then perform operations.

#### Step 2

Loosen the screws on the fuse enclosure.

Figure 9.1. Removing the screw enclosure



#### Step 3

Lift the fuse box opening, remove the fuse, insert a new fuse into the slot, and close the fuse box. If you hear a click and the raised dots on the sides snap into the box, the fuse is properly installed.

Figure 9.2. Replacing a fuse

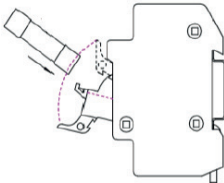


Table 9.1. Fuse specifications

Fuse	Required Specifications		
Category	Lower Limit	Typical Value	Upper Limit
Component type	-	Fuse	-
Fuse type	-	Fast blow fuse	-
Rated voltage (V AC/DC)	1100 V DC	-	-
Rated current	32 A	-	-
Breaking capacity	10 kA	-	-
Nominal fusing heat I <sup>2</sup> T	600	-	1000
Cold resistance value	-	-	0.005 Ω
Package dimensions (the dimension tolerance shall be specified in the specifications provided by the supplier)	-	14 mm x 51 mm	-

Table 9-2 Fuse model

No.	Fuse model	Manufacturer
1	FWL-32A14F	Cooper Xi'An Fusegear
2	VC14-32A1100VDCAR	Vicfuse
3	RS309-MM-14C32A	Sinofuse Electric



### 9.2 SOC Change Description

- How does the SOC change from 99% to 100% when the battery is about to be fully charged?
- When the SOC is greater than 99%, the battery switches to float charging and the charging current decreases gradually. Finally, the SOC reaches 100%.
- When the battery temperature is low, the charging power is displayed as about 300 W, but the SOC does not change. Why?
- When the internal temperature of the battery module is low, the internal heating component starts to heat the battery. The heating power is 300 W (typical value). When the heating component is working, the battery is not charged and the SOC does not change. Battery heating helps to keep the cell at a proper operating temperature and prolong the service life of the product.

9.3 Checking Cable Connection when the Battery Fails to Be Upgraded

If the battery fails to be upgraded, check the cable connections by referring to **5 Electrical Connection**. If the upgrade fails, reconnect the cables correctly and perform the upgrade again.

9.4 How Do I Recycle Used Batteries?


-  **NOTICE** – The Company does not recycle batteries. Contact local recycling agencies to handle batteries.
-  **NOTICE** – If there are no such agencies in your area, you can contact the nearest foreign recycling agencies.

**Step 1**  
Contact the nearest recycling agency.

**Step 2**  
Recycling agencies assess the costs.

**Step 3**  
Recycling agencies carry out recycling, which can be done in two ways:

- Onsite recycling: Recycling agencies can visit your sites to recycle lithium batteries, but the price depends on actual conditions such as the distance and transportation expenses.
- Centralized recycling: You can collect all lithium batteries to be recycled in one place for the recycling agencies to handle.

-  **NOTE** – You need to cover the related transportation expenses.

**Step 4**  
Recycling companies handle recycling. The recycled lithium batteries are at the disposal of the recycling companies.

10. Acronyms and Abbreviations

A	APP	Application
B	BMS	Battery Management System
D	DC	Direct Current
E	EMI	Electromagnetic interference
F	FIT	Feed-in tariff
P	PV	Photovoltaic
V	VPP	Virtual Power Plant



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