

UltraPower 100&Diesel power generation

UltraPower 100 & Diesel power generation product specification



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1. Scope

This product specification is only applicable to UltraPower 100 All-in-one Cabinet.

Product Name:UltraPower 100

Model Number: HVS-R0103P0050-M

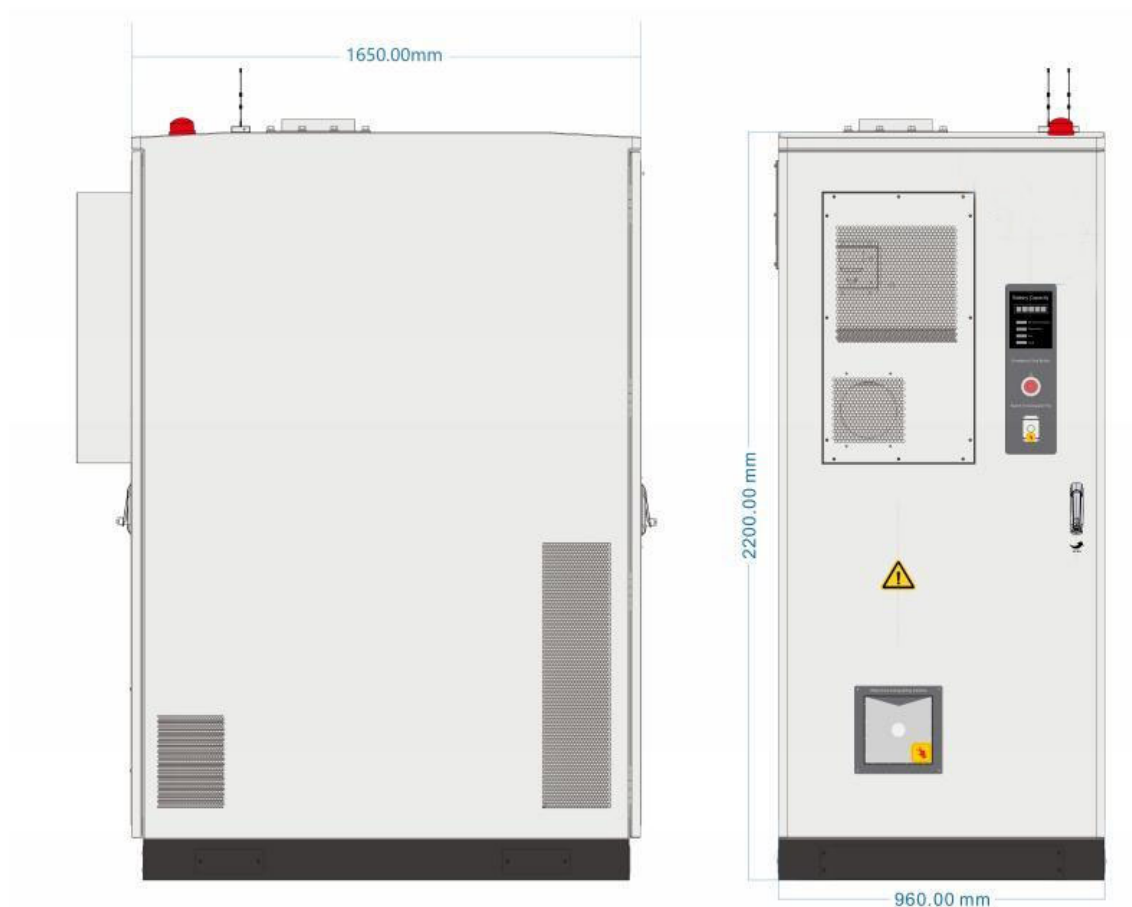
2. Product functions and parameters

2.1. Product function characteristics

UltraPower 100 features an All-in-One design,consisting 9 air-cooling battery packs,a 50kW hybrid inverter,a BMS,an EMS,an smart temperature control system,a precision suppression and explosion-proof combined fire protection system,as well as cabinet structure and electrical auxiliary equipment,with a battery rated capacity of 103.68kWh.

Its appearance is shown below:





picture 1:outline of Integrated intelligent distributed PV and energy storage system

Integrated intelligent distributed PV and energy storage system has following characteristics:

Safe

- Electrical multi-dimensional fusion perception,multi-level Circuit breaker protection.
- Internal integration of photovoltaic/energy storage/diesel generator/PCS equipment,more unified bus control, improve system stability.
- Adopt the design concept of very early thermal runaway risk warning,integrating detection, fire suppression,combustible gas detection,smoke exhaust,Linkage protection with BMS and EMS,targeted fire extinguishing at the cabin level,to ensure the safe operation of energy storage.
- Intelligent temperature control system, system temperature difference $\leq 5^{\circ}\text{C}$, battery cycle life increased by 12%.

Simple

- All in one design, modular installation, single cabinet covers an area of only 1.42 square meters.
- Full commercial application scenarios and grid-friendly.
- Simple parallel expansion, covering 50kW-300kW wide power range.
- Overall delivery, factory prefabrication, machine transportation is easy to install and operation. Reducing transportation, installation and commissioning fee by 15%.

Smart

- Cloud platform management system support remote/local monitoring, intelligently operation. On-site maintenance for free.
- Intelligent balancing policy and intelligent system warning to ensure the consistency of the battery life cycle.
- Support black start function, reliable power supply in off-grid/micro-grid mode.
- A variety of operation mode options (support virtual power plant, grid-connected, off-grid) which improve revenue.

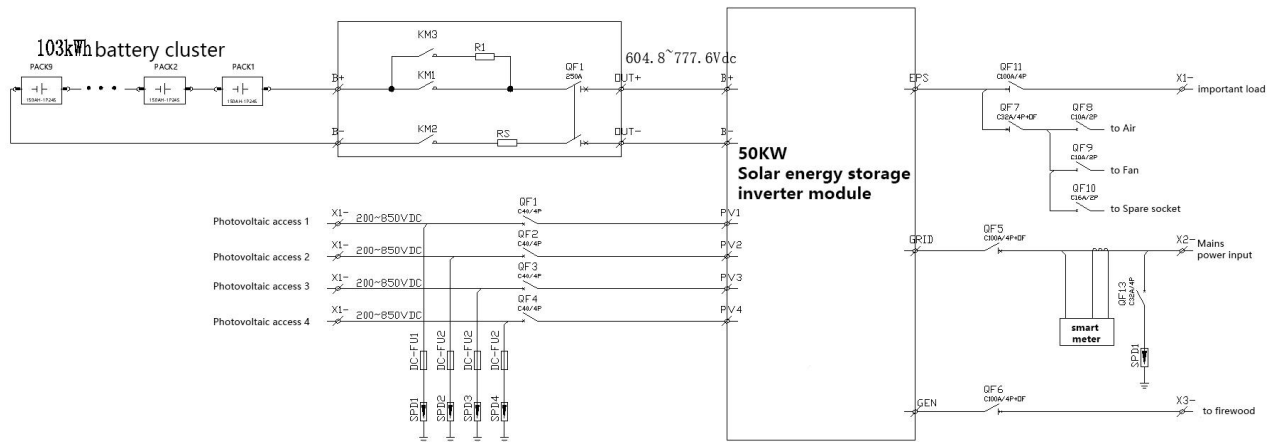
2.2. Product specification

Table 1 Product Specification Parameters

Product model	HVS-R0103P0050-M
PV parameter	
Maximum input power	50kW
Starting voltage	200V
Photovoltaic maximum voltage	1000Vdc
Photovoltaic rated voltage	630Vdc
MPPT operating voltage range	200-850Vdc
MPPT quantity	4
Number of single MPPT input channels	2
Maximum input current (Each MPPT)	30A*4
Maximum short-circuit current (Each MPPT)	40A*4
Energy storage parameter	
Nominal energy	103kWh
Nominal voltage	690Vdc

Battery voltage range	605~777 Vdc
Rated charge/discharge current	75A
Maximum charge/discharge current	90A
Ac output parameter	
Rated output power	50kW
Rated input power	50kW
Maximum output current	75A
Rated voltage (input and output)	3L/N/PE; 400V
Off-grid switching time	<20ms
Grid frequency	50Hz/60Hz
Voltage total harmonic distortion	<3%@Rated power&Linear load
Ac output parameter (generator end)	
Maximum input apparent power **	60kVA
Maximum charging power of battery	50kW
Rated voltage (output)	3L/N/PE; 220/380V;230/400V;240/415V
Rated AC frequency	50/60
Maximum input current	87A
Mechanical parameters	
Weight	Net weight 1480kg; Gross weight 1570kg
Overall dimension	960×1650×2245 (W×D×Hmm)
Package size	1030×1720×2400 (W×D×Hmm)
Communication mode	RS485, Ethernet, 4G
Environmental parameters	
Operating temperature	-20℃~50℃ (>45℃ derate)
Storage temperature	-20℃~45℃
Relative humidity	5~95%RH, No condensation
Altitude	3000m (>2000 derate)
Class of protection	IP54

3. Electrical primary diagram

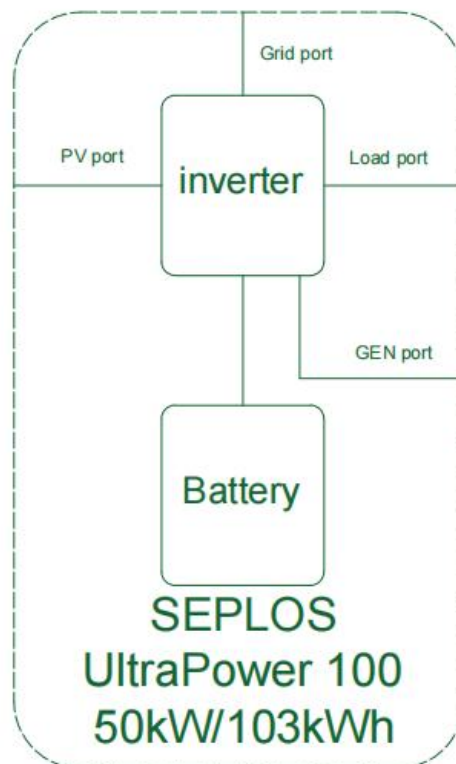


picture 2: Product electrical schematics

4. Diagram

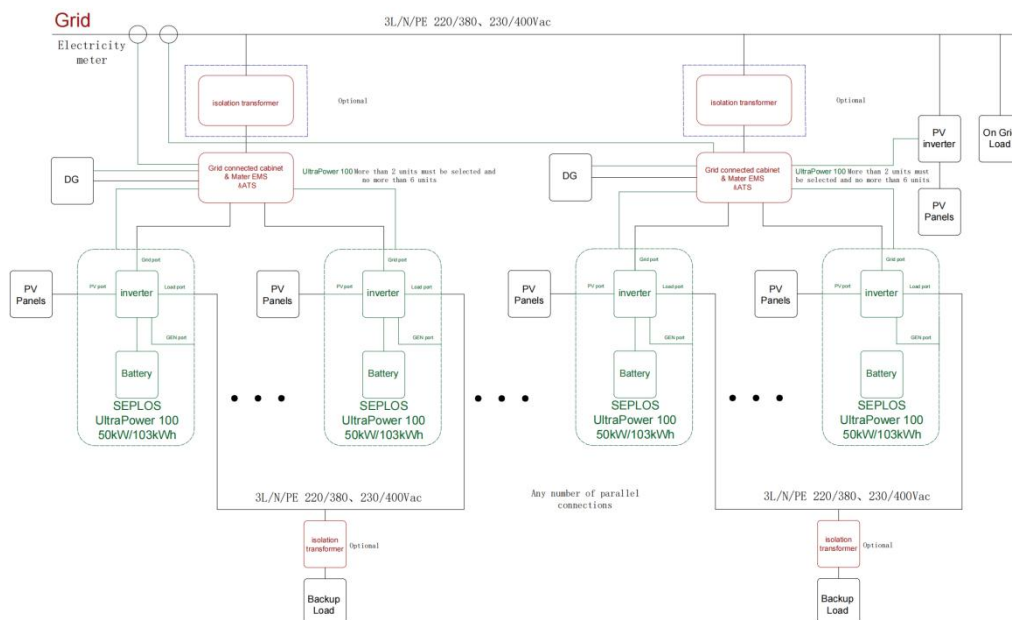
The following figure represents the UltraPower 100 all in one system.

The case legend will not be described again.

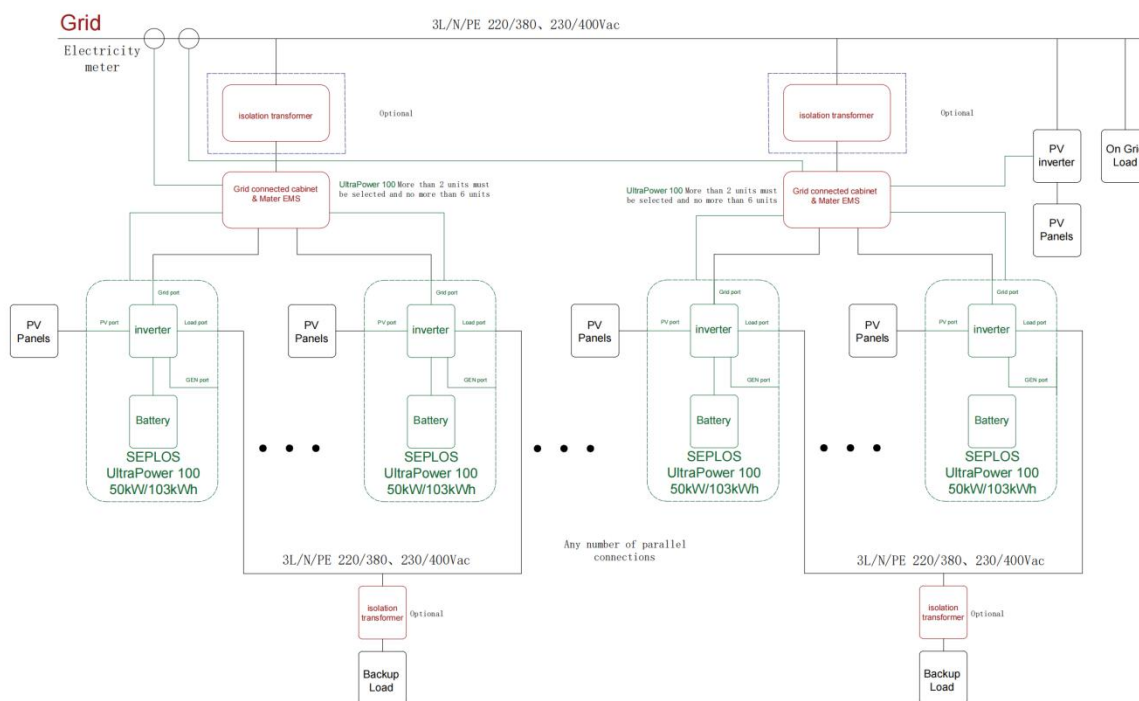


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Pic1:Grid connected with diesel generator,the main load is not powered off,black is the power wire.If there are frequent power outages,the original.Green is the communication wire
photovoltaic can be connected to the grid cabinet.(Black is the power wire,green is the communication wire)

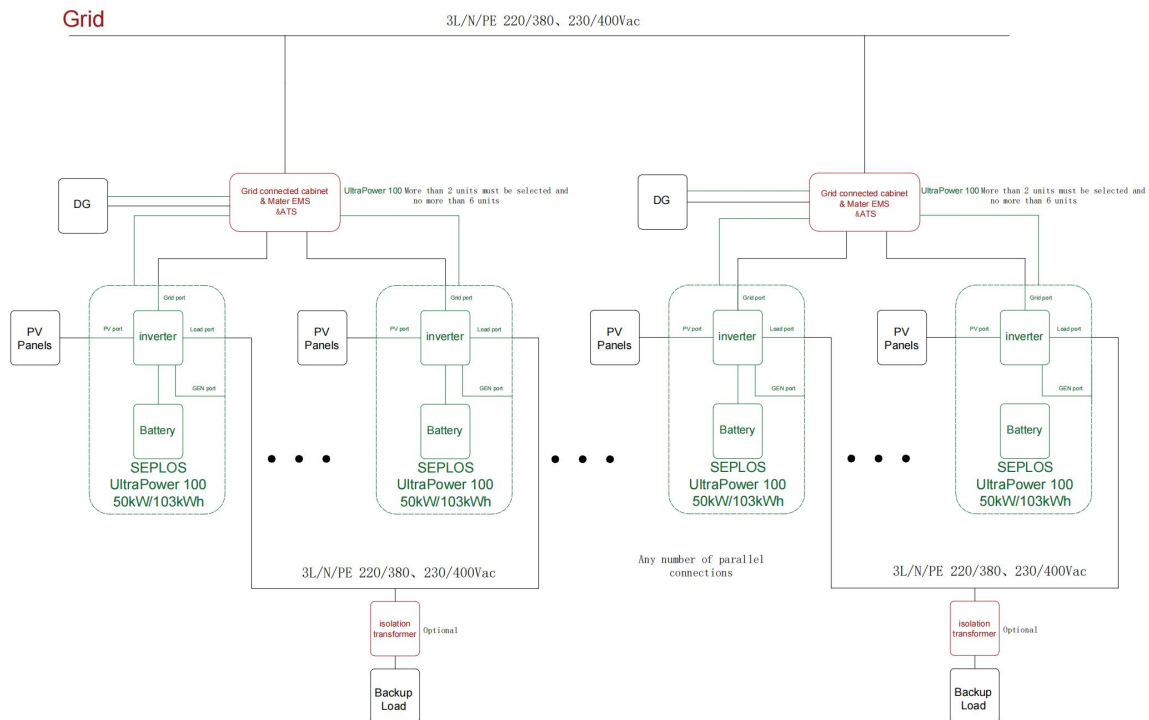


Pic2:Grid connected without diesel generators.Battery backup

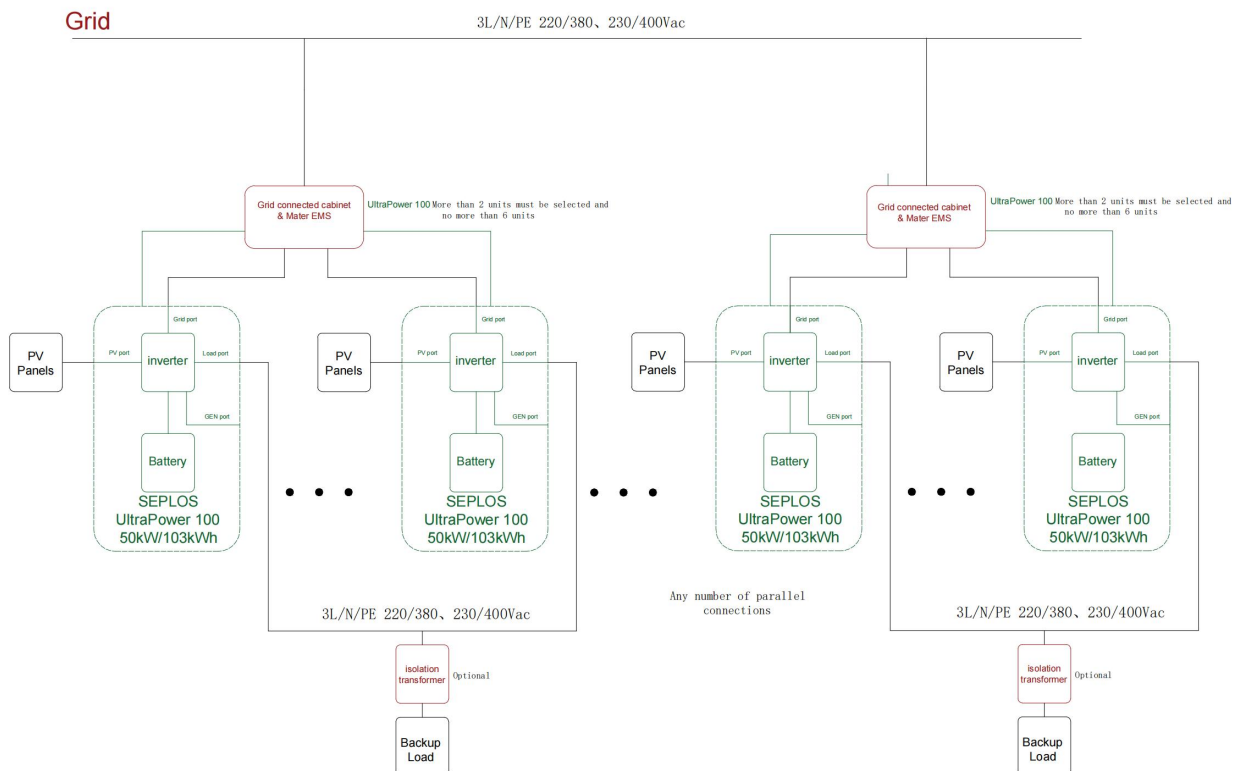


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Pic3:Off grid with diesel generator.Never power off

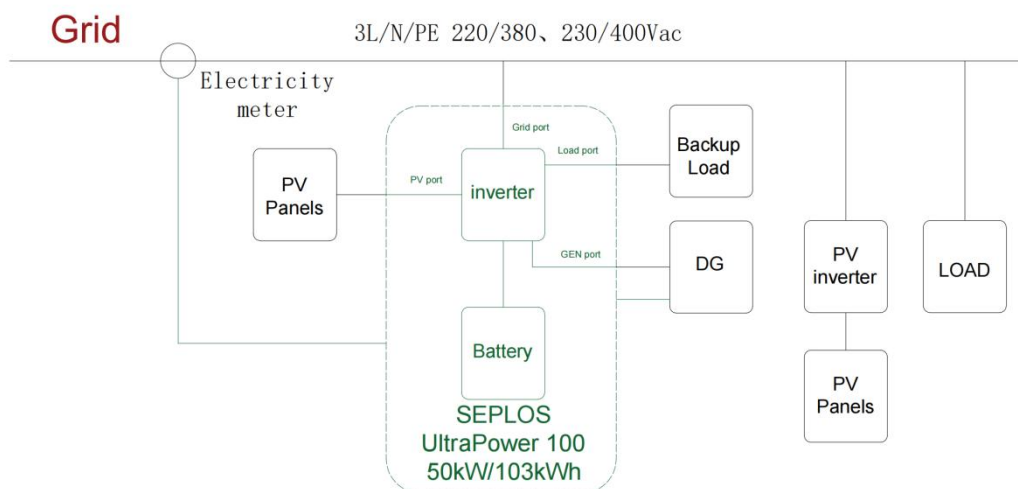


Pic4:Off grid without diesel generator.Battery backup

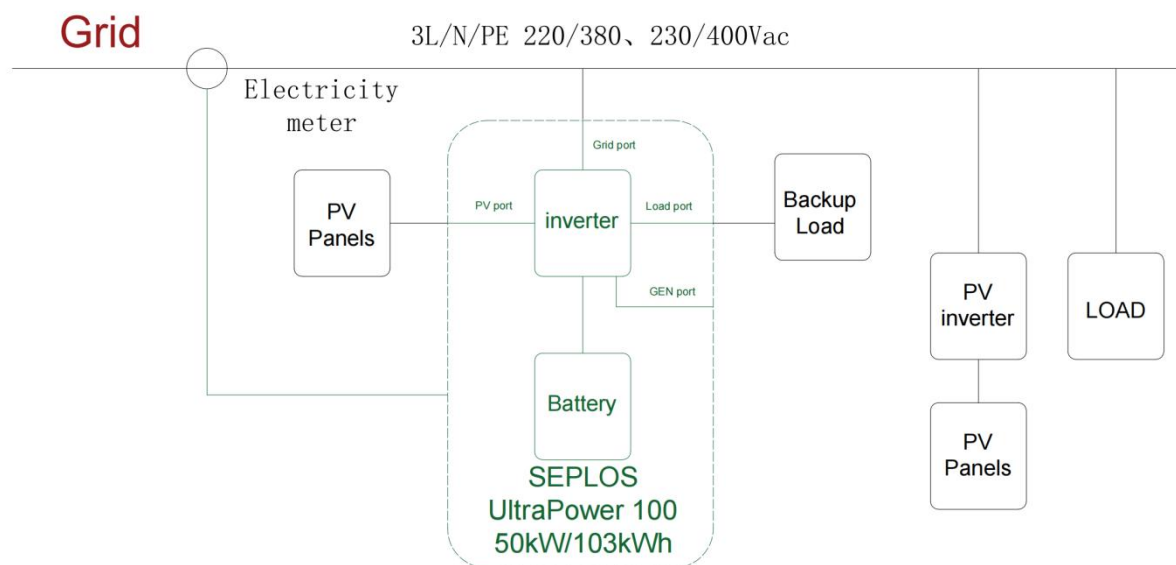


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Pic5:Single machine grid connected with diesel generator,the main load is not powered off

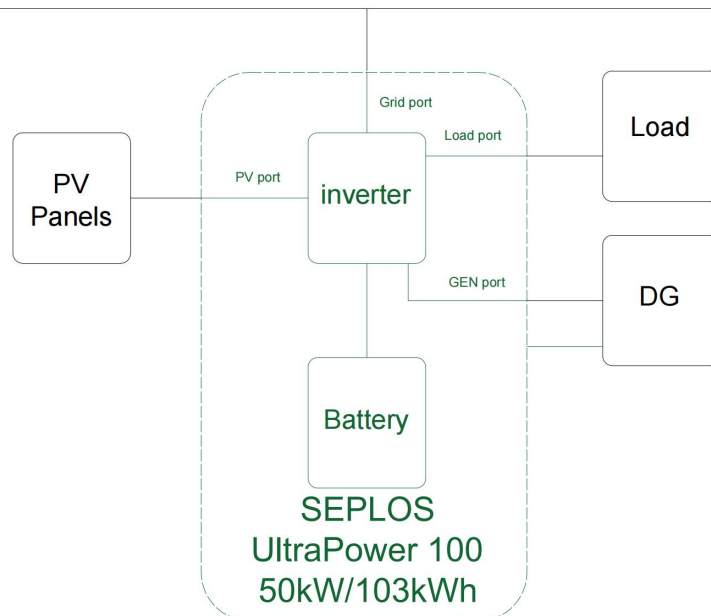


Pic6:Single machine grid connection without diesel generator



Grid

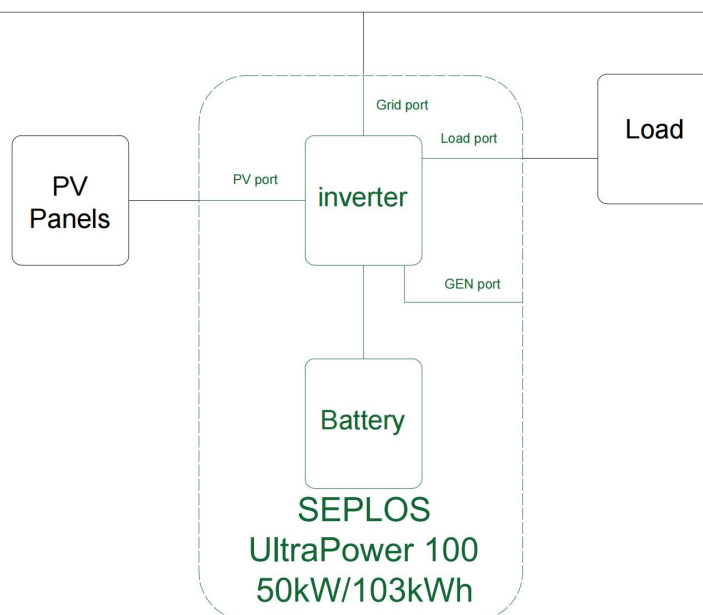
3L/N/PE 220/380、230/400Vac



Pic8:Single machine off grid without diesel generator

Grid

3L/N/PE 220/380、230/400Vac



5. Configuration list

Table 2 Product configuration list

Number	Item	Quantity	Unit	Remarks
1	Battery PACK	9	set	Single PACK:11.52kWh
2	Cabinet	1	pcs	-
3	High voltageTank	1	pcs	-
4	Fire protection system	1	set	Perfluorohexanone
5	Temperature control system	1	set	Intelligent air conditioning, intelligent fan and air duct design
6	hybrid inverter	1	pcs	50kW
7	EMS	1	pcs	Data can be connected to the cloud platform
8	Auxiliary distribution	1	set	-
9	Cable and others	1	set	-

6.Safety Instruction

6.1 General Safety Precautions

Before transporting, storing, installing, operating, using, and maintaining the equipment, please read this manual thoroughly, operate strictly according to the manual, and follow all safety precautions identified on the equipment and in the manual. The "instructions," "notes," "cautions," "warnings," and "dangers" in the manual do not represent all the safety matters to be observed; they supplement all safety precautions. You must also comply with relevant international, national, or regional standards, as well as industry practices. assumes no liability for any violations of general safety operation requirements or violations of safety standards in design, production, and use of the equipment. The equipment should be used in an environment that meets design specifications. Otherwise, equipment failure may occur, leading to abnormal equipment function or component damage, which is not covered by the quality assurance; likewise, bears no liability for personal injury or property damage that may result. When transporting, storing, installing, operating, using, and maintaining the equipment, comply with local laws, regulations, and standards. The safety precautions in the manual are supplementary to local laws, regulations, and standards.

Is not responsible for the following situations or their consequences:

- 1) Installation and usage environments that do not comply with relevant international, national, or regional standards.
- 2) Operation outside the conditions described in this manual.
- 3) Unauthorized disassembly, alteration of the product, or modification of software codes.
- 4) Operation not in accordance with the product and documentation instructions and safety warnings.
- 5) Equipment damage caused by abnormal natural events (earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, force majeure).
- 6) Transport damage caused by you or your appointed third party.

- 7) Damage due to storage conditions not meeting product documentation requirements.
- 8) Negligence, improper operation, or deliberate damage by you or a third party, resulting in hardware or data damage to the equipment.
- 9) System damage caused by you or a third party, including relocation and installation of systems not in accordance with this manual, and damage caused by unauthorized adjustments, changes, or removal of identification marks.
- 10) Defects, malfunctions, or damage caused by acts, events, negligence, or accidents beyond the seller's reasonable control, including power outages or electrical faults, theft, war, unrest, internal strife, terrorism, intentional or malicious damage, etc.



Reverse engineering, decompiling, disassembling, dismantling, adapting, implanting, or other derivative operations on the equipment software are prohibited. It is forbidden to study the internal implementation of the equipment, obtain the equipment software source code, steal intellectual property, etc., and to disclose any performance tests of the equipment software.

6.2 Personal Safety



- | | |
|---|---|
|  | 1) Strictly prohibit live operation during installation. Live installation and removal of cables can generate arcs, sparks, or cause fires and explosions, leading to fires or personal injury. |
| | 2) Fire, electric shock, or explosion can occur during equipment operation due to non-standard or incorrect operation, resulting in personal injury or property loss. |
| | 3) Do not wear conductive objects like watches, bracelets, rings, necklaces during work to avoid electric shock burns. |

	4) Use specialized insulated tools during work to avoid electric shock injuries or short circuits. The insulation voltage level must meet local laws, regulations, standards, and specifications. Use specialized protective equipment, such as protective clothing, insulated shoes, safety goggles, safety helmets, insulated gloves, etc., during work.
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6.3 Personnel Requirements

Operations such as lifting and transporting, installation and wiring, and operation and maintenance of the equipment must be carried out by professional electrical technicians who meet local specifications. Operators should wear protective gear that meets local safety requirements.



Fig 1.3-1 Personnel Dress Requirements

Operators must meet the following requirements:

- 1) Do not wear conductive items like watches, bracelets, rings, necklaces during installation, operation, and maintenance to avoid electric shock burns.
- 2) Comply with the laws, regulations, and relevant standards of the country or region during transportation, transshipment, installation, wiring, and maintenance.

- 3) Be familiar with the composition and working principles of the entire energy storage system and operate according to the manual.
- 4) Have received professional training related to the installation and trial operation of electrical equipment, possess certain knowledge in electronics, electrical wiring, and mechanics, and be familiar with electrical and mechanical schematics.
- 5) Have the ability to respond to emergencies or sudden situations that may occur during installation or trial operation.

1.4 Electrical Safety



1) Ensure that the equipment is undamaged before making electrical connections, as damage may cause electric shock or fire.

2) Non-standard or incorrect operations may lead to accidents such as fire or electric shock.



3) Prevent foreign objects from entering the equipment during operation, as this may cause short circuits or damage to the equipment, reduction in load supply, power drop, and personal injury.

Equipment requiring grounding must have the protective earth wire installed first during installation; it must be the last to be removed during disassembly.



Do not allow cables to pass through equipment air inlets and outlets.

6.5 General Requirements

- 1) Installation, operation, and maintenance must be carried out according to the steps in the manual. Do not modify, add, or change the equipment without authorization, and do not change the installation order.
- 2) Grid connection operation requires permission from the electrical department of the country or region. Follow power station safety specifications, such as the operation ticket and work ticket systems.
- 3) Set up temporary fences or warning ropes in the work area and hang “ No Entry” signs. Non-workers are strictly forbidden from entering.
- 4) Before installing or removing power cables, disconnect the equipment itself and its upstream and downstream switches.
- 5) If liquid enters the equipment, immediately turn off the power and do not continue to use it.
- 6) Before operating the equipment, carefully check that the tools used meet the requirements and are logged; after operation, count and collect the tools to prevent them from being left inside the equipment.
- 7) Before installing power cables, confirm that the cable labels are correct and that the cable terminals have been insulated.
- 8) When installing the equipment, use a torque tool of the appropriate range to tighten the screws. When tightening with a wrench, ensure that the wrench is not skewed, and the torque value deviation does not exceed the specified 10%.
- 9) After installation, ensure that all electrical components, protective covers, insulation tubes, and other devices are in place to avoid the risk of electric shock.
- 10) If the equipment has multiple inputs, disconnect all inputs and wait for the equipment to be completely powered down before operating.
- 11) When maintaining downstream electrical or distribution equipment, disconnect the corresponding output switch of the power supply equipment.
- 12) When maintaining equipment, hang a “ Do Not Close” sign on the upstream and downstream switches or circuit breakers and post warning signs to prevent accidental connection.

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13) Faults must be fully resolved before re-powering. When diagnosing and troubleshooting faults, the following safety measures must be completed if power off is necessary: power off > test for electricity > install grounding wire > hang signs and set up barriers.

14) Regularly check the equipment terminal screws, confirm they are tightened and not loose. If cables are damaged, they must be replaced by professional personnel to avoid risks.

15) Do not tamper with, damage, or cover up labels and nameplates on the equipment, and timely replace labels that have become unclear due to long-term use.

16) Do not use water, alcohol, or oil solvents to clean the internal and external electrical components of the equipment.

6.6 Grounding Requirements

1) The equipment grounding impedance should meet local electrical standards.

2) Equipment must be permanently connected to the protective ground. Before operating the equipment, check its electrical connections to ensure reliable grounding.

3) Do not operate equipment without installing a grounding conductor.

4) Do not damage the grounding conductor.

5) For equipment using three-core sockets, ensure that the ground terminal in the three-core socket is connected to the protective ground.

6) If it is a large contact current device, before connecting the input power, the protective ground terminal of the equipment chassis must be grounded first to prevent contact current from causing electric shock to the human body.

6.7 Wiring Requirements

1) The selection, installation, and routing of cables must comply with local laws, regulations, and standards.

2) During the laying of power cables, avoid twisting or coiling. If the power cable is not long enough, replace it with a new one; do not make joints or welds in the power cable.

3) All cables must be securely connected, well insulated, and of the appropriate specification.

4) Cable ducts and through holes should have no sharp edges, and protective measures should be in place where cables pass through to prevent damage by sharp edges or burrs.

- 5) If cables enter the cabinet from the top, they should be bent in a U-shape outside the cabinet before entering.
- 6) Cables of the same type should be bundled together, neatly and without damage to the outer sheath; cables of different types should be laid at least 30mm apart and should not be intertwined or crossed.
- 7) Seal cable entries with sealing putty immediately after wiring or when leaving the wiring process to prevent moisture and small animals from entering.
- 8) Buried cables should be reliably fixed using cable supports and cable clamps, and cables in the backfill soil area should be closely fitted to the ground to prevent deformation or damage during backfilling.
- 9) When external conditions, such as installation methods or environmental temperatures, change, it is necessary to refer to IEC-60364-5-52 or local regulations and standards to verify cable selection, such as whether the current carrying capacity meets requirements.
- 10) Using cables in high-temperature environments may lead to aging and damage of the insulation layer. The distance between cables and heat-generating devices or heat source areas should be at least 30mm.
- 11) At low temperatures, severe impacts or vibrations can cause the plastic sheath of the cable to become brittle and crack.
- 12) To ensure construction safety, the following requirements should be followed: All cables should be laid and installed at temperatures above 0°C. When handling cables, especially in low-temperature environments, they should be handled gently. If the storage temperature of the cable is below 0°C, the cable must be stored in a room- temperature environment for more than 24 hours before laying.
- 13) Unconventional operations, such as pushing cables directly off a vehicle, are prohibited to avoid damage to the cables, which can lead to decreased performance, affecting current carrying capacity and temperature rise.

6.8 Anti-static Requirements

	Human-generated static electricity can damage static-sensitive components on circuit boards, such as BMU boards.
	1) Wear anti-static gloves before touching the equipment or handling circuit boards.
	2) When holding a circuit board, hold it by the edges without components and avoid touching the components with your hands.
	3) Circuit boards that have been removed should be wrapped in anti-static materials for storage or transportation.

6.9 Environmental Requirements



- 1) It is strictly forbidden to place the equipment in environments with flammable or explosive gases or smoke, and any operation in such environments is prohibited.
- 2) Do not store flammable or explosive materials in the vicinity of the equipment.
- 3)Keep the equipment away from heat sources or fire sources, such as fireworks, candles, heaters, or other heating devices, as this may cause equipment damage or fire.



- 1) Install the equipment away from liquids and not under locations prone to condensation, such as water pipes or air vents; it should also not be installed under air conditioning vents, ventilation openings, or windows in machine rooms where water leakage is likely, to prevent liquids from entering the equipment and causing faults or short circuits.
- 2)Do not block the ventilation ports or cooling system of the equipment during operation, and do not cover it with other items, to prevent overheating and fire.

- 1) The storage environment for the equipment should have suitable temperature and humidity, be clean, dry, well-ventilated, and free from dust and condensation.
- 2) Do not install or operate the equipment beyond the specified technical parameters, as this may affect the performance and safety of the equipment.
- 3) Do not install, use, or operate outdoor equipment or cables in severe weather conditions such as thunderstorms, rain, snow, high winds of level 6 or above (including but not limited to moving equipment, operating equipment and cables, plugging and unplugging outdoor signal interfaces, working at heights, outdoor installations, opening doors, etc.).
- 4) Do not install equipment in environments with dust, smoke, volatile gases, corrosive gases, infrared radiation, organic solvents, or high salt content.
- 5) Do not install equipment in environments with conductive metallic dust or magnetic dust.
- 6) Do not install equipment in areas prone to mold, mildew, or other microorganisms.
- 7) Avoid installing equipment in areas with strong vibrations, loud noise sources, and strong electromagnetic interference.
- 8) The installation site should comply with local laws, regulations, and relevant standards.
- 9) Ensure the installation surface is solid and not composed of materials like rubber soil, weak soil, or prone to sinking.
- 10) Avoid low-lying areas or areas prone to water accumulation.
- 11) The site's elevation should be above the highest historical water level of the area.
- 12) If the equipment is installed in areas with lush vegetation, in addition to routine weeding, the ground below the equipment should be hardened, such as by laying cement or stones.
- 13) Before installing, operating, or maintaining the equipment, clear any accumulated water, ice, snow, or other debris from the top. Open the door only after ensuring that no debris will fall into the equipment.
- 14) Seal all cable entry points. Use sealing clay for cable entry points that are in use and use the provided covers for those not in use. The correct sealing method is shown in the figure below.

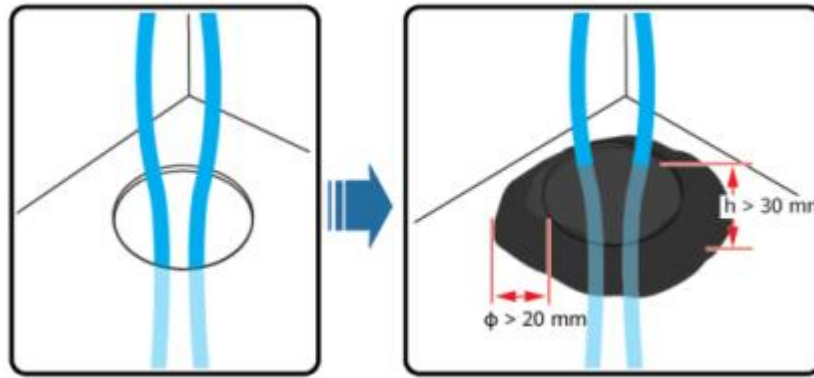


Figure 1.9-1 Standard for Sealing Cable Entry Points

6.10 Mechanical Safety

High-altitude work requires wearing safety helmets, safety belts, or lanyards, securely attached to firm structural components. Do not hang on unstable moving objects or metal with sharp edges to prevent accidents due to hook slippage and falls.



1) Tools should be complete and professionally inspected for quality. Do not use tools with damage, those that fail

inspection, or are beyond their inspection validity. Ensure tools are secure and not overloaded.

2) Before installing the equipment in the cabinet, ensure the cabinet is properly fixed to prevent tilting or collapsing due to an unstable center of gravity, which could injure installers or damage the equipment.

3) When removing equipment from the cabinet, be careful with potentially unstable or heavy equipment inside the cabinet to avoid crushing or impact injuries.



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

6.11 General Requirements

- 1) Paint scratches that occur during the transportation and installation of equipment must be repaired promptly, and it is strictly forbidden for the scratched areas to remain exposed for an extended period.
- 2) Welding, cutting, or any other operations involving electrical arcs on the equipment are prohibited without the assessment and approval of our company.
- 3) Installation of other equipment on top of the equipment is prohibited without the evaluation and authorization of our company.
- 4) When working in the space above the equipment, additional protection must be added to the top of the equipment to prevent damage to the equipment.
- 5) Please use the correct tools and be familiar with their proper usage.

6.12 Safe Handling of Heavy Objects

- 1) When handling heavy objects, select appropriate handling tools and ensure an adequate number of personnel coordinate their efforts based on the weight of the cargo to ensure safe handling. The recommended methods for handling goods by our company are shown in the diagram below.



Figure 1.12-1 Schematic Diagram of Different Methods for Handling Goods of Varying Weights.

- 2) When manually handling equipment, wear protective gloves and anti-crush shoes, and use other safety protective gear as required.
- 3) During the equipment handling process, take precautions to avoid scratching the equipment surface or damaging components and cables.
- 4) When using a forklift for handling, ensure that the forklift forks are positioned in the middle to prevent tipping. Before moving, secure the equipment to the forklift using ropes and assign personnel to oversee the process.

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- 5) Exercise caution when moving equipment to prevent collisions or falls.
- 6) Choose sea transport or well-maintained roads for transportation; rail and air transport are not supported. During transportation, minimize vibrations and tilting as much as possible.
- 7) The tilting angle of the equipment cabinet must adhere to the requirements shown in the diagram, with a tilt angle of $\alpha \leq 10^\circ$ when packaged and $\alpha \leq 5^\circ$ after unpacking.

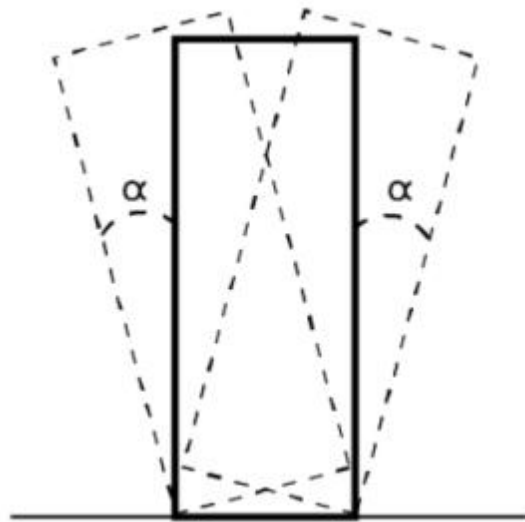


Figure 1.12-2 Schematic Diagram of Allowable Tilting Angles for Cabinet

6.13 High Altitude Safety

- 1) Any operation conducted at a height of more than 2 meters above ground level is considered a high-altitude operation and requires the presence of a safety supervisor.
- 2) Individuals must undergo relevant training and obtain the necessary qualifications before engaging in high-altitude operations.
- 3) High-altitude operations should be halted in the event of rain or other hazardous conditions. After such conditions pass, the safety officer and technical personnel must inspect all operation equipment to ensure safety before resuming work.
- 4) In high-altitude work areas, dangerous prohibited zones must be marked and clearly identified, and access by unauthorized personnel must be strictly prohibited.
- 5) Guardrails and signs must be installed at openings and holes in high-altitude work areas to prevent accidental falls.
- 6) Below the work area in high-altitude operations, it is strictly forbidden to store

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scaffolding, planks, or other objects. Ground personnel are prohibited from staying or passing directly beneath the high-altitude work area.

7) Ensure that tools and equipment are properly secured to prevent damage to equipment or injury to personnel due to falling objects.

8) It is strictly prohibited for personnel working at heights to throw objects from a high elevation to the ground or vice versa. Instead, use hoists, baskets, elevated platforms, or cranes for transporting objects.

9) Whenever possible, avoid simultaneous operations on upper and lower levels. If unavoidable, dedicated protective shelters or other measures must be implemented between upper and lower levels, and upper levels must strictly avoid stacking tools and materials.

10) When dismantling scaffolding upon completion of work, it must be done in a step-by-step manner from top to bottom, and simultaneous dismantling of upper and lower levels must be strictly prohibited to prevent collapse.

11) Personnel engaged in high-altitude work must strictly adhere to high-altitude safety regulations, and the company assumes no responsibility for accidents resulting from violations of high-altitude safety operation rules.

12) Playfulness and resting are strictly prohibited during high-altitude work.

6.14 Climbing Safety

- 1) When there is a possibility of electrical operations at heights, wooden ladders or insulated ladders should be used.
- 2) Platforms with protective barriers should be prioritized for climbing operations, and single-pole ladders should be prohibited.
- 3) Before using a ladder, ensure that it is in good condition, capable of bearing the weight, and strictly avoid overloading.
- 4) The ladder must be placed on a stable surface, and there must be someone to hold the ladder during use.



Figure 1.14-1 Schematic Diagram of Personnel Assisting on a Ladder

- 5) Maintain a stable posture while climbing, ensuring that your body's center of gravity does not deviate from the ladder edge to reduce the risk and ensure safety.
- 6) Secure the rope firmly when using an extension ladder.

6.15 Lifting Safety

- 1) Personnel involved in lifting operations must undergo relevant training and be qualified before commencing work.
- 2) The lifting area must be demarcated with temporary warning signs or barriers.
- 3) The foundation for lifting must meet the load-bearing requirements of the crane.
- 4) Before lifting, ensure that lifting tools are securely fixed to a fixed object or wall that meets the weight-bearing standards.
- 5) During lifting, walking beneath the lifting arm or load is strictly prohibited.
- 6) Dragging steel cables or lifting gear and using hard objects to strike are prohibited during lifting.
- 7) During lifting, ensure that the angle between the two cables does not exceed 90° , as shown in the following diagram.

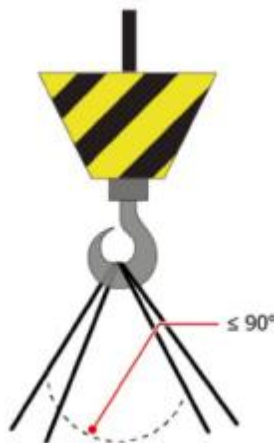


Figure 1.15-1 Schematic Diagram of Cable Angle during Lifting Operations

6.16 Drilling Safety

- 1) Prior approval from the customer or contractor is required before drilling.
- 2) When drilling, wear safety protective equipment such as protective goggles and gloves.
- 3) Avoid pre-embedded pipelines or cables during drilling to prevent short circuits or other hazards.
- 4) During drilling, protect the equipment from debris and promptly clean up after drilling to prevent debris from entering the equipment.

6.17 Equipment Safety

1. ESS Safety

This product specification is only applicable to YT-DS5T103-PV050-B02 optical storage integrated intelligent distributed energy storage products.

	1) Opening the cabinet doors is prohibited during system operation.
	2) Avoid standing near the cabinet doors, including within their opening range, during an ESS fault.
	ESS must have protective measures such as fences or walls, along with erected safety warning signs for isolation, to prevent unauthorized personnel from entering during operation and causing personal injury or property damage.

- 1) The installation layout of the ESS must comply with local standards for fire safety distances or firewalls, including but not limited to the "GB51048-2014 Electrochemical Energy Storage Station Design Specification" and the "NFPA 855 Standard for the Installation of Stationary ESS."
- 2) ESS should undergo regular fire safety inspections, at least once a month.
- 3) During live inspections of the system, pay attention to danger warning signs on the equipment and avoid standing at the cabinet doors.
- 4) After replacing power components of the ESS or changing connections, manual initiation of connection testing and topology recognition is required to prevent abnormal system operation.
- 5) It is recommended that users have their own recording devices to document the detailed process of installing, operating, and maintaining the equipment.

2. Battery Safety



1) Short-circuiting the positive and negative terminals of the battery is strictly prohibited, as it can cause a short circuit. A battery short circuit can instantly generate a large current and release a significant amount of energy, leading to battery leakage, smoking, release of combustible gases, thermal runaway, fire, or explosion. To prevent battery short circuiting, maintenance with the battery charged is not allowed.

2) Do not expose the battery to high-temperature environments or near heating devices such as intense sunlight, fire sources, transformers, heaters, etc. Overheating of the battery can cause leakage, smoking, release of combustible gases, thermal runaway, fire, or explosion.

3) The battery must not be subjected to mechanical vibrations, falls, collisions, puncturing by sharp objects, or voltage impacts, as these could damage the battery or cause fires.

4) Dismantling, modifying, or damaging the battery (such as inserting foreign objects, external pressure, immersion in water or other liquids) is strictly forbidden, to avoid causing battery leakage, smoking, release of combustible gases, thermal runaway, fire, or explosion.

5) Contact of battery terminals with other metal objects is prohibited as it may cause heating or electrolyte leakage.

6) Using or replacing batteries with incorrect models poses a risk of fire or explosion. Please use batteries of the specified model recommended by the manufacturer.

	7) Battery electrolyte is toxic and volatile. In case of electrolyte leakage or abnormal odors, avoid contact with the leaked liquid or gases. Non-professionals should not approach and must contact professionals immediately. Professionals should wear protective goggles, rubber gloves, gas masks, protective clothing, etc., turn off the equipment promptly, remove the leaking batteries, and contact a technical engineer for handling. 8) The battery is a sealed system and under normal operating conditions, no gases are released. However, in extreme misuse scenarios such as burning, puncturing, compression, lightning strike, overcharging, or other conditions that might cause thermal runaway, the battery could be damaged or undergo abnormal chemical reactions internally, potentially leading to electrolyte leakage or the production of gases like CO or H₂. Ensure proper venting measures for combustible gases on-site to prevent combustion or equipment corrosion. 9) Gases produced by burning batteries can irritate the eyes, skin, and throat. Take appropriate precautions.
	1) Batteries should be installed away from areas prone to liquid intrusion, such as air conditioning vents, ventilation openings, windows in machine rooms, water pipes, etc., to prevent liquids from entering the equipment and causing failures or short circuits. 2) When installing and commissioning batteries, adhere to construction standards and equip with fire safety facilities, such as fire sand, CO₂ fire extinguishers, etc. Before operation, ensure the availability of fire safety facilities compliant with

	local laws and standards.
	3)Before unpacking batteries for storage and transport, ensure that the outer packaging is intact and correctly placed according to the packaging box labels,strictly prohibiting upside-down,sideways, vertical,inclined placement,and stacking in compliance with the stacking requirements on the packaging, to avoid any impacts or falls that could damage or scrap the batteries.
	4) After unpacking, place batteries in the specified direction,strictly forbidding upside-down, sideways, vertical, inclined, or stacked placement, to avoid any impacts or falls that could damage or scrap the batteries.
	5) Tighten the copper busbars or cable terminal screws as specified in the manual, regularly check for tightness, rust,corrosion,or other foreign objects, and clean them.Otherwise, loose screws can cause excessive connection voltage drop, and high currents can cause excessive heating, burning the battery.
	6)After battery discharge, charge the battery promptly to prevent damage due to over-discharge.

Disclaimer: I s not responsible for damage to batteries provided by the company due to the following reasons:

- 1) Battery damage caused by earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or force majeure.
- 2) Direct damage to batteries due to on-site equipment operating environments or external electrical parameters not meeting the requirements for normal operation, including but not limited to actual operating temperatures of batteries being too high or too low, unstable electrical grid conditions, frequent power outages, etc.
- 3) Battery damage, falls, leaks, ruptures, etc., due to improper operation or failure to connect the batteries as required.
- 4) Battery damage caused by over-discharge due to failure to power up the batteries promptly after on-site installation and system connection.
- 5) Battery damage due to failure to accept delivery promptly.
- 6) Incorrect setting of battery operation management parameters.
- 7) Mixing batteries provided by the company with other batteries, causing accelerated capacity degradation, including but not limited to: mixing with batteries of other brands or different rated capacities.
- 8) Frequent over-discharge of batteries due to improper maintenance, on-site capacity expansion, or long-term inability to fully charge.
- 9) Failure to properly maintain and care for batteries according to the operating manual of the accompanying equipment, including but not limited to: not regularly checking whether battery terminal screws are tightened.
- 10) Battery damage due to storage not in accordance with requirements (such as storing in humid or rain-prone environments).
- 11) Battery damage due to failure to charge promptly, causing over-storage and resulting in capacity loss or irreversible damage.
- 12) Battery damage caused by you or a third party, including but not limited to: unauthorized relocation or installation of batteries against the company's requirements.
- 13) Changing the battery usage scenario without notifying the company.
- 14) Connecting additional loads to the battery on your own.
- 15) Exceeding the maximum storage period of the battery.

3.General Requirements

This product specification is only applicable to YT-DS5T103-PV050-B02 optical storage integrated intelligent distributed energy storage products developed by Digital Energy Technology Co.,LTD.

	1) Do not expose batteries to high-temperature environments or near heating devices, such as sunlight, fire sources, transformers, heaters, etc. Overheating of batteries may cause fires or explosions.
	2) Dismantling, modifying, or damaging batteries (such as inserting foreign objects, immersing in water or other liquids) is strictly prohibited, to avoid causing battery leakage, overheating, fire, or explosion.
	3)Lithium-ion battery ESS have a high fire risk. Consider the following safety risks before working on batteries.
	4)Battery electrolyte is flammable, toxic, and volatile.
	5)Thermal runaway of batteries can produce combustible gases and harmful gases such as CO and HF.
	6)Accumulation of combustible gases produced after thermal runaway of batteries poses a risk of deflagration and explosion. ESS must be installed and unloaded in accordance with the laws and industry standards of the region.Rough handling can cause short circuits or damage to batteries inside the cabinet, potentially leading to battery leakage, rupture, explosion, or fire.

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- 1) Batteries must be stored in a separate warehouse, in their external packaging, to avoid mixing with other materials, open-air storage, and excessive stacking. The site must have fire safety facilities that meet requirements, such as fire sand, fire extinguishers, etc.
- 2) Do not disassemble the external packaging of batteries under normal circumstances. If recharging of batteries is required, it must be done by professionals according to requirements. After recharging, the batteries should be repackaged.
- 3) After unpacking batteries for outdoor use, it is recommended to power them up within 24 hours. If timely powering up is not possible, store the batteries indoors, in a dry environment free from corrosive gases.
- 4) Batteries should be placed according to the anti-inversion labels or tags on the packaging boxes, to avoid leakage from long-term inverted storage.
- 5) Batteries should be protected from impacts.
- 6) When handling batteries, carry them in the direction required by the battery, prohibiting inversion or tilting.
- 7) Use batteries within the temperature range specified in this manual. When the environmental temperature of the battery is below the lower limit of the working temperature, do not charge to avoid internal short circuits due to crystallization at low temperatures.
- 8) Dispose of waste batteries according to local laws and regulations, and do not treat batteries as household waste. Improper disposal of batteries can lead to environmental pollution.
- 9) Do not use damaged batteries (batteries with dents or other damage to the casing). Damaged batteries may release flammable gases, and should not be stored near undamaged products.
- 10) The storage location for damaged batteries should not contain flammable materials, and non-professionals should not approach.
- 11) During the storage of damaged batteries, monitor them to ensure there are no signs of smoke, flame, electrolyte leakage, or heating.
- 12) If the battery pack is accidentally drenched, do not continue with the installation. Transport it to a safe isolation point and promptly apply for spare part replacement.
- 13) Ensure no direct sunlight or rain exposure, dry and well-ventilated environment, clean surroundings, and absence of excessive infrared radiation, organic solvents, or corrosive gases.

4.Recharging Requirements

- 1) If it has been more than 6 months since the last charge, the battery needs to be recharged. Failure to recharge as required may affect the battery's performance and lifespan.
- 2) Consult a service engineer for the production completion time of the battery pack.
- 3) Before installing the battery pack, check for any abnormalities. Abnormalities in the battery pack include significant deformation or damage to the outer shell, total positive to total negative voltage being approximately 0V, or impedance from the positive or negative ears to the ground being less than 50k Ω .

5.Battery Installation Requirements

- 1) Please use the specified model of the battery. Using non-specified models may result in battery damage.
- 2) Before installing the battery, check that the packaging is intact. Do not use batteries with damaged packaging.
- 3) Batteries should be placed horizontally and secured.
- 4) During the installation of batteries, do not place installation tools or miscellaneous items on the batteries.
- 5) Pay attention to the positive and negative terminals during the installation process, and avoid short-circuiting the battery's terminals.
- 6) During installation, use a torque wrench to ensure terminal connections are tightened and regularly check for looseness.

6. Battery Short Circuit Protection

	Short circuits in batteries can produce a large current instantaneously and release a significant amount of energy, potentially causing personal injury and property loss.
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- 1) When installing or maintaining batteries, use insulating tape to wrap exposed cable terminals on the battery.
- 2) Avoid foreign objects (such as conductive objects, screws, liquids, etc.) entering the battery and causing a short circuit.

7. Hazard and Toxicity Description

	1.Hazard: Contact of battery terminals with other metals may cause heating or electrolyte leakage.The electrolyte is flammable; if it leaks, immediately move the battery away from the fire.
	2.Toxicity: Vapors produced by burning batteries may irritate the eyes, skin, and throat.

8.Battery Anomaly Handling Measures

	1) In case of electrolyte leakage or abnormal odors, avoid contact with the leaked liquid or gas. Non-professionals should not approach, and professional personnel should be contacted immediately.Professionals should wear protective goggles,rubber gloves,gas masks, protective clothing, etc., to prevent harm caused by electrolyte spillage.
	2) The electrolyte is corrosive and can cause skin irritation and chemical burns upon contact.

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	If contact with battery electrolyte occurs, take the following measures:
	3)Inhalation: Evacuate the contaminated area, inhale fresh air immediately, and seek medical help.
	4) Eye Contact: Immediately rinse eyes with plenty of water for at least 15 minutes without rubbing, and seek medical help.
	5)Skin Contact: Immediately wash the contact area with plenty of water and soap, and seek medical help.
	6)Ingestion: Seek medical help immediately.

9. In Case of Battery Drop

- 1) After a battery drop (with or without packaging), if there are no obvious deformations or damages and no obvious odors, smoke, or fire, proceed with caution.
- 2) In a warehouse: Evacuate personnel, use mechanical tools by professionals to transport the battery to a safe open space, and contact a service engineer. Leave the battery stationary for 1 hour and monitor the temperature within $\pm 10^{\circ}\text{C}$ of room temperature before handling.
- 3) At the ESS site: Evacuate personnel, close the ESS door, use mechanical tools by professionals to transport the battery to a safe open space, and contact a service engineer. Leave the battery stationary for 1 hour before handling.
- 4) If a battery drop results in obvious odors, damage, smoke, or fire, immediately evacuate personnel, contact professionals, report the incident, and extinguish the fire with fire-fighting equipment by professionals ensuring safety.
- 5) After a battery has fallen, it is prohibited to continue use. Please contact our company's service engineer for assessment.

10. Maintenance and Replacement

- 1) Before removing components from the cabinet, please ensure that other components on the cabinet are not loose or pose safety hazards.
- 2) When performing maintenance on the ESS, there must be two or more personnel present at the site.
- 3) During equipment maintenance, insulated materials should be used to cover nearby energized components.
- 4) Opening the cabinet is prohibited during adverse weather conditions such as rain, snow, lightning, sandstorms, heavy fog, etc.
- 5) Before the fans are powered off or stopped, it is prohibited to touch the running fans with fingers, components, screws, tools, or circuit boards.
- 6) Do not power on the equipment before troubleshooting.
- 7) When conducting live inspections of the system, pay attention to the danger warning signs on the equipment and avoid standing at the energy storage cabinet door.
- 8) After de-energizing equipment other than battery packs, wait for 15 minutes to ensure that the equipment is completely de-energized before performing any operations on the equipment.

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9) Switches that need to be disconnected for maintenance must have conspicuous labels affixed to them.

10) After replacing power components or making wiring changes to the ESS, manual wire detection and topology recognition must be initiated to prevent abnormal system operation.

11) After completing maintenance and replacement procedures, promptly lock the battery cabinet door and securely store the key.

7.Product Introduction

7.1 Product Definition

PV&ESS All-in-one Smart Distributed cabinet (refer to as PV&ESS All-in-one Cabinet)) is a novel ESS that combines photovoltaic, power generation, load management, and energy storage. It goes beyond simple modular stacking, ensuring reliable and efficient electricity consumption for users while contributing to stable power supply for local public grids and enhancing overall power quality. Additionally, it aids in reducing the need for grid expansion and alleviating hardware investments in local power supply systems.

The product system adopts a modular design, with individual modules for Power Conversion System (PCS), photovoltaic capacity, energy storage capacity, energy management system (EMS), fire protection system, air conditioning insulation system, and combustible gas emission system. This modular approach allows each component to operate optimally, leveraging their respective advantages.

The Power Conversion System (PCS) provides a stable and reliable power source for loads. Using advanced technology, it integrates solar power, grid electricity, and energy storage batteries to supply power to loads.

Photovoltaic (PV) collects solar energy and transmits it to the user through PCS. From a long-term perspective, it provides users with reliable clean energy while saving the electricity costs of users. Energy storage batteries provide users with a continuous and reliable power source, particularly in situations requiring uninterrupted power supply. They also help in smoothing peak power demand and reducing overall power consumption.

The energy management system (EMS), employing advanced smart algorithms, optimizes the sources of electricity for users, enhancing the economic efficiency of power consumption and ensuring reliable power supply.

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The fire protection system ensures the safety of the product itself and can be integrated with the user's fire protection system for a comprehensive fire protection solution.

The air conditioning insulation system precisely controls battery temperature, extending battery lifespan and enhancing battery power supply.

The combustible gas emission system releases gases produced during battery charging and discharging outside, reducing gas concentration inside and minimizing the risk of combustion and explosion.

Through a well-designed configuration of Power Conversion System (PCS) , photovoltaic capacity and energy storage capacity, the system can operate in grid connection (leveraging peak and off-peak electricity price differentials) and off-grid (in areas with unreliable or no grid power) status.

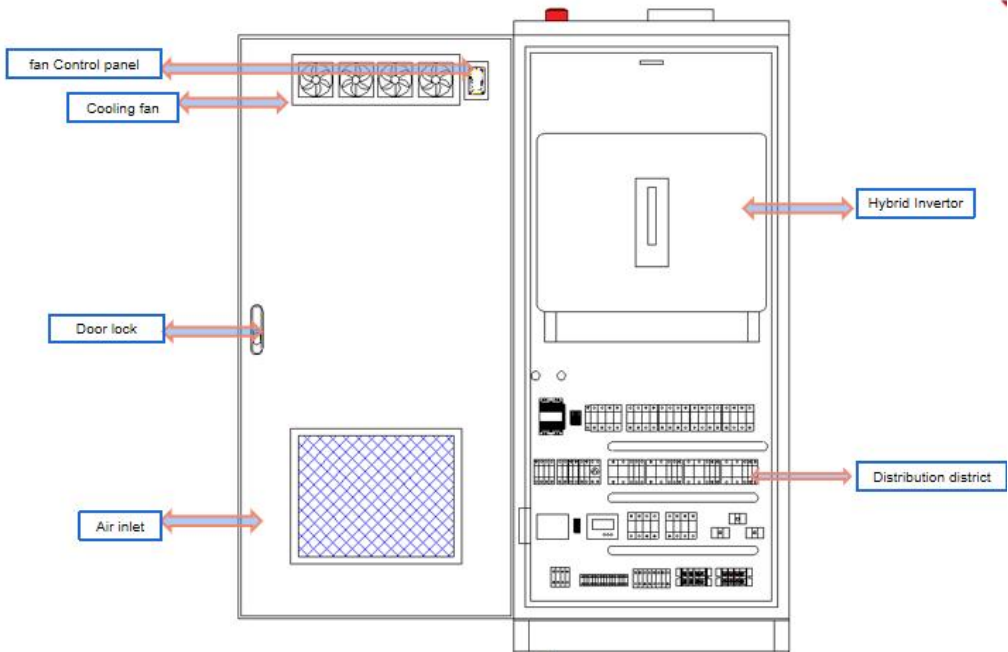
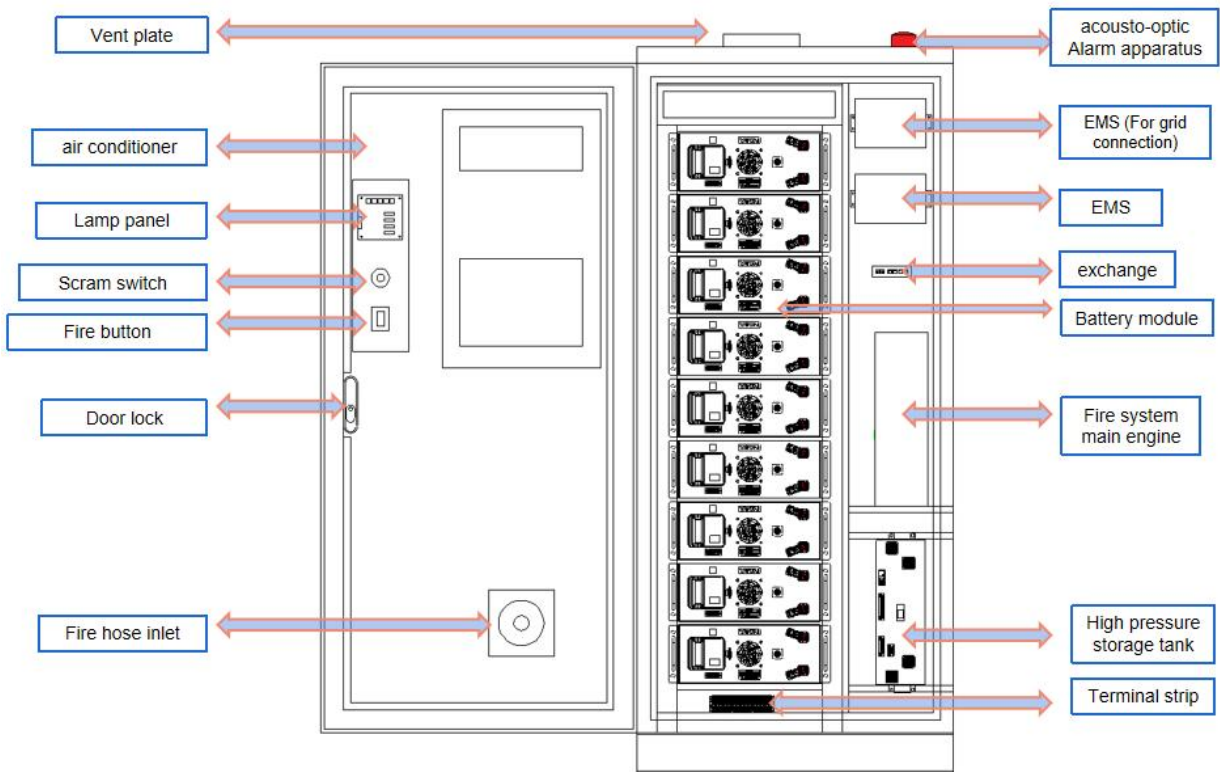
7.2 System Composition

This product is a smart micro grid system that intelligently regulates the distribution of multiple sources and loads. The overall design is housed in a comprehensive cabinet containing up to 9 battery packs, a high-voltage box, BMS, EMS, air conditioning system, fire protection system, and one 50 kW PCS.



Figure 2.2-1 PV&ESS All-in-one Cabinet

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7.3 Battery PACK

The Battery PACK is composed of 24 cells, each with a capacity of 150Ah, along with one fan, one BMU, and structural and electrical components for cell support. The PACK integrates a temperature-controlled air duct, a dedicated channel for combustible gas emission, among other features. The rated capacity of the battery PACK is 11.52 kWh.

Table 2.3-1 Detailed parameters of Battery PACK

No	Parameters	Product specification	Condition
1	Series and parallel connection modes	1P24S	
2	Rated capacity	11.52kWh	@25℃±2℃, 0.5Ccharge/discharge
3	Rated voltage	76.8V	3.2V*24S
4	Maximum charging voltage	86.4V	3.6V*24S
5	Minimum discharge voltage	67.2V	2.8 V*24S
6	Charge-discharge rate	≤0.5C	
7	Normal operating temperature range(charging)	0~50℃	
8	Normal operating temperature range(discharging)	-20~50℃	
9	Storage temperature range	Within 3 months: 0~35℃ Within 1 month: -20~45℃	
10	Optimal storage temperature	25℃	
11	Operating humidity range	5%~95% RH	
12	Altitude	≤2000m	
13	External dimensions L*W*H (mm)	857.5±2*428 ±2*176 ±2	
14	Weight	87.8 ±2kg	

Product Dimensional Diagram:

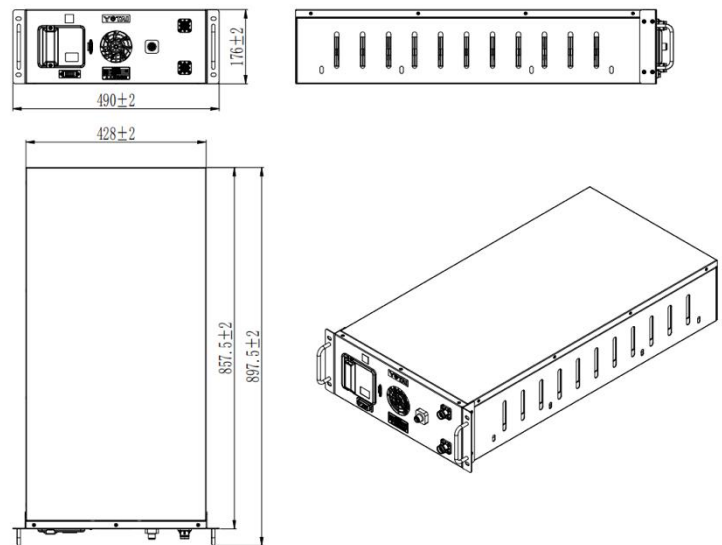


Figure 2.3-1 Battery Pack External Dimension Diagram

When the battery module needs to be stored for an extended period, charge the battery module to a battery level between 15% and 40%. Perform a standard charging and discharging current cycle at least once a month, and activate with a low current (0.1C) every three months. Environment requirements: temperature 0 °C ~35 °C relative humidity ≤60%, atmospheric voltage 86kPa~106kPa, placed in a dry, ventilated place, avoid contact with corrosive substances, away from fire and heat sources.

After packaging, the battery module should be transported to prevent severe vibration, impact, or compression during transportation, and protect against exposure to sunlight and rain. Various transportation methods, such as automobiles, trains, ships, and aircraft, can be used.

7.4 High-voltage Tank

The high-voltage tank is the control part of the entire battery pack, responsible for main circuit interruption control and safe management of the charging and discharging processes of the battery clusters to ensure the safe, reliable, and stable operation of the battery. Its interior mainly consists of pre-charge resistor, fuse, circuit breaker, DC contactor, and shell, among other components. The specifications of the high-voltage box are shown in the table below.

Table 2.4-1 Parameters of the High-voltage Tank

No.	Item	Parameters	Remarks
1	Maximum voltage[Vdc]	1000	
3	Rated current[A]	200	
4	Maximum current[A]	250	
5	Temperature range[°C]	-25~ +55	
6	Humidity range	0~95%RH	No condensing
7	Communication mode	CAN	
8	Communication protocol	CAN2.0B	
9	Altitude[m]	<3000	>2000m derate
10	Ingress protection	IP20	
11	Weight[kg]	20 ± 3	

7.5 BMS - Battery Management System

The BMS system of this product adopts a dual-level architecture, primarily designed for real-time monitoring of the battery pack. It can detect individual cell voltage, total voltage, current, temperature, etc., making real-time judgments about the battery's operational status. It uploads battery pack status information and alarm messages, and when necessary, cuts off the battery pack circuit output for protection.

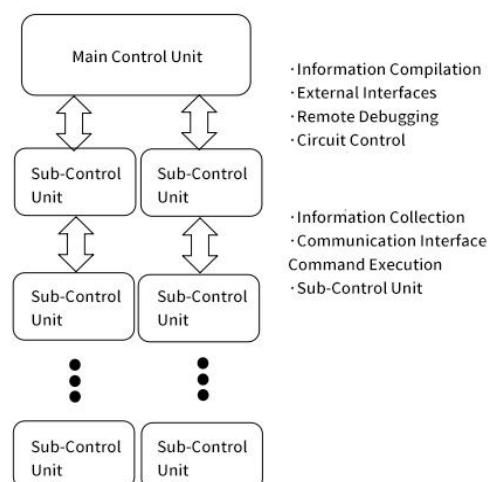


Figure 2.5-1 BMS Dual-Level Architecture Diagram

1.Cooperative Control Management Unit Overview - Battery Management Unit (BMU)

The BMU is a vital component of the Energy Storage Battery Management System (BMS), playing a decisive role in the safe application and lifespan extension of the energy storage battery pack during collective use. The BMU accurately collects voltage and temperature data from individual cells, enabling real-time monitoring of battery status. Additionally, the BMU features temperature information monitoring, passive cell balancing management,module fan control, and other functions.

2. Functions and Characteristics of Cooperative Control Unit

- 1) Battery single-cell voltage function with high accuracy and fast data acquisition,applicable to various battery types,compatible with lithium iron phosphate,lithium manganese oxide,lithium titanium oxide, and ternary batteries.
- 2)Temperature sampling function:High-precision and reliable data acquisition,supporting sampling of 24 series single-cell batteries and up to 28 external temperature channels.
- 3) Balancing: Passive balancing with a maximum balancing current of 80mA.
- 4) isoSPI communication: From-control unit samples information through isoSPI communication and uploads it to the main control, with automatic address allocation. Up to 30 from-control units can be daisy-chained on a single isoSPI communication line, requiring confirmation with technical personnel if exceeding this quantity.
- 5) 485 communication function: Implements DIO input-output control, applicable for functions like program upgrades.
- 6) 1 high-side output: Maximum sustained output of 1A for a single high-side switch with internal status detection for hardware self-check.
- 7) GPIO output and input: 2 open-drain I/O outputs, supporting PWM waves, and two I/O inputs.
- 8) Rich self-diagnostic functions, meeting functional safety certification requirements.
- 9) All materials conform to UL-94V0 flame retardancy.
- 10)Complies with 1500V safety regulations, supporting UL certification for systems exceeding 1500V.

3.Main Control Management Unit Overview - (BCU)

The main control unit is the control core of the battery management system, detecting battery single-cell voltage,temperature,etc., through communication with the from-control unit.It monitors external characteristics parameters such as total battery pack voltage, charge-discharge current,ground insulation resistance,estimates and monitors internal battery status (capacity, SOC, SOH, etc.) based on appropriate algorithms.On this basis,it manages battery pack charge-discharge, thermal management, insulation detection, single-cell balancing, and fault alarms. It can exchange data with PCS,EMS,human-machine interfaces,etc.,through a communication bus and communicate with the BMU through a daisy chain.

4. Functions and Characteristics of Main Control Unit

- 1) High-reliability design: Software, hardware, and structural design follow relevant professional standards.
- 2) High safety: Comprehensive protection functions with multiple redundant protection measures for battery protection under various limit and unexpected conditions.
- 3) Strong anti-interference ability: Designed considering the high-power and complex wiring electromagnetic environment of ESS. All component selections meet high reliability requirements, and input-output interfaces and communication interfaces use effective isolation and filtering to meet the harsh electromagnetic environment of practical applications.
- 4)Precise signal acquisition and SOC estimation: Uses internationally renowned high-precision sampling chips, combines strengths from various SOC algorithms in the industry,and features smart learning to ensure accuracy in signal acquisition and SOC estimation.
- 5) Rich external interfaces: Abundant digital, analog, and communication interfaces, meeting the interface requirements of various projects.
- 6) Broad expandability: Adopts a daisy chain architecture, and the from-control units can be flexibly configured between 1 and 20 based on the number of battery series.
- 7) Flexible configuration upgrade, the product can be flexibly configured using upper computer software based on different application requirements, and rapid program upgrades can be achieved through the CAN communication port.
- 8) All materials conform to UL-94V0 flame retardancy.
- 9) Rich self-diagnostic functions, meeting functional safety certification requirements.

7.6 EMS - Energy Management System

The Energy Management System (EMS) is the energy dispatching and management center of the PV storage system. Through real-time communication with the BMS (Battery Management System), PV storage inverter, circuit energy meter, manageable load devices, and peripheral devices (air conditioning, fire protection) it collects critical data from all communication substations. Through data collection, processing, analysis, internal program logic operation, it controls the orderly and robust operation of the ESS. The EMS used in this product possesses powerful data processing capabilities, is compatible with multiple communication protocols, can quickly interface with BMS and PCS available on the market, and supports remote servicing. The specific parameters are shown in the table below.

Table 2.6-1 EMS Parameters

No.	Item	Technical specification
1	Mobile communication	Support China Mobile, China Unicom, China Telecom 4G/3G/2G full Netcom communication module
2	Ethernet interface	Total 2 channels, 10M/100M, standard RJ45 interface
3	RS485 interface	Total 4 channels, electrical isolation, voltage 2500Vrms, 12Pin Phoenix terminal interface
4	CAN bus interface	Total 2 channels, electrical isolation, voltage 2500Vrms, Phoenix terminal interface
5	RS232 interface	Total 1 channel, electrical isolation, 1500Vdc, DB9 female debugging interface
6	USB interface	A total of 1 channel, HOST or OTG (can be selected by dip), Type-A interface, used for USB flash drive read and write or firmware upgrade burning
7	DO signal interface	4 channels, passive signal output, maximum voltage: 30Vdc, maximum current: 3A, relay electrical isolation, voltage 4000Vrms
8	DI signal interface	4 channels, passive switching signal input, electrical isolation, voltage 4000Vrms

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9	Operating power source	12 ±3V/24±3V, maximum current 3A, standard 5.08mm pitch Phoenix terminals
10	Dimension	215 × 150 × 44 (mm) (not including mounting ears)
11	Operating environment temperature	-30~ +70℃
12	Storage and transportation environment temperature	-40~ +85℃
13	Operating relative humidity	20%~90% no condensing
14	Storage and transportation relative humidity	20%~90% no condensing
15	Altitude	<2000m
16	Mounting mode	The chassis is equipped with mounting ears on both sides,supporting wall-mounted and modular installations.

7.7 Fire Suppression System

This product employs a set of perfluorohexane extinguishing agent with a fire suppression accuracy at the chamber level. It reserves a PACK-level fire interface, and users can opt for PACK-level fire suppression (if not specified, the default is chamber level). The configuration of the fire suppression system equipment is as follows:

Table 2.7-1 Specifications of the Fire Suppression System for this Product

No.	Equipment	Model	Qty.
1	5kg main assembly of fire control device	EVFH-F-5/2.5 W ZE	1set
2	Solenoid valve		1
3	Quick-insert hose	Ø8 PA	3.5m
4	Composite detector	ZEKB0600	1
5	Safety fence	GS8590-EX.3	1
6	Nozzle	External thread G 3/8	1
7	Sound and light alarm	RF1500A	1
8	Alarm start switch		1

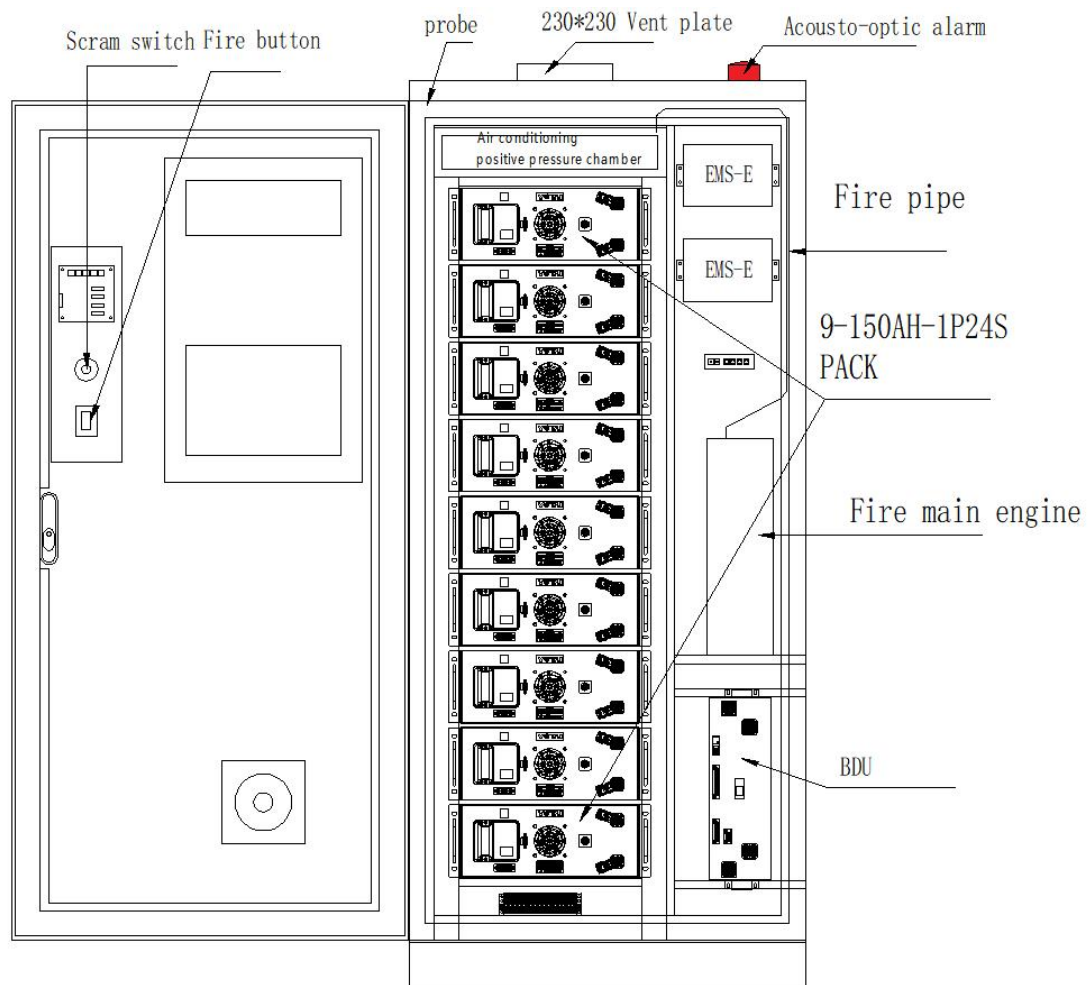


Figure 2.7-1 Fire Suppression System Layout Diagram

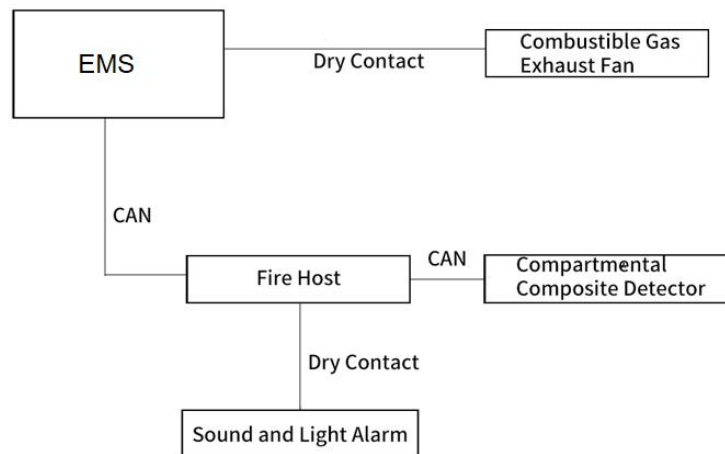


Figure 2.7-2 Communication Topology of the Fire Suppression System

7.8 Hybrid inverter

The hybrid inverter used in this product is a three-phase and off-grid energy storage inverter, which is suitable for the energy management for photovoltaic, battery, power grid. The electricity from the photovoltaic panels is used for load electricity, and excess electricity can be stored in the battery. When the battery is fully charged, the excess power can be transmitted to the public grid. When the electricity generated by the photovoltaic is not enough to meet the load demand of user, the battery will discharge to the load. If there is not enough energy stored in the battery, grid will power the load through the system.

The inverter used in this product is an inverter without isolation transformer, and there is no isolation between DC input and AC output.

Table 2.8-1 Hybrid inverter Parameters

Category	Technical specification	Technical parameter
PV input	Maximum input power	50kW

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parameter	Maximum input voltage	1000V
	MPPT voltage range/rated voltage	200-850V/630V
	Starting voltage	200V
	Maximum input current	30A
	Maximum short-circuit current	40A
	MPPT number	4
	Number of MPPT input strings per channel	2
Battery parameter	Operating voltage range	200-800V
	Maximum charge/discharge current	100A
	Maximum charge/discharge power	50kW
	Battery type	Li-ion/Lead-acid
Grid-connected output parameters	Rated output power	50kW
	Maximum apparent power	50kVA
	Rated output voltage	400V , 3L/N/PE
	Rated frequency	50Hz/60Hz
	Maximum output current	75A
Off-grid output parameters	Rated voltage	400V , 3L/N/PE
	Rated frequency	50Hz/60Hz

	Rated output current	75A
	Rated output power	50kW
	Maximum apparent output power	50kVA
	Off-grid switching time	<20ms
Efficiency	Maximum efficiency	98.40%
	European efficiency	97.50%
Protection	Ac overcurrent protection	Be equipped with
	Earth fault protection	Be equipped with
	Power network monitoring and protection	Be equipped with
	Residual current detection protection	Be equipped with
	Over/under voltage protection	Be equipped with
	ISO protection	Be equipped with
	DC injection monitoring	Be equipped with
	Feedback current monitoring	Be equipped with
	Island protection	Be equipped with
	Load protection	Be equipped with
	Overheat protection	Be equipped with
	Operating temperature	-25℃~+50℃ (>45℃

	range	derate)
	Working altitude	<4000m (>2000m derate)
	Noise index	<40dB
	Topological structure	Transformerless isolation
	Cooling mode	Integrated fan
	Class of protection	IP54
	Relative humidity range	5~90%
	DC connector type	Quick plug terminal
	AC connector type	Terminal
	Man-machine interaction mode	LCD
	Cloud communication	RS485 (4G/GPRS could choose)
	BMS communication mode	CAN
	Electric meter communication mode	RS485
	Installation mode	Wall hanging/floor
	Electricity consumption at night	<10W
	Dimension (W*D*H)	800 ×620 ×300mm
	Weight	72kg

7.9 Multi-Unit Parallel Solution

This product supports a multi-unit parallel solution, with a maximum support of 3 cabinets in parallel. Customers can choose the number of cabinets according to their actual needs. In a multi-unit parallel configuration, customers need to purchase a mains input distribution box, an EPS load output distribution box, and a general load output distribution box. The mains input distribution box distributes mains power to each cabinet; the EPS load distribution box consolidates the EPS load output of multiple cabinets, then distributes it to various loads; the general load distribution box consolidates the general load output of multiple cabinets, then distributes it to various loads.

7.10 Electrical Schematic Diagram

The inverter used in this product is a three-phase and off-grid energy storage inverter, which is suitable for the energy management of photovoltaic, battery, load and power grid.

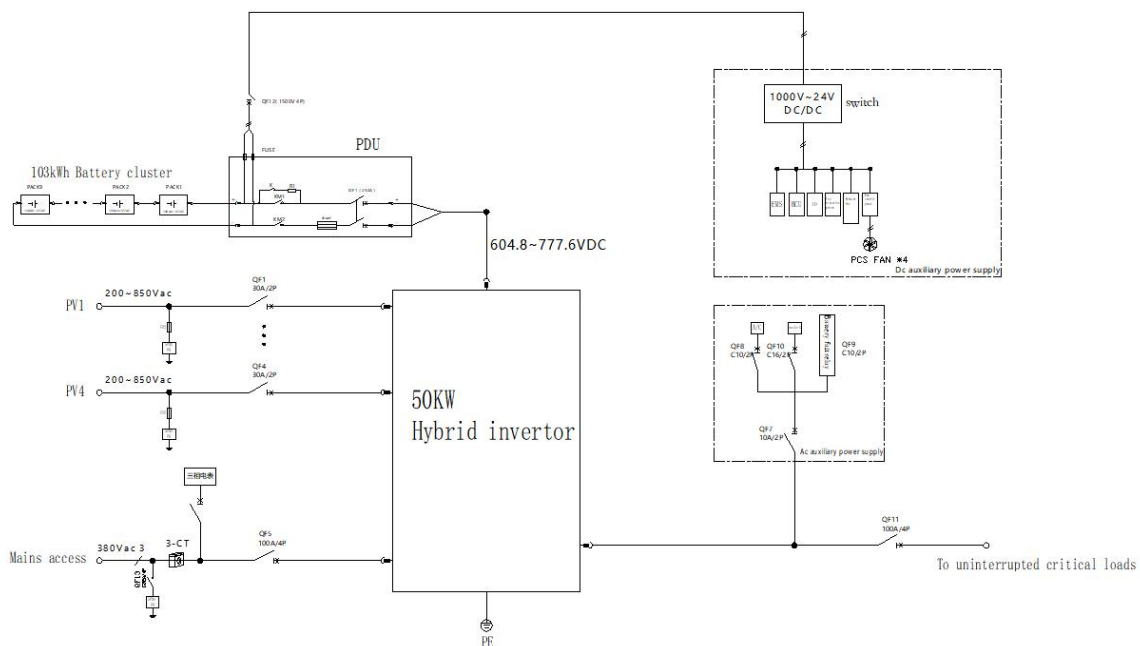


Figure 2.9-1 Electrical schematic diagram of single product

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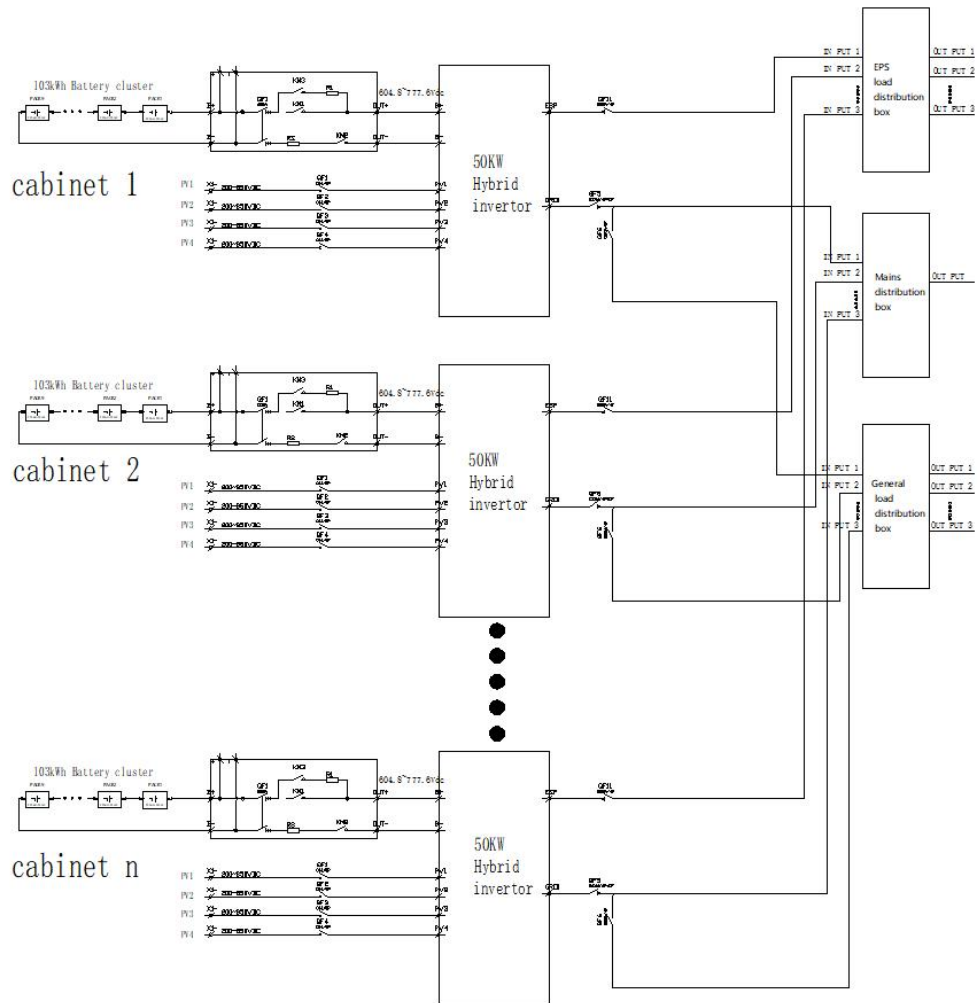


Figure 2.9-2 Electrical schematics of multi-machine parallel products

7.12 Specifications

Table 2.12-1 Specifications for PV&ESS All-in-one Cabinet

Product Model	YT-DS5T103-PV050-B02
Photovoltaic parameter	
Maximum input power	50kW
Starting voltage	200V
Photovoltaic maximum voltage	1000Vdc
Photovoltaic rated voltage	630Vdc
MPPT Operating voltage range	200-850Vdc
MPPT Number	4
Number of single MPPT input channels	2
Maximum input current (per MPPT)	30A*4
Maximum short circuit current (per MPPT)	40A*4
DC side energy storage parameters	
Nominal energy	103kWh
Nominal voltage	690Vdc
Battery voltage range	605~777 Vdc
Rated charge/discharge current	75A
Maximum charge/discharge current	90A
AC parameter	
Rated output power	50kW
Rated input power	50kW
Maximum output current	75A
Rated voltage (input and output)	3L/N/PE; 400V
Off-grid switching time	<20ms
Grid frequency	50Hz/60Hz
Voltage total harmonic distortion	<3%@Rated power & linear load
Mechanical parameter	

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Weight	Net weight1500kg、Gross weight with packaging1570kg
Overall dimension	960 × 1650 × 2245 （W × D × Hmm）
Package size	1030 × 1720 × 2400 （W × D × Hmm）
Communication mode	RS485, Ethernet , 4G
Environmental parameter	
Operating temperature	-20℃~50℃ （Derating above 45 ° C）
Storage temperature	-20℃~45℃
Relative humidity	5~95%, No condensation
Altitude	3000m （Derating above 2000 meters）
Class of protection	IP54

8. Product transportation and installation

8.1 Product transportation and storage requirements

This product meets the requirements of vehicle, ship and other transportation. The shipping box must be firm and the outside of the box should conform to the national standard.

There should be signs such as "Handle with care" and "moisture-proof". Before packing the product, ensure that the remaining battery power is about 40%-50%, and turn off all switches to check whether the components are firmly installed. Due to the external environment (such as temperature, transportation, storage, etc.), the product specifications are subject to the specific factory date. Avoid: direct rain, snow or falling into water, falling or mechanical impact during transportation.

Do not transport batteries if they leak or bulge. Contact a battery recycling company for handling.

8.2 Installation Environment Requirements

	The site selection must meet the requirements of GB 51048 Design Code for Electrochemical Energy Storage Power Station, NFPA 855 Standard for the Installation of Stationary ESS and local regulations.
---	---

Energy storage systems are only suitable for outdoor scenarios and require outdoor deployment; indoor placement is not supported. The site selection criteria are generally as follows:

- 1) The installation location should not be in low-lying areas, and the horizontal plane of the installation should be higher than the historical highest water level in that area.
- 2) The distance from airports, buried waste disposal sites, riverbanks, or dams should be $\geq 2000\text{m}$.
- 3) Choose an open area, ensuring that there are no obstacles within a 10m radius around the site.
- 4) Maintain a distance of at least 50m from residential areas to avoid noise pollution, stay away from sources of ignition, and prohibit children from entering.
- 5) Have convenient transportation conditions and a reliable fire suppression system.
- 6) Meet the immediate space requirements and leave space for expansion based on the needs of the entire life cycle.
- 7) Select a well-ventilated location, and do not block ventilation openings or heat dissipation systems during equipment operation to prevent overheating and fire.

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8) Installing energy storage systems in areas prone to salt damage can lead to corrosion and potential fire hazards. Do not install energy storage systems outdoors in areas prone to salt damage. Salt-prone areas refer to regions within 2000m of the coastline or areas influenced by sea winds. The extent of the impact of sea winds varies based on meteorological conditions (such as typhoons, seasonal winds) or topography (presence of embankments, hills).

	1)When the safety clearance at the selected site fails to meet the relevant national standards, it is advisable to reconsider the site selection.
	2)If no more suitable site is available, it is recommended to install a fire wall with a fire resistance rating of not less than 3 hours according to DBJT 15-81-2022 "Technical Code for Fire Resistance Design of Building Concrete Structures." The thickness of the fire wall should be $\geq 200\text{mm}$, as shown in the table below. Simultaneously, considerations should be given to the requirements of equipment transportation, installation, maintenance, and other spaces.
	3)It is recommended to refer to T/CEC 373-2020: The length and height of the fire wall should extend beyond the outline of the prefabricated container by 1 meter each. Also, refer to NFPA 855-2020 "Standard for the Installation of Stationary Energy Storage Systems": When there is an independent fire wall with a 1-hour fire resistance rating, the clearance is allowed to be reduced to 914mm.

Table 3.1-1 Minimum Values of Wall Thickness and Cover Thickness for Longitudinal Reinforcement

Fire Resistance Limit (min)	Wall Thickness (mm) / Cover Thickness of Longitudinal Reinforcement (mm)			
	u=0.35		u=0.7	
	One-sided Fire Exposure	Two-sided Fire Exposure	One-sided Fire Exposure	Two-sided Fire Exposure
60	140/15	140/15	140/15	140/15
90	140/15	140/15	140/20	170/20
120	150/20	160/20	160/30	220/30
180	180/35	200/40	210/45	270/50

Note: u is the ratio of combined axial voltage to the normal temperature axial bearing capacity at the point where the force is applied to the wall.

Site selection should avoid areas not recommended by industry standards and regulations, including but not limited to the following locations, regions, and places:

- 1) Areas with strong vibration, strong noise sources, and strong electromagnetic field interference.
- 2) Places with dust, oil smoke, harmful gases, corrosive gases, etc.
- 3) Places for production or storage of corrosive, flammable, or explosive materials.
- 4) Areas with existing underground facilities.
- 5) Areas with poor geological conditions such as rubber soil, soft soil layers, prone to water accumulation, and sinking ground.
- 6) Areas with seismic faults and earthquake intensities greater than nine degrees.
- 7) Areas directly threatened by mudslides, landslides, quicksand, and sinkholes.
- 8) Within the boundaries of mining subsidence (faulting) zones.
- 9) Within the blast danger zone.
- 10) Areas that may be submerged after dam or dike failure.
- 11) Important sanitary protection zones for water supply sources.
- 12) Historical and cultural heritage protection zones.

8.3 Installation Space Requirements

To ensure the normal maintenance of equipment inside the cabinet and facilitate the normal movement of tools, it is recommended to reserve sufficient space around the cabinet installation location. The minimum size of the reserved space should not be less than the minimum size shown in the figures below:

- 1) For a single cabinet, reserve a minimum installation spacing of $\geq 1500\text{mm}$ on the side with the door open and $\geq 1000\text{mm}$ on the side without the door open. For multiple cabinets, consider the later maintenance of battery packs, and the minimum reserved space should not be less than the minimum size shown in the figures below.
- 2) A maintenance aisle with a net width of $\geq 1000\text{mm}$ should be set around the cabinet or on one side.
- 3) It is recommended to use a fence to isolate and protect the equipment area, with a height of 1.5m.
- 4) The spacing design above only considers installation and operation requirements. The final spacing must meet local fire requirements.

5)

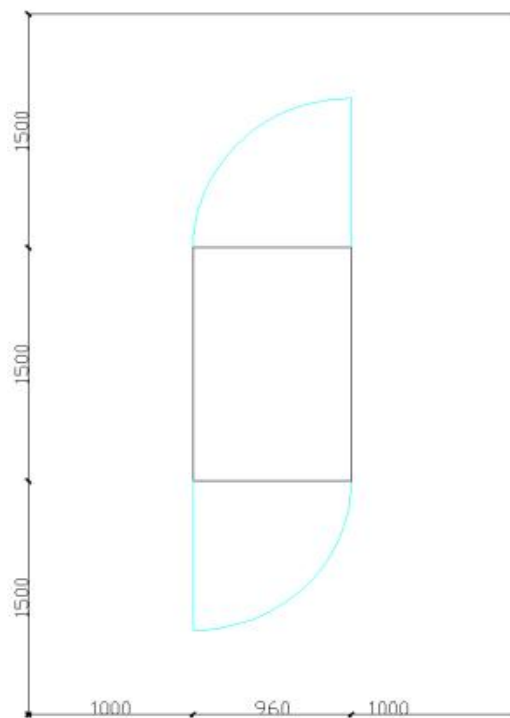


Figure 3.2-1 Schematic Diagram of Single Cabinet Installation Space Requirements (unit:mm)

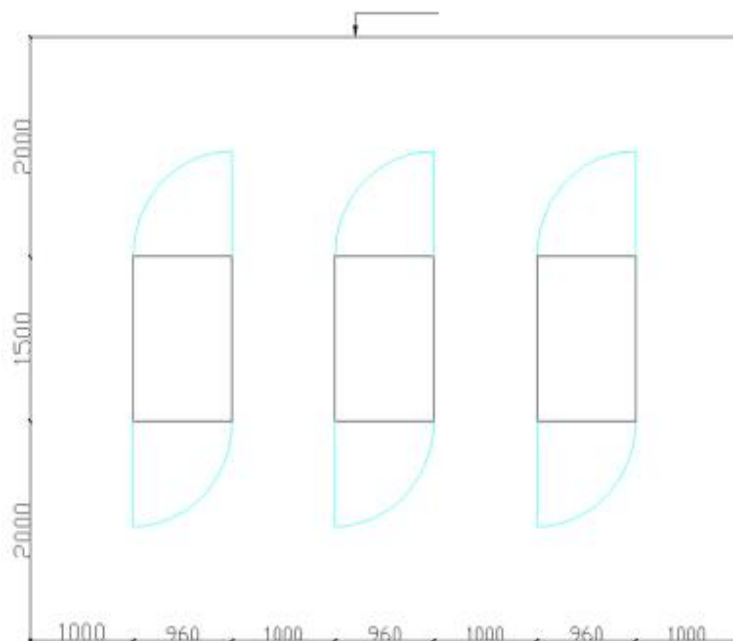


Figure 3.2-2: Schematic Diagram of Multiple Cabinets Installed in Parallel Space Requirements

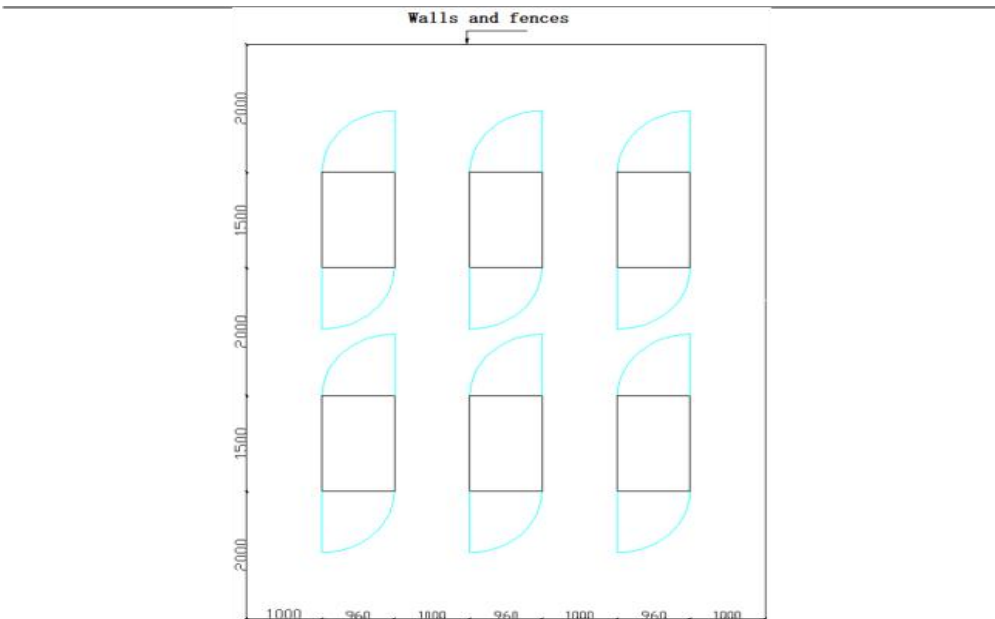


Figure 3.2-3: Schematic Diagram of Multiple Cabinets Arranged in Double Rows Back-to-Back Installation Space Requirements

8.4 Cabinet Installation



The cabinet is relatively heavy, and before constructing the foundation, the conditions of the installation site (mainly referring to geological conditions and environmental climate conditions, etc.) should be carefully examined. Only on this basis can the design and construction of the foundation be started.

The storage location of the cabinet needs to be prepared by a professional construction team in advance. Sufficient space should be left around it for installation and maintenance. If the power lines run through the bottom cable trench, foundation preparation should be done in advance to meet the requirements of lightning protection, waterproofing, rodent prevention, and ventilation. The foundation for cabinet installation must be designed and constructed according to certain standards to meet the requirements of mechanical support, cable routing, and later maintenance and inspection. The following requirements must be met during foundation construction:

1) The soil at the cabinet installation site needs to have a certain degree of compactness.

It is recommended that the relative compaction of the soil at the installation site is $\geq 98\%$. If the soil is loose, measures must be taken to ensure the stability of the foundation.

2) The bottom of the cabinet foundation pit must be compacted and filled to provide sufficient and effective support for the cabinet.

3) The cabinet foundation should be constructed according to the foundation drawing provided by the supplier or the foundation drawing confirmed by our company. The surface tolerance of the foundation should be $\pm 5\text{mm}$.

4) Elevate the base of the cabinet to prevent rainwater from eroding the base and interior of the battery cabinet.

5) The cross-sectional area and height of the foundation should meet the requirements.

6) Drainage measures should be built according to local geological conditions.

7) Build a sufficiently sized and high-quality cement foundation. The height of the foundation should be determined by the construction party based on the site geology.

8) Consider cable routing during foundation construction.

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- 9) Construct a maintenance platform around the foundation for convenient maintenance in the future.
- 10) Based on the location and size of cable entry and exit points inside the cabinet, sufficient space should be reserved for AC/DC cable trays during foundation construction, and cable conduits should be embedded in advance.
- 11) Determine the specifications and quantity of sleeve pipes based on the cable model and the number of incoming and outgoing lines.
- 12) Build a drainage system to prevent the cabinet base or internal equipment from being immersed in water during heavy rainfall or abundant precipitation.
- 13) Both ends of all embedded pipes should be temporarily sealed to prevent impurities from entering; otherwise, it will be inconvenient for later wiring.
- 14) After connecting all cables, seal the cable entry and exit points and joints with fire-resistant mud or other suitable materials to prevent rodents from entering.

The recommended cabinet installation foundation is shown in the below:

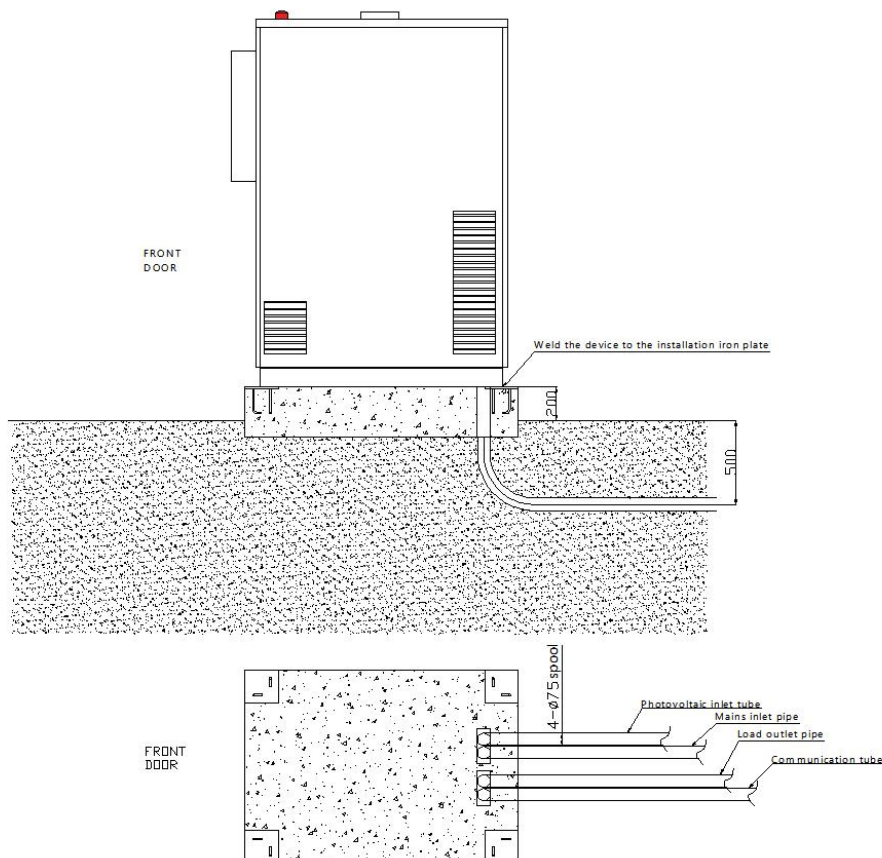
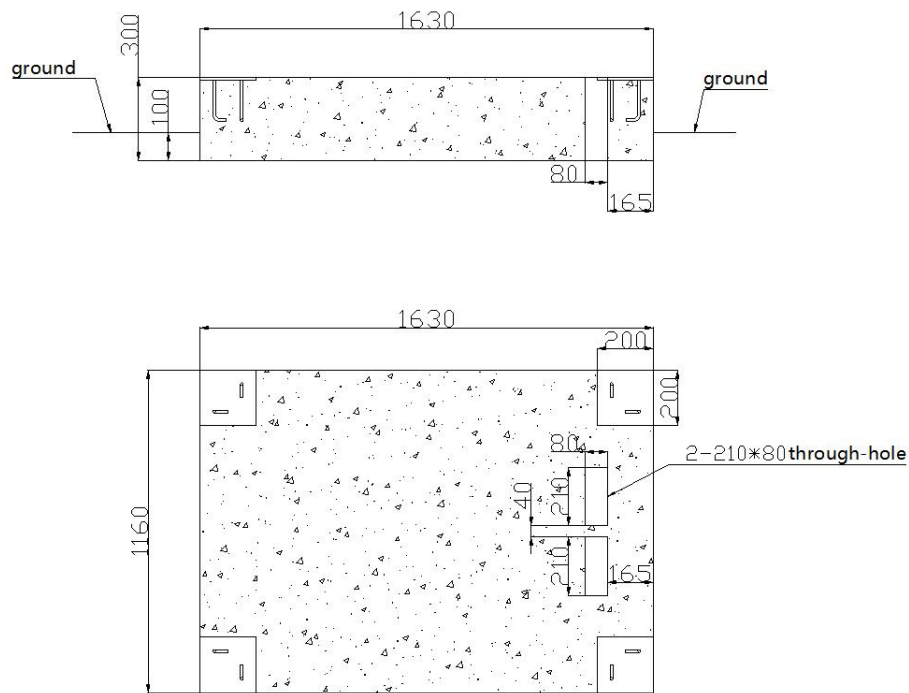


Figure 3.3-1 Equipment foundation drawing (unit: mm)



Basics

Figure 3.3-2 Equipment foundation drawing (unit: mm)

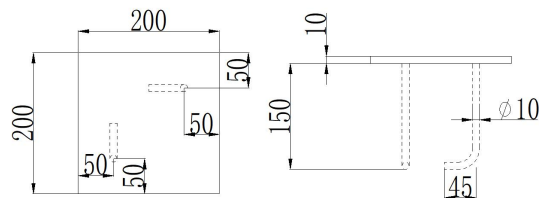


Figure 3.3-3 Equipment foundation drawing (unit: mm)

Basic manufacturing instructions

- 1) The site is compacted and smooth
- 2) Cement base material C25
- 3) The part below the foundation ground shall not be less than 100mm
- 4) Before cementing, bury wire pipe (4*75mm) with a depth greater than 500mm
- 5) When the cement is poured, the installation iron plate should be embedded according to the dimensions of the drawing

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- 6) Pay attention to the position and size of pre-opening holes when cement is poured
- 7) After the cement pouring, the equipment should be maintained for more than 7 days before installation

Mounting plate instructions

- 1) The mounting iron plate is Q235
- 2) Iron plate size 200*200*10mm
- 3) Weld two ϕ 10 steel bars to the bottom of the iron plate, as shown in the figure above

8.5 Photovoltaic panel installation

User must inquire professionals to install the photovoltaic panel according to the user manual. Please pay attention to the following during installation:

- 1) When photovoltaic panels are exposed to sunlight, they generate electricity and can cause fatal voltages and electric shocks.
- 2) The inverter is a multi-power system, and the operator must wear appropriate personal protective equipment: safety helmet, insulated wire and gloves etc.
- 3) The operator must use measuring equipment to ensure that there is no voltage in the cable before touching the output cable of the photovoltaic panel.
- 4) It is strictly prohibited to install photovoltaic modules in rainy, snowy and windy weather conditions.
- 5) It is strictly prohibited to handle photovoltaic modules by one person, it must be carried by two people, and it should be handled lightly to avoid large vibration of the components, so as not to cause hidden cracks of photovoltaic modules.
- 6) Photovoltaic modules of the same size and specifications can be connected in series.
- 7) Do not use when the photovoltaic module is damaged.
- 8) The unpacked battery components at the construction site should be placed face up and flat, and the bottom should be padded with wooden pallets and panel packaging materials. It is strictly prohibited to put them upright, tilted or suspended.
- 9) It is strictly prohibited to expose the back of the component directly to sunlight.
- 10) During the construction process, it is strictly prohibited to step on the panels, to avoid the barbaric construction behavior of component installation to the maximum extent, the design unit should fully consider the reserved channel for component installation, and should not blindly

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affect the high quality of the construction of the power station in order to pursue the installed capacity.

11) It is strictly prohibited to squeeze or use sharp objects to knock, collide, scratch any part of the photovoltaic module.

12) Do not place or touch the installation tool on the photovoltaic module at will.

13) Do not touch the metal parts of the photovoltaic module.

14) It is strictly prohibited to connect the positive and negative plugs of the same photovoltaic module connection line.

15) It is strictly prohibited to lift the component by lifting the junction box or connecting piece. The assembly of photovoltaic modules and accessories should be prepared with the following tools:

1) The fasteners of the photovoltaic module bracket must meet the requirements of national standards, and the hot-dip galvanized parts are used to ensure their life and anti-corrosion fastening purposes. The number, specifications, models and varieties of bolts, nuts, flat washers and spring washers should be complete, with good performance and meet the design requirements. After each bolt is tightened, the length of the exposed part of the bolt should be $\frac{2}{3}$ of the diameter of the bolt.

2) Tools: socket wrench, open wrench, box wrench, hex wrench, level, north pointer, steel measuring tape, torque wrench, wire rope, horizontal pipe, horse stool, step ladder, etc. must meet the requirements of engineering construction and quality inspection.

Wiring between components shall meet the following requirements:

1) The number and path of photovoltaic module connections should meet the design requirements;

2) The indirect plug-in of the photovoltaic module should be firmly connected;

3) The connection between the external cable and the plug-in should be tin lined;

4) The open circuit voltage and short circuit current of the photovoltaic module string should be tested after the series connection of the photovoltaic module;

5) The connection lines between photovoltaic modules can be fixed by brackets, and fixed, and should be neat and beautiful;

6) The positive and negative of the same group of photovoltaic modules or photovoltaic modules should not be short-circuited;

7) Do not touch the metal parts of the photovoltaic module string;

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8) It is strictly prohibited to connect photovoltaic modules in the rain.

8.6 Pre-Installation Inspection

1.Tool Preparation

Before installing equipment,the tools needed,including installation tools and personal protective tools, must be prepared, as shown below.

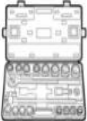
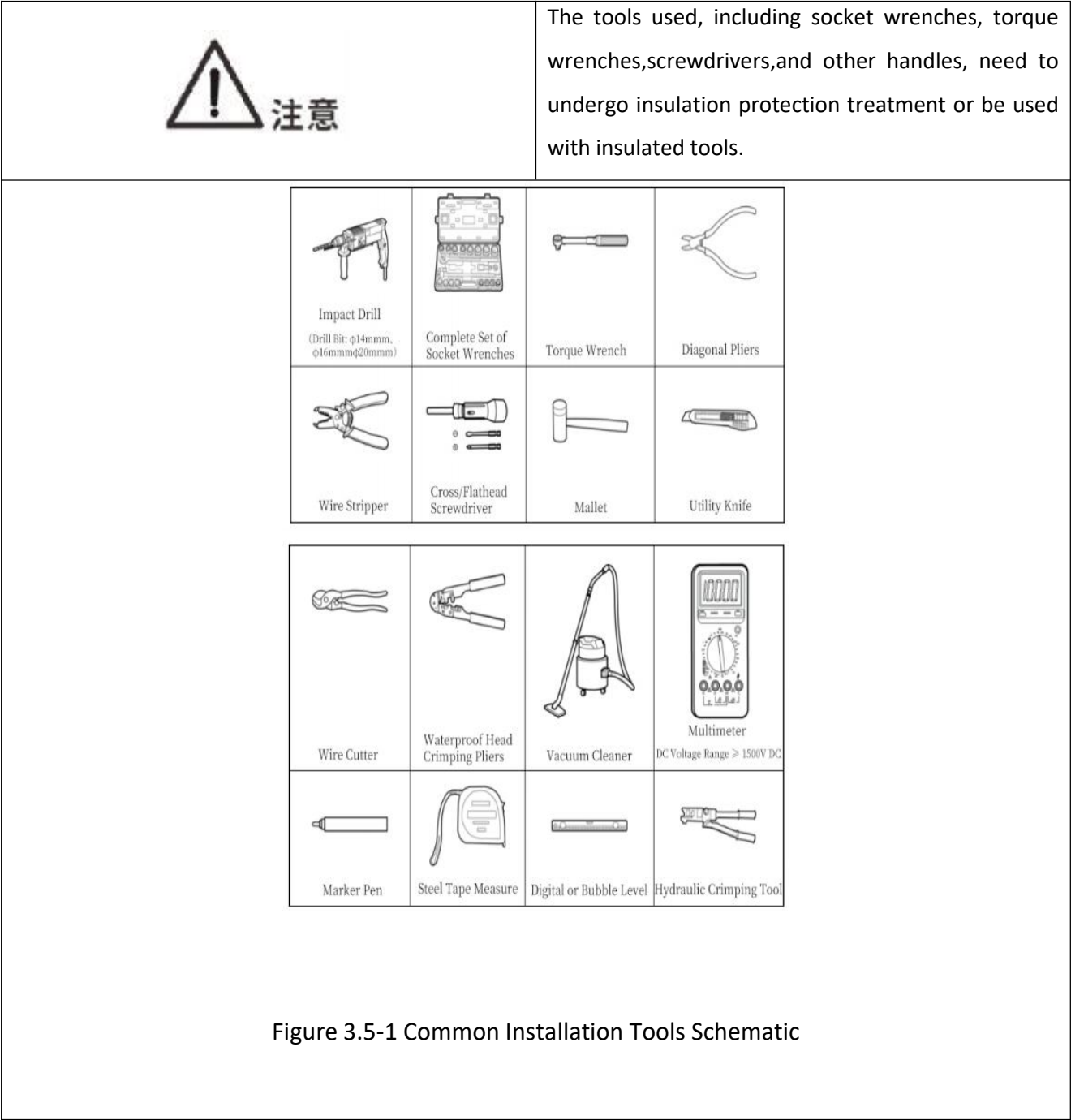
 注意		The tools used, including socket wrenches, torque wrenches,screwdrivers,and other handles, need to undergo insulation protection treatment or be used with insulated tools.			
 Impact Drill (Drill Bit: φ14mm, φ16mmφ20mm)		 Complete Set of Socket Wrenches	 Torque Wrench	 Diagonal Pliers	
 Wire Stripper		 Cross/Flathead Screwdriver	 Mallet	 Utility Knife	
 Wire Cutter		 Waterproof Head Crimping Pliers	 Vacuum Cleaner	 Multimeter DC Voltage Range ≥ 1500V DC	
 Marker Pen		 Steel Tape Measure	 Digital or Bubble Level	 Hydraulic Crimping Tool	

Figure 3.5-1 Common Installation Tools Schematic



Figure3.5-2 Personal Protective Equipment Schematic

2. Installation Environment Inspection

Inspect according to site requirements, and proceed with the installation only if the requirements are met. The company will not be responsible for any losses caused by forced installation that does not meet the requirements.

	Marking the Safety Zone: Use red construction markings to circle the safety area. Clear obstacles within the safety zone, and prominently display construction and safety warning signs.
--	---

4.Electrical Connection

4.1 Overview of Electrical Connection

The inverter used in this product integrates the functions of energy storage and photovoltaic grid-connected connection. This product provides mains access port, photovoltaic DC input port, ground cable connection and communication line connection port when multiple machines are in parallel. The system application diagram is shown below.

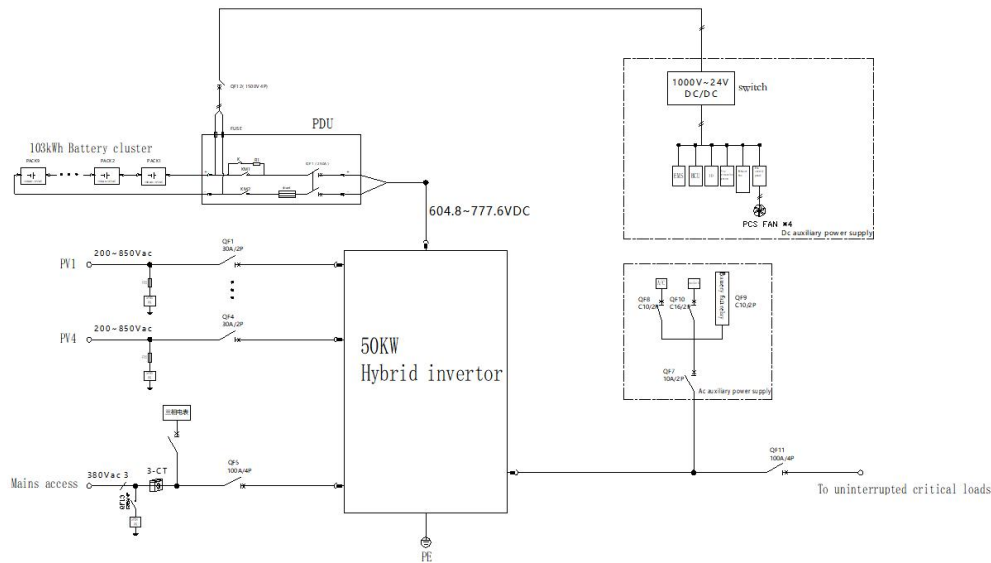


Figure 4.1-1 Electrical Main Wiring Diagram

4.2 Grounding Wire Connection



Prohibit the installation of fuses, switches, etc., on the protective ground wire.



Grounding complies with local electrical safety regulations.

The product cabinet is equipped with one grounding point. After the cabinet is installed, install the grounding lead wire. It is recommended to use 16-35mm² single-core outdoor copper core yellow-green wire, with DT/OT terminals. Secure one end of the yellow-green wire tightly to the cabinet grounding bus with an M6 screw, and connect the other end to the grounding angle iron. The grounding angle iron is recommended to be an $\angle 50 \times 5 \times 2500$ mm hot-dip galvanized grounding iron. Before connecting, drive the grounding iron vertically into the ground. The cabinet requires no less than one grounding point. The grounding schematic is shown in the figure below:

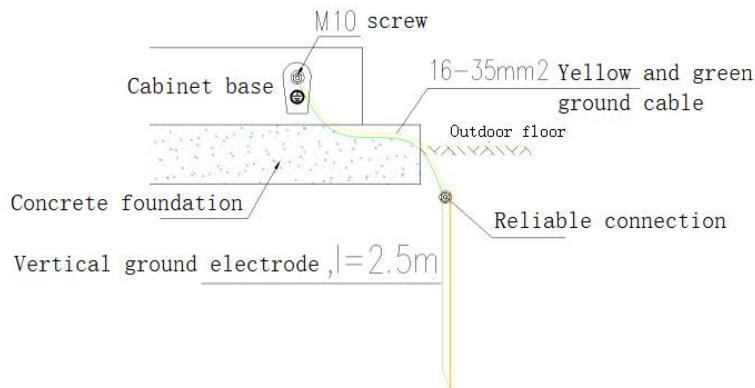


Figure 4.2-1 Cabinet grounding diagram

8.3 AC Line Connection

	1) When connecting AC lines, ensure that the cables are not damaged or broken, and ensure that the N line connection is reliable to avoid damage to AC equipment within the system.
	2) After connecting AC lines, ensure that the terminals are fully aligned and in good contact, and the AC input lines are vertical.

This product provides general load and important load interfaces to meet the needs of different loads. The load can be connected to the lower side of the QF11 switch. Before wiring, please disconnect the AC circuit breaker QF5 and QF11.

The mains input terminal is located on the right terminal block of the power distribution panel. 25mm² copper cables are recommended for the mains and load lines, or recalculate the cables based on the ambient temperature at the installation site, cable heat dissipation conditions and cable length.

See the following figure

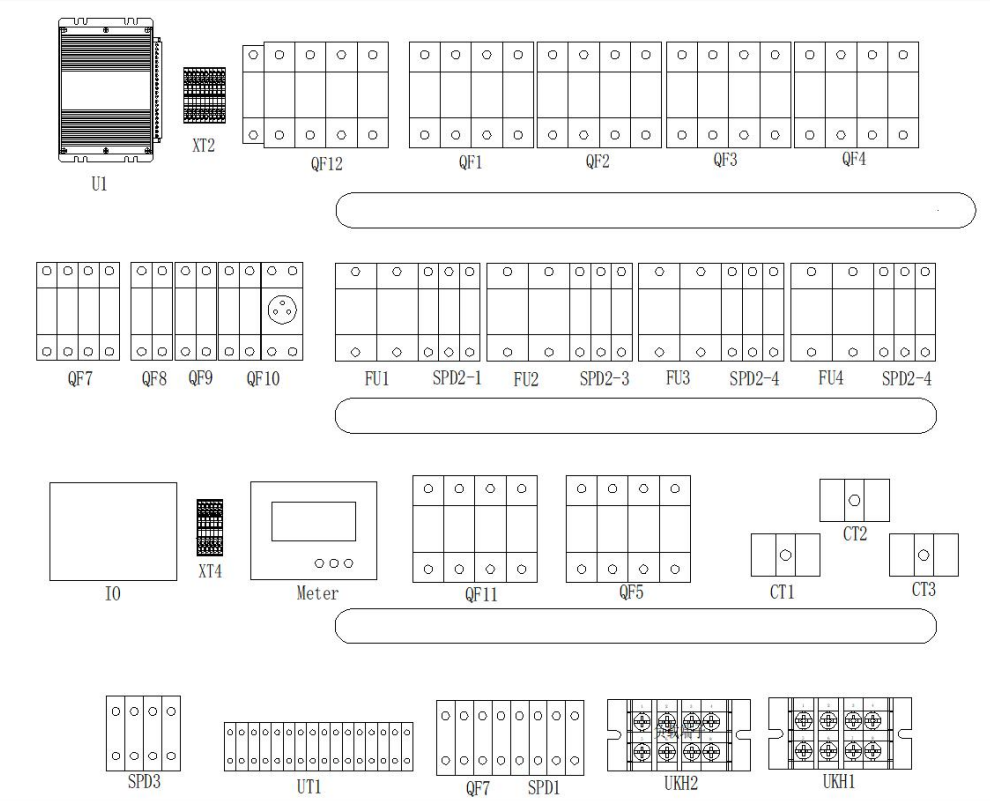


Figure 4.3-1 Power distribution panel layout

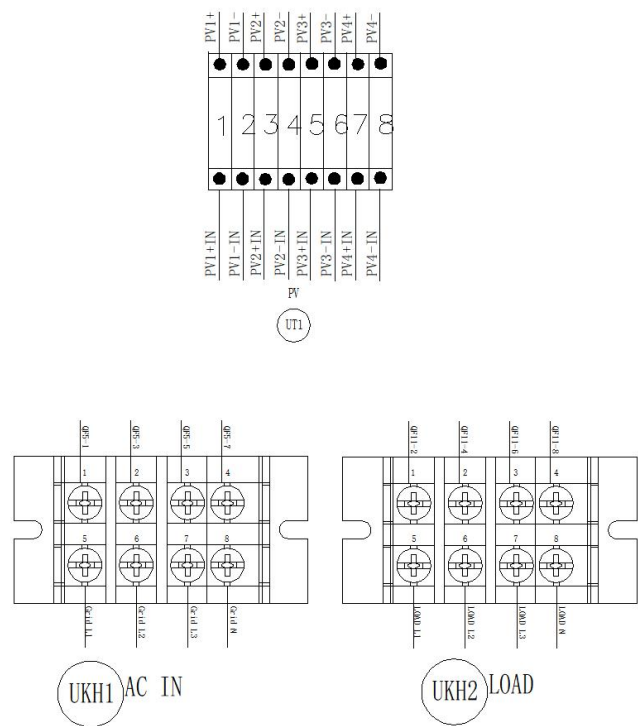


Figure 4.3-2 Definition of the terminal block on the power distribution panel

8.4 Photovoltaic power generation access

	1)Once the photovoltaic array is exposed to sunlight, it will produce deadly high voltage, when the inverter is connected to the photovoltaic, please ensure that the photovoltaic array is well insulated.
	2)Ensure that the maximum voltage of each PV string is always less than 1000 V.
	3)Each input of the inverter operates independently, and each has an independent MPPT, so the photovoltaic group structure of each photovoltaic input can be different from that of another photovoltaic input, including panel type, number of cells, inclination etc.

Before photovoltaic power generation is connected, the following points should be noted:

- 1) In order to make full use of the input power of the photovoltaic panel, the photovoltaic series of the same way should be consistent, including the same model, the same number of panels, the same inclination, the same azimuth.
- 2) Before wiring, pay attention to disconnect the circuit breaker on the front panel of the DC distribution box.
- 3) Before wiring, it should be noted that the positive and negative terminals should not be reversed.

The PV access point of this product is located at terminals 1-8 of the UT1 terminal block on the left side of the power distribution panel. It can provide four PV connections. Note the correct sequence of cable connections. The photovoltaic input line is recommended to use 4-6mm² photovoltaic cables.



In grid-connected mode, when the user's load power is less than the battery discharge or photovoltaic power generation power of the product, if no counter-current measures are taken, the excess power of the product will be reverted to the public power grid, which may cause instability or even collapse of the power grid system. Therefore, this product needs counter-current protection.

8.5 Anti-backflow Meter Connection

The principle of anti-backflow is as follows: the user's normal line power flows from the public power grid to the user. When the user load power is less than the discharge power of the battery or the photovoltaic power generation power of this product, the user's line power flows from the user to the public power grid, which is called reverse power. During the discharge process of this product, due to fluctuations in load power, changes in electricity usage, and other reasons, energy backflow may also occur. The anti-backflow solution can effectively avoid this problem and ensure the safe and efficient operation of the energy storage system. Based on the specific usage scenarios of this product, this manual recommends several anti-backflow solutions:

(1) Anti-backflow measures for a single transformer

When this product is connected to the low-voltage 400VAC side of the user's transformer, the energy storage system charges directly from the low-voltage busbar during charging and supplies power to the load directly through the low-voltage busbar during discharge.

The sum of the charging power of the energy storage system and the load power must not exceed the corresponding transformer capacity or maximum demand value during charging, and the energy storage system is not allowed to discharge to the corresponding high-voltage side of the transformer during discharge. The schematic diagram is shown in Figure 4.5-1

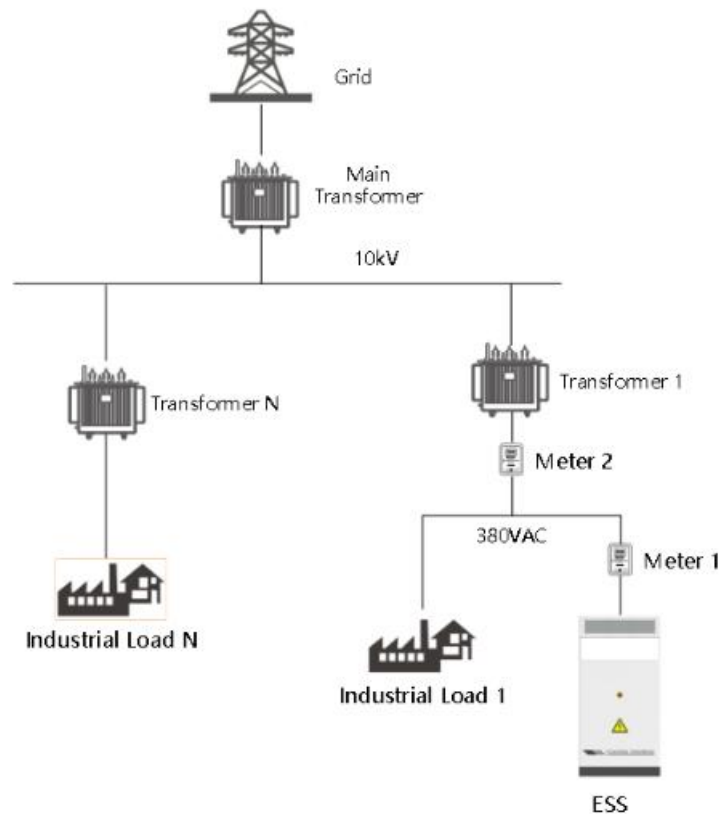


Figure 4.5-1 Schematic Diagram of The Product Connected to a Single Transformer

Anti-backflow system configuration scheme:

- ① Use Meter 1 (included in this product) on the energy storage system side for bidirectional metering of energy storage system charging and discharging;
- ② Add Meter 2 on the low-voltage side of Transformer 1 for anti-backflow and overload metering detection;
- ③ When Meter 2 detects current flowing to Transformer 1, Meter 2 will feedback the detected grid access point data to the EMS (Energy Management System) of this product. The EMS responds quickly to dynamically adjust the output power of the inverter, thereby achieving zero power grid access.
- ④ If there are many types of loads and frequent fluctuations, for more accurate metering and control, a separate metering meter can also be added on the load side, and the energy storage discharge power can be adjusted in real-time based on the power of the load side meter.

2) Anti-backflow measures on the low-voltage side of multiple transformers

Some users' 10kV busbars are connected to multiple transformers with different capacities. If this product is installed under one of the transformers, during certain periods, the discharge of this

UltraPower 100&Diesel power generation product can be sent to the 10kV busbar of the corresponding transformer and then sent to the loads under other transformers for use. However, the energy storage system is not allowed to discharge to the high-voltage side of the main transformer. This situation is more common in some larger industrial parks, where the capacities of transformers in the park vary. The energy storage system is often only connected to the transformer with relatively large electricity loads. When the electricity consumption under this transformer is low, the energy storage system can boost the voltage to the 10kV busbar through this transformer and then step down through other transformers in the park to supply electricity to the loads under this transformer. The schematic diagram is shown in Figure 4.5-2:

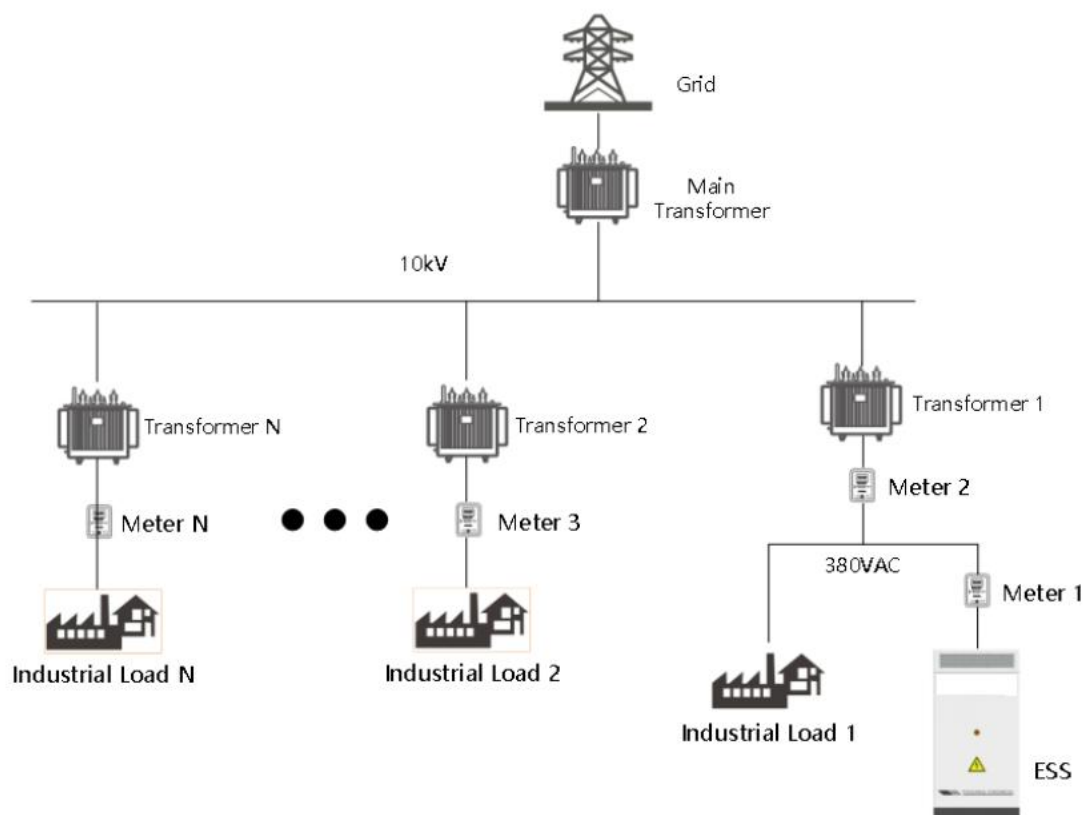


Figure 4.5-2 Schematic Diagram of Multiple Transformer Park Connection for This Product

- Part One

System Configuration Scheme:

1) Use Meter 1 (included with this product) on the energy storage system side for bidirectional metering of energy storage system charging and discharging.

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2) Add Meter 2 on the low-voltage side of Transformer 1 for overload protection of this transformer.

3) Add meters to other transformers.

4) Meters 2 to N calculate the sum for anti-backflow purposes.

Note:

1) If multiple subsystems are connected to the low-voltage side of different transformers, they can all refer to the connection method shown for Transformer 1 in the diagram.

2) This scheme involves the addition of multiple meters, which may pose difficulties in construction due to issues such as wiring and control 485 communication line length.

(2) Anti-backflow measures on the high-voltage side of multiple transformers

To address the issues identified in scheme 2, anti-backflow measures can be implemented on the high-voltage side of the park. The schematic diagram is shown in Figure 4.5-3:

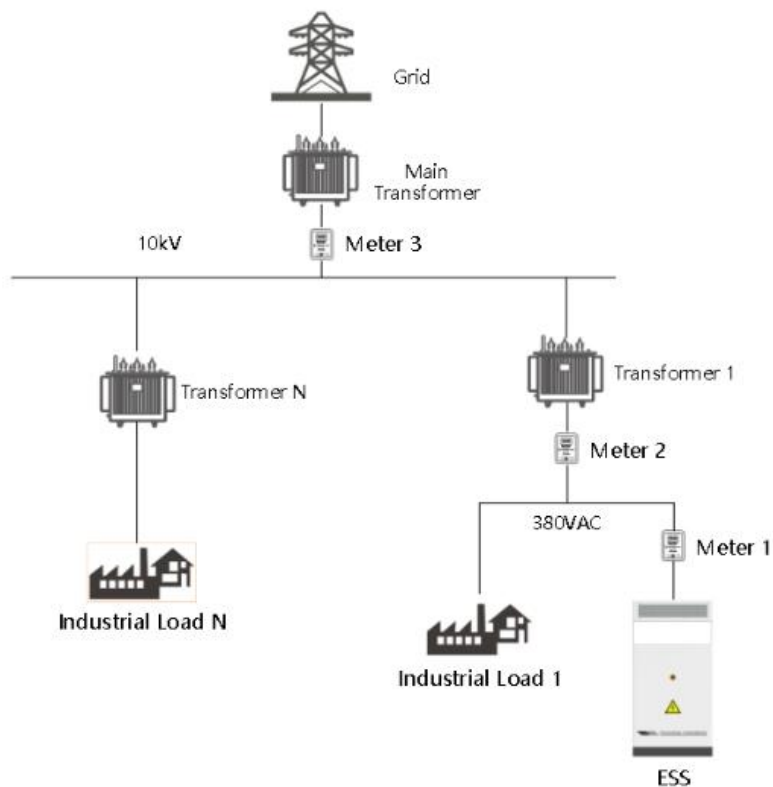


Figure 4.5-3 Schematic Diagram of Multiple Transformer Park Connection for this Product - Part Two

UltraPower 100&Diesel power generation
System Configuration Scheme:

- 1) Use Meter 1 (included with this product) on the energy storage system side for bidirectional metering of energy storage system charging and discharging.
- 2) Add Meter 2 on the low-voltage side of Transformer 1 for overload protection of this transformer.
- 3) Add high-voltage Meter 3 on the primary transformer's 10kV side for high-voltage anti-backflow detection.
- 4) Meter 3 should be connected on the high-voltage side, which may require a significant power-off area for wiring and specialized personnel for installation. Additionally, PT(potential transformer) configuration is required.

Due to the large difference in electricity consumption between different users, it is difficult to unify the anti-countercurrent detection meter of this product. Its supporting transformer and the RS485 communication line between the meter and this product need to be purchased by the customer. The electric meter is recommended to use Ankore DTSD1352 or Yada DTSD3366D multifunctional electric meter. It is recommended to use the port type 0.66-K current transformer. The transformer for the high voltage side countercurrent prevention scheme should be selected according to the user's power distribution device.

3) This product anti-countercurrent wiring mode

After installing the anti-current meter and transformer, the customer needs to use an RS485 cable to lead the meter signal to the cabinet of this product for communication with the EMS. The customer can connect the cabinet end of the RS485 cable to the signal lightning protection terminal at the bottom, where 485+ is connected to terminal 3 and 485- is connected to terminal 4. Signal lightning protection is below IO.

8.6 Multi-Unit Parallel Connection

1) AC access

If multiple cabinets are used, the AC mains of each cabinet are connected. For details about how to connect load lines, see 4.3 Connecting a Single Cabinet. When multiple cabinets are installed in the same place, a single mains distribution box can be used. The power distribution box imports one power supply from the customer's low-voltage distribution network and distributes it to each optical storage cabinet. Customers can also set the

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general load distribution box and EPS load distribution box according to their own needs, in order to better distribute power.

2) Photovoltaic access

For details, see 4.4 Connecting a Single Cabinet.

3) Communication line wiring

When multiple PCS are connected in parallel, the PCS of each cabinet must be connected in series through RS485 communication, and the EMS must be connected in series through Ethernet communication. The RS485 communication of the PCS is connected to the PARA communication wiring terminal of the PCS. The Ethernet RJ45 cable of the EMS is connected to the lightning protection lower end of the network port in the electrical cabin of the optical storage cabinet.



Figure 4.6-1 PCS Communication terminal definition diagram

9.System power-on

9.1 Pre-Power-On Inspection



1)The energy storage system can only be put into operation after confirmation by a qualified professional.

2)For energy storage systems that have been out of service for a long time, a comprehensive and meticulous inspection of the equipment must be conducted before powering on. The system can only be powered on after ensuring that all indicators meet the requirements

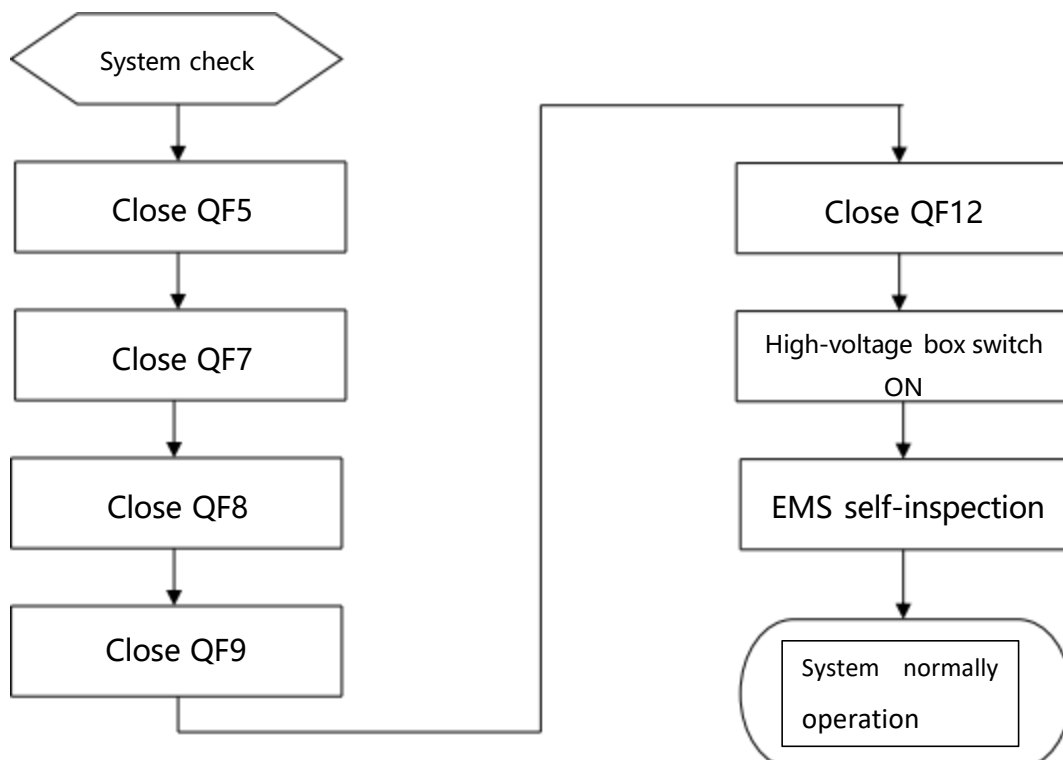
- 1) Check if the wiring is correct.
- 2) The protective covers inside the equipment are securely installed.
- 3) The emergency stop button is in the released state.
- 4) Check to ensure there are no grounding faults.
- 5) Use a multimeter to measure the AC and DC side voltages to ensure they meet the startup conditions and there is no risk of overvoltage.
- 6) Check to ensure no tools or parts are left inside the equipment.
- 7) The energy storage system can only be put into operation after confirmation by a qualified professional.
- 8) For energy storage systems that have been out of service for a long time, a comprehensive and meticulous inspection of the equipment must be conducted before powering on. The system can only be powered on after ensuring that all indicators meet the requirements.

9.2 ESS Power On



If there is a tripping phenomenon of the circuit breaker during the power-on process, pause to close other circuit breakers. Immediately check whether the downstream load of the tripped circuit breaker has a short circuit.

- 1) Check and confirm that the AC lightning arrester is normal, and the AC lightning arrester circuit breaker is closed.
- 2) Close the mains power switch QF5。
- 3) Close the auxiliary power supply switch QF7。
- 4) Close the auxiliary power supply switch QF8。
- 5) Close the fan power supply switch QF9。
- 6) Close the 24V switch power supply switch QF12。
- 7) Turn the handle of the DC circuit breaker in the sub-controller box to ON, and close the circuit breaker.
- 8) Control the BMS main contactor to close through EMS operation. Wait for about 5 seconds, observe that the BMS main contactor status is closed, indicating that the operation is successful



9.3 Photovoltaic system powered on

- 1) Check and confirm that the DC lightning protection device is normal and the DC lightning protection fuse is closed.
- 2) Check and confirm whether the PV DC lines are properly connected and whether the MC4 terminals are connected.
- 3) Check and confirm whether the positive and negative terminals of each PV DC line are correctly connected.
- 4) Close DC switch QF1, QF2, QF3, QF4.