WEIHENG

WH-TIANWU-300TS

TIANWU CONTROL CABINET

User Manual

Trademark Statement

Note: Your purchase of the products, services or features is subject to Weiheng's commercial contracts and terms and conditions. As a result, all or part of the products, services or features described in this document may not be consistent with your specific purchase or use. Weiheng makes no statements or warranties, express or implied, with respect to the contents of this document.

This document may be updated from time to time due to product version upgrades or other factors. Unless otherwise agreed, this document is provided as a guide only and no representations, information or recommendations contained herein constitute a warranty of any kind, either express or implied.

Jiangsu Weiheng Intelligent Technology Co., Ltd.

Address: Luoshe Town, Huishan District, Wuxi, Jiangsu Province, China (80m Northeast of the Intersection of Jianghai West Road and Luonan Avenue)

Postal Code: 214000

Website: weiheng-tech.com

Introduction

Overview

This document provides guidance on the installation, electrical connection, commissioning, and troubleshooting methods for the TIANWU-300TS-A TIANWU control cabinet (hereinafter referred to as the "AC control cabinet"). Prior to installation and operation of the AC control cabinet, please read this manual carefully, ensuring full comprehension of the safety information and familiarity with the functions and features of the equipment.

BEWARE

All operations of the equipment must be performed by well-trained and qualified electrical technicians. Operators must possess a thorough understanding of the construction and working principle of the entire system, as well as applicable standards of the country/region where the project is located.

Symbol Convention

In this document, the following symbols may be used with the meanings described below.

Symbols	Description
	It indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
	It indicates a hazard with a moderate level of risk that, if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk that, if not avoided, could cause minor or moderate injury.
	It is used to convey warning information related to equipment or environmental safety. If not avoided, it may result in damage to equipment, loss of data, degradation of equipment performance, or other unpredictable consequences. The "BEWARE" symbol does not refer to personal injury.
	It is used to emphasize important/critical information, best practices, and tips. The "NOTE" symbol is not a safety warning and does not refer to personal injury, equipment damage, or environmental hazards.

Revision History

The revision history tracks the description of all updates to the document. The latest version of the document contains all changes from previous revisions.

Document Version: 01 (2024-5-27)

V1.0

Table of Contents

1 Safety Precautions

1.1 General Safety

Statement

Please thoroughly read this manual before installing, operating, and maintaining the equipment, and follow the markings present on the equipment, as well as all safety precautions outlined in this manual.

The "BEWARE", "CAUTION", "WARNING", and "DANGER" instructions contained in this manual do not cover all safety considerations that need to be observed, but are only intended to supplement all safety precautions. Weiheng disclaims any liability for damages resulting from failure to comply with general safe operation requirements or from violation of safety standards applicable to the design, production, and use of the equipment.

This equipment must be used in an environment that meets the design specifications, otherwise the equipment may fail, resulting in equipment malfunctions, component damage, personal safety accidents, property losses, etc., which are not covered by the quality warranty.

Be sure to install, operate and maintain the equipment in accordance with local laws, regulations, and specifications. The safety precautions contained in this manual are intended only to supplement to local laws and regulations.

Weiheng shall not be held liable in any of the following circumstances:

- Installing or operating the equipment in an environment that exceeds applicable international, national, or local standards;
- Failure to operate the equipment under the conditions specified in this manual;
- Unauthorized disassembly, modification of the product or alteration of the software codes;
- Failure to operate the equipment in accordance with the operating instructions and safety warnings present on the product or outlined in the document;
- Damage to the equipment caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood, mudslide);

- Damage caused by customer failure to comply with transport and installation requirements;
- Damage caused by storage conditions not meeting the requirements specified in the product document;
- Damage to the hardware or data of the equipment due to customer negligence, improper operation or intentional damage;
- Damage to the system caused by third parties or customers, including relocation and installation of the system not in accordance with the requirements of this manual, and adjustment, modification, or removal of identification marks not in accordance with the requirements of this manual;
- Defects, failures or damage caused by acts, events, negligence or accidents beyond the reasonable control of the Seller, including power outages or electrical failures, theft, war, riots, civil commotion, terrorism, intentional or malicious damage, etc.

General Requirements

DANGER

The equipment operates at high voltages and improper handling poses a risk of electric shock or fire, which may cause death, serious injury, or substantial property damage. Always operate according to instructions:

- Follow the operating procedures and safety precautions described in this manual and other relevant documents.
- Follow warning labels, cautions, and protective measures affixed to the equipment.
- Use the correct tools as specified in this manual and be proficient in the proper use of the tools.
- Comply with the safety regulations of the power plant, such as implementing the operation ticket and work ticket system.
- No one except the operator is allowed to access the equipment. Temporary warning signs or fencing must be erected to isolate the area during operation of the equipment.
- All warning labels, cautions, and protective measures affixed to the equipment shall remain legible. Unauthorized alteration, damage, or obstruction of such safety information is strictly prohibited. Any illegible markings shall be replaced in a timely manner.
- Do not perform installation, wiring, maintenance and replacement operations while the equipment is powered on.
- Do not clean the electrical components inside the equipment with water.

- Check the equipment for damage, such as holes, dents or other signs of possible internal damage.
- Check that the pre-installed cables of the equipment are securely connected.
- Check that the equipment is free from displacement of internal components, or unauthorized modification of internal structure and installation procedures.
- Do not power on the equipment until it has been installed or approved by qualified personnel.
- Measure the voltage at the contact point before touching any conductor surface or terminal, and confirm that the protective grounding conductor of the equipment or parts to be repaired is securely grounded to ensure that there is no risk of electric shock.
- Immediately press the EMERGENCY STOP switch and notify the on-site management if any liquid ingress is detected in the equipment.
- Do not open the cabinet door while the system is operating.
- Wear arc-resistant clothing when powering on the equipment for the first time or working on the live main circuit.

CAUTION

- Do not perform arc welding, drilling, or cutting operations on the equipment. Such operations may damage the sealing of the entire enclosure, the electromagnetic shielding performance of the equipment, the internal components and cables, and the metal chips generated during the operation may cause short circuits, affecting the equipment function or causing equipment damage.
- The casing temperature is elevated during operation of the equipment, posing a risk of burns. Avoid physical contact with the equipment.
- If, during operation of the equipment, a fault is detected that may cause personal injury or damage to the equipment, stop operation immediately, notify the person in charge, and take effective protective measures.
- Evacuate the area immediately if an audible/visual fire alarm is activated.
- Close and lock the cabinet door if the equipment has to be left temporarily unattended during the maintenance procedure.

BEWARE

- All transport, transit, installation, wiring, and maintenance activities must comply with the applicable laws, regulations, and standards of the country or region where the work is performed.
- The materials to be prepared by the user and the tools required during operation must comply with the applicable laws, regulations, and standards of the country or region where the work is performed.
- Permission from the local power authority must be obtained before the equipment is connected to the grid.
- Before opening the cabinet door during installation, operation, and maintenance, be sure to remove any accumulated water, snow, or other debris from the top of the enclosure to prevent debris from falling into the enclosure.

NOTE

- It is prohibited to reverse engineer, decompile, disassemble, dismantle, adapt, implant, or perform other derivative operations on the equipment software. It is not allowed to research the internal implementation of the equipment, obtain the source code of the equipment software, or steal

intellectual property rights in any way, nor is it allowed to disclose the results of any performance tests of the equipment software.

- It is recommended that users prepare video recording devices to document the detailed process of installation, operation, and maintenance of the equipment.

1.2 Personnel Requirements

BEWARE

- Only qualified personnel are permitted to perform tasks related to the equipment, including transport, transit, installation, wiring, and maintenance. When operating the equipment, operators must wear personal protective equipment that complies with local safety requirements.
- Operators must have completed Weiheng's relevant training programs, passed the required examinations, and demonstrated professional knowledge of the ESS.

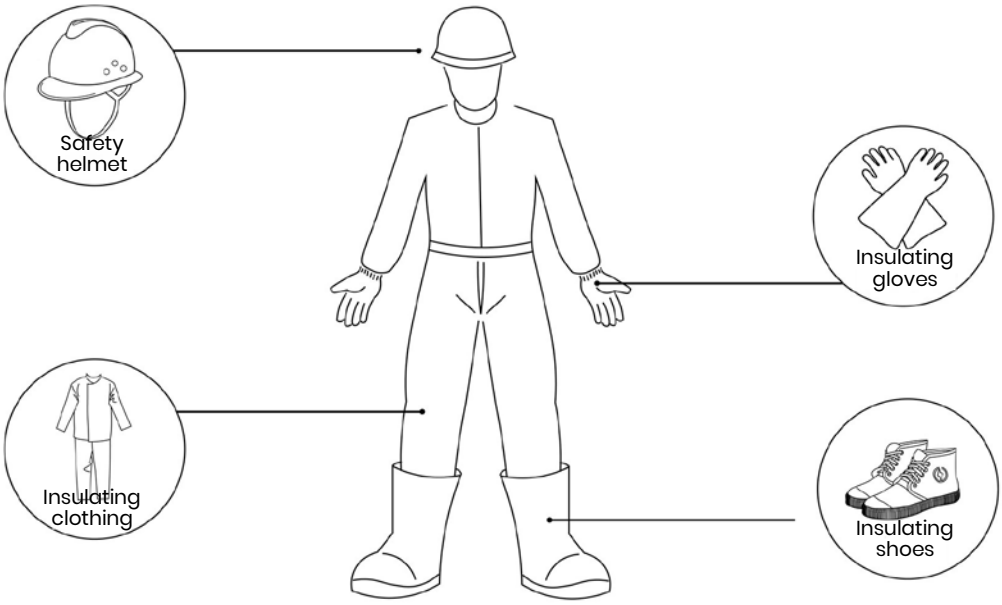


Figure 1-1 Illustration of Personal Protective Equipment

NOTE

- Local regulations and industry standards shall be consulted for specific qualification requirements.
- Do not wear watches, bracelets, bangles, rings, necklaces, or other conductive items during installation, operation, or maintenance to prevent electric shock and burns.
- All transport, transit, installation, wiring, and maintenance activities must comply with the applicable laws, regulations, and standards of the country/region where the work is performed.

- It is important to ensure a comprehensive understanding of the construction and working principle of the entire AC control cabinet, and conduct all activities in accordance with the instructions provided in this manual.

1.3 Storage and Installation Environment Requirements

General requirements

NOTE

- During the storage period, relevant evidence demonstrating compliance with product storage requirements, including temperature and humidity logs, photos of the storage environment, and inspection reports, must be properly maintained.
- The storage environment must be maintained in a clean and dry condition to prevent dust and moisture contamination. The equipment shall be protected from exposure to rain or groundwater.
- The ambient air must not contain any corrosive or flammable gases.
- Do not store the equipment in a tilted or inverted position.
- Equipment that has been stored for two years or more shall be inspected and tested by qualified personnel before being put into use.

Control Cabinet Storage Requirements

NOTE

- Stacking storage is prohibited.
- Store the equipment on a level surface (for long-term or temporary storage).
- Keep the cabinet door securely closed.
- Storage temperature: -30 °C~+60°C, humidity: 5%RH~95%RH.
- Avoid direct sunlight or rain, maintain a dry and well-ventilated environment, keep the surrounding area clean, and ensure that the equipment is located away from sources of intense infrared radiation, organic solvents, corrosive gases, and ignition.
- The warehouse keeper shall be responsible for making monthly statistics of the AC control cabinet inventory and reporting them to the planning department on a regular basis.
- Stored AC control cabinets must be shipped based on the "first in, first out" principle.

Installation Environment Requirements

For site selection, please refer to **3.1 Site Selection Requirements**. The following requirements must also be met during on-site installation:

- The installation layout of the AC control cabinet must meet the local standard requirements for fire protection distance or fire walls, including but not limited to the requirements of GB 51048-2014: Design Code for Electrochemical Energy Storage Power Station and NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.
- It is prohibited to place the equipment in an environment with flammable, explosive gases, or smoke, and to operate the equipment in such an environment.
- The installation, use, and operation of outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, plugging and unplugging outdoor signal interfaces, working at heights, and outdoor installation) is prohibited during thunderstorms, rain, snow, and winds of level 6 or above.
- It is recommended to install fences, walls, and other protective measures around the AC control cabinet, and erect safety warning signs to isolate the area and prevent unauthorized personnel from accessing the equipment during operation, which may result in personal injury or property damage.
- Do not block the vents and the cooling system during operation of the equipment to prevent fires caused by high temperatures.
- The equipment shall be installed in an area free from liquids and away from locations prone to condensation (such as under water pipes, air outlets) or prone to potential water leakage (such as under air conditioners, vents, machine room cable exit windows) to prevent liquid from entering the equipment and causing faults or short circuits.
- The installation site must be located away from sources of ignition, and no flammable or explosive materials shall be placed in the vicinity of the equipment.
- If the equipment is installed in an area with lush vegetation, periodic weeding and hardening of the soil beneath the equipment is required to prevent weed growth.

Elevated Work Requirements

- Implement proper safety protection measures, including using safety helmets, safety harnesses, waist safety belt, and attaching them to robust and reliable structural members. Do not hang them on moving

unstable objects or sharp-edged metals, to prevent the hook from slipping and causing a fall accident.

- The elevated work site must be clearly designated as a restricted, hazardous area with prominent markings to deter unauthorized access.
- The ground area directly beneath the elevated work zone must be kept clear of any stacked scaffolding, planks, or other debris. Ground personnel are prohibited from staying or passing directly below the high-altitude operation area.
- Do not throw objects from a high place to the ground or vice versa. All items must be transported using appropriate methods such as ropes, hanging baskets, overhead vehicles, or cranes.
- All scaffolding, planks, and work platforms utilized for elevated work must undergo a thorough safety inspection and certification prior to use, ensuring structural reliability and preventing scaffold overloading.
- Elevated work must be immediately suspended during rain or other potentially hazardous conditions. Thereafter, Weiheng's safety supervisor and relevant technicians must inspect all equipment and give approval before elevated work can be safely resumed.
- All edges and openings within the elevated work zone shall be outfitted with guardrails and markings to prevent the risks of accidental falls or step-through incidents.
- Securely carry all necessary apparatus and tools during operations to prevent accidental falling.
- If an elevated worker is found to be violating safety protocols and performing construction work improperly, the site supervisor or safety officer must immediately issue a warning and instruct the worker to make corrections. Work may not be resumed until the elevated worker is in full compliance with established operating specifications.

1.4 Loading/Unloading and Transport Requirements

NOTE

During loading/unloading and transport, care should be taken to handle gently and provide moisture protection measures. Due to the influence of external environmental factors (such as temperature, transport and storage conditions), the product specifications are subject to the date of manufacture.

Transport Requirements:

- Storage systems or batteries are not intended for railway or air transport methods.
- For sea transport, the International Maritime Dangerous Goods Code (IMDG) must be observed.
- For land transport, the requirements of the Authorization Dangerous Road (ADR) or JT/T 617-2018: Regulations concerning Road Transportation of Dangerous Goods must be followed.
- All regulatory requirements set forth by the transport authorities in the countries of origin, transit, and destination should be observed.
- Comply with international transport rules for dangerous goods and the regulatory requirements set forth by the transport authorities in relevant countries.
- Monitoring is required throughout the entirety of the transport process.
- Vehicles used for land transport must have sufficient load capacity (cabinet weight: approximately 3000kg per unit).
- The speed limit for land transport is 80km/h on flat roads and 60km/h on rugged roads, with local traffic regulations taking precedence if they conflict with these guidelines.
- Stacking is prohibited during port handling and on-board transport. During transport, precautions should be taken to prevent goods from:
- Falling into water;
- Dropping or experiencing mechanical impact;
- Overturning or tipping.

NOTE

If the above situation occurs, follow the emergency procedures in Section 1.9.

1.5 Electrical Safety

Wiring Requirements

NOTE

- Do not push cables directly off the vehicle or otherwise mishandle them.
- Do not route cables through the air inlet/outlet of the equipment.
- Cables of the same type shall be bundled together, while cables of different types shall be spaced at least 30 mm apart without intertwining or crossing.
- If the site has to be left unattended temporarily after or during the wiring process, the cable openings must be immediately sealed using sealing mud to prevent the ingress of small animals.
- Cables used in high-temperature environments are susceptible to insulation aging and damage. A minimum clearance of 30 mm must be maintained between cables and heat-generating components or heat source peripheries.
- Select cables that are in compliance with local laws and regulations.
- Cable troughs and openings must be free of sharp edges and provided with appropriate protection.
- Cable conduits or openings shall be protected against damage from sharp edges or burrs.
- Cables used in the ESS must be firmly connected, well-insulated, and comply with the appropriate specifications.
- After wiring, the cables must be securely fixed using cable supports and clamps. For cables in backfilled soil areas, ensure they are in close contact with the ground to prevent deformation or damage during backfilling.
- At low temperatures, violent impact and vibration may cause the outer plastic sheath of the cables to become brittle and crack. To ensure construction safety, the following requirements shall be followed:

  1. All cables must be laid and installed at temperatures above 0°C. Care shall be taken when handling cables, especially in low-temperature environments.

  2. If cables are stored at temperatures below 0°C, they must be placed at room temperature for at least 24 h prior to installation.

Grounding Requirements

- Do not damage grounding conductors.
- Do not operate the equipment without installed grounding conductors.
- The main grounding body of the equipment must be permanently connected to the protective grounding network. Before operating the equipment, the electrical connection must be checked to ensure reliable grounding.
- The grounding impedance of the equipment shall meet the requirements specified in GB 50054-2011 and any applicable local electrical standards.

AC/DC Operation Requirements

- Before installing or removing the power cord, turn off the power switch first.
- Prior to connecting the power cord, verify that the label on the power cord is correct.
- If the equipment has multiple inputs, all inputs shall be disconnected and the equipment shall be completely de-energized before any work is performed.

Operation, Maintenance and Repair Safety Requirements

- Turn off the circuit breaker before connecting or disconnecting any cables.
- Place a "Do Not Close" warning sign on the open switch.
- Use a voltage tester of the appropriate rating to verify the equipment is completely de-energized.
- Cover or wrap any nearby live parts with insulating sheeting or tape.
- Before performing any operation, maintenance or repair activities, connect the circuit to be repaired securely to the grounding circuit using a grounding wire.

BEWARE

- Prior to connecting cables, verify that the label on the cable is correct.
- If the equipment has multiple inputs, all inputs should be disconnected and the equipment should be completely de-energized before any work is performed.

- After the repair is completed, remove the grounding wire between the repaired circuit and the grounding circuit.

1.6 Mechanical Safety

Transport Safety

BEWARE

- This equipment must be lifted using a lifting frame.
- When using a forklift to move the equipment, ensure that the forklift has sufficient load capacity and that the center of gravity of the equipment is between the forklift legs to prevent personal injury and equipment damage;
- Forklift load capacity: ≥3 t;
- Recommended fork length: ≥1.5 m, fork width: 80cm~160cm, fork thickness: 25cm~70cm.

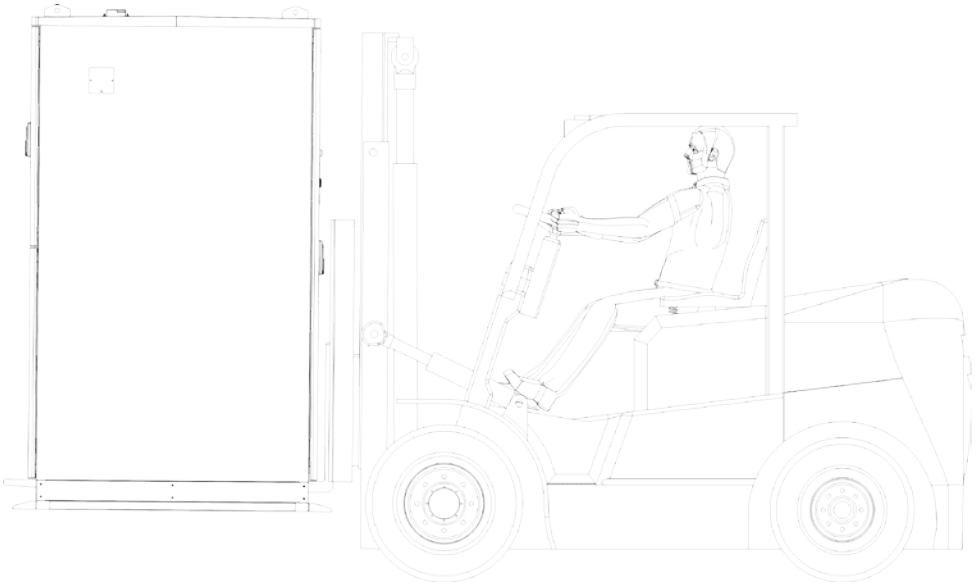


Figure 1-2 Handling Schematic

Safety Instructions for Ladder Use

- Using straight ladders is prohibited.
- Before using a ladder, ensure it is in good condition and the load capacity meets the requirements. Overloading is strictly prohibited.
- Use wooden or fiberglass ladders when working overhead where electricity may be involved.
- When working overhead, it is preferable to use platform ladders with guardrails, where all four feet are securely fixed and the ladder is held by one person.
- For herringbone ladders, the rope must be secured and a person must hold the ladder during use.

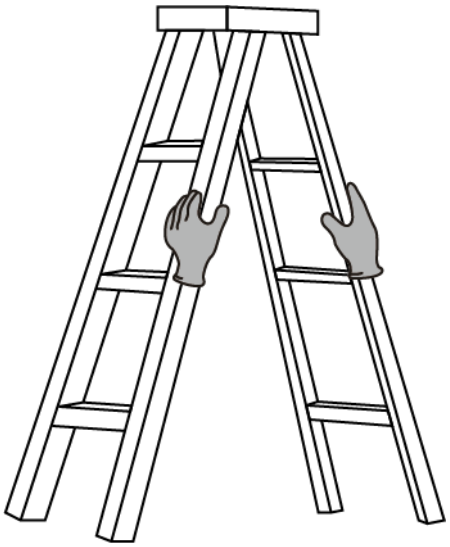


Figure 1-3 Holding Ladder

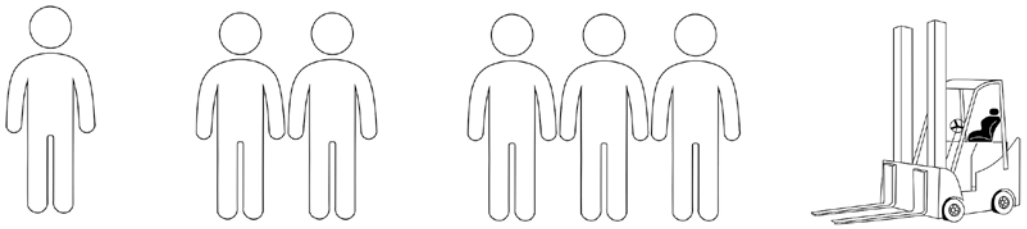
- When climbing a ladder, please pay attention to the following actions to reduce danger and ensure safety.

⚠CAUTION

- Maintain a stable body posture.
- Stand on the ladder without exceeding the 4th rung from the top.
- Ensure your center of gravity remains within the ladder frame.

Safety Instructions for Handling Heavy Objects

- When handling heavy objects, arrange for the number of people recommended in the diagram to ensure collaborative operation and load sharing.



<18 kg (<40 lbs) | 18-32 kg (40 -70 lbs) | 32-55 kg (70-121 lbs) | >55 kg (>121 lbs)

- Wear protective gloves, anti-smash anti-puncture safety shoes and other personal protective equipment when handling the equipment by hand.
- Protect the equipment from surface scratches or damage to internal components/cables during handling.
- For forklift handling, ensure the forks are centered under the load to prevent tipping. Secure the equipment to the forklift with ropes before moving, and assign a dedicated person to monitor during movement.
- Move the equipment carefully to avoid collisions or falls.

1.8 Maintenance and Replacement

⚠CAUTION

Before removing any component from the cabinet, verify that all other components are securely fastened.

- A minimum of two people are required on site when performing maintenance on the AC control cabinet.
- During equipment maintenance, always use insulating materials to cover nearby live components.
- Do not open the cabinet door in severe weather conditions such as rain, snow, lightning, sandstorms, or heavy fog.
- Never allow objects (such as fingers, components, screws, or tools) to come into contact with a running fan before it is powered off or stops rotating.
- Do not power on the equipment before troubleshooting.
- During live system patrol inspections, observe hazard warnings on the equipment and avoid standing near the cabinet door.
- After shutting down the equipment, wait 15min to ensure complete de-energization before proceeding with any operation on the equipment.
- A "Do Not Close" warning sign must be displayed on any switch that is disconnected for maintenance.
- After replacing power components or changing wiring in the control cabinet, manually initiate wiring detection and topology identification to prevent system malfunctions.
- Lock the cabinet door, secure the safety cable, and keep the key in a safe location immediately after completing maintenance and replacement.

1.9 Emergency Procedures

In the event of an incident, including but not limited to those listed below, immediately take appropriate measures to ensure the safety of all personnel on site, and contact Weiheng's service engineers.

In Case of Fire

DANGER

Recommendations for on-site operation and maintenance personnel:

1. In case of fire, evacuate the building or equipment area and activate the fire alarm bell. Call the fire department immediately to notify professional firefighters and provide them with relevant product information.
2. Never re-enter the burning building or equipment area, or open the door of the AC control cabinet. Isolate and monitor the site, and restrict access to unauthorized personnel.
3. After contacting the fire department, remotely shut down the system while prioritizing your own safety.
4. Upon the arrival of professional firefighters, provide them with relevant product information.
5. Once professional firefighters confirm the fire is extinguished, allow qualified personnel to handle the situation according to local regulations. Do not open the door of the AC control cabinet without authorization.
6. Post-disaster product maintenance: Contact Weiheng's service engineers for evaluation.

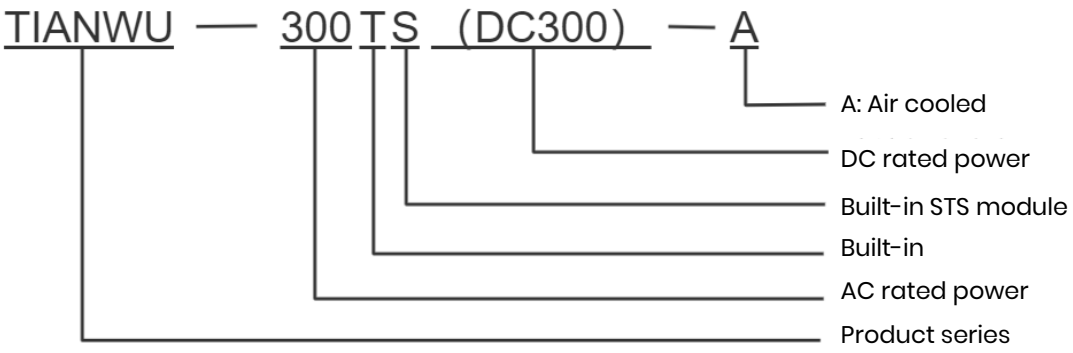
Recommendations for fire professionals:

1. Refer to the product information provided by the operation and maintenance personnel.
2. Do not open the door of the AC control cabinet if the internal safety of the cabinet cannot be guaranteed.
3. Please follow local fire regulations for fire extinguishing operations.

2 Product Introduction

2.1 Model Description

Product Model Description:



This document primarily focuses on the following product models:

WH -TIANWU - 300TS - A

2.2 Functions and Features

2.2.1. Product Functions

The TIANWU series AC control cabinet achieves streamlined integration of modular power conversion system (PCS), local energy management monitoring, power distribution, and environmental control systems. The modular PCS simplifies maintenance and capacity expansion, while the front maintenance design minimizes space requirements for footprint and maintenance access. With these unique features, the AC control cabinet ensures high safety and reliability, enabling rapid deployment and cost-effective operation with high energy efficiency and intelligent management capabilities. The operating strategy for its typical applications are described below:

Grid-connected Mode: The AC control cabinet is connected to the energy storage battery cabinet, and the PCS power module converts DC power to AC power and feeds it into the grid, which can achieve fast frequency response (FFR) and frequency control reserve (FCR).

On-grid/Off-grid Mode: In the event of a sudden grid power outage, the grid-off controller automatically switches to off-grid mode, allowing the equipment to draw power from the energy storage battery cabinet to supply loads. In this case, the photovoltaic (PV) components maintain normal operation and provide additional power to the system via the DC-DC converter. When grid power is restored, the system automatically switches to on-grid mode to resume using grid power.

Off-grid Mode: When grid power is unavailable, the AC control cabinet powers loads using its own PV components and energy storage battery. This mode is suitable for microgrids and island operations, ensuring the continuity of essential living and working functions.

2.2.2 Product Features

The TIANWU series AC control cabinet incorporates advanced digital control technology and proprietary energy management system (EMS) to optimize control performance and improve system reliability. It offers high adaptability to various application scenarios with the following functions and features:

- **Real-time status monitoring and fault recording, enabling fault warning and location;**
- **Highly integrated structure for easy transport, operation and maintenance;**
- **Fully pre-assembled, eliminating the need to install battery modules on site;**
- **Quick on-site installation within 8 h**
- **Waterproof model for outdoor applications, accommodating the needs of various installation sites;**
- **Modular design for parallel operation and ease of system expansion;**
- **Enables grid dispatching and primary frequency/voltage regulation;**

2.3. Appearance

Figure 2-1 Appearance and Dimensions

NOTE

The foundation must be provided according to the construction site design drawings, which can be obtained from Weiheng's product manager.

2.4 Components

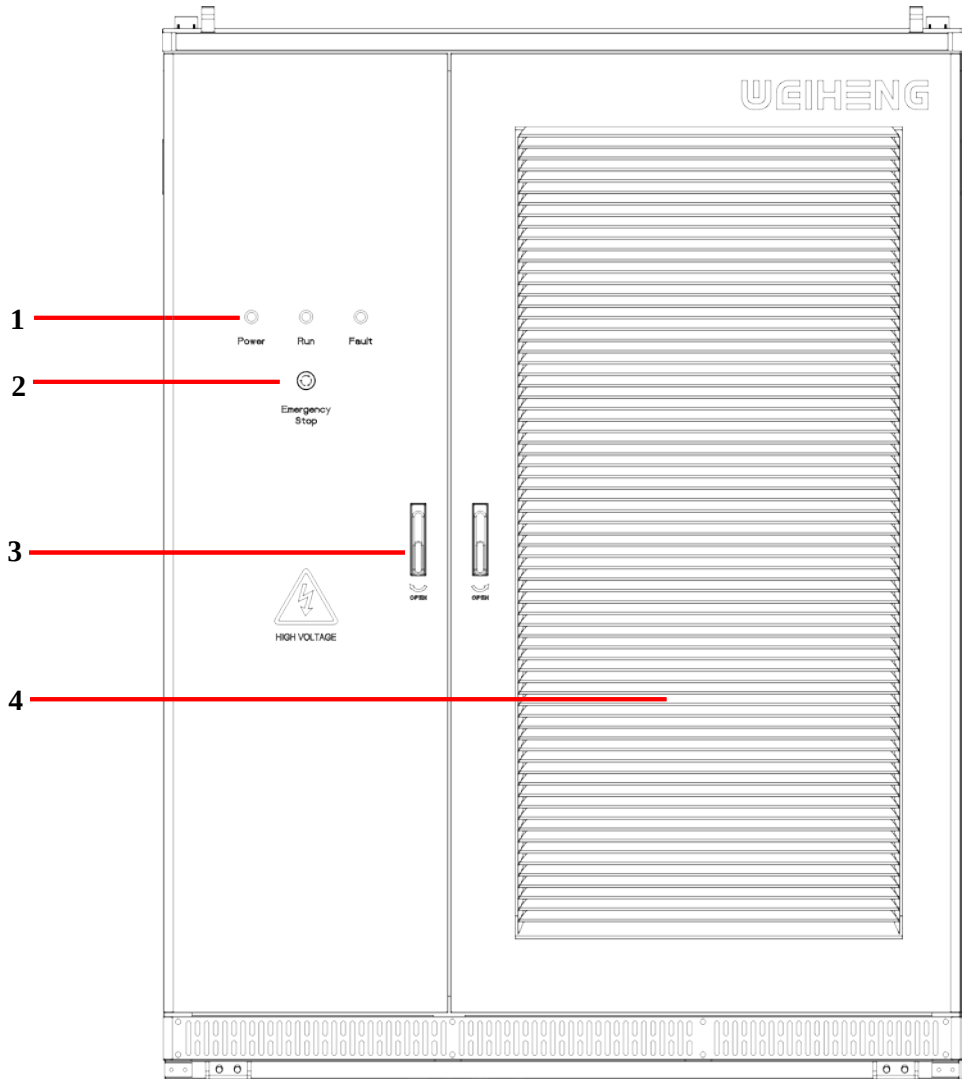


Figure 2-2 Product - Front View

Table 2-1 Component Configuration

SN	Name	Quantity	Description
1	Indicator	3	Power indicator: White, illuminates when the auxiliary power supply is switched on; Operation indicator: Green, illuminates steadily when the equipment is in normal operation; Alarm indicator: Yellow, illuminates when the equipment encounters an alarm-triggered fault.
2	Emergency stop	1	Cut off the power supply and stop the equipment operation by using the emergency stop switch.
3	Door handle	2	Turn the handle to open the control cabinet door.
4	Air inlet	1	Air inlet of the control cabinet.

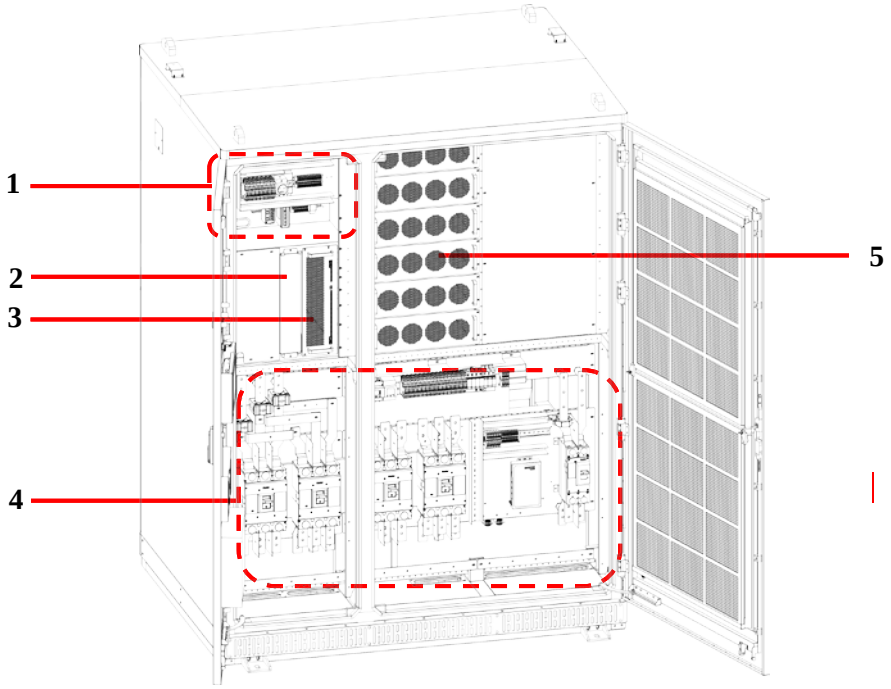


Figure 2-3 Product Internal Layout - Front View

Table 2-2 Component Configuration 2

SN	Module Description	Quantity	Description
1	Communication Power Distribution Area	1 set	Terminal block, power distribution area for communication equipment.
2	UPS	1 unit	Uninterruptible Power System (UPS): Ensures normal operation of the ESS even during power anomalies.
3	STS module	1 pc	Automatic switching between on-grid and off-grid modes.
4	LV Power Distribution Area	1 set	AC/DC circuit breaker, power distribution area with terminal block.
5	PCS Power Module	6 pcs	50kW energy storage converter, used for energy conversion between battery packs and the grid.

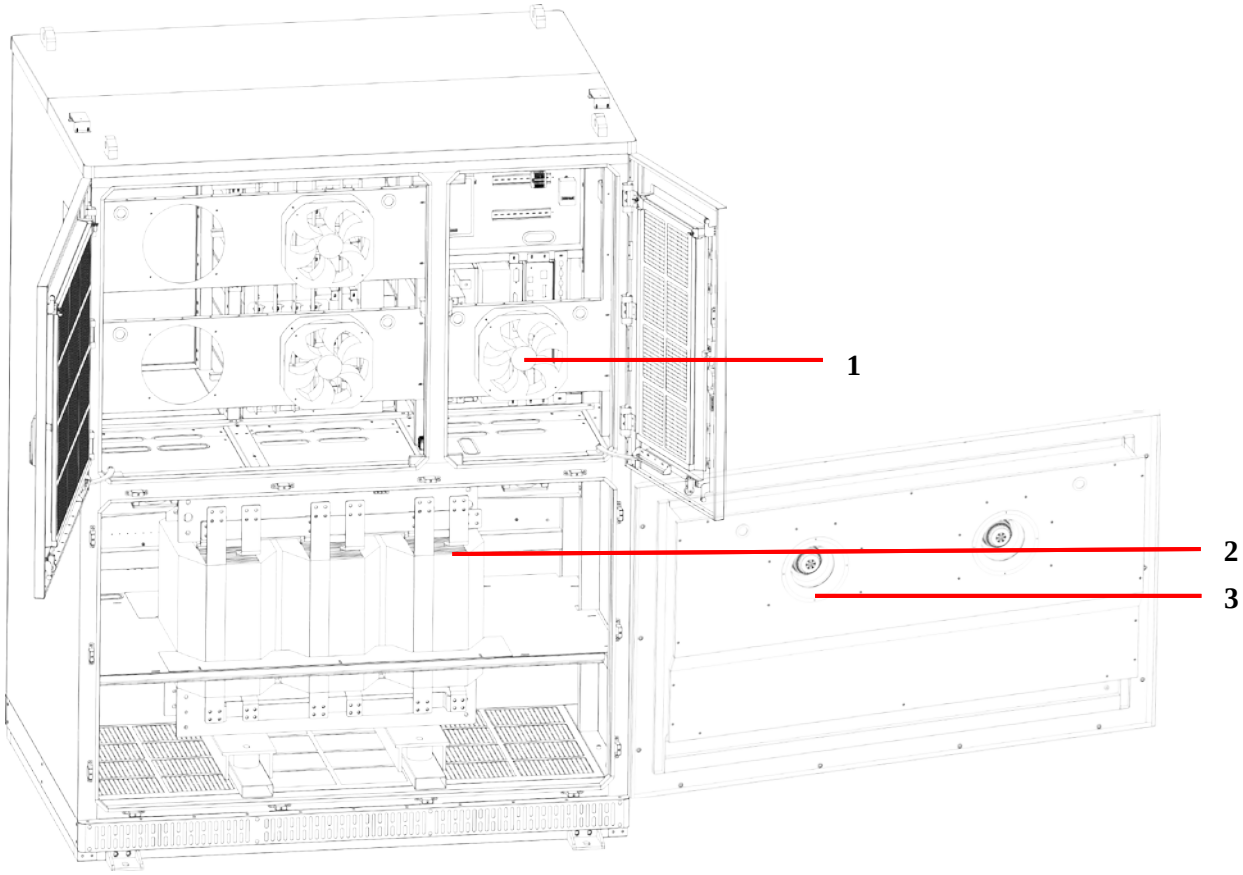


Figure 2-4 Product Internal Layout - Rear View

Table 2-3 Component Configuration 3

SN	Module Description	Quantity	Description
1	Fan Unit	3 pcs	Provide heat dissipation for PCS power modules.
2	Transformer	1 set	Stabilize system voltage and maintain a stable isolation environment.
3	Embedded fan unit	2 pcs	Provide heat dissipation for the transformer.

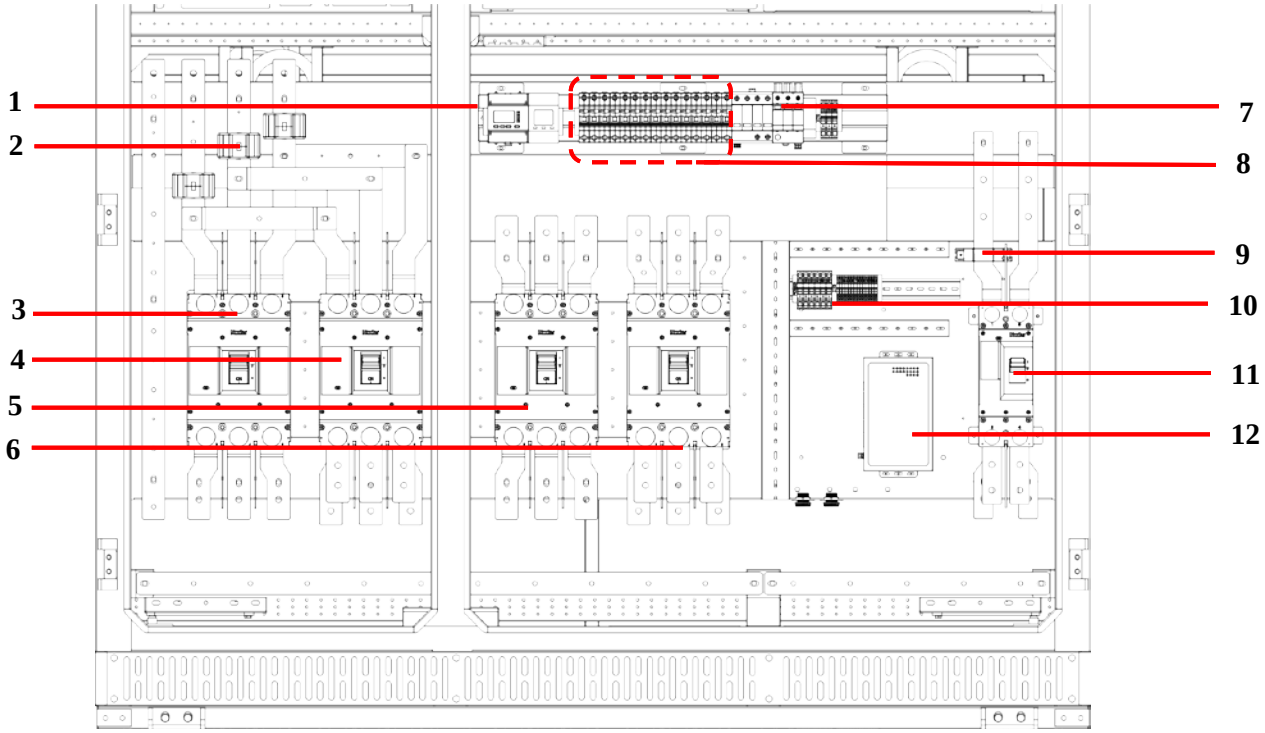


Figure 2-5 LV Power Distribution Area

Table 2-4 Components in LV Power Distribution Area

SN	Module Description	Quantity	Description
1	Meter	1 set	Include AC meter (PJ1) and DC meter (PJ2)
2	AC current transformer	3 pcs	Provides real-time AC current data
3	Diesel generator switch (QF2)	1 pc	Diesel generator input line connection position
4	Utility power switch (QF1)	1 pc	Grid input line connection position
5	Bypass switch (QF6)	1 pc	Connect the load side and the grid side
6	Load switch (Q-F3)	1 pc	Load side cable connection position
7	Surge Protector	1 set	Include AC lightning arrester (SPD1) and DC lightning arrester (SPD2)
8	Circuit breaker group	1 set	(MCB01) AC meter switch (MCB02) Surge protector switch (MCB1) Main switch for auxiliary power supply (MCB6) Auxiliary power supply for battery cabinet #1 (MCB7) Auxiliary power supply for battery cabinet #2 (MCB8) Auxiliary power supply for battery cabinet #3
9	DC current transformer	1 pc	Provides real-time DC current data

10	Auxiliary power supply terminal block	Group 1	Provide auxiliary power supply to the battery cabinet
11	DC switch (QF4)	1 pc	Battery bus connection position
12	N580 serial server	1 unit	Convert 485 communication signals into TCP communication.

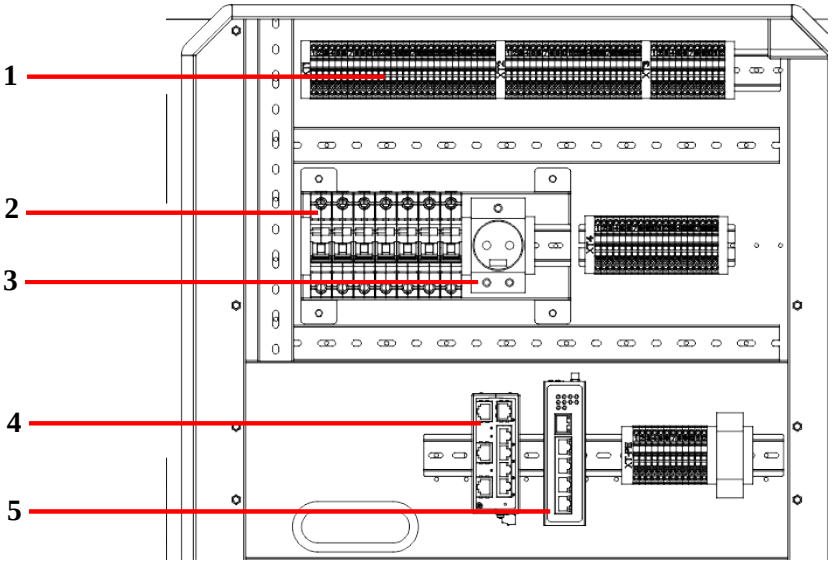


Figure 2-6 Communication Power Distribution Area

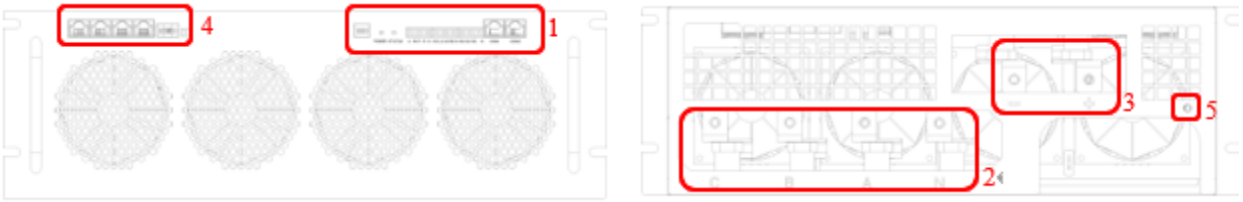
Table 2-5 Components in Communication Power Distribution Area

SN	Module Description	Quantity	Description
1	Terminal block	5 sets	Terminals used to connect secondary devices.
2	Air-operated switch	Group 1	(MCB03) Pre-charge switch (MCB2) UPS input switch (MCB3) European socket switch (MCB4) Cooling fan switch (MCB5) UPS output switch
3	European Socket	1 pc	European socket.
4	Switch	1 unit	Provide data exchange
5	Router	1 unit	Isolate internal device data from external device data

2.5.1 PCS

Module description:

The energy storage converter system is mainly used to achieve power conversion between the grid and the battery, and enable monitoring and management of the exchange process. The energy storage converter supports two operation modes: on-grid and off-grid.



(1) Signal port (2) AC interface (3) DC interface (4) Paralleling interface (5) Grounding port

Figure 2-7 PCS Appearance

- The signal port consists of a dip switch, indicator, Phoenix terminal, and RJ45 terminal.

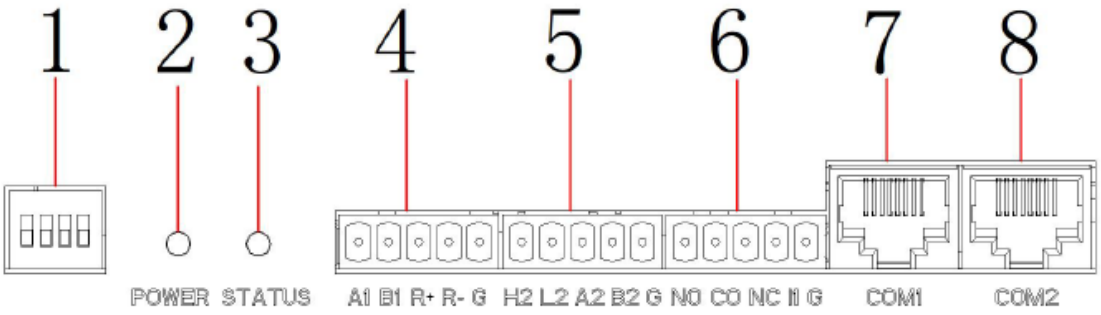


Figure 2-8 Signal Ports Schematic

Table 2-8 List of Signal Ports

SN	Name	Description
1	Dip Switch Address	Set different addresses to enable paralleling operation of multiple units.
2	Power Indicator (Red)	The power indicator illuminates steadily after the equipment is connected to AC/DC power supply.
3	Status Indicator (Green)	The status indicator illuminates steadily when the equipment is in operation.
4	485 Communication Interface 1	Internal communication interface
5	485 Communication Interface 2	Internal communication interface 2
6	I/O Interface	I/O Communication Interface
7	RJ45 Interface 1 (CAN Communication Interface)	Equipment external communication port
8	RJ45 Interface 2 (CAN Communication Interface)	Equipment external communication port 2

- The AC interface is connected to the grid using a copper busbar secured with M6 screws. The terminals are arranged as follows: C, B, A, and N, from left to right.

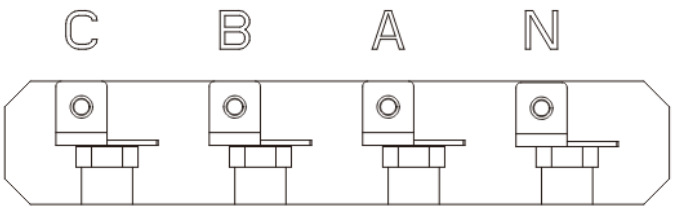


Figure 2-9 AC Interface Schematic

- The DC interface is connected to the DC power source using a copper busbar secured with M6 screws. The terminals are arranged as follows: DC- and DC+, from left to right.

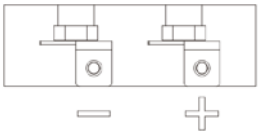


Figure 2-10 DC Interface Schematic

- Paralleling interface: For paralleling operation of multiple modules, it is required to connect their paralleling interfaces with a paralleling cable.

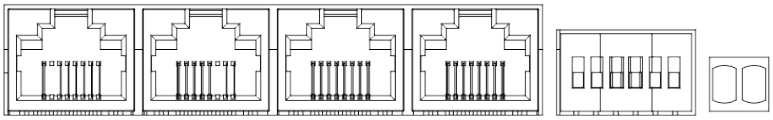


Figure 2-11 Paralleling Interface Schematic

Table 2-9 Technical Specifications of 50kW Air-Cooled Energy Storage Converter

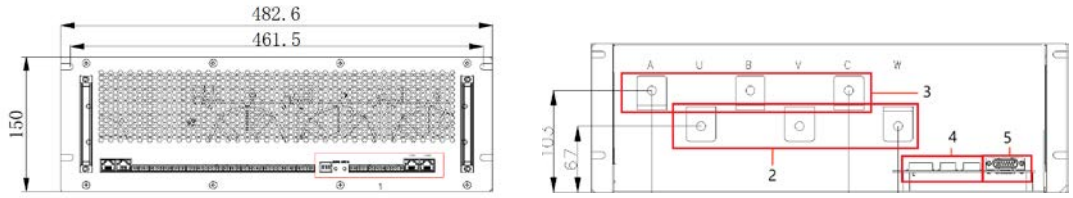
Model	WH-BEC-50AC
Rated power	50kW
Max power	55kW
DC Operating Voltage Range	500V~950V
DC Side Full Load Voltage Range	600V~950V
Maximum DC Current	110A
Rated AC Voltage	400Vac，3W+PE
Rated Frequency	50/60Hz（±5Hz）
Rated AC Current	72A
Overload Capacity	110% for normal operation; 120% for 1 min
Current Distortion	＜3% (rated power)
Power Factor Adjustment Range	-1 leading ~ +1 lagging
With Unbalanced Load Capacity	100%
Compatible Battery	Lithium battery
Charging Method	According to BMS commands/three-stage/MPPT
Working mode	Constant current, constant power, MPPT, AC voltage source
Maximum Efficiency	98.5%
Dimensions (W*D*H)	483 (or 444 without mounting lugs) * 600 * 150 mm
Weight (approx.)	35kg
Isolation Method	Non-isolated
Protection Rating	IP21
Operating temperature	-25°C ~ 55°C (derating above 45℃)
Relative humidity	0~95% (non-condensing)
cooling method	Intelligent air cooling
Noise	＜70 dB
Altitude	3,000 m (derating above 3,000 m)
Communication interface	CAN

2.5.2 STS

Module description:

The energy storage converter system is mainly used to achieve power conversion between the grid and the battery. It utilizes a three-level topology with a maximum efficiency of 99%, ensuring higher power quality. It also enables intelligent switching between on-grid and off-grid modes with a switching time of less than 10 ms. The standard rack-mounted modular design allows for flexible configuration, easy maintenance, and simple capacity expansion.

Figure 2-12 STS Appearance



(1) Signal port (2) Grid interface (3) PCS interface (4) External power supply interface (5) Paralleling interface

- The signal port consists of a dip switch, indicator, Phoenix terminal, and RJ45 terminal.

Figure 2-13 Signal Ports

Table 2-10 Description of Signal Ports

SN	Name
1	Paralleling interface
2	Output digital signals (DO1-DO10)
3	Input digital signals (DI1-DI19)
4	Not used
5	Not used
6	Dial switch
7	Indicator
8	Current sampling interface
9	Not used
10	RJ45 Interface (CAN communication interface)

DO Outputs

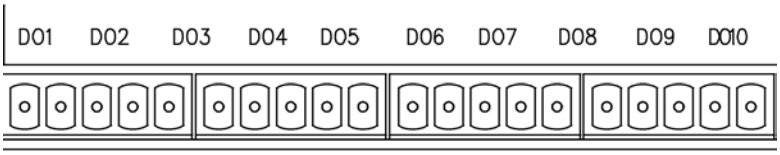


Figure 2-14 Output Digital Signals

Figure 2-11 Description of Output Digital Signal Interfaces

Standard number	Status description
DO1	AC/DC side switch tripping
DO2	Transformer pre-charge control
DO3~DO10	Not used

DI Inputs

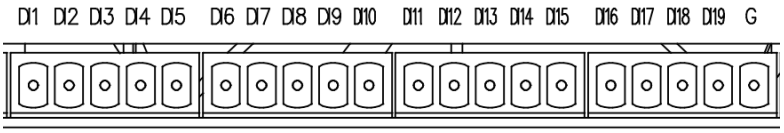


Figure 2-15: Input Digital Signals

Figure 2-12 Description of Input Digital Signal Interfaces

Standard number	Status description
DI1	Load switch status (normally open when the switch is tripped)
DI2	Diesel engine switch status (normally open when the switch is tripped)
DI3	Utility power switch status (normally open when the switch is tripped)
DI4	PV switch status (normally open when the switch is tripped)
DI5	Battery switch status (normally open when the switch is tripped)
DI6~DI9	Not used
DI10	External EPO signal (normally open)
DI11	EMS fault signal (normally close; open on fault)
DI12	Transformer over-temperature fault (normally close; open on fault)
DI13	Not used
DI14	Battery fault (normally close, open on fault)
DI15~DI17	Not used
DI18	Bypass switch status (normally open when the switch is tripped)

DI19	Not used
G	Common end

2.5.2 Transformer

Equipment Description:

The transformer can step up the lower voltage electrical energy from the energy storage system to a higher voltage suitable for grid connection or load use. This helps accommodate various electrical system and equipment requirements, ensuring effective transmission and utilization of electrical energy. By providing electrical isolation, the transformer effectively reduces the risk of interference and fault propagation, thereby improving system safety and reliability. This is essential to protect downstream equipment from grid failures.

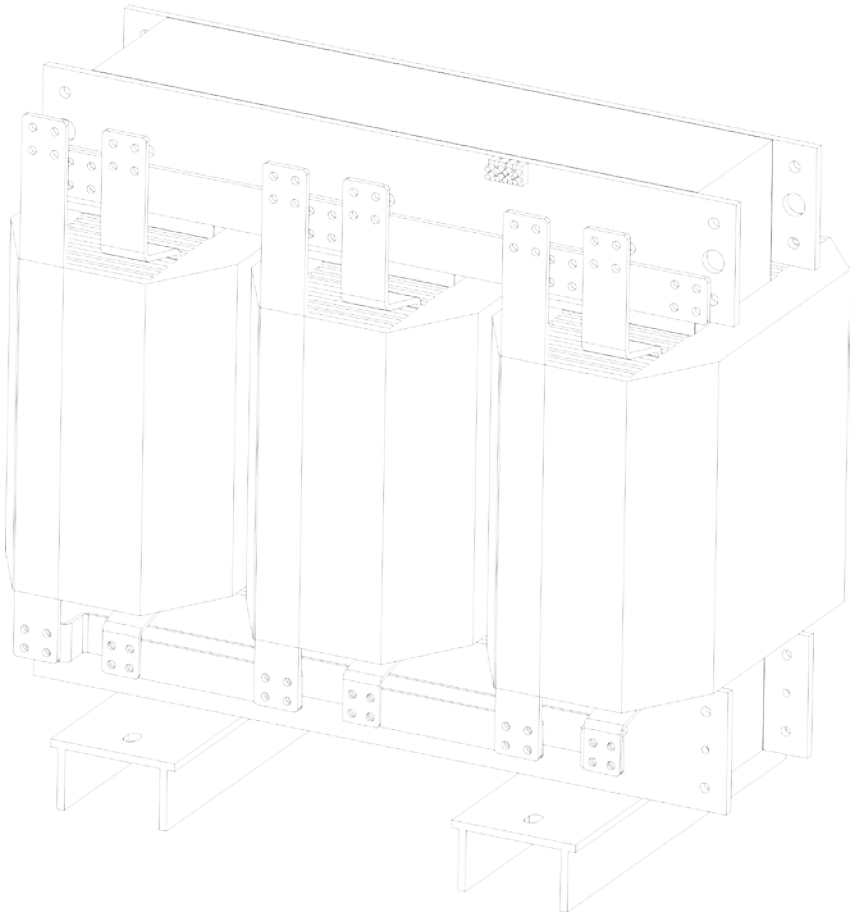


Figure 2-16 Transformer Appearance

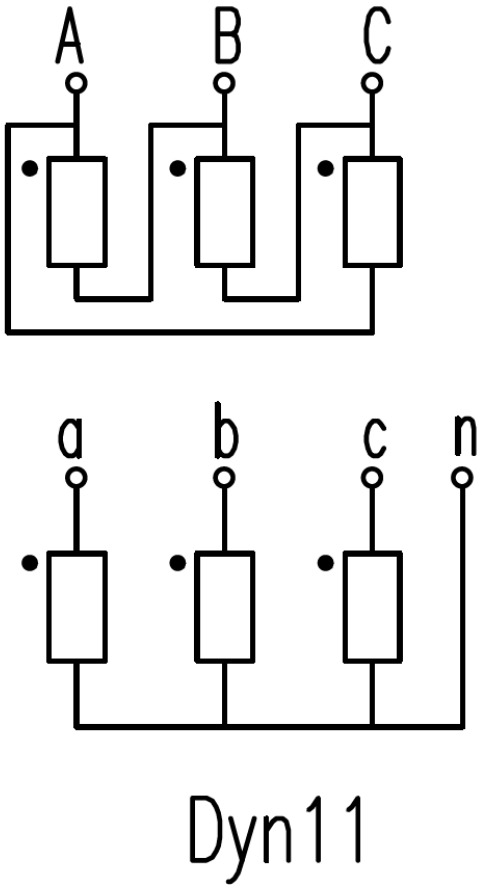


Figure 2-17 Transformer Schematic

Table 2-15 Transformer Parameters

Name	Isolation Transformer
Rated power	400 kVA
Input voltage	400 V
Input current	577.4 A
Rated Frequency	50 Hz
Output voltage	400 V
Output current	577.4 V
Operating temperature	-10 ~ 45 ℃
Operating humidity	0 ~ 95 %
Overload Capacity	-
Altitude	0~3000 m

2.5.2 BMS

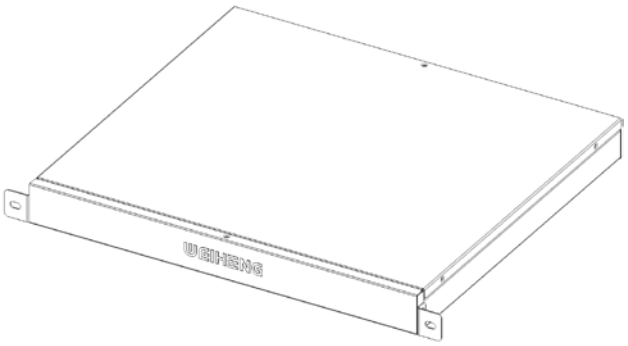


Figure 2-18 BMS Appearance

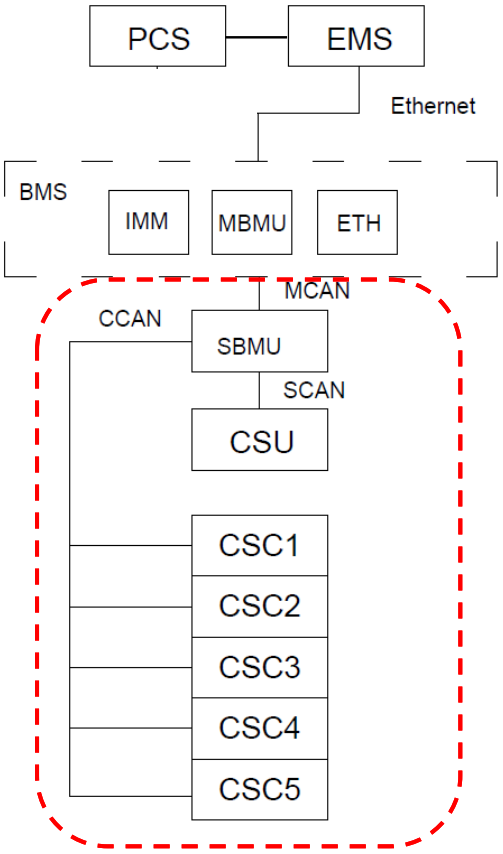


Figure 2-19 BMS System Connection Diagram

Note: The devices within the red box are located inside the TIANWU-233P/E battery cabinet and need to be connected to the TIANWU-300TS-A control cabinet using communication cables.

BMS component description:

- 1x main battery management unit (MBMU): Enables management and analysis of various battery data.
- 1x insulation detection module (IMM): Detects the insulation value between the positive/negative pole and the ground.
- 1x Ethernet conversion module (ETH): Enables external transmission of battery data via the network port.

Table 2-4 System Performance Parameters

Item	Performance parameters	Value	Remarks
Storage temperature	Range	-40°C ~ +85°C	
Operating temperature	Range	-40°C ~ +60°C	
Operating Voltage	Range	20V~26V	All BMS functions are normal
IP Protection Rating	Protection Rating	IP40D	
Cell Voltage Sampling	Range	1V~4.85V	
	Accuracy	±5mV	0°C ~ +60°C
		±10mV	-40°C ~ 0°C or 60°C ~ 85°C
	Cell Voltage Sampling Channels	52/56	Maximum 56 channels, configurable according to project requirements
Module Internal Cell Temperature Sampling	Range	-40°C ~ +125°C	
	Accuracy	±2°C	-20°C~+60°C
		±3°C	-40°C~-20°C&+60°C~+85°C
	Temperature Sampling Channels	4+4+4+4	Maximum 16 channels per CSC
Current Sampling	Range	±500A	
	Cycle	10ms	
	Accuracy	<1%FSR	-40°C ~ 85°C
HV Sampling	Range	0V ~ 1500V	
	Accuracy	1%FSR	
Balancing	Balanced Current	100mA@3.2V	Can be enabled for all channels
SOC	Accuracy	＜±5%	LFP, based on specific operating conditions
SOH	Accuracy	＜±5%	
Ambient Temperature Detection	Range	-40°C ~ +85°C	
	Accuracy	±3°C	
Insulation Detection	Detection Range	0 ~ 10MΩ	
	Accuracy	-30% ~ 0%	

	Detection time	≤10s	Single-side Y capacitor <0.47 μf

2.5.3 EMS100

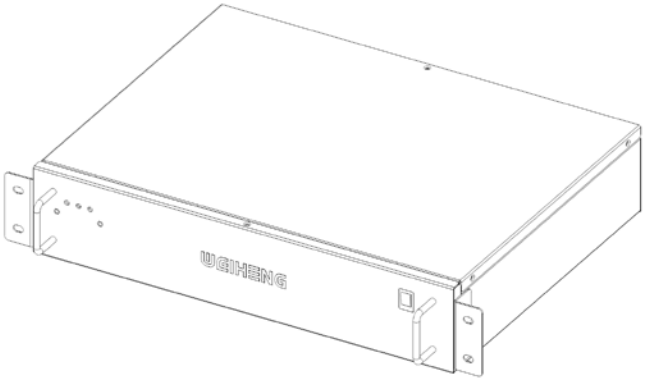


Figure 2-20 EMS100 Appearance

Function description: The EMS100 is a control host designed for energy storage battery management systems. It enables real-time data and fault information acquisition, fault protection, MCU closing control for battery packs; and provides real-time operating data acquisition, power control, and fault protection for the PCS. It also supports interlocked control with liquid cooling and fire protection systems, and configuration of various control strategies to ensure reliable system operation.

Table 2-5 Technical Parameters

Item name	Parameter Description
CPU	ARM main control platform, Cortex A7 core
RAM	512MB DDR3
Memory	4GB eMMC
Operation System	Linux
Interface	Ethernet: 2 ports, 10/100Mbps, support Modbus TCP protocol
	RS485: 4 ports, Modbus RTU
	CAN: 2 ports
	DI: 4 ports, support passive dry and wet nodes (24V\9V)
	AI: 2 ports, current (4~20mA), voltage (0~5V, 0~10V), resistance (e.g., 0~10k or resistance-type temperature and humidity sensor)
	DO: 4 ports, relay output (5A@AC250V/DC30V)
Power Supply Mode	200～240Vac

Operating temperature	-30～60°C
Storage temperature	-40～85°C
Operating Humidity Range	0~95% (no condensation)
Protection Rating	IP20
Dimensions (W*H*D)	2U
Installation Method	Rack-mounted or wall-mounted

2.6. Working Principle

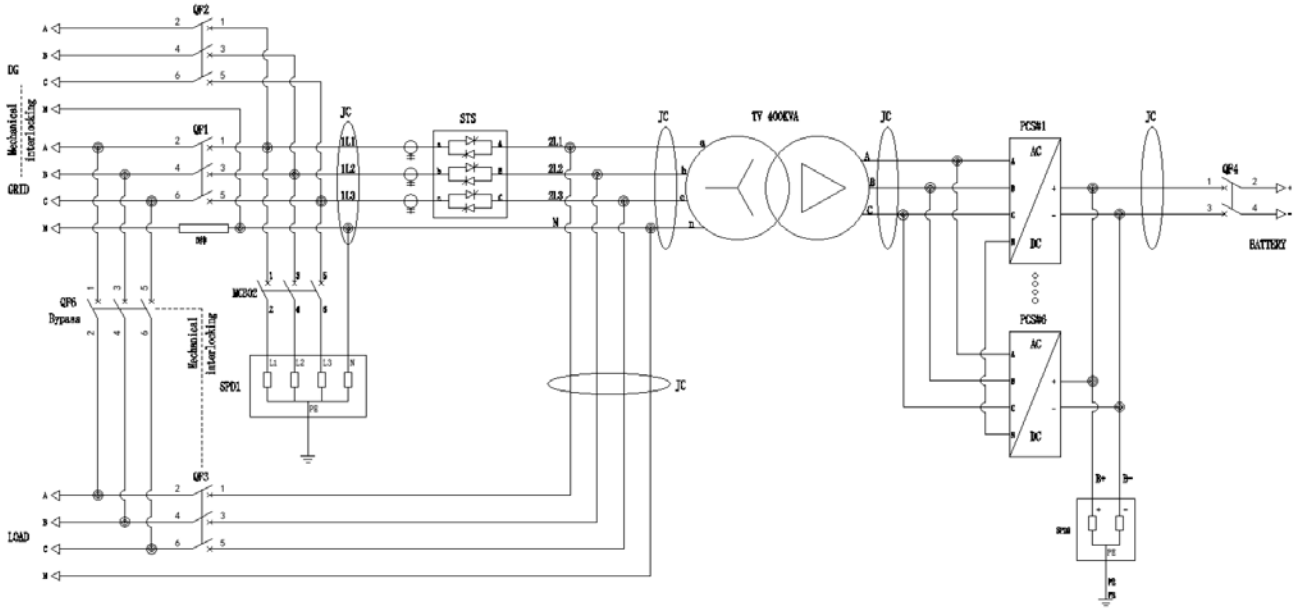


Figure 2-21 System Block Diagram

The AC control cabinet has 5 operating conditions: active, inactive, fault, standby, and offline.

Table 2-18 Equipment Status

Equipment Status	Description
Active	The AC control cabinet charges/discharges the energy storage battery cabinet.
Inactive	The AC control cabinet stops charging/discharging the energy storage battery cabinet, and the battery cabinet is powered off.
Fault	If an internal device fault is detected, the system enters the fault state.
Standby	The AC control cabinet stops charging/discharging the energy storage battery cabinet, and the battery cabinet is powered on.
Offline	The EMS is not started or the operation panel is disconnected from the system.

3 Site Requirements

3.1 Site Selection Requirements

BEWARE

The site shall be selected in accordance with GB 51048: Design Code for Electrochemical Energy Storage Power Station, NFPA 855: Standard for the Installation of Stationary Energy Storage Systems, and applicable local regulations.

The AC control cabinet is designed for outdoor installation. For indoor application, refer to local regulations. General site selection requirements:

- Select the installation site at a high elevation above the maximum historical water level rather than in a low-lying area.
- Maintain a minimum distance of 2 km from airports, landfills, riverbanks, and dams.
- Choose a spacious location and ensure a 10m unobstructed area around the site.
- Maintain a minimum distance of 50 m from residential areas to avoid noise pollution.
- Ensure convenient access to transportation facilities and reliable fire suppression systems.
- Provide sufficient space for current and future needs, including potential expansion throughout the life cycle.
- Choose a well-ventilated location.
- Avoid installing the AC control cabinet outdoors in coastal areas where it is prone to corrosion and subsequent potential fires. Coastal areas refer to areas within 2 km of the coastline or affected by sea winds. Areas affected by sea winds vary based on meteorological conditions (e.g., typhoons, seasonal winds) and terrain features (e.g., dikes, hills).

NOTE

1. If the selected site fails to meet national standards for safety clearance, it is recommended to select a new site.
2. If no suitable alternative site is available, it is recommended to install a fire wall with a minimum 3 h fire resistance rating for safety, with adequate space for equipment transport, installation and maintenance.
3. Establish firewalls in accordance with NFPA855-2020: Standard for the Installation of Stationary Energy Storage Systems.
4. Site selection shall exclude locations, areas, and places that are not recommended by industry standards and regulations, including but not limited to:
   - Areas with high vibration, noise, or electromagnetic interference;
   - Places where dust, fumes, harmful or corrosive gases are produced or are present;
   - Places where corrosive, flammable, or explosive materials are produced or stored;
   - Places with existing underground facilities;
   - Areas with poor geological conditions, such as rubber soil, soft soil layers, or areas prone to water accumulation and subsidence;
   - Earthquake faults and areas with seismic intensity greater than 9 degrees;
   - Locations susceptible to direct hazards such as mudslides, landslides, quicksand, or caves;
   - Locations affected by mining subsidence (dislocation) hazards;
   - Areas affected by explosion hazards;
   - Areas at risk of flooding due to dam or dike failure;
   - Important water source and sanitary protection zones;
   - Historical and cultural relic protection zones;
   - Crowded areas, high-rise buildings, and underground structures.

3.2 Forklift Requirements

- Ensure that the forklift has a load capacity of at least 3t before using it.
- Recommended fork length: ≥1.5 m.

3.3 Lifting Requirements

- Before lifting, ensure that the crane and lifting rope meet the load capacity requirements. This ESS must be lifted using a lifting frame.
- When installing and disassembling the lifting equipment, avoid dragging it across the enclosure to prevent scratches.

Lifting Procedure	Precautions
Before Lifting	**Crane lifting capacity: > 3t, working radius: ≥ 2 m. If the site work conditions do not meet the requirements, seek professional evaluation.**
	All personnel involved in lifting operations must undergo appropriate training and be qualified before performing any lifting tasks.
	Lifting tools must be thoroughly inspected and deemed complete before use.
	Ensure all lifting tools are securely attached to load-bearing fixtures or walls.
	Proceed only in clear, windless weather when lifting the equipment outdoors.
	Verify that the crane and wire rope meet all necessary specifications before lifting.
	Verify that all equipment doors are closed and securely locked.
	Ensure that the wire rope connection is secure and reliable.
	It is recommended to use a consistent left-to-right or right-to-left sequence to ensure smooth lifting.
During Lifting	**Restrict access to the lifting area to authorized personnel only. Never stand under the crane boom.**
	Ensure the crane is properly positioned. Avoid lifting excessive distances.
	Maintain stability throughout the lifting process, with no more than a 5° diagonal tilt of the enclosure.
	Keep the angle between the two lifting cables no more than 90°.
	Handle with care when lifting or lowering the equipment. Lower the enclosure slowly and smoothly to avoid impact damage to internal components.
	Once the container touches the base, wait until the base is evenly loaded before releasing the lifting wire ropes.

	Avoid dragging steel cables or spreaders with bare hands.
	After securing the first cabinet, proceed with lifting subsequent cabinets.

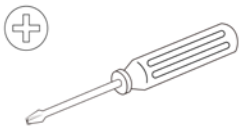
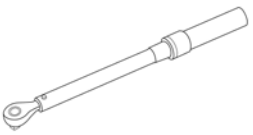
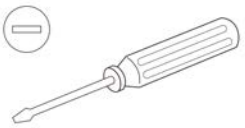
4 Equipment Installation

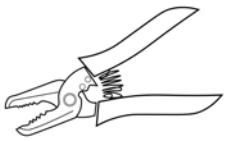
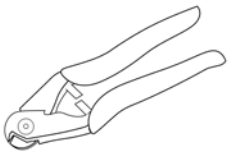
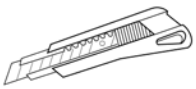
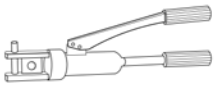
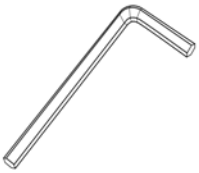
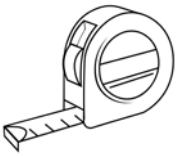
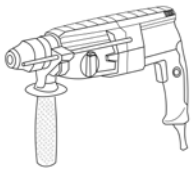
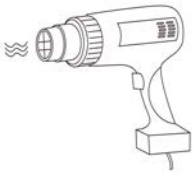
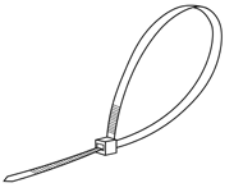
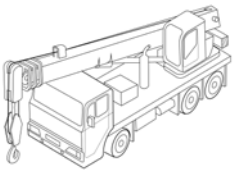
4.1 Pre-Installation Preparation

NOTE

- The illustrated tools are for reference only and may differ from actual tools.
- Due to varying site conditions, this tool list may not be exhaustive. On-site installers and users are responsible for preparing unlisted tools based on actual needs.

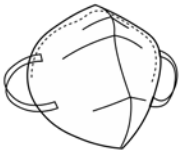
Installation Tools

			
Phillips Insulated Torque Screwdriver	Insulated Torque Socket Wrench (including extension rod) ● Socket size: 7mm~19mm ● Socket depth: ≥32mm ● Socket interface compatible with torque wrench ● Torque range: 1.2N·m~45N·m	Flathead Insulated Torque Screwdriver	Diagonal Pliers

 Wire Strippers	 Wire Cutters	 Rubber Hammer	 Utility Knife
 Crimping Tool	 Hydraulic Pliers	 Hex Wrench: 5mm~12mm	 Multimeter DC Voltage range ≥1500V DC
 Steel Tape	 Spirit Level	 Vacuum Cleaner	 Impact Drill
 Impact Drill Bit Φ16mm	 Heat Shrink Tubing	 Heat Gun	 Cable Tie
 Insulated Ladder	 Crane	 Manual Forklift	 Forklift

 Lifting Rope & Shackle Rope length: ≥2200mm×8	 Crowbar

Personal Protective Equipment

 Insulating gloves	 Protective Gloves	 Goggles	 Dust Mask
 Insulating shoes	 Reflective Vest	 Safety helmet	 Safety Harness

Before unpacking the equipment, inspect the outer packaging for visible damage such as holes, cracks, or other signs of possible internal damage, and verify that the product model is correct. If the packaging appears abnormal or the equipment mode does not match, do not open the packaging and contact your dealer immediately.

NOTE

It is recommended to remove the outer packaging within 24h before preparing to install the cabinet.

WARNING

If the cabinet height exceeds 2 m, ensure appropriate safety precautions for elevated work are in place when removing the outer packaging.

Deliverable Inspection After unpacking the equipment, inspect all deliverables to ensure they are complete and free of visible damage. If any items are missing or damaged, contact your dealer immediately.

4.2 Cable Selection

For crimping OT/DT terminals, please refer to **A Crimping OT/DT Terminals**.

Name	Type	Conductor Cross-Sectional Area	Description
AC Input Line	3-core outdoor copper wire	≥240mm2	The cable cross-sectional areas listed in the table are the minimum required for normal system operation. Armored cables can be selected according to the site environment.
Neutral Input Line	Single-core outdoor copper wire	≥120mm2	
Protective Ground Wire	Single-core outdoor copper wire	≥120mm2	

4.2 Installing the AC Control Cabinet and Cables

Precautions

DANGER

- Before making any electrical connections, ensure that all switches in the ESS are in the "OFF" position. Otherwise, the high voltage of the ESS may cause electric shock hazards.
- Measure the voltage at the contact point before touching any conductor surface or terminal, and confirm that the protective grounding conductor of the equipment or parts to be repaired is securely grounded to ensure that there is no risk of electric shock.

WARNING

- Equipment damage caused by improper wiring is not covered by the equipment warranty.
- Only qualified electricians can perform electrical connection operations.
- Operators must wear personal protective equipment when making electrical connections.

NOTE

The cable colors shown in all electrical connection diagrams within this section are for reference only. Cables shall be selected according to local cable standards, with yellow-green dual-color wires reserved exclusively for protective grounding).

Installation Procedure

Step 1 Remove the packaging of the ESS.

After confirming that the equipment is placed horizontally, remove the four side plates and top cover of the wooden box, then remove the internal pearl cotton and PE bag wrapped around the equipment.

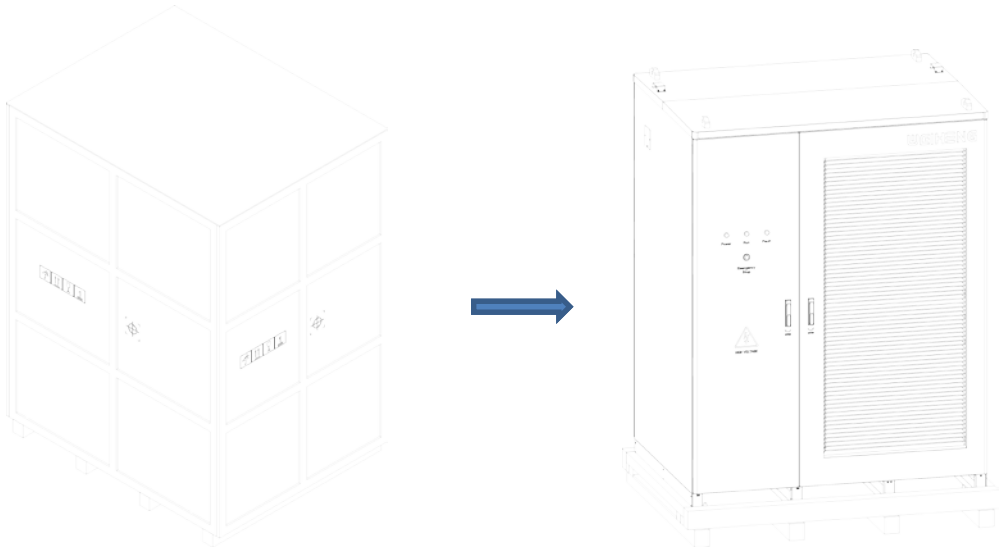


Figure 4-1 Remove the packaging

Step 2 Remove the wooden limiters on the pallet.

Use a crowbar to remove the 4 wooden limiters on the front, back, left and right sides of the pallet.

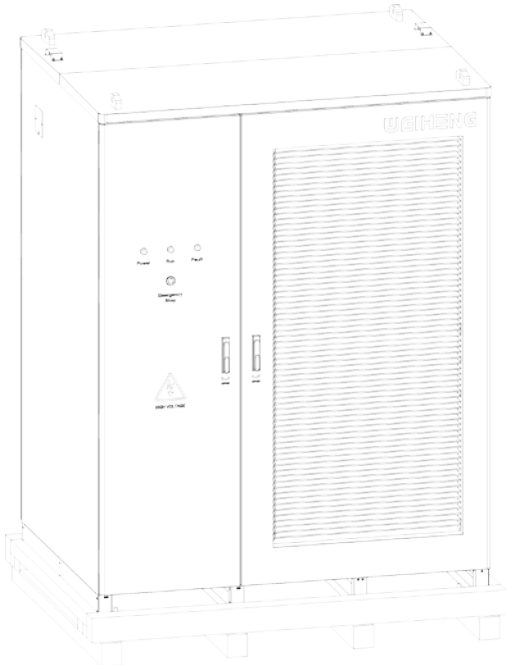


Figure 4-2 Remove the wooden limiters on the pallet

Step 3 Remove the pallet.

Use a hex socket wrench to remove the fixing bolts (4x M16 hex head bolts, 4x M16 nuts and flat washers) at the bottom of the equipment. Remove the wooden pallet after the equipment is lifted by a forklift or crane.

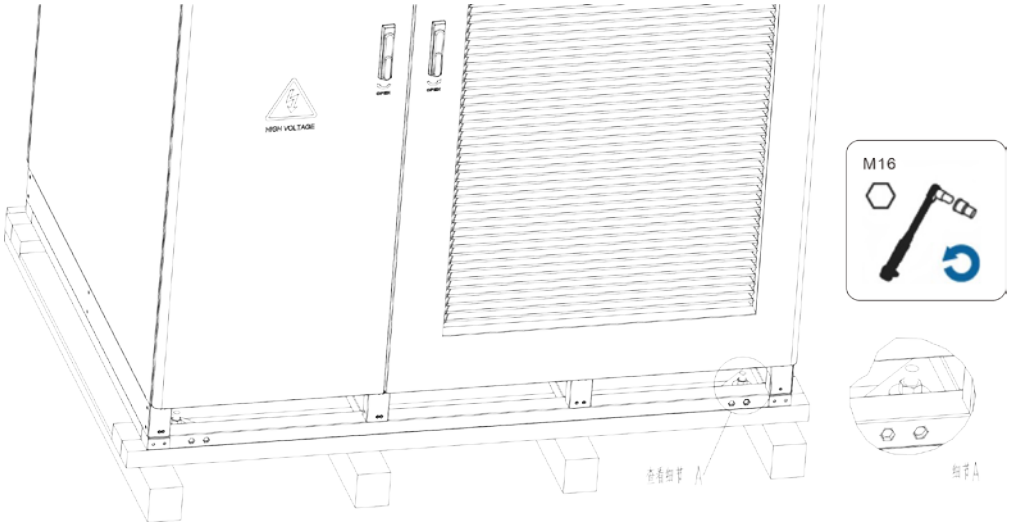


Figure 4-3 Removing the pallet

Step 4 Drill holes on the foundation and install expansion screws (M16×100, 4 pcs in total).

Use an impact drill to drill 4 holes with a diameter of 20 mm and a depth of 65-70mm on the installation foundation. The hole spacing is shown as below. Hammer in four M16×100 expansion bolts. (Exposed thread length above the platform: 30-35 mm)

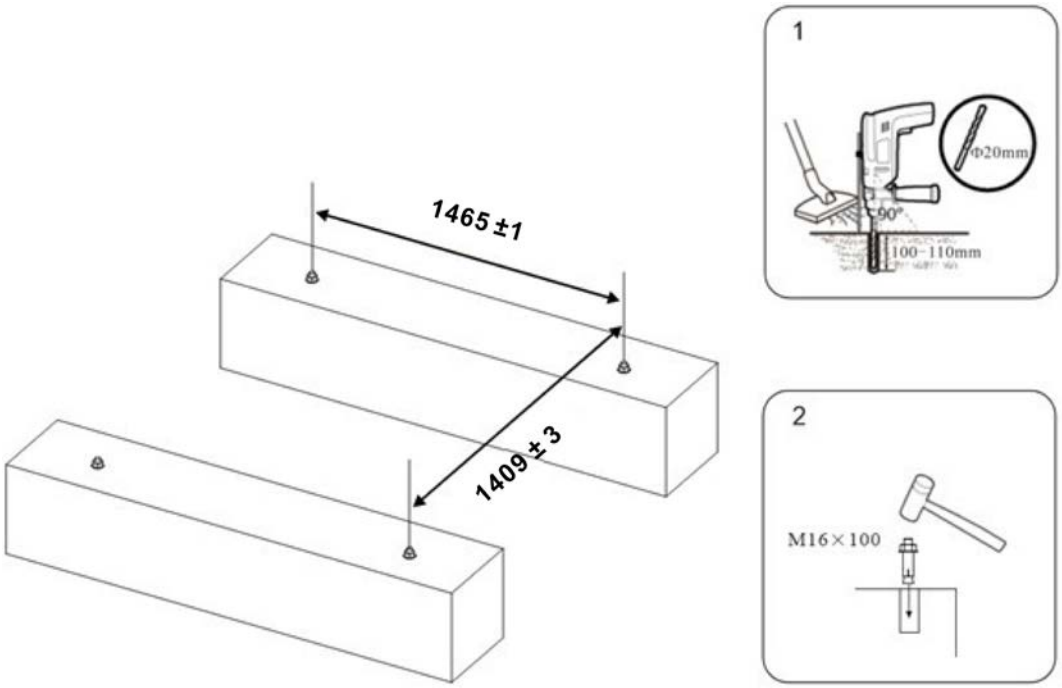


Figure 4-4 Drill holes on the foundation and install expansion bolts

Step 5 Move the cabinet to the mounting platform using a forklift or crane.

Figure 4-5 Move the ESS to the mounting platform using a forklift

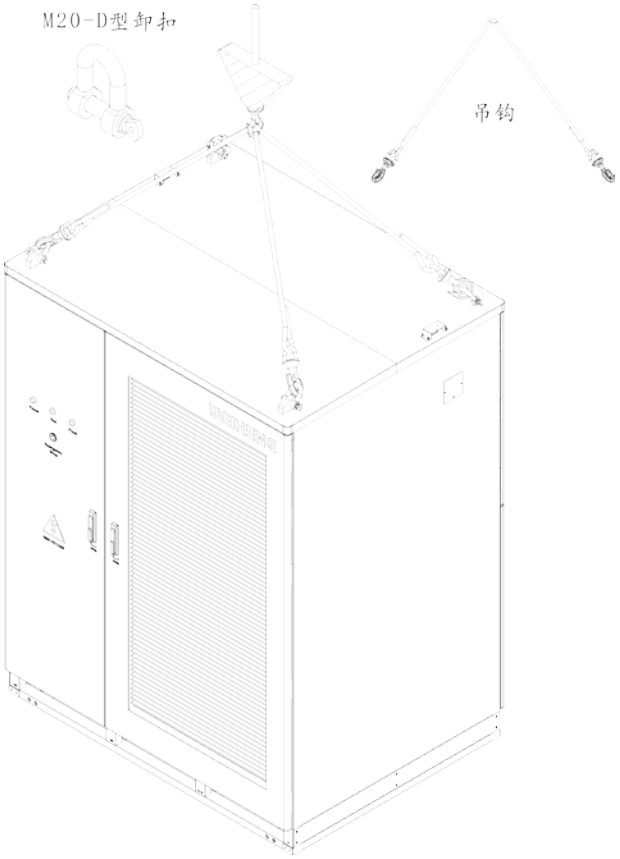


Figure 4-6 Move the cabinet to the mounting platform using a crane

BEWARE

When using a forklift to move the equipment, secure the equipment with appropriate straps based on the actual situation to prevent the risk of overturning.

When using a crane to move the equipment, choose an appropriate lifting plan based on the actual conditions to ensure stable lifting.

Step 6 Fix the ESS.

Use a hex socket wrench to install the fixing bolts (4x M16 hex nuts and flat washers) at the bottom of the equipment (recommended wrench torque:165 N·m).

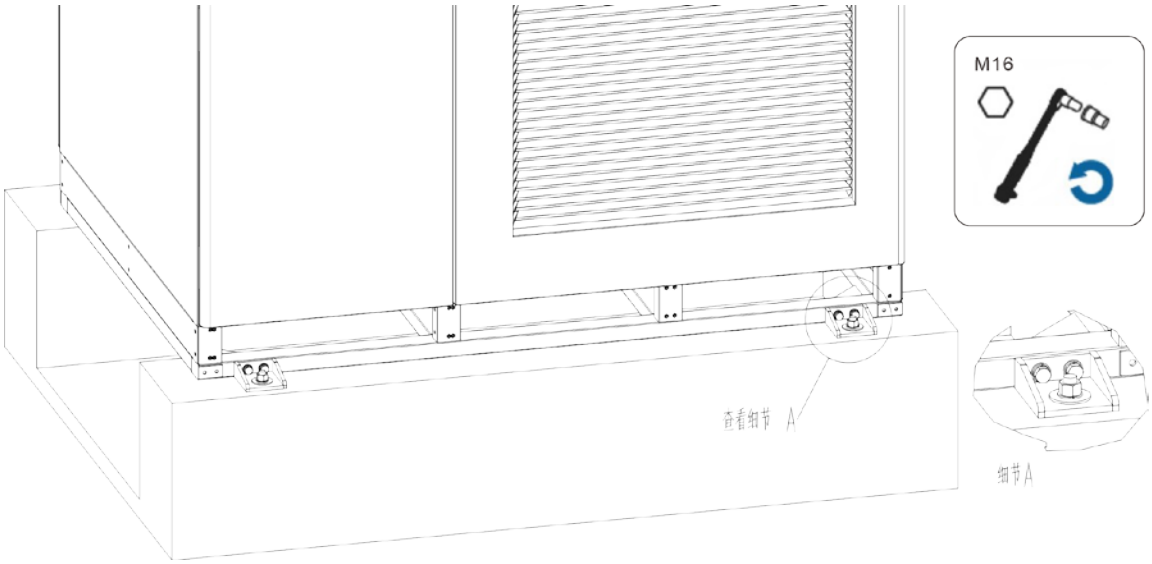


Figure 4-7 Fix the ESS on the mounting platform

Step 7 Connect the housing grounding wire.

Use a hex socket wrench to install the grounding busbar on the base with an M10×25 hex head bolt and flat washer (recommended wrench torque: 45 N·m).

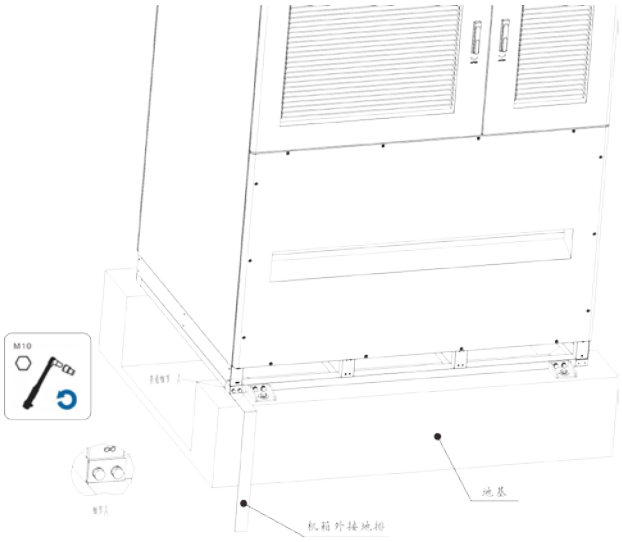


Figure 4-8 Install the grounding wire (enclosure)

Step 8 Open the front door.

For the left door, use the door lock key to turn the latch counterclockwise. After the door handle pops out, turn the door handle 90° clockwise and pull the cabinet left door open. For the right door, use the door lock key to turn the latch clockwise. After the door handle pops out, turn the door handle 90° counterclockwise and pull the right cabinet door open.

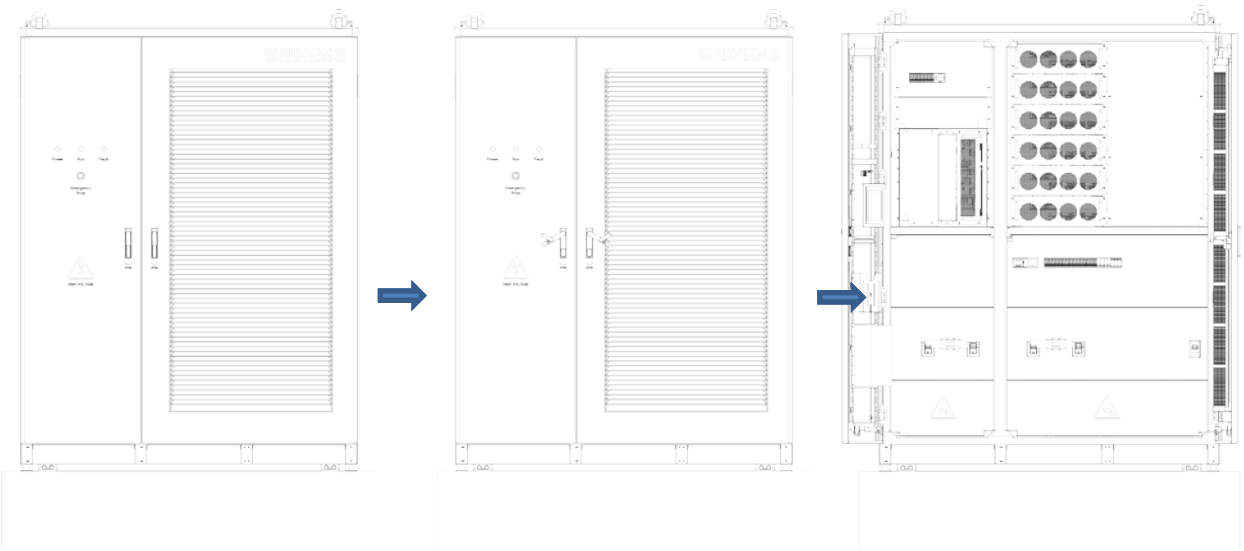


Figure 4-9 Open the front door

Step 9 Remove the protective plate.

Use a hex socket wrench to remove the bottom protective plates (8x M6*12 cross-head hex combination screws).

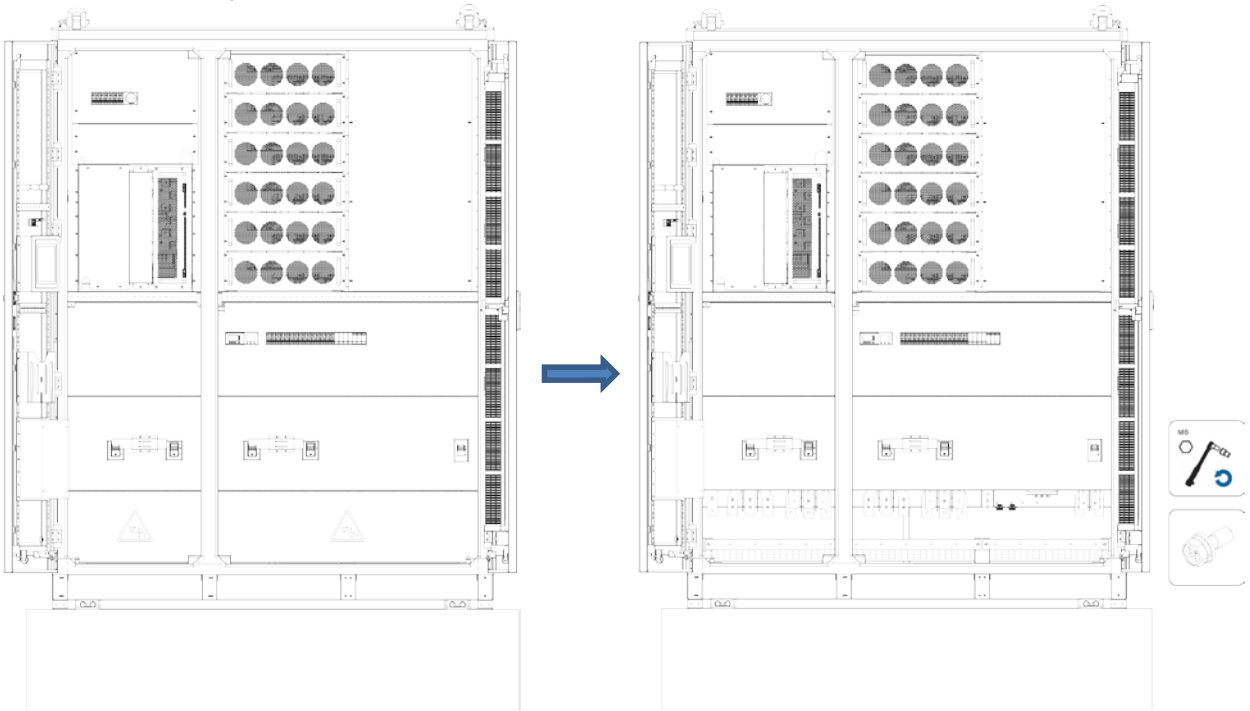


Figure 4-10 Remove the protective plate

Step 10 Install the AC/DC cables (recommended wrench torque for cable fastening bolt: 20 N·m).

Figure 4-11 Install the AC/DC cables

Step 11 Install the network and communication cables.

Connect the external communication network cable to the network port marked with the red box.

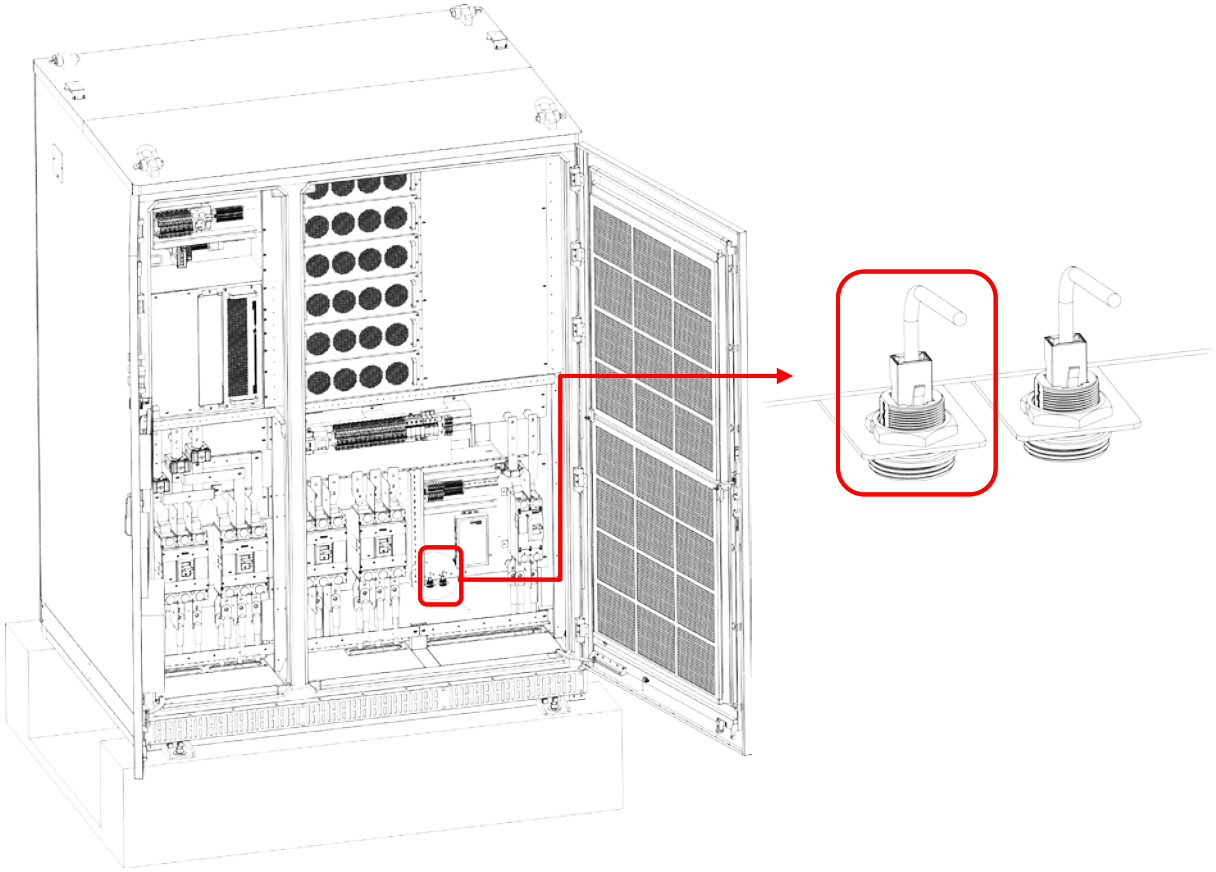


Figure 4-12 Install the communication network cable

Step 12 Install the communication cable to the TIANWU-233P as well as the auxiliary power supply cable.

Connect the communication cable (shielded twisted-pair cable) between TIANWU-233E/P and TIANWU-300TS-A according to the electrical diagram.

Connect the auxiliary power supply cable (shielded twisted-pair cable) between TIANU-233E/P and TIANWU-300TS-A according to the electrical diagram.

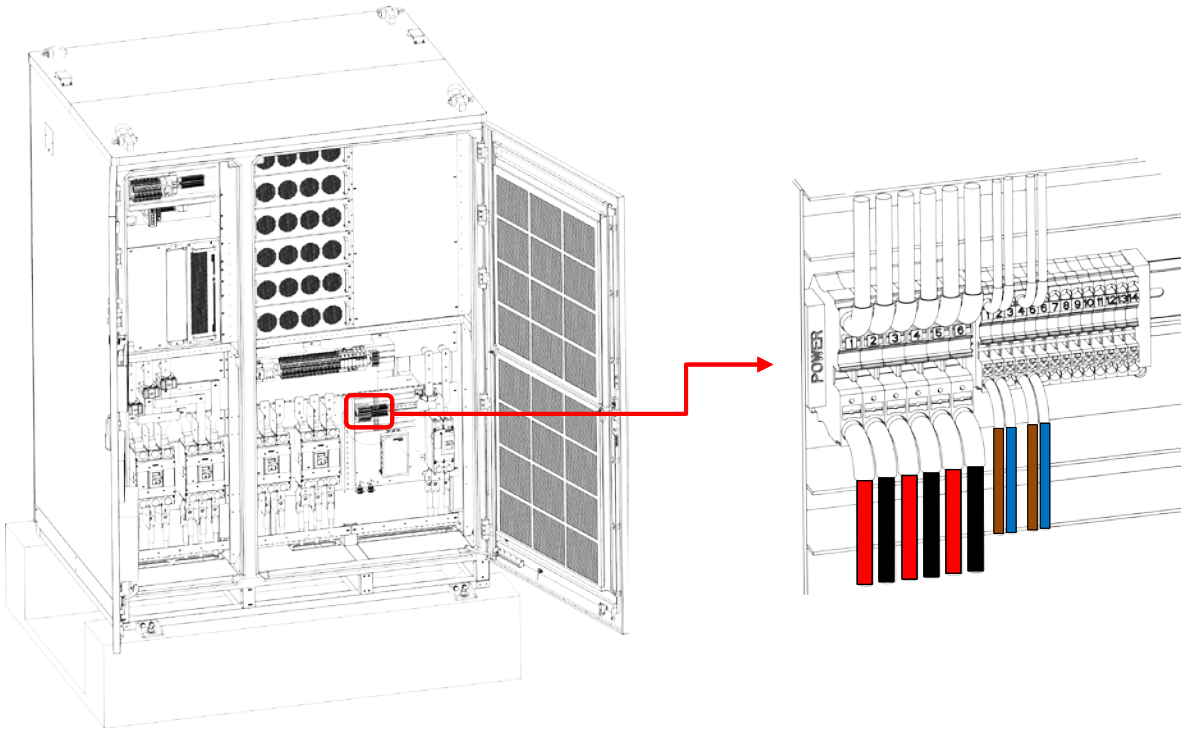


Figure 4-13 Installing communication cables

Step 13 Re-install the protective plates.。

Use a hex socket wrench to install the protective plates with 8 M6*12 cross-head hex combination screws.

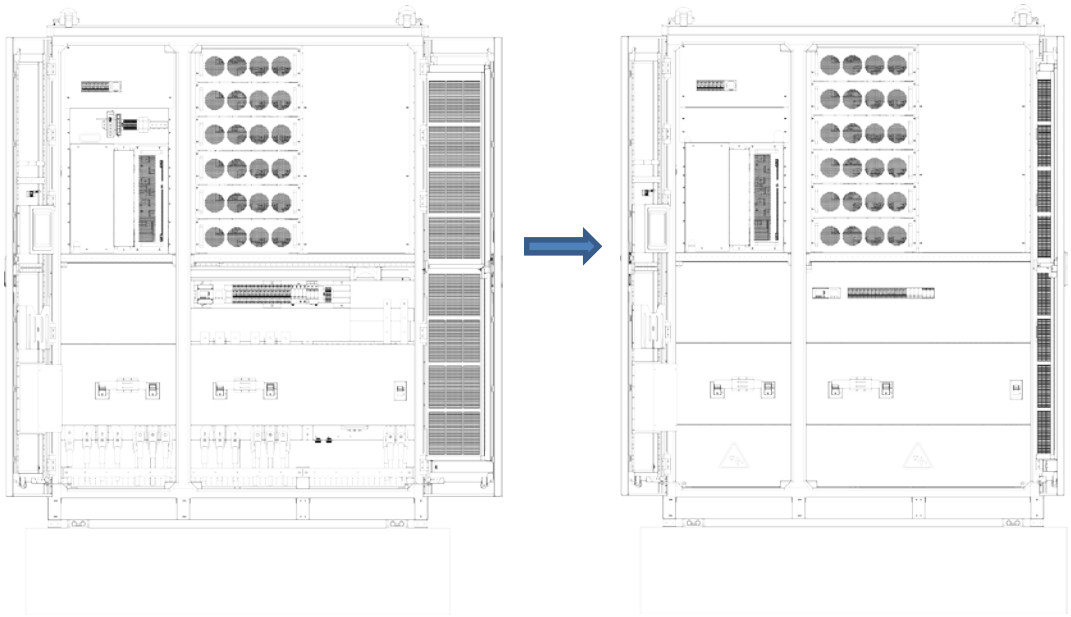


Figure 4-14 Reinstall the electrical compartment cover and protective plate

Step 14 Close the front door.

Close the cabinet door, turn the door handle clockwise 90°, make sure the latch and lock head are in place, and then snap the door handle.

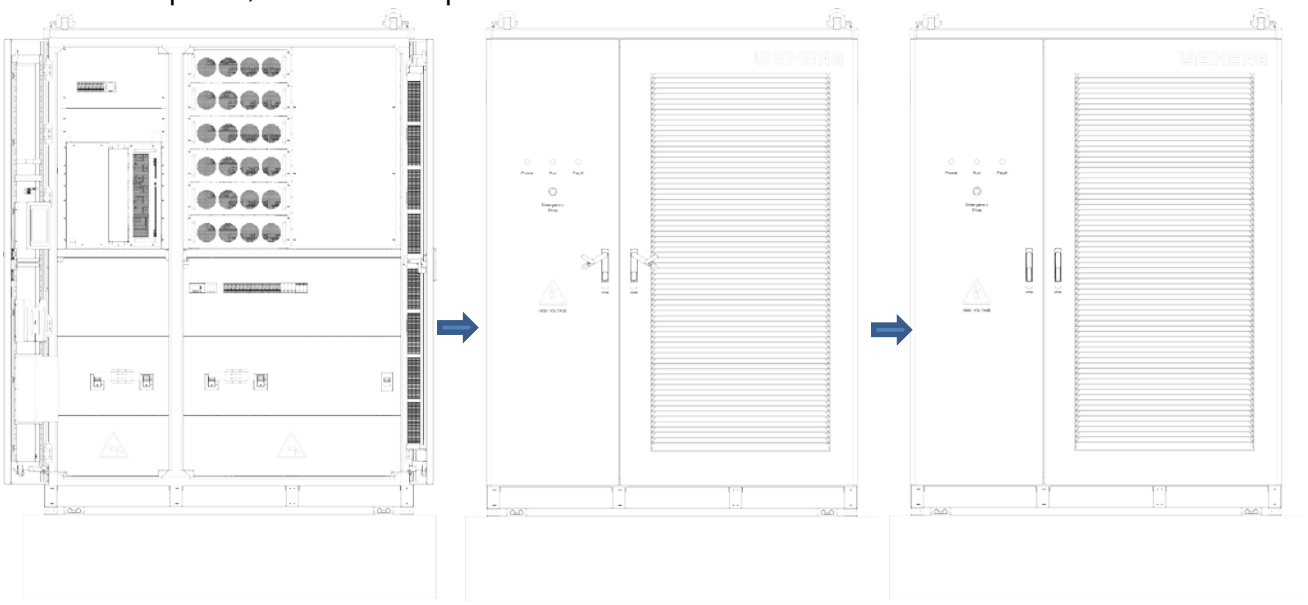


Figure 4-15 Close the front door

Step 15 Install the front and rear cover plates on the base.

Use a hex socket wrench to install the front and rear cover plates of the equipment base with 16 M5*20 hex round-head combination screws.

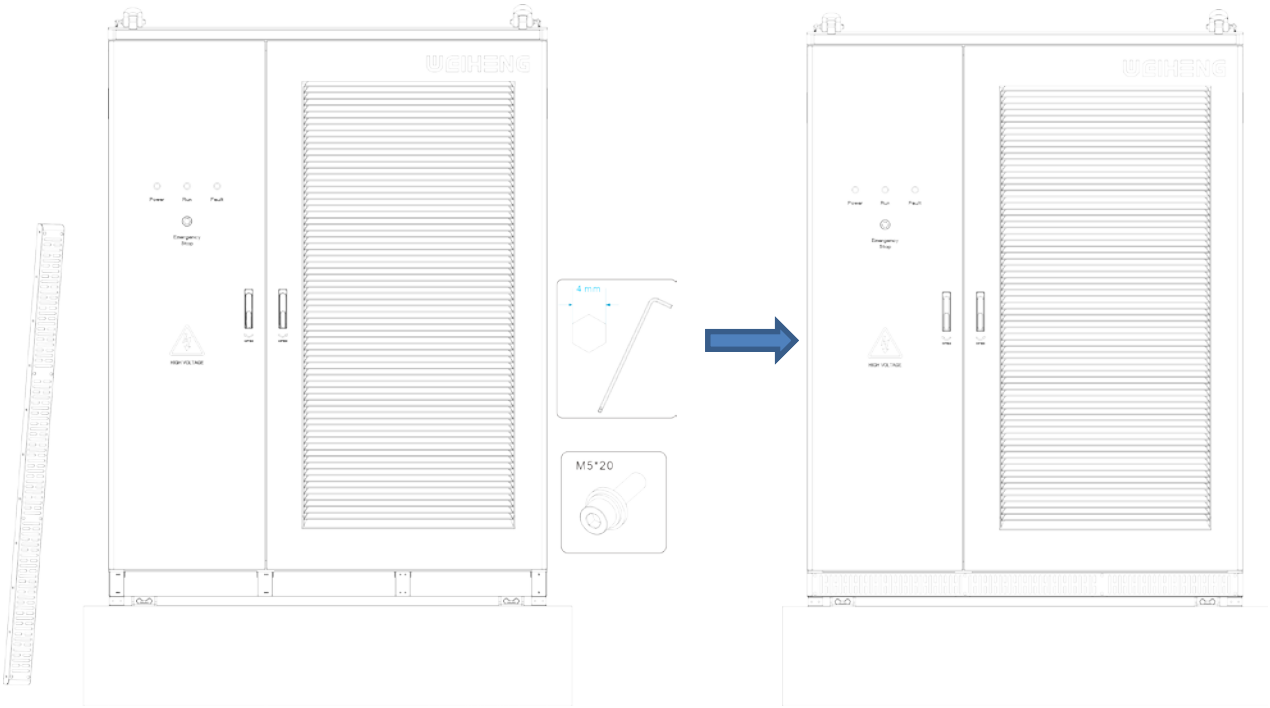


Figure 4-16 Install the front and rear cover plates on the base

5 System Power-On

5.1 Pre-Power-On Inspection

SN	Inspection Item	Acceptance criteria
1	Equipment Appearance	The equipment is intact and free of visible damage, rust, or peeling paint. Repaint any areas with peeling paint.
		All labels on the equipment are clearly visible and legible. Replace damaged labels promptly.
2	Cable Appearance	Cable protective layers are well wrapped and free of visible damage.
		Cable conduits/hoses are intact.
3	Cable Connection	Cable connections are correctly positioned according to the design.
		Terminals are properly installed in accordance with specifications, and connections are secure and reliable.
		All cables are clearly identified at both ends with legible labels that are oriented in a consistent manner.
4	Cable Routing	Cables are routed by separating strong and weak power systems.
		Cabling is organized in a neat and orderly manner.
		Cable ties are trimmed flush, eliminating sharp edges or protrusions.
		Bends are properly managed with sufficient slack, without over-tensioning cables.
		All cables are routed straight and smooth inside the cabinet, avoiding crossovers.
5	Switch	All circuit breakers in the power distribution cabinet are in the OFF position.
		All switches in the HV box are in the OFF position. (battery cabinet)
6	Enclosure Grounding	Each enclosure has at least two securely connected grounding points with a maximum contact resistance of 0.1Ω.
7	Identification	Identification is correct, legible, and complete.

8	Sealing of Cable Openings	All cable openings are properly sealed.
9	Battery Pack	All battery pack are free of visible damage.
10	Foreign Objects	All foreign objects such as tools, and leftover installation materials are removed from the cabinet.
11	Power Distribution Area Cover Plate	The cover plates in the power distribution area are free of visible cracks, dents, scratches, breakage, or looseness.
12	Sub-Components (EMS, BMS, UPS, etc.)	All sub-components are free of visible damage.

5.2 Power-On Procedure

Table 5-1 Power-On Procedure

Step	Item	Remarks
1	Activate the QF1 AC input line and QF4 DC input line.	The QF2 diesel generator switch and QF1 must not be activated simultaneously. After the power supply is connected, measure the AC voltage to ensure it meets the rating requirements.
2	Activate the MCB03 pre-charge switch.	Wait about 60 s until you hear a sound indicating relay actuation and verify that the STS status indicator is steady green before proceeding the next step.
3	Activate the MCB01, MCB02 and MCB1.	
4	Activate the MCB2-4 and MCB6-8.	Press and hold "ON" for 10 s until a "beep" sounds, then the UPS is switched on.
5	Activate the MCB5 power supply module switch.	
6	The power-on process is completed.	The entire cabinet is powered on. Pay attention to safety precautions during operation.

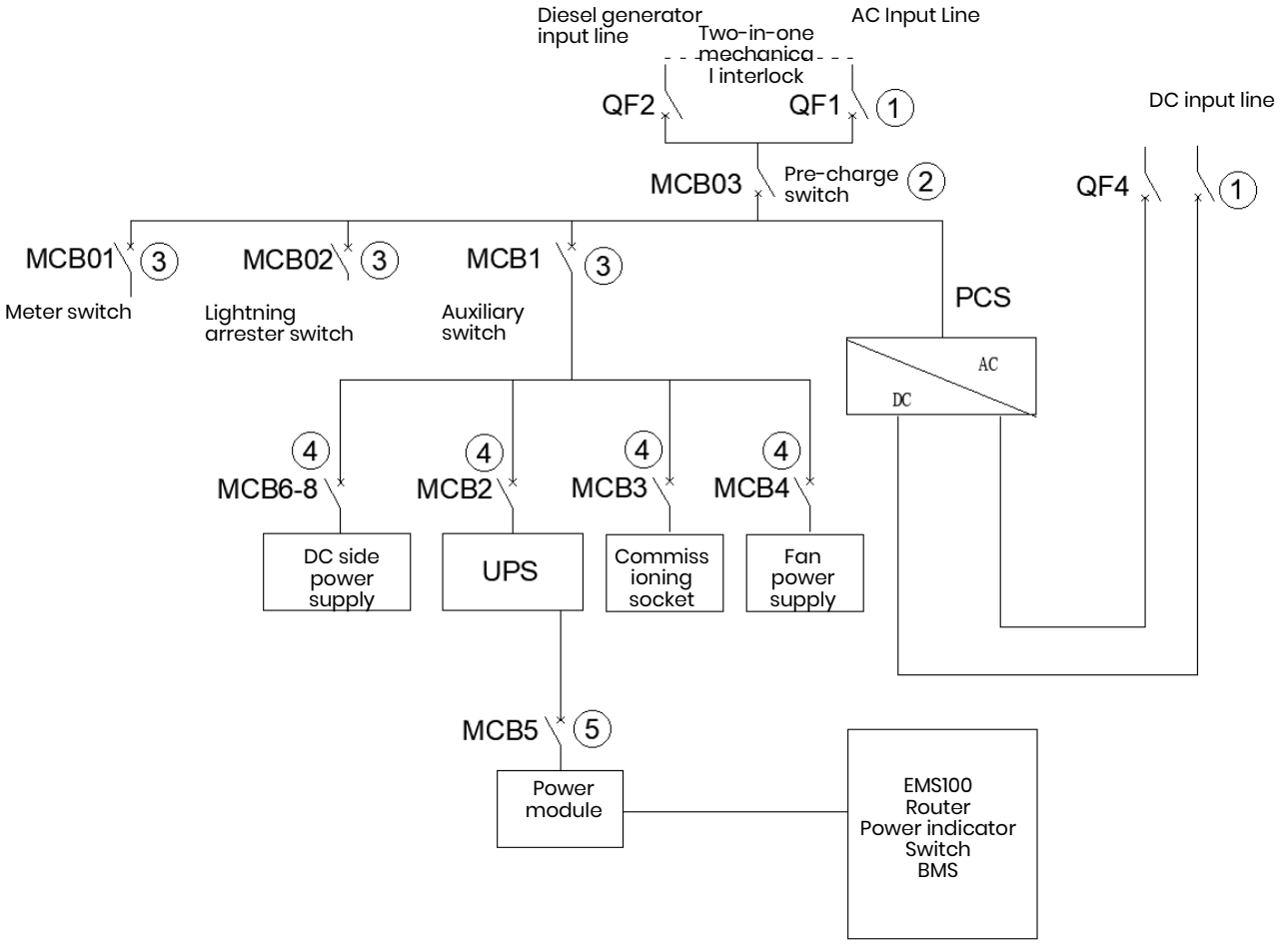


Figure 5-1 Power-On Procedure Schematic

6 Power-On Commissioning (PANGU-LITE)

Prerequisites

1. All on-site equipment has been fully commissioned upon arrival.
2. The system has been successfully powered on, and all alarms have been cleared.
3. Commissioning devices for startup are available on site.

6.1 Preparation and PANGU LITE Access

Operation Procedures

After the auxiliary power supply is connected, turn on the touch screen on the door of the AC control cabinet and enter the PANGU LITE screen.

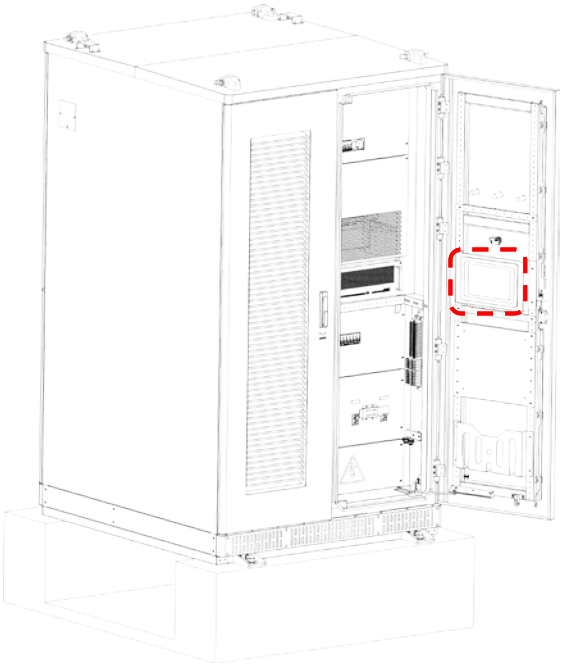


Figure 6-1 Touch Screen Position

6.2 HMI Description

Home Screen:

1. After accessing this screen, you can customize the language, time zone, display settings, and other parameters at the top right corner.
2. This screen shows the direction of energy flow in the energy storage system, as well as the real-time operating status of the PCS, battery and grid. The alarm/message system refreshes the operating status and data every 5s.
3. This flow shows the three-phase voltage and current of the grid, the power supply of the PCS, as well as the SOC, voltage and current of the battery.
4. PCS operating conditions:
   Charging: Indicate that the equipment is charging.
   Discharging: Indicate that the equipment is discharging.
   Offline: Indicate that the equipment is in an offline state.
   Standby: Indicates that the equipment is functioning normally without faults and is not in the charging or discharging process.
   Inactive: Indicate that the equipment has stopped operating.

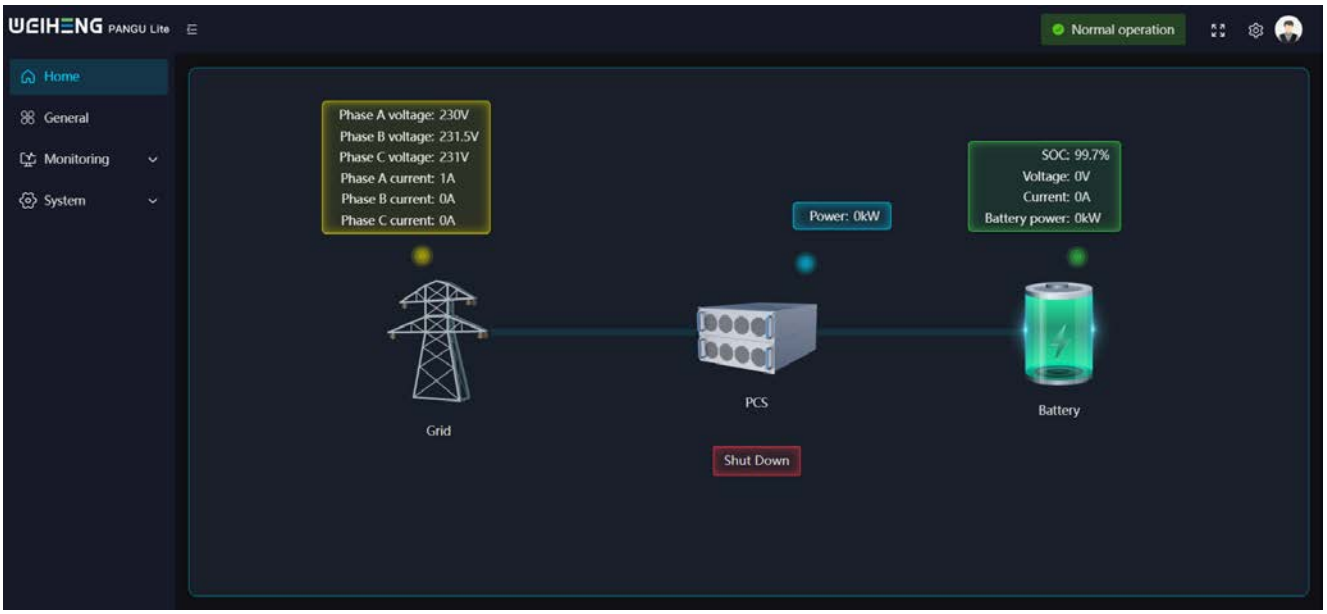


Figure 6-2 PANGU LITE - Home

Energy Storage Overview:

Display basic system information, including EMS-SN, rated power, rated capacity, maximum charge power, number of PCS units, number of battery clusters, charge/discharge power, available charge/discharge capacity, SOH, and SOC.

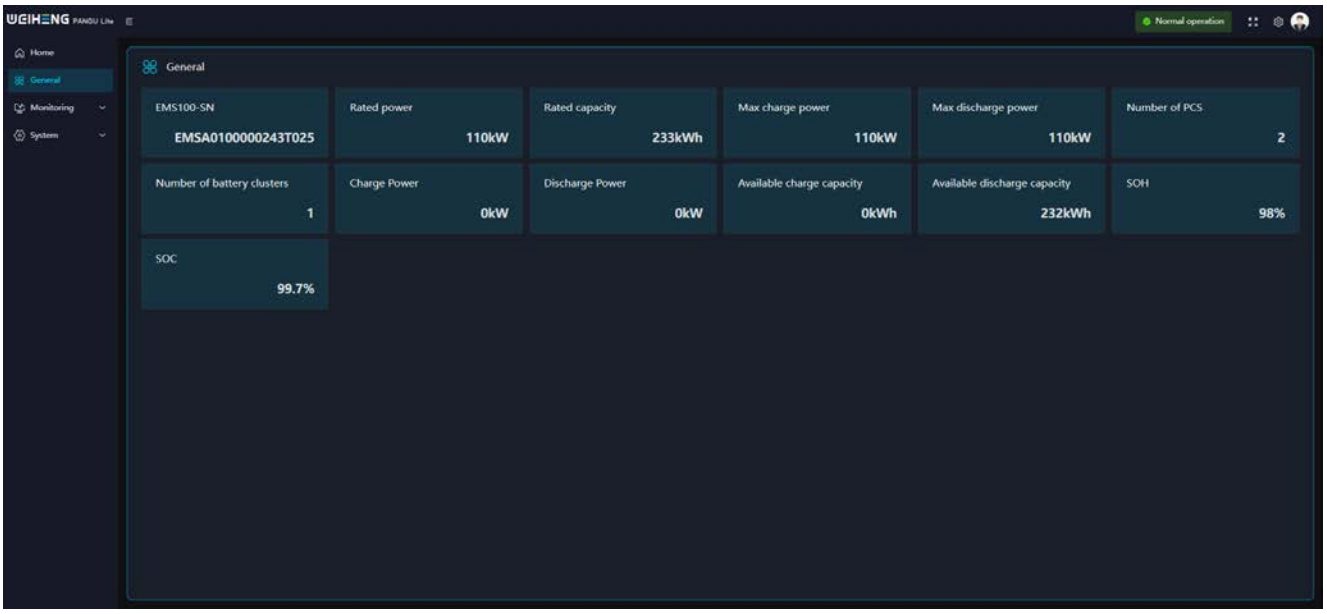


Figure 6-3 PANGU LITE - Energy Storage Overview

Operation Monitoring - PCS Screen:

This screen allows real-time monitoring of DC current, DC voltage, and three-phase voltage data, and monitors all operating conditions of the PCS. It also displays operating and simulated data of the PCS, including design capacity, maximum and minimum design voltage, frequency, power factor, active power and reactive power.

Figure 6-4 Operation Monitoring - PCS Screen

Operation Monitoring - BMS Screen:

This screen displays SOC/SOH monitoring information, operating status, and detailed operating data for the battery BMS. It also displays real-time status and data for all battery clusters.

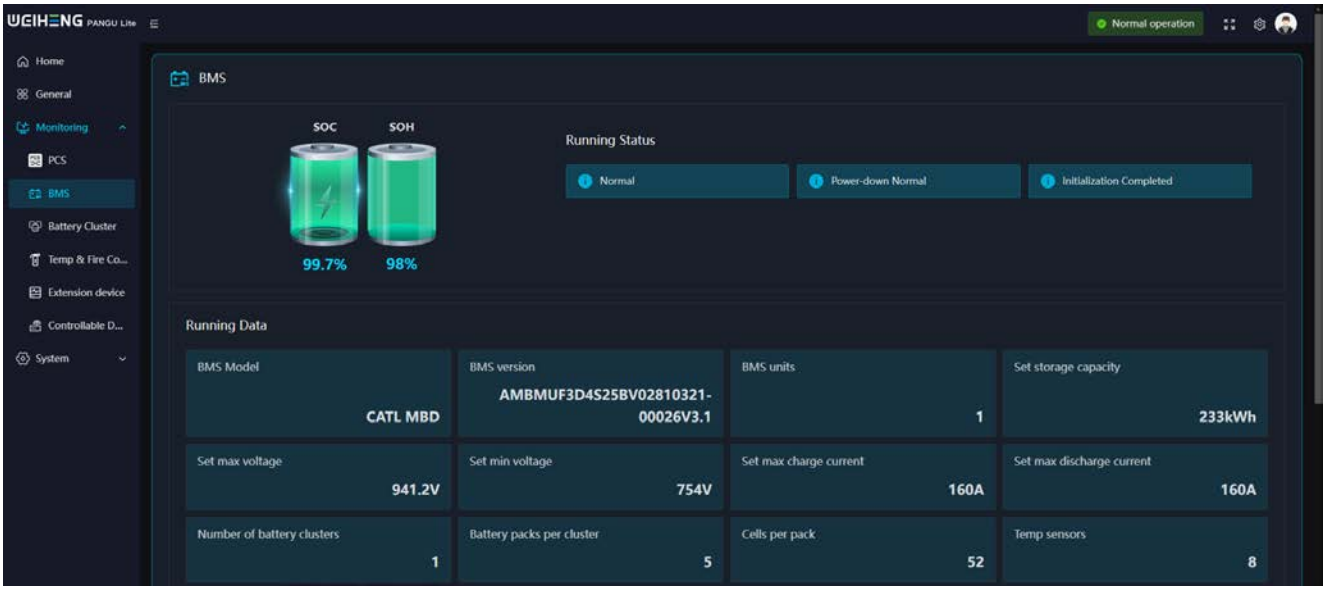


Figure 6-5 Operation Monitoring - BMS Screen

Operation Monitoring - Battery Cluster Screen:

This screen monitors the voltage and temperature of each battery in the pack, as well as all operating data for the entire battery cluster.

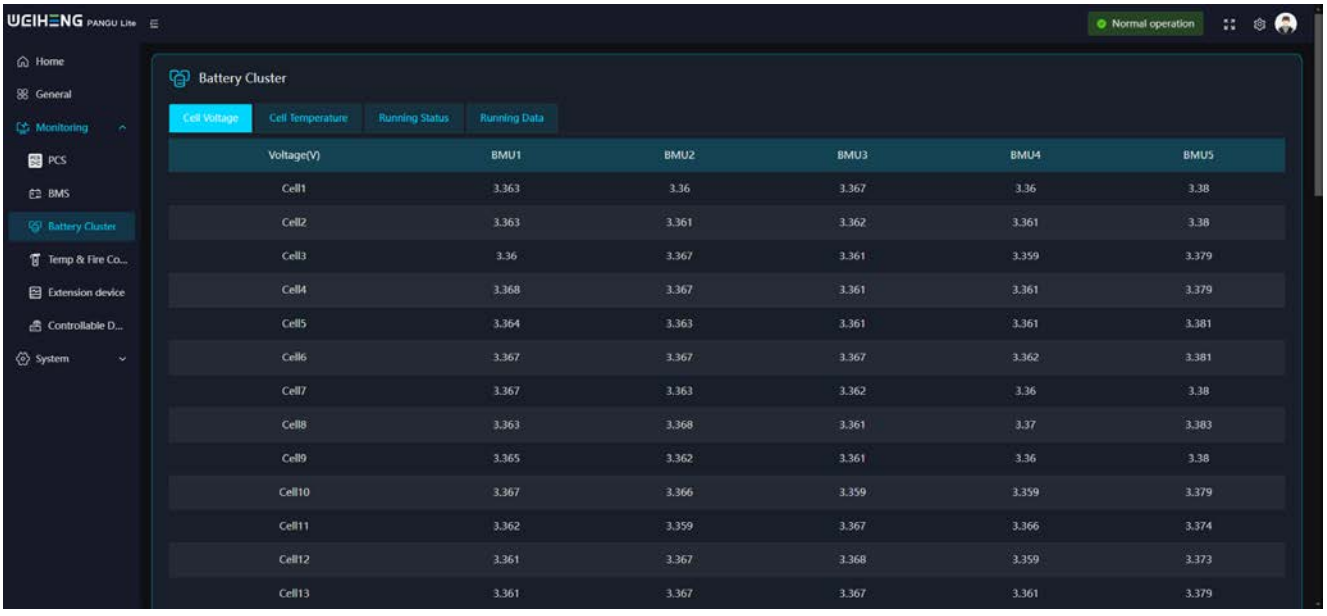


Figure 6-6 Operation Monitoring - Battery Cluster Screen

Operation Monitoring - Temperature Control & Fire Safety Screen:

This screen monitors the inlet and outlet water temperature, pressure and operating status of the water cooling system, as well as the operating status of the air conditioning and fire protection systems.

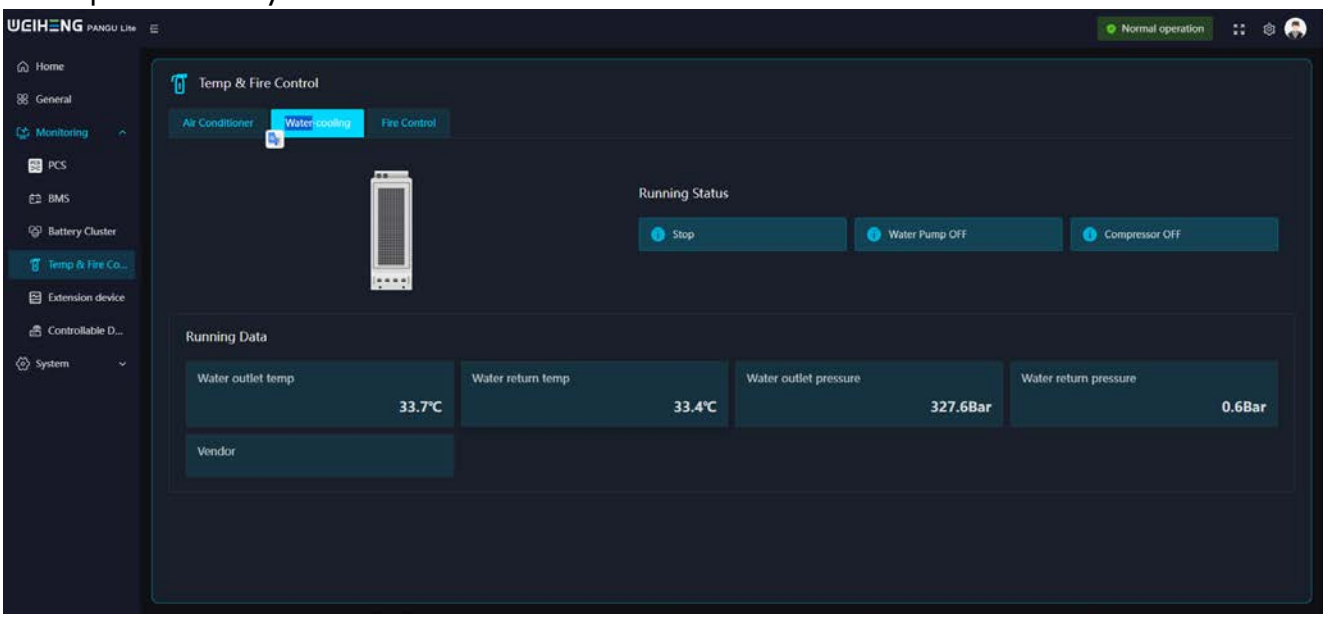


Figure 6-7 Operation Monitoring - Air Conditioning & Fire Protection Screen

System Configuration - System Status Screen:

This screen allows you to view the system operating status and perform system control.

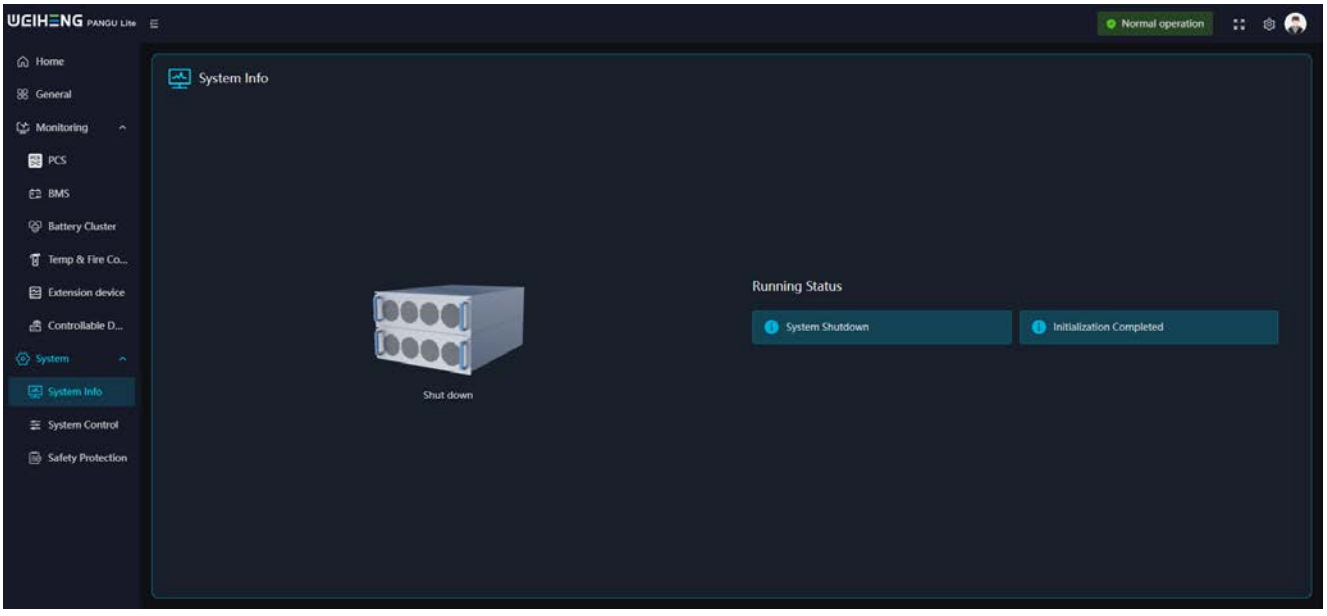


Figure 6-8 System Configuration - System Status Screen

System Configuration - System Control Screen:

This screen allows you to control the energy storage system, including the system switch, reset, grid switch, control mode, SOC lower discharge limit, power factor, power control, and coordination control switch.

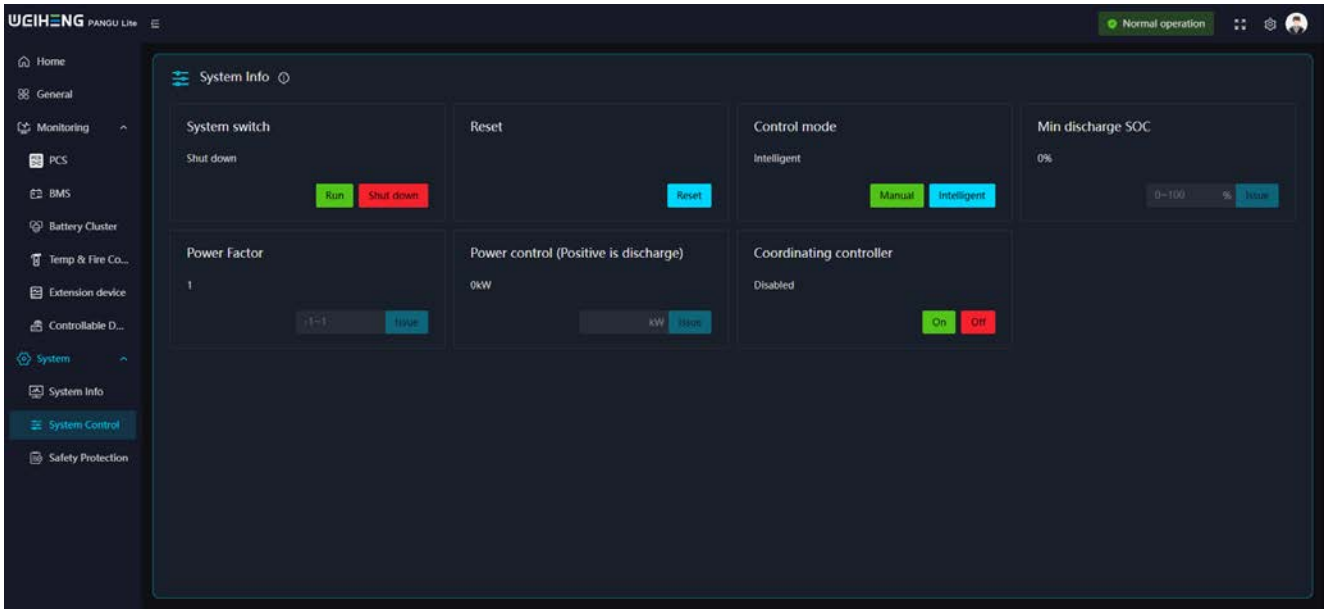
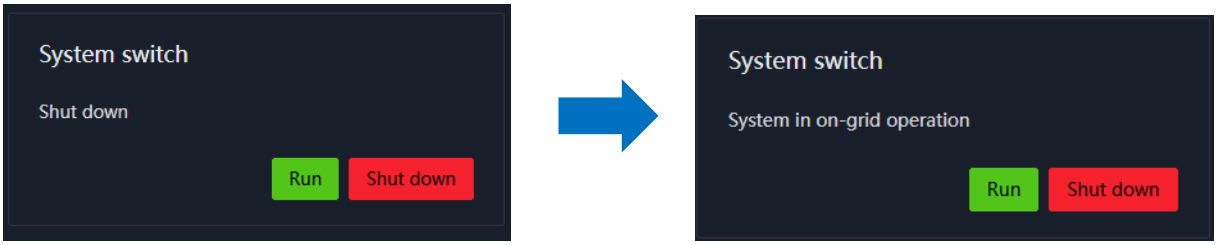


Figure 6-9 System Configuration - System Control Screen

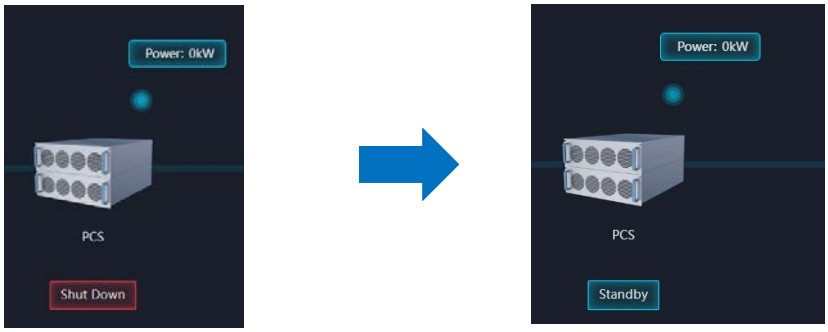
6.3 Startup Procedure

Operation Procedures

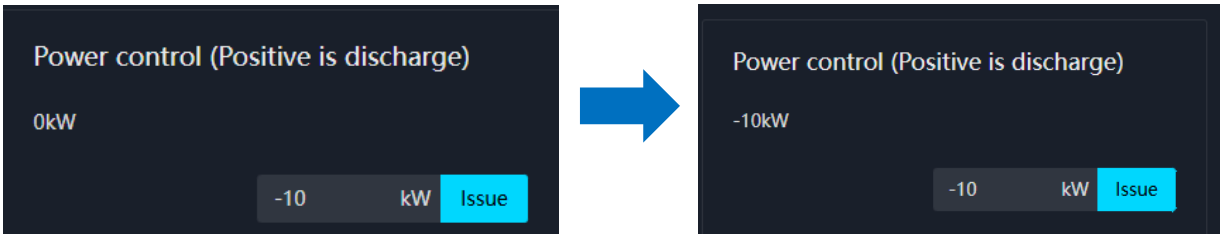
Step 1: Navigate to "System Configuration > System Control", click the "Start" button, and verify that the equipment status has been switched to on-grid mode.



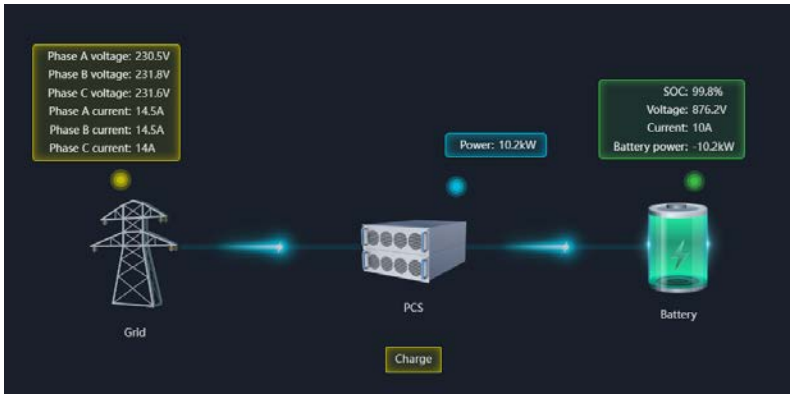
Step 2: Check the "Home" screen to verify that the PCS is in standby mode.



Step 3: Navigate to "System Configuration > System Control", enter -10 kW in the "Power Control" module, and click the "Apply" button.



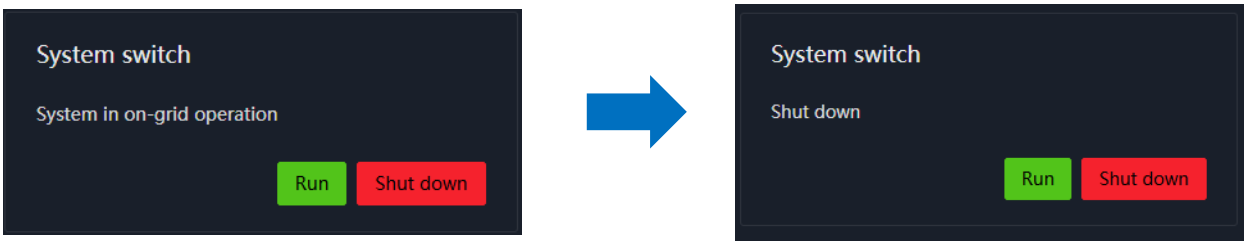
Step 4: Check the "Home" screen to verify that the PCS is in charging mode, and view the real-time display of system operating power.



6.4 Shutdown Procedure

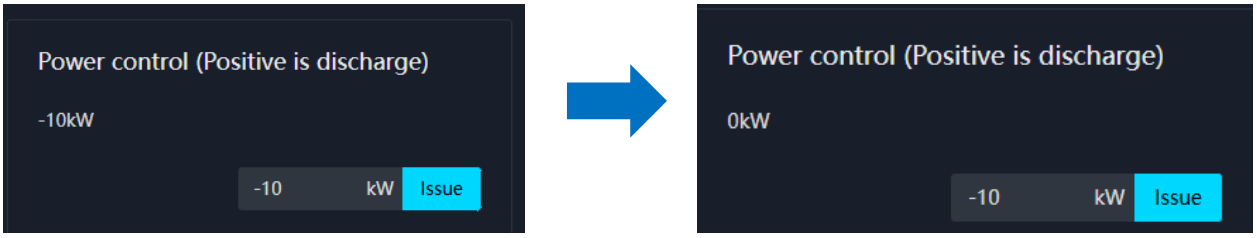
Operation Procedures

Step 1: Navigate to "System Configuration > System Control", enter 0 kW in the "Power Control" module, and click the "Apply" button.

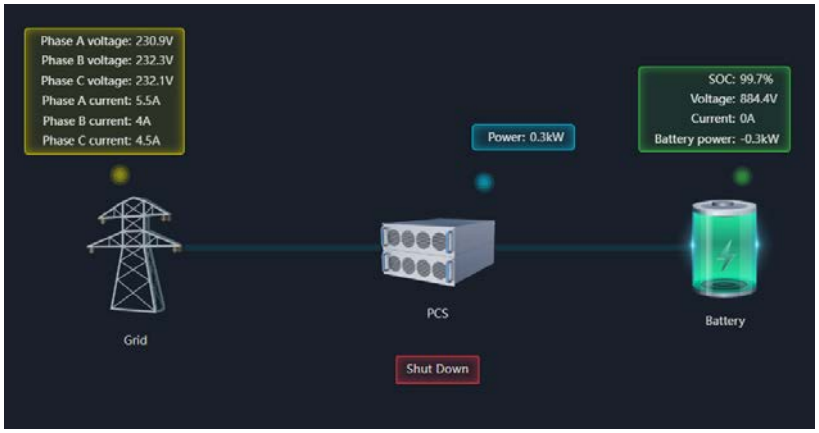


Step 2: Check the "Home" screen to verify that the PCS is in standby mode.

Step 3: Navigate to "System Configuration > System Control", click the "Stop" button, and verify that the equipment status has been switched to inactive mode.



Step 4: Check the "Home" screen to verify that the PCS is in inactive mode, indicating that the equipment has been shut down.



7 System Power-Off

BEWARE

When equipment installation and commissioning are completed, there is no need to switch off the power supply to the system; simply follow the power-off procedure. If the equipment needs to be powered off for maintenance, please refer to the power-off procedure in this section.

7.1 Power-off Procedure

Table 7-1 Power-Off Procedure

Step	Item	Remarks
1	Turn off the MCB5 power module switch.	Press and hold "OFF" for 10 s until a "beep" sounds, then the UPS is switched off.
2	Turn off the MCB2-3 and MCB6-8.	To turn off the MCB6-8, follow the power-off procedure for the energy storage battery cabinet. Refer to the operation manual of the energy storage battery cabinet for detailed steps.
3	Turn off the MCB01, MCB02 and MCB1.	
4	Turn off the MBC03, QF1 and QF4.	
5	The power-off process is completed.	The entire cabinet is powered off. Pay attention to safety precautions during operation.

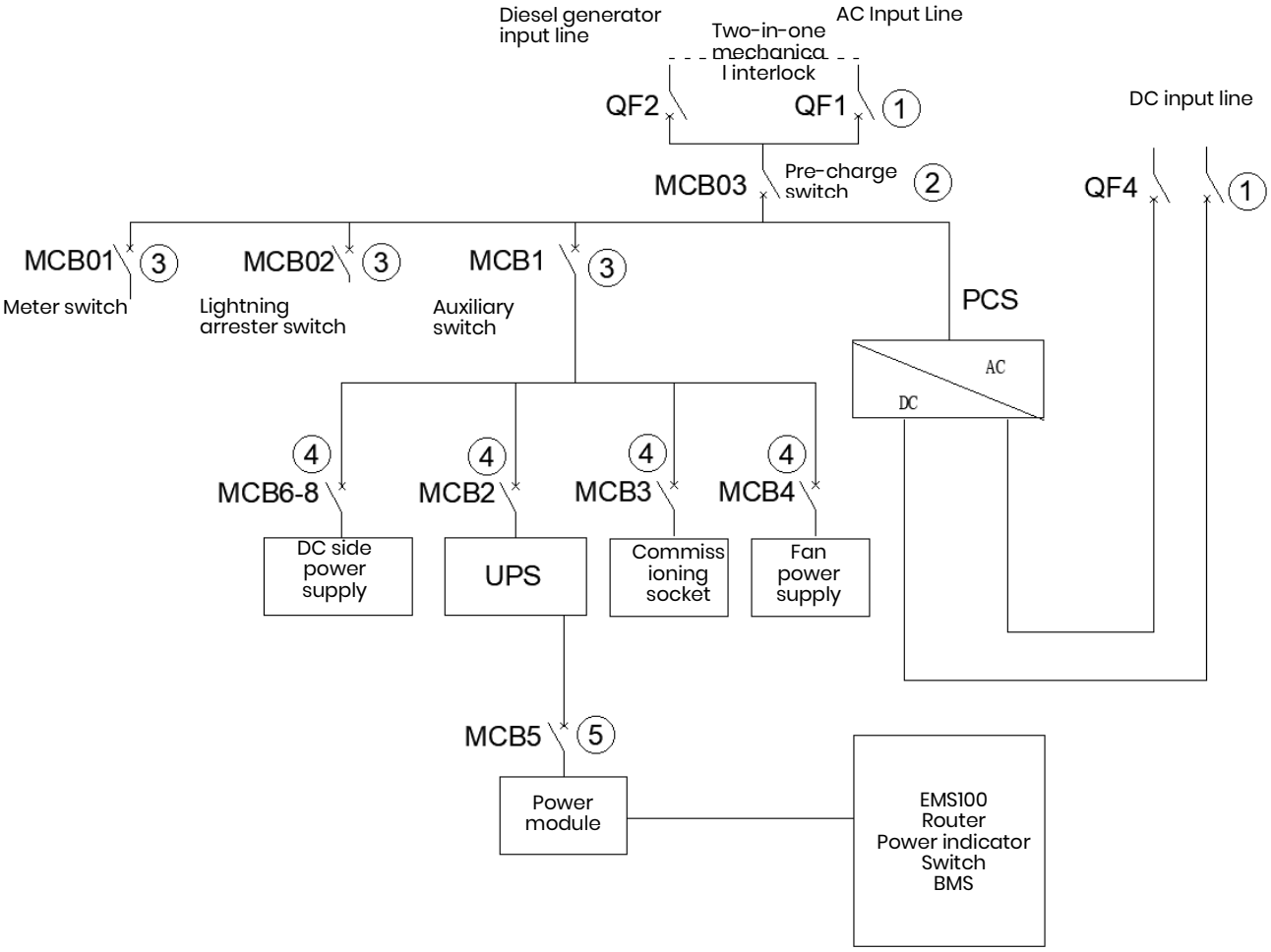


Figure 7-1 Power-Off Procedure Diagram

7.2 Bypass Mode

BEWARE

The energy storage system bypass mode is a working mode used in special circumstances, typically during system faults, for simple maintenance (with the presence of voltage between certain electrical switches where safety precautions are required), or when abnormalities occur. The primary purpose of bypass mode is to provide a power supply independent of the energy storage equipment, thereby maintaining the continuity and reliability of critical loads.

Enable Bypass Mode

Step 1: First, switch off the equipment according to Section 7.1 "Power-off Procedure" and verify that the QF3 load switch is in the OFF position.

Step 2: Verify that the three-phase AC voltage is within the normal range, turn on the QF6 bypass switch, and check if the load has resumed power supply.

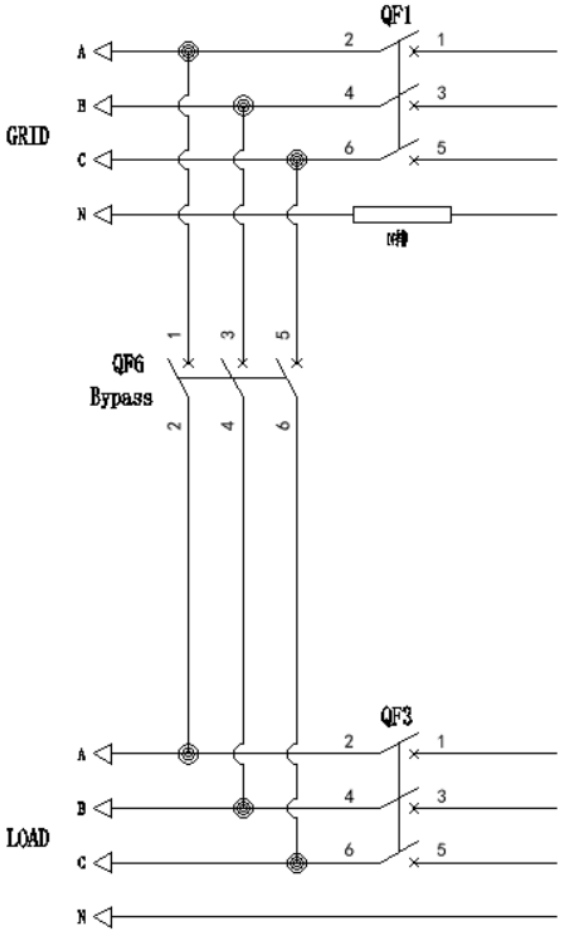


Figure 7-2 Bypass Mode Schematic

Disable Bypass Mode

Step: Verify that the load side can be powered down, then turn off the QF6 bypass switch and switch on the equipment according to Section 5.2 "Power-on Procedure".

8 Alarm and Maintenance

Alarms are classified into the following levels:

- Fault: The equipment fails and the converter stops operation (charging/discharging).
- Alarm: The equipment experiences a decrease in output power or a malfunction due to external factors, but the charging/discharging operation of the converter remains unaffected.

8.1 Alarm Troubleshooting

Alarm/Fault	Problem Cause	Troubleshooting method
Lightning arrester alarm	Lightning arrester failure	Check the lightning arrester signal cable for loose connection; Check the lightning arrester indicator for discoloration; Replace the AC lightning arrester.
Grid Overvoltage/Undervoltage Fault	Abnormal grid-connected side voltage	Check if the grid-connected side voltage is abnormal.
Grid Overfrequency/Underfrequency Fault	Abnormal grid-connected side frequency	Check if the grid-connected side voltage is abnormal.
Islanding Protection Fault	Abnormal grid-connected side voltage	Check if the grid-connected side voltage is abnormal.
HV/LV Ride-Through Alarm	Abnormal grid-connected side voltage	Check if the grid-connected side voltage is abnormal.
Grid Voltage Imbalance Fault	Abnormal grid-connected side voltage	Check if the grid-connected side voltage is abnormal.
Grid Phase Error Fault	Incorrect phase sequence connection on the grid-connected side	Swap any two of the phase conductors in the ABC three-phase cable.
DC Voltage Low Alarm	Insufficient DC side voltage	Check if the DC wiring is loose or abnormal;

		Check if the battery is turned on.
DC Voltage Reverse Connection Fault	Incorrect DC external wiring	Swap the positive and negative conductors of the DC cable.
DC Voltage High/Low Fault	DC switch activated or not	Check if the DC input voltage is abnormal;
Busbar Overvoltage Fault	Load imbalance Software error	Check if the DC wiring is loose or abnormal; Contact the manufacturer.
Busbar Half-Voltage Imbalance Fault	Load imbalance Software error	Check if the load is abnormal; Contact the manufacturer.
Overtemperature Derating Alarm	Excessive internal temperature	Check if the air inlet/outlet of the electrical compartment is blocked; Check if the internal fan is operating normally; Contact the manufacturer.
Transformer Overtemperature Fault	Abnormal transformer heat dissipation	Check if the ambient fan is operating normally; Check if the temperature switch wiring is loose; Check if the air inlet/outlet of the electrical compartment is blocked.
Power Tube Overtemperature Fault	Excessive internal temperature	Check if the air inlet/outlet of the electrical compartment is blocked; Check if the internal fan is operating normally; Contact the manufacturer.

Balancing Bridge Overtemperature Fault	Excessive internal temperature	Check if the air inlet/outlet of the electrical compartment is blocked; Check if the internal fan is operating normally; Contact the manufacturer.
DC Overcurrent Fault	Excessive DC current	Check if there is a short circuit or wire damage on the DC side; Replace the AC control cabinet module or contact the manufacturer.
Balancing Bridge Overcurrent Fault	Excessive internal current	Check if the off-grid load exceeds the limit; Replace the AC control cabinet module or contact the manufacturer.
Output Overload/Overcurrent Fault	Excessive AC side power/current	Check if the grid voltage is normal; Check if there is a short circuit or wire damage on the DC side; Check if the off-grid load exceeds the limit; Replace the AC control cabinet module or contact the manufacturer.
Wave-by-Wave Current Limiting Fault	Excessive AC side current DC side voltage oscillation	Check if the grid voltage is normal; Check if the off-grid load exceeds the limit; Check if the DC side voltage is normal; Replace the AC control cabinet module or contact the manufacturer.

Communication Interruption Fault	Communication interrupted	Check if the communication network cable between modules is loose or abnormal; Check whether the communication network cable of the local controller is loose or abnormal.
Paralleling/Synchronization Fault	Paralleling/synchronization signal interrupted	Check if the paralleling cable is loose or abnormal; Check if the paralleling settings are abnormal; Hardware circuit is damaged.
Relay Open/Short Circuit Fault	Internal relay failure Software error	Replace the AC control cabinet module; Contact the manufacturer to replace the internal board.
Pre-Charging Fault	Internal soft-start circuit failure	Replace the AC control cabinet module; Contact the manufacturer to replace the internal board.
Battery Type Configuration Error	External DC Wiring Error	Check if the correct DC switch is connected to the corresponding battery or DC source.
Fan 1/2/3 Alarm	Internal fan failure	Replace the AC control cabinet module; Contact the manufacturer to replace the internal fan.
Leakage Current Fault	Excessive leakage current Software error	Check the Hall leakage current sensor for loose or abnormal connection;

		Check if the grounding wire is disconnected.
Abnormal Insulation Resistance Fault	Low ground insulation Software error	Check if the AC/DC cables are damaged or shorted to the ground; Check if the battery wiring is damaged or shorted to the ground.
Module Loss Alarm	Module-to-screen communication interrupted	Check if the communication network cable between modules is loose or abnormal;

⚠ WARNING: The table above lists only typical alarms and faults. If you experience any problems not listed, please contact the manufacturer directly.

8.2 Routine Maintenance

Due to ambient temperature, humidity, dust, vibration and aging of internal components, the converter may experience some potential problems during operation. To ensure the long-term and stable operation of the AC control cabinet, maintenance personnel need to be arranged for regular patrol inspections to detect and resolve problems in a timely manner. Monthly maintenance (maximum 3 months) is recommended for converters installed in areas with heavy dust, high salt mist, or heavy industrial areas. Maintenance every 3 months (maximum 6 months) is recommended for AC cabinets installed in favorable climatic conditions.

Maintenance Object	Action	Referenced standards
Enclosure	Check the overall appearance Check the vent Check the door lock	No visible coating peeling, scratches, or rust No visible water leakage No dust accumulation in the vent No damage to the door lock
AC Control Cabinet	Check noise and vibration Check the front panel vent Check the contact surface of the rear copper busbar	The front panel fan rotates normally, without jamming or abnormal noise The surface of the front panel vent is clean and unblocked No corrosion, discoloration or dust accumulation on the copper busbar and contact surface
Electrical	Check the lightning arrester Check the contact surface of the cable copper busbar	The lightning arrester functions normally No loose or detached connections of screws and sockets

		No corrosion, discoloration or dust accumulation on the copper busbar and contact surface

9 Technical Data

Model	WH-TIANWU-300TS-A
Rated power	300kw
Maximum DC Current	660A
Rated DC voltage	832V
Rated AC Voltage	400V
Rated AC Frequency	50Hz
Power factor	-1~1
Overload Capacity	110% for long-term operation
Protection Rating	IP55
Relative humidity	≤95%
Operating Temperature	-20~55℃ (derating above 45℃)
Operating Altitude	≤2000m
Dimensions (W*D*H)	1750*1350*2309mm
Isolation	Dry type Transformers

A Crimping OT/DT Terminals

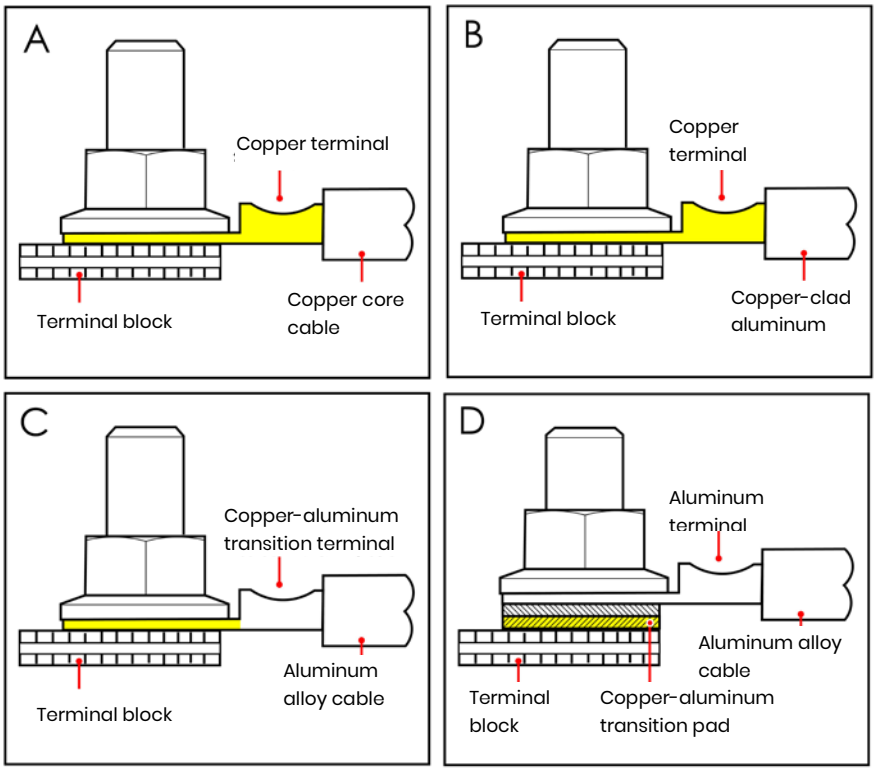
OT/DT Terminal Requirements

- For copper core cables, please use copper terminals.
- For copper-clad aluminum cables, copper terminals are required.
- For aluminum alloy cables, use copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition pads.

BEWARE

- It is strictly forbidden to connect aluminum terminals directly to terminal blocks, as this may cause electrochemical corrosion and affect the reliable cable connection.
- When using copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition pads, ensure compliance with IEC61238-1.
- When using copper-aluminum transition pads, ensure proper orientation so that the aluminum side of the pad contacts the aluminum terminal, and the copper side contacts the terminal block.

Figure A-1 OT/DT Terminal Requirements



Crimping OT/DT Terminals

BEWARE

- Do not scratch the conductor when stripping the cable.
- The cavity formed by the conductor crimping tab of the OT/DT terminal after crimping shall completely enclose the conductor, and the conductor shall be tightly connected to the OT/DT terminal without any looseness.
- The crimped area can be covered with heat shrink tubing or insulating tape. Below is an example of using heat shrink tubing.
- When using a heat gun, pay attention to safety precautions to prevent damage to the equipment.

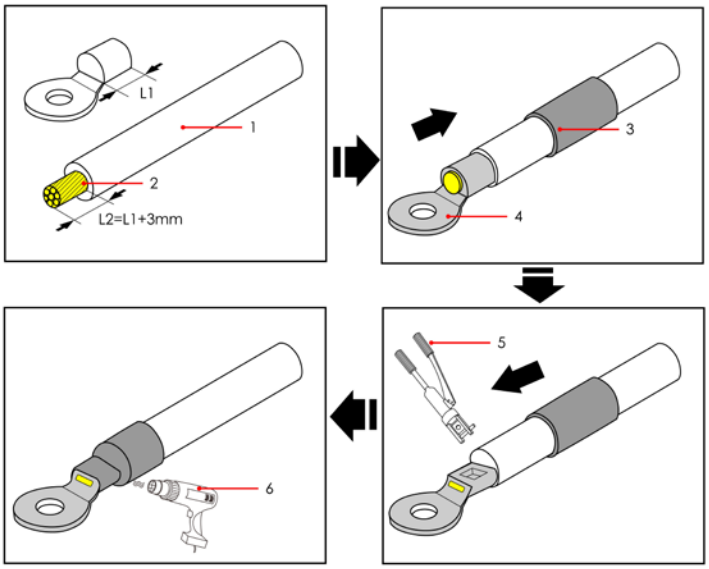


Figure A-2 Crimping OT Terminal

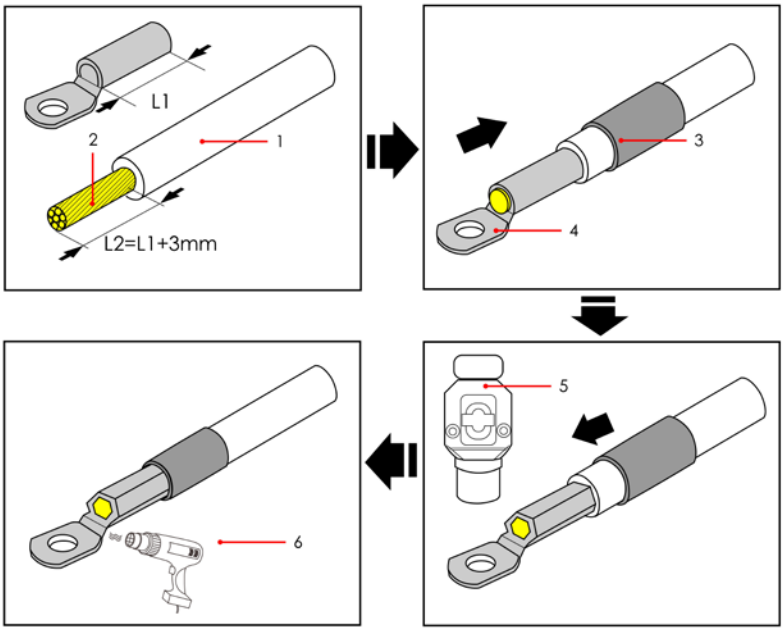


Figure A-3 Crimping DT Terminal

(1) Cable
(2) Conductor
(3) Heat shrink tubing
(4) OT/DT Terminal
(5) Hydraulic crimping pliers
(6) Heat gun

B How to Repaint

Prerequisites

- Repainting outdoors without shelter is strictly prohibited in severe weather conditions such as rain, snow, strong winds, sandstorms.
- The paint required for repainting has been prepared according to the color chart delivered with the equipment.

Cabinet Color

- Top cover and base: RAL 7046, small orange peel texture
- Enclosure and other sheet metal parts: RAL 7035, small orange peel texture

Repainting Instructions

Maintain the intact appearance of the equipment by repainting any paint loss immediately.

NOTE

Visually inspect the extend of paint damage and prepare the necessary tools and adequate materials according to actual needs on site.

Table A-1 Repainting Instructions

Paint Damage	Tools & Materials	Operation Procedures	Description
Shallow scratches (without exposure of steel substrate)	Hand spray paint or paint, brush (for small area repainting), fine sandpaper, anhydrous ethanol, cotton cloth, spray gun (for large area repainting).	Follow Steps 1 + 2 + 4 + 5.	1. Use the color chart delivered with the equipment to match the topcoat (acrylic paint) color to the specified Pantone number. 2. For minor scratches, small stains, and rust, hand spray or brush painting is recommended. 3. For extensive scratches, large stains and rust, use a spray gun to apply the paint. 4. Apply a thin, even coat of paint where practical, avoiding droplet formation and ensuring a smooth surface.
Non-wipeable stains and rust			
Deep scratches (primer damaged, steel substrate exposed)	Hand spray paint or paint, zinc-rich primer, brush (for small area repainting), fine sandpaper, anhydrous ethanol, cotton cloth, spray gun (for large area repainting).	Follow Steps 1 + 2 + 3 + 4 + 5.	
Logo and pattern damage or dents	For damaged logos and patterns, provide the logo dimensions and color code, and contact a local advertising and painting service provider to develop and execute a repair scheme based on the logo dimensions, color and damage situation. 1. For dents with an area less than 100 mm^2 and a depth less than 3		

	mm, fill them with unsaturated polyester resin putty (Poly-Putty base) and then follow the repainting procedure for deep scratches. 2. For dents with an area greater than 100 mm2 or a depth greater than 3 mm, find a local supplier to provide a separate repair scheme based on the actual situation.	5. Allow the repainted surface to dry for approximately 30 min before proceeding with subsequent operations.

Operation Procedures

Step 1 Use fine sandpaper to gently sand the damaged area to remove any stains or rust.

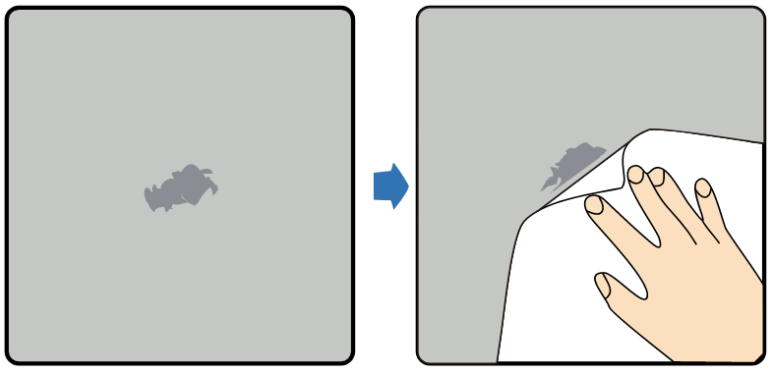


Figure B-1 Sanding Damaged Coating with Fine Sandpaper

Step 2 Wipe the sanded area or the area to be repaired with a cotton cloth dampened with anhydrous ethanol to remove surface dirt and dust. Then wipe it dry with a clean cotton cloth.

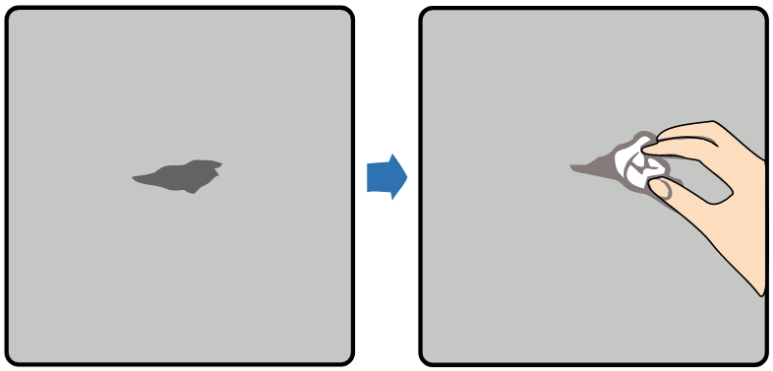


Figure B-2 Treating Damaged Coating with Anhydrous Ethanol

Step 3 Apply a zinc-rich primer to the damaged coating using a brush or spray gun.

BEWARE

- If the substrate is exposed in the area to be repaired, apply an epoxy zinc-rich primer and allow it to dry completely to cover the substrate. Then apply an acrylic topcoat.
- Select an epoxy zinc-rich primer or acrylic topcoat of the appropriate color to match the surface finish of the equipment.

Step 4 Depending on the extent of the paint damage, choose one of the following methods: self-spraying, brushing, or spray gun application.
Apply the paint evenly to the damaged area until no trace of coating damage is visible.

BEWARE

- Apply a thin, even coat of paint where practical, avoiding droplet formation and ensuring a smooth surface.
- For equipment with multi-colored patterns, mask the areas with other colors using tape and white paper before repainting to prevent contamination.

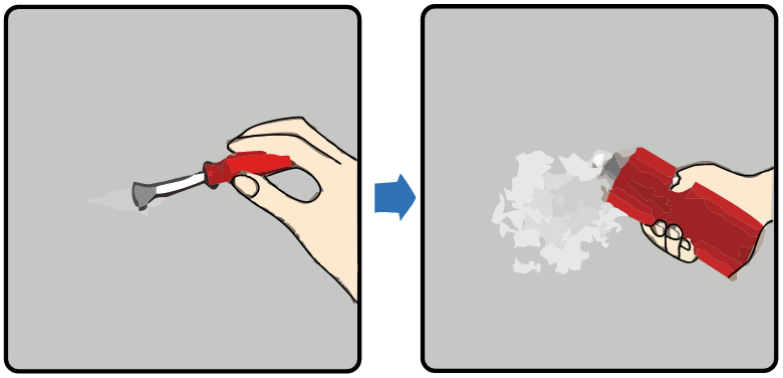


Figure B-3 Repainting Damaged Coating on Equipment

Step 5 Allow the brush-painted area to dry for approximately 30 min, then inspect for compliance with the requirements.

NOTE

- The repainted area must match the color of the surrounding area. Use a colorimeter to measure the color difference ($\Delta E \leq 3$). If a colorimeter is unavailable, visually inspect the repainted area to ensure a seamless blend with the surrounding area, free of any visible edge. The coating must be free of bumps, scratches, peeling, or cracks.

- For spray painting, it is recommended to spray three coats and then observe whether it meets the requirements. If not, repeat the spraying process until the requirements are met.

D Contact Details

Please contact us if you have any questions about this product.

Table D-1 Customer Service Contact Details

Country	E-mail	Tel
CHINA	salvator.xu@weiheng-tech.com	15852585119

E Abbreviations

A

ACAN	CAN used for communication between MBMU and PCS

B

BMS	Battery Management System

C

CSC	Cell Supervision Circuit
CCAN	CAN used for communication between CSC and SBMU
CAN	Controller Area Network

E

ETH	Ethernet Module
EMS	Energy Management System

I

IMM	Isolation Monitor Module

L

LAN	local area network

M

MCAN	CAN used for communication between SBMU and MBMU
MSD	Manual Service Disconnect

S

SOC	state of capacity
SCAN	CAN used for communication between SBMU and CSU

U

UPS	uninterruptible power system

附录 1

Appendix 1

巡检项目 Inspection project	方法 Method	是-✓ 否- × 不适用-O Yes-✓ No- × Not applicable-O	异常记录 Abnormal record
灭火系统是否完整 Is the fire extinguishing system	目测 Visual inspection		
灭火系统是否在有效期内 Whether the fire extinguishing system is within the validity period	目测 Visual inspection		
散热系统是否完整 Is the cooling system complete	目测 Visual inspection		
散热系统风道是否堵塞 Is the cooling system air duct blocked	目测 Visual inspection		
电柜外观是否变形 Whether the appearance of the electric cabinet is deformed	目测 Visual inspection		
电柜外观是否生锈破损 Whether the appearance of the electric cabinet is rusted or damaged	目测 Visual inspection		
电柜内部是否有水气 Is there water vapor inside the electric cabinet	目测 Visual inspection		
低压线束是否松脱或者破损 Whether the LV harness is loose or damaged	目测 Visual inspection		
高压线束是否松脱或者破损 Whether the HV harness is loose or damaged	目测 Visual inspection		
线束是否与结构件干涉 Whether the wiring harness interferes with the structural parts	目测 Visual inspection		
高压连接是否烧蚀 Whether the high voltage connection is ablated	目测 Visual inspection		

结构件固定螺栓是否松脱或者缺失 Whether the fixing bolt of structural parts is loose or missing	目测 Visual inspection		
维护开关（MSD）是否完整且安装可靠 Is MSD complete and reliable	目测 Visual inspection		
液冷管是否破损 Whether the water cooling pipe is damaged	目测 Visual inspection		
电池室内是否有恶臭味 Is there a foul smell in the battery compartment	鼻嗅 Sniffing		

