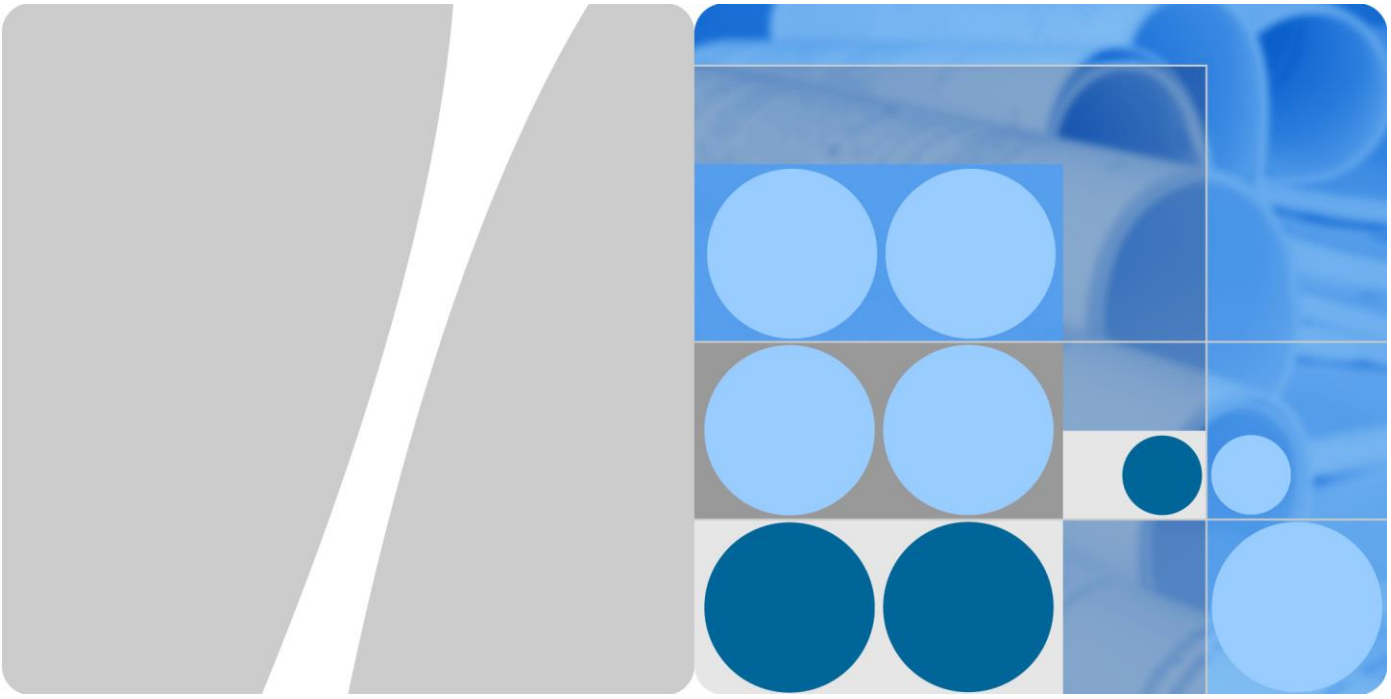

TP482000B V300R002C03 Telecom Power (TP482000B-N20B1, TP482000B-N20B2, TP481200B-N20B1, and TP481200B-N20B2)

User Manual

Issue 07

Date 2020-04-10

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About This Document

Purpose

This document describes the DC power system in terms of its features, configurations, components, and maintenance methods.

The figures provided in this document are for reference only.

Intended Audience

This document is intended for:

- Sales engineers
- Technical support personnel
- Maintenance personnel

Symbol Conventions

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

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

Change History

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

Issue 07 (2020-04-10)

Updated 7.2.1 Replacing the Main Control Board.

Issue 06 (2019-12-01)

Optimized the content about rectifiers.

Issue 05 (2017-06-30)

Modified 7.2.1 Replacing the Main Control Board.

Modified 7.3.1 Replacing the Signal Sampling Board.

Issue 04 (2017-05-25)

Optimized the descriptions.

Issue 03 (2017-01-03)

Modified 5.2.1 SMU05A.

Issue 02 (2016-05-31)

Modified Figure 4-3, Figure 4-4 and C Engineering Design Drawings.

Issue 01 (2016-01-13)

This issue is the first official release.

Contents

1 Safety Precautions

1.1 General Safety

Statement

Before installing, operating, and maintaining the equipment, read this document and observe all the safety instructions on the equipment and in this document.

The "NOTICE", "CAUTION", "WARNING", and "DANGER" statements in this document do not cover all the safety instructions. They are only supplements to the safety instructions. Huawei will not be liable for any consequence caused by the violation of general safety requirements or design, production, and usage safety standards.

Ensure that the equipment is used in environments that meet its design specifications. Otherwise, the equipment may become faulty, and the resulting equipment malfunction, component damage, personal injuries, or property damage are not covered under the warranty.

Follow local laws and regulations when installing, operating, or maintaining the equipment. The safety instructions in this document are only supplements to local laws and regulations.

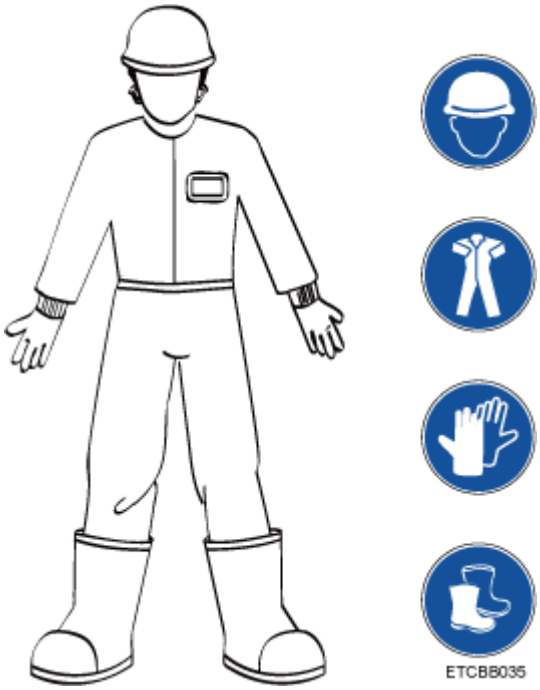
Huawei will not be liable for any consequences of the following circumstances:

- Operation beyond the conditions specified in this document
- Installation or use in environments which are not specified in relevant international or national standards
- Unauthorized modifications to the product or software code or removal of the product
- Failure to follow the operation instructions and safety precautions on the product and in this document
- Equipment damage due to force majeure, such as earthquakes, fire, and storms
- Damage caused during transportation by the customer
- Storage conditions that do not meet the requirements specified in this document

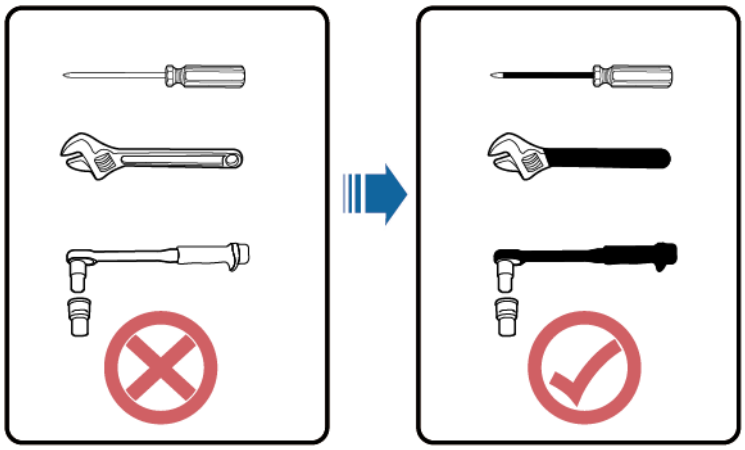
General Requirements

- Before installing, operating, or maintaining the equipment, remove any conductive objects such as watches or metal jewelry like bracelets, bangles, and rings to avoid electric shock.

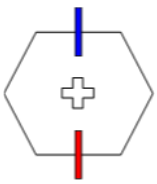
- When installing, operating, or maintaining the equipment, wear dedicated protective gears such as insulation gloves, goggles, and safety clothing, helmet, and shoes, as shown in the following figure.



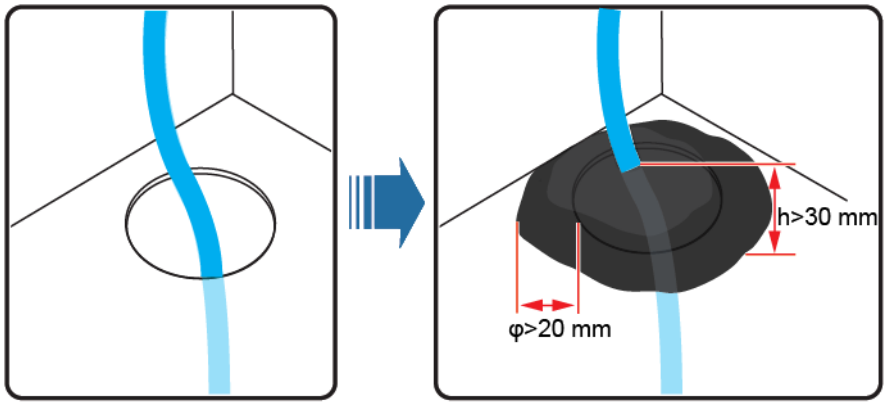
- Use insulated tools or tools with insulated handles, as shown in the following figure.



- Follow the specified procedures for installation, operation, and maintenance.
- Ensure that bolts are tightened with a torque wrench and marked using red or blue color. Installation personnel mark tightened bolts in blue. Quality inspection personnel confirm if the bolts are tightened and then mark them in red. (The marks should cross the edges of the bolts, as shown in the following figure.)



- Before installing, operating, or maintaining a cabinet, clean up any water, ice, snow, or other sundries on the top of the cabinet to prevent sundries from falling into the cabinet when you open the cabinet door.
- Do not install, use, or operate outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, inserting connectors to or removing connectors from signal ports connected to outdoor facilities, working at heights, and performing outdoor installation) in harsh weather conditions such as lightning, rain, snow, and level 6 or stronger wind.
- Before handling a conductor surface or terminal, measure the contact point voltage and ensure that there is no risk of electric shock.
- Ensure that all slots are installed with boards or filler panels. Avoid hazards caused by hazardous voltages or energy on boards. Ensure that the air channel is normal, control electromagnetic interference, and prevent dust and other sundries on the backplane, baseplate, and boards.
- After installing the equipment, remove idle packing materials such as cartons, foam, plastics, and cable ties from the equipment area.
- In the case of a fire, immediately leave the building or the equipment area, and turn on the fire alarm bell or make an emergency call. Do not enter the building on fire in any case.
- Do not stop using protective devices. Pay attention to the warnings, cautions, and related precautionary measures in this document and on the equipment. Promptly replace warning labels that have worn out.
- Keep irrelevant people away from the equipment. Only operators are allowed to access the equipment.
- All cable holes should be sealed. Seal the used cable holes with firestop putty. Seal the unused cable holes with the caps delivered with the cabinet. The following figure shows the criteria for correct sealing with firestop putty.



- Do not use water, alcohol, oil, or other solvents to clean electrical components inside and outside a cabinet.

Personal Safety

- If there is a probability of personal injury or equipment damage during operations on the equipment, immediately stop the operations, report the case to the supervisor, and take feasible protective measures.
- To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telecommunication network voltage (TNV) circuits.
- Do not power on the equipment before it is installed or confirmed by professionals.

Symbol Conventions

To ensure personal and equipment safety, observe all the safety instructions marked on the equipment when installing, operating, and maintaining the equipment.

Symbol	Description
	Indicates a part exposed to high voltage. This symbol warns operators that both direct and indirect contact with the power grid is fatal. Such areas include hazardous voltage points or protective power supply covers that may be removed during maintenance.
	Warns users of overheating. This symbol is attached to a device surface that may overheat and cause scalding. It warns users not to touch the surface during operations or maintenance. Users should wear heat insulation gloves before operations to prevent scalding.
 or 	Indicates protection earthing. This symbol is attached next to a protection ground terminal next to grounded equipment and an external ground system. An equipment ground cable is connected to an external ground bar through the protection ground terminal.
	Indicates equipotential bonding. This symbol is found with equipotential terminals inside equipment.
	Indicates electrostatic discharge (ESD). This symbol is used in all electrostatic sensitive areas. Before operating equipment in these areas, wear ESD gloves or an ESD wrist strap.
	Indicates that the equipment is safe to use at altitudes below 2000 m (6561.6 ft.).
	Indicates that the equipment is not safe to use in tropical climates.
 or	Indicates a fan assembly or moving part. This symbol is silkscreened on or attached to the panel of a fan assembly, warning operators to keep away. Do not touch the blades when the fan is rotating.
 or  or 	Indicates that users should refer to the instruction. This symbol is used when the usage of a device port cannot be clearly described. For example, this symbol can be used in but not limited to the following scenarios: 1. For a multi-power device, use it near the power supply to replace the multi-power supply identifier. The symbol indicates that the device has multiple power inputs. Therefore, when powering off the device, you must disconnect all power inputs. 2. If there are multiple output ports, use the symbol near the output ports. Connect cables according to the rated power output and configuration parameter information in the instruction. 3. If there are multiple slots, use the symbol near the slot

Symbol	Description
	information. For details, see the description of slot information, restrictions on boards, and usage conditions in the instruction.

1.2 Personnel Requirements

- Personnel who plan to install or maintain Huawei equipment must receive thorough training, understand all necessary safety precautions, and be able to correctly perform all operations.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment.
- Personnel who will operate the equipment, including operators, trained personnel, and professionals, should possess the local national required qualifications in special operations such as high-voltage operations, working at heights, and operations of special equipment.

NOTE

- Professionals: personnel who are trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation, operation, and maintenance
- Trained personnel: personnel who are technically trained, have required experience, are aware of possible hazards on themselves in certain operations, and are able to take protective measures to minimize the hazards on themselves and other people
- Operators: operation personnel who may come in contact with the equipment, except trained personnel and professionals

1.3 Electrical Safety

Grounding

- The protective ground of the equipment should be reliably connected to the ground screw on the metal enclosure (grounding resistance ≤ 0.1 ohm).
- For the equipment that needs to be grounded, install the ground cable first when installing the equipment and remove the ground cable last when removing the equipment.
- Do not damage the ground conductor.
- Do not operate the equipment in the absence of a properly installed ground conductor.
- For the equipment that uses a three-pin socket, ensure that the ground terminal in the socket is connected to the protection ground.

AC and DC Power

DANGER

- The power system is energized by power sources with hazardous voltage. Direct or indirect contact (through damp objects) with the power sources may result in electric shock.
- Non-standard and improper operations may result in fire or electric shock.
- Do not connect or disconnect power cables with power on. Transient contact between the core of the power cable and the conductor will generate electric arcs or sparks, which may cause fire or personal injury.

- If the power supply to the equipment is permanently connected, install an easily accessible disconnector at the exterior of the device.
- Before making electrical connections, switch off the disconnector on the upstream device to cut off the power supply if people may contact energized components.
- If a "high electricity leakage" tag is attached on the equipment, ground the protective ground terminal on the equipment enclosure before connecting the AC power supply; otherwise, electric shock as a result of electricity leakage may occur.
- Before installing or removing a power cable, turn off the power switch.
- Before connecting a power cable, check that the label on the power cable is correct.
- Before connecting the power supply, ensure that cable connections are correct.
- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.

Cabling

- When routing cables, ensure that a distance of at least 30 mm exists between the cables and heat-generating components or areas. This prevents damage to the insulation layer of the cables.
- Do not route cables behind the air intake and exhaust vents of the equipment.
- Ensure that cables meet the VW-1 flame spread rating requirements.
- Bind cables of the same type together. When routing cables of different types, ensure that they are at least 30 mm away from each other.
- Ensure that all cables are securely bound. Route and bind cables so that they appear neat and tidy and their cable sheaths are intact.
- If an AC input power cable is connected to the cabinet from the top, bend the cable in a U shape outside the cabinet and then route it into the cabinet.
- Ensure that the bending radius of each cable is at least five times the diameter of the cable.
- When routing power cables, ensure that there is no coiling or twisting. Do not join or weld power cables. If necessary, use a longer cable.

ESD

- When installing, operating, and maintaining the equipment, comply with the ESD protection regulations and wear the ESD clothing, gloves, and wrist strap.
- When holding a board, hold its edge without touching any components. Do not touch the components with your bare hands.
- Package boards with ESD packaging materials before storing or transporting them.

1.4 Installation Environment Requirements

- To prevent fire due to high temperature, ensure that the ventilation vents or heat dissipation system are not blocked when the equipment is running.
- Ensure that there are no acid, alkaline, or other corrosive gases in the installation place.
- Do not place the equipment near heat sources or exposed fire sources, such as electric heaters, microwave ovens, roasters, water heaters, furnace fire, candles, or other places where high temperature may occur. Otherwise, the enclosure will melt or the equipment will heat up, which can cause a fire.
- Install the equipment in an area far away from liquids. Do not install it under areas prone to condensation, such as under water pipes and air exhaust vents, or areas prone to water leakage, such as air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that no liquid enters the equipment to prevent faults or short circuits.
- Before installing the equipment into a cabinet, ensure that the cabinet is secured and will not tilt or fall down due to loss of balance, which can cause personal injury or equipment damage.
- Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.

Installation at Heights

Working at heights refers to operations that are performed at least 2 meters above the ground.

Do not at heights in any of the following situations:

- Rainwater remains on steel pipes or other risky conditions exist. After the preceding conditions no longer exist, the safety director and relevant technical personnel need to check the involved equipment. Operators can begin working only after obtaining consent.
- When working at heights, comply with local relevant laws and regulations.
- Only trained and qualified personnel are allowed to work at heights.
- Before working at heights, check the climbing tools and safety gears such as safety helmets, safety belts, ladders, springboards, scaffolding, and lifting equipment. If they do not meet the requirements, take corrective measures or disallow working at heights.
- Wear personal protective equipment such as the safety helmet and safety belt or waist rope and fasten it to a solid structure. Do not mount it on an insecure moveable object or metal object with sharp edges. Make sure that the hooks will not slide off.

DANGER

- Set a restricted area and eye-catching signs for working at heights to warn away irrelevant personnel.
- Carry the operation machinery and tools properly to prevent them from falling off and causing injuries.
- Personnel involving working at heights are not allowed to throw objects from the height to the ground, or vice versa. Objects should be transported by tough slings, hanging baskets, highline trolleys, or cranes.
- Do not perform operations on the upper and lower layers at the same time. If unavoidable, install a dedicated protective shelter between the upper and lower layers or take other protective measures. Do not pile up tools or materials on the upper layer.
- Ensure that guard rails and warning signs are set at the edges and openings of the area involving working at heights to prevent falls.
- Do not pile up scaffolding, springboards, or other sundries on the ground under the area involving working at heights. Do not allow people to stay or pass under the area involving working at heights.
- Inspect the scaffolding, springboards, and workbenches used for working at heights in advance to ensure that their structures are solid and not overloaded.
- Dismantle the scaffolding from top down after finishing the job. Do not dismantle the upper and lower layers at the same time. When removing a part, ensure that other parts will not collapse.
- Do not loiter when working at heights. Do not sleep at heights.

- Any violations must be promptly pointed out by the site manager or safety supervisor and the involved personnel should be prompted for correction. Personnel who fail to stop violations will be forbidden from working.
- Operators who violate the safety regulations are responsible for accidents caused. The supervisor has to bear the responsibility accordingly.

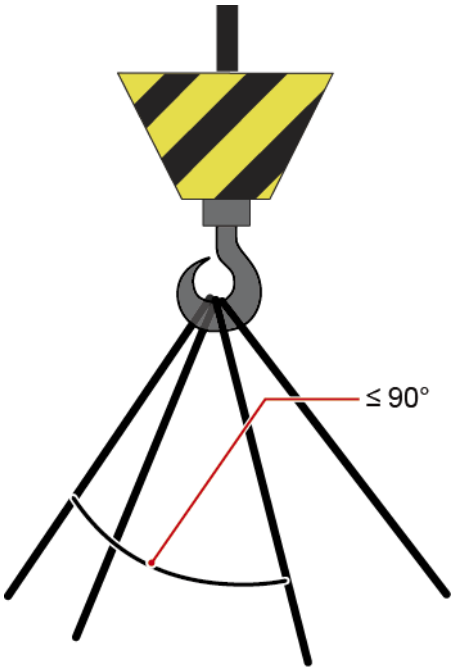
1.5 Mechanical Safety

Hoisting Devices

DANGER

Do not walk under hoisted objects.

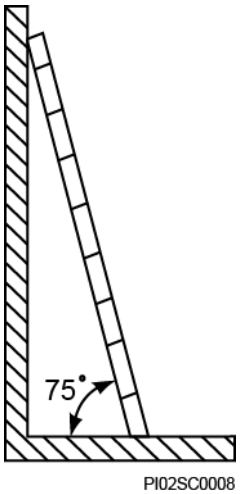
- Only trained and qualified personnel should perform hoisting operations.
- Check that hoisting tools are available and in good condition.
- Before hoisting objects, ensure that hoisting tools are firmly secured onto a load-bearing object or wall.
- Ensure that the angle formed by two hoisting cables is no more than 90 degrees, as shown in the following figure.



- Do not drag steel ropes and hoisting tools or bump hoisted objects against hard objects during hoisting.

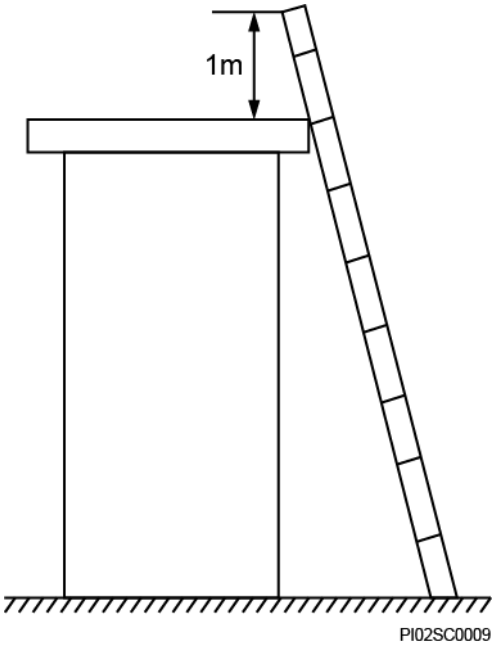
Using Ladders

- Use wooden or fiberglass ladders when you need to perform live working at heights.
- When a step ladder is used, ensure that the pull ropes are secured and the ladder is held firm.
- Before using a ladder, check that it is intact and confirm its load bearing capacity. Do not overload it.
- Ensure that the wider end of the ladder is at the bottom, or protective measures have been taken at the bottom to prevent the ladder from sliding.
- Ensure that the ladder is securely positioned. The recommended angle for a ladder against the floor is 75 degrees, as shown in the following figure. An angle rule can be used to measure the angle.



When climbing a ladder, take the following precautions to reduce risks and ensure safety:

- Keep your body steady.
- Do not climb higher than the fourth rung of the ladder from the top.
- To climb onto a roof, ensure that the ladder top is at least one meter higher than the roof line, as shown in the following figure.



- Ensure that your body's center of gravity does not shift outside the legs of the ladder.

Drilling Holes

When drilling holes into a wall or floor, observe the following safety precautions:

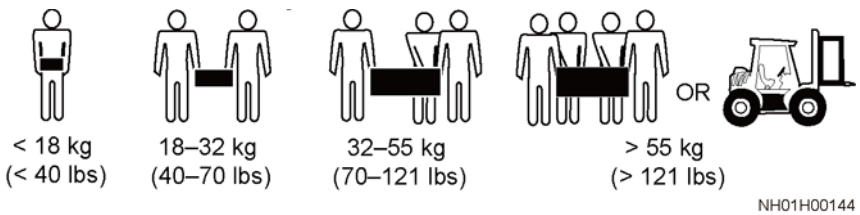
NOTICE

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

- Wear goggles and protective gloves when drilling holes.
- When drilling holes, protect the equipment from shavings. After drilling, clean up any shavings that have accumulated inside or outside the equipment.

Moving Heavy Objects

- Be cautious to avoid injury when moving heavy objects.



- When moving the equipment by hand, wear protective gloves to prevent injuries.

- Move or lift the equipment by holding its handles or lower edges. Do not hold the handles of modules (such as power supply units, fans, and boards) that are installed in the equipment because they cannot support the weight of the equipment.

1.6 Battery Safety

If no battery is involved, skip this section.

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

Basic Requirements

Before operating batteries, carefully read the safety precautions for battery handling and master the correct battery connection methods.

DANGER

- Do not expose batteries at high temperatures or around heat-generating devices, such as sunlight, fire sources, transformers, and heaters. Excessive heat exposure may cause the batteries to explode.
- Do not burn batteries. Otherwise, the batteries may explode.
- To avoid leakage, overheating, fire, or explosions, do not disassemble, alter, or damage batteries, for example, insert sundries into batteries or immerse batteries in water or other liquids.
- When replacing a battery, use a battery of the same model or type. Improper replacement may cause the battery to explode.
- Do not connect a metal conductor to the battery poles or touch the battery terminals. Otherwise, the battery may be short-circuited and heat up, which can cause injuries such as burning.

To ensure safety during battery installation, operation, and maintenance, pay attention to the following:

- Do not wear conductive articles such as watches, bracelets, bangles, and rings.
- Wear goggles, rubber gloves, and protective clothing to prevent skin contact with electrolyte in the case of electrolyte overflow. If a battery leaks, protect the skin or eyes from the leaking liquid. If the skin or eyes come in contact with the leaking liquid, wash it immediately with clean water and go to the hospital for medical treatment.
- Use dedicated insulated tools.
- Move batteries in the required direction. Do not place a battery upside down or tilt it.
- Keep the battery loop disconnected during installation and maintenance.
- Do not drop, squeeze, or puncture a battery. Protect batteries from external high pressure to prevent internal short circuits and overheating.
- Dispose of waste batteries in accordance with local laws and regulations. Do not dispose of batteries as household waste. If a battery is disposed of improperly, it may explode.

- Do not use a damaged battery.
- To prevent injuries or explosion, do not allow children or pets to swallow or bite a battery.
- If batteries experience discoloration, deformation, abnormal heating, or other abnormalities during working, charging, or storage, stop using the batteries and replace them with new ones.
- Batteries can work properly with the allowed charge and discharge parameters when the temperature is within the specified range. If the temperature is outside the specified range, the battery charge and discharge performance and safety are affected.

Battery Installation

Before installing batteries, observe the following safety precautions:

- Install batteries in a dry and cool environment with good ventilation, which is away from high temperature and flammable materials, and take precautions against fire.
- Place and secure batteries horizontally.
- Note the polarities when installing batteries. Do not short-circuit the positive and negative poles of the same battery or battery string. Otherwise, the battery may be short-circuited.
- When installing a battery string, retain at least one breakpoint to prevent a loop being formed. After checking that the installation is correct, close the breakpoints to finish the installation.
- During the installation, insulate the terminals of cables connecting batteries. Ensure that the terminals do not come into contact with metal components such as the cabinet.
- Secure battery cables or copper bars by tightening bolts to the required torque. Loose connections will result in excessive voltage drop or cause batteries to burn out in the case of excessive current.
- Check battery connections periodically, ensuring that all bolts are securely tightened.

Battery Short Circuit

DANGER

Battery short circuits can generate high instantaneous current and release a great amount of energy, which may cause equipment damage or personal injury.

- If permitted, disconnect the batteries in use before performing any other operations.
- To avoid battery short-circuit, do not maintain batteries with power on.

Flammable Gas

NOTICE

- Do not use unsealed lead-acid batteries.
- To prevent fire or corrosion, ensure that flammable gas (such as hydrogen) is properly exhausted for lead-acid batteries.

Lead-acid batteries emit flammable gas when used. Ensure that batteries are kept in a well-ventilated area and take preventive measures against fire.

Battery Leakage

NOTICE

Battery overheating causes deformation, damage, and electrolyte spillage.

If the battery temperature exceeds 60°C, check for and promptly handle any leakage.

Electrolyte overflow may damage the equipment. It will corrode metal parts and boards, and ultimately damage the boards.

⚠ WARNING

When the electrolyte overflows, absorb and neutralize the electrolyte immediately. When moving or handling a battery whose electrolyte leaks, note that the leaking electrolyte may hurt human bodies.

If the electrolyte overflows, follow the instructions of the battery manufacturer or neutralize the electrolyte by using sodium bicarbonate (NaHCO3) or sodium carbonate (Na2CO3).

Lithium Battery

The safety precautions for lithium batteries are similar to those for lead-acid batteries except that you also need to note the precautions described in this section.

⚠ WARNING

There is a risk of explosion if a battery is replaced with an incorrect model.

- A battery can be replaced only with a battery of the same or similar model recommended by the manufacturer.
- When handling a lithium battery, do not place it upside down, tilt it, or bump it with other objects.
- Keep the lithium battery loop disconnected during installation and maintenance.
- When the ambient temperature is lower than the lower limit of the operating temperature (charge is forbidden at 0°C), do not charge the battery. Otherwise, a short circuit would occur inside the battery.
- Do not throw a lithium battery in fire.

- When maintenance is complete, return the waste lithium battery to the maintenance office.

2 Overview

2.1 Introduction

The TP482000B is Huawei's fourth-generation high-performance indoor telecom power system. The system supplies reliable –48 V DC power to equipment in central equipment rooms. The TP482000B is available in four different models of combined cabinets, each of which contains an AC power distribution unit (PDU), a DC PDU, rectifiers, and a site monitoring unit (SMU). Each cabinet has a maximum capacity of 2400 A.

The TP482000B supports cabinet interconnection. TP482000B cabinets of the same model can be interconnected, and TP482000B cabinets can also be interconnected with TP483000D AC cabinets and DC cabinets.

Table 2-1 Product series

Product	Model	Cabinet Type	Remarks
TP482000B	TP482000B-N20B1	2400 A combined cabinet	Supports flexible power distribution.
	TP482000B-N20B2		
	TP481200B-N20B1	1200 A combined cabinet	
	TP481200B-N20B2		
TP483000D	TPA38401B-N20B1	400 A AC cabinet	Optional. Supports flexible power distribution.
	TPA38631B-N20B1	630 A AC cabinet	
	TPD48202B-N20B1	2000 A DC cabinet	
	TPD48302B-N20B1	3000 A DC cabinet	

NOTE

- The combined cabinets TP482000B-N20B1 and TP481200B-N20B1 apply to 220/380 V AC power grids.
- The combined cabinets TP482000B-N20B2 and TP481200B-N20B2 support 120/208 V and 220/380 V AC power grids.

2.2 Features

- Flexible application
  - Installed on a concrete floor or an ESD floor.
  - Smoothly evolves to:
- 2400 A combined cabinet: 12,000 A
- 1200 A combined cabinet: 6000 A
  - Reuses cables for relocation and reconstruction.
- Wide AC input voltage range
  - 50 A rectifier: 85 V AC to 300 V AC (phase voltage; derated at less than 176 V AC)
- Comprehensive battery management

  The power system effectively manages lead-acid batteries and flooded batteries, which extends the battery lifespan.
- High density
  - A 50 A rectifier has a density of 42.7 W/inch^3.
  - A single TP482000B cabinet has a maximum capacity of 144 kW. If multiple cabinets are interconnected, the capacity can reach 720 kW.
  - A single TP481200B cabinet has a maximum capacity of 72 kW. If multiple cabinets are interconnected, the capacity can reach 360 kW.
- High efficiency

  Rectifiers have a maximum efficiency of 98% and a power factor of 0.99.
- Automatic current equalization

  A digital current equalization technology is used to automatically equalize current among rectifiers without control from the SMU. The current equalization imbalance is less than ±5%.
- Intelligent hibernation

  Rectifiers can hibernate automatically based on load power, which saves energy, reduces emissions, and improves reliability.
- Real-time monitoring

  The SMU monitors the system operating parameters, analyzes operating status, and reports alarms when detecting faults.
- Flexible NMS connection

  The power system can communicate a power and environment network management system (NMS), NetEco, and other NMSs over the Simple Network Management Protocol (SNMP), Hypertext Transfer Protocol Secure (HTTPS), or YDN protocols. The SMU supports remote management, monitors and controls the power system, and reports alarms promptly in unattended mode.
- Easy operations

  The liquid crystal display (LCD) and five buttons on the SMU allow users to quickly view system information.
- Fault isolation

  All rectifiers support fault isolation. If one rectifier is faulty, the other rectifiers still work properly.
- Easy maintenance

The rectifiers are hot-swappable, which facilitates installation and maintenance and lowers the operational expenditure (OPEX).

- Robust protection
  - A built-in DC surge protective device (SPD) provides 10 kV (8/20 μs) in differential mode and 20 kV (8/20 μs) in common mode.
  - A built-in AC SPD provides 20 kA (8/20 μs) nominal lightning strike discharge current and 40 kA (8/20 μs) at the maximum.
  - Rectifiers provides 5 kA and 6 kV protection.
  - The signal ports resist 0.5 kV voltage-to-ground in differential mode and 1 kV in common mode.
- High reliability
  - The power system has a service life of 10 years, mean time between failures (MTBF) of 500,000 hours, and a failure rate of 2000 FITs.

3 Product Configurations

3.1 Single-Cabinet Configurations

Table 3-1 TP482000B-N20B1 configurations

Item	TP482000B-N20B1 Typical Configurations	TP482000B-N20B1 Flexible Configurations
AC input system	220/380 V AC three-phase four-wire	
AC input terminal	Two 3-pole 200 A terminal blocks	
Load route	• Layer 1: six 500 A NT3 fuses • Layer 2: six 160 A NT00 fuses, six 100 A NT00 fuses	• Layer 1: – Six NT1 fuses, six NT2 fuses, six NT3 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers • Layer 2: – Twelve NT00 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers
Rectifier circuit breaker	Forty-eight 1-pole 32 A circuit breakers	
Rectifier	Forty-eight R4850G2s, R4850N2s, or R4850S1s	
AC surge protection	• Two 20 kA/40 kA SPDs • Two 4-pole 32 A SPD circuit breakers	
Battery route	Two groups of two 1250 A NT4 fuses connected in parallel	
Battery current monitoring	Two 2000 A/25 mV shunts	
Total load current monitoring	One 2000 A/25 mV shunt	
DC power indicator	One DC power indicator (green)	
System alarm indicator	One system alarm indicator (red)	

Item	TP482000B-N20B1 Typical Configurations	TP482000B-N20B1 Flexible Configurations
DC surge protection	DC SPD (10 kA in differential mode, 20 kA in common mode, 8/20 μs)	
Monitoring unit	SMU05A	
Signal monitoring	Power distribution monitoring unit	

Table 3-2 TP482000B-N20B2 configurations

Item	TP482000B-N20B2 Typical Configurations	TP482000B-N20B2 Flexible Configurations
AC input system	120/208 V AC (three-phase three-wire or three-phase four-wire), compatible with 220/380 V AC three-phase four-wire	
AC input terminal	Two 3-pole 300 A terminal blocks	
Load route	• Layer 1: six 500 A NT3 fuses • Layer 2: six 160 A NT00 fuses, six 100 A NT00 fuses	• Layer 1: – Six NT1 fuses, six NT2 fuses, six NT3 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers • Layer 2: – Twelve NT00 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers
Rectifier circuit breaker	Sixteen 2-pole 63 A circuit breakers	
Rectifier	Forty-eight R4850G2s, R4850N2s, or R4850S1s	
AC surge protection	• Two 20 kA/40 kA SPDs • Two 4-pole 32 A SPD circuit breakers	
Battery route	Two groups of two 1250 A NT4 fuses connected in parallel	
Battery current monitoring	Two 2000 A/25 mV shunts	
Total load current monitoring	One 2000 A/25 mV shunt	
DC power indicator	One DC power indicator (green)	
System alarm indicator	One system alarm indicator (red)	
DC surge protection	DC SPD (10 kA in differential mode, 20 kA in common mode, 8/20 μs)	
Monitoring unit	SMU05A	
Signal monitoring	Power distribution monitoring unit	

Table 3-3 TP481200B-N20B1 configurations

Item	TP481200B-N20B1 Typical Configurations	TP481200B-N20B1 Flexible Configurations
AC input system	220/380 V AC three-phase four-wire	
AC input circuit breaker	One 3-pole 200 A circuit breaker	
Load route	• Layer 1: four 500 A NT3 fuses, two 400 A NT2 fuses • Layer 2: six 160 A NT00 fuses, six 100 A NT00 fuses	• Layer 1: – Six NT1 fuses, six NT2 fuses, six NT3 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers • Layer 2: – Twelve NT00 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers
Rectifier circuit breaker	Twenty-four 1-pole 32 A circuit breakers	
Rectifier	Twenty-four R4850G2s, R4850N2s, or R4850S1s	
AC surge protection	• One 20 kA/40 kA SPD • One 4-pole 32 A SPD circuit breaker	
Battery route	Two 1000 A NT4 fuses	
Battery current monitoring	Two 1000 A/25 mV shunts	
Total load current monitoring	One 1000 A/25 mV shunt	
DC power indicator	One DC power indicator (green)	
System alarm indicator	One system alarm indicator (red)	
DC surge protection	DC SPD (10 kA in differential mode, 20 kA in common mode, 8/20 μs)	
Monitoring unit	SMU05A	
Signal monitoring	Power distribution monitoring unit	

Table 3-4 TP481200B-N20B2 configurations

Item	TP481200B-N20B2 Typical Configurations	TP481200B-N20B2 Flexible Configurations
AC input system	120/208 V AC (three-phase three-wire or three-phase four-wire), compatible with 220/380 V AC three-phase four-wire	
AC input circuit	One 3-pole 300 A circuit breaker	

Item	TP481200B-N20B2 Typical Configurations	TP481200B-N20B2 Flexible Configurations
breaker		
Load route	• Layer 1: four 500 A NT3 fuses, two 400 A NT2 fuses • Layer 2: six 160 A NT00 fuses, six 100 A NT00 fuses	• Layer 1: – Six NT1 fuses, six NT2 fuses, six NT3 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers • Layer 2: – Twelve NT00 fuses – Twenty-four 63 A circuit breakers or sixteen 100 A circuit breakers
Rectifier circuit breaker	Twenty-four 2-pole 32 A circuit breakers	
Rectifier	Twenty-four R4850G2s, R4850N2s, or R4850S1s	
AC surge protection	• One 20 kA/40 kA SPD • One 4-pole 32 A SPD circuit breaker	
Battery route	Two 1000 A NT4 fuses	
Battery current monitoring	Two 1000 A/25 mV shunts	
Total load current monitoring	One 1000 A/25 mV shunt	
DC power indicator	One DC power indicator (green)	
System alarm indicator	One system alarm indicator (red)	
DC surge protection	DC SPD (10 kA in differential mode, 20 kA in common mode, 8/20 μs)	
Monitoring unit	SMU05A	
Signal monitoring	Power distribution monitoring unit	

3.2 Typical Multi-cabinet Configurations

Table 3-5 lists the typical configurations of TP482000B-N20B1 or TP482000B-N20B2. Table 3-6 lists the typical configurations of TP481200B-N20B1 or TP481200B-N20B2.

Table 3-5 TP482000B-N20B1 or TP482000B-N20B2 typical configurations

System Capacity (kW)	144	288	432	576	720
Combined cabinet TP482000B-N20B1 or TP482000B-N20B2 (PCS)	1	2	3	4	5

System Capacity (kW)	144	288	432	576	720
Connecting copper bar (group)	/	1	2	3	4
Inter-cabinet signal cable (PCS)	/	2	3	4	5

Table 3-6 TP481200B-N20B1 or TP481200B-N20B2 typical configurations

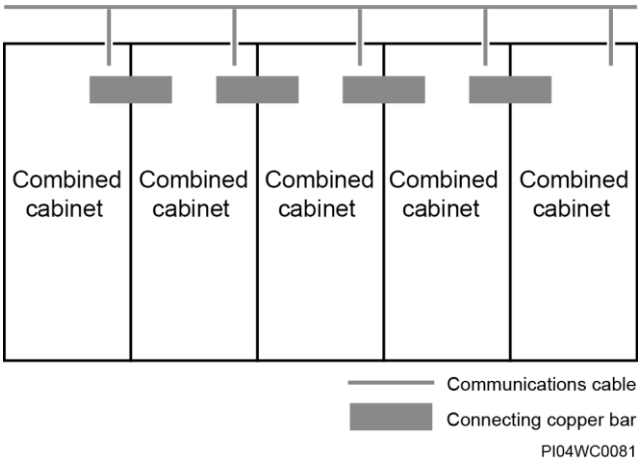
System Capacity (kW)	72	144	216	288	360
Combined cabinet TP481200B-N20B1 or TP481200B-N20B2 (PCS)	1	2	3	4	5
Connecting copper bar (group)	/	1	2	3	4
Inter-cabinet signal cable (PCS)	/	2	3	4	5

NOTE

TP483000D AC cabinets and DC cabinets can be connected to TP482000B cabinets.

3.3 Typical Multi-cabinet Layout

Figure 3-1 360 kW/720 kW system



NOTE

Only combined cabinets of the same model can be connected together, up to a maximum of five cabinets.

4 Cabinet Configurations

4.1 Combined Cabinet

TP482000B-N20B1

Figure 4-1 and Table 4-1 illustrate the TP482000B-N20B1 configurations. Load routes can be flexibly configured based on site requirements.

Figure 4-1 TP482000B-N20B1 configurations

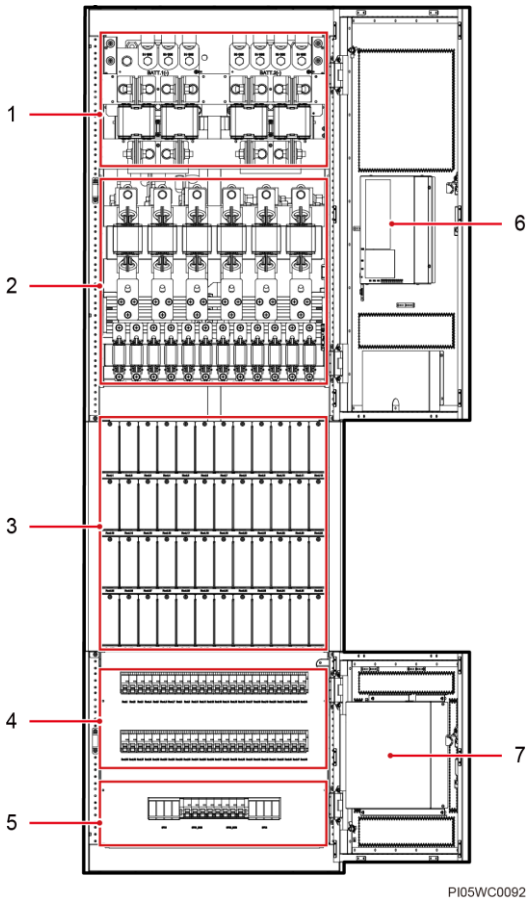


Table 4-1 TP482000B-N20B1 configurations

No.	Name	Specifications	Remarks
1	Battery fuse	Single layer: two groups of two NT4 fuses connected in parallel	Typical configuration
2	Load fuse	• Single layer: six NT3 fuses • Single layer: twelve NT00 fuses	
3	Space for rectifiers	Forty-eight 50 A rectifiers	
4	Rectifier circuit breaker	Dual layers: forty-eight 1-pole 32 A circuit breakers	
5	AC SPD and SPD circuit breaker	• Two 20 kA/40 kA SPDs • Two 4-pole 32 A SPD circuit breakers	
6	SMU05A	1 PCS	
7	Power distribution monitoring unit	1 PCS	

TP482000B-N20B2

Figure 4-2 and Table 4-2 illustrate the TP482000B-N20B2 configurations. Load routes can be flexibly configured based on site requirements.

Figure 4-2 TP482000B-N20B2 configurations

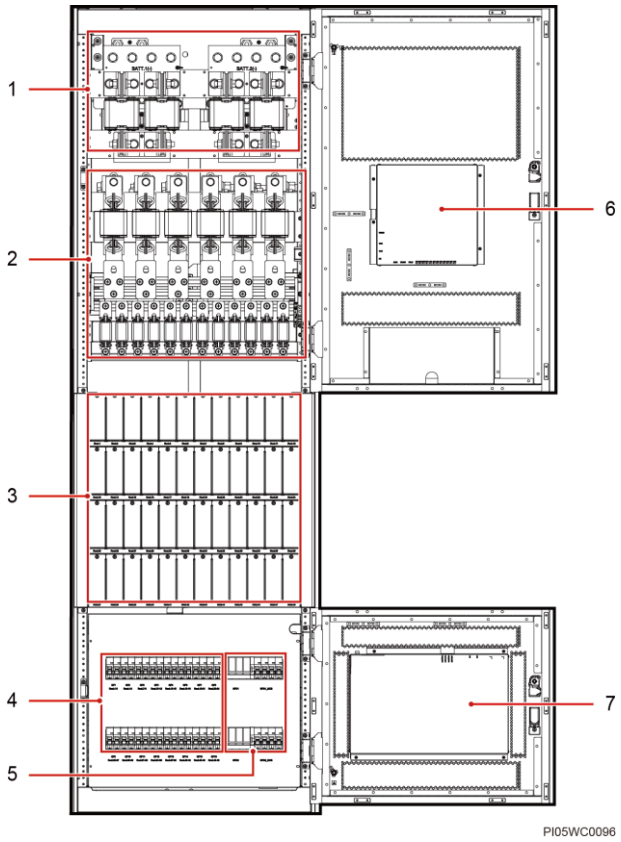


Table 4-2 TP482000B-N20B2 configurations

No.	Name	Specifications	Remarks
1	Battery fuse	Single layer: two groups of two NT4 fuses connected in parallel	Typical configuration
2	Load fuse	• Single layer: six NT3 fuses • Single layer: twelve NT00 fuses	
3	Space for rectifiers	Forty-eight 50 A rectifiers	
4	Rectifier circuit breaker	Dual layers: sixteen 2-pole 63 A circuit breakers	
5	AC SPD and SPD circuit breaker	• Two 20 kA/40 kA SPDs • Two 4-pole 32 A SPD circuit breakers	
6	SMU05A	1 PCS	
7	Power distribution monitoring unit	1 PCS	

TP481200B-N20B1

Figure 4-3 and Table 4-3 illustrate the TP481200B-N20B1 configurations. Load routes can be flexibly configured based on site requirements.

Figure 4-3 TP481200B-N20B1 configurations

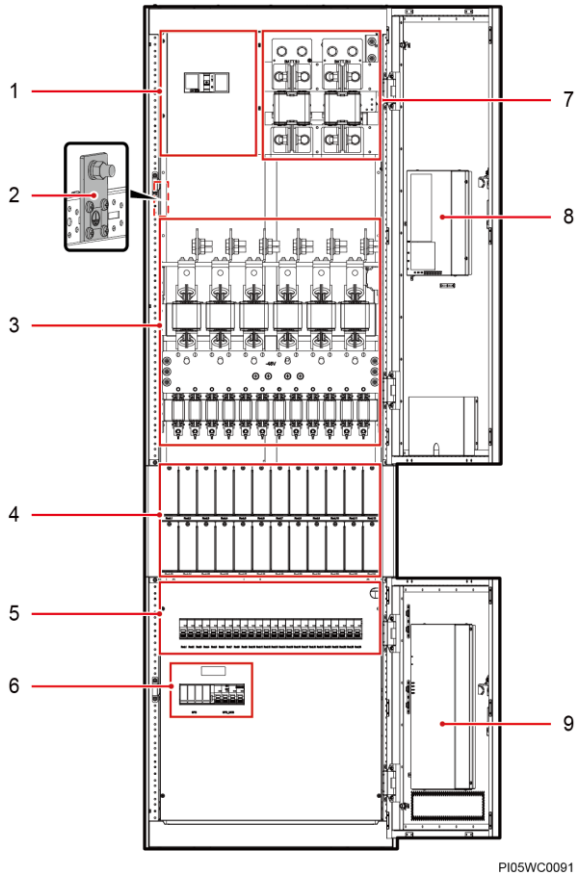


Table 4-3 TP481200B-N20B1 configurations

No.	Name	Specifications	Remarks
1	AC input box	One 3-pole 200 A circuit breaker	Typical configuration
2	Cabinet ground bar	-	
3	Load fuse	• Single layer: four NT3 fuses, two NT2 fuses • Single layer: twelve NT00 fuses	
4	Space for rectifiers	Twenty-four 50 A rectifiers	
5	Rectifier circuit breaker	Single layer: twenty-four 1-pole 32 A circuit breakers	
6	AC SPD and SPD circuit breaker	• One 20 kA/40 kA SPD • One 4-pole 32 A SPD circuit breaker	

No.	Name	Specifications	Remarks
7	Battery fuse	Single layer: two NT4 fuses	
8	SMU05A	1 PCS	
9	Power distribution monitoring unit	1 PCS	

TP481200B-N20B2

Figure 4-4 and Table 4-4 illustrate the TP481200B-N20B2 configurations. Load routes can be flexibly configured based on site requirements.

Figure 4-4 TP481200B-N20B2 configurations

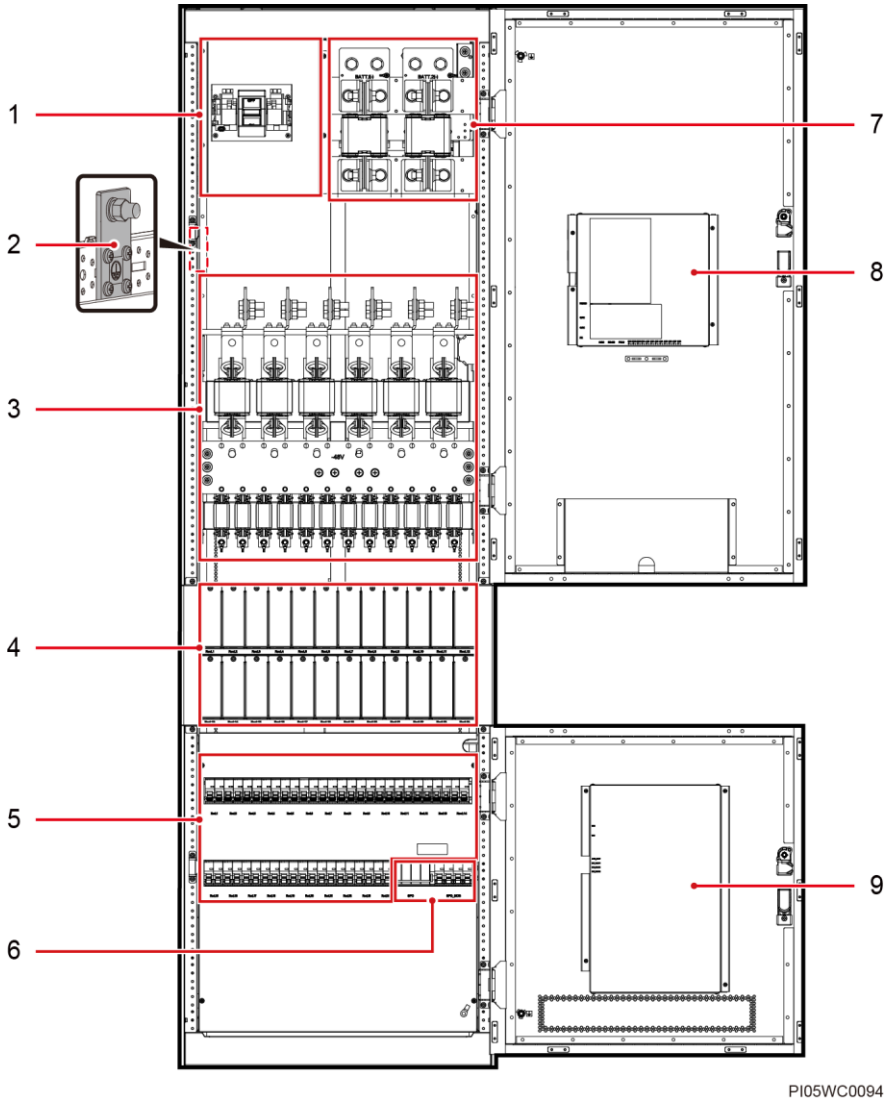


Table 4-4 TP481200B-N20B2 configurations

No.	Name	Specifications	Remarks
1	AC input box	One 3-pole 300 A circuit breaker	Typical configuration
2	Cabinet ground bar	-	
3	Load fuse	• Single layer: four NT3 fuses, two NT2 fuses • Single layer: twelve NT00 fuses	
4	Space for rectifiers	Twenty-four 50 A rectifiers	
5	Rectifier circuit breaker	Dual layers: twenty-four 2-pole 32 A circuit breakers	
6	AC SPD and SPD circuit breaker	• One 20 kA/40 kA SPD • One 4-pole 32 A SPD circuit breaker	
7	Battery fuse	Single layer: two NT4 fuses	
8	SMU05A	1 PCS	
9	Power distribution monitoring unit	1 PCS	

4.2 AC Cabinet

Configure the AC input, AC output, and emergency lighting output for the TP483000D AC cabinet based on site requirements, as illustrated in Figure 4-5 and Table 4-5.

Figure 4-5 AC cabinet configurations

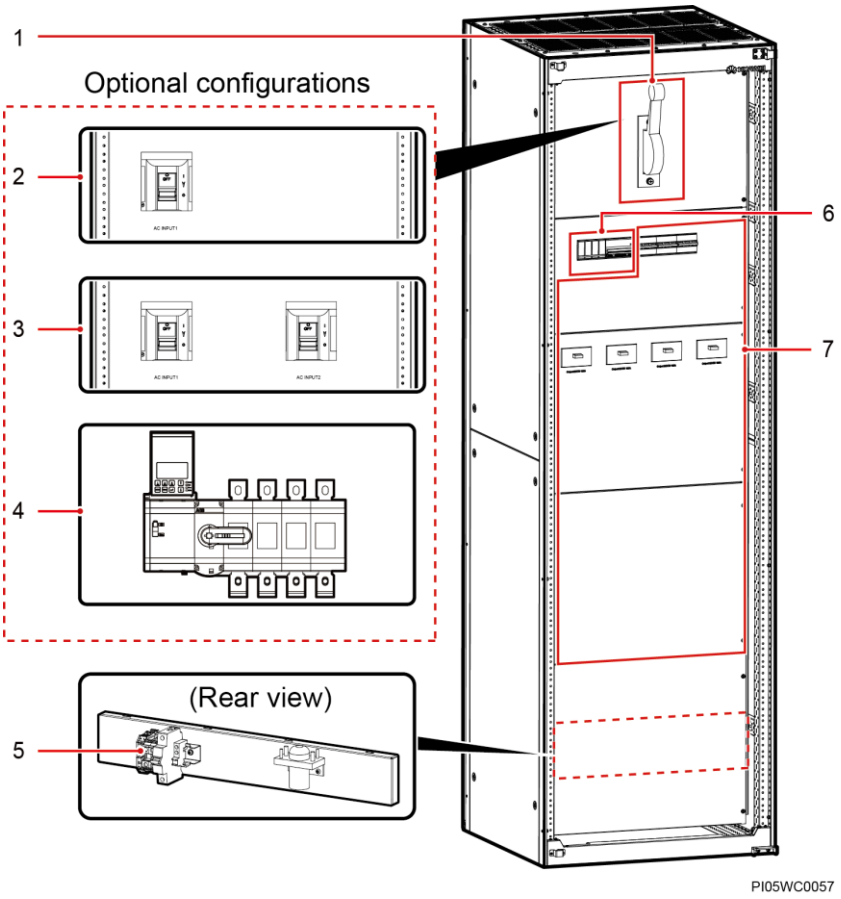


Table 4-5 AC cabinet configurations

No.	Item	Cabinet Model	Specifications	Remarks
1	Knife switch	TPA38401B-N20B1	One 400 A knife switch	Typical configuration
		TPA38631B-N20B1	One 600 A knife switch	Typical configuration
2	MCCB	TPA38401B-N20B1	One 400 A MCCB	Optional configuration
		TPA38631B-N20B1	One 630 A MCCB	Optional configuration
3	Manual transfer switch (MTS)	TPA38401B-N20B1	One 400 A MTS	Optional configuration
		TPA38631B-N20B1	One 630 A MTS	Optional configuration
4	AC transfer switch (ATS)	TPA38401B-N20B1	One 400 A ATS	Optional configuration
		TPA38631B-N20B1	One 630 A ATS	Optional configuration
5	Emergency lighting output	TPA38401B-N20B1	One 100 A light	Optional configuration
		TPA38631B-N20B1		
6	AC SPD and AC surge protection circuit breaker	TPA38401B-N20B1	• One 20 kA/40 kA SPD • One 4-pole 32 A surge protection circuit breaker	Typical configuration
		TPA38631B-N20B1		

No.	Item	Cabinet Model	Specifications	Remarks
7	AC output	TPA38401B-N20B1	• One 3-pole 63 A MCB, one 3-pole 32 A MCB, and three 1-pole 32 A MCBs • Four 3-pole 160 A MCCBs	Typical configuration
		TPA38631B-N20B1	• One 3-pole 63 A MCB, one 3-pole 32 A MCB, and three 1-pole 32 A MCBs • Six 3-pole 160 A MCCBs	Typical configuration
		TPA38401B-N20B1 TPA38631B-N20B1	• MCB group 1: five 3-pole 63 A MCBs or three 3-pole 100 A MCBs • MCCB: four 100 A (or 160 A, 200 A, or 250 A) MCCBs, up to a maximum of three layers • MCB group 2: eight 3-pole 63 A MCBs or six 3-pole 100 A MCBs	Optional configuration **NOTE** If you select three layers of MCCBs, you do not need to select MCB group 2.

4.3 DC Cabinet

Configure the battery route and load route for the TP483000D DC cabinet based on site requirements. For battery route configurations, see Figure 4-6 and Table 4-6. For load route configurations, see Figure 4-7 and Table 4-7.

Figure 4-6 Battery route configurations for a DC cabinet

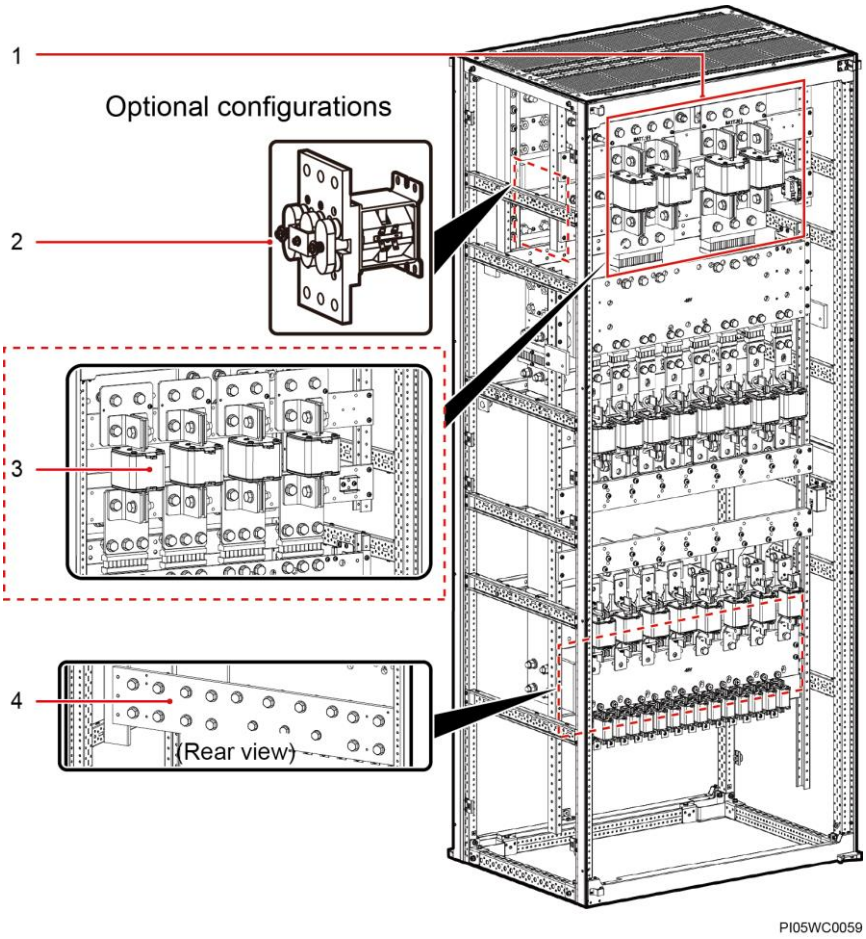


Table 4-6 Battery route configurations for a DC cabinet

No.	Item	Cabinet Model	Specifications	Remarks
1	Battery fuse	TPD48202B-N20B1 TPD48302B-N20B1	Two groups of two NT4 fuses connected in parallel	Typical configuration
2	Contactor	TPD48202B-N20B1 TPD48302B-N20B1	3000 A	Optional configuration
3	Battery fuse	TPD48202B-N20B1	• Six NT3 fuses • Four NT4 fuses	Optional configuration
		TPD48302B-N20B1		
4	Copper RTN expansion bar	TPD48202B-N20B1 TPD48302B-N20B1	N/A	Optional configuration

Figure 4-7 Load route configurations for a DC cabinet

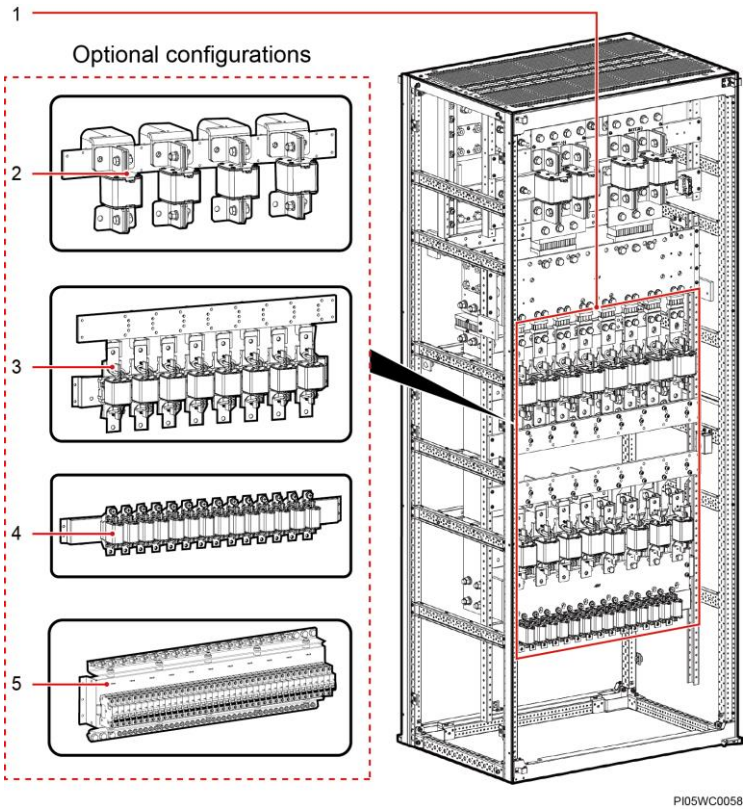


Table 4-7 Load route configurations for a DC cabinet

No.	Item	Cabinet Model	Specifications	Remarks
1	Load fuse	TPD48202B-N20B1	• Layer 1: six NT3 fuses and two NT1 fuses • Layer 2: fourteen NT00 fuses	Typical configuration
	Load fuse	TPD48302B-N20B1	• Layer 1: eight NT3 fuses • Layer 2: four NT2 fuses and four NT1 fuses • Layer 3: fourteen NT00 fuses	Typical configuration
2	Load fuse	TPD48202B-N20B1 TPD48302B-N20B1	Single layer: four NT4 fuses	Optional configuration **NOTE** A maximum of three layers of fuses or circuit breakers can be configured for the load route. If NT4 fuses are selected, configure a maximum of two layers of fuses or circuit breakers.
3	Load fuse	TPD48202B-N20B1 TPD48302B-N20B1	Single layer: eight NT3 fuses	
			Single layer: eight NT2 fuses	
			Single layer: eight NT1 fuses	
4	Load fuse	TPD48202B-N20B1 TPD48302B-N20B1	Single layer: fourteen NT00 fuses	
5	Load circuit	TPD48202B-N20B1	Single layer: thirty-eight 1-pole	

No.	Item	Cabinet Model	Specifications	Remarks
	breaker	TPD48302B-N20B1	6–63 A MCBs	
			Single layer: twenty-five 1-pole 63–125 A MCBs	

NOTE

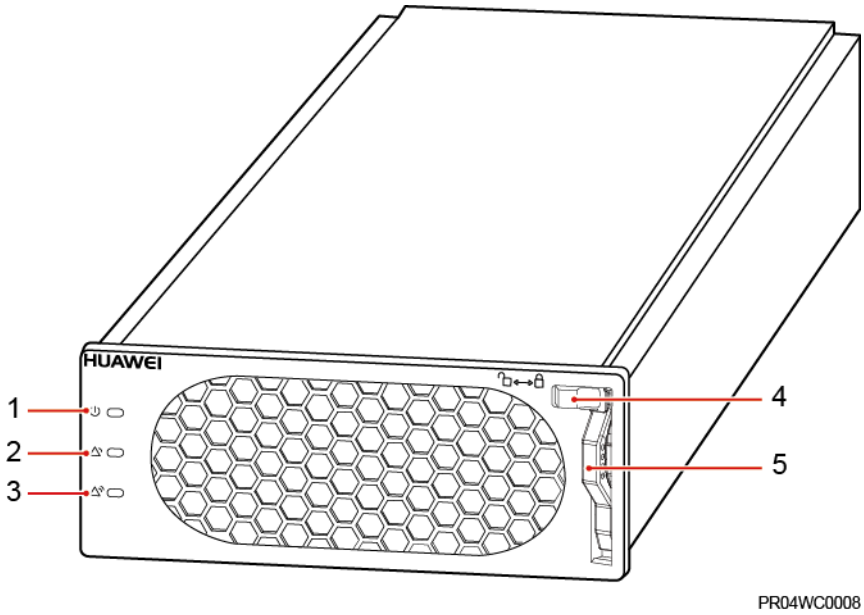
The capacity of a single layer of load fuses or circuit breakers does not exceed 1000 A.

5 Components

5.1 Rectifier

A rectifier converts AC input power into stable DC power.

Figure 5-1 Appearance



(1) Power indicator (2) Alarm indicator (3) Fault indicator

(4) Locking latch (5) Handle

Table 5-1 Indicator description

Indicator	Color	Status	Description
Power indicator	Green	Steady on	The rectifier has an AC input.
		Off	The rectifier has no AC input.
			The rectifier is faulty.

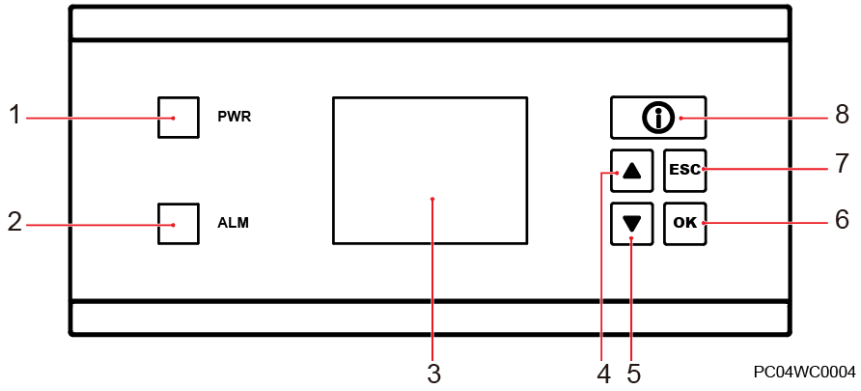
Indicator	Color	Status	Description
		Blinking at 0.5 Hz	The rectifier is being queried.
		Blinking at 4 Hz	The rectifier is loading an application program.
Alarm indicator	Yellow	Off	No alarm is generated.
		Steady on	• A warning is generated due to ambient overtemperature. • The rectifier has generated a protection shutdown alarm due to ambient overtemperature or undertemperature.
			AC input overvoltage or undervoltage protection has been triggered.
			The rectifier is in hibernation state.
		Blinking at 0.5 Hz	The communication between the rectifier and the external device is interrupted.
Fault indicator	Red	Off	The rectifier is normal.
		Steady on	The rectifier locks out due to output overvoltage.
			The rectifier has no output due to an internal fault.

5.2 Monitoring Unit

5.2.1 SMU05A

Panel

Figure 5-2 SMU05A panel



(1) Power indicator (2) Alarm indicator (3) Liquid crystal display (LCD)

(4) Up button (5) Down button (6) OK button

(7) Escape button (8) Info button

Buttons

The SMU panel has five buttons for setting and querying parameters on the LCD.

Table 5-2 Button description

Button	Name	Description
▲	Up	Scrolls through the menus or changes the value of a parameter.
▼	Down	
ESC	Escape	Displays software version information on the standby screen. Returns to the previous menu without saving the settings.
OK	OK	Enters the main menu from the standby screen. Enters a submenu from the main menu. Saves parameter settings.
ⓘ	Info	Enters the standby screen from any screen or enters the active alarm screen from the standby screen. If the Info button is blinking at 0.5 Hz, the SMU05A is running properly and communicating with the host properly.

Button	Name	Description
		If the Info button is blinking at 4 Hz, the SMU05A is running properly but is not communicating with the host properly.

Note:

- After a menu is displayed, the LCD screen becomes dark if no button is pressed within 30 seconds; the standby screen is displayed if no button is pressed within 1 minute.
- After login, the login screen is displayed again if no button is pressed within 1 minute.
- The preset password is **000001**.
- To restart the SMU, hold down ESC and OK for more than 10 seconds.
- To increase or decrease a parameter value quickly, hold down ▲ or ▼.

LCD

The SMU05A uses a 3.5-inch LCD, which displays up to seven rows of large-font menu items on each screen.

Ports

Figure 5-3 SMU05A ports

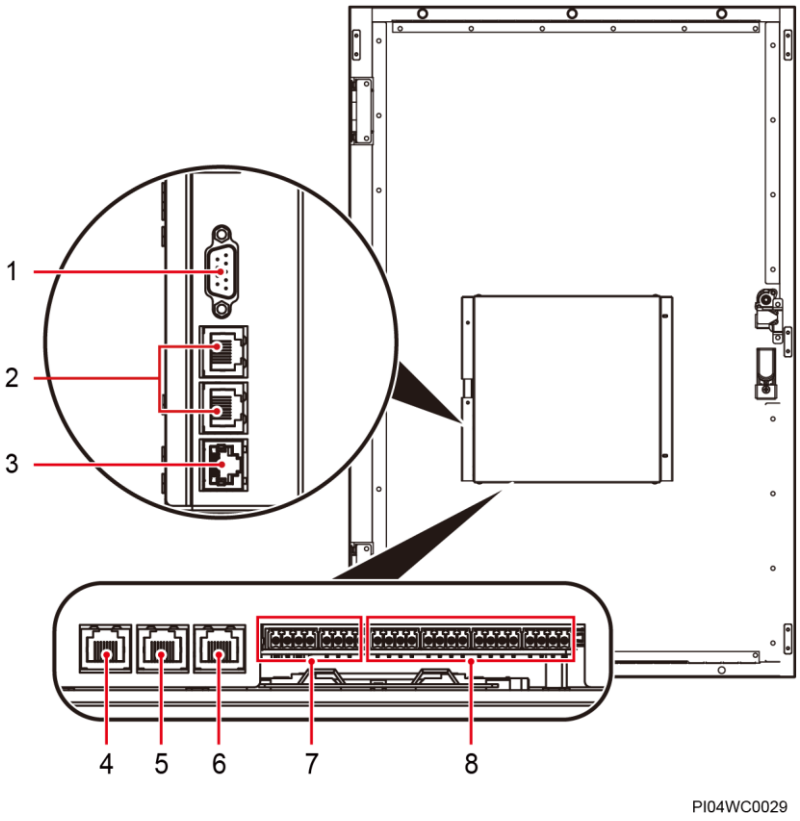


Table 5-3 Port description

No.	Port	Description	Protocol Compliance
1	RS232	Connects to a network management system (NMS).	YDN protocol Baud rate: 9600 bits/s or 19,200 bits/s
2	Control area network (CAN)	Connects inter-cabinet communications cables.	CAN 2.0
3	Fast Ethernet (FE)	Connects to an NMS. 10/100M auto-negotiation	HTTPS, SNMP, and Bin
4	COM	Connects to an intelligent communications device.	Modbus protocol
5	RS485	Connects to a personal computer (PC) or an NMS.	YDN protocol or Huawei master/slave protocol
6	PELU	Cabinet e-label port.	N/A
7	DIN	Four dry contact inputs.	N/A
8	ALM	Eight dry contact outputs.	N/A

Figure 5-4 RS232 port pins

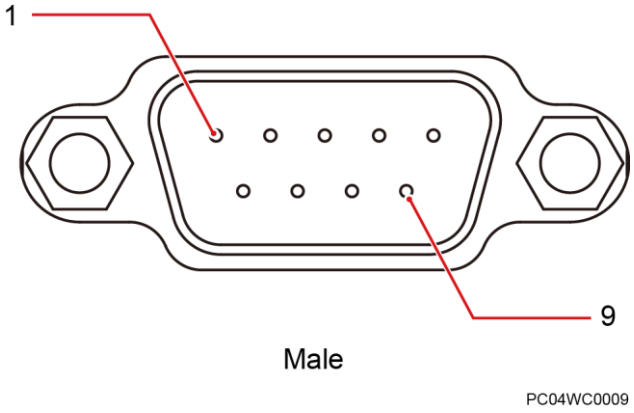


Table 5-4 RS232 port pin definition

Pin	Signal	Description
2	RXD	Receive
3	TXD	Transmit
5	GND	Ground
1, 4, 6, 7, 8, and 9	N/A	N/A

Figure 5-5 CAN/FE/COM/RS485/PELU port pins

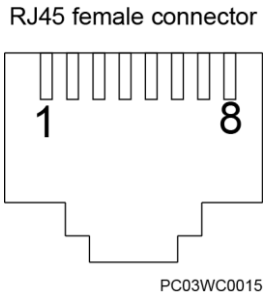


Table 5-5 CAN port pin definition

Pin	Signal	Description
7	CAN_H	CAN high level signal
8	CAN_L	CAN low level signal
1, 2, 3, 4, 5, and 6	N/A	N/A

Table 5-6 FE port pin definition

Pin	Signal	Description
1	TX+	Transmit
2	TX-	
3	RX+	Receive
6	RX-	
4, 5, 7, and 8	N/A	N/A

Table 5-7 COM port pin definition

Pin	Signal	Description
1	RS485+	RS485 data+
2	RS485-	RS485 data-
4	RS485+	RS485 data+
5	RS485-	RS485 data-
7	CAN_H	CAN high level signal
8	CAN_L	CAN low level signal
3 and 6	-	-

Table 5-8 RS485 port pin definition

Pin	Signal	Description
1	RS485T+	RS485 transmit
2	RS485T-	
4	RS485R+	RS485 receive
5	RS485R-	
7	CAN_H	CAN high level signal
8	CAN_L	CAN low level signal
3 and 6	-	-

Table 5-9 PELU port pin definition

Pin	Signal	Description
1	5 V	+5 V power output
3	GND	Signal ground
4	SDA	I^2C data
5	SCL	I^2C clock
2, 6, 7, and 8	N/A	N/A

Table 5-10 Dry contact description

Port	Silk Screen	Description	Associated Alarm
Dry contact input ports	DIN1	Dry contact input 1	N/A
	DIN2	Dry contact input 2	
	DIN3	Dry contact input 3	
	DIN4	Dry contact input 4	
Dry contact output ports	ALM1	Dry contact output 1	N/A
	ALM2	Dry contact output 2	
	ALM3	Dry contact output 3	
	ALM4	Dry contact output 4	
	ALM5	Dry contact output 5	

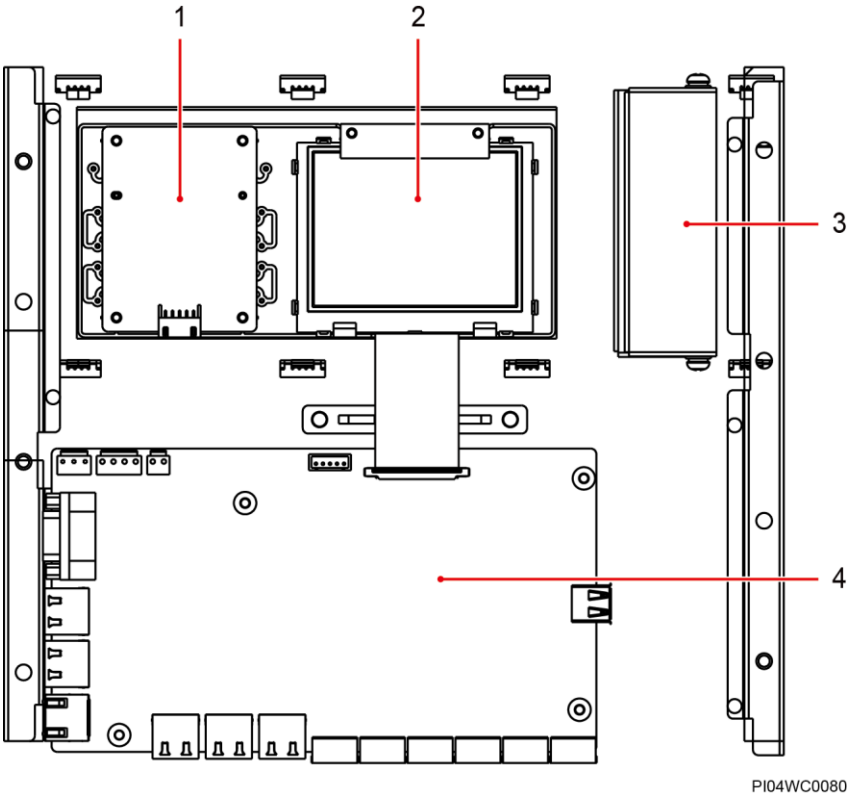
Port	Silk Screen	Description	Associated Alarm
	ALM6	Dry contact output 6	
	ALM7	Dry contact output 7	
	ALM8	Dry contact output 8	

Interior

NOTE

The following figure shows the internal structure with the cover removed.

Figure 5-6 SMU05A interior



(1) Button board (2) LCD

(3) Indicator (4) Main control board

5.2.2 Power Distribution Monitoring Unit

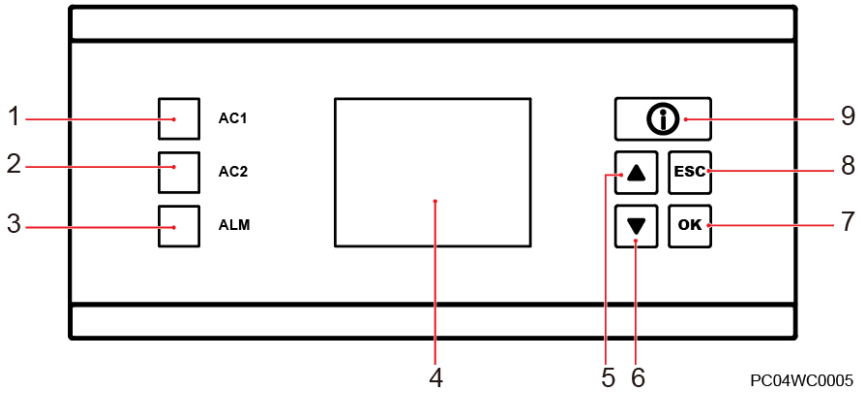
The power distribution monitoring unit is used to monitor AC or DC power distribution. It provides detection, alarm, and communication functions.

Panel

NOTE

The power distribution monitoring unit on a combined cabinet has no panel.

Figure 5-7 Panel of the power distribution monitoring unit (AC cabinet)

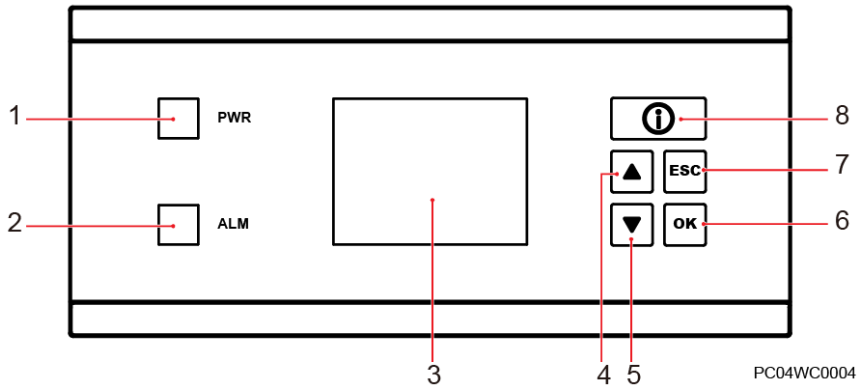


(1) AC input 1 indicator (2) AC input 2 indicator (3) Alarm indicator

(4) LCD (5) Up button (6) Down button

(7) OK button (8) ESC button (9) Info button

Figure 5-8 Panel of the power distribution monitoring unit (DC cabinet)



(1) Power indicator (2) Alarm indicator (3) LCD

(4) Up button (5) Down button (6) OK button

(7) ESC button (8) Info button

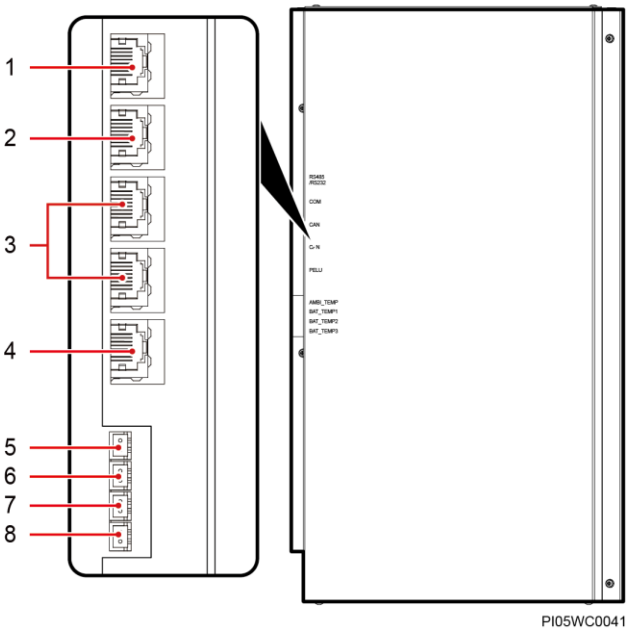
Buttons

Table 5-11 Buttons on the power distribution monitoring unit

Button	Name	Description
▲	Up	Scrolls up menus.
▼	Down	Scrolls down menus.
ESC	Escape	Returns to the upper-level menu.
OK	OK	• Enters the main menu from the standby screen. • Enters a submenu from the main menu.
ⓘ	Info	Enters the standby screen from any screen, or enters the active alarm screen from the standby screen.

Ports

Figure 5-9 Ports on the power distribution monitoring unit (AC or DC cabinet)



(1) RS485/RS232 port

(2) COM port

(3) CAN ports

(4) PELU port

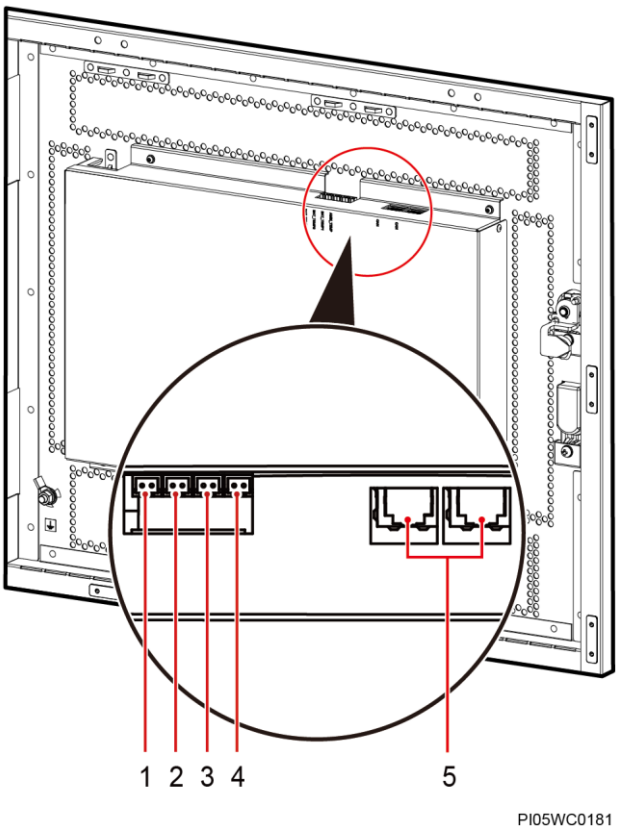
(5) Ambient temperature sensor port AMBI_TEMP

(6) Battery temperature sensor port BAT_TEMP1 (reserved)

(7) Battery temperature sensor port BAT_TEMP2 (reserved)

(8) Battery temperature sensor port BAT_TEMP3 (reserved)

Figure 5-10 Ports on the power distribution monitoring unit (combined cabinet)



(1) Battery temperature sensor port BAT_TEMP3 (reserved)

(2) Battery temperature sensor port BAT_TEMP2 (reserved)

(3) Battery temperature sensor port BAT_TEMP1 (reserved)

(4) Ambient temperature sensor port AMBI_TEMP

(5) CAN ports

Table 5-12 Communications port description

Port	Description	Communications Protocol
CAN	Connects inter-cabinet communications cables.	CAN2.0
RS485/RS232	Connects to a host or NMS.	YDN protocol or Huawei master/slave protocol
COM	Connects to an intelligent communications device.	Modbus protocol
PELU	Cabinet e-label port.	-

Figure 5-11 RS485/RS232/COM/CAN/PELU port pins

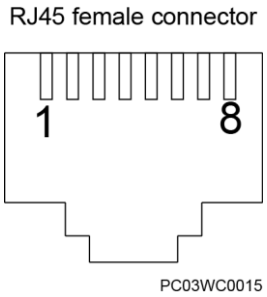


Table 5-13 CAN port pin definitions

Pin	Signal	Description
7	CAN_H	CAN high level signal
8	CAN_L	CAN low level signal
1, 2, 3, 4, 5, 6	-	-

Table 5-14 RS485/RS232 port pin definitions

Pin	Signal	Description
1	RS485+	RS485 data + (A)
2	RS485-	RS485 data – (B)
3	RS232_RXD	Receives data over RS232.
6	GND	Signal ground
7	RS232_TXD	Transmits data over RS232.
4, 5, 8	-	-

Table 5-15 COM port pin definitions

Pin	Signal	Description
1	RS485+	RS485 data + (A)
2	RS485-	RS485 data – (B)
3, 4, 5, 6, 7, 8	-	-

Table 5-16 PELU port pin definitions

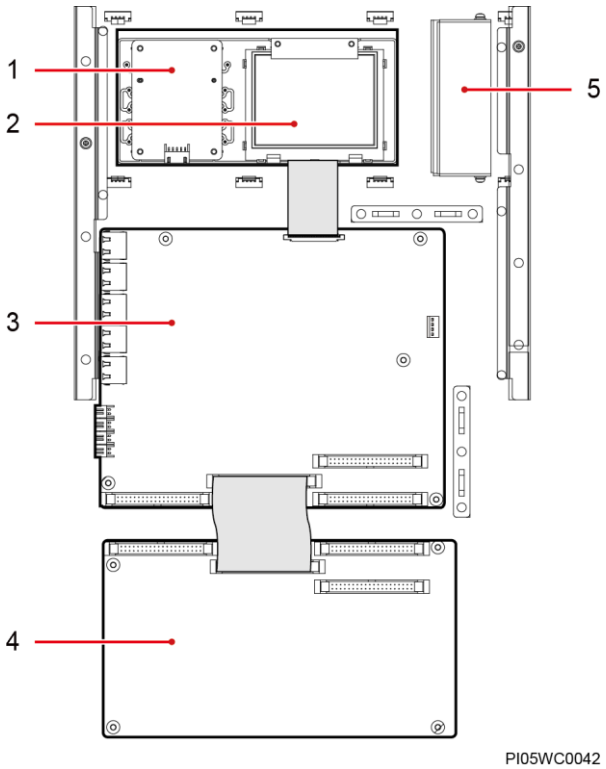
Pin	Signal	Description
1	5V	5 V power output, positive
3	GND	Signal ground
4	SDA	I^2C data
5	SCL	I^2C clock
2, 6, 7, 8	-	-

Interior

NOTE

The figure shows the interior structure with the cover removed.

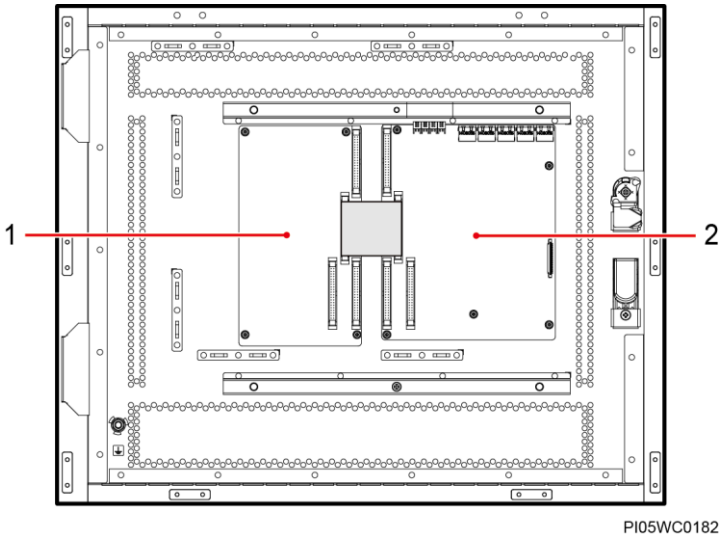
Figure 5-12 Interior of the power distribution monitoring unit (AC or DC cabinet)



(1) Button board (2) LCD (3) Signal sampling board

(4) Signal transfer board (5) Indicator

Figure 5-13 Interior of the power distribution monitoring unit (combined cabinet)



(1) Signal transfer board (2) Signal sampling board

6 Routine Maintenance

6.1 Cabinet

Table 6-1 Cabinet maintenance checklist

No.	Check Item	If...	Then...
1	Check whether the cabinet paint is flaking or there are scratches on the cabinet surface.	The cabinet is scratched.	Repaint the cabinet.
2	Check whether the cabinet is rusted or corroded.	The environment quality of the equipment room is poor.	Evaluate the risk and improve the environment of the equipment room.
3	Check whether the cabinet door lock is damaged.	The door lock is rusty or has been tampered with.	Replace the door lock.
4	Check whether the front and rear of rectifiers are blocked or dusty.	The front or rear of rectifiers is blocked or dusty.	Remove the blockage or clean up the dust.

6.2 AC and DC Power Distribution

Table 6-2 AC and DC power distribution maintenance

No.	Maintenance Item	If...	Then...
1	Check whether an indicator on the surge protective device (SPD) is red.	• Red: The SPD is damaged due to a voltage surge or lightning strike. • Green: The SPD is normal.	Replace the SPD if it is damaged.
2	Check the SPD circuit breaker status.	• OFF: A voltage surge or lightning strike has occurred. • ON: The SPD is normal.	1. Replace the circuit breaker if it is damaged, replace it 2. Turn on the circuit breaker if the SPD is intact.

No.	Maintenance Item	If...	Then...
3	Check for AC input undervoltage.	• AC input power cables have a large voltage drop. • AC input power cables are in poor contact. • The mains voltage is too low.	1. Replace AC input power cables with shorter or thicker cables. 2. Connect AC input power cables securely. 3. Provide the voltage data to the power supplier.
4	Check for AC input overvoltage.	The mains voltage is too high.	Provide the voltage data to the power supplier.
5	Check whether the AC input voltage is open-phase.	• AC input power cables are in poor contact, short-circuited, or damaged. • The mains supply has failed.	1. Check and rectify the cables. 2. Provide the open-phase data to the power supplier.
6	Check whether a DC output circuit breaker is OFF and a fuse is blown.	• Load overcurrent occurs. • Load short-circuit occurs.	Rectify any overcurrent or short circuit. Turn on the circuit breaker or replace the fuse.
7	Check for DC busbar overvoltage.	A rectifier is abnormal.	Replace the abnormal rectifier.
8	Check for DC busbar undervoltage.	• The AC power supply has failed. • The system is overloaded. • A rectifier is abnormal.	1. Resume the AC power supply. 2. Check the load status and rectify faults if any. 3. Replace the abnormal rectifier.
9	Check whether the temperature of a DC busbar working at room temperature exceeds 95°C.	• The DC busbar is loose or in poor contact. • The system is overloaded.	1. Check and secure cabinet busbar connections. 2. Check the load status and rectify faults if any.

6.3 Rectifier

Table 6-3 Rectifier maintenance checklist

No.	Check Item	If...	Then...
1	Check the green indicator status (normal: steady on).	Off: • There is no AC input. • The rectifier is faulty.	1. Check the rectifier AC input. 2. Replace the rectifier.
2	Check the yellow indicator status (normal: off).	Steady on: • The rectifier generates an alarm for power limiting due to ambient overtemperature. • The rectifier has shut down as a protective measure	1. Check the ambient temperature status, and clean the cabinet air channel. 2. Rectify faults in the indoor temperature control system. 3. Check the AC input voltage.

No.	Check Item	If...	Then...
		because the ambient temperature exceeds the upper or lower threshold. • AC input over/undervoltage protection has been triggered. • The rectifier is in hibernation.	4. If the rectifier is in hibernation, no action is required.
		Blinking: • The rectifier communication has failed • The rectifier is faulty.	1. Check that the rectifier communications cable is securely connected. 2. Replace the rectifier.
3	Check the red indicator status (normal: off).	Steady on: • The rectifier is latched off due to output overvoltage. • The rectifier is faulty.	1. Check that the cabinet is not connected to an external DC power source that has a higher voltage. 2. Check that the rectifier output voltage is normal. 3. Replace the rectifier.

6.4 SMU

Table 6-4 SMU maintenance checklist

No.	Check Item	If...	Then...
1	Check the green indicator status.	Off: • There is no DC input. • The SMU is faulty.	1. Check that the DC input power cable is securely connected. 2. Check that the communications cable is securely connected. 3. Replace the SMU.
2	Check the red indicator status.	Steady on: • A critical or major alarm has been generated. • The SMU is faulty.	1. Check components related to the generated alarms. 2. Replace the SMU.
3	Check the LCD screen status.	• The LCD flat cable is loose. • The SMU is faulty.	1. Check that the LCD flat cable is securely connected. 2. Replace the SMU.
4	Check that the SMU can communicate with the NMS.	• The communications cable is loose. • Networking parameters are not correctly set.	1. Check that the communications cable is securely connected. 2. Check that networking parameter settings are correct.

6.5 Parameters on the SMU

Table 6-5 SMU parameter maintenance

No.	Maintenance Item	If...	Then...
1	Check whether the displayed battery capacity and number of battery strings are the same as the actual data.	• Parameters are set incorrectly. • The number of batteries is changed, or batteries are replaced.	Set battery parameters again.
2	Check **Charge Current Limit Coefficient**. The value is typically **0.10C10** and adjustable.	N/A	Change the value as required. Otherwise, retain **0.10C10**.
3	Check whether the displayed battery temperature is the same as the actual temperature.	• The battery temperature sensor is faulty. • The SMU is faulty.	1. Replace the battery temperature sensor. 2. Replace the SMU.
4	Check whether the displayed total load current is the same as the actual current measured by a clamp meter.	• The current monitoring cable is loose. • The SMU is faulty.	1. Check that the current monitoring cable is securely connected. 2. Replace the SMU.
5	Check whether the displayed battery charge current displayed on the SMU is the same as the actual current measured by a clamp meter.	• The current monitoring cable is loose. • The SMU is faulty.	1. Check that the current monitoring cable is securely connected. 2. Replace the SMU.
6	Check whether the difference between the displayed DC output voltage and the measured DC busbar voltage is less than ±0.5 V DC.	• The cabinet busbar and cables are loose or in poor contact. • The SMU is faulty.	1. Check and secure cabinet busbar and cable connections. 2. Replace the SMU.

6.6 Cables

Table 6-6 Cable maintenance checklist

No.	Check Item	If...	Then...
1	Check whether signal cables and power cables are separately bound.	Signal cables and power cables are bound together.	Bind signal cables and power cables separately.
2	Check whether cables are at least 20 mm away from DC negative busbars, fuses, and shunts.	Cables are installed too close to DC negative busbars, fuses, and shunts.	Install cables at least 20 mm away from DC negative busbars, fuses, and shunts.

No.	Check Item	If...	Then...
3	Check whether all cables are bound neatly.	Cables are not properly bound.	Bind cables neatly.
4	Check whether the cabinet ground bar is securely connected to the site or equipment room ground point.	The cabinet ground bar is not securely connected to the site or equipment room ground point.	Connect the cabinet ground bar to the site or equipment room ground point.
5	Check whether ground cables are rusty.	Cables have corroded after being used for a long time.	Replace rusty cables.
6	Check whether the DC RTN+ busbar is grounded.	The DC RTN+ busbar is not properly grounded.	Connect the ground cable to the DC RTN+ busbar properly.
7	Check whether cables are at danger of overheating deteriorating.	• Cables are too thin. • Cables are not properly routed.	• Replace the cables with cables of the required thickness. • Route the cables properly.
8	Check whether cables are misshapen by metal parts.	Cables are not properly installed.	Replace the cables and route them properly.
9	Check whether cables pass behind the air exhaust vents of rectifiers.	Cables pass behind the air exhaust vents of rectifiers.	Reroute the cables to prevent cable overheating.
10	Check whether power cables use standard terminals.	Cables do not use stand terminals.	Replace with standard terminals.
11	Check whether cable insulation is damaged.	Cable insulation is damaged.	Reinsulate the cables with insulation tape.

7 Parts Replacement

7.1 Replacing a Rectifier

Prerequisites

- A pair of protective gloves, an ESD box or bag, and the cabinet door key are available.
- The new rectifier is intact.
- The AC input to the power system is normal and batteries are in float charging mode.

Procedure

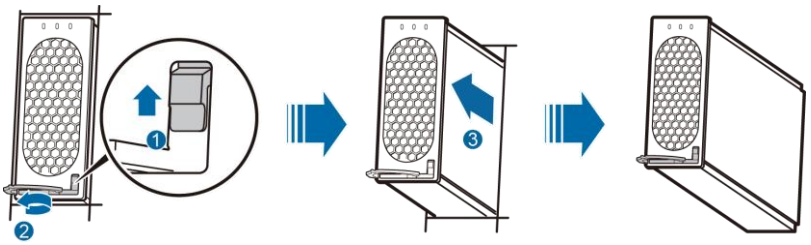
Step 1 Put on protective gloves.

Step 2 Push the locking latch on the right of the rectifier panel upwards.

> **CAUTION**
>
> To prevent burns, exercise caution when removing a rectifier because the rectifier may be hot as a result of continuous operation.

Step 3 Gently draw the handle outwards, and then remove the rectifier from the slot, as shown in Figure 7-1.

Figure 7-1 Removing the rectifier

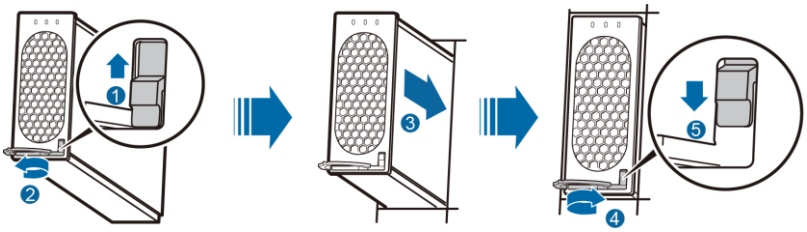


Step 4 Push the locking latch on the new rectifier upwards, and pull out the handle.

Step 5 Place the new rectifier in the appropriate slot.

Step 6 Gently slide the new rectifier along the guide rail, and push the locking latch downwards, as shown in Figure 7-2.

Figure 7-2 Installing a new rectifier



Step 7 Remove the protective gloves.

----End

Follow-up Procedure

Pack the removed component and have it sent to the local Huawei warehouse.

7.2 Replacing the SMU05A

7.2.1 Replacing the Main Control Board

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- You have obtained a PC and network cable. The computer supports Windows XP or later and Internet Explorer 7.0 or later.
- The new SMU05A main control board is intact.
- You have obtained the SMU05A IP address, subnet mask, gateway address, and web user interface (WebUI) user name and password from the administrator.

Context

To replace the main control board, you do not need to disconnect the AC input to the power system.

Procedure

Step 1 Back up SMU parameters.

NOTE

Skip Step 1 if the main control board has been severely damaged and data backup cannot be completed.

1. Connect one end of the network cable to the fast Ethernet (FE) port on the SMU and the other end to the network port on the PC.

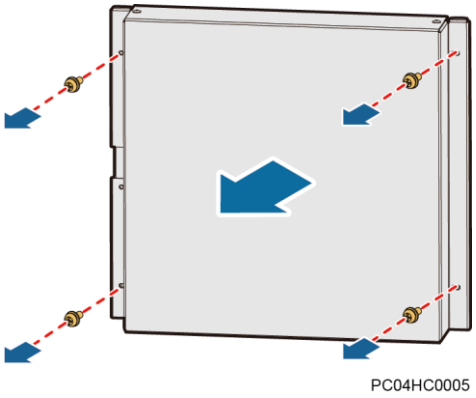
2. Set the IP addresses of the PC and SMU to the same network segment.
3. In Internet Explorer on the PC, enter the SMU IP address. On the login page, enter the user name and password you obtained to log in to the WebUI.
4. On the WebUI, choose **Maintenance** > **Configuration File**.
5. Click **Back Up Local Cabinet Current Settings**. In the displayed dialog box, click **Save** to save the configuration file to the PC.

Step 2 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 3 Record the positions of cables connected to RJ45 ports on the SMU, and disconnect the cables from the ports.

Step 4 Unscrew and remove the SMU cover, as shown in Figure 7-3.

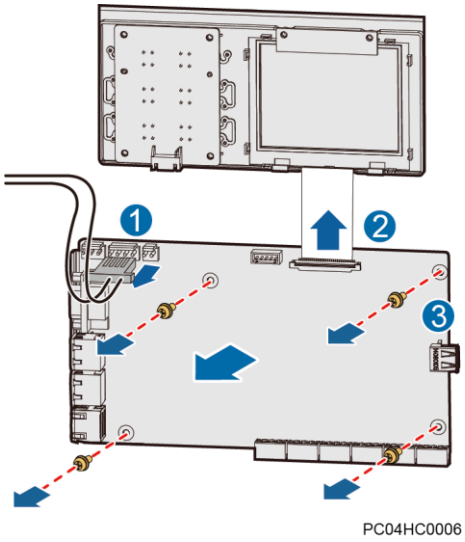
Figure 7-3 Removing the SMU cover



Step 5 Remove the main control board, as shown in Figure 7-4.

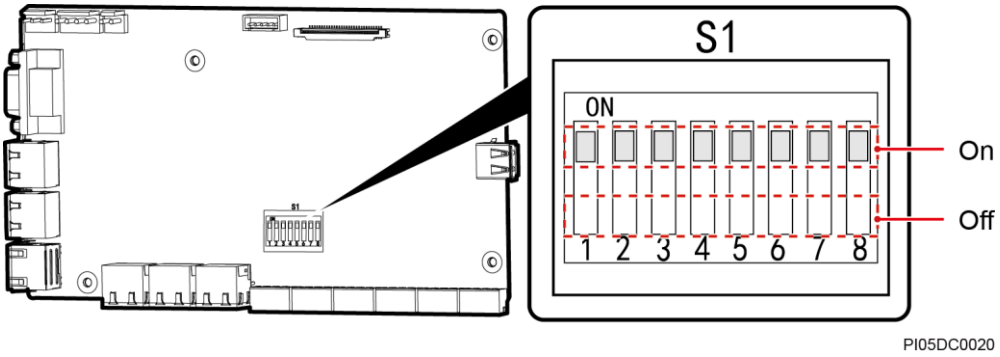
1. Record the positions of cables connected to the main control board, and disconnect the power cable from the J12 port on the main control board.
2. Disconnect communications cables and signal cables from the main control board.
3. Unscrew and remove the main control board.

Figure 7-4 Removing the main control board



Step 6 Record the settings of DIP switch S1 for the main control board, as shown in Figure 7-5.

Figure 7-5 DIP switch S1



NOTE

The DIP switch settings shown in Figure 7-5 are for reference only.

Table 7-1 Combined cabinet DIP switch settings

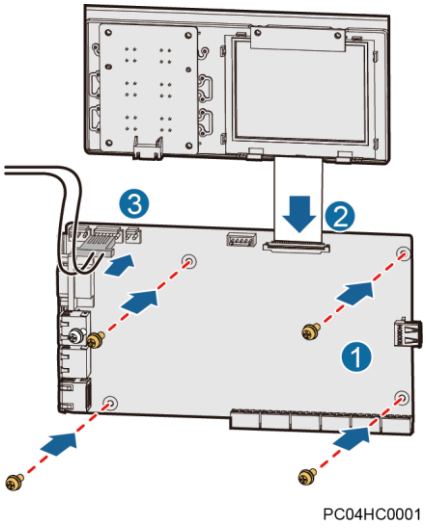
Cabinet No.	Monitoring Address	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5–Bit 8
1	1	On	On	On	• If a combined cabinet is located at either end of the power system, there is no need to operate toggle switch 4. • If a combined cabinet is in any other position, set toggle switch 4 to Off.	Toggle switches 5 to 8 are set before delivery, and no further action is required.
2	2	Off	On	On		
3	3	On	Off	On		
4	4	Off	Off	On		
5	5	On	On	Off		

Step 7 Set DIP switch S1 for the new main control board based on the recorded information.

Step 8 Install the new main control board, as shown in Figure 7-6.

1. Place the new main control board in position and tighten the screws.
2. Reconnect the communications cables and signal cables to the new main control board based on the recorded information.
3. Reconnect the power cable to the J12 port on the main control board.

Figure 7-6 Installing a main control board



Step 9 Place the SMU cover in position and tighten the screws.

Step 10 Reconnect the cables to the RJ45 ports on the SMU based on the recorded information.

Step 11 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

Step 12 Import the SMU configuration file that you have backed up.

NOTE

- If data backup cannot be completed in Step 1, skip Step 12 and set the SMU parameters again by referring to the installation guide.
- After you import the configuration file, the SMU restarts.

1. Connect the network cable to the FE port on the SMU, and set the SMU IP address to the same network segment as the PC IP address on the LCD. Table 7-2 lists the menus.

Table 7-2 Setting the SMU IP address

Main Menu	Second-Level Menu	Third-Level Menu	Default Value	Setting
Setting Wizard	Network Parameters	IP	192.168.0.10	Apply to the network administrator for an address.
		Subnet Mask	255.255.255.0	Apply to the network

Main Menu	Second-Level Menu	Third-Level Menu	Default Value	Setting
				administrator for an address.
		Gateway	192.168.0.1	Apply to the network administrator for an address.

2. In Internet Explorer on the PC, enter the SMU IP address. On the login page, enter a user name and password to log in to the WebUI. The preset user name is **admin**, and the preset password is **Changeme**.
3. On the WebUI, choose **Maintenance** > **Configuration File**.
4. Click **Scan** after **Import Local Cabinet a new configuration file**, locate the configuration file on the PC, and click **Upload** to import the file.

----End

7.2.2 Replacing the LCD

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new LCD is intact.

Context

To replace the LCD, you do not need to disconnect the AC input to the power system.

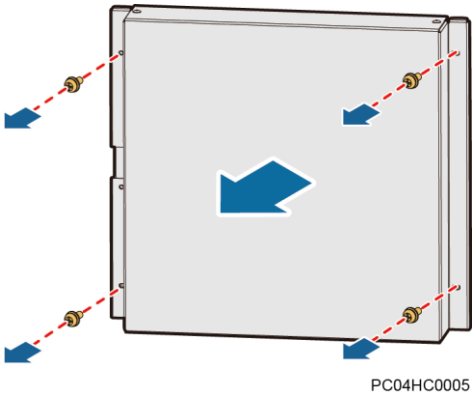
Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 2 Record the positions of cables connected to RJ45 ports on the SMU, and disconnect the cables from the ports.

Step 3 Unscrew and remove the SMU cover.

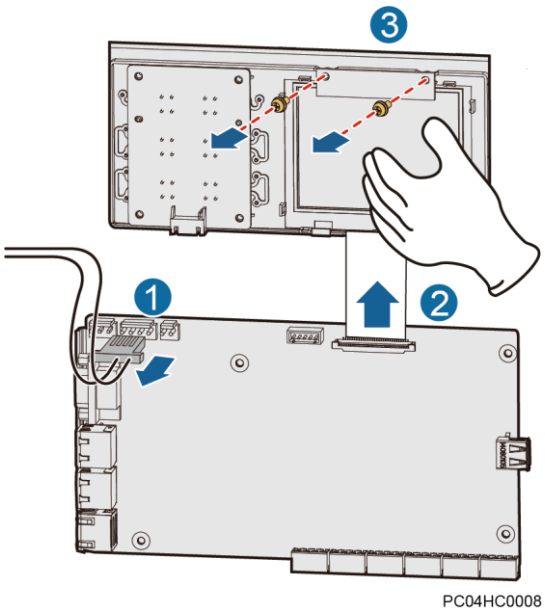
Figure 7-7 Removing the SMU cover



Step 4 Remove the LCD, as shown in Figure 7-8.

1. Disconnect the input power cable from the J12 port on the main control board.
2. Disconnect the LCD flat cable from the main control board.
3. Unscrew and remove the LCD.

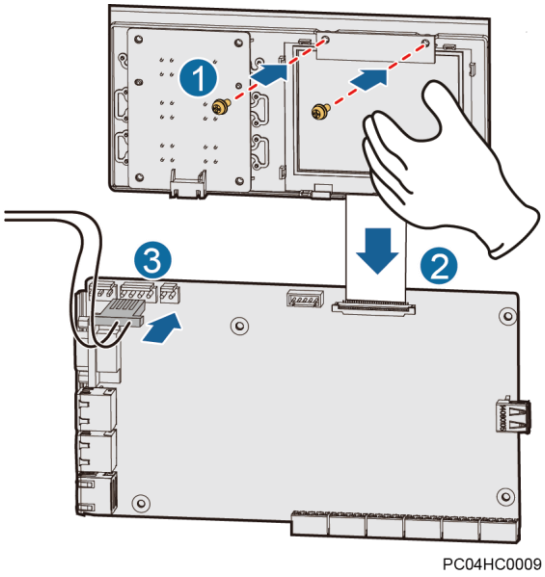
Figure 7-8 Removing an LCD



Step 5 Install the new LCD, as shown in Figure 7-9.

1. Place the new LCD in position and tighten the screws.
2. Connect the LCD flat cable to the main control board.
3. Reconnect the power cable to the J12 port on the main control board.

Figure 7-9 Installing an LCD



Step 6 Place the SMU cover in position and tighten the screws.

Step 7 Reconnect the cables to the RJ45 ports on the SMU based on the recorded information.

Step 8 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

7.2.3 Replacing the Button Board

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new button board is intact.

Context

To replace the button board, you do not need to disconnect the AC input to the power system.

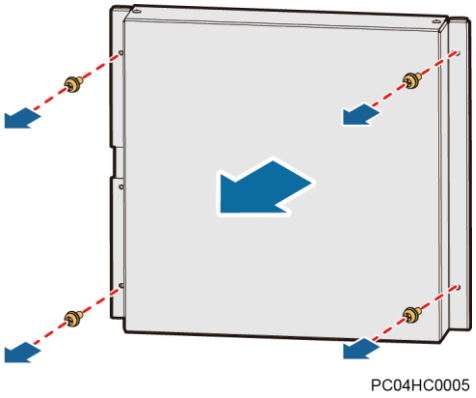
Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 2 Record the positions of cables connected to RJ45 ports on the SMU, and disconnect the cables from the ports.

Step 3 Remove the cover from the SMU.

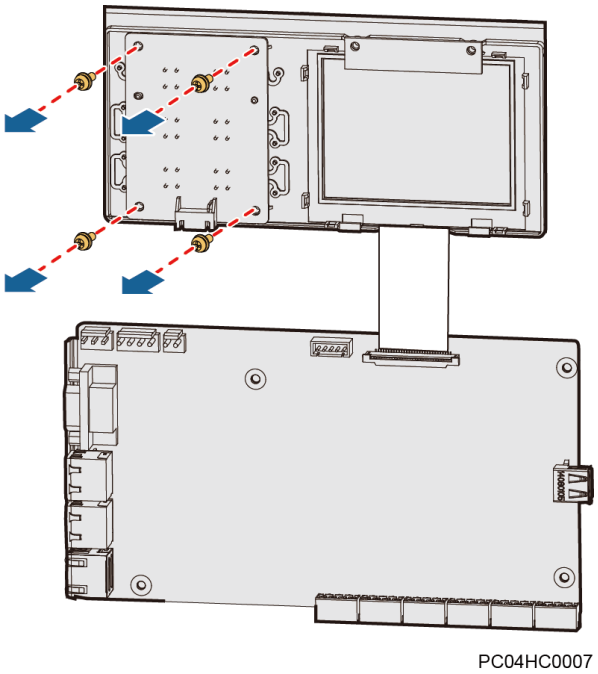
Figure 7-10 Removing the SMU cover



Step 4 Record the positions of cables connected to the button board, and disconnect the cables.

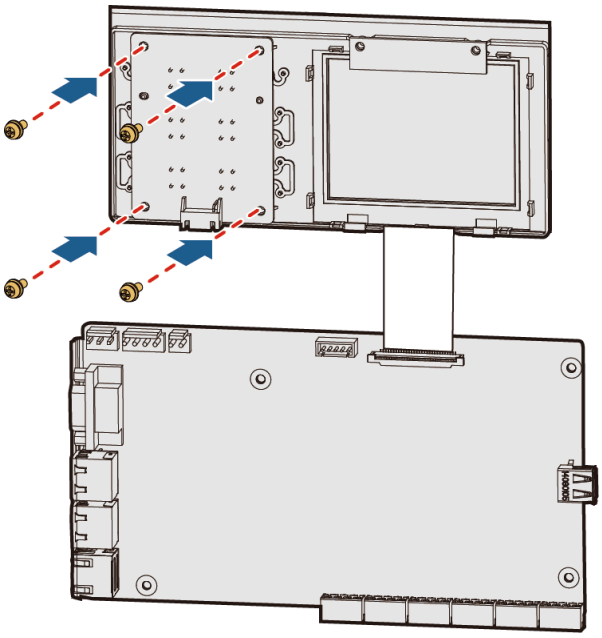
Step 5 Unscrew and remove the button board, as shown in Figure 7-11.

Figure 7-11 Removing a button board



Step 6 Place the new button board in position and tighten the screws, as shown in Figure 7-12.

Figure 7-12 Installing a button board



Step 7 Reconnect the cables to the button board based on the recorded information.

Step 8 Place the SMU cover in position and tighten the screws.

Step 9 Reconnect the cables to the RJ45 ports on the SMU based on the recorded information.

Step 10 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

7.3 Replacing the Power Distribution Monitoring Unit

7.3.1 Replacing the Signal Sampling Board

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new signal sampling board is intact.

Context

To replace the signal sampling board, you do not need to disconnect the AC input to the power system.

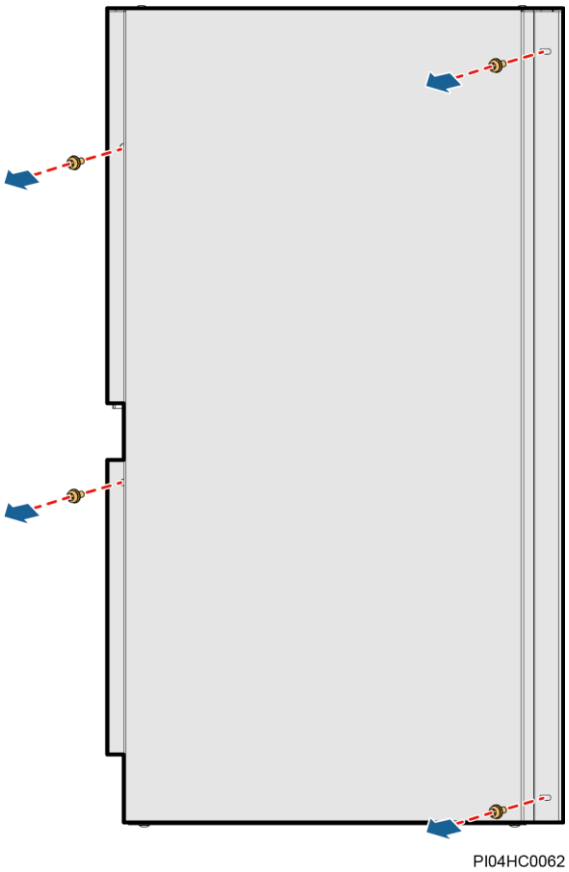
Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 2 Record the positions of cables connected to RJ45 ports on the power distribution monitoring unit, and disconnect the cables from the ports.

Step 3 Unscrew and remove the cover from the power distribution monitoring unit, as shown in Figure 7-13.

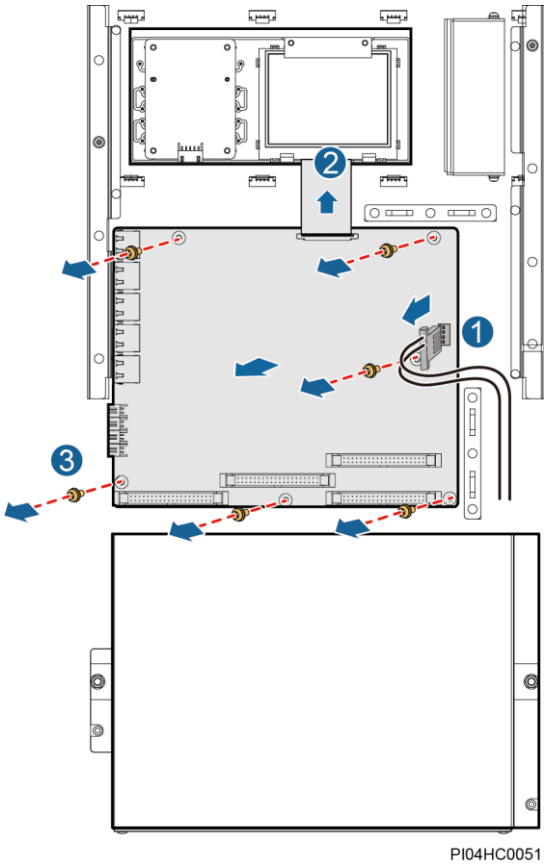
Figure 7-13 Removing the cover from the power distribution monitoring unit



Step 4 Remove the signal sampling board, as shown in Figure 7-14.

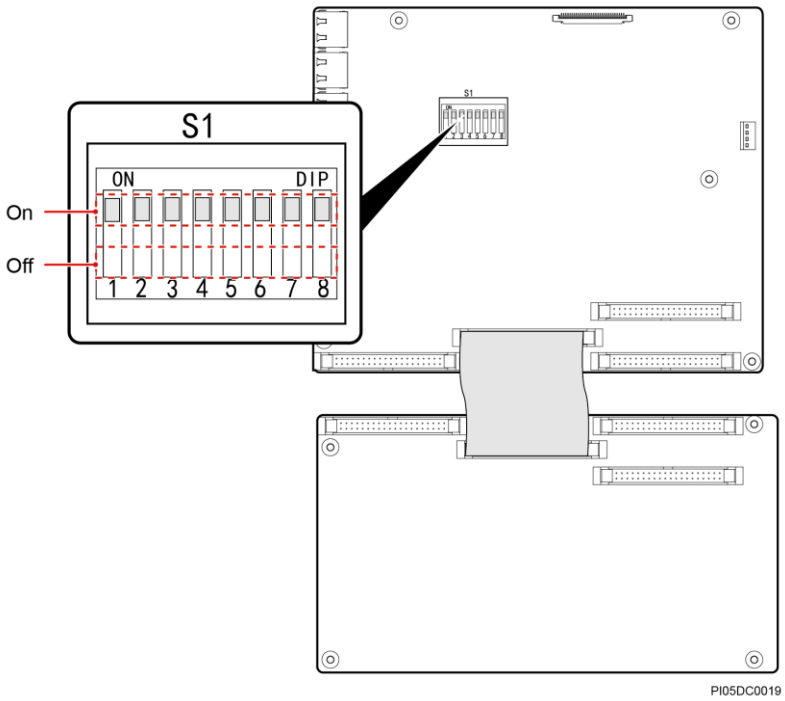
1. Record the positions of cables connected to the signal sampling board, and disconnect the power cable from the J98 port on the signal sampling board.
2. Disconnect communications cables and signal cables from the signal sampling board.
3. Unscrew and remove the signal sampling board.

Figure 7-14 Removing a signal sampling board



Step 5 Record the settings of dual-in-line package (DIP) switch S1 for the signal sampling board, as shown in Figure 7-15.

Figure 7-15 DIP switch S1



NOTE

The DIP switch settings shown in Figure 7-15 are for reference only.

Table 7-3 Combined cabinet DIP switch settings

Cabinet No.	Monitoring Address	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7–Bit 8
1	23	On	Off	Off	On	Off	• If an combined cabinet is located at either end of the power system, there is no need to operate toggle switch 6. • If an combined cabinet is in any other position, set toggle switch 6 to Off.	Toggle switches 7 to 8 are set before delivery, and no further action is required.
2	24	Off	Off	Off	On	Off		
3	25	On	On	On	Off	Off		
4	26	Off	On	On	Off	Off		
5	27	On	Off	On	Off	Off		
6	28	Off	Off	On	Off	Off		
7	29	On	On	Off	Off	Off		
8	30	Off	On	Off	Off	Off		
9	31	On	Off	Off	Off	Off		
10	32	Off	Off	Off	Off	Off		

Table 7-4 AC cabinet DIP switch settings

Cabinet No.	Monitoring Address	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7–Bit 8
1	1	On	On	On	On	On	• If an AC cabinet is located at either end of the power system, there is no need to operate toggle switch 6. • If an AC cabinet is in any other position, set toggle switch 6 to Off.	Toggle switches 7 to 8 are set before delivery, and no further action is required.
2	2	Off	On	On	On	On		
3	3	On	Off	On	On	On		
4	4	Off	Off	On	On	On		
5	5	On	On	Off	On	On		
6	6	Off	On	Off	On	On		
7	7	On	Off	Off	On	On		
8	8	Off	Off	Off	On	On		

Table 7-5 DC cabinet DIP switch settings

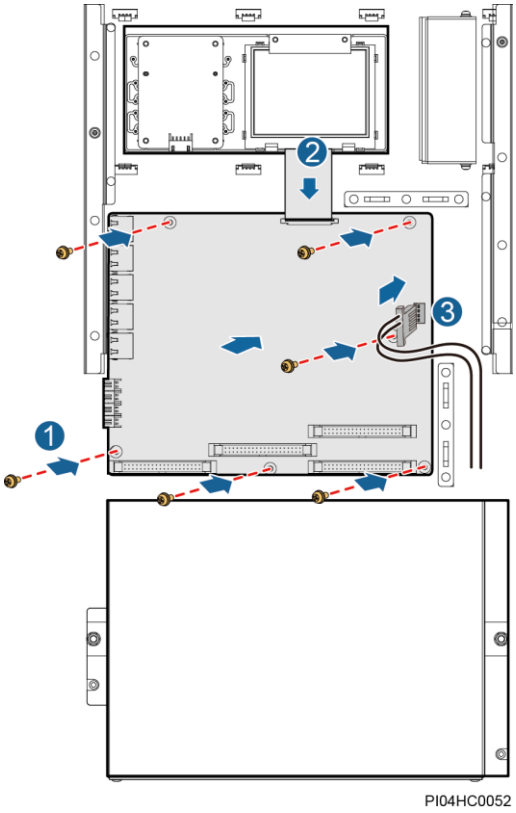
Cabinet No.	Monitoring Address	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7–Bit 8
1	9	On	On	On	Off	On	• If a DC cabinet is located at either end of the power system, there is no need to operate toggle switch 6. • If a DC cabinet is in any other position, set toggle switch 6 to Off.	Toggle switches 7 to 8 are set before delivery, and no further action is required.
2	10	Off	On	On	Off	On		
3	11	On	Off	On	Off	On		
4	12	Off	Off	On	Off	On		
5	13	On	On	Off	Off	On		
6	14	Off	On	Off	Off	On		
7	15	On	Off	Off	Off	On		
8	16	Off	Off	Off	Off	On		
9	17	On	On	On	On	Off		
10	18	Off	On	On	On	Off		
11	19	On	Off	On	On	Off		
12	20	Off	Off	On	On	Off		
13	21	On	On	Off	On	Off		
14	22	Off	On	Off	On	Off		

Step 6 Set DIP switch S1 for the new signal sampling board based on the recorded information.

Step 7 Install the new signal sampling board, as shown in Figure 7-16.

1. Place the new signal sampling board in position and tighten the screws.
2. Reconnect the communications cables and signal cables to the new signal sampling board based on the recorded information.
3. Reconnect the power cable to the J98 port on the signal sampling board.

Figure 7-16 Installing a signal sampling board



Step 8 Place the cover on the power distribution monitoring unit, and tighten the screws.

Step 9 Reconnect the cables to the RJ45 ports on the power distribution monitoring unit based on the recorded information.

Step 10 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

7.3.2 Replacing the LCD

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new LCD is intact.

Context

To replace the LCD, you do not need to disconnect the AC input to the power system.

Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

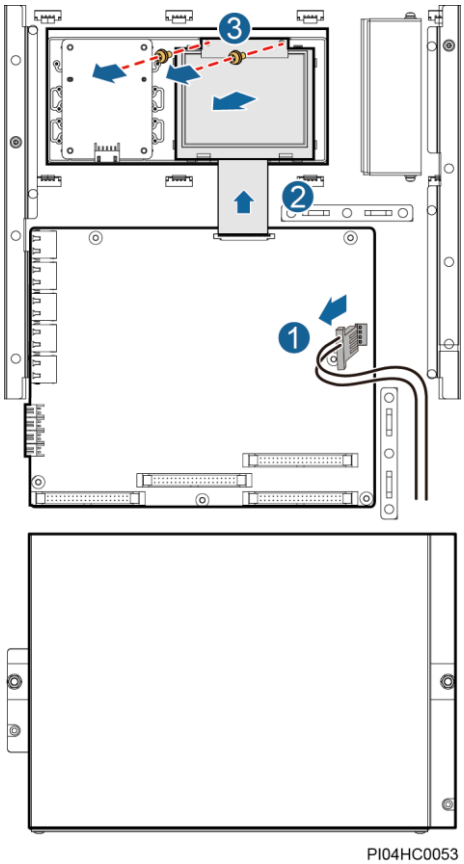
Step 2 Record the positions of cables connected to RJ45 ports on the power distribution monitoring unit, and disconnect the cables from the ports.

Step 3 Unscrew and remove the cover from the power distribution monitoring unit, as shown in Figure 1.

Step 4 Remove the LCD, as shown in Figure 7-17.

1. Disconnect the input power cable from the J98 port on the signal sampling board.
2. Disconnect the LCD flat cable from the signal sampling board.
3. Unscrew and remove the LCD.

Figure 7-17 Removing an LCD

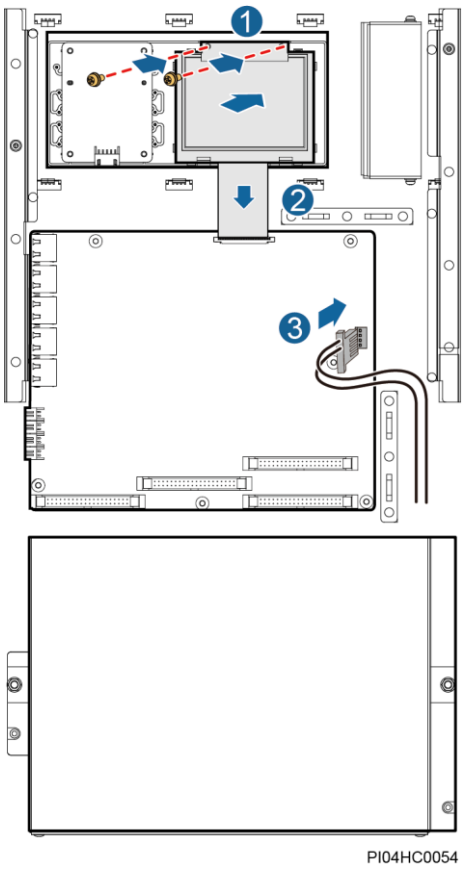


Step 5 Install the new LCD, as shown in Figure 7-18.

1. Place the new LCD in position and tighten the screws.

2. Connect the LCD flat cable to the signal sampling board.
3. Reconnect the input power cable to the J98 port on the signal sampling board.

Figure 7-18 Installing an LCD



Step 6 Place the cover on the power distribution monitoring unit, and tighten the screws.

Step 7 Reconnect the cables to the RJ45 ports on the power distribution monitoring unit based on the recorded information.

Step 8 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

7.3.3 Replacing the Button Board

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new button board is intact.

Context

To replace the button board, you do not need to disconnect the AC input to the power system.

Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

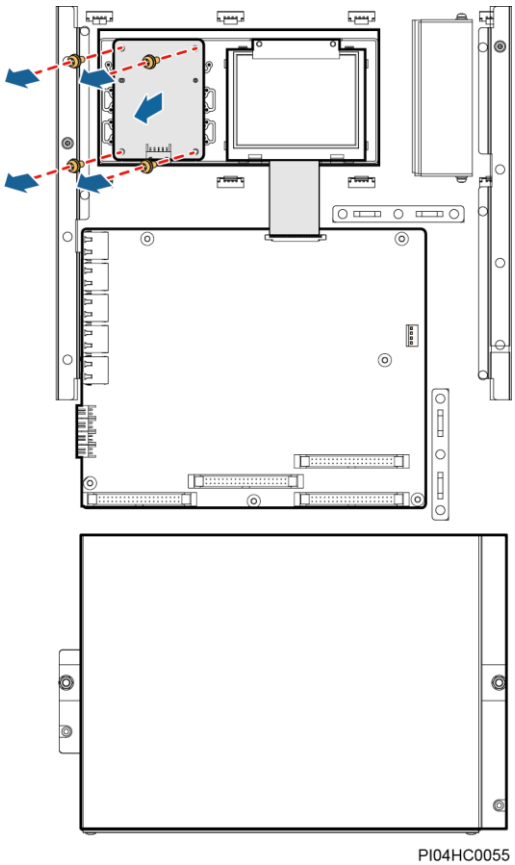
Step 2 Record the positions of cables connected to RJ45 ports on the power distribution monitoring unit, and disconnect the cables from the ports.

Step 3 Remove the cover from the power distribution monitoring unit, as shown in Figure 1.

Step 4 Record the positions of cables connected to the button board, and disconnect the cables.

Step 5 Unscrew and remove the button board, as shown in Figure 7-19.

Figure 7-19 Removing a button board



Step 6 Place the new button board in position and tighten the screws.

Step 7 Reconnect the cables to the button board based on the recorded information.

Step 8 Place the cover on the power distribution monitoring unit, and tighten the screws.

Step 9 Reconnect the cables to the RJ45 ports on the power distribution monitoring unit based on the recorded information.

Step 10 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

7.3.4 Replacing the Signal Transfer Board

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new signal transfer board is intact.

Context

Disconnect the AC input to the power system only when you need to replace the signal transfer board for the power distribution monitoring unit in an AC cabinet.

DANGER

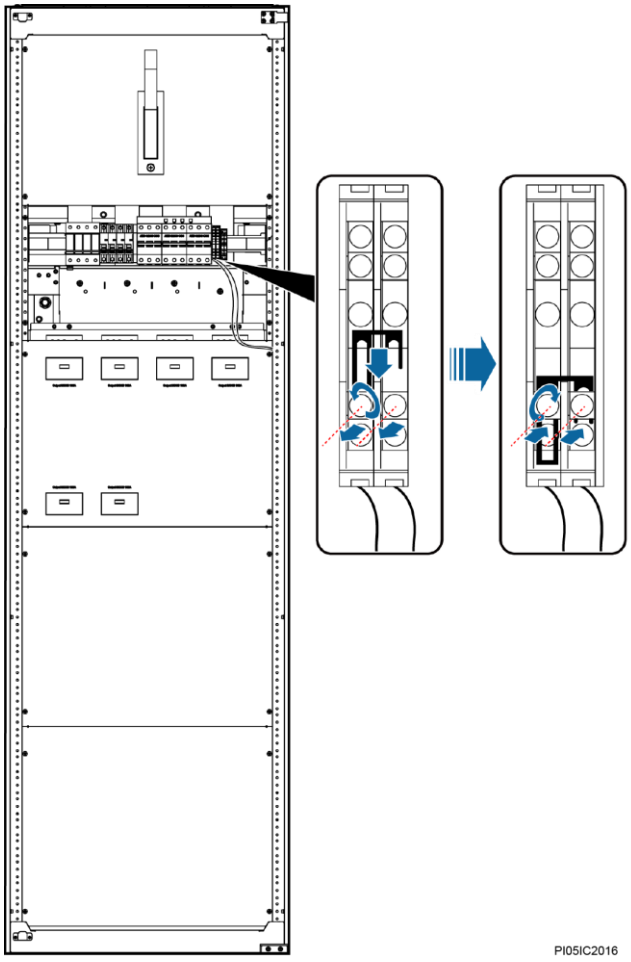
Do not perform operations with power on because the signal transfer board for the power distribution monitoring unit in an AC cabinet has dangerous voltages.

Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 2 Loosen the screws on the maintenance terminal of the AC transformer in the AC cabinet. After the metal bridgeware slides down to short-circuit the maintenance terminal, tighten the screws, as shown in Figure 7-20.

Figure 7-20 Short-circuiting a maintenance terminal



NOTE

If the power distribution monitoring unit is not connected to the AC cabinet, skip Step 2 and Step 12.

Step 3 Record the positions of cables connected to RJ45 ports on the power distribution monitoring unit, and disconnect the cables from the ports.

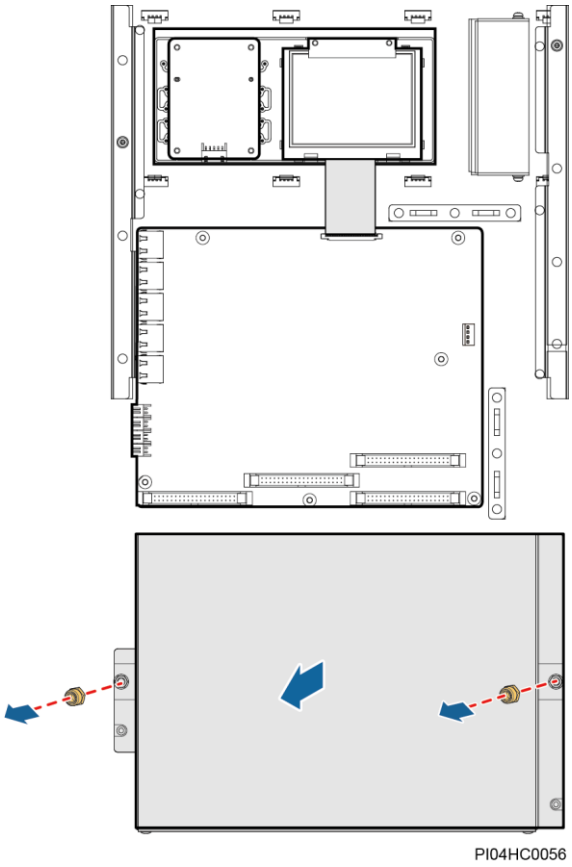
Step 4 Unscrew and remove the cover from the power distribution monitoring unit, as shown in Figure 1.

Step 5 Unscrew and remove the cover from the signal transfer board, as shown in Figure 7-21.

NOTICE

Use an M4 hex key to unscrew the cover of the signal transfer board.

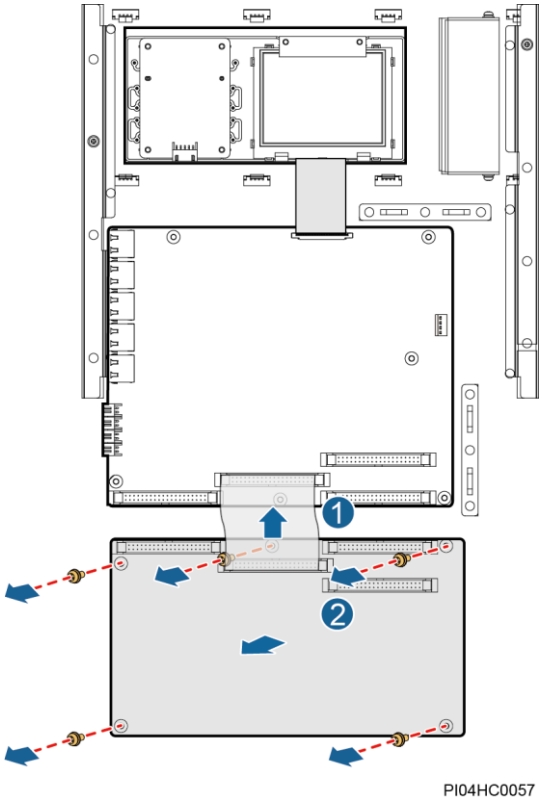
Figure 7-21 Removing the cover from a signal transfer board



Step 6 Remove the signal transfer board, as shown in Figure 7-22.

1. Record the positions of cables connected to the signal transfer board, and disconnect the cables.
2. Unscrew and remove the signal transfer board.

Figure 7-22 Removing a signal transfer board



Step 7 Place the new signal transfer board in position and tighten the screws.

Step 8 Connect the cables to the new signal transfer board based on the recorded information.

Step 9 Place the cover on the signal transfer board, and tighten the screws.

Step 10 Place the cover on the power distribution monitoring unit, and tighten the screws.

Step 11 Reconnect the cables to the RJ45 ports on the power distribution monitoring unit based on the recorded information.

Step 12 Loosen the screws on the maintenance terminal of the AC transformer in the AC cabinet, move the metal bridgeware to the original position, and tighten the screws.

Step 13 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

7.4 Replacing an AC SPD

Prerequisites

- You have obtained an ESD wrist strap, a pair of ESD gloves, an ESD box or bag, a tool kit, and the cabinet door key.
- The new AC SPD is intact and the indication window is green.

DANGER

Do not replace an AC SPD during a thunderstorm.

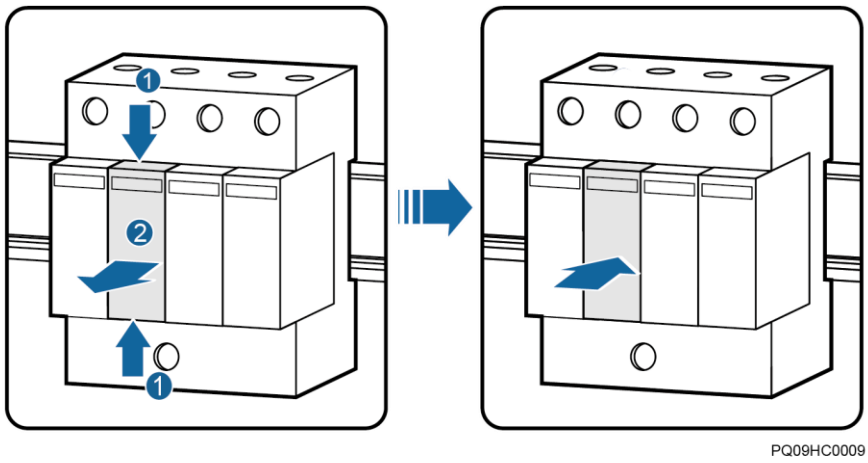
Procedure

Step 1 Connect the ground cable for the ESD wrist strap, and put on the ESD wrist strap and ESD gloves.

Step 2 Hold down the faulty AC SPD and pull it out, as shown in Figure 7-23.

Step 3 Install the new AC SPD, as shown in Figure 7-23.

Figure 7-23 Replacing an AC SPD



Step 4 Disconnect the ground cable for the ESD wrist strap, and take off the ESD wrist strap and ESD gloves.

----End

Follow-up Procedure

Check that the alarm for the AC SPD is cleared.

7.5 Replacing a Circuit Breaker

Prerequisites

DANGER

Before replacing an AC circuit breaker, switch off the upstream input circuit breaker.

- The cabinet door key, insulation tape, and required tools are available.

- The new circuit breaker is intact and has the same specifications as the circuit breaker to be replaced.

Procedure

Step 1 Switch off the circuit breaker that is to be replaced.

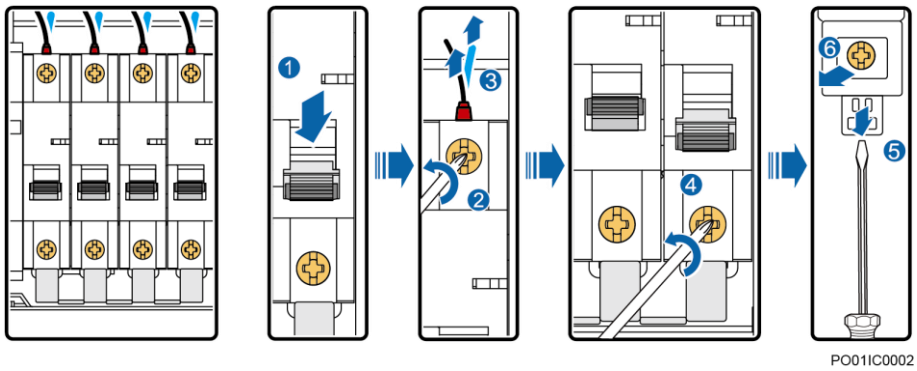
Step 2 Record the positions where the output cable and signal cable terminals connect to the circuit breaker.

Step 3 Loosen the screw that secures the upper port of the circuit breaker using a Phillips screwdriver, and remove the output power cable and signal cable terminals. Wrap the cable and terminals using insulation tape.

Step 4 Loosen the screw that secures the lower port of the circuit breaker using a Phillips screwdriver, and open the buckle at the base of the circuit breaker using an insulated flat-head screwdriver.

Step 5 Remove the circuit breaker from the guide rail. Figure 7-24 shows how to remove the circuit breaker.

Figure 7-24 Removing the circuit breaker



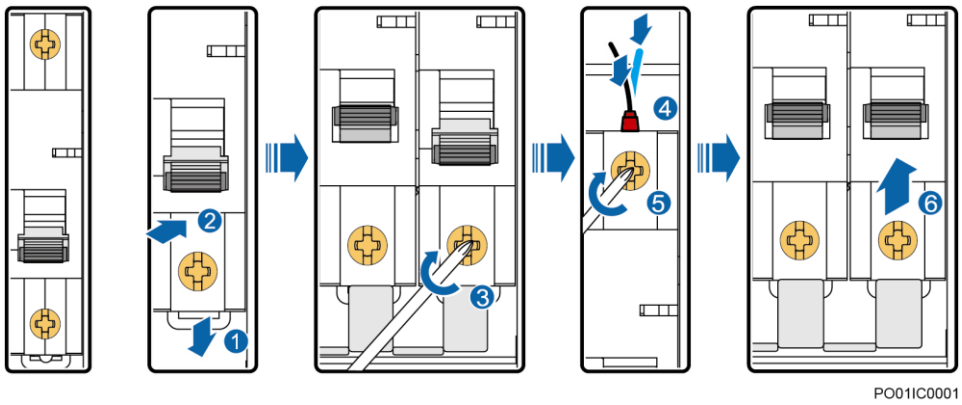
Step 6 Switch off the new circuit breaker. Press the buckle at the circuit breaker base using an insulated flat-head screwdriver and install the new circuit breaker. Then remove the screwdriver so that the buckle secures the circuit breaker to the guide rail.

Step 7 Tighten the screw that secures the lower port of the circuit breaker.

Step 8 Remove the insulation tape from the output power cable and signal cable terminals. Then connect the output power cable and signal cable terminals to the upper port of the circuit breaker and tighten the screw.

Step 9 Switch on the circuit breaker. Figure 7-25 shows how to install the new circuit breaker.

Figure 7-25 Installing the new circuit breaker



----End

7.6 Replacing a Fuse

Prerequisites

- You have obtained the cabinet door key and tool kit.
- The new fuse is intact and it is the same model as the old fuse.

Context

⚠ CAUTION

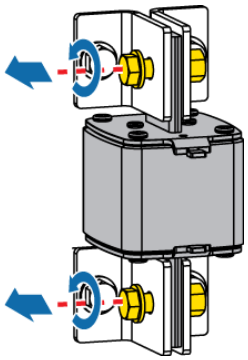
- Replacing an intact fuse will disconnect the power supply to loads. Obtain the customer's consent before replacement.
- If the fuse is in the battery route, change the system output voltage to the same as the battery voltage.

Fuses are hot-swappable. You do not need to disconnect the AC input to the power system.

Procedure

Step 1 Loosen the bolts that secure the fuse, as shown in Figure 7-26.

Figure 7-26 Loosening bolts



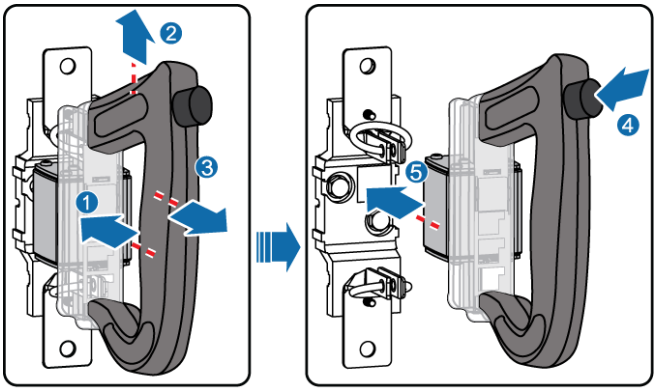
NOTE

If the fuse is not secured by bolts, skip Step 1 and Step 4.

Step 2 Remove the fuse, as shown in Figure 7-27.

1. Insert the two heads of the fuse extracting unit into the mounting ears of the fuse.
2. Move the fuse extracting unit upwards to lock the fuse.
3. Hold the fuse extracting unit and pull out the fuse.
4. Press the button on the fuse extracting unit.
5. Move the fuse away from the fuse extracting unit.

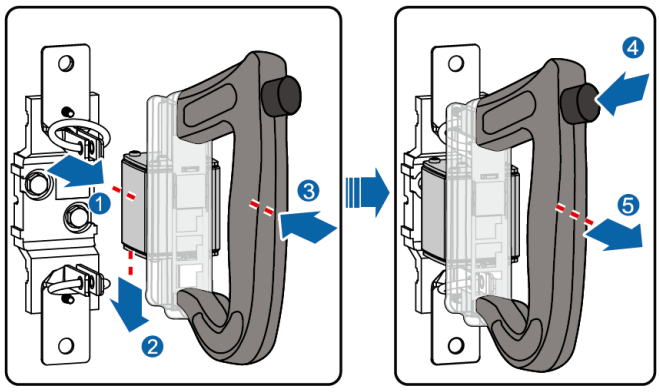
Figure 7-27 Removing a fuse



Step 3 Install the new fuse, as shown in Figure 7-28.

1. Insert the mounting ears of the new fuse into the two heads of the fuse extracting unit.
2. Move the fuse to lock it into the fuse extracting unit.
3. Hold the fuse extracting unit, align the fuse with the fuse base, and insert the fuse into the fuse base.
4. Press the button on the fuse extracting unit.
5. Move the fuse away from the fuse extracting unit.

Figure 7-28 Installing a fuse



Step 4 Tighten bolts to secure the fuse.

----End

8 Emergency Handling

8.1 Background

To ensure the DC supply remains uninterruptible, take emergency measures to rectify any DC output faults.

DC output faults include:

- AC power distribution circuits are irrecoverably damaged.
- DC loads or DC power distribution components are short-circuited.
- Rectifiers shut down because the SMU is out of control.
- Rectifiers lock out due to DC output overvoltage.
- Disasters occur.

8.2 AC Power Distribution Faults

If the AC input to rectifiers is interrupted due to AC PDU faults, connect AC input power cables to rectifier circuit breakers.

8.3 AC Power Failure

If an AC power failure will be rectified soon, use batteries to power DC loads. If an AC power failure will last a long time or is caused by unknown reasons, start a diesel generator (D.G.). You are advised to keep the D.G. running for at least 5 minutes before switching the power system to the D.G. mode to minimize the impact of D.G. startup on power equipment. You also need to switch on rectifier input circuit breakers one by one to minimize the impact of rectifier startup on the D.G.

8.4 DC Power Distribution Faults

If a DC power distribution unit (PDU) is faulty, take emergency measures as follows:

1. Load short-circuit: Remove the corresponding load fuse. If you need to replace the fuse immediately, check that the fuse can be replaced with the power off.

2. Power distribution short-circuit: DC power distribution short circuits caused by misoperations or force majeure will severely affect the security of communications equipment. Countermeasures include:
   - Disconnect the AC supply.
   - Disconnect battery strings from the power system.
   - Use batteries or rectifiers to directly power the loads.

8.5 Disasters

Disasters include communications equipment failures caused by lightning strikes, water damage, earthquakes, or fires. Take precautions against disasters that could severely affect communications security, and ensure that suitable countermeasures, personnel, material resources, regulations, and repair procedures are available at the local communications site to handle any emergencies.

A Technical Specifications

Table A-1 Technical specifications for the combined cabinet

Category	Item	Specifications
Environment	Operating temperature	–10°C to +45°C
	Transport temperature	–40°C to +70°C
	Storage temperature	–40°C to +70°C
	Operating humidity	5%–95% RH (non-condensing)
	Storage humidity	≤ 95% RH (non-condensing)
	Altitude	0–4000 m When the altitude ranges from 2000 m to 4000 m, the operating temperature decreases by 1°C for each additional 200 m.
	Other requirements	• There should be no conductive dust, corrosive gas, or explosion hazard. • Dust, corrosive substances, pests, molds, and other indicators should be controlled in accordance with Class 3.1 requirements in ETSI EN 300 019-1-3 (V2.3.2 or later).
AC input	Input system	• TP482000B-N20B1: 220/380 V AC three-phase four-wire • TP482000B-N20B2: 120/208 V AC (three-phase three-wire or three-phase four-wire), compatible with 220/380 V AC three-phase four-wire • TP481200B-N20B1: 220/380 V AC three-phase four-wire • TP481200B-N20B2: 120/208 V AC (three-phase three-wire or three-phase four-wire), compatible with 220/380 V AC three-phase four-wire
	Input frequency	50/60 Hz (range: 45–66 Hz)
	Power factor	≥ 0.99 (rated load)

Category	Item	Specifications
	Total harmonic distortion (THD)	< 5% (rated input; 50%–100% load)
DC output	Output voltage range	–42 V DC to –58 V DC
	Default output voltage	–53.5 V DC
	Output power	Maximum output power = Output power of a single rectifier x Number of rectifiers.
	Regulated voltage precision	≤ ±1%
	Psophometrically weighted noise	≤ 2 mV (300–3400 Hz)
	Peak-to-peak noise	≤ 200 mV (rated input voltage and load; bandwidth ≤ 20 MHz)
AC input protection	AC input overvoltage alarm threshold	290 V AC ±10 V AC (rectifier input voltage), hysteresis ≤ 10 V AC
	AC input undervoltage alarm threshold	170 V AC ±10 V AC (rectifier input voltage), hysteresis ≤ 10 V AC
	AC input overvoltage protection threshold	305 V AC ±10 V AC (rectifier input voltage), 5 V AC ≤ hysteresis ≤ 15 V AC
	AC input undervoltage protection threshold	85 V AC ±3 V AC (rectifier input voltage), hysteresis > 5 V AC, max. undervoltage protection recovery threshold 90 V AC ±3 V AC
DC output protection	DC output overvoltage alarm threshold	Default value: –58.5 V DC ±0.3 V DC
	DC output overvoltage alarm recovery threshold	Default value: –58.0 V DC ±0.3 V DC (0.5 V DC lower than the overvoltage alarm threshold)
	DC output undervoltage alarm threshold	Default value: –45.0 V DC ±0.3 V DC
	DC output undervoltage alarm recovery threshold	Default value: –45.5 V DC ±0.3 V DC (0.5 V DC higher than the undervoltage alarm threshold)
Electromagnetic compatibility (EMC)	Conducted emission (CE)/Radiated emission (RE)	EN300386, Class A
	Harmonic current	EN61000-3-12
	Voltage fluctuation and flicker	EN61000-3-11
	ESD	EN61000-4-2 Enclosure port: 6 kV (criterion B) contact discharge; 8 kV (criterion B) air discharge Signal port: 2 kV (criterion R) contact discharge

Category	Item	Specifications
	Electrical fast transient (EFT)	EN61000-4-4 AC power port: ±2 kV (criterion B); DC power port: ±1 kV (criterion B); signal port: ±1 kV (criterion B)
	Radiated susceptibility (RS)	EN61000-4-3 10 V/m (criterion A)
	Conducted susceptibility (CS)	EN61000-4-6 Power port: 10 V; signal port: 3 V (criterion A)
	Surge susceptibility	EN61000-4-5 AC power port: ±6 kV/3 kA (criterion B) DC output power port: 2 kV in differential mode, 4 kV in common mode (criterion B)
	Voltage dip (DIP)	EN61000-4-11
Others	AC surge protection	Nominal lightning strike discharge current: 20 kA (8/20 μs); maximum lightning strike discharge current: 40 kA (8/20 μs)
	DC surge protection	Differential mode: 10 kA (8/20 μs); common mode: 20 kA (8/20 μs)
	Safety compliance	IEC/EN60950-1/GB4943
	Mean time between failures (MTBF)	500,000 hours (30°C)
Structure	Power system dimensions (H x W x D)	2000 mm x 600 mm x 600 mm
	Weight	< 150 kg (excluding rectifiers)
	Protection level	IP20
	Installation mode	On a concrete floor or ESD floor
	Maintenance mode	• 2400 A cabinet: Maintained from the front or rear (at least 400 mm away from a wall) • 1200 A cabinet: front maintenance
	Cabling mode	AC cables are routed in and out from the bottom or top. DC cables are routed out from the top and can be routed out from the bottom if a side compartment is added.
	Cooling mode	Natural cooling

Table A-2 Technical specifications for AC cabinets

Category	Item	Specifications
Environment	Operating temperature	–10°C to +45°C

Category	Item	Specifications
	Storage temperature	–40°C to +70°C
	Transport temperature	–40°C to +70°C
	Operating humidity	5%–95% RH (non-condensing)
	Storage humidity	5%–95% RH (non-condensing)
	Altitude	0–4000 m When the altitude ranges from 2000 m to 4000 m, the operating temperature decreases by 1°C for each additional 200 m.
	Other requirements	• There should be no conductive dust, corrosive gas, or explosion hazard. • Dust, corrosive substances, pests, molds, and other indicators should be controlled in accordance with Class 3.1 requirements in ETSI EN 300 019-1-3 (V2.3.2 or later).
AC input	Input system	220/380 V AC three-phase, five-wire
	Rated capacity	• TPA38401B-N20B1: 400 A • TPA38631B-N20B1: 600 A
	Rated input line voltage	380 V AC
	Input voltage range	260–530 V AC (line voltage)
	Input frequency	45–66 Hz
Cabinet structure	Dimensions (H x W x D)	2000 mm x 600 mm x 600 mm
	Weight	< 120 kg
	Protection level	IP20
	Installation mode	On a concrete floor or ESD floor
	Cable routing	Routed in and out from the top or bottom
	Maintenance mode	Maintained from the front or rear (at least 650 mm away from a wall)
	Heat dissipation	Natural

Table A-3 Technical specifications for DC cabinets

Category	Item	Specifications
Environment	Operating temperature	–10°C to +45°C
	Storage temperature	–40°C to +70°C
	Transport temperature	–40°C to +70°C
	Operating humidity	5%–95% RH (non-condensing)

Category	Item	Specifications
	Storage humidity	5%–95% RH (non-condensing)
	Altitude	0–4000 m When the altitude ranges from 2000 m to 4000 m, the operating temperature decreases by 1°C for each additional 200 m.
	Other requirements	• There should be no conductive dust, corrosive gas, or explosion hazard. • Dust, corrosive substances, pests, molds, and other indicators should be controlled in accordance with Class 3.1 requirements in ETSI EN 300 019-1-3 (V2.3.2 or later).
DC output	Rated voltage	–53.5 V DC
	Nominal voltage	–48 V DC
	DC output voltage	–42 V DC to –58 V DC
	Maximum output current	• TPD48202B-N20B1: ≤ 2000 A (load output: 2000 A; battery charge current: 400 A) • TPD48302B-N20B1: ≤ 3000 A (load output: 3000 A; battery charge current: 500 A)
	Regulated voltage precision	≤ 1%
	Voltage drop	≤ 500 mV (ambient temperature: 20°C)
Cabinet structure	Dimensions (H x W x D)	2000 mm x 800 mm x 600 mm
	Weight	< 180 kg
	Protection level	IP20
	Installation mode	On a concrete floor or ESD floor
	Cable routing	Routed in and out from the top or bottom
	Maintenance mode	Maintained from the front or rear (at least 650 mm away from a wall)
	Heat dissipation	Natural

B Electrical Conceptual Diagram

Figure B-1 Electrical conceptual diagram of TP482000B-N20B1

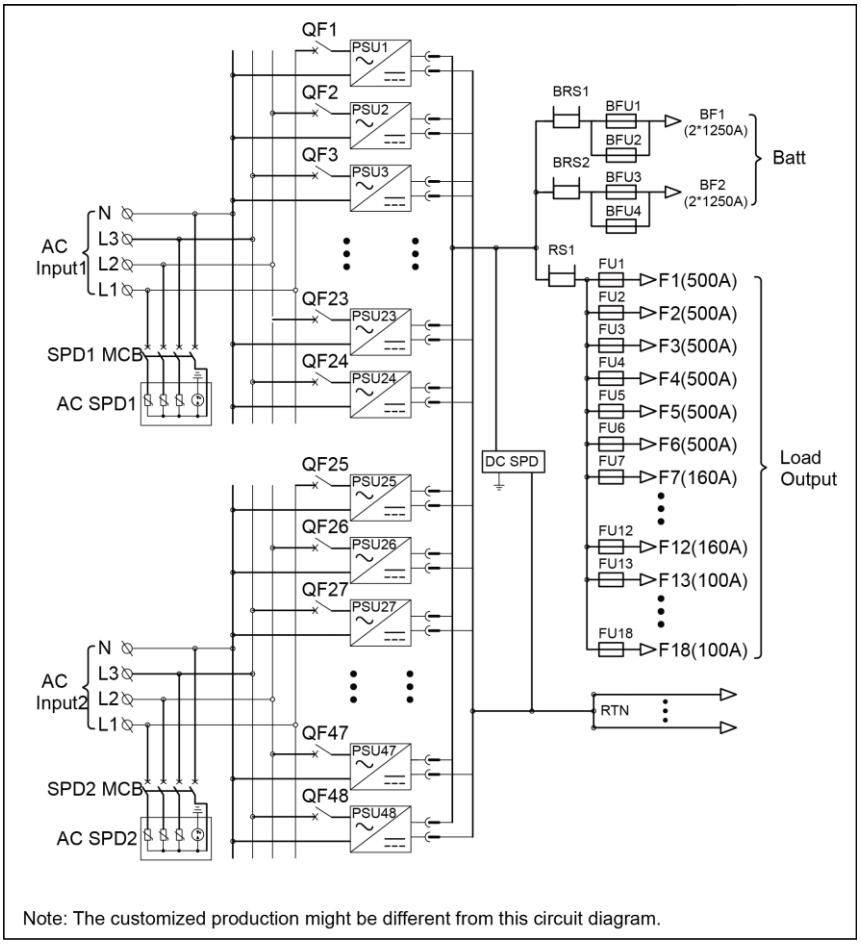


Figure B-2 Electrical conceptual diagram of TP482000B-N20B2

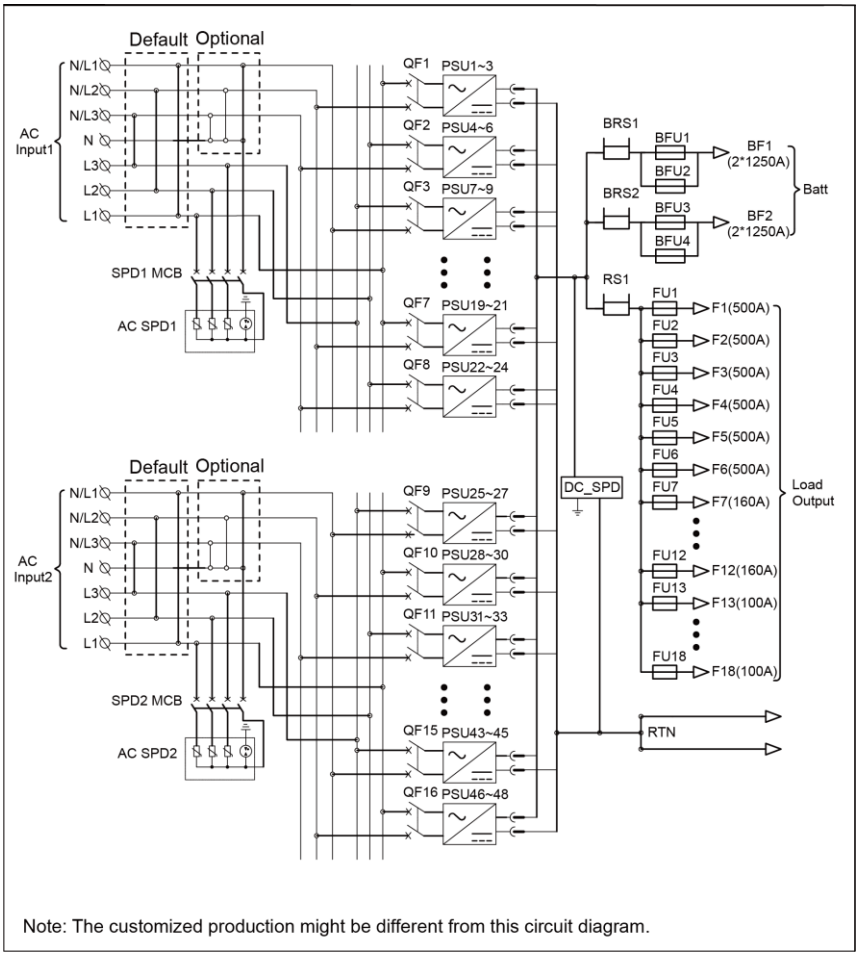


Figure B-3 Electrical conceptual diagram of TP481200B-N20B1

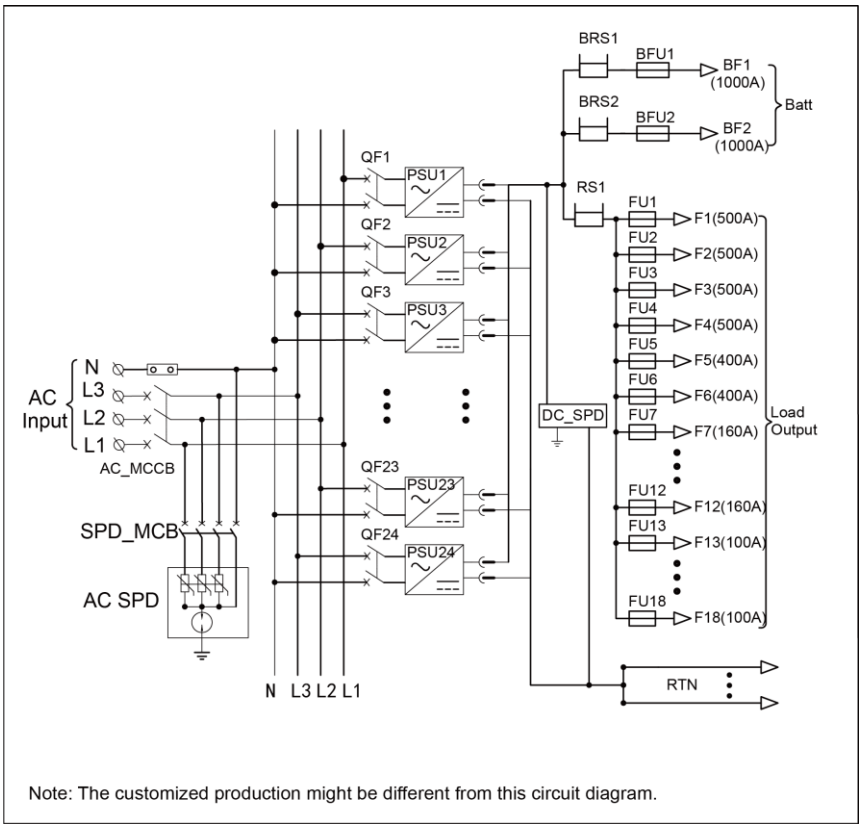


Figure B-4 Electrical conceptual diagram of TP481200B-N20B2

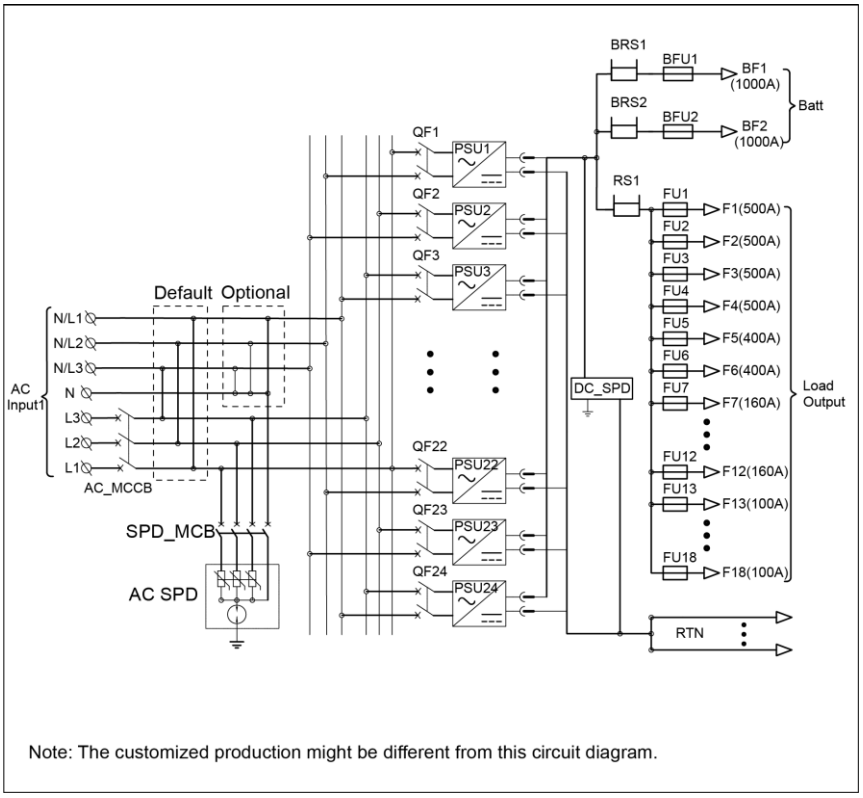


Figure B-5 Electrical conceptual diagram of TP483000D AC

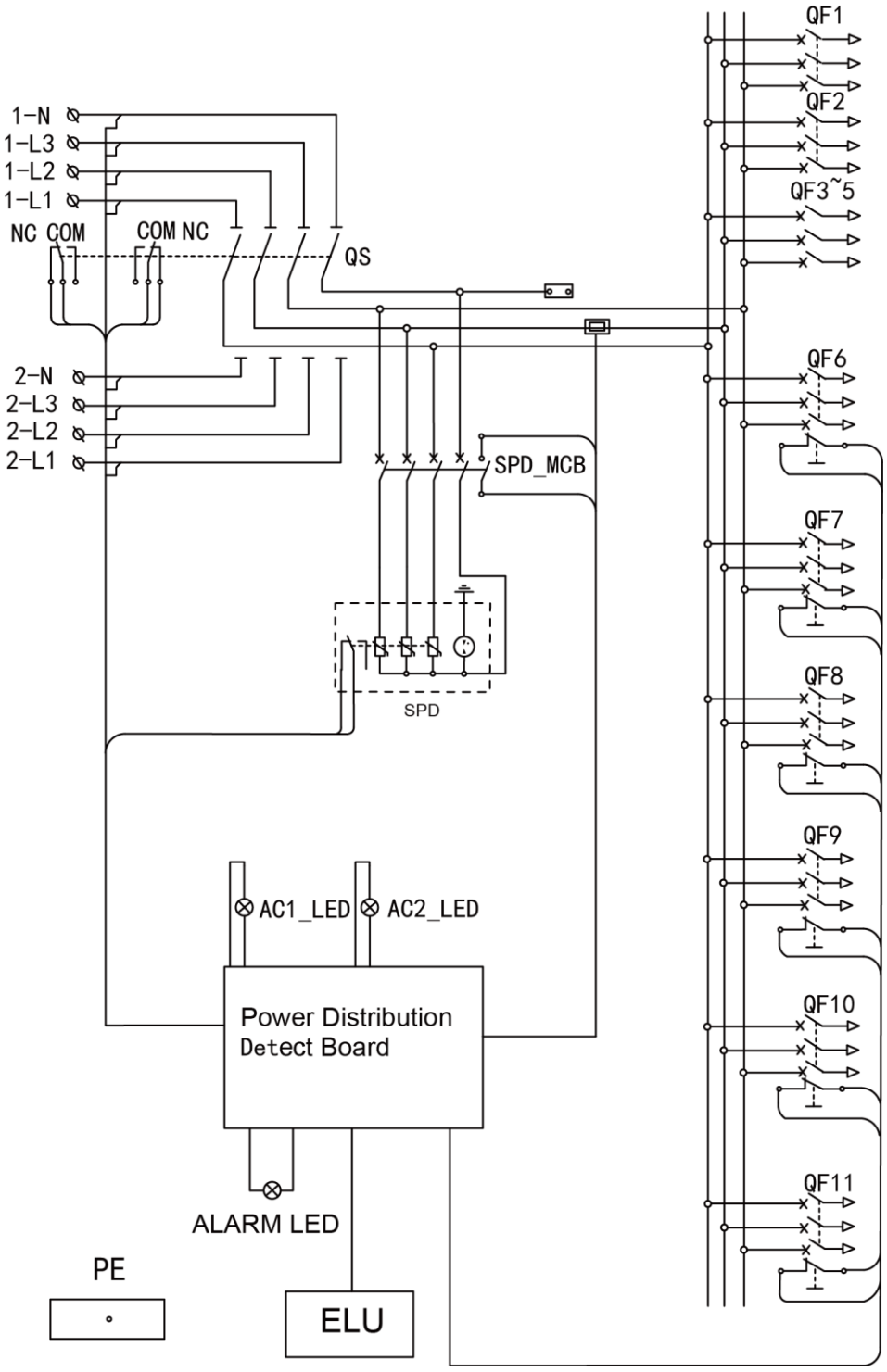
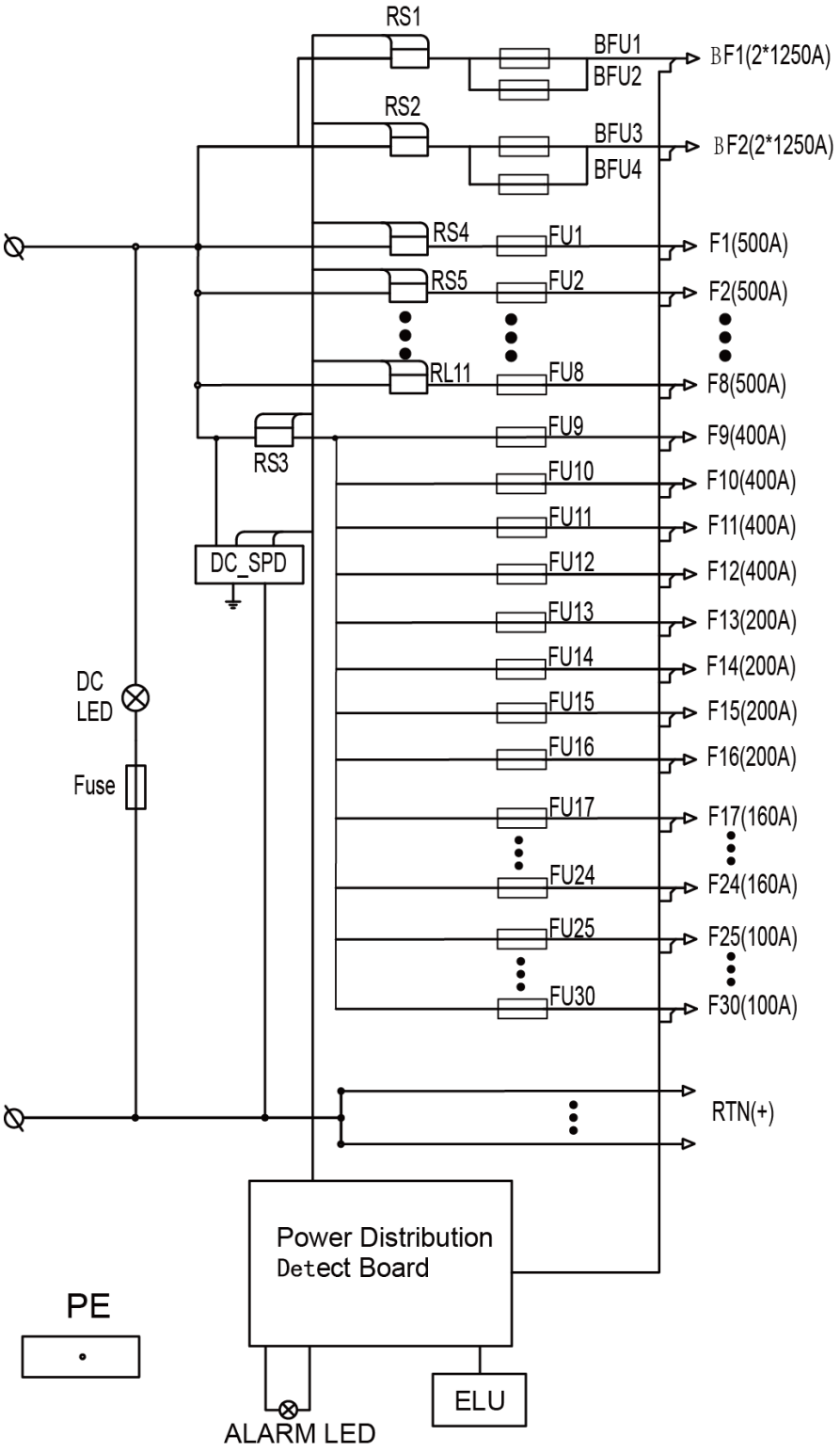


Figure B-6 Electrical conceptual diagram of TP483000D DC



C Engineering Design Drawings

Figure C-1 Engineering design drawing for the 1200 A cabinet

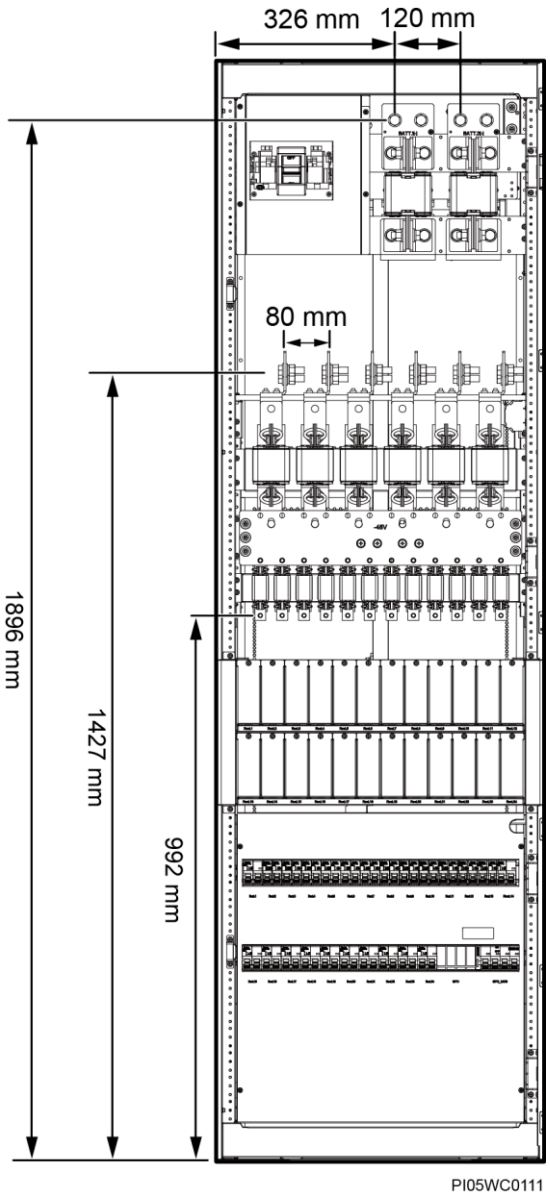
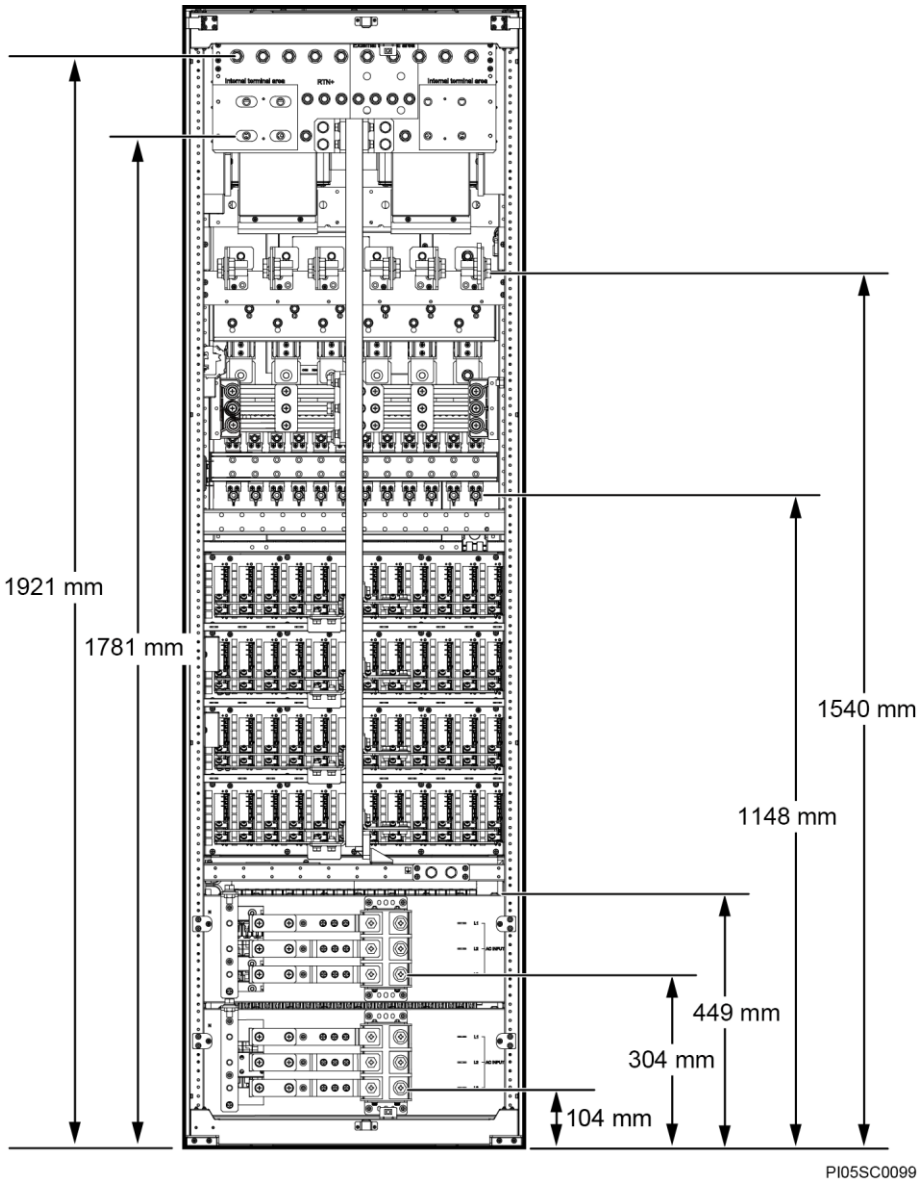


Figure C-2 Engineering design drawing for the 2400 A cabinet#fig1747175074710



D Maintenance Record Forms

This section describes maintenance record forms.

Table D-1 Maintenance registration

Site Name	Site Address	Maintenance Personnel	Maintenance Date

Table D-2 Cabinet maintenance records

No.	Maintenance Item	Result	Measures
1	The cabinet paint does not flake and there are no scratches on the cabinet surface.	□ Passed □ Failed	□ Repaint the cabinet. □ Others_____
2	The cabinet is not rusted or corroded.	□ Passed □ Failed	□ Improve the equipment room environment. □ Others_____
3	The door lock is intact.	□ Passed □ Failed	□ Replace the door lock. □ Others_____
4	The front and rear of rectifiers are neither blocked nor dusty.	□ Passed □ Failed	□ Remove the blockage. □ Clean the dust. □ Others_____

Table D-3 AC and DC power distribution maintenance records

No.	Maintenance Item	Result	Measure
1	No indicator on the SPD is red.	□ Passed □ Failed	□ Replace the SPD. □ Others_____

No.	Maintenance Item	Result	Measure
2	The SPD circuit breaker is intact and ON.	□ ON □ OFF	□ Replace the circuit breaker. □ Switch on the circuit breaker. □ Others_____
3	AC input undervoltage does not occur.	Minimum AC voltage: ____ V AC □ Passed □ Failed	□ Reduce the cable length, or thicken the cable. □ Secure cable connections. □ Provide the voltage data to the power supplier. □ Others_____
4	AC input overvoltage does not occur.	Maximum AC voltage: ____ V AC □ Passed □ Failed	□ Provide the voltage data to the power supplier. □ Others_____
5	The AC input voltage is not open-phase.	□ Passed □ Failed	□ Change the cables. □ Provide the voltage data to the power supplier. □ Others_____
6	The DC output circuit breaker is ON, and the fuse is intact.	□ Passed □ Failed	□ Rectify load faults. □ Switch on the circuit breaker. □ Replace the circuit breaker. □ Replace the fuse. □ Others_____
7	DC busbar overvoltage does not occur.	Busbar voltage: ____ V DC □ Passed □ Failed	□ Replace the rectifier. □ Others_____
8	DC busbar undervoltage does not occur.	Busbar voltage: ____ V DC □ Passed □ Failed	□ Resume the AC power supply. □ Check the load status, and rectify faults. □ Replace the rectifier. □ Others_____
9	The DC busbar temperature does not exceed 95°C at the room temperature.	Busbar temperature: ____°C □ Passed □ Failed	□ Secure busbar connections. □ Check the load status, and rectify faults. □ Others_____

Table D-4 Rectifier maintenance records

No.	Maintenance Item	Result	Measures
1	The green indicator is steady on.	□ Steady on □ Off □ Blinking	□ Change the AC input power cables. □ Replace the rectifier. □ Others_____
2	The yellow indicator is off.	□ Steady on □ Off □ Blinking	□ Clean the air channel. □ Provide the voltage data to the power supplier. □ Change the communications cables. □ Replace the rectifier. □ Others_____
3	The red indicator is off.	□ Steady on □ Off	□ Troubleshoot the external DC power source. □ Replace the rectifier. □ Others_____

Table D-5 SMU maintenance records

No.	Maintenance Item	Result	Measures
1	The green indicator is steady on.	□ Steady on □ Off	□ Change the DC input power cables. □ Change the communications cables. □ Replace the SMU. □ Others_____
2	The red indicator is off.	□ Steady on □ Off	□ Troubleshoot the related parts. □ Replace the SMU. □ Others_____
3	The LCD display is normal.	□ Normal display □ No display	□ Change the LCD flat cable. □ Replace the SMU. □ Others_____
4	The SMU communication with the NMS is normal.	□ Passed □ Failed	□ Change the communications cables. □ Set network parameters again. □ Others_____

Table D-6 SMU parameter maintenance records

No.	Maintenance Item	Result	Measures
1	The battery capacity and number of battery strings displayed on the SMU are the same as the actual data.	Battery capacity: ____ Ah Number of battery strings: ____ □ Passed □ Failed	□ Set battery parameters again. □ Others_____
2	Check **Charge Current Limit Coefficient**. The value is typically **0.10C10** and adjustable.	Current limit coefficient: ____C10	□ Set the current limit coefficient again. □ Others_____
3	The battery temperature displayed on the SMU is the same as the actual temperature.	Battery temperature: ____°C □ Passed □ Failed	□ Replace the battery temperature sensor. □ Replace the SMU. □ Others_____
4	The total load current displayed on the SMU is the same as the actual current measured by a clamp meter.	Total load current: ____ A □ Passed □ Failed	□ Change the battery monitoring cables. □ Replace the SMU. □ Others_____
5	The battery charge current displayed on the SMU is the same as the actual current measured by a clamp meter.	Charge current: ____ A □ Passed □ Failed	□ Change the battery monitoring cables. □ Replace the SMU. □ Others_____
6	The difference between the DC output voltage displayed on the SMU and the measured DC busbar voltage is within ±0.5 V DC.	Displayed voltage: ____ V DC Busbar voltage: ____ V DC □ Passed □ Failed	□ Secure busbar connections. □ Secure cable connections. □ Replace the SMU. □ Others_____

Table D-7 Cable maintenance records

No.	Maintenance Item	Result	Measures
1	Signal cables and power cables are separately bound.	□ Passed □ Failed	□ Change the cable routing. □ Others_____
2	Cables are at least 20 mm away from negative DC busbars, fuses, and shunts.	□ Passed □ Failed	□ Change the cable routing. □ Others_____

No.	Maintenance Item	Result	Measures
3	All cables are bound properly.	□ Passed □ Failed	□ Bind the cables. □ Others_____
4	Devices in the cabinet have been connected to the cabinet ground bar.	□ Passed □ Failed	□ Connect the intra-cabinet ground cables. □ Others_____
5	The cabinet ground bar is securely connected to the site or equipment room ground point.	□ Passed □ Failed	□ Connect the cabinet ground cables. □ Others_____
6	Ground cables are not rusty.	□ Passed □ Failed	□ Change the rusty cables. □ Others_____
7	The DC RTN+ busbar is grounded.	□ Passed □ Failed	□ Modify the RTN+ busbar ground bar. □ Others_____
8	Cables do not overheat or deteriorate.	□ Passed □ Failed	□ Change the cables. □ Others_____
9	Cables are squeezed and distorted by metal parts.	□ Passed □ Failed	□ Change the cables. □ Others_____
10	No cable passes behind the air exhaust vents of rectifiers.	□ Passed □ Failed	□ Change the cable routing. □ Others_____
11	Power cables use standard terminals.	□ Passed □ Failed	□ Use power cables with standard terminals. □ Others_____

E Acronyms and Abbreviations

A	
ATS	automatic transfer switch
E	
EMC	electromagnetic compatibility
EMS	electromagnetic susceptibility
ESD	electrostatic discharge
F	
FE	fast Ethernet
H	
HTTPS	hypertext transfer protocol secure
L	
LCD	liquid crystal display
M	
MTS	manual transfer switch
S	
SMU	site monitoring unit
SNMP	Simple Network Management Protocol

SPD	surge protection device

