LUNA2000-200KTL-H0 Smart Power Control System

User Manual

Issue	05
Date	2022-06-30

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About This Document

Purpose

This document describes the installation, electrical connections, commissioning, maintenance, and troubleshooting of the LUNA2000-200KTL-H0 Smart Power Control System (also referred to as Smart PCS). Before installing and operating the Smart PCS, ensure that you are familiar with the features, functions, and safety precautions provided in this document.

Intended Audience

This document is applicable to:

- Installers
- Users

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 updates made in previous issues.

Issue 05 (2022-06-30)

Updated **5.7 Connecting AC Power Cables**.

Updated **7 Powering On the Smart PCS**.

Updated **11 Technical Data**.

Updated **C Grid Code**.

Issue 04 (2022-04-20)

Updated **1.5 Mechanical Safety**.

Updated **2.3 Appearance**.

Updated **4.4 Moving the Smart PCS**.

Updated **9.4 Device Replacement**.

Issue 03 (2022-01-15)

Updated **4.7 Installing the Smart PCS on the DCBOX**.

Updated **11 Technical Data**.

Updated **D Contact Information**.

Issue 02 (2021-11-15)

Updated **2.5 Typical Application Scenarios**.

Updated **4.7 Installing the Smart PCS on the DCBOX**.

Updated **5.2 Preparing Cables**.

Updated **5.8 Connecting FE Communications Cables**.

Updated **8.2.2 Setting Protection Parameters**.

Updated **8.2.3 Setting Feature Parameters**.

Updated **8.2.4 Setting Power Adjustment Parameters**.

Issue 01 (2021-08-30)

This issue is used for first office application (FOA).

Contents

1 Safety Information

1.1 General Safety

Statement

Before installing, operating, and maintaining the equipment, carefully read this document and observe all safety instructions provided herein and written on the equipment itself.

The information provided under the **NOTICE**, **CAUTION**, **WARNING**, and **DANGER** headings within this manual is not intended to cover all applicable safety policies, but instead acts as a supplement to the comprehensive safety information provided. The Company will not be liable for any consequences that may arise due to violations of general safety requirements or safety standards concerning the design, production, and usage of the equipment.

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

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

The Company will not be liable for any consequences in any 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, fires, and storms

- Damage during transportation by the customer due to failure to comply with transportation requirements
- Storage conditions that do not meet the requirements specified in this document

General Requirements

DANGER

Ensure that power is off during installation.

- 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.
- 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 activate the fire alarm or call emergency services. Do not enter the affected building under any circumstances.
- Do not obscure, damage, or block any warning labels on the equipment.
- Tighten screws to the specified torque using appropriate tools when installing the equipment.
- Ensure that you are aware of the system's composition and working principles, as well as any relevant national/local standards.
- Repaint any scratched surfaces caused during equipment transportation or installation in a timely manner. Scratched equipment should not be exposed to an outdoor environment for extended periods.
- Do not open equipment panels.
- Do not perform reverse engineering, decompilation, disassembling, disassembly, adaptation, implantation, or other derivative operations on device software. Do not study the internal implementation of the device, obtain the source code of the device software, steal intellectual property rights, or disclose any of the performance test results of the device software.

Personal Safety

- If there is a likelihood of personal injury or equipment damage during operations, immediately stop, report the case to the supervisor, and take feasible protective measures.
- Use tools correctly to prevent personal injury or equipment damage.
- Do not touch the equipment while it is in use, as the enclosure is hot.

1.2 Personnel Requirements

- Installation or maintenance personnel must be well trained, fully understand all 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 all relevant local or nationally required qualifications for special operations (including high-voltage operations, working at heights, and operation of special equipment).
- Only professionals or authorized personnel should replace equipment or components (including software).

NOTE

- Professionals: personnel who are trained or experienced in equipment operations and fully understand the potential hazards involved in equipment installation, operation, and maintenance
- Trained personnel: personnel who are technically trained, have the required experience, are aware of potential hazards during certain operations, and are able to take protective measures to minimize any hazards to themselves and others
- Operators: operations personnel who may come in contact with the equipment, but excluding trained personnel and professionals

1.3 Electrical Safety

Grounding

- 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.
- Ensure that the equipment is connected permanently to the protective ground. Before operating the equipment, check its electrical connection to ensure that it is reliably grounded.

General Requirements

DANGER

Before connecting cables, ensure that the equipment is intact. Otherwise, electric shocks or fire may occur.

- Ensure that all electrical connections comply with local electrical standards.
- Obtain approval from the local electric utility company before connecting the equipment to the grid.
- Ensure that the cables you have prepared meet local regulations.
- Use dedicated insulated tools when performing high-voltage operations.

AC and DC Power

DANGER

Do not install or remove 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.

- Before making electrical connections, switch off the corresponding disconnectors on the AC and DC sides to cut the power supply if people may contact energized components.
- Before connecting a power cable, check that the label on the power cable is correct.
- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.

Cabling

- When routing cables, ensure at least 30 mm clearance between the cables and heat-generating components or areas. This prevents damage to the insulation layer of the cables.
- 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 the cables are properly connected and insulated, and meet specifications.

1.4 Installation Environment Requirements

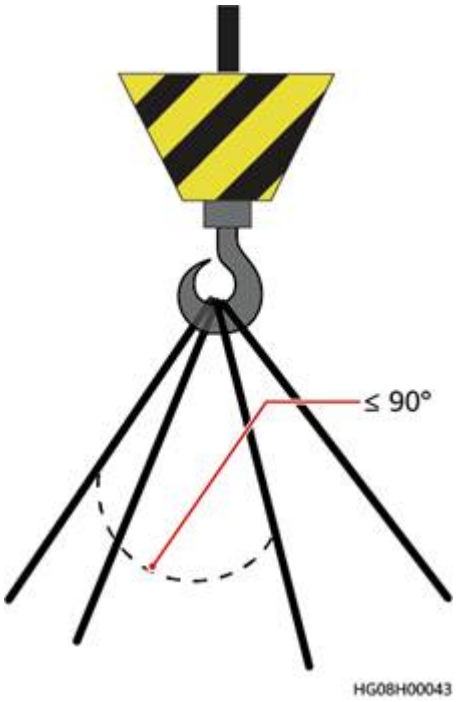
- Ensure that the equipment is installed in a well ventilated environment.
- To prevent fire due to high temperature, ensure that the ventilation vents or heat dissipation system are not blocked when the equipment is running.
- Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.

1.5 Mechanical Safety

Hoisting

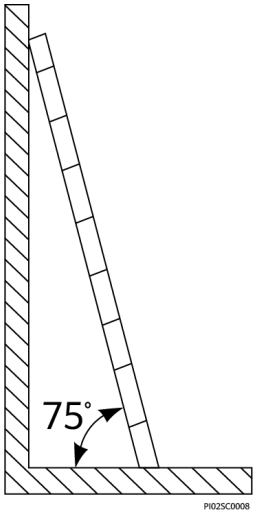
- The foundation where hoisting is performed on must meet the load-bearing requirements.
- Before hoisting objects, ensure that hoisting tools are firmly secured onto a fixed object or wall that meets the load-bearing requirements.
- Do not drag steel ropes and hoisting tools or bump the hoisted objects against hard objects during hoisting.
- During hoisting, do not stand or walk under the crane or the hoisted objects.
- Install temporary warning signs or fences to isolate the hoisting area.

- Ensure that the angle between two hoisting ropes is no more than 90 degrees, as shown in the following figure.



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

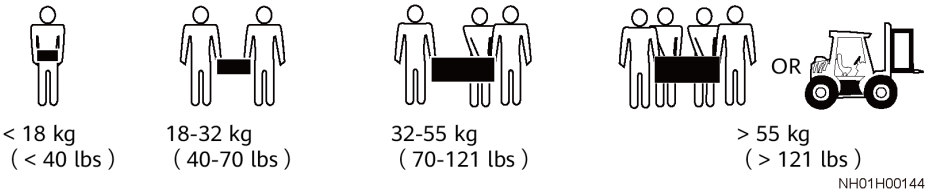
Drilling Holes

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

- 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.

1.6 Maintenance and Replacement

DANGER

High voltage generated by the equipment during operation may cause an electric shock, which could result in death, serious injury, or serious property damage. Prior to maintenance, power off the equipment and strictly comply with the safety precautions in this document and relevant documents.

- Maintain the equipment with sufficient knowledge of this document and using proper tools and testing equipment.
- Before maintaining the equipment, power it off and follow the instructions on the delayed discharge label to ensure that the equipment is powered off.
- Place temporary warning signs or erect fences to prevent unauthorized access to the maintenance site.
- If the equipment is faulty, contact your dealer.
- The equipment can be powered on only after all faults are rectified. Failing to do so may escalate faults or damage the equipment.

2 Product Overview

2.1 Model

Model number

Figure 2-1 Model

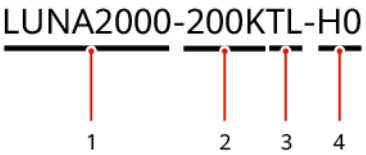


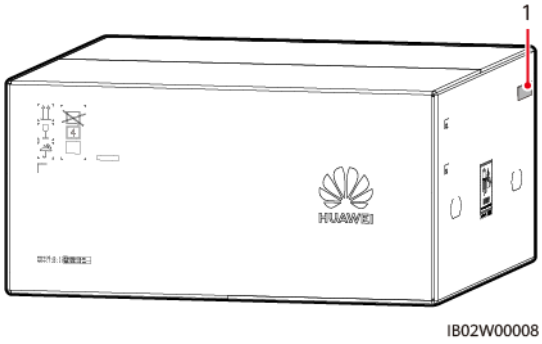
Table 2-1 Model number description

No.	Meaning	Description
1	Product family name	LUNA2000: Smart PCS
2	Power level	200K: The power level is 200 kW.
3	Topology	TL: transformerless
4	Product Code	H0: product series using 1500 V DC voltage

Model Identification

You can obtain details of the device model from the model label on the external package and the nameplate on the side of the enclosure.

Figure 2-2 Position of the model label on the external package



(1) Position of the model label

2.2 Functions and Features

Functions

The Smart PCS is a modular energy storage controller that converts the DC power generated by the batteries into AC power, and then feeds that AC power into the power grid. In addition, it converts AC power from the grid to DC power and stores the DC power in the batteries.

Features

Intelligence

- The DC bus architecture implements high-efficiency charging and discharging.
- Bi-directional and quadrant operation is available for both active and reactive power.
- Modular design: Devices with different power levels can be flexibly combined based on customer requirements to facilitate deployment.
- Smart air cooling: The fan speed can be adjusted based on the ambient temperature and load to maximize the service life of fans and minimize maintenance needs.
- Long-term overload at 110% and short-term overload at 120%.

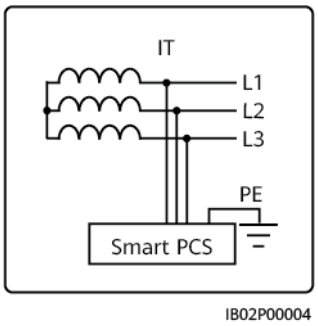
Safety

- DC bus short circuit protection: quick and safe power off in case of a DC bus short circuit.
- Embedded DC and AC surge protection devices (SPDs): all-round surge protection.

Power Grid Type

The Smart PCS supports IT power grids.

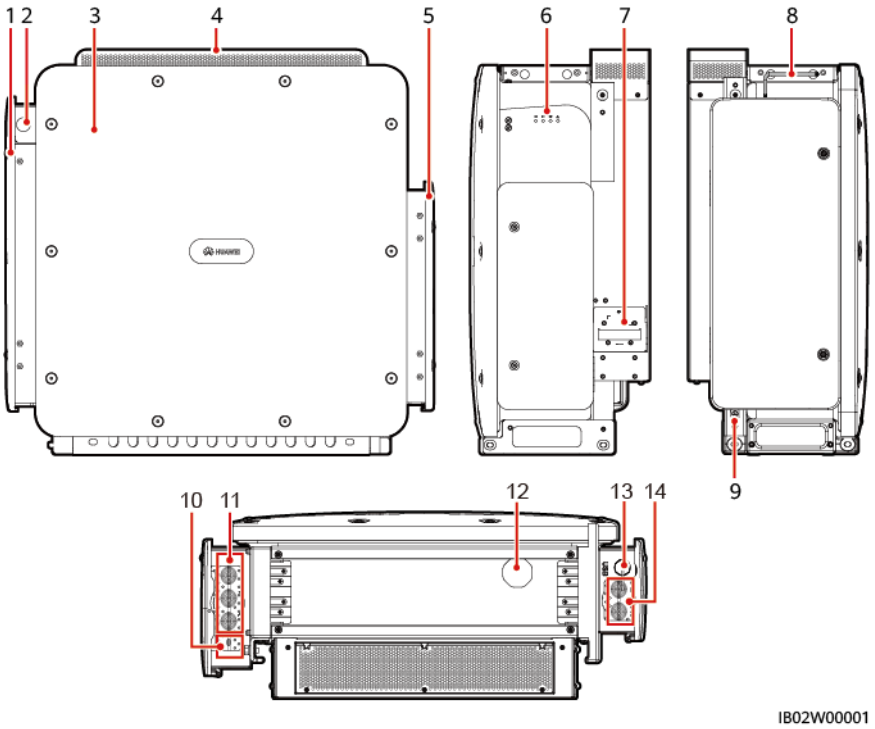
Figure 2-3 Power grid type



2.3 Appearance

Appearance

Figure 2-4 Appearance



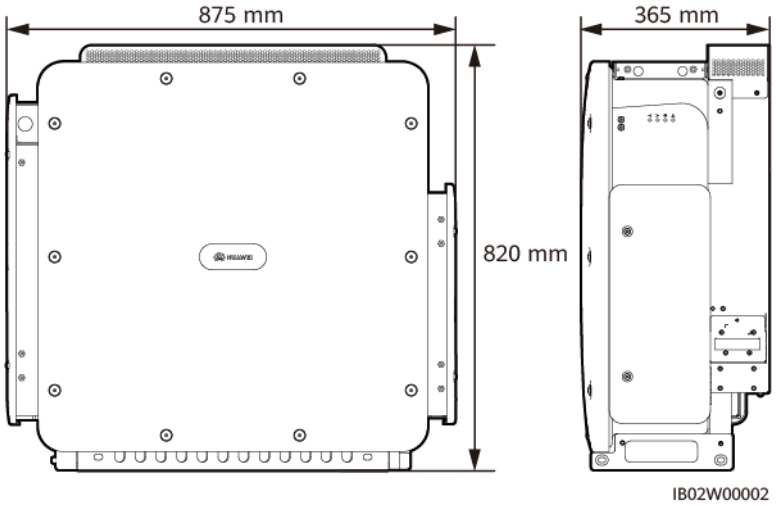
(1) AC maintenance compartment	(2) Communications cable hole (FE)	(3) Panel
(4) Protective cover	(5) DC maintenance compartment	(6) LED indicator
(7) External fan tray	(8) Security Torx wrench[1]	(9) Protective ground point
(10) Communications cable hole (COM)	(11) AC power cable hole	(12) Ventilation valve

(13) USB port	(14) DC power cable hole	NA

Note [1]: The security Torx wrench is delivered with the device and is tied to the bracket on the top of the chassis. Remove the security Torx wrench from the bracket and keep it safe.

Dimensions

Figure 2-5 Dimensions



Safety Label Description

Table 2-2 Safety label description

Label	Name	Description
	Operation warning	Potential hazards exist after the equipment is powered on. Take protective measures when working on the device.
	Burn warning	Do not touch the product, as the shell becomes hot during operation.
	Electric shock hazard warning	There may be a risk of shock when the device is powered on. Take protective measures during operation and maintenance (O&M).

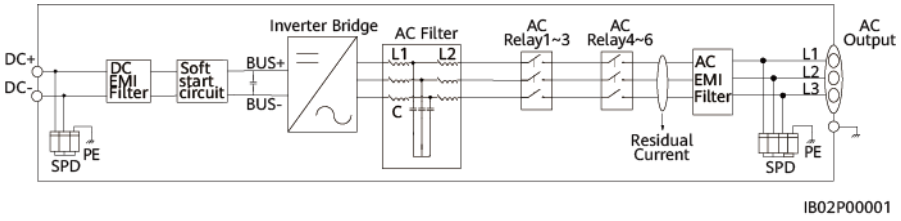
Label	Name	Description
	Delayed discharge	• There may be a risk of shock when the device is powered on. Only qualified and trained electrical technicians should install and operate the device. • Residual voltage exists after the device is powered off. It takes 15 minutes for the device to discharge to a safe voltage.
	Refer to documentation	Instructs operators to refer to the documentation provided with the device.
	Protection ground	Indicates the position for connecting the ground cable.
	Equipotential bonding	Indicates the position for equipotential bonding.
	Fan operation warning	Do not touch the fan when the device is running to avoid injury.
	Fan replacement warning	Disconnect the fan's power connector before replacing it.
	Weight label	Due to its weight, the device should be carried by four persons or by using a forklift.

2.4 Working Principle

2.4.1 Circuit Diagram

The Smart PCS implements rectification and inversion through a three-phase three-level converter. The rectified output is converted from three-phase AC power to DC power and then stored in the energy storage system (ESS). The inverted output is filtered to a three-phase AC voltage, which is then isolated and boosted by a three-phase transformer and fed into the power grid.

Figure 2-6 Circuit Diagram



2.4.2 Working Modes

The Smart PCS can work in standby, operating, or shutdown mode.

Figure 2-7 Working mode

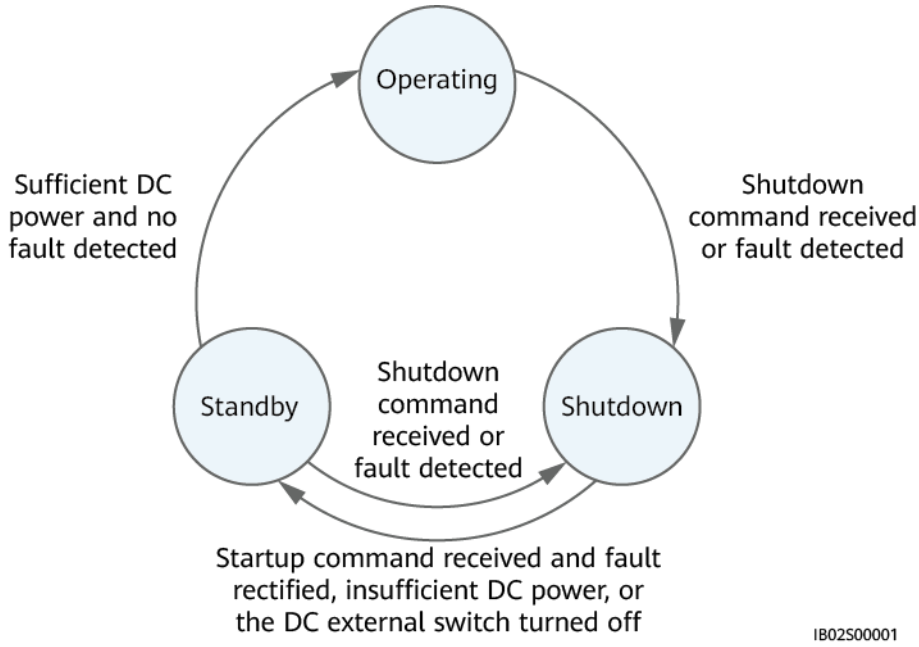


Table 2-3 Working mode description

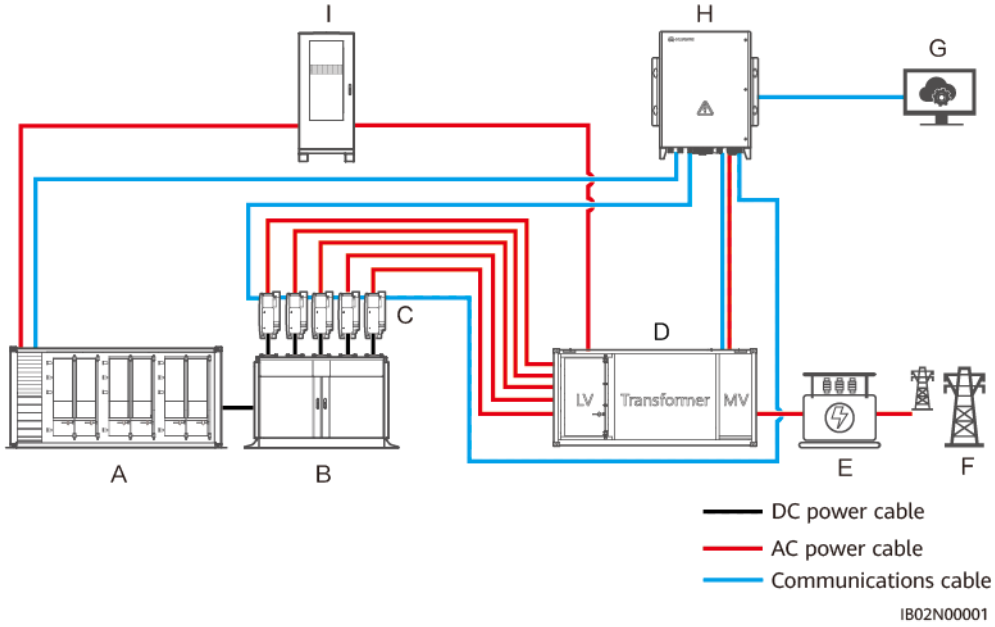
Working Modes	Description
Standby	The Smart PCS enters Standby mode when the external environment does not meet the operating requirements. In standby mode: • The Smart PCS continuously performs status check and enters Operating mode once the operating requirements are met. • The Smart PCS enters Shutdown mode upon receiving a shutdown command or detecting a fault after startup.

Working Modes	Description
Operating	In operating mode: • The Smart PCS controls charge and discharge based on system commands. • The Smart PCS enters Shutdown mode after detecting a fault or receiving a shutdown command.
Shutdown	• In Standby or Operating mode, the Smart PCS enters Shutdown mode after detecting a fault or receiving a shutdown command. • In Shutdown mode, the Smart PCS enters Standby mode when a startup command is received and faults are rectified, the DC power is insufficient, or the DC external switch is turned off.

2.5 Typical Application Scenarios

The system consists of the Smart ESS (including the Smart Rack Controller), DC LV Panel, Smart PCS, Smart Transformer Station, Distribution Transformer, and step-up transformer.

Figure 2-8 Networking application



(A) Smart ESS
(B) DC LV Panel
(C) Smart PCS
(D) Smart Transformer Station (STS)
(E) Step-up transformer
(F) Power grid
(G) Management system
(H) Smart Array Controller
(I) Distribution Transformer

3 Storage

NOTICE

- Do not transport devices without appropriate packaging.
- Do not tilt the packaging or place it upside down.

If the Smart PCS is not installed immediately, it should be stored according to the requirements outlined in this section. Store the packaged Smart PCS in a ventilated, dry, and clean indoor environment. In addition, ensure that the following requirements are met:

- Place the Smart PCS inside the original packaging with the desiccant bag, and seal it using tape.
- Store the Smart PCS in a clean and dry place, away from wet floors and protected from dust and corrosion caused by water vapor or rain.
- Maintain a storage temperature between –40°C to +70°C, and humidity between 5%–95% RH. The air must not contain corrosive or flammable gases.
- A maximum of four Smart PCSs can be stacked. To avoid personal injury or device damage, exercise caution when stacking Smart PCSs to prevent them from falling over.
- Check the Smart PCS regularly (recommended: once every three months). Replace any packing materials that become damaged during storage.
- If the Smart PCS has been stored for more than two years, it must be checked and tested by professionals before being put into use.

4 Installation

4.1 Environment Requirements

Basic Requirements

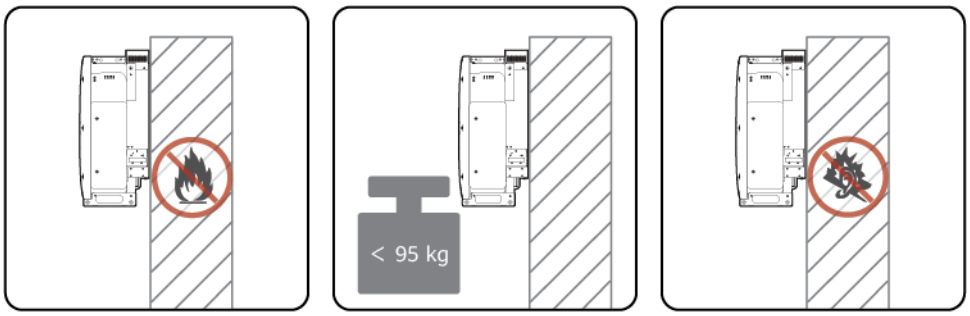
- Do not install the Smart PCS in working or living areas.
- If the device is installed in public places (such as parking lots, stations, and factories) other than working and living areas, install a protective net outside the device and erect a warning sign to isolate it. This is to avoid personal injury or property loss caused by accidental contact or other reasons during device operation.
- Do not install the Smart PCS near flammable materials.
- Do not install the Smart PCS near explosive materials.
- Do not install the Smart PCS near corrosive substances.
- Do not install the Smart PCS where its enclosure and heat sink are easily accessible, as the voltage is high and certain parts become hot during operation.
- The Smart PCS must be installed in a well-ventilated environment to ensure good heat dissipation.
- If the Smart PCS is installed in a closed environment, a heat dissipation or ventilation device must be installed. The indoor ambient temperature cannot be higher than the external ambient temperature.
- You are advised to install the Smart PCS in a sheltered area, or with an awning over it.
- The Smart PCS will become corroded if installed in areas exposed to salt. Before installing the Smart PCS outdoors in such areas, consult with the Company. An area exposed to salt refers to regions within 500 m of the coast, or those exposed to a sea breeze (this can vary due to such weather conditions as typhoons and monsoons, or terrain such as dams and hills).

Mounting Structure Requirements

- The device must be installed in a fireproof structure.

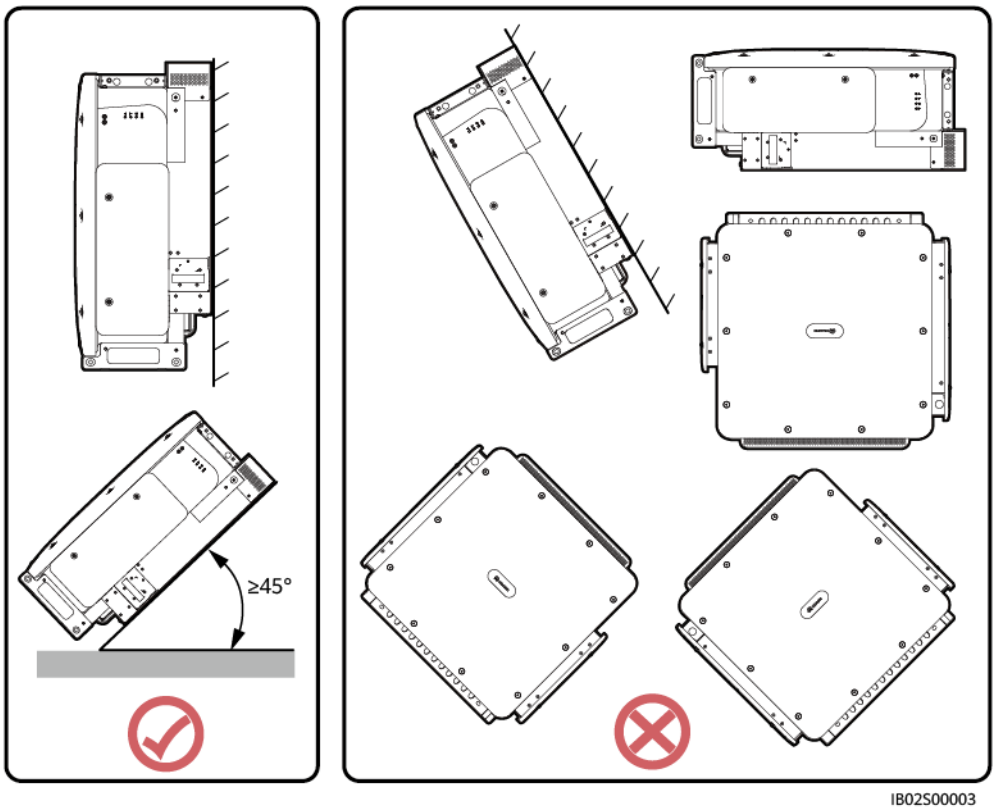
- Do not install the Smart PCS on flammable building materials.
- The Smart PCS is heavy. Ensure that the installation surface is solid enough to bear its weight.
- In residential areas, do not install the Smart PCS on gypsum boards or walls made of similar materials which offer weak sound insulation performance to avoid disturbing residents.

Figure 4-1 Mounting structure



Installation Angle Requirements

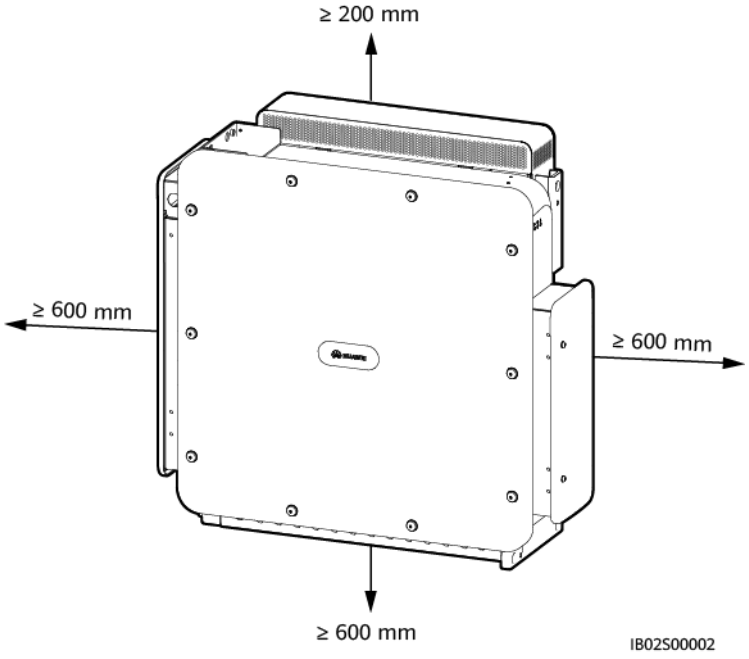
Figure 4-2 Installation angle



Installation Clearance Requirements

Reserve sufficient clearance around the Smart PCS for installation and heat dissipation.

Figure 4-3 Installation clearance (support-mounting and wall-mounting scenarios)



NOTE

For ease of installing the Smart PCS on the mounting bracket, connecting cables, and future maintenance, it is recommended that the bottom clearance be kept between 600 mm and 730 mm. For further questions regarding clearance, consult local technical support engineers.

When installing multiple devices, install them in horizontal mode if sufficient space is available and install them in triangle mode if the space is insufficient. Stacked installation is not recommended.

Figure 4-4 Horizontal installation (recommended)

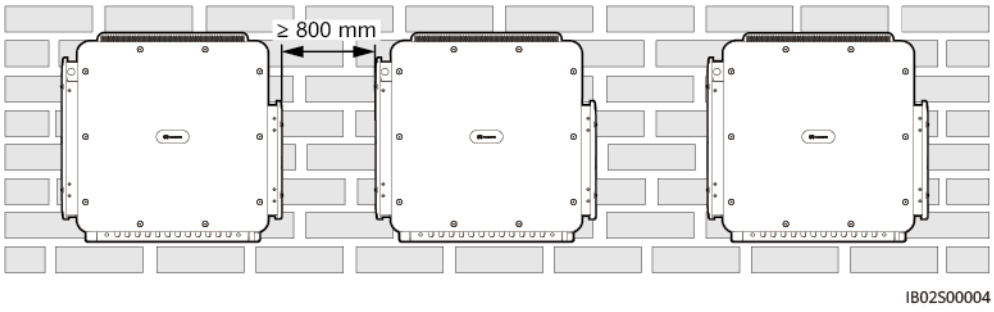


Figure 4-5 Triangle installation (recommended)

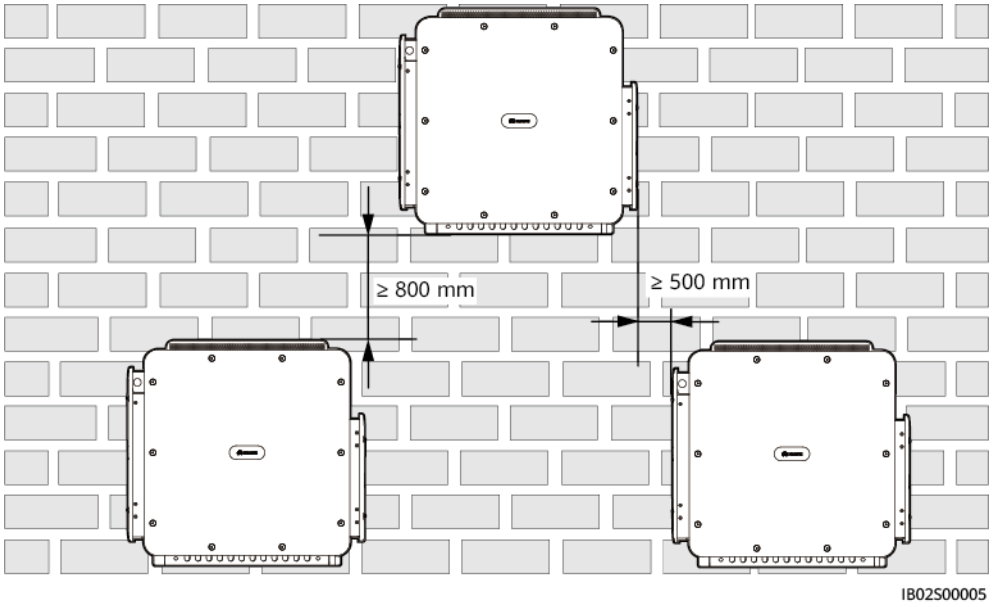
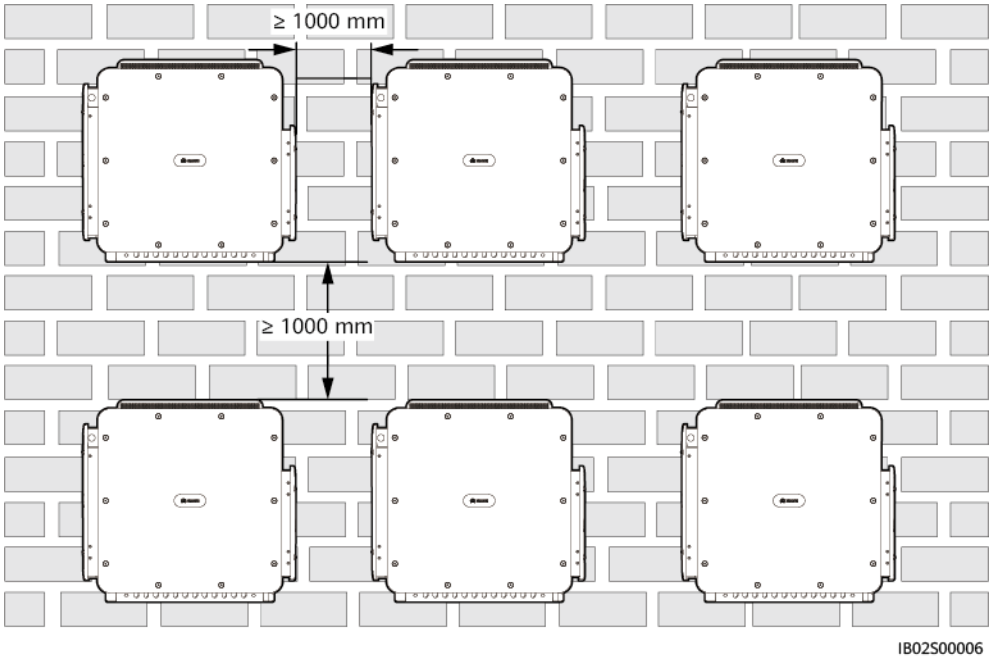


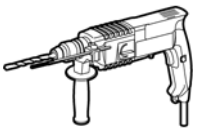
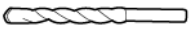
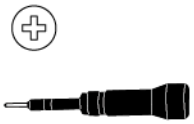
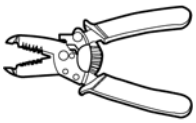
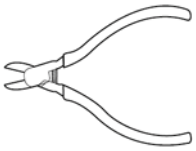
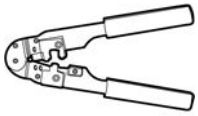
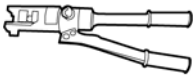
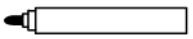
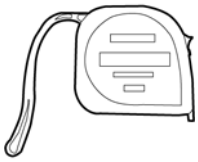
Figure 4-6 Stacked installation (not recommended)

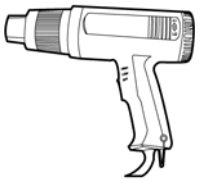


4.2 Preparing Tools

Before installation, the following tools need to be prepared.

Installation Tools

 Hammer drill	 Drill bit (Φ14 mm and Φ16 mm)	 Insulated torque socket wrench (including an extension bar ≥ 50 mm)	 Phillips insulated torque screwdriver
 Wire strippers	 Rubber mallet	 Utility knife	 Diagonal pliers
 Cable cutter	 RJ45 crimping tool	 Vacuum cleaner	 Hydraulic pliers
 Marker	 Steel measuring tape	 Level	 Cable tie

 Heat-shrink tubing	 Heat gun	 Step ladder	 Digital multimeter DC voltage measurement range ≥ 1500 V DC AC voltage measurement range ≥ 800 V AC
 Crane Hoisting capability ≥ 3 t; operation radius ≥ 2 m	 Lifting rope Length of the lifting rope ≥ 1.8 m	-	-

Personal Protective Equipment (PPE)

 Insulated gloves	 Goggles	 Dust mask	 Safety shoes
 Reflective vest	 Safety helmet	 Protective gloves	-

4.3 Pre-installation Checks

Checking the Outer Packing

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

NOTE

You are advised to install the device within 24 hours of removing the outer packing.

Unpacking the Device

Step 1 Use diagonal pliers to cut the packing tape, and use a utility knife to slice the tape along the gaps in the packaging. Take care not to damage the device inside.

Step 2 Open the packaging and check the deliverables.

----End

Checking Deliverables

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

NOTE

For details about the number of accessories delivered with the device, see the *Packing List* included in the packaging.

4.4 Moving the Smart PCS

If the installation position is too high to install the Smart PCS directly on the mounting bracket, run a rope (strong enough to bear the weight of the Smart PCS) through the two lifting eyes, and use it to hoist the Smart PCS.

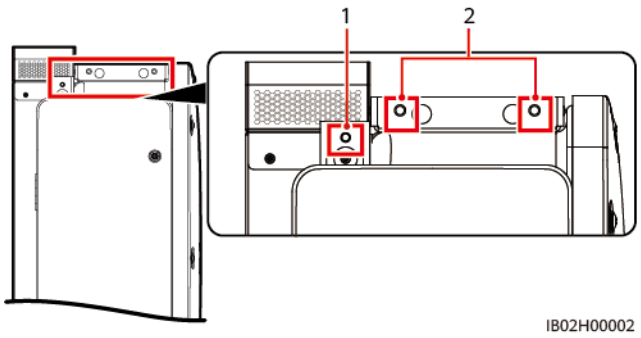
CAUTION

Ensure that the lifting handles are installed to the correct screw holes. Do not install them to the mounting bracket screw holes on the top. Incorrect installation may cause device damage or personal injury.

NOTICE

- Four persons or appropriate transportation tools are required to move the device.
- Place a foam pad or cardboard under the device to protect its enclosure from damage.
- Use lifting handles to facilitate installation, which are optional and delivered separately. Ensure that the lifting handles are securely installed. After the installation is complete, remove the lifting handles and keep them properly.
- To prevent damage to the device surfaces, do not use metal lifting ropes such as steel ropes.
- Slowly and steadily hoist and position the Smart PCS to avoid bumping and damaging the device enclosure.

Hole Description



(1) Lifting handle screw hole

(2) Mounting bracket screw holes

Procedure

Step 1 Remove the device from the packaging and move it to the installation position.

Figure 4-7 Manual handling

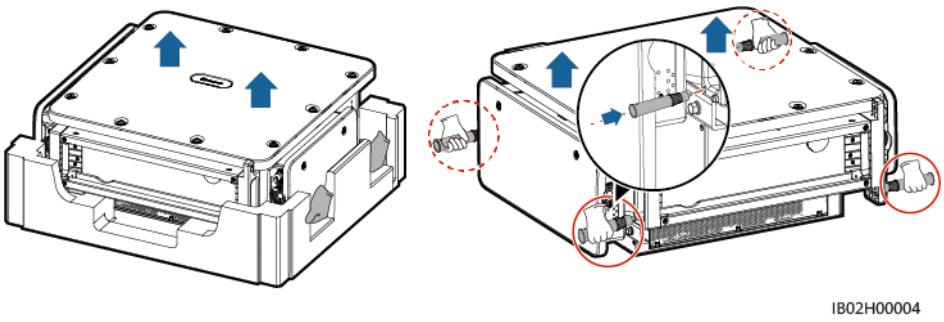
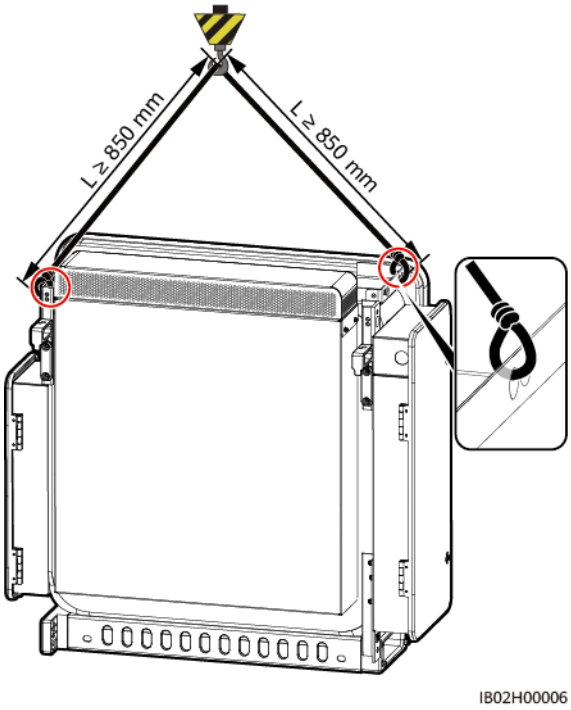


Figure 4-8 Hoisting



----End

4.5 Support-Mounted Installation

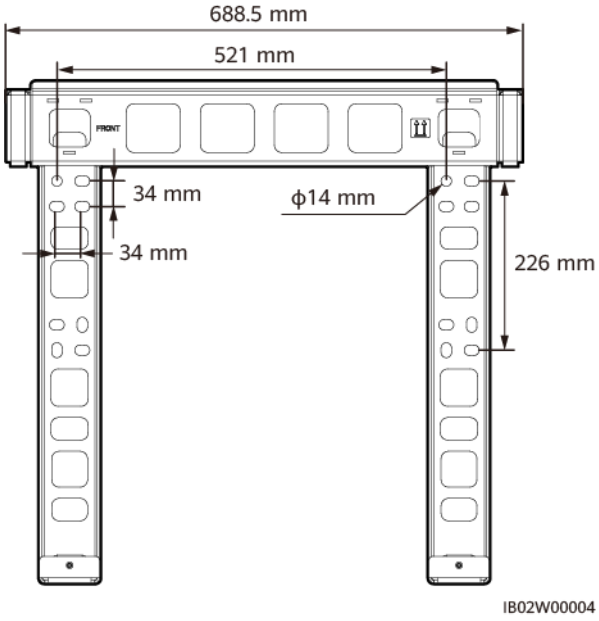
Prerequisites

Purchase the mounting bracket separately from the Company.

Mounting Bracket Dimensions

The Smart PCS mounting bracket has four groups of tapped holes, with each group containing four tapped holes. Mark any hole in each group based on site requirements and mark four holes in total. The two round holes are recommended.

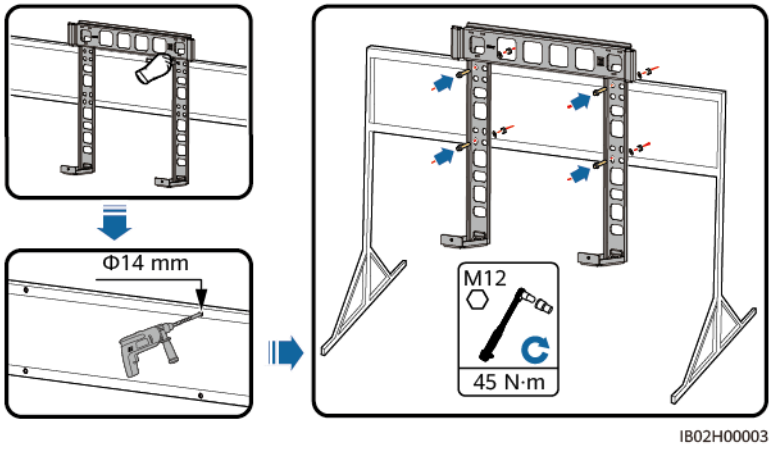
Figure 4-9 Hole dimensions



Installation Procedure

Step 1 Install the mounting bracket.

Figure 4-10 Installing the mounting bracket

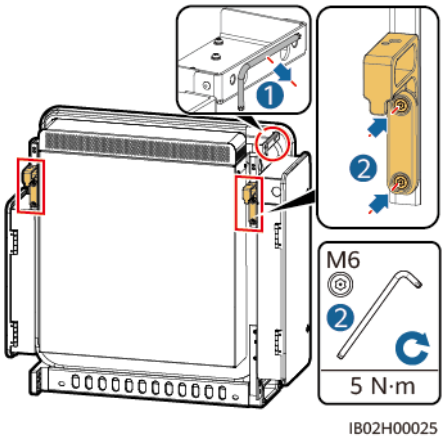


NOTE

If the bolt length does not meet the installation requirements, prepare M12 bolts and use them together with the delivered M12 nuts.

Step 2 Install mounting ears.

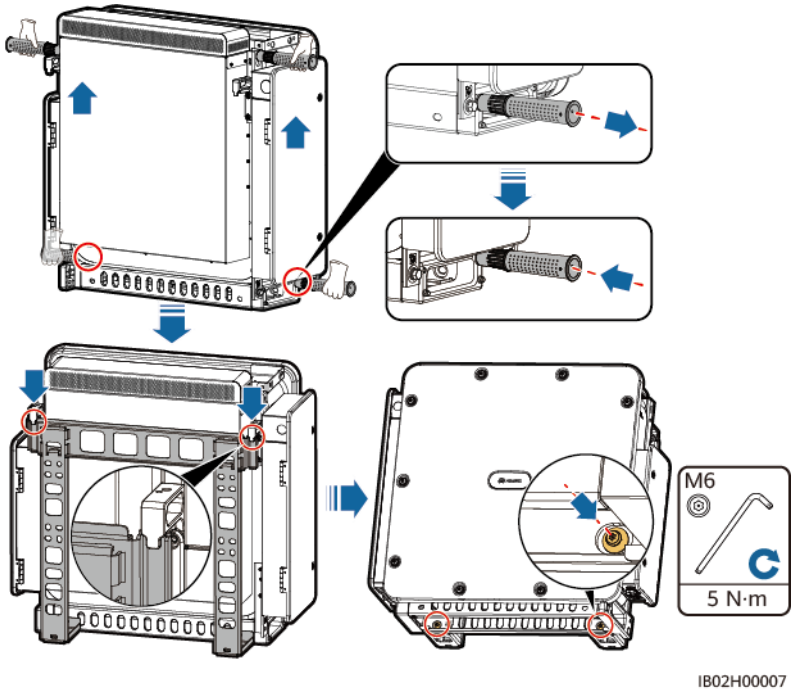
Figure 4-11 Installing mounting ears



Step 3 Install the device on the mounting bracket.

Step 4 Tighten the two screws at the bottom of the device.

Figure 4-12 Installing the device



NOTE

After the Smart PCS is secured, you need to configure a DC LV Panel. For details about the DC LV Panel specifications, contact local technical support engineers.

----End

4.6 Wall-Mounted Installation

Prerequisites

- You have prepared expansion bolts. M12x60 stainless steel expansion bolts are recommended.
- Purchase the mounting bracket separately from the Company.

Installation Procedure

Step 1 Install the mounting bracket.

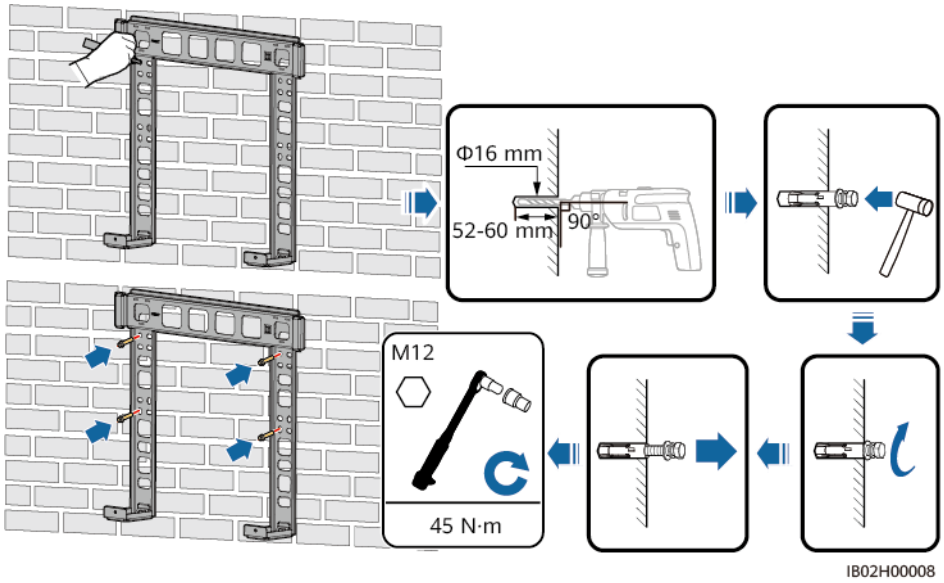
WARNING

Avoid drilling holes into the water pipes or power cables buried in the wall.

NOTICE

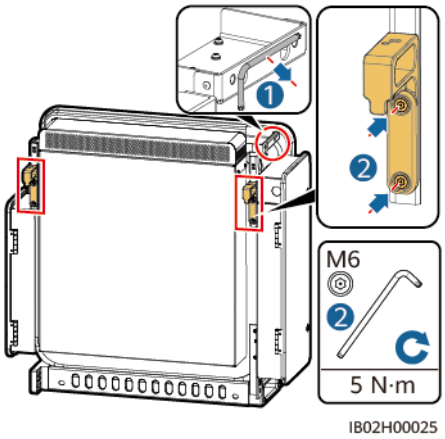
- To avoid inhaling dust and to prevent dust from falling into your eyes, ensure that safety goggles and a dust mask are worn when drilling holes.
- Wipe away any dust in or around the holes and measure the spacing. If the holes are inaccurately positioned, drill the holes again.
- Level the top of the expansion sleeve with the concrete wall after removing the bolt, spring washer, and flat washer. Otherwise, the mounting bracket will not be securely installed on the concrete wall.

Figure 4-13 Installing the mounting bracket



Step 2 Install mounting ears.

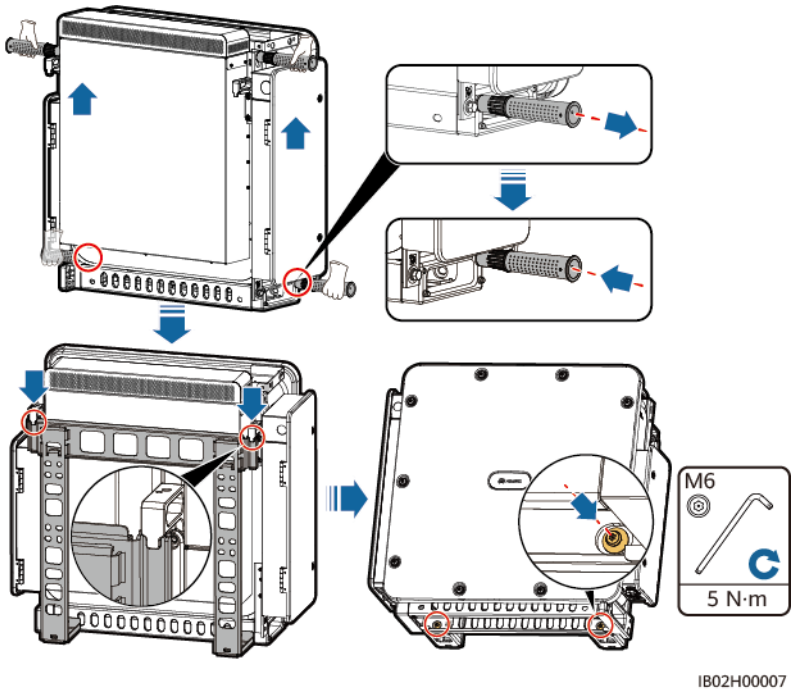
Figure 4-14 Installing mounting ears



Step 3 Install the device on the mounting bracket.

Step 4 Tighten the two screws at the bottom of the device.

Figure 4-15 Installing the device



NOTE

After the Smart PCS is secured, you need to configure a DC LV Panel. For details about the DC LV Panel specifications, contact local technical support engineers.

----End

4.7 Installing the Smart PCS on the DCBOX

NOTE

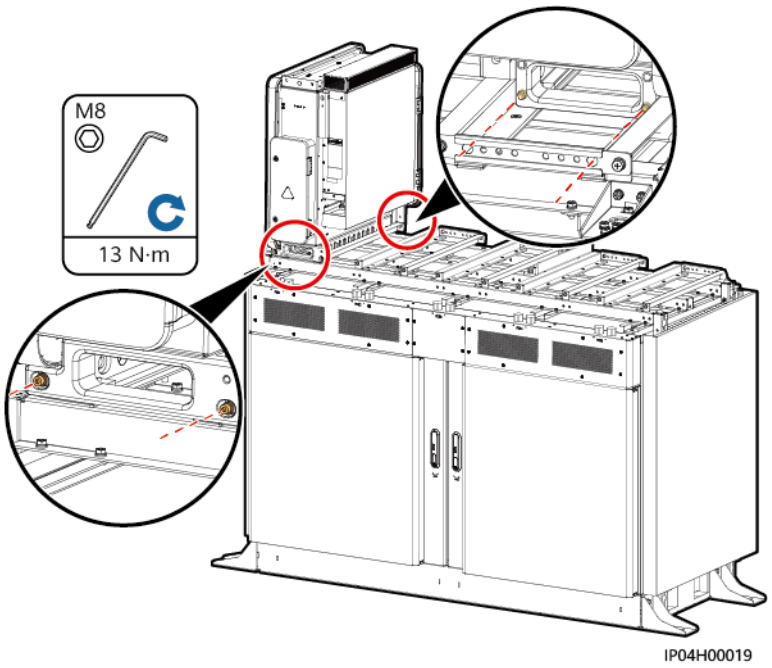
- A maximum of five Smart PCSs can be installed on the top of the DC LV Panel (DCBOX). If less than five Smart PCSs will be installed, install them from left to right. Otherwise, the Smart PCS fasteners cannot be used.
- The installation method of all Smart PCSs is the same. Install the Smart PCS according to the direction shown in the figure. This section uses one Smart PCS as an example.

Installation Description

- Use the DCBOX-9/5-H0 DCBOX purchased from the Company.
- For details, see *DCBOX DC LV Panel User Manual*.

Installation Diagram

Figure 4-16 Installation



5 Electrical Connections

5.1 Precautions

DANGER

Before connecting cables, ensure that the DC and AC switches on the Smart PCS and all switches connecting to it are set to the OFF position. Otherwise, the high voltage of the device may result in electric shocks.

WARNING

- Device damage resulting from incorrect cable connections is not covered under any warranty.
- Only certified electricians are authorized to connect cables.
- Connect cables according to the wiring labels inside the device.
- Wear proper PPE at all times when connecting cables.
- Before connecting cables to ports, leave enough slack to reduce the tension on the cables and prevent poor cable connections.

NOTE

The cable colors shown in the electrical connection diagrams provided in this chapter are for reference only. Select cables in accordance with local cable specifications (green-and-yellow cables are only used for PE). The factors that affect cable selection include the rated current, cable type, routing mode, ambient temperature, and maximum expected line loss.

5.2 Preparing Cables

Table 5-1 Cable description (S: cross-sectional area of the AC cable conductor; S_p: cross-sectional area of the ground cable conductor)

No.	Cable	Type	Conductor Cross-Sectional Area Range	Outer Diameter	Source
1	DC power cable (multi-core)	Two-core outdoor cable and M12 OT/DT terminal	70–185 mm^2	30–60 mm	Prepared by the customer
	DC power cable (single core)	Single-core outdoor cable and M12 OT/DT terminals	50–185 mm^2	15–35 mm	Prepared by the customer
2	Ground cable[1]	Single-core outdoor copper cable and M10 OT/DT terminals	$S_p \geq S/2$	-	Prepared by the customer
3	FE communications cable	CAT 5E outdoor shielded network cable (internal resistance ≤ 1 ohms/10 m) and the shielded RJ45 connector	0.2 mm^2	4.5–7.5 mm	The cable delivered with the device is 1.2 m long. You can also prepare a cable according to site requirements.
4	AC power cable (multi-core)	Three-core (L1, L2, L3) outdoor cable and M12 OT/DT terminals (L1, L2, L3)	70–240 mm^2	30–65 mm	Prepared by the customer
	AC power cable (single core)	Single-core outdoor cable and M12 OT/DT terminals	70–240 mm^2	15–35 mm	Prepared by the customer
Note [1]: The value of S_p is valid only if the conductors of the ground cable and AC power cable are made of the same material. If the materials are different, ensure that the conductor cross-sectional area of the ground cable produces a conductance equivalent to that of the area S/2. The specifications of the ground cable are subject to this table or calculated according to IEC 60364-5-54.					

5.3 Connecting the Ground Cable

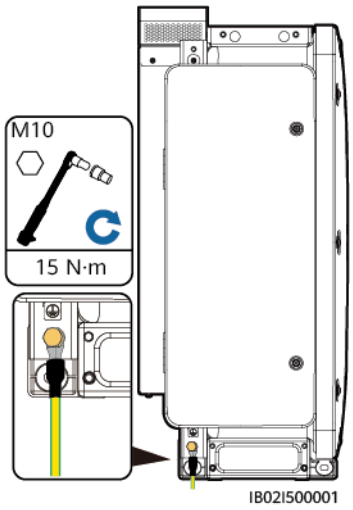
NOTICE

- The grounding should comply with local electrical safety regulations.
- It is recommended that the Smart PCS be connected to a nearby ground point. The ground points of all Smart PCSs in the same array must be connected to ensure equipotential connections to ground cables.
- The ground point in the AC maintenance compartment serves only as the equipotential connection point of the protective ground point, and cannot replace the protective ground point of the chassis shell.

Procedure

Step 1 Connect the ground cable to the grounding point.

Figure 5-1 Connecting the ground cable (AC side of the chassis shell)



----End

Follow-up Procedure

To enhance the corrosion resistance of a ground terminal, apply silica gel or paint after connecting the ground cable.

5.4 Opening the Maintenance Compartment Door

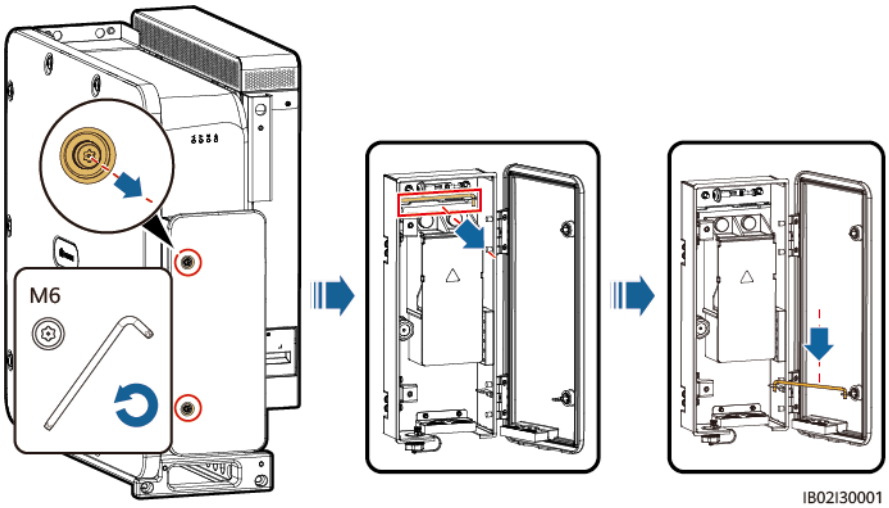
NOTICE

- Do not open the Smart PCS panel.
- Before opening the maintenance compartment door of the Smart PCS, turn off the external switches on the AC and DC sides.
- If you need to open the maintenance compartment door during rainy or snowy conditions, take protective measures to prevent rain or snow from entering the maintenance compartment. Otherwise, ensure that the maintenance compartment door remains closed.
- Do not leave unused screws in the maintenance compartment.

5.4.1 Opening the DC Maintenance Compartment Door

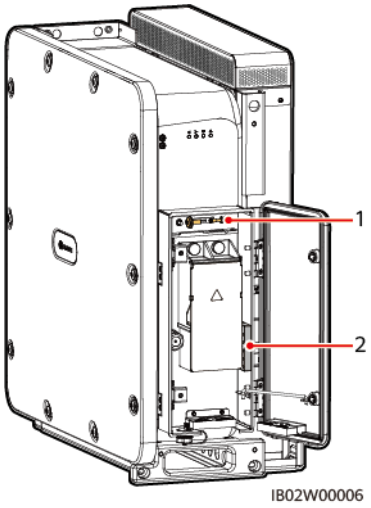
Step 1 Open the DC maintenance compartment door.

Figure 5-2 Opening the DC maintenance compartment door



Step 2 Remove the accessories from the DC maintenance compartment and store them properly for future use.

Figure 5-3 Removing accessories from the DC maintenance compartment



(1) Spare screws on the door panel of the maintenance compartment

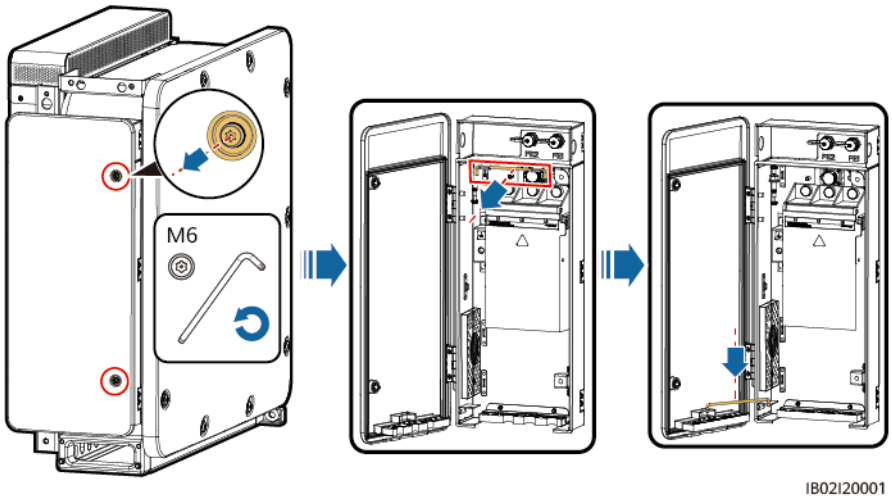
(2) Crimping module

----End

5.4.2 Opening the AC Maintenance Compartment Door

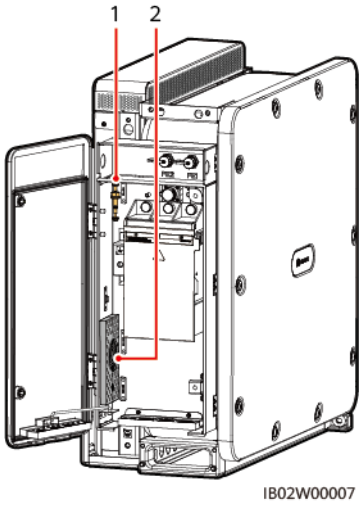
Step 1 Open the AC maintenance compartment door.

Figure 5-4 Opening the AC maintenance compartment door



Step 2 Remove the accessories from the AC maintenance compartment and store them properly for future use.

Figure 5-5 Removing accessories from the AC maintenance compartment



(1) Spare screws on the door panel of the maintenance compartment

(2) Crimping module

----End

5.5 (Optional) Replacing the Crimping Module

Procedure

NOTE

If the AC and DC power cables are multi-core cables, replace the crimping module.

Step 1 Replace the crimping module.

Figure 5-6 Replacing the crimping module (on the DC side)

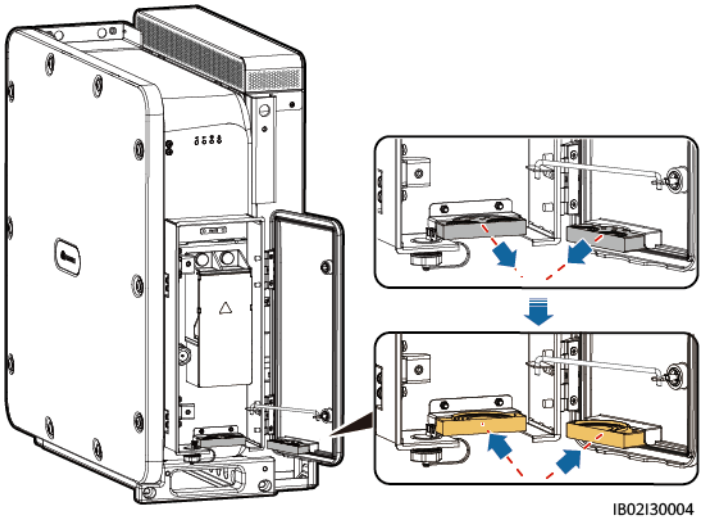
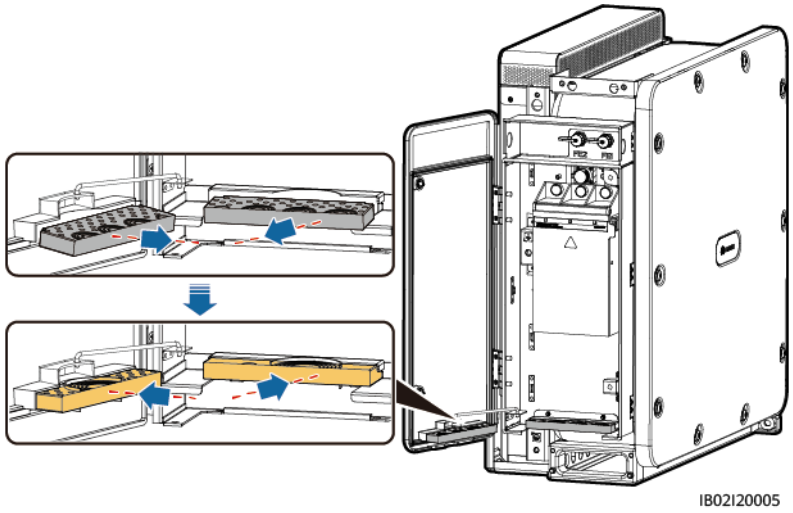


Figure 5-7 Replacing the crimping module (on the AC side)



----End

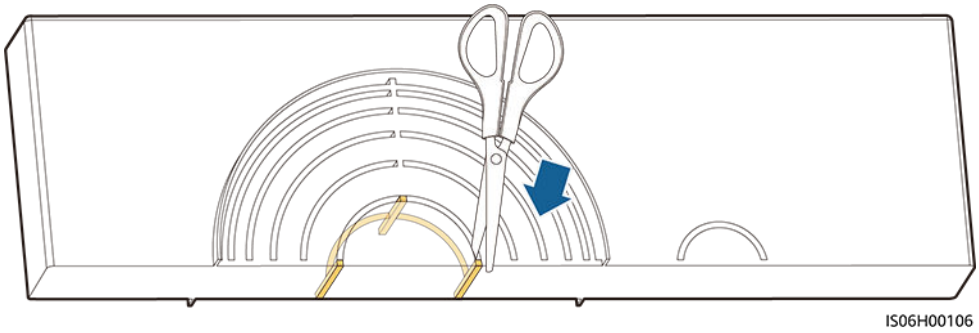
Follow-up Procedure

Use scissors to cut off the joints of the rubber rings in order to remove them. Remove all rubber rings in the same way.

NOTE

Remove the rubber rings according to the cable diameter range, and ensure that the crimping module is not damaged. Otherwise, the device may fail to offer the expected level of protection.

Figure 5-8 Removing the rubber ring



5.6 Connecting DC Power Cables

Precautions

Before connecting the DC power cables, check the following items:

- Check that the DC switches between the DC side of the Smart PCS and the DC LV Panel busbar are in the OFF position.
- Check the polarities of the cables and label them properly.

Procedure

NOTICE

- The cable outer diameter can be measured using the ruler sticker in the maintenance compartment.
- Ensure that the cable jacket is in the maintenance compartment.
- Ensure that the DC power cables are connected securely. Otherwise, the Smart PCS may fail to operate, or become overheated during operation due to an unreliable connection, which will damage the terminal block.

Step 1 Prepare cables by referring to section **B Crimping an OT or DT Terminal**.

Step 2 Remove rubber rings according to the cable diameter range.

Step 3 Connect the DC power cables to the terminal block and ensure that the cables are securely connected.

NOTICE

Do not pull the cables horizontally after they have been secured, as this may damage the wiring terminals.

Figure 5-9 Single-core cable connections (recommended)

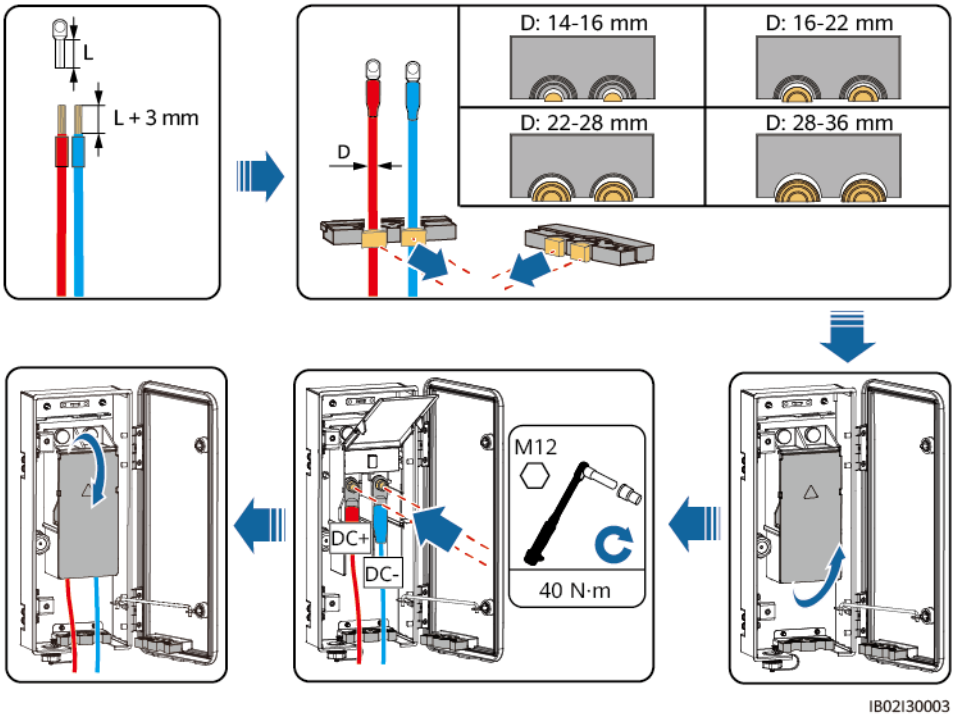
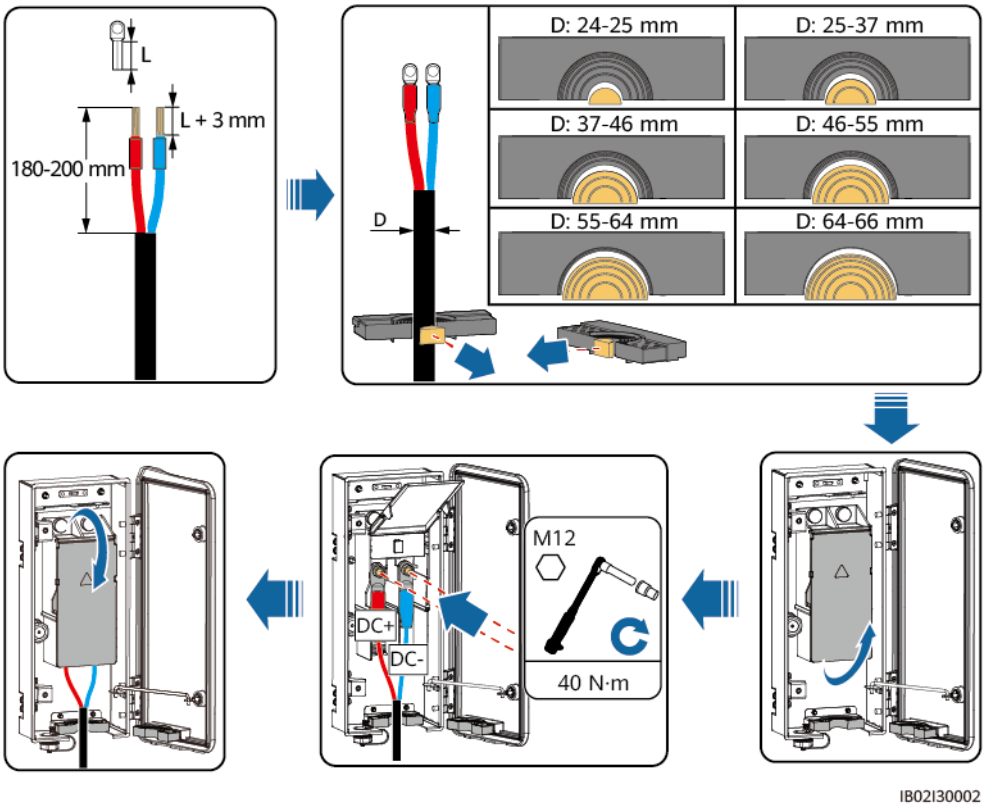


Figure 5-10 Multi-core cable connections (not recommended)



----End

5.7 Connecting AC Power Cables

Precautions

A three-phase AC switch should be installed on the AC side of the Smart PCS. To ensure that the Smart PCS can safely disconnect itself from the power grid if an exception occurs, select a proper overcurrent protection device in compliance with local power distribution regulations.

⚠ WARNING

Do not connect loads between the Smart PCS and the AC switch.

NOTICE

- The cable outer diameter can be measured using the ruler sticker in the maintenance compartment.
- If a cable has a jacket, ensure that the jacket is in the maintenance compartment.
- Ensure that the AC power cables are connected securely. Otherwise, the Smart PCS may fail to operate, or become overheated during operation due to an unreliable connection, which will damage the terminal block.
- Do not pull the cables horizontally after they have been secured, as this may damage the wiring terminals.

Step 1 Prepare cables by referring to section **B Crimping an OT or DT Terminal**.

Step 2 Remove rubber rings according to the cable diameter range.

Step 3 Connect the AC power cables to the terminal block and ensure that the cables are securely connected.

NOTE

The cable colors in these figures are for reference only. Select appropriate cables according to local standards.

Figure 5-11 Single-core cable connections

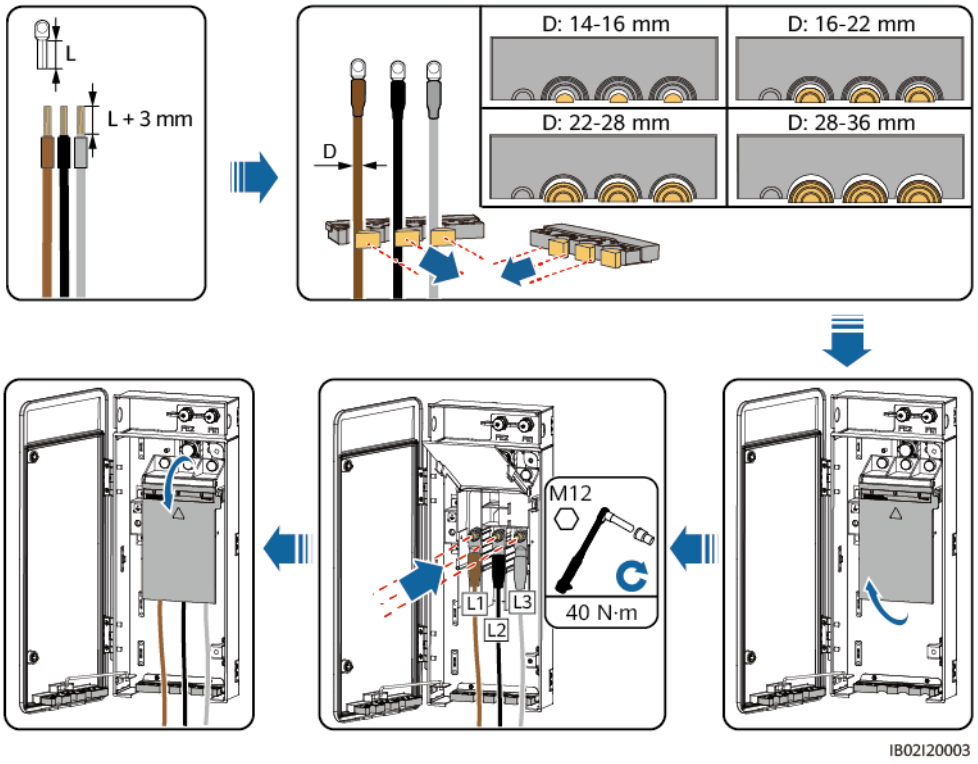
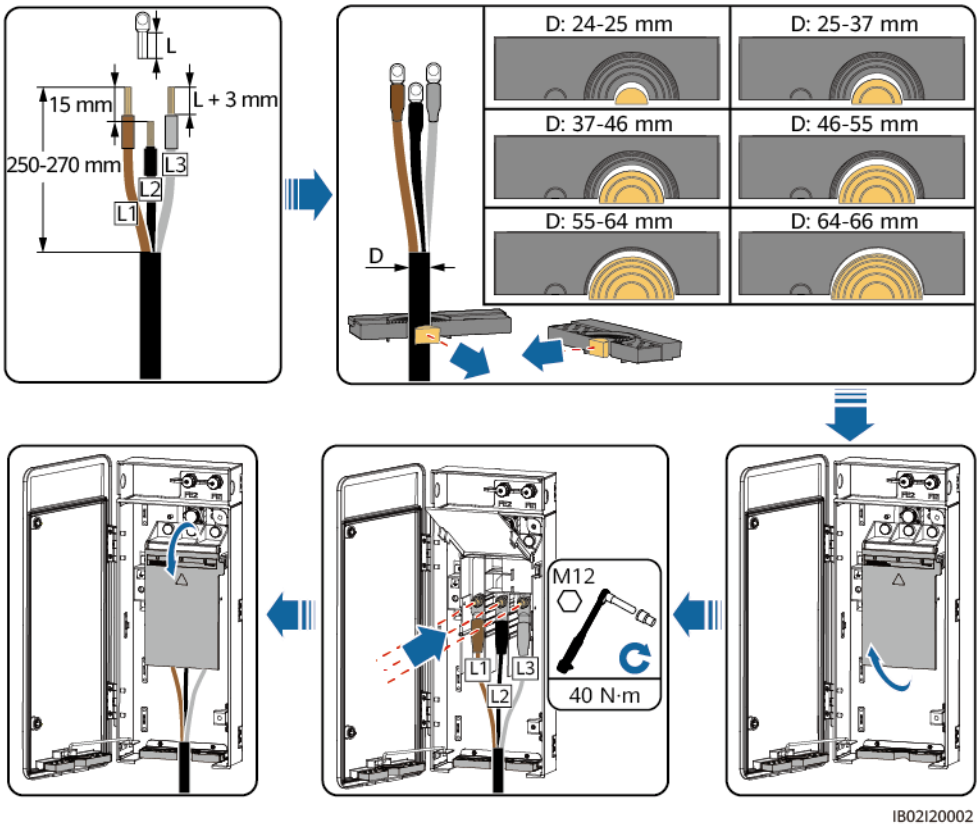


Figure 5-12 Multi-core cable connections

NOTE

It is recommended that the stripped length of the L2 wire be 15 mm shorter than that of the L1 or L3 wire.



----End

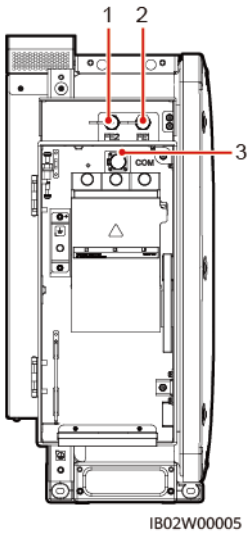
5.8 Connecting FE Communications Cables

NOTICE

- The Smart PCS is connected to the SmartModule through FE communications cables. Ensure that the FE ports on the two ends are connected to GE2 and GE3 of the SmartModule.
- For multiple Smart PCSs, connect all Smart PCSs in hand-in-hand mode through FE communications cables into a ring network.
- The FE communications cable delivered with the Smart PCS is 1.2 m long. Use the original cable if possible.

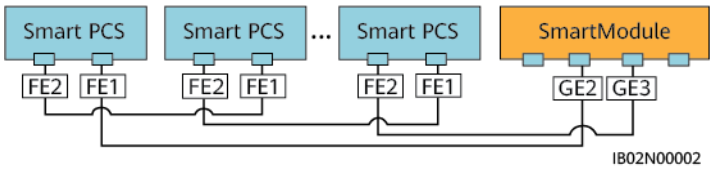
Communication Port Description

Figure 5-13 Port description



(1) Network port 2 (FE2) (2) Network port 1 (FE1) (3) Communications port (COM) (reserved)

Figure 5-14 Communications cable connection

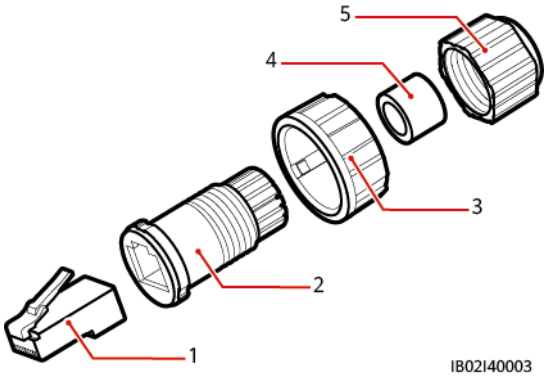


Procedure

Step 1 Remove an appropriate length of the insulation layer from the shielded network cable using a wire stripper.

Step 2 Insert the shielded network cable through the sealing nut, seal ring, coupling nut, and plastic housing in sequence.

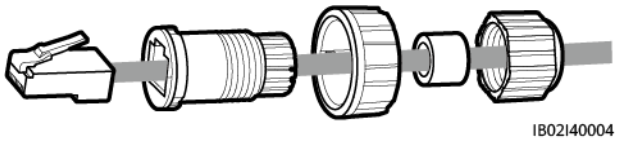
Figure 5-15 Waterproof RJ45 connector composition



(1) Shielded plug	(2) Plastic housing	(3) Coupling nut
(4) Seal ring	(5) Sealing nut	-

Step 3 Line up the exposed wires of the network cable in sequence and connect them to the corresponding pins in the plug.

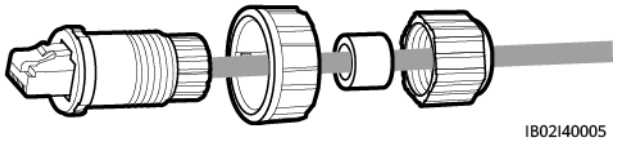
Figure 5-16 Connecting the plug



Step 4 Crimp the plug using a crimping tool.

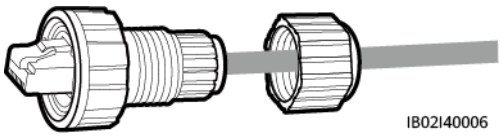
Step 5 Secure the plastic housing to the plug.

Figure 5-17 Connecting the plastic housing



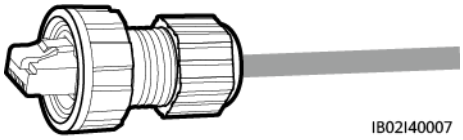
Step 6 Insert the seal ring into the plastic housing and secure the coupling nut to the plastic housing.

Figure 5-18 Connecting the seal ring and coupling nut



Step 7 Secure the sealing nut to the plastic housing.

Figure 5-19 Connecting the sealing nut

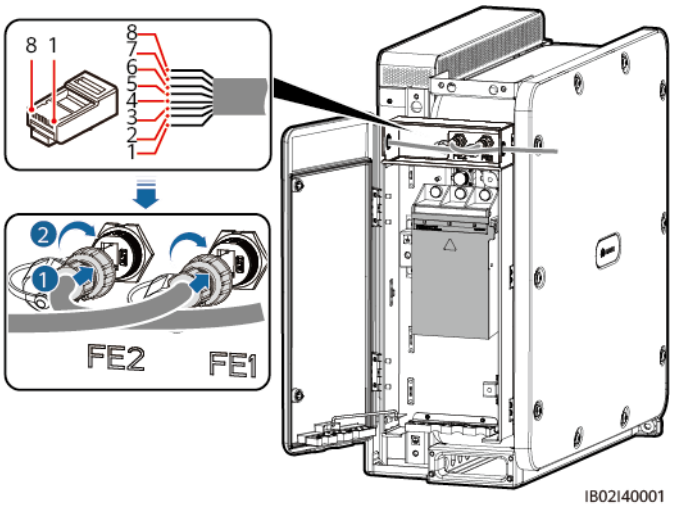


NOTICE

Ensure that the sealing nut is secured.

Step 8 Insert the plug into the FE port on the Smart PCS and tighten the coupling nut.

Figure 5-20 Connecting FE communications cables



(1) White-and-orange	(2) Orange	(3) White-and-green	(4) Blue
(5) White-and-blue	(6) Green	(7) White-and-brown	(8) Brown

----End

Follow-up Procedure

To remove the waterproof RJ45 connector from the Smart PCS, first remove the coupling nut, then press the clip on the RJ45 connector and pull it out.

5.9 Closing Maintenance Compartment Doors

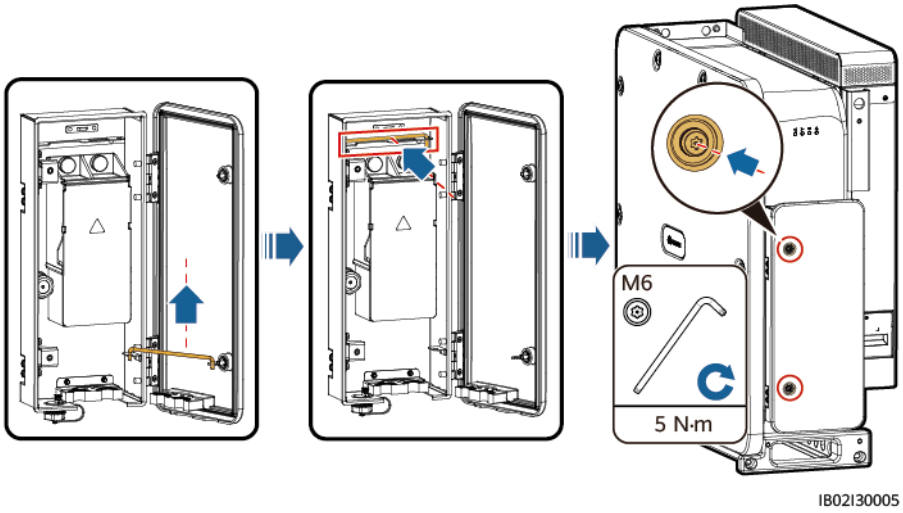
NOTICE

- Before closing a maintenance compartment door, check that the cables are connected correctly and securely, close the terminal block cover, and remove any dirt or other unnecessary items from the maintenance compartment.
- If a maintenance compartment door screw becomes lost, obtain a spare screw from the accessory bag in the maintenance compartment.

5.9.1 Closing the DC Maintenance Compartment Door

Step 1 Adjust the support bar, close the maintenance compartment door, and tighten the two screws on the door.

Figure 5-21 Closing the DC maintenance compartment door

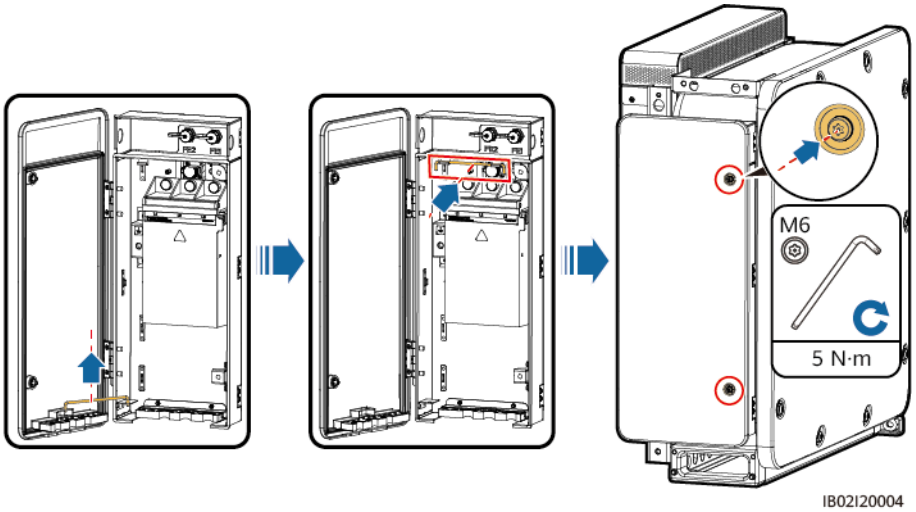


----End

5.9.2 Closing the AC Maintenance Compartment Door

Step 1 Adjust the support bar, close the maintenance compartment door, and tighten the two screws on the door.

Figure 5-22 Closing the AC maintenance compartment door



----End

6 Checking Before Power-On

Check the items listed in the following table. In case of any nonconforming items, rectify the fault and reinstall the parts. Then check the items in the table again until all they all pass the check.

Table 6-1 Item

Check Item	Expected Result
Installation checks	The Smart PCS is not deformed or damaged.
	The Smart PCS is properly installed.
	The clearance around the Smart PCS meets requirements.
Electrical connection checks	The external switches on the AC and DC sides are in the OFF position.
	All cables are intact and free from any damage or cracks.
	All ground cables are connected securely and reliably.
	All AC power cables are connected correctly and securely, and no open circuits or short circuits occur.
	All DC cables are connected securely in correct polarity, and no open circuits or short circuits occur.
	The communications cables are connected correctly and securely.
Other check items	The crimping module is securely installed.
	The AC maintenance compartment is clean and tidy.
	The DC maintenance compartment is clean and tidy.
	The AC maintenance compartment door is closed and the screws on the door are tightened.
	The DC maintenance compartment door is closed and the screws on the door are tightened.

Check Item	Expected Result
	The waterproof plugs on the unused USB, COM, and FE ports are secured.

7 Powering On the Smart PCS

Ensure that all the preceding items are checked and meet requirements before power-on.

Precautions

NOTICE

- Before turning on the AC switch between the Smart PCS and the power grid, check whether the AC voltage is within the required range using a multimeter. (See the local power grid standard.)
- If the Smart PCS has not been used for six months or longer after being installed, it must be checked and tested by professionals before operation.

Procedure

Step 1 Turn on the AC switch between the AC side of the Smart PCS and the power grid.

Step 2 Turn on the DC switch between the DC side of the Smart PCS and the DC LV Panel busbar.

Step 3 Deliver a startup command on the SUN2000 app, SmartLogger, or the management system, and wait for the system soft start.

Step 4 Observe the LED indicators to check the running status of the Smart PCS.

----End

Indicator Description

- You can view the running status of the Smart PCS by observing the LED indicators on the panel.

Figure 7-1 LED indicators

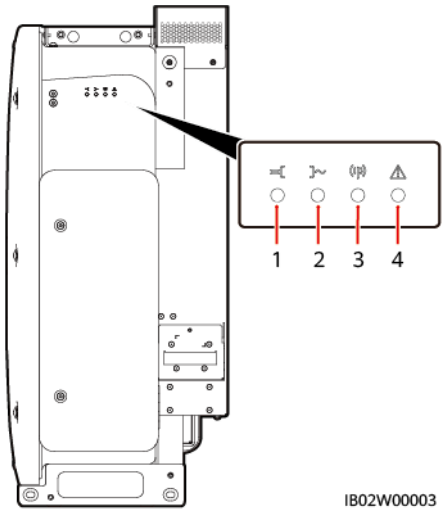


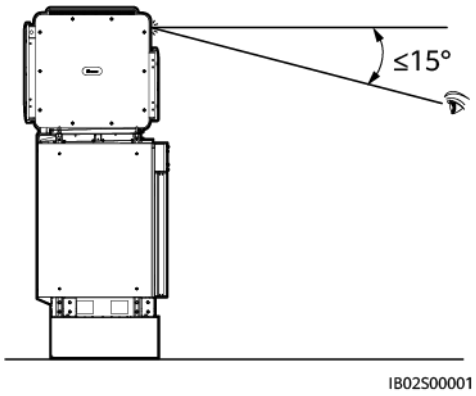
Table 7-1 LED indicators

No.	Category	Indicator Status (Blinking Fast: On for 0.2s and then Off for 0.2s; Blinking Slowly: On for 1s and then Off for 1s)	Description
1	DC indication	Steady green	The DC side is properly connected, and the auxiliary power inside the device is working.
		Blinking green slowly	The device is in standby mode.
		Blinking red fast	An environmental fault occurs on the DC side.
		Off	The DC side is not properly connected, or the auxiliary power inside the device is not working.
2	Running indication	Steady green	The device is operating in grid-tied mode.
		Blinking green slowly	The system environment is normal and the device is not in the working state.
		Blinking red fast	An environmental fault occurs on the AC side.
		Off	The AC side is not connected to the power grid.
3	Communication indication	Blinking green fast	The device receives data through the northbound FE ports.
		Off	The device has not received data through the FE ports in at least 10s.

No.	Category	Indicator Status (Blinking Fast: On for 0.2s and then Off for 0.2s; Blinking Slowly: On for 1s and then Off for 1s)	Description
4	Fault/ Maintenance indication 	Steady red	A major alarm is generated on the device.
		Blinking red fast	A minor alarm is generated on the device.
		Blinking red slowly	A warning is generated on the device.
		Blinking green slowly	The device is under local maintenance or shuts down after receiving a command.
		Off	No alarm is generated, and no local maintenance operations are performed.

- If the Smart PCS is installed on the DC LV Panel (or at a height of about 2.4 m from the ground), you are advised to check the status of the Smart PCS by using the SmartLogger or app. The optimal viewing distance of the indicators on the Smart PCS is 3 m to 5 m away from the device and the viewing angle is ≤ 15°.

Figure 7-2 Optimal indicator viewing distance and angle



NOTE

- Local maintenance refers to the operation of inserting a WLAN module into the USB port of the device. For example, connecting to the SUN2000 app through the WLAN module.
- If alarms are generated during local maintenance, the fault/maintenance indicator shows the local maintenance state first. After the WLAN module is removed, the indicator shows the alarm state.

8 Device Commissioning

8.1 App Commissioning

8.1.1 App Introduction

Functions

The SUN2000 app (also referred to as the app) is a convenient local maintenance platform that connects to the Smart PCS through the WLAN and allows users to query alarms, configure parameters, and perform routine maintenance.

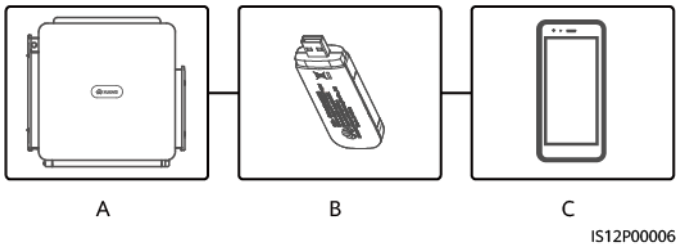
Connection Mode

After the DC or AC side of the Smart PCS is powered on, the app can connect to the Smart PCS through the WLAN module.

NOTICE

- The USB-Adapter2000-C WLAN module is supported.
- The mobile phone operating system must be Android 5.0 or later.
- Huawei and Samsung phones are recommended.

Figure 8-1 WLAN module connection



(A) Smart PCS (B) WLAN module (C) Mobile phone

NOTICE

- If the AC switch between the Smart PCS and the power grid is turned on, but the external switch on the DC side of the Smart PCS is turned off, some parameters cannot be set. Turn on the external switch on the DC side, and then reset the parameters.
- If you change the grid code, some parameters may be restored to factory defaults. After the grid code is changed, check whether any previously set parameters are affected.
- When the Smart PCS receives a reset, shutdown, or upgrade command, it may disconnect from the grid, affecting the energy yield.
- When the Smart PCS is powered on for the first time, ensure that the parameters are set correctly by professional personnel. Incorrect parameter settings may result in noncompliance with the local standards and affect the normal operations of the device.
- Only professionals are allowed to set the grid, protection, feature, and power adjustment parameters of the Smart PCS. If the grid, protection, and feature parameters are set incorrectly, the Smart PCS may disconnect from the grid. If the power adjustment parameters are set incorrectly, the Smart PCS may not connect to the power grid as required. In these cases, the energy yield will be affected.

NOTE

- Configurable parameters vary depending on the grid code.
- The parameter names, value ranges, and default values are subject to change.

8.1.2 Logging In to the App

Prerequisites

- The DC or AC side of the Smart PCS is powered on.
- Connect through a WLAN module:
  a. The WLAN module has been inserted into the USB port at the bottom of the Smart PCS.
  b. The WLAN function has been enabled on your phone.

c. Keep the mobile phone within 5 m of the Smart PCS to ensure good communication between them.

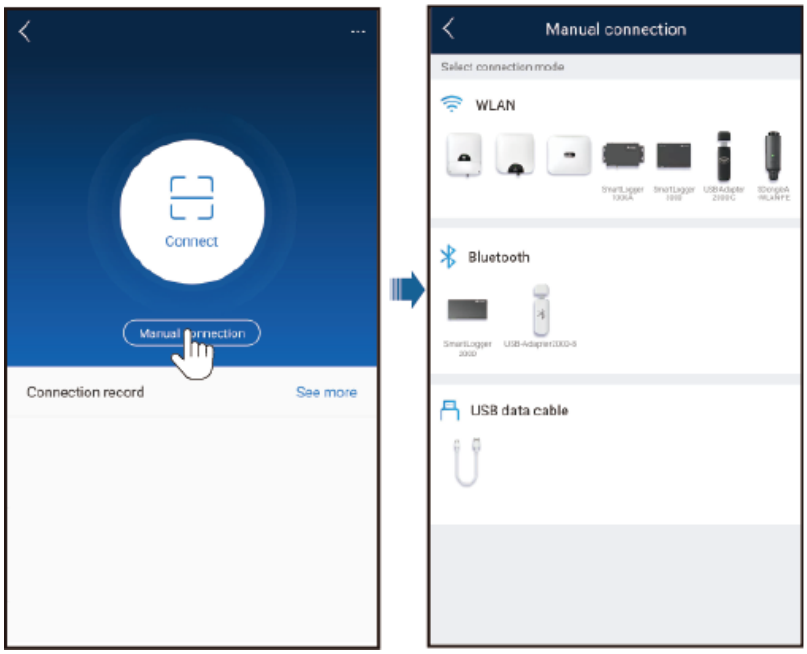
Procedure

Step 1 In the SUN2000 app, select a connection mode.

NOTE

- The screenshots in this section correspond to the SUN2000 app 6.22.10.116 (Android).
- If using a WLAN connection, scan the QR code of the WLAN module to access the login screen.
- If using a WLAN connection, the initial name of the WLAN hotspot is **Adapter-WLAN module SN** and the initial password is **Changeme**. Use the initial password upon first power-on and change it immediately after login. To ensure account security, change the password periodically and do not forget the new password. Passwords that are left unchanged for a long period of time may become vulnerable to theft or cracking. If a password is lost, the associated device can no longer be accessed. In such cases, the Company will not be liable for any loss incurred by the plant.

Figure 8-2 Selecting a connection mode

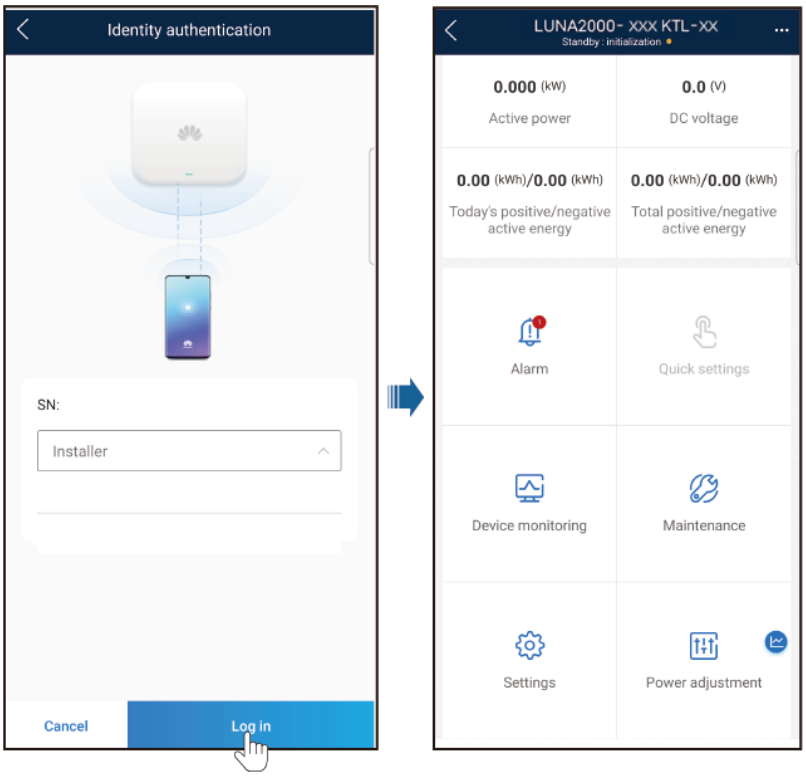


Step 2 Select the login user and enter the login password. The main menu page is displayed.

NOTICE

- When you log in to the system for the first time, set the login password. To ensure account security, change the password periodically and do not forget the new password. Passwords that are left unchanged for a long period of time may become vulnerable to theft or cracking. If your password is lost, the associated device must be restored to its factory settings. The Company will not be held liable for any losses resulting from improper password management.
- You will be locked out for 10 minutes after five consecutive failed password attempts within two minutes.

Figure 8-3 Login



NOTE

Set the correct grid code for the Smart PCS based on regions and application scenarios.

----End

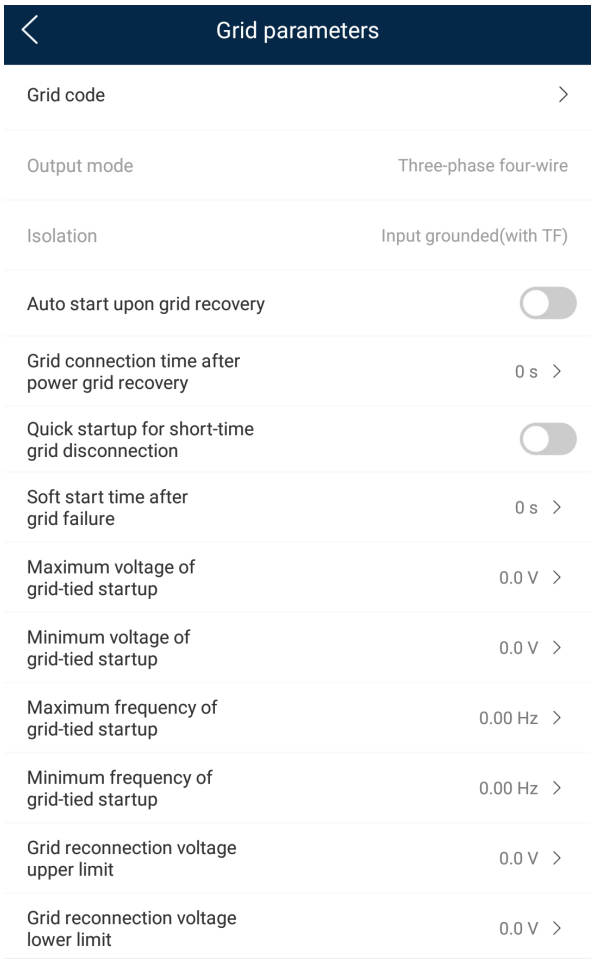
8.2 Setting Parameters

8.2.1 Setting Grid Parameters

Procedure

Step 1 Choose **Settings** > **Grid parameters** to set grid parameters.

Figure 8-4 Grid parameters (installer)



----End

Parameters

No.	Parameter	Description
1	Grid code	Set this parameter based on the grid code of the country or region where the device is used.
2	Output mode	Specifies supported power grid types.
3	Isolation	Specifies the device grounding status at the DC side and the connection to the power grid.
4	Auto start upon grid recovery	Specifies whether to allow the device to automatically start after the power grid recovers.

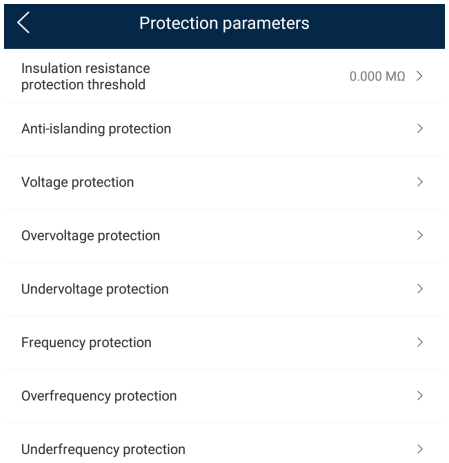
No.	Parameter	Description
5	Grid connection time after power grid recovery (s)	Specifies the time after which the device begins restarting following recovery of the power grid.
6	Quick startup for short-time grid disconnection	Specifies whether to allow the device to quickly start after the power grid recovers from a short-time failure.
7	Duration for determining short-time grid disconnection (ms)	In order to comply with the standards of certain countries and regions, the device should not disconnect from the power grid in cases where the grid experiences a short-time failure. After the fault is rectified, the output power of the device must be quickly restored.
8	Soft start time after grid failure (s)	Specifies the time required for gradual power increase when the device restarts following power grid recovery.
9	Maximum voltage of grid-tied startup (V)	According to the standards of certain countries and regions, initial grid connection is not allowed when the grid voltage is higher than the maximum voltage for grid connection.
10	Minimum voltage of grid-tied startup (V)	According to the standards of certain countries and regions, initial grid connection is not allowed when the grid voltage is below the minimum voltage for grid connection.
11	Maximum frequency of grid-tied startup (Hz)	According to the standards of certain countries and regions, initial grid connection is not allowed when the grid frequency is higher than the maximum frequency for grid connection.
12	Minimum frequency of grid-tied startup (Hz)	According to the standards of certain countries and regions, initial grid connection is not allowed when the grid frequency is below the minimum frequency for grid connection.
13	Grid reconnection voltage upper limit (V)	According to the standards of certain countries and regions, grid reconnection is not allowed when the grid voltage is higher than the maximum grid voltage for grid reconnection.
14	Grid reconnection voltage lower limit (V)	According to the standards of certain countries and regions, grid reconnection is not allowed when the grid voltage is below the minimum grid voltage for grid reconnection.
15	Grid reconnection frequency upper limit (Hz)	According to the standards of certain countries and regions, grid reconnection is not allowed when the grid frequency is higher than the maximum grid frequency for grid reconnection.
16	Grid reconnection frequency lower limit (Hz)	According to the standards of certain countries and regions, grid reconnection is not allowed when the grid frequency is below the minimum grid frequency for grid reconnection.
17	Delay time for connecting automatically to the network	Specifies the time after which the device begins restarting following the power grid recovery.

8.2.2 Setting Protection Parameters

Procedure

Step 1 Choose **Settings** > **Protection parameters** to set protection parameters.

Figure 8-5 Protection parameters (installer)



----End

Parameters

No.	Category	Parameter	Description
1	Insulation resistance protection threshold	Insulation resistance protection threshold (MΩ)	To ensure its safety, the device detects the insulation resistance of the DC side to the ground when it starts a self-check. If the detected value is less than the preset value, the device does not connect to the grid.
2	Anti-islanding protection	Active islanding protection	Specifies whether to enable the active islanding protection function.
3		Passive islanding protection	Specifies whether to enable the passive islanding protection function.
4	Voltage protection	Unbalance voltage protection threshold (%)	Specifies the device protection threshold when the power grid voltage is unbalanced.
5		Phase protection point (°)	The Japanese standard requires that during passive islanding detection, protection should be triggered if an abrupt voltage phase change is detected.

No.	Category	Parameter	Description
6		Phase angle offset protection	The standards of certain countries and regions require the device be protected when the phase angle offset of the power grid three phases exceeds a certain value.
7		10-min undervoltage protection threshold	Specifies the 10-minute undervoltage protection threshold.
8		10-min undervoltage protection time	Specifies the 10-minute undervoltage protection duration.
9		10-min overvoltage protection threshold (V)	Specifies the 10-minute overvoltage protection threshold.
10		10-min overvoltage protection time (ms)	Specifies the 10-minute overvoltage protection duration.
11	Overvoltage protection	Level-N overvoltage protection threshold (V)	Specifies the level-N grid overvoltage protection threshold.
12		Level-N overvoltage protection time (ms)	Specifies the level-N grid overvoltage protection duration.
13	Undervoltage protection	Level-N undervoltage protection threshold (V)	Specifies the level-N grid undervoltage protection threshold.
14		Level-N undervoltage protection time (ms)	Specifies the level-N grid undervoltage protection duration.
15	Frequency protection	Frequency change rate protection	If this parameter is set to **Enable**, the device is protected when the power grid frequency changes too fast.
16		Frequency change rate protection threshold (Hz/s)	Specifies the frequency change rate protection threshold.

No.	Category	Parameter	Description
17		Frequency change rate protection time (s)	The device is protected when the grid frequency change duration exceeds the value.
18	Overfrequency protection	Level-N overfrequency protection threshold (Hz)	Specifies the level-N grid overfrequency protection threshold.
19		Level-N overfrequency protection time (ms)	Specifies the level-N grid overfrequency protection duration.
20	Underfrequency protection	Level-N underfrequency protection threshold (Hz)	Specifies the level-N grid underfrequency protection threshold.
21		Level-N underfrequency protection time (ms)	Specifies the level-N grid underfrequency protection duration.

NOTE

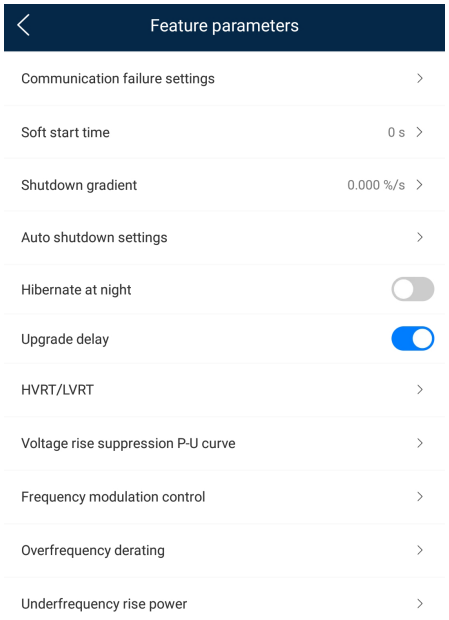
N is 1, 2, 3, 4, 5, or 6.

8.2.3 Setting Feature Parameters

Procedure

Step 1 Choose **Settings** > **Feature parameters** to set feature parameters.

Figure 8-6 Feature parameters (installer)



----End

Parameters

No.	Category	Parameter	Description	Remarks
1	Communication failure settings	Communication interruption duration	Specifies the duration for determining communication interruption between the device and the SmartLogger.	-
2		Communication interrupt shutdown	The standards of certain countries and regions require the device to shut down after communication is interrupted for a set period.	If this parameter is set to **Enable**, the device automatically shuts down after the **communication interruption duration** is reached.
3		Communication resumed startup	If this parameter is set to **Enable**, the device automatically starts after communication recovers. If this parameter is set to **Disable**, the device needs to be started manually after communication recovers.	This parameter is displayed when the automatic shutdown upon communication interruption is set to **Enable**.

No.	Category	Parameter	Description	Remarks
4		Communication disconnection fail-safe	If this parameter is set to **Enable**, the device performs protection according to the set power when communication between the device and the SmartLogger is interrupted for a period longer than **Communication disconnection detection time**.	-
5		Communication disconnection detection time (s)	Specifies the fail-safe detection time for disconnection between the device and the SmartLogger or Smart Dongle.	This parameter is displayed when the protection in the case of communication failure is set to **Enable**.
6		Active power mode when communication fails	Specifies the protection threshold of the active power after communication is interrupted. The value can be a percentage or a fixed value.	This parameter is displayed when the protection in the case of communication failure is set to **Enable**.
7		Active power threshold when communication fails (%)	Specifies the active power threshold in percentage.	This parameter is displayed when the protection in the case of communication failure is set to **Enable** and **Active power threshold when communication fails** is set to a percentage.
8		Active power threshold when communication fails (kW)	Specifies the active power threshold as a fixed value.	This parameter is displayed when the protection in the case of communication failure is set to **Enable** and **Active power threshold when communication fails** is set to a fixed value.

No.	Category	Parameter	Description	Remarks
9		Reactive power mode when communication fails	Specifies the protection threshold of the reactive power after communication is interrupted, including Q/S and power factor.	This parameter is displayed when the protection in the case of communication failure is set to **Enable**.
10		Reactive power threshold when communication fails (%)	Specifies the Q/S threshold of the reactive power (%)	This parameter is displayed when the protection in the case of communication failure is set to **Enable** and **Reactive power threshold when communication fails** is set to **Q/S**.
11		Reactive power threshold when communication fails	Specifies the power factor threshold of the reactive power (PF)	This parameter is displayed when the protection in the case of communication failure is set to **Enable** and **Reactive power threshold when communication fails** is set to **Power factor**.
12	Soft start time	Soft start time (s)	Specifies the duration required for gradual power increase when the device starts.	-
13	Shutdown gradient	Shutdown gradient (%/s)	Specifies the power change rate when the device shuts down.	-
14	Auto shutdown settings	Shutdown at 0% power limit	If this parameter is set to **Enable**, the device shuts down after receiving the 0% power limit command. If this parameter is set to **Disable**, the device does not shut down after receiving the 0% power limit command.	-

No.	Category	Parameter	Description	Remarks
15	Hibernate at night	Hibernate at night	The device performs the monitoring function at night. If this parameter is set to **Enable**, the monitoring function of the device will hibernate at night to reduce power consumption.	-
16	Upgrade delay	Upgrade delay	This parameter is mainly used in upgrade scenarios where the power supply at DC side is disconnected.	After the upgrade starts, if **Upgrade delay** is set to **Enable**, the upgrade package is loaded first. After the DC side power supply recovers and the activation conditions are met, the device automatically activates the upgrade.
17	HVRT/LVRT	HVRT	HVRT is short for high voltage ride-through. When the grid voltage is abnormally high for a short time, the device cannot disconnect from the power grid immediately and must continue to operate for some time.	-
18		HVRT triggering threshold (V)	Specifies the threshold for triggering HVRT. The threshold settings should meet the local grid standard.	This parameter is displayed when **HVRT** is set to **Enable**. - This parameter is displayed when **LVRT** is set to **Enable**.

No.	Category	Parameter	Description	Remarks
19		HVRT gradient K1	During HVRT, the device must generate positive-sequence reactive power to support the power grid. This parameter is used to set the positive-sequence reactive power generated by the device. For example, if you set **HVRT gradient K1** to **2**, the increment of positive-sequence reactive current generated by the device is 20% of the rated current when the AC voltage increases by 10% during HVRT.	
20		HVRT gradient K2	During HVRT, the device must generate negative-sequence reactive power to support the power grid. This parameter is used to set the negative-sequence reactive power generated by the device. For example, if you set **HVRT gradient K2** to **2**, the increment of negative-sequence reactive current generated by the device is 20% of the rated current when the AC voltage increases by 10% during HVRT.	
21		LVRT	LVRT is short for low voltage ride-through. When the grid voltage is abnormally low for a short time, the device cannot disconnect from the power grid immediately and must continue to operate for some time.	-
22		LVRT triggering threshold (V)	Specifies the threshold for triggering LVRT. The threshold settings should meet the local grid standard.	This parameter is displayed when **LVRT** or **HVRT** is set to **Enable**. ● This parameter is displayed when

No.	Category	Parameter	Description	Remarks
23		LVRT gradient K1	During LVRT, the device must generate positive-sequence reactive power to support the power grid. This parameter is used to set the positive-sequence reactive power generated by the device. For example, if you set **LVRT gradient K1** to **2**, the increment of positive-sequence reactive current generated by the device is 20% of the rated current when the AC voltage decreases by 10% during HVRT.	**LVRT** or **HVRT** is set to **Enable**. • LVRT recovery threshold = LVRT triggering threshold + VRT exit hysteresis threshold • HVRT recovery threshold = HVRT triggering threshold + VRT exit hysteresis threshold
24		LVRT gradient K2	During LVRT, the device must generate negative-sequence reactive power to support the power grid. This parameter is used to set the negative-sequence reactive power generated by the device. For example, if you set **LVRT gradient K2** to **2**, the increment of negative-sequence reactive current generated by the device is 20% of the rated current when the AC voltage decreases by 10% during HVRT.	
25		LVRT active current maintenance coefficient	Specifies the active current proportional coefficient before and during LVRT.	
26		Percentage of LVRT reactive current limiting	During LVRT, the device is required to limit the reactive current. For example, if you set **Percentage of LVRT reactive current limiting** to **50**, the reactive current upper limit of the device is 50% of the rated current during LVRT.	

No.	Category	Parameter	Description	Remarks
27		Threshold of LVRT zero-current mode	When **Zero current due to power grid fault** is enabled, if the power grid voltage is less than the value of **Threshold of LVRT zero-current mode** during LVRT, the zero current mode is used. Otherwise, the mode configured in LVRT mode is used.	
28		LVRT mode	Sets LVRT mode. The options are **Zero-current mode**, **Constant current mode**, **Reactive power priority mode**, and **Active power priority mode**.	
29		LVRT characteristic curve	Specifies the low voltage ride-through capability of the device.	-
30		Grid voltage protection shield during VRT	Specifies whether to shield the undervoltage protection function during LVRT or HVRT.	This parameter is displayed when **LVRT** or **HVRT** is set to **Enable**.
31		VRT exit hysteresis threshold	Specifies the LVRT/HVRT recovery threshold.	• This parameter is displayed when **LVRT** or **HVRT** is set to **Enable**. • LVRT recovery threshold = LVRT triggering threshold + VRT exit hysteresis threshold • HVRT recovery threshold = HVRT triggering threshold + VRT exit hysteresis threshold
32		VRT active current limiting percentage	Specifies the percentage of the maximum active current to the rated current during fault ride-through (FRT).	-

No.	Category	Parameter	Description	Remarks
33		VRT active power recovery gradient	Specifies the recovery rate when the active current recovers to the value at the moment before FRT.	-
34		Zero current due to power grid fault	Specifies whether to enable the **Zero current due to power grid fault** function.	-
35		Zero current due to power grid fault	This parameter can only be set for the VDE4120.	-
36	Voltage rise suppression P-U curve	Voltage rise suppression	The standards of certain countries and regions require that when the output voltage exceeds a certain value, the device must suppress a rise in voltage by outputting reactive power and reducing active power.	-
37		Voltage rise suppression reactive adjustment point (%)	The standards of certain countries and regions require the device to generate a certain amount of reactive power when the output voltage exceeds a certain value.	• This parameter is displayed when **Voltage rise suppression** is set to **Enable**. • The value of **Voltage rise suppression active derating point** must be greater than that of **Voltage rise suppression reactive adjustment point**.
38		Voltage rise suppression active derating point (%)	The standards of certain countries and regions require the active power of the device to be derated by a certain slope when the output voltage exceeds a certain value.	-

No.	Category	Parameter	Description	Remarks
39		P-U characteristic curve	The device adjusts P/Pn (the ratio of the active power to the rated power) in real time based on **U/Un(%)** (the ratio of the actual power grid voltage to the rated power grid voltage).	-
40		P-U characteristic curve adjustment time	Specifies the time from the response to the end of the adjustment based on the P-U curve.	-
41	Frequency modulation control	Frequency modulation control	The standards of certain countries and regions require that if the power grid frequency fluctuates around a certain value, the device needs to fine-tune the active power output based on the frequency regulation ratio to help stabilize the power grid frequency. In this case, set this parameter to **Enable**.	-
42		Adjustment ratio of frequency modulation control	Specifies the adjustment ratio of the active power output.	This parameter is displayed when the frequency regulation control is set to **Enable**.
43		Response deadband of frequency-based control	Specifies the threshold for triggering the frequency regulation control. For example, if this parameter is set to 0.1 Hz, the frequency regulation control is not triggered when the frequency is within reference frequency ±0.1 Hz.	-
44		Power change gradient of frequency-based control	Specifies the active power change gradient of frequency regulation.	-
45		Power change limit of frequency-based control	Specifies the upper limit for active power adjustment of frequency regulation.	-

No.	Category	Parameter	Description	Remarks
46		Initial delay in the frequency sensitive mode	Specifies the delay response time of frequency regulation.	-
47	Overfrequency derating	Overfrequency derating	If this parameter is set to **Enable**, the active power of the device will be derated according to a certain slope when the grid frequency exceeds the frequency that triggers overfrequency-caused derating.	-
48		Cutoff frequency of overfrequency derating (Hz)	Specifies the frequency threshold for cutting off overfrequency-caused derating.	• This parameter is displayed when the power derating caused by overfrequency is set to **Enable**. • The parameter setting should meet the following condition: **Quit frequency of overfrequency derating** ≤ **Trigger frequency of overfrequency derating** < **Cutoff frequency of overfrequency derating**.
49		Cutoff power of overfrequency derating (%)	Specifies the power threshold for cutting off overfrequency-caused derating.	
50		Trigger frequency of overfrequency derating (Hz)	The standards of certain countries and regions require the output active power of devices to be derated when the power grid frequency exceeds a certain value.	
51		Quit frequency of overfrequency derating (Hz)	Specifies the frequency threshold for exiting overfrequency-caused derating.	
52		Power drop gradient of overfrequency derating (%/s)	Specifies the decrease rate of the overfrequency-caused derating power.	
53		Power recovery gradient of overfrequency derating (%/min)	Specifies the power recovery rate of the overfrequency-caused derating.	
54		Frequency detection filter time (ms)	Specifies the frequency detection filter time.	-

No.	Category	Parameter	Description	Remarks
55		Recovery delay of frequency-based active power derating	Specifies the exiting delay time after the frequency reaches the quit frequency of overfrequency-caused derating.	-
56		Execution delay of frequency-based active power derating	Specifies the effective delay time of overfrequency-caused derating when the frequency reaches the trigger frequency of overfrequency-caused derating.	-
57		Hysteresis of frequency-based active power derating	Specifies whether to enable overfrequency-caused derating hysteresis.	-
58	Underfrequency rise power	Underfrequency rise power	The standards of certain countries and regions require that when the power grid frequency is lower than the frequency threshold for power raising, the device needs to increase the active power output to help increase the power grid frequency. In this case, set this parameter to **Enable**.	-
59		Power recovery gradient of underfrequency rise power (%/min)	Specifies the power recovery rate of underfrequency-caused raising.	This parameter is displayed when the power raising caused by underfrequency is set to **Enable**.
60		Cutoff frequency of underfrequency rise power (Hz)	Specifies the frequency threshold for stopping underfrequency-caused raising.	
61		Cutoff power of underfrequency rise power (%)	Specifies the power threshold for stopping underfrequency-caused raising.	
62		Trigger frequency of underfrequency rise power (Hz)	Specifies the frequency threshold for power raising.	

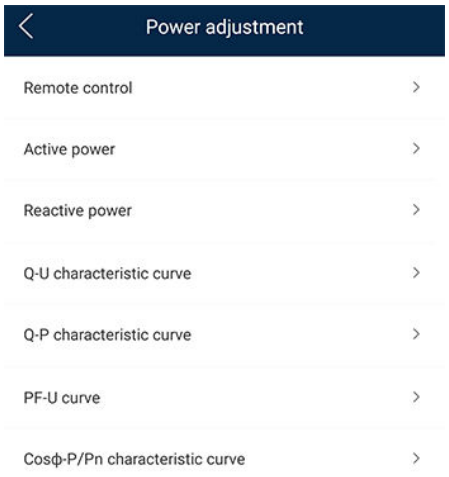
No.	Category	Parameter	Description	Remarks
63		Quit frequency of underfrequency rise power (Hz)	Specifies the exit frequency of power raising caused by underfrequency.	
64	O&M via USB connection	O&M via USB connection	Set the USB O&M port status to **Always On** or **Always OFF**.	-

8.2.4 Setting Power Adjustment Parameters

Procedure

Step 1 On the home screen, tap **Power adjustment** to go to the parameter setting screen.

Figure 8-7 Power adjustment parameters (installer)



----End

Parameters

No.	Category	Parameter	Description	Remarks
1	Remote control	Remote power schedule	If this parameter is set to **Enable**, the device responds to the scheduling instruction from the remote port. If this parameter is set to **Disable**, the device does not respond to the scheduling instruction from the remote port.	-

No.	Category	Parameter	Description	Remarks
2		Schedule instruction valid duration (s)	Specifies the validity period of the scheduling instruction.	When this parameter is set to 0, the scheduling instruction takes effect permanently.
3	Active power	Active power change gradient (%/s)	Specifies the change rate of the device's active power.	-
4		Active power (kW)	Specifies the fixed active power of the device.	-
5		Active power (%)	Specifies the active power of the device in percent.	-
6	Reactive power	Reactive power change gradient (%/s)	Specifies the change rate of the device's reactive power.	-
7		Power factor	Specifies the power factor of the device.	-
8		Reactive power compensation (Q/S)	Specifies the reactive power of the device.	-
9	Q-U characteristic curve	Q-U characteristic curve	The device adjusts Q/S (the ratio of the output reactive power to apparent power) in real time based on **U/Un(%)** (the ratio of the actual power grid voltage to the rated power grid voltage).	-
10		Q-U characteristic curve mode	Specifies the reactive power compensation mode of the device output.	-
11		Delay for Q-U characteristic curve to take effect	Specifies the delay time for Q-U adjustment.	-
12		Power percentage for triggering Q-U scheduling	Specifies the reference apparent power in percent. When the actual apparent power of the device is greater than the value of this parameter, the Q-U characteristic curve scheduling function is enabled.	-

No.	Category	Parameter	Description	Remarks
13		Power percentage for exiting Q-U scheduling	Specifies the P/Pn when the device exits the Q-U scheduling.	-
14		Limit value for minimum PF of Q-U characteristic curve	Specifies the minimum power factor for Q-U adjustment.	-
15	Q-P characteristic curve	Q-P characteristic curve	The device adjusts Q/Pmax (the ratio of the reactive power to the maximum active power) in real time based on P/Pmax (the ratio of the active power to the maximum active power).	-
16	PF-U curve	PF-U characteristic curve	The device adjusts the power factor in real time based on **U/Un(%)** (the ratio of the actual power grid voltage to the rated power grid voltage).	-
17		PF (U) voltage detection filter time	Specifies the time for filtering the grid voltage in the PF-U curve.	-
18	Cosφ-P/Pn characteristic curve	Cosφ-P/Pn characteristic curve	The device adjusts the output power factor cosφ in real time based on P/Pn (%).	-
19		Reactive power compensation (cosφ-P) trigger voltage	Specifies the voltage threshold for triggering reactive power compensation based on the curve.	-
20		Reactive power compensation (cosφ-P) exit voltage	Specifies the voltage threshold for exiting reactive power compensation based on the curve.	-
21		Reactive power adjustment time	Specifies the adjustment time for the reactive power to reach the target value during reactive power adjustment.	-

9 Device Maintenance

9.1 Routine Maintenance

Maintenance Items

To ensure long-term operation of Smart PCS, you are advised to perform routine maintenance as described in this chapter.

CAUTION

When cleaning the system, connecting cables, and checking grounding reliability, power off the system and ensure that the external switches on the DC and AC sides are turned off.

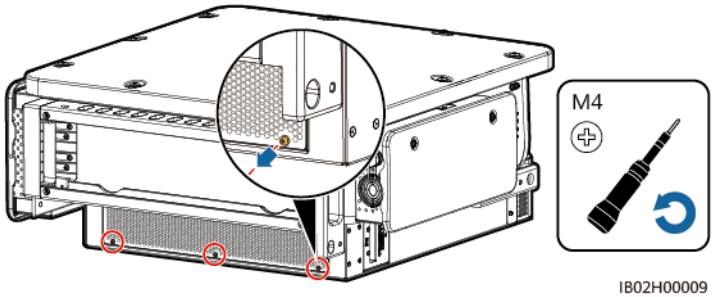
Table 9-1 Maintenance checklist

Check Item	Check Method	Maintenance Interval
• Cleanness of the air inlet • Cleanness of the air outlet • Fans	• Check whether there is dust on the air inlet and outlet. If necessary, remove and clean the baffles. • Check whether the fans produce abnormal sounds during operation.	Once every 6 to 12 months

Check Item	Check Method	Maintenance Interval
System running status	• Check that the Smart PCS is not damaged or deformed. • Check that the Smart PCS operates with no abnormal sounds. • Check that the parameters are set correctly.	Once every 6 months
Cable connections	• Check that cables are secured. • Check that cables are intact, and ensure that any parts in contact with metallic surfaces are not scratched. • Check that the idle COM, USB, and FE ports are protected by waterproof caps.	The first inspection must be performed 6 months after the initial commissioning. Subsequent inspections can be performed every 6 to 12 months.
Grounding reliability	Check that ground cables are securely connected.	The first inspection must be performed 6 months after the initial commissioning. Subsequent inspections can be performed every 6 to 12 months.

Removing the Air Inlet Baffle

Figure 9-1 Removing the baffle

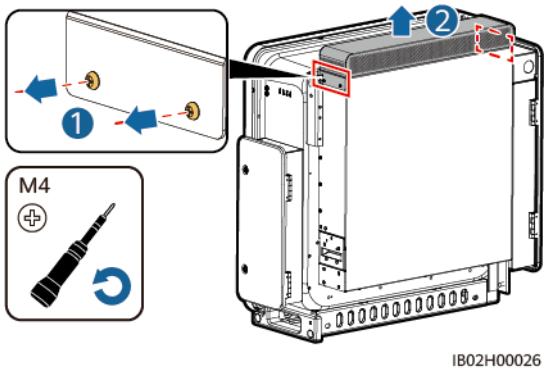


NOTICE

After cleaning is complete, reinstall the air inlet baffle. Tighten the screws to a torque of 1.2 N·m.

Removing the Air Outlet Protective Cover

Figure 9-2 Removing the protective cover



NOTICE

After cleaning is complete, reinstall the air outlet protective cover. Tighten the screws to a torque of 1.2 N·m.

9.2 Powering Off the Smart PCS

Context

Perform the following procedures when powering off the Smart PCS for maintenance or replacement to prevent personal injury and equipment damage.

⚠ CAUTION

- If the DC switch between the Smart PCS and the DC LV Panel busbar is automatically turned off, do not turn on the switch before the fault is rectified.
- If the AC switch between the Smart PCS and the grid is automatically turned off, do not turn on the switch before the fault is rectified.
- Before power-off for maintenance, do not touch the energized components of the Smart PCS, as this may result in electric shocks or arcs.

Procedure

Step 1 Wear proper personal protective equipment (PPE).

Step 2 Deliver a shutdown command on the SUN2000 app, SmartLogger, or management system.

Step 3 Turn off the AC switch between the Smart PCS and the grid.

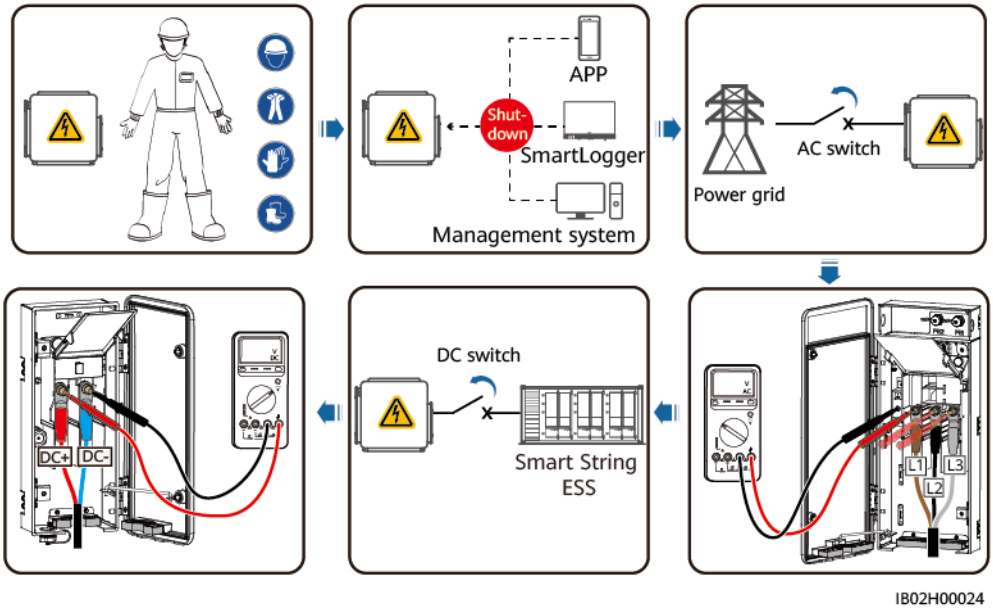
Step 4 Open the AC maintenance compartment door, install a support bar, and use a multimeter to measure the voltage between the AC terminal block and the ground. Ensure that the AC side of the Smart PCS is disconnected.

Step 5 Turn off the DC switch between the Smart PCS and the DC LV Panel busbar.

Step 6 Open the DC maintenance compartment door, install a support bar, and use a multimeter to measure the voltage between the DC terminal block and the ground. Ensure that the DC side of the Smart PCS is disconnected.

Step 7 Wait for 15 minutes and then troubleshoot or repair the Smart PCS.

Figure 9-3 Powering off the Smart PCS



WARNING

- Do not open the panel for maintenance if the Smart PCS is emitting odor or smoke, or exhibits other obvious problems.
- If the Smart PCS does not emit odor or smoke and is intact, repair or restart it based on the alarm handling suggestions.

----End

9.3 Replacing a Fan

CAUTION

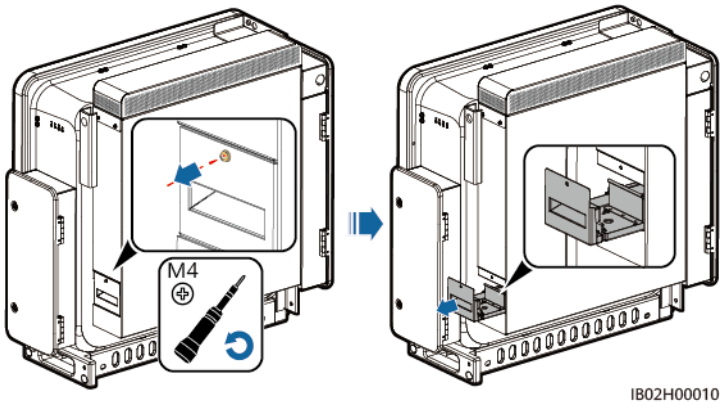
- Before replacing a fan, power off the Smart PCS.
- When replacing a fan, use insulation tools and wear PPE.

NOTE

If the fan gets stuck when being pulled or pushed, slightly lift it.

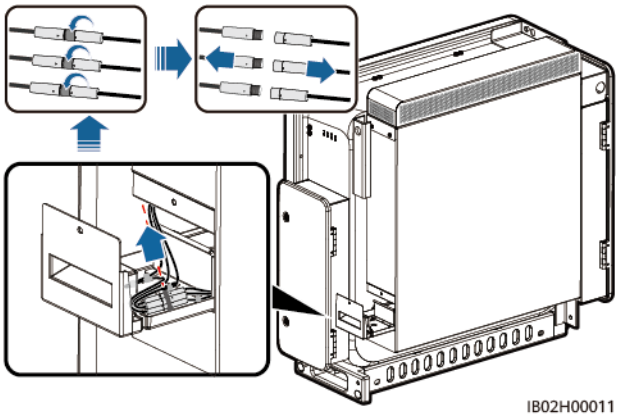
Step 1 Remove the screws from the fan tray and store them properly. Pull out the fan tray until it is flush with the Smart PCS.

Figure 9-4 Pulling out fan tray (1)



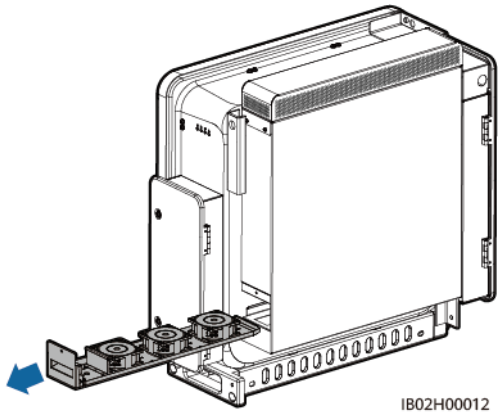
Step 2 Remove the cable ties shared by the cables, unscrew the connectors, and disconnect the cables.

Figure 9-5 Disconnecting cables



Step 3 Pull out the fan.

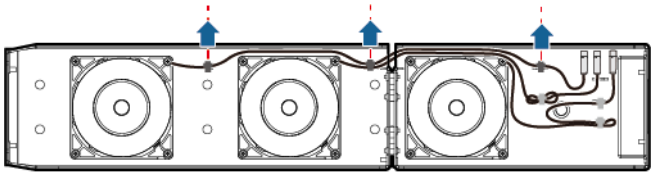
Figure 9-6 Pulling out fan tray (2)



Step 4 Remove cable ties from the faulty fan.

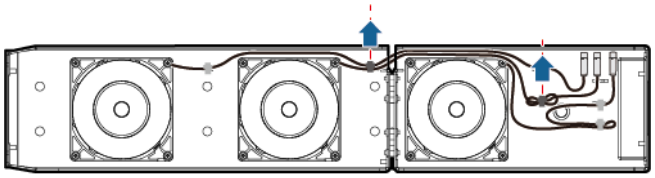
- Fan 1 is faulty.

Figure 9-7 Removing cable ties from fan 1



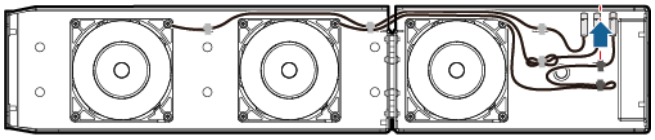
- Fan 2 is faulty.

Figure 9-8 Removing cable ties from fan 2



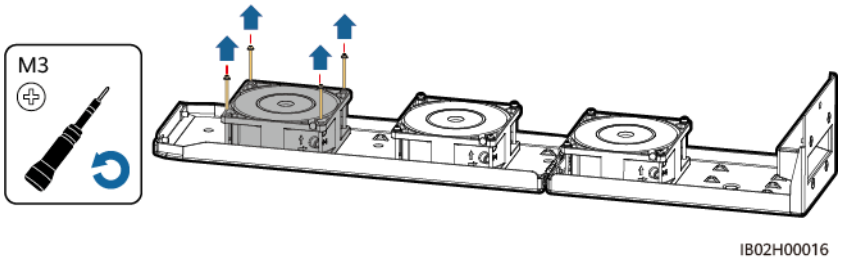
- Fan 3 is faulty.

Figure 9-9 Removing the cable tie from fan 3



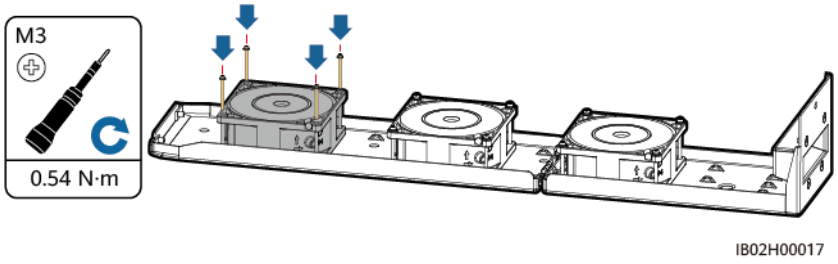
Step 5 Remove the faulty fan (fan 1 is used as an example).

Figure 9-10 Removing the fan



Step 6 Install a new fan (fan 1 is used as an example).

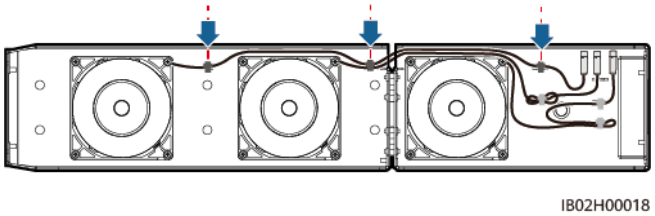
Figure 9-11 Installing a new fan



Step 7 Bind the fan cables.

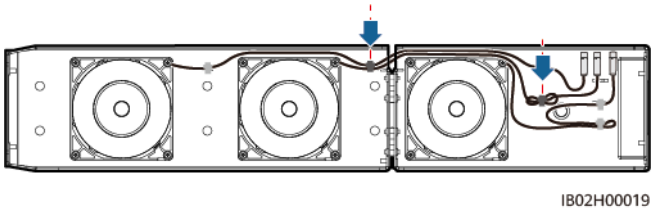
- Binding positions for fan 1

  Figure 9-12 Binding the cables of fan 1

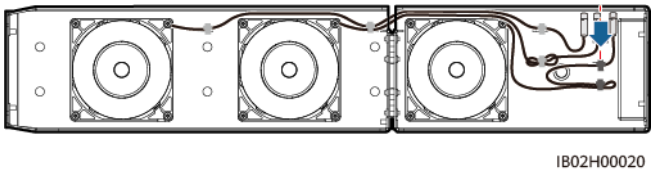
- Binding positions for fan 2

  Figure 9-13 Binding the cables of fan 2

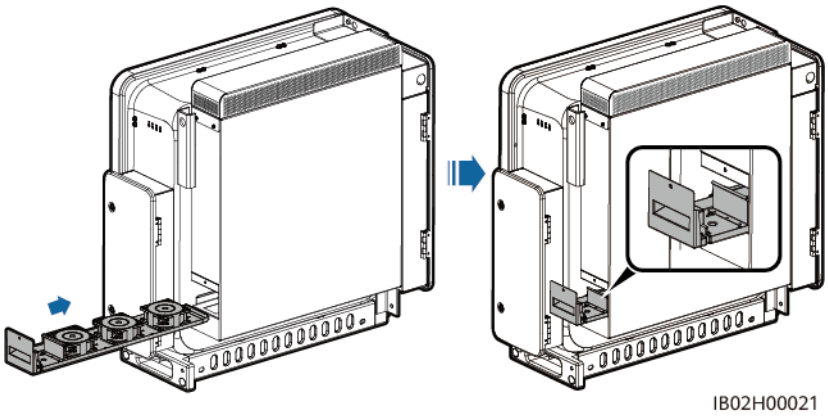
- Binding positions for fan 3

  Figure 9-14 Binding the cables of fan 3

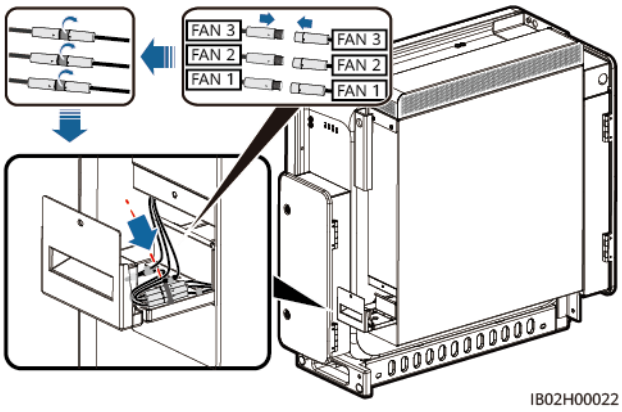
Step 8 Push in the fan tray until the fan baffle plate is flush with the Smart PCS.

Figure 9-15 Pushing in the fan tray



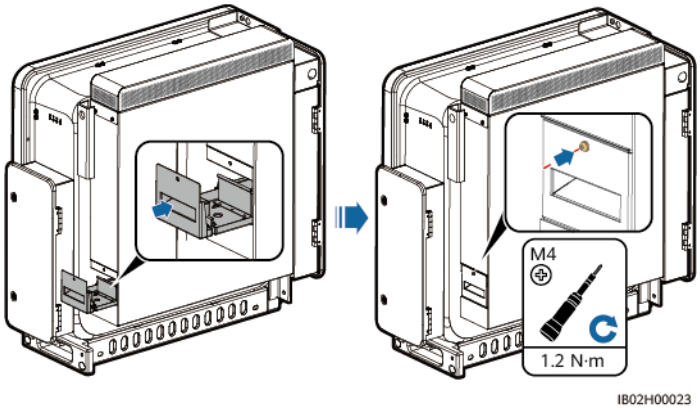
Step 9 Connect the cables correctly according to the cable labels, and then bind the cables.

Figure 9-16 Binding the cables



Step 10 Push the fan tray into the slot and tighten the screws.

Figure 9-17 Reinstalling the fan tray



----End

9.4 Device Replacement

Context

The device enclosure is severely damaged or the device hardware is faulty due to external forces.

Procedure

Step 1 Deliver a shutdown command on the SUN2000 app, SmartLogger, or management system.

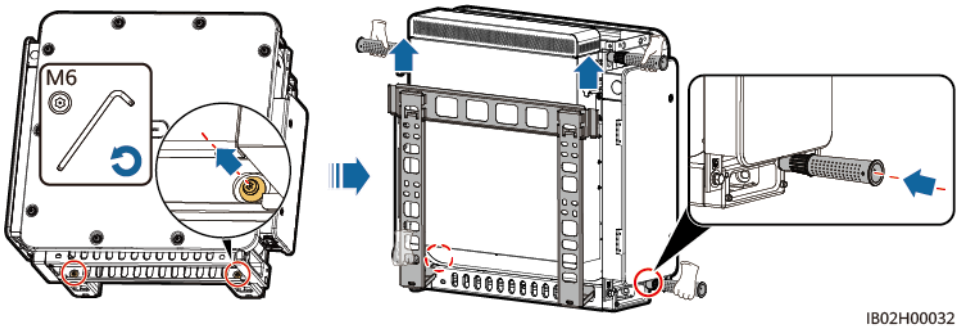
Step 2 Turn off the external switches on the DC and AC sides.

Step 3 Remove the DC power cables, AC power cables, communications cables, and ground cable from the Smart PCS in sequence.

Step 4 Remove the Smart PCS based on site requirements.

1. Support-mounted or wall-mounted

Figure 9-18 Removing the Smart PCS



2. Installed on the DCBOX

Figure 9-19 Removing screws from the Smart PCS

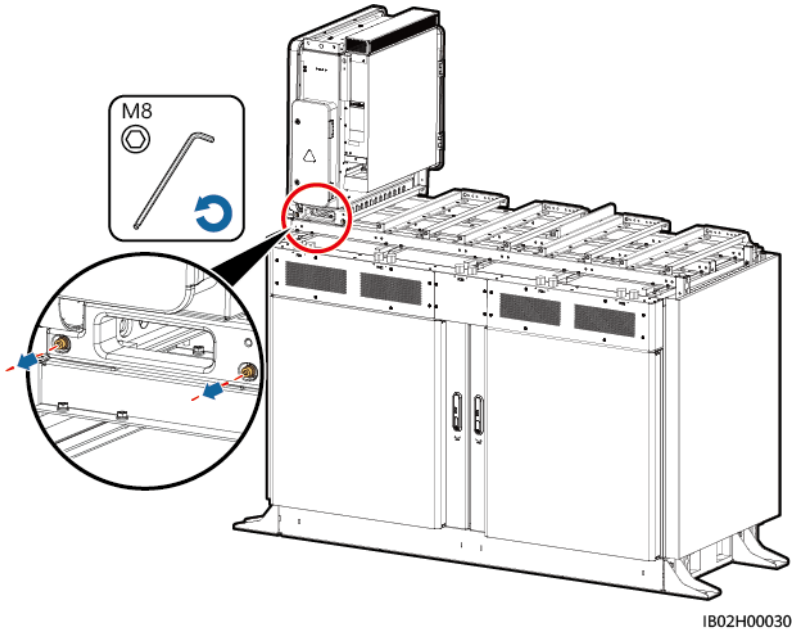
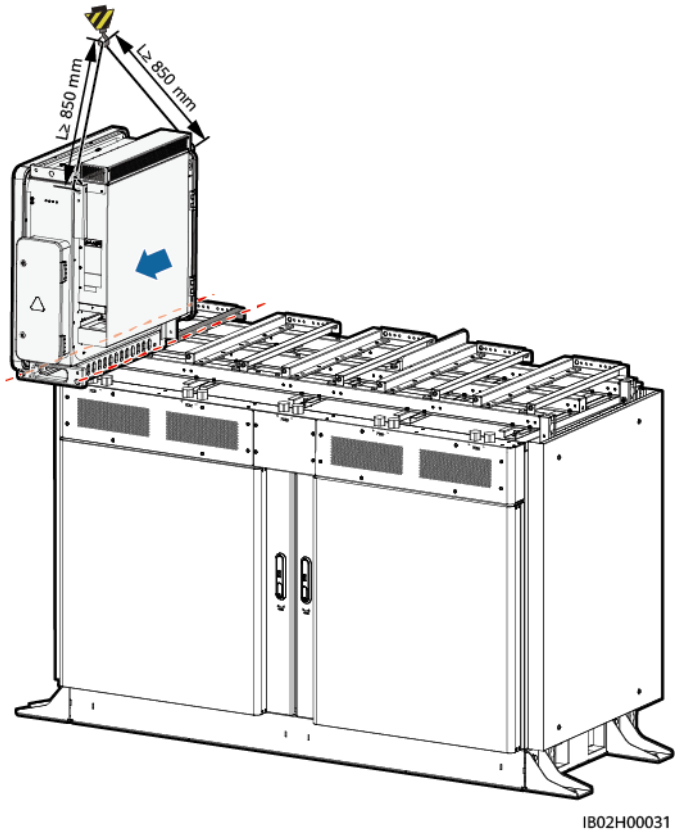


Figure 9-20 Removing the Smart PCS



Step 5 Install the new Smart PCS.

Step 6 Connect the ground cable, DC power cables, AC power cables, and communications cables in sequence. For details, see **5 Electrical Connections**.

Step 7 Power on the Smart PCS. Observe the LED indicators to check the running status of the Smart PCS and verify that the replacement is successful.

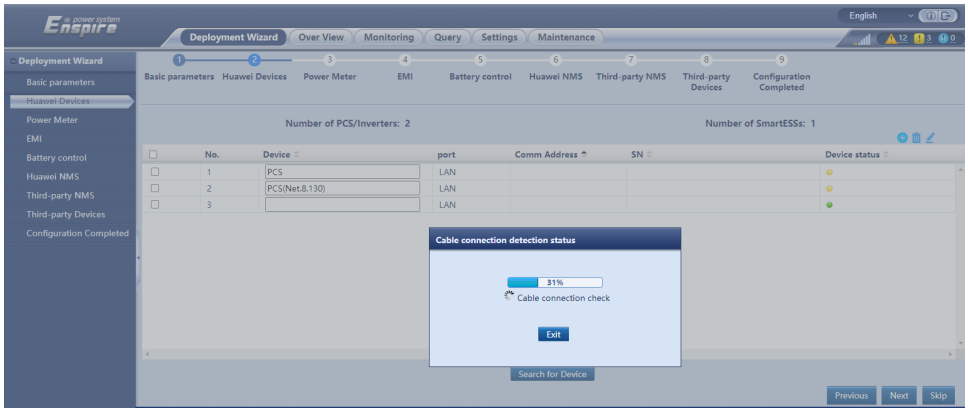
----End

Follow-up Procedure

Step 1 Power on the system. For details, see the system power-on section in the *LUNA2000-2.0MWH Series Smart String ESS User Manual*.

Step 2 Log in to the SmartLogger WebUI, enter the deployment wizard, and click **Search for Device** to check cable connections and allocate addresses.

Figure 9-21 Searching for devices

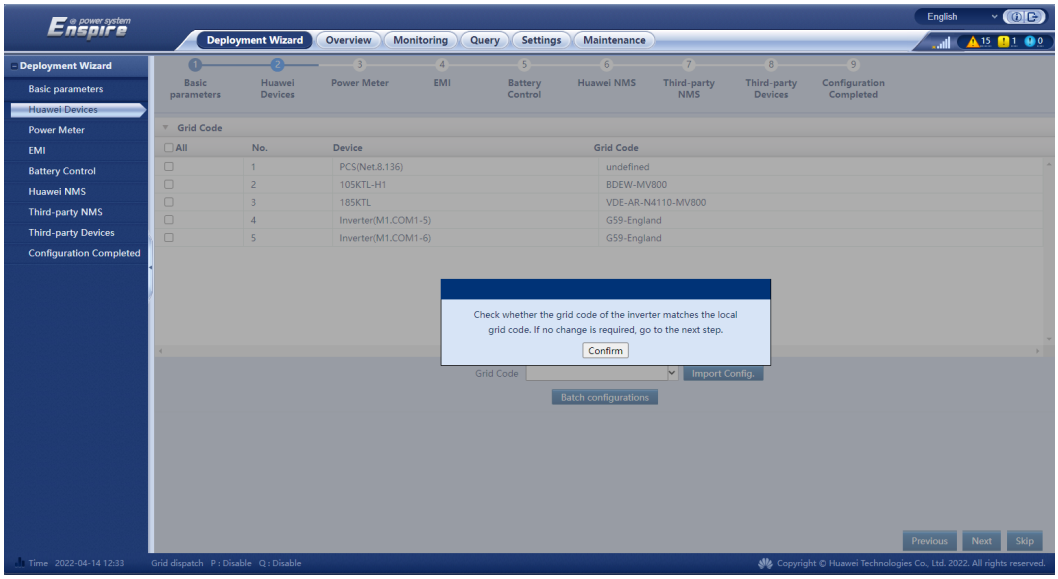


NOTE

- During the process of **Search for Device**, do not perform upgrade operations (such as upgrading through the app, network management system, or WebUI).
- When you click **Search for Device**, cable connections (DC and AC) will be checked before device search (not applicable to third-party devices), and device addresses will be automatically allocated.
- After the cable connection check and device search are complete, if a cable connection alarm is generated, you can click the alarm icon to view the corresponding alarm information.
- If an alarm is generated when the cable connection check fails, click the alarm icon to view the alarm cause and handling suggestions. After the fault is rectified, check the cable connection again.
- After the cable connection check and device search are complete, click to view the corresponding topology information.
- After a device is added or deleted, you need to click **Search for Device** again. Otherwise, the system topology will not update.

Step 3 (Optional) Change the grid code to ensure that the new Smart PCS grid code matches the local standard code.

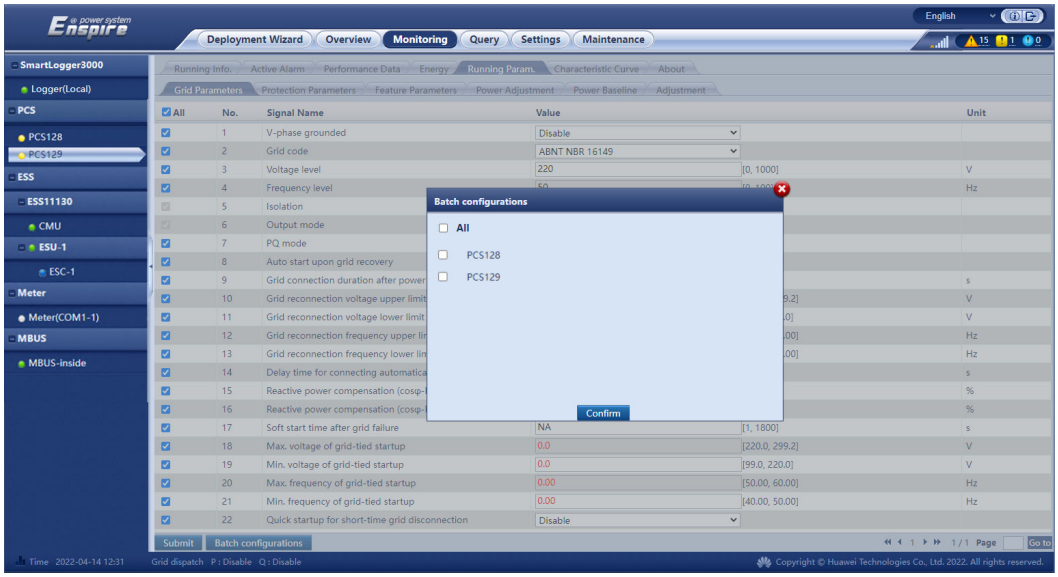
Figure 9-22 Grid parameters



Step 4 **Grid Parameters**, **Protection Parameters**, **Feature Parameters**, **Power Adjustment**, and **Power Baseline** of the new device must be synchronized with those of the running device. This section uses **Grid Parameters** settings as an example to describe how to synchronize data. The operations for setting other parameters are similar.

Click **Monitoring**, select a running device, choose **Running Param.** > **Grid Parameters** > **All** > **Batch configurations**, and click **Confirm** to synchronize data to the new device.

Figure 9-23 Setting running parameters

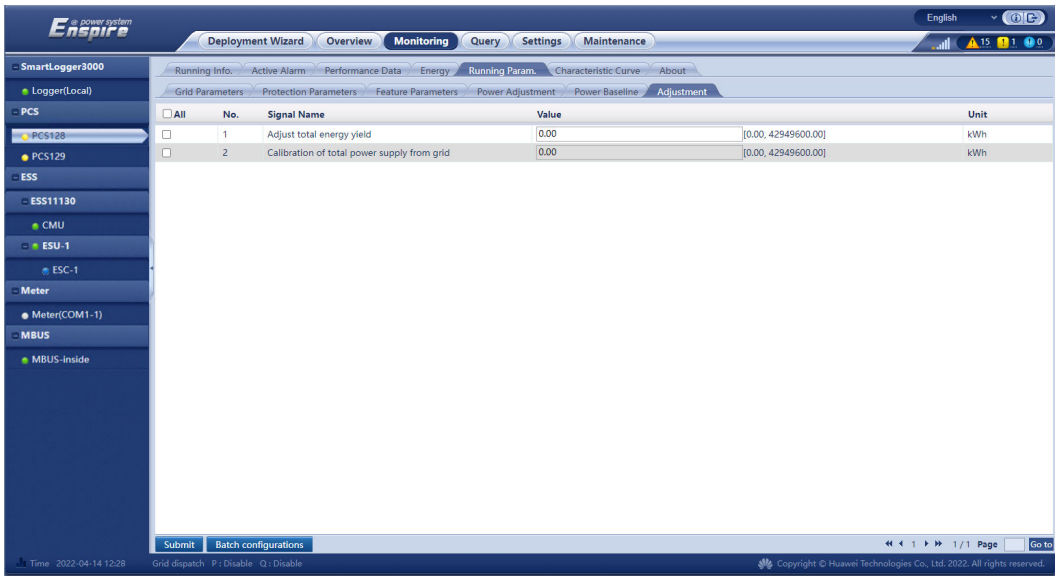


Step 5 Click **Monitoring**.

1. Select the faulty Smart PCS, choose **Running Param.** > **Adjustment**, and record the values of **Adjust total energy yield** and **Calibration of total power supply from grid**.

2. Select the new device, choose **Running Param.** > **Adjustment**, and set **Adjust total energy yield** and **Calibration of total power supply from grid** to be the same as those of the original device.

Figure 9-24 Energy yield calibration



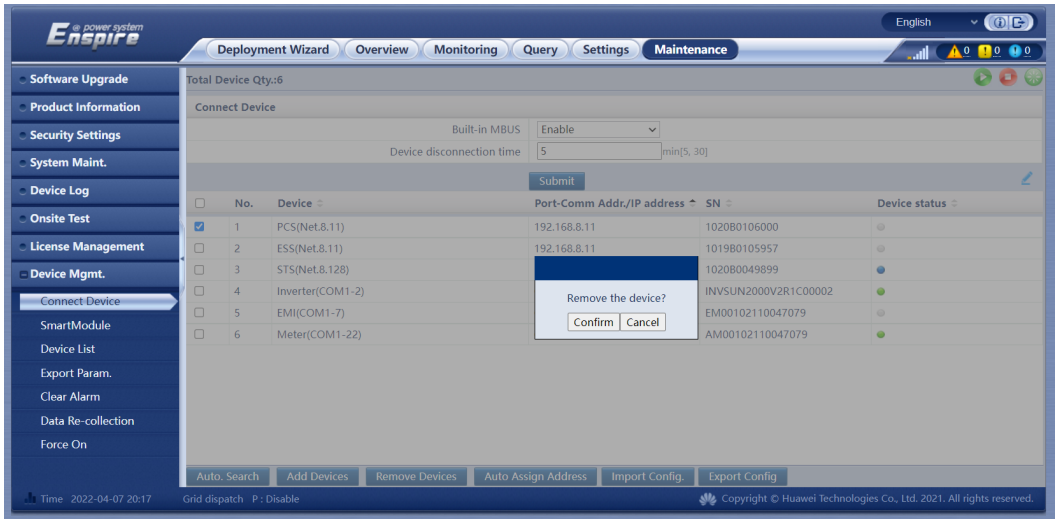
Step 6 After the topology is identified successfully, update the Smart PCS software. Ensure that the software version of the new Smart PCS is the same as that of the running Smart PCS on site.

Step 7 View the running status of the Smart PCS to check whether the Smart PCS functions properly.

Step 8 Delete the faulty Smart PCS.

Choose **Maintenance** > **Connect Device**, select the faulty Smart PCS, click **Remove Devices**, and click **Confirm**.

Figure 9-25 Deleting a device

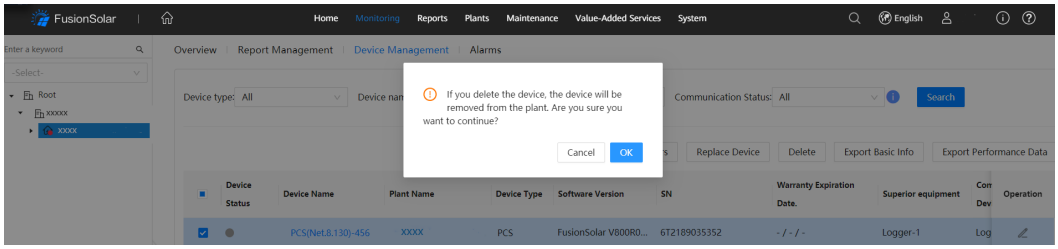


Step 9 (Optional) Log in to the Smart PV Management System, enter the PV plant, click **Device Management**, select the faulty Smart PCS, click **Delete**, and click **OK**.

NOTE

- Perform this step if you have purchased the PV plant management system.
- The software version corresponding to the user interface (UI) screenshots in this section is iMaster NetEco V600R022C00SPC120. The UI may vary by software versions and the screenshots are for reference only.

Figure 9-26 Deleting a device



----End

9.5 Disposing of the Smart PCS

If the Smart PCS reaches the end of its service life, dispose of the device according to local regulations for the disposal of electrical equipment.

10 Alarm Reference

Alarm severities are defined as follows:

- Major: The Smart PCS is faulty. As a result, the output power decreases or the grid-tied power generation is stopped.
- Minor: Some components of the Smart PCS are faulty without affecting the grid-tied power generation.
- Warning: The Smart PCS works properly. The output power decreases or some authorization functions fail due to external factors.

Table 10-1 Common alarms and troubleshooting measures

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2004	DC Overvoltage	Major	Cause ID = 1 The DC bus voltage of the device exceeds the upper threshold.	Turn off the AC and DC switches, wait for 5 minutes, and then turn on the AC and DC switches. If the fault persists, contact your dealer or technical support.
2005	DC in Reverse Polarity	Major	Cause ID = 1 The DC bus of the device is connected in reverse polarity.	Power off the device (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: Check whether the DC terminals are connected in reverse polarity. If yes, adjust the DC polarities.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2006	DC Short-Circuited or in Reverse Polarity	Major	Cause ID = 1 The DC bus of the device is short-circuited or connected in reverse polarity.	Power off the device (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: Check whether the DC terminals are short-circuited or connected in reverse polarity. If yes, adjust the DC bus cable connection.
2007	DC Connected in Series	Major	Cause ID = 1 The DC buses of the device are connected in series.	Power off the device (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: Check whether the DC terminals are connected in series. If yes, adjust the DC bus cable connection.
2008	DC Bus Not Securely Connected	Major	Cause ID = 1 The DC bus of the device is not securely connected.	Power off the device (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: Check whether the DC terminals are connected securely. If not, adjust the DC bus cable connection.
2031	Phase Wire Short-Circuited to PE	Major	Cause ID = 1 The phase wire is short-circuited to PE or its impedance to PE is low.	Check the impedance of the phase wire to PE, locate the position with low impedance, and rectify the fault.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2032	Grid Failure	Major	Cause ID = 1 1. The power grid experiences an outage. 2. The AC circuit is disconnected or the AC circuit breaker is OFF.	1. Check whether the AC voltage is normal. 2. The AC power cable is disconnected or the AC circuit breaker is OFF.
2033	Grid Undervoltage	Major	Cause ID = 1 The grid voltage is below the lower threshold or the undervoltage duration exceeds the time that triggers low voltage ride-through (LVRT).	1. If the alarm occurs occasionally, the power grid may be abnormal temporarily. The device automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid voltage is within the allowed range. If not, contact the local power operator. If yes, modify the power grid undervoltage protection threshold after obtaining the consent of the local power operator. 3. If the fault persists for a long time, check the connection between the AC switch and the input power cable.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2034	Grid Overvoltage	Major	Cause ID = 1 The grid voltage exceeds the higher threshold or the high voltage duration has lasted for more than the value specified by HVRT.	1. If the alarm occurs occasionally, the power grid may be abnormal temporarily. The device automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid voltage is within the allowed range. If not, contact the local power operator. If yes, modify the power grid overvoltage protection threshold after obtaining the consent of the local power operator. 3. Check whether the peak voltage of the power grid is too high. If the fault occurs frequently and persists for a long time, contact the local power operator.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2035	Grid Voltage Imbalance	Major	Cause ID = 1 The difference between grid phase voltages exceeds the upper threshold.	1. If the alarm occurs occasionally, the power grid may be abnormal temporarily. The device automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid voltage is within the normal range. If not, contact the local power operator. 3. If the fault persists for a long time, check the connection of the AC cable. 4. If the AC cable is correctly connected and the alarm persists and affects the operation of the plant, contact the local power operator.
2036	Grid Overfrequency	Major	Cause ID = 1 Power grid exception: The power grid frequency is higher than the frequency required in the local standard.	1. If the alarm occurs occasionally, the power grid may be abnormal temporarily. The device automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid frequency is within the allowed range. If not, contact the local power operator. If yes, modify the power grid overfrequency protection threshold after obtaining the consent of the local power operator.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2037	Grid Underfrequency	Major	Cause ID = 1 Power grid exception: The power grid frequency is lower than the frequency required in the local standard.	1. If the alarm occurs occasionally, the power grid may be abnormal temporarily. The device automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid frequency is within the allowed range. If not, contact the local power operator. If yes, modify the power grid underfrequency protection threshold after obtaining the consent of the local power operator.
2038	Grid Frequency Unstable	Major	Cause ID = 1 Power grid exception: The actual grid frequency change rate does not comply with the local power grid standard.	1. If the alarm occurs occasionally, the power grid may be abnormal temporarily. The device automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the grid frequency is within the allowed range. If not, contact the local power operator.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2039	AC Overcurrent	Major	Cause ID = 1 The grid experiences a dramatic voltage drop or is short-circuited. As a result, the transient AC current of the device exceeds the upper threshold and triggers protection.	1. The device detects its external working conditions in real time. After the fault is rectified, the device automatically recovers. 2. If the alarm occurs frequently and affects the operation of the power plant, check whether AC short circuit exists. If the fault persists, contact your dealer or technical support.
2040	DC Component Overhigh	Major	Cause ID = 1 The DC component in the AC current exceeds the upper threshold.	1. The device detects its external working conditions in real time. After the fault is rectified, the device automatically recovers. 2. If the alarm occurs frequently, contact your dealer or technical support.
2051	Abnormal Residual Current	Major	Cause ID = 1 The ground insulation resistance decreases during device operation.	1. If the alarm occurs occasionally, the external circuit may be abnormal temporarily. The device will automatically recover after the fault is rectified. 2. If the alarm occurs frequently or persists, check whether the DC-to-ground impedance is too low.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2061	Abnormal Grounding	Major	Cause ID = 1 1. The neutral wire or PE cable of the device is not connected. 2. The output mode of the device does not match the actual cable connection.	Power off the device (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: 1. Check that the PE cable of the device is connected properly. 2. If the device is connected to a TN power grid, check whether the neutral wire is properly connected and whether the voltage to ground is normal. 3. After powering on the device, check whether the output mode set on the device matches the actual cable connection.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2062	Low Insulation Resistance	Major	Cause ID = 2 1. The battery rack is short-circuited to the ground. 2. The battery rack is in a humid environment and the insulation between the battery rack and ground is poor.	Send a shutdown command to devices connected to the same DC bus. Start insulation impedance detection for the battery rack to locate the fault. After the fault is located, perform the following operations: 1. Check the resistance between the battery rack and the ground. If a short circuit or insufficient insulation is found, rectify it. 2. Check the battery rack-to-ground impedance. If a short circuit or inadequate insulation is found, rectify it. 3. If the impedance is lower than the specified protection threshold in rainy and cloudy days, change the **Insulation resistance protection threshold** setting.
2063	Cabinet Overtemperature	Minor	Cause ID = 1, 2 1. The device is installed in a place with poor ventilation. 2. The ambient temperature is high. 3. The device is faulty.	1. Check the ventilation and ambient temperature of the device installation position. 2. If the ventilation is poor or the ambient temperature exceeds the upper threshold, improve the ventilation and heat dissipation. 3. If the ventilation and ambient temperature meet requirements, contact your dealer or technical support.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2064	Device Fault	Major	Cause ID = 3–12, 16, 17, 19 A major fault has occurred on a circuit inside the device. Cause ID = 18 The AC soft-start board is abnormal, the DC precharge circuit is abnormal, or the common DC bus is short-circuited.	• Cause ID = 3–12, 16, 17, 19 Turn off the AC and DC switches, wait for 5 minutes, and then turn on the AC and DC switches. If the fault persists, contact your dealer or technical support. • Cause ID = 18 Power off the device (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: Check whether the common DC bus is short-circuited. If not, turn on the AC and DC switches, and restart the AC soft-start circuit. If the fault persists, contact your dealer or technical support.
2065	Upgrade Failed or Version Mismatch	Minor	Cause ID = 1–4 The upgrade ends abnormally. Cause ID = 8 The communication protocol version is incorrect.	• Cause ID = 1–4 1. Perform the upgrade again. 2. If the upgrade fails for multiple times, contact your dealer or technical support. • Cause ID = 8 1. Perform the upgrade again. 2. If the upgrade fails for multiple times, contact your dealer or technical support.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2086	External Fan Abnormal	Major	Cause ID = 1–3, corresponding to FAN 1–3 The external fan is short-circuited, the power supply is insufficient, or the air channel is blocked.	1. Turn off the AC and DC switches, check that the fan blades are normal, and clear the foreign objects around the fan if there are any. 2. Reinstall the fan and turn on the AC and DC switches. If the fault persists after the device runs for 15 minutes, replace the external fan.
2087	Internal Fan Abnormal	Major	Cause ID = 1–4 The internal fan is short-circuited, the power supply is insufficient, or the fan is damaged.	Turn off the AC and DC switches, wait for 5 minutes, and then turn on the AC and DC switches. If the fault persists after the device runs for 5 minutes, contact your dealer or technical support to replace the device.
2095	Invalid Certificate	Warning	Cause ID = 1 The digital signature certificate is invalid.	Check the time or replace the digital signature certificate.
2096	Certificate About to Expire	Warning	Cause ID = 1 The digital signature certificate is about to expire.	Replace the digital signature certificate in time.
2097	Certificate Expired	Major	Cause ID = 1 The digital signature certificate has expired.	Replace the digital signature certificate immediately.

Alarm ID	Alarm Name	Severity	Possible Cause	Suggestion
2098	Parallel System Abnormal	Major	Cause ID = 1 The parallel communication line is abnormal.	Power off the devices connected to the same DC bus (turn off the AC and DC switches, and wait for a period specified on the device safety warning label), and then perform the following operations: Check that the communications cable is securely connected and turn on the AC and DC switches. If the fault persists, contact your dealer or technical support.
61440	Faulty Monitoring Unit	Minor	Cause ID = 1 1. The flash memory is insufficient. 2. The flash memory has bad sectors.	Turn off the AC and DC switches, wait for 5 minutes, and then turn on the AC and DC switches. If the fault persists, replace the monitoring board or contact your dealer or technical support.

11 Technical Data

Efficiency

Technical Specifications	LUNA2000-200KTL-H0
Maximum efficiency	99.01%

DC Side

Technical Specifications	LUNA2000-200KTL-H0
Number of DC outputs	1
Maximum DC voltage	1500 V
Maximum DC power	245 kW
Maximum DC current	207.6 A
Minimum startup voltage[1]	540 V
Full-load voltage range	1180–1350 V (rectification mode) 1180–1280 V (inverter mode)
Operating DC voltage range	1180–1500 V
Rated DC voltage	1180 V
Note [1]: minimum startup voltage of the auxiliary power inside the device.	

Power Grid

Technical Specifications	LUNA2000-200KTL-H0
Rated AC voltage	800 V
Rated AC power	200 kW

Technical Specifications	LUNA2000-200KTL-H0
Maximum apparent power	240 kVA
Maximum active power	240 kW
Rated AC current	144.3 A
Maximum AC current	173.2 A
Rated grid frequency	50 Hz/60 Hz
Power factor	1 leading and 1 lagging
Maximum total harmonic distortion (rated power)	< 3%

Protection

Technical Specifications	LUNA2000-200KTL-H0
Anti-islanding protection	Supported
AC overcurrent protection	Supported
DC reverse polarity protection	Supported
DC surge protection	Type II
AC surge protection	Type II
Insulation resistance detection	Supported
Residue current monitoring unit (RCMU)	Supported
Overvoltage category	DC II/AC III

Display and Communication

Technical Specifications	LUNA2000-200KTL-H0
Display	LED indicator, WLAN module + app
Ethernet	Supported
USB	Supported

General Specifications

Technical Specifications	LUNA2000-200KTL-H0
Dimensions (W x H x D)	875 mm x 820 mm x 365 mm
Net weight	< 95 kg
Operating temperature	–25°C to +60°C (derated at +40°C or higher)
Cooling mode	Intelligent air cooling
Maximum operating altitude	4000 m (derated when altitude is greater than 2000 m)
Relative humidity	0%–100% RH
Input and output terminals	OT/DT terminals
IP rating	IP66
Topology	Transformerless

A Downloading and Installing the Apps

SUN2000 app: Access Huawei AppGallery, search for **SUN2000**, and download the app installation package. Alternatively, scan the QR code below (https://appgallery.cloud.huawei.com/appdl/C10279542) to download the app installation package.

QR code:

B Crimping an OT or DT Terminal

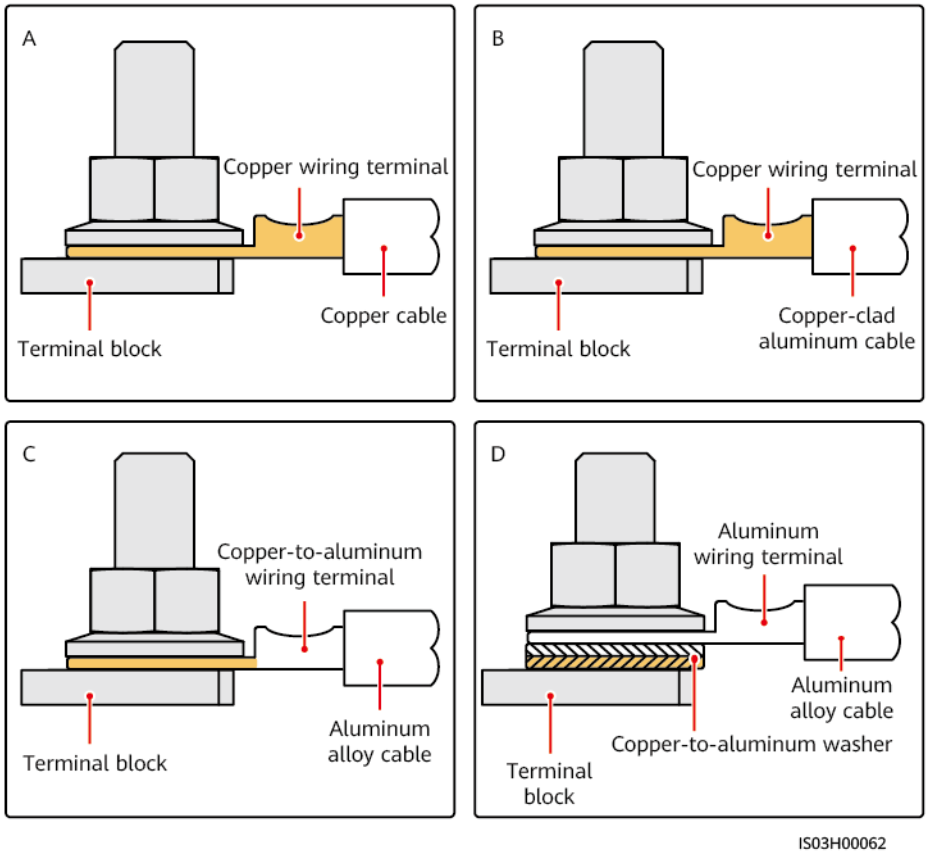
Requirements for OT/DT terminals

- If a copper cable is used, use copper wiring terminals.
- If a copper-clad aluminum cable is used, use copper wiring terminals.
- If an aluminum alloy cable is used, use copper-to-aluminum wiring terminals, or aluminum wiring terminals with copper-to-aluminum washers.

NOTICE

- Do not connect aluminum wiring terminals directly to the AC or DC terminal block, as this may lead to electrochemical corrosion which affects the reliability of cable connections.
- Comply with IEC 61238-1 requirements when using copper-to-aluminum wiring terminals, or aluminum wiring terminals with copper-to-aluminum washers.
- Ensure that the aluminum side of the washer contacts the aluminum wiring terminal, and the copper side contacts the terminal block.

Figure B-1 Requirements for OT/DT terminals

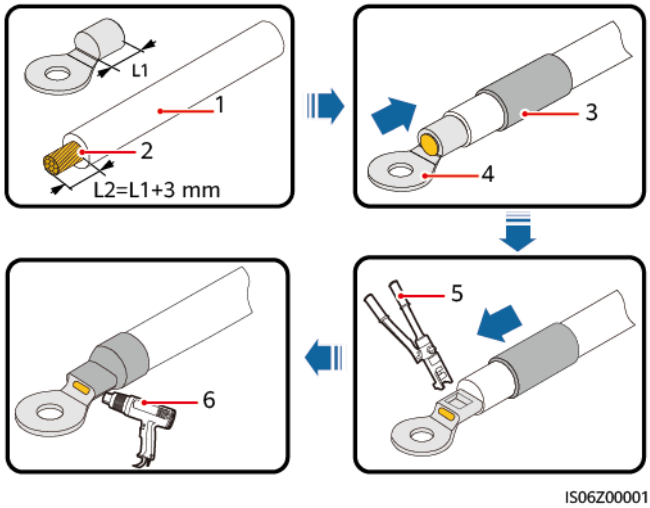


Crimping an OT or DT Terminal

NOTICE

- Avoid scratching the core wire when stripping a cable.
- The cavity formed after the conductor crimp strip of the OT or DT terminal has been crimped must completely wrap around the core wires. In addition, the core wires must be in close contact with the OT or DT terminal.
- Wrap the wire crimping area with heat-shrink tubing or insulation tape. Heat-shrink tubing is used in this section as an example.
- Take care when using a heat gun to avoid heat damage to the equipment.

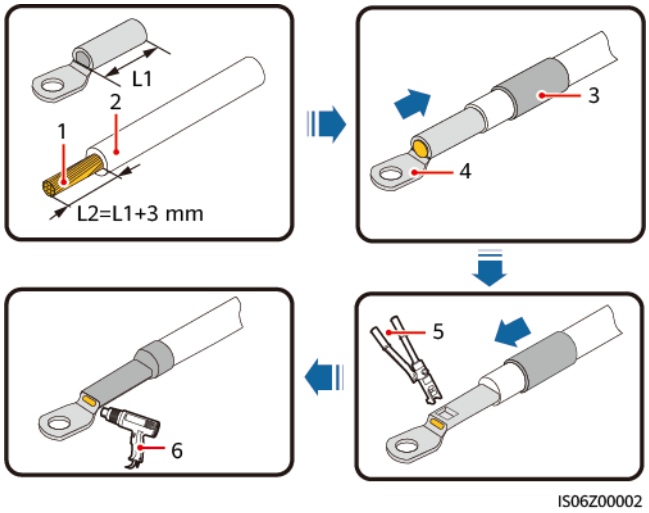
Figure B-2 Crimping an OT terminal



(1) Cable (2) Core (3) Heat-shrink tubing

(4) OT terminal (5) Hydraulic pliers (6) Heat gun

Figure B-3 Crimping a DT terminal



(1) Cable (2) Core (3) Heat-shrink tubing

(4) DT terminal (5) Hydraulic pliers (6) Heat gun

C Grid Code

NOTE

Grid codes are subject to change, and those listed are for reference only.

Set the correct grid code for the Smart PCS based on regions and application scenarios.

Grid Code	Description	LUNA2000-200KTL-H0
CHINA-GBT34120-MV800	China medium-voltage power grid for commercial energy storage	Supported
IEC61727-MV800	IEC medium-voltage power grid (50 Hz)	Supported
Chile-MV800	Chile medium-voltage power grid	Supported
TAI-PEA-MV800	Thailand PEA medium-voltage power grid	Supported
EN50549-MV800	Ireland power grid	Supported
IEC61727-MV800-60HZ	IEC medium-voltage power grid (60 Hz)	Supported
CEI0-16-MV800	Italy medium-voltage power grid	Supported
VDE-AR-N4120-HV800	VDE4120 standard medium-voltage power grid	Supported
CHILE-PMGD-MV800	Chile PMGD medium-voltage power grid	Supported
TAI-MEA-MV800	Thailand MEA medium-voltage power grid	Supported
G99-TYPEB-HV-MV800	UK G99_TypeB_HV medium-voltage power grid	Supported

Grid Code	Description	LUNA2000-200KTL-H0
G99-TYPEC-HV-MV800	UK G99_TypeC_HV medium-voltage power grid	Supported
G99-TYPED-MV800	UK G99_TypeD medium-voltage power grid	Supported
VDE-AR-N4110-MV800	Germany medium-voltage power grid (800 V)	Supported
POLAND-EN50549-MV800	Poland medium-voltage power grid	Supported
CHINA-CUSTOM-MV800	China 800 V power grid (custom)	Supported
Vietnam-MV800	Vietnam medium-voltage power grid	Supported
AUSTRIA-MV800	Austria medium-voltage TypeB power grid	Supported
AUSTRIA-HV800	Austria medium-voltage TypeD power grid	Supported

D Contact Information

If you have any questions about this product, please contact us.

Table D-1 Customer service contact information

Region	Country	Email	Tel
Europe	France	eu_inverter_support@huawei.com	0080033888888
	Germany		
	Spain		
	Italy		
	United Kingdom		
	Netherlands		
	Other countries	For details, visit solar.huawei.com.	
Asia-Pacific	Australia	eu_inverter_support@huawei.com	1800046639
	Turkey	eu_inverter_support@huawei.com	-
	Malaysia	apsupport@huawei.com	0080021686868 /1800220036
	Thailand		(+66) 26542662 (local rate call)
			1800290055 (free in Thailand)
	China	solarservice@huawei.com	400-822-9999
	Other countries	apsupport@huawei.com	0060-3-21686868

Region	Country	Email	Tel
Japan	Japan	Japan_ESC@ms.huawei.com	0120258367
India	India	indiaenterprise_TAC@huawei.com	1800 103 8009
Republic of Korea	Republic of Korea	Japan_ESC@ms.huawei.com	-
North America	United States	eu_inverter_support@huawei.com	1-877-948-2934
	Canada	eu_inverter_support@huawei.com	1-855-482-9343
Latin America	Mexico	la_inverter_support@huawei.com	018007703456 /0052-442-4288288
	Argentina		0-8009993456
	Brazil		0-8005953456
	Chile		800201866 (fixed-line only)
	Other countries		0052-442-4288288
Middle East and Africa	Egypt	eu_inverter_support@huawei.com	08002229000 /0020235353900
	UAE		08002229000
	Southern Africa		0800222900
	Saudi Arabia		8001161177
	Pakistan		0092512800019
	Morocco		0800009900
	Other countries		0020235353900

E Acronyms and Abbreviations

L	
LED	Light emitting diode
R	
RCMU	Residual current monitoring unit
S	
Smart PCS	Smart Power Control System

