LUNA2000-(4472, 5015) Series Smart String Grid Forming ESS Solution

User Manual

Issue	07
Date	2025-07-22

HUAWEI TECHNOLOGIES CO., LTD.

Copyright © Huawei Technologies Co., Ltd. 2025. All rights reserved.

No part of this document may be reproduced or transmitted in any form or by any means without prior written consent of Huawei Technologies Co., Ltd.

Trademarks and Permissions

and other Huawei trademarks are trademarks of Huawei Technologies Co., Ltd.
All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

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

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: https://e.huawei.com

About This Document

Purpose

This document describes the cable connections, power-on and commissioning, and power-off operations for the LUNA2000-(4472, 5015) series Smart String Grid Forming ESS Solution (on-grid).

The safety precautions, product introduction, site selection requirements, and maintenance information of the devices involved in the solution are described in the user manuals or maintenance manuals of the corresponding devices. For details, see **A Reference Documents**.

The WebUI screenshots in this document are for reference only. The user interface (UI) may vary with software versions.

Statement

In this document, LUNA only refers to specific models of Huawei Smart String Grid Forming ESS and Smart PCS.

In this document, JUPITER only refers to a specific model of Huawei STS.

Intended Audience

This document is intended for:

- Technical support engineers
- Hardware installation engineers
- Commissioning engineers

Symbol Conventions

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

 Copyright © Huawei Technologies Co., Ltd.

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

Change History

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

Issue 07 (2025-07-22)

Added **1.1.3 PV+ESS Low-Voltage Coupling Solution**.

Issue 06 (2025-05-30)

Updated **1.1.1 ESS-Only Solution**.

Updated **1.1.2 PV+ESS Medium-Voltage Coupling Solution**.

Updated **2.1 Installation**.

Updated **2.2 Cable Connections**.

Updated **3.2.2 Commissioning Using the Deployment Wizard**.

Updated **A Reference Documents**.

Issue 05 (2025-04-25)

Updated **1.2.2 Site-Level Communication Logic (Single Monitoring Ring Network + Single Control Ring Network)**.

Updated **3.2.2 Commissioning Using the Deployment Wizard**.

Copyright © Huawei Technologies Co., Ltd.

Issue 04 (2025-03-30)

Updated **1.2.3 Site-Level Communication Logic (Dual Monitoring Ring Networks + Single Control Ring Network)**.

Updated **1.2.4 Site-Level Communication Logic (Dual-Link Monitoring Network + Dual-Link Control Network)**.

Updated **2.1 Installation**.

Updated **2.2 Cable Connections**.

Updated **3.1.1 Preparations**.

Updated **3.1.3 Powering On the ESS Array**.

Updated **3.2.1 Preparations and WebUI Login**.

Updated **3.2.2 Commissioning Using the Deployment Wizard**.

Updated **3.2.3 Follow-up Procedure for the PCS**.

Issue 03 (2025-02-18)

Updated **1.2.3 Site-Level Communication Logic (Dual Monitoring Ring Networks + Single Control Ring Network)**.

Updated **1.2.4 Site-Level Communication Logic (Dual-Link Monitoring Network + Dual-Link Control Network)**.

Updated **2.2 Cable Connections**.

Updated **3.2.2 Commissioning Using the Deployment Wizard**.

Issue 02 (2025-01-08)

Added **1.2.3 Site-Level Communication Logic (Dual Monitoring Ring Networks + Single Control Ring Network)**.

Added **1.2.4 Site-Level Communication Logic (Dual-Link Monitoring Network + Dual-Link Control Network)**.

Added **5.1 Why Does the ESS Still Fail to Discharge When Its SOC Is Higher Than the End-of-discharge SOC?**.

Updated **1.2.1 Array-Level Communication Logic**.

Updated **1.2.2 Site-Level Communication Logic (Single Monitoring Ring Network + Single Control Ring Network)**.

Issue 01 (2024-10-30)

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

 Copyright © Huawei Technologies Co., Ltd.

Contents

About This Document ii

1 Solution Introduction 1

1.1 Networking Architecture 1

1.1.1 ESS-Only Solution 1

1.1.2 PV+ESS Medium-Voltage Coupling Solution 3

1.1.3 PV+ESS Low-Voltage Coupling Solution 6

1.2 Communication Logic 7

1.2.1 Array-Level Communication Logic 7

1.2.2 Site-Level Communication Logic (Single Monitoring Ring Network + Single Control Ring Network) 10

1.2.3 Site-Level Communication Logic (Dual Monitoring Ring Networks + Single Control Ring Network) 13

1.2.4 Site-Level Communication Logic (Dual-Link Monitoring Network + Dual-Link Control Network) 16

1.3 O&M Methods 18

1.4 ESS Array Layout Principles 19

2 Installation and Cable Connections 21

2.1 Installation 21

2.2 Cable Connections 23

2.3 Suggestions on Preventing Incorrect Cable Connection 25

3 Deployment and Commissioning 27

3.1 Array Power-On 27

3.1.1 Preparations 27

3.1.2 (Optional) Powering On the PV Array 28

3.1.3 Powering On the ESS Array 29

3.2 Basic Service Commissioning 31

3.2.1 Preparations and WebUI Login 31

3.2.2 Commissioning Using the Deployment Wizard 33

3.2.3 Follow-up Procedure for the PCS 44

3.3 Shutdown and Power-Off 45

4 System Startup and Operation 47

5 FAQ 49

5.1 Why Does the ESS Still Fail to Discharge When Its SOC Is Higher Than the End-of-discharge SOC? 49

 Copyright © Huawei Technologies Co., Ltd.

A Reference Documents..... 50
B Contact Information..... 52
C Acronyms and Abbreviations..... 54

 Copyright © Huawei Technologies Co., Ltd.

1 Solution Introduction

1.1 Networking Architecture

1.1.1 ESS-Only Solution

Figure 1-1 shows the single-array networking of the ESS-only solution.

Figure 1-1 Networking architecture of the ESS-only solution

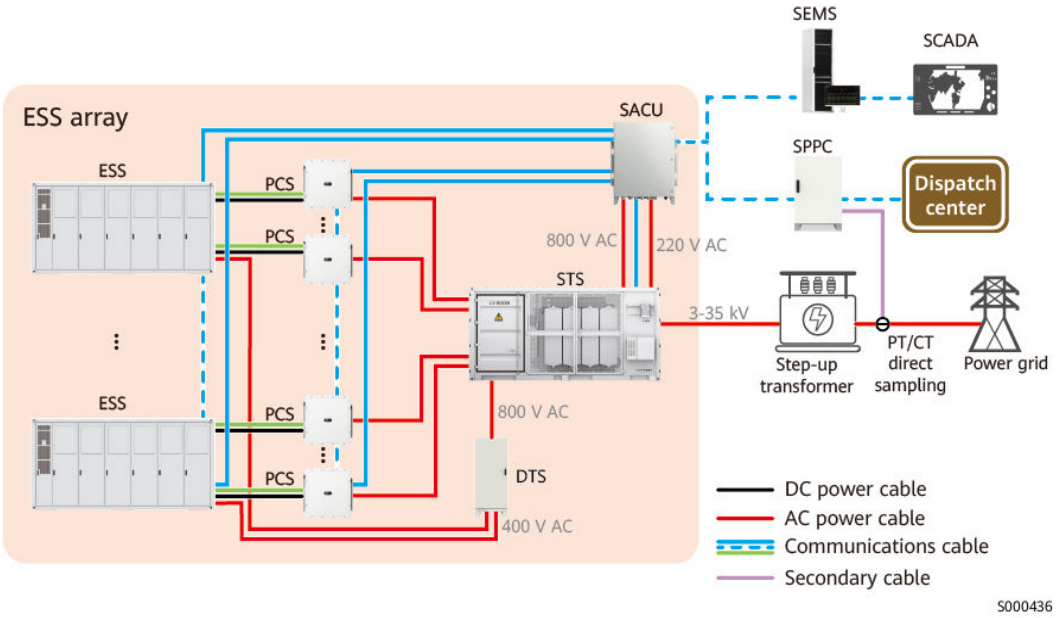


Table 1-1 lists the equipment of an ESS array in the grid following (GFL) scenario.

 Copyright © Huawei Technologies Co., Ltd.

Table 1-1 ESS array components in the GFL scenario

Device	Model	Remarks
Smart String Energy Storage System (ESS)	• LUNA2000-4472-2S • LUNA2000-5015-2S	Purchased from the Company.
Smart Power Control System (PCS)	LUNA2000-213KTL-H0	Purchased from the Company.
Smart Array Controller (SACU)	SmartACU2000D-D-11	Purchased from the Company. If the STS has a built-in SACU, you do not need to purchase the SACU separately.
Smart Transformer Station (STS)	• STS-3000K-H1 • STS-6000K-H1 • JUPITER-9000K-H0 • JUPITER-3000K-H1 (built-in SACU) • JUPITER-6000K-H1 (built-in SACU) • JUPITER-9000K-H1 (built-in SACU)	Purchased from the Company or other vendors.
Distribution Transformer (DTS)	DTS-200K-D0	Purchased from the Company or other vendors.
Smart Power Plant Controller (SPPC)	• SPPC2000-A01 (current sampling level: 1 A) • SPPC2000-A02 (current sampling level: 5 A)	Purchased from the Company or other vendors. One SPPC supports 64 arrays.
Smart Energy Management System (SEMS)	SEMS2000	Purchased from the Company or other vendors.

Table 1-2 lists the equipment of an ESS array in the grid forming (GFM) scenario.

Table 1-2 ESS array components in the GFM scenario

Device	Model	Remarks
ESS	• LUNA2000-4472-2S • LUNA2000-5015-2S	Purchased from the Company.

Copyright © Huawei Technologies Co., Ltd.

Device	Model	Remarks
PCS	LUNA2000-213KTL-H0	Purchased from the Company.
SACU	SmartACU2000D-D-11	Purchased from the Company.
STS	• JUPITER-3000K-H1-GF • JUPITER-3000K-H1 (built-in SACU) • JUPITER-6000K-H1 (built-in SACU)	Purchased from the Company or other vendors. If the STS has a built-in SACU, you do not need to purchase the SACU separately. To use the JUPITER-6000K-H1 (built-in SACU), contact technical support to help you place an order.
DTS	DTS-200K-D0	Purchased from the Company or other vendors.
SPPC	• SPPC2000-A01 (current sampling level: 1 A) • SPPC2000-A02 (current sampling level: 5 A)	Purchased from the Company or other vendors. One SPPC supports 64 arrays.
SEMS	SEMS2000	Purchased from the Company or other vendors.

NOTICE

The equipment used in the project must meet the local environment requirements.

1.1.2 PV+ESS Medium-Voltage Coupling Solution

Figure 1-2 shows the single-array networking of the PV+ESS medium-voltage coupling solution. It is recommended that the inverters in the PV array communicate with the SACU over MBUS. They can also communicate with each other over RS485 using a network cable.

Copyright © Huawei Technologies Co., Ltd.

Figure 1-2 Networking architecture of the PV+ESS medium-voltage coupling solution

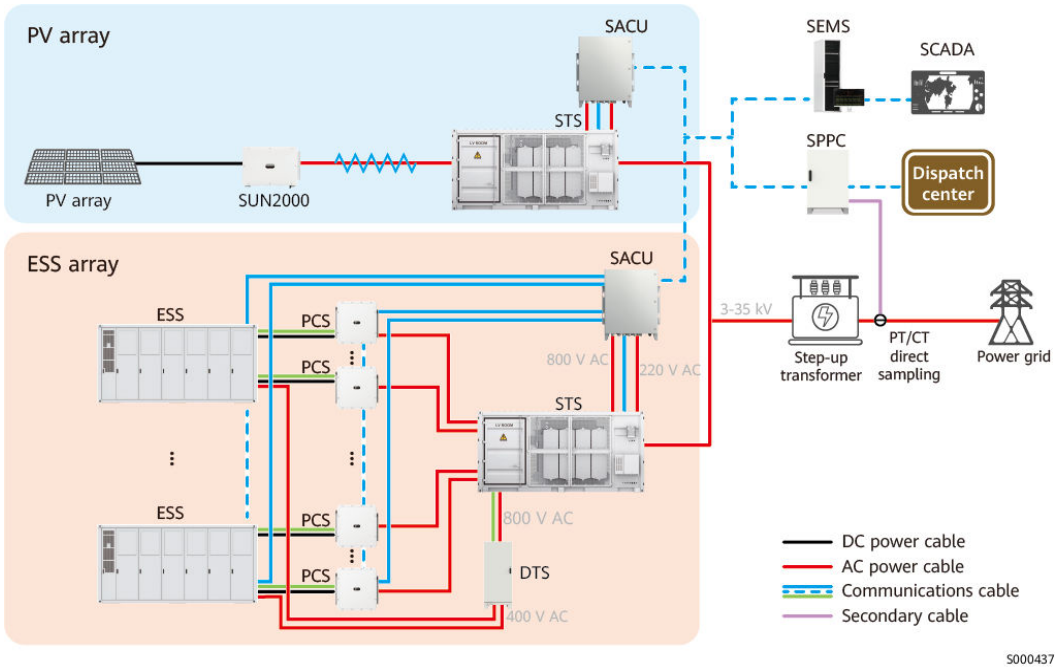


Table 1-3 lists the equipment of an ESS array in the grid following (GFL) scenario.

Table 1-3 ESS array components in the GFL scenario

Device	Model	Remarks
Smart String Energy Storage System (ESS)	• LUNA2000-4472-2S • LUNA2000-5015-2S	Purchased from the Company.
Smart Power Control System (PCS)	LUNA2000-213KTL-H0	Purchased from the Company.
Smart Array Controller (SACU)	SmartACU2000D-D-11	Purchased from the Company. If the STS has a built-in SACU, you do not need to purchase the SACU separately.
Smart Transformer Station (STS)	• STS-3000K-H1 • STS-6000K-H1 • JUPITER-9000K-H0 • JUPITER-3000K-H1 (built-in SACU) • JUPITER-6000K-H1 (built-in SACU) • JUPITER-9000K-H1 (built-in SACU)	Purchased from the Company or other vendors.

Copyright © Huawei Technologies Co., Ltd.

Device	Model	Remarks
Distribution Transformer (DTS)	DTS-200K-D0	Purchased from the Company or other vendors.
Smart Power Plant Controller (SPPC)	• SPPC2000-A01 (current sampling level: 1 A) • SPPC2000-A02 (current sampling level: 5 A)	Purchased from the Company or other vendors. One SPPC supports 64 arrays.
Smart Energy Management System (SEMS)	SEMS2000	Purchased from the Company or other vendors.

Table 1-4 lists the equipment of an ESS array in the grid forming (GFM) scenario.

Table 1-4 ESS array components in the GFM scenario

Device	Model	Remarks
ESS	• LUNA2000-4472-2S • LUNA2000-5015-2S	Purchased from the Company.
PCS	LUNA2000-213KTL-H0	Purchased from the Company.
SACU	SmartACU2000D-D-11	Purchased from the Company.
STS	• JUPITER-3000K-H1-GF • JUPITER-3000K-H1 (built-in SACU) • JUPITER-6000K-H1 (built-in SACU)	Purchased from the Company or other vendors. If the STS has a built-in SACU, you do not need to purchase the SACU separately. To use the JUPITER-6000K-H1 (built-in SACU), contact technical support to help you place an order.
DTS	DTS-200K-D0	Purchased from the Company or other vendors.

Copyright © Huawei Technologies Co., Ltd.

Device	Model	Remarks
SPPC	• SPPC2000-A01 (current sampling level: 1 A) • SPPC2000-A02 (current sampling level: 5 A)	Purchased from the Company or other vendors. One SPPC supports 64 arrays.
SEMS	SEMS2000	Purchased from the Company or other vendors.

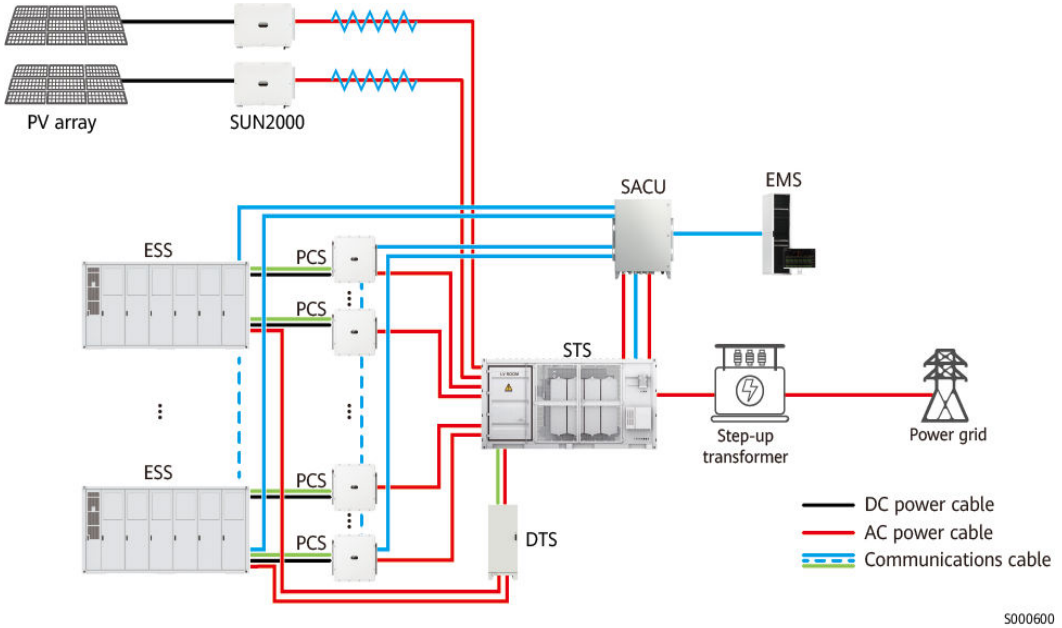
NOTICE

The equipment used in the project must meet the local environment requirements.

1.1.3 PV+ESS Low-Voltage Coupling Solution

The PV+ESS low-voltage coupling solution supports only the GFL scenario. **Figure 1-3** shows the intra-array networking.

Figure 1-3 Networking architecture of the PV+ESS low-voltage coupling solution



For details about key device selection, see **Table 1-1**.

Copyright © Huawei Technologies Co., Ltd.

Table 1-5 Components in the PV+ESS low-voltage coupling array

Device	Model	Remarks
Smart String Energy Storage System (ESS)	LUNA2000-4472-2S	Purchased from the Company.
Smart Power Control System (PCS)	LUNA2000-213KTL-H0	Purchased from the Company.
PV inverter	• SUN2000-300KTL-H0 • SUN2000-330KTL-H1 • SUN2000-330KTL-H2	Purchased from the Company.
Smart Array Controller (SACU)	SmartACU2000D-D-11	Purchased from the Company. If the STS has a built-in SACU, you do not need to purchase the SACU separately.
Smart Transformer Station (STS)	• JUPITER-3000K-H1 (built-in SACU) • JUPITER-6000K-H1 (built-in SACU) • JUPITER-9000K-H1 (built-in SACU)	Purchased from the Company or other vendors.
Distribution Transformer (DTS)	DTS-200K-D0	Purchased from the Company.
Energy management system (EMS)	-	Purchased by the customer.

1.2 Communication Logic

1.2.1 Array-Level Communication Logic

One SACU manages multiple ESSs, PCSs, and one STS that form an array.

In the ESS array:

- The ESSs form a ring network through Ethernet ports or optical ports to communicate with the SACU. Each ESS ring network can connect to a maximum of eight ESSs, and one array supports a maximum of one ESS ring network.
- The PCSs form a ring network through Ethernet ports to communicate with the SACU. Each PCS ring network can connect to a maximum of 16 PCSs, and one array supports a maximum of three PCS ring networks (48 PCSs).
- The STS communicates with the SACU through the Ethernet port or RS485 port, and the DTS communicates with the STS through dry contacts.

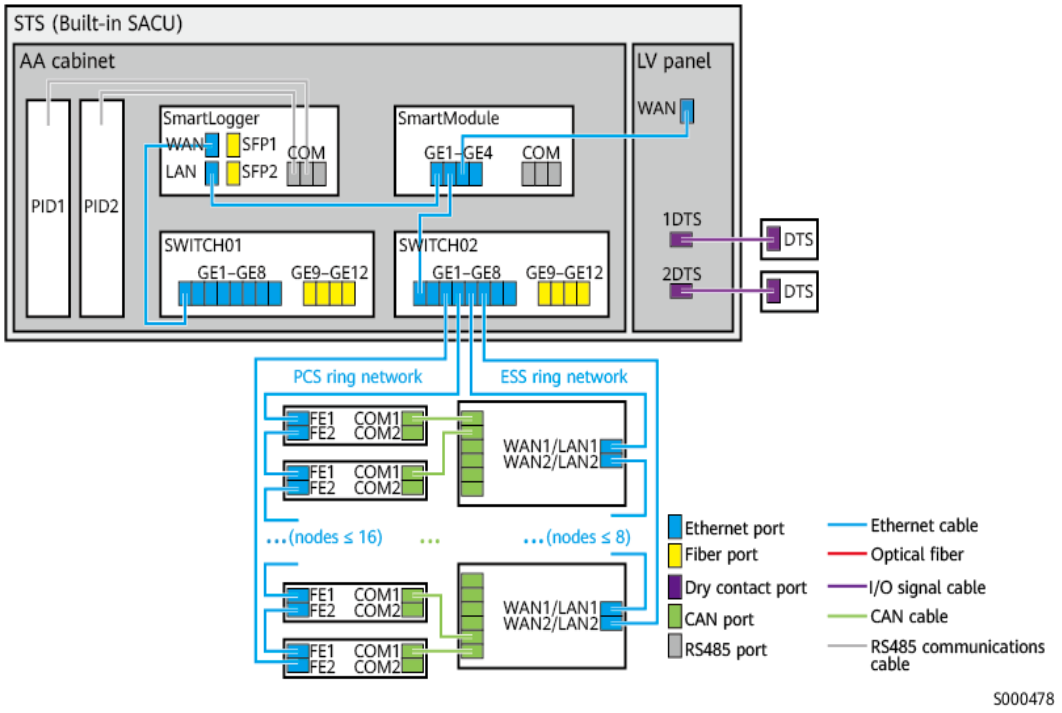
 Copyright © Huawei Technologies Co., Ltd.

- The ESS communicates with the PCS over CAN. Each battery rack of the ESS connects to one PCS, or two or four PCSs in hand-in-hand chain mode. For details, see **Table 1-6**.

Select a networking mode based on the quantity of ESSs and PCSs in the array, communication mode between the ESSs and the SACU, and optical fiber deployment.

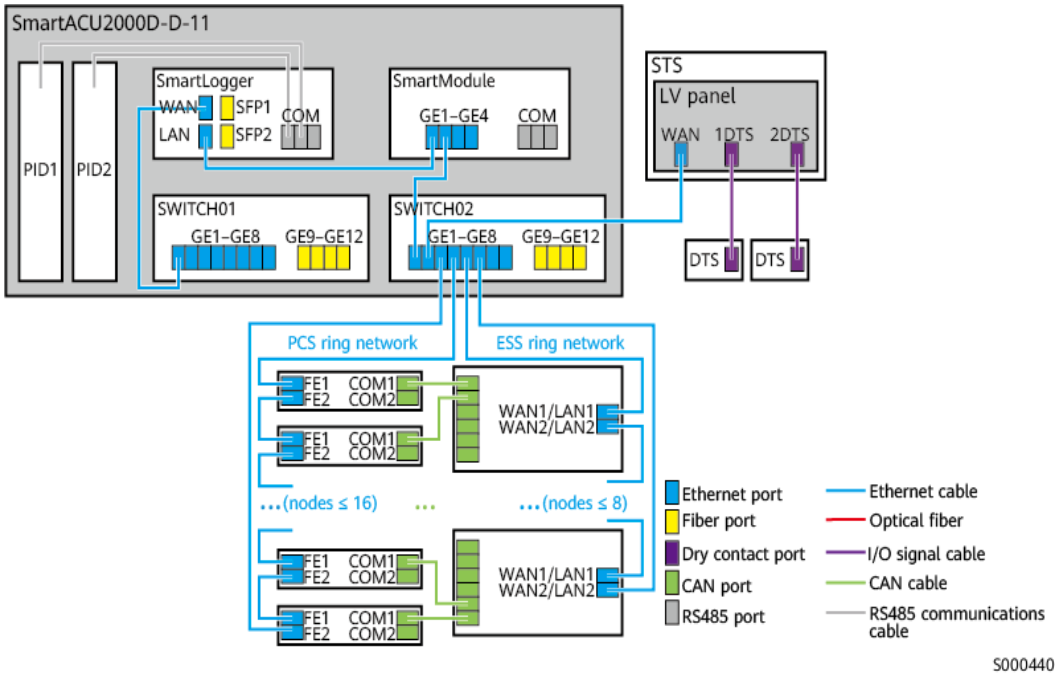
Figure 1-4 and **Figure 1-5** show the communication logic within an ESS array. The port numbers in the figures are device silk screens.

Figure 1-4 Communication logic (STS with built-in SACU)



 Copyright © Huawei Technologies Co., Ltd.

Figure 1-5 Communication logic (separate SACU)



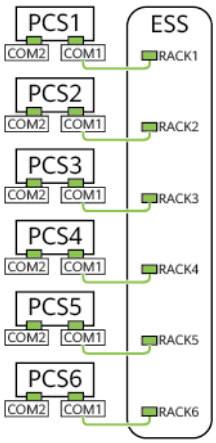
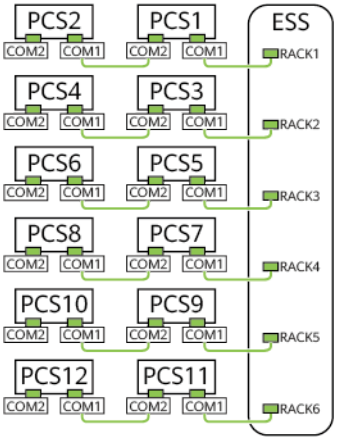
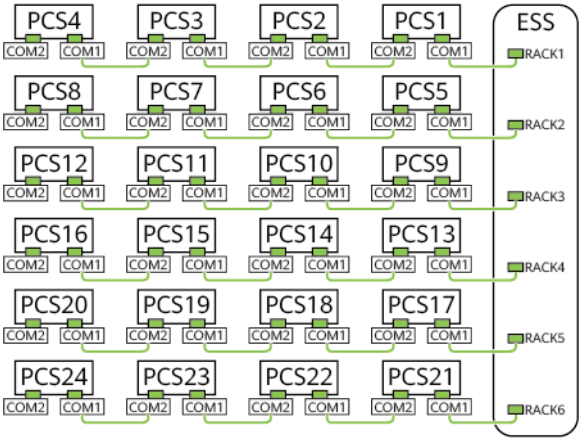
NOTE

- Ethernet cables are recommended for ESS ring network communication. If the Ethernet ports of the SACU southbound switch SWITCH02 are fully occupied by the PCS ring networks, the ESS ring network can communicate with the SACU through optical ports.
- The STS communicates with the SACU over Ethernet or RS485, depending on the STS model.
  - The JUPITER series STS communicates with the SmartLogger through the WAN port on the STS and the LAN port on the SmartLogger.
  - The STS series STS communicates with the SmartLogger through the RS485 port on the STS and the COM3 port on the SmartLogger.
- For the SmartModule in the SACU, the GE1 and GE4 ports are used to connect to the SmartLogger, and the GE2 and GE3 ports are used to connect to the southbound ring network through a network switch. Ensure that these ports are used correctly.
- For the SmartModule in the ESS, GE1 and GE4 are used to connect to the CMU, and GE2 and GE3 are used to connect to the BCU ring network. Ensure that these ports are used correctly.

The following describes how to connect the ESS battery racks to the PCSs over serial port communication. The quantity of PCSs corresponding to each battery rack of an ESS must be the same.

 Copyright © Huawei Technologies Co., Ltd.

Table 1-6 Cable connections for serial port communication between the ESS battery racks and PCSs

Solution	Communications Cable Connection
Each battery rack corresponds to one PCS.	
Each battery rack corresponds to two PCS.	
Each battery rack corresponds to four PCS.	

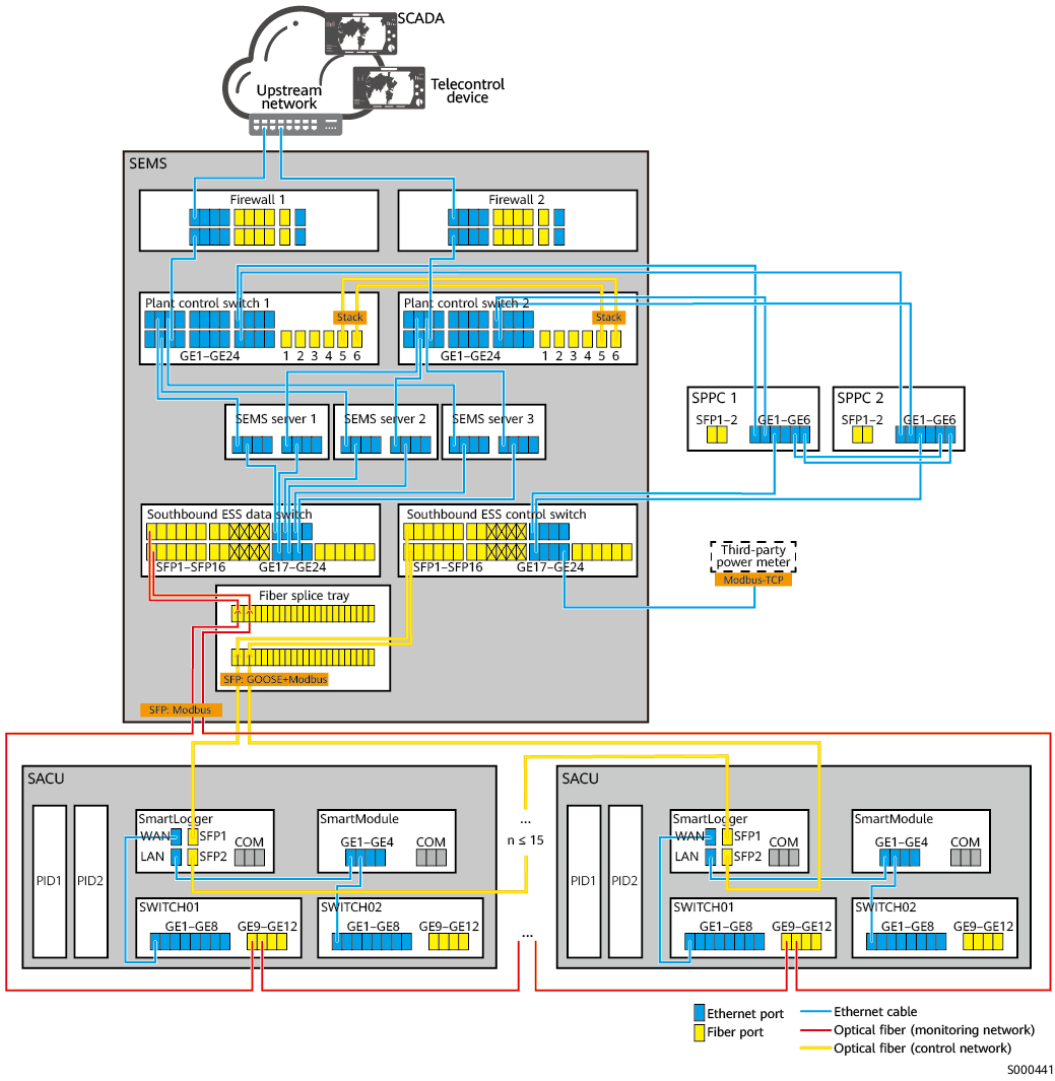
1.2.2 Site-Level Communication Logic (Single Monitoring Ring Network + Single Control Ring Network)

The SACUs form a ring network in hand-in-hand mode and communicate with the built-in network management system (NMS) server of the SEMS through the

 Copyright © Huawei Technologies Co., Ltd.

northbound Modbus-based monitoring network. The SACUs also communicate with the SPPC through the GOOSE/Modbus-based control network. The monitoring network is isolated from the control network. The port numbers in **Figure 1-6** are device silk screens. Each SEMS can connect to a maximum of 12 SACU ring networks (including PV arrays and ESS arrays. It is recommended that SACU ring networks be ≤ 10 to reserve a proper number of standby optical ports). A maximum of 15 SACUs (recommended: ≤ 10) can be connected to each ring network.

Figure 1-6 Single monitoring ring network + single control ring network (Huawei SEMS + Huawei SPPC)



If a third-party EMS is used, the SACU ring network can also be connected to the northbound monitoring network over IEC 104. See **Figure 1-7** and **Figure 1-8**.

 Copyright © Huawei Technologies Co., Ltd.

Figure 1-7 Single monitoring ring network + single control ring network (third-party EMS + Huawei SPPC)

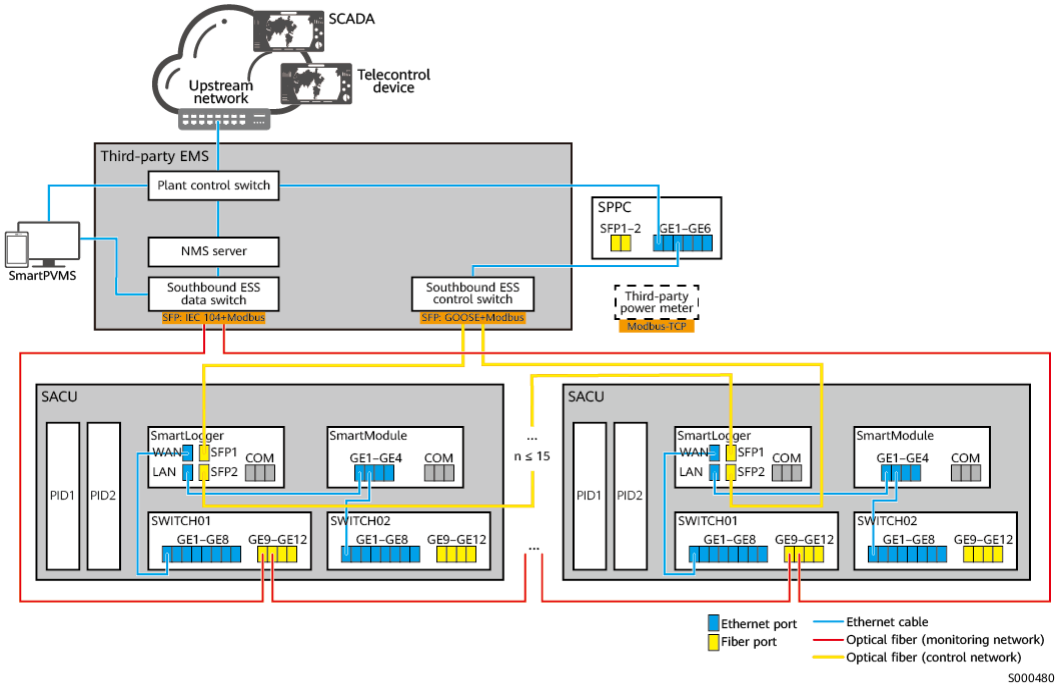
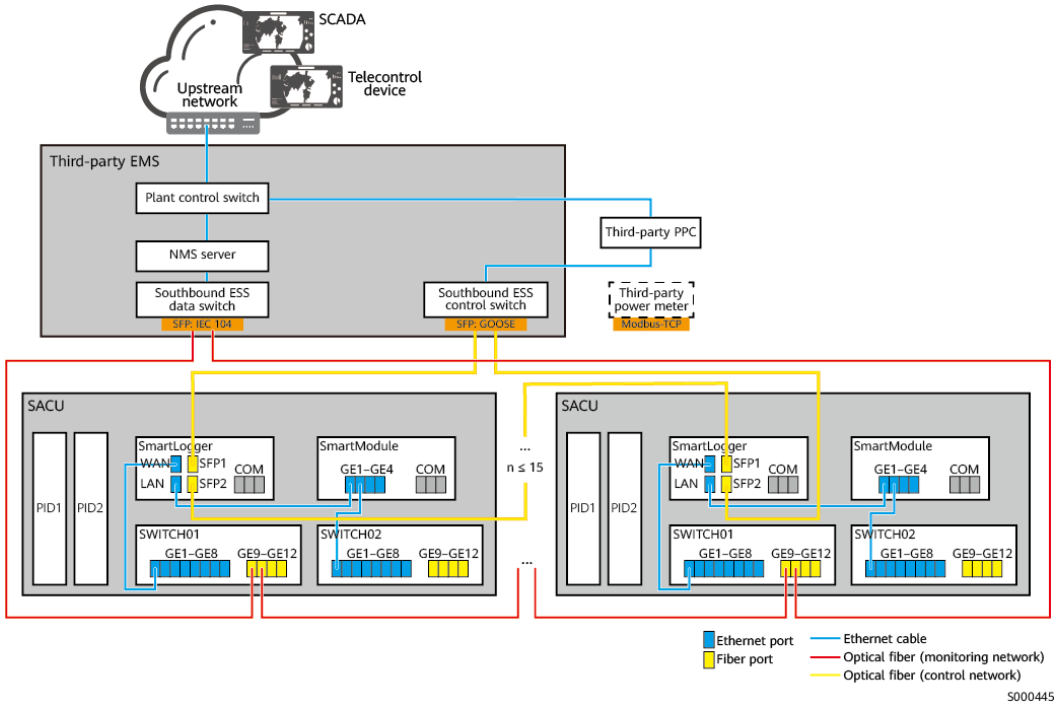


Figure 1-8 Single monitoring ring network + single control ring network (third-party EMS + third-party PPC)



 Copyright © Huawei Technologies Co., Ltd.

NOTE

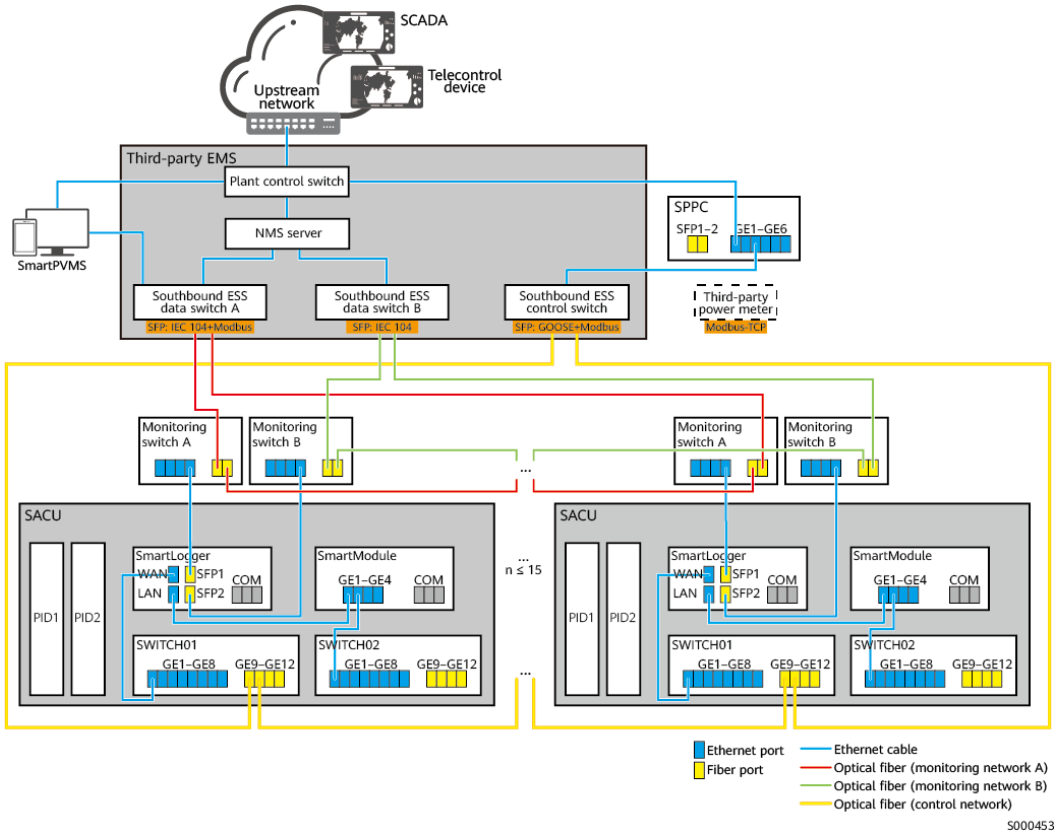
- Gigabit single-mode optical modules must be used at the central site (central control room or management system site). Four-core or eight-core single-mode armored optical cables with a transmission wavelength of 1310 nm and an outer diameter less than 18 mm must be used.
- The fiber channel switch must support the standard RSTP, and the bridge priority of the switch must be higher than 0x8000 of the SmartLogger (recommended value: 0x7000; a smaller value indicates a higher bridge priority). For details about how to configure the RSTP and bridge priority of the switch, contact the vendor.
- The PPC communicates with the SACU ring network through the southbound control switch of the EMS. In the PV+ESS solution, it is recommended that the southbound PV control switch and southbound ESS control switch be planned in the same subnet for PPC southbound control. If the IP addresses cannot be on the same subnet, configure routes to ensure network accessibility.
- Optical fibers can also be used for PPC southbound and northbound communication.
- For the single monitoring ring network solution, when planning cable connection for the SACU ring network, you can connect the SFP1/SFP2 port of the SmartLogger to the monitoring network and connect the WAN port to the control network through an optical port of SWITCH01. Select a proper cable connection solution based on the project requirements.

1.2.3 Site-Level Communication Logic (Dual Monitoring Ring Networks + Single Control Ring Network)

The SACU communicates with the third-party NMS server through the IEC104-based dual monitoring ring networks and communicates with the SPPC through the GOOSE/Modbus-based control network. The monitoring network is isolated from the control network. The two southbound ESS data switches of the third-party EMS form two ring networks with the SACUs of the ESS arrays. The port numbers in **Figure 1-9** are device silk screens.

Copyright © Huawei Technologies Co., Ltd.

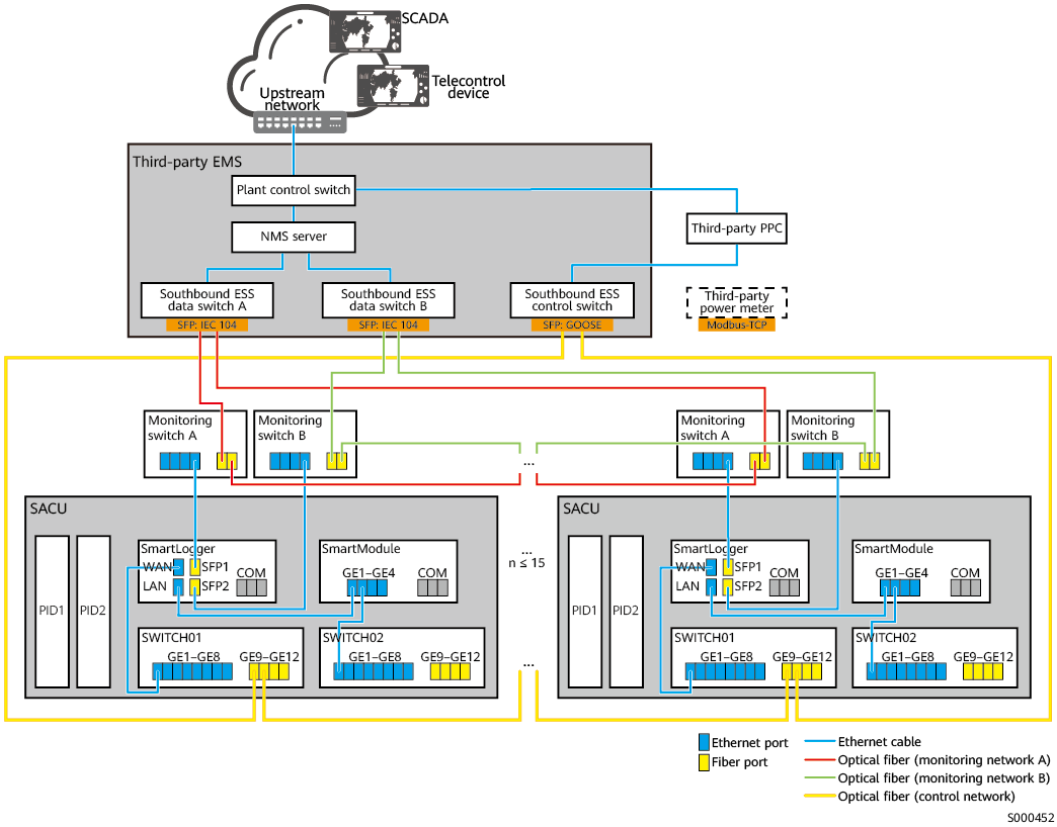
Figure 1-9 Dual monitoring ring networks + single control ring network (third-party EMS + Huawei SPPC)



If a third-party PPC is used, southbound devices can be monitored and controlled over IEC 104 and GOOSE. See **Figure 1-10**.

 Copyright © Huawei Technologies Co., Ltd.

Figure 1-10 Dual monitoring ring networks + single control ring network (third-party EMS + third-party PPC)

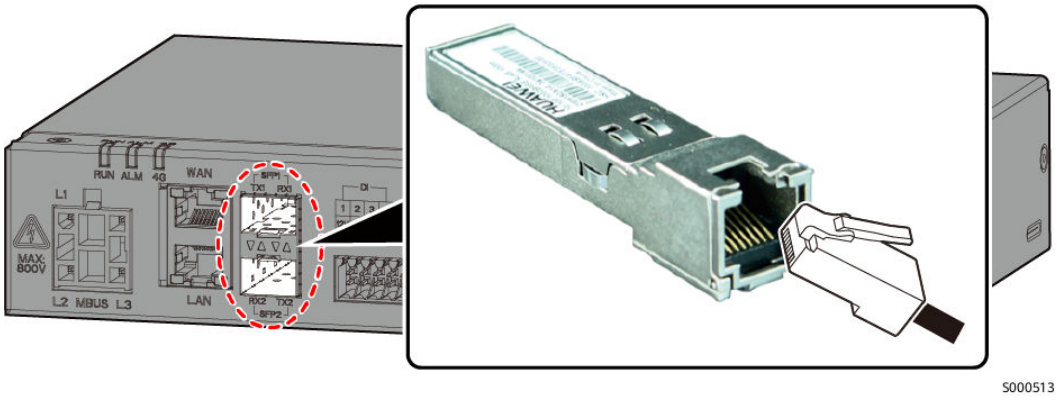


NOTE

- Gigabit single-mode optical modules must be used at the central site (central control room or management system site). Four-core or eight-core single-mode armored optical cables with a transmission wavelength of 1310 nm and an outer diameter less than 18 mm must be used.
- The fiber channel switch must support the standard RSTP, and the bridge priority of the switch must be higher than 0x8000 of the SmartLogger (recommended value: 0x7000; a smaller value indicates a higher bridge priority). For details about how to configure the RSTP and bridge priority of the switch, contact the vendor.
- The PPC communicates with the SACU ring network through the southbound control switch of the EMS. In the PV+ESS solution, it is recommended that the southbound PV control switch and southbound ESS control switch be planned in the same subnet for PPC southbound control. If the IP addresses cannot be on the same subnet, configure routes to ensure network accessibility.
- For the networks shown in **Figure 1-9** and **Figure 1-10**, two additional S5735I-S8T4SN-V2 network switches need to be configured for each ESS array to form ring networks. These networks apply only to third-party transformer stations. Reserve installation positions for the network switches in the transformer stations. Use network cables or optical fibers to connect these network switches to the SFP1 and SFP2 optical ports on the SmartLogger based on the actual situation. (If network cables are used, the optical-to-electrical conversion modules as shown in **Figure 1-11** shall be configured for the SmartLogger.)
- Optical fibers can also be used for PPC southbound and northbound communication.

 Copyright © Huawei Technologies Co., Ltd.

Figure 1-11 Optical-to-electrical conversion module

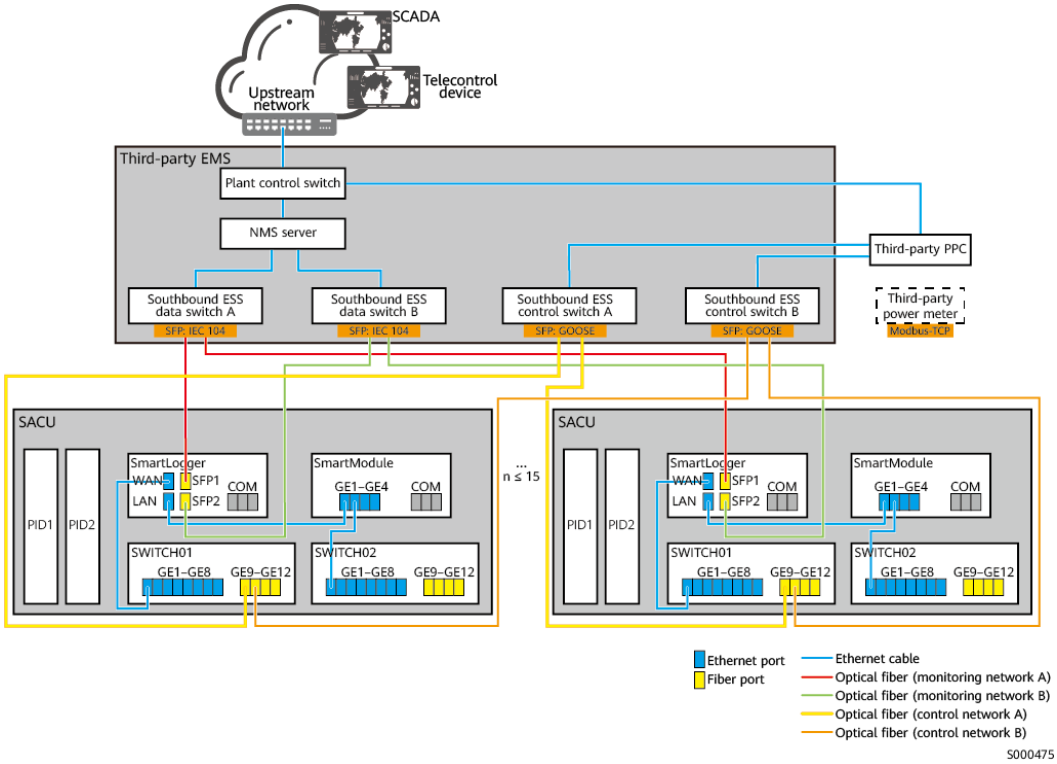


1.2.4 Site-Level Communication Logic (Dual-Link Monitoring Network + Dual-Link Control Network)

The SACU communicates with the third-party NMS server through the IEC104-based dual-link monitoring network and communicates with the third-party SPPC through the GOOSE-based dual-link control network. The monitoring network is isolated from the control network, and each network has isolated A/B dual-link redundancy backup.

Figure 1-12 shows the star topology. The port numbers in the figure are device silk screens.

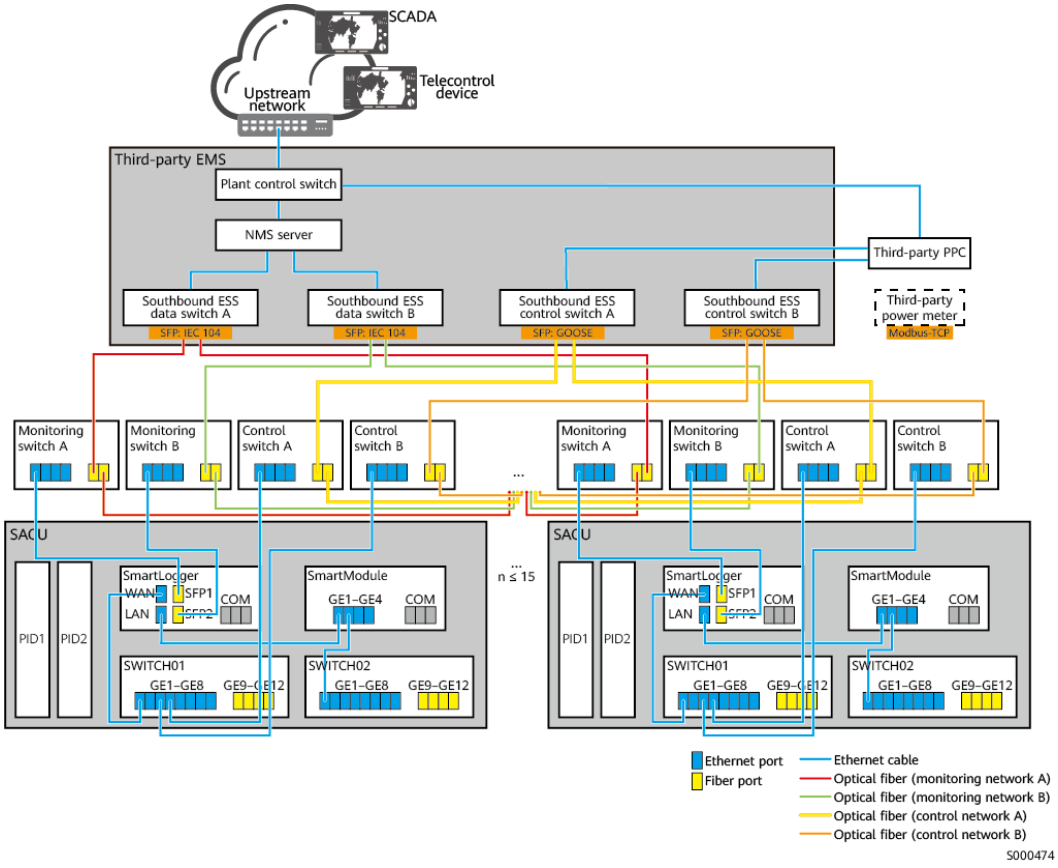
Figure 1-12 Dual-link monitoring network + dual-link control network (star topology)



 Copyright © Huawei Technologies Co., Ltd.

Figure 1-13 shows the ring topology.

Figure 1-13 Dual-link monitoring network + dual-link control network (ring topology)

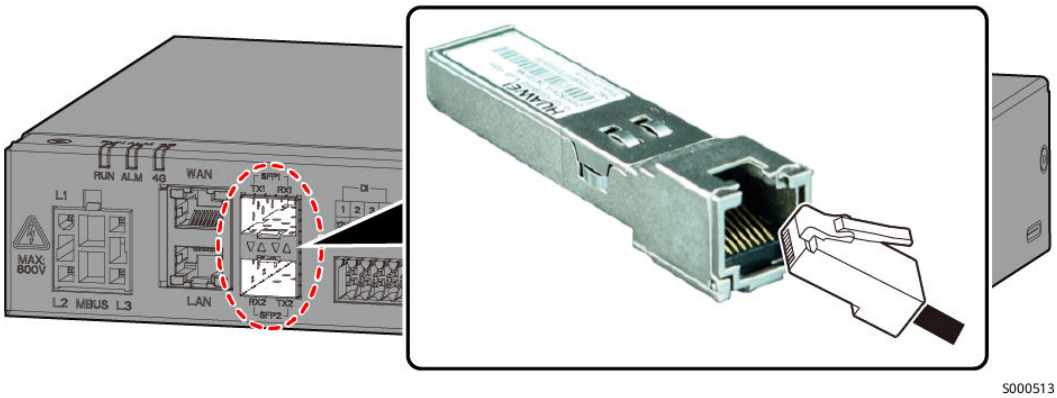


 Copyright © Huawei Technologies Co., Ltd.

NOTE

- Gigabit single-mode optical modules must be used at the central site (central control room or management system site). Four-core or eight-core single-mode armored optical cables with a transmission wavelength of 1310 nm and an outer diameter less than 18 mm must be used.
- The fiber channel switch must support the standard RSTP, and the bridge priority of the switch must be higher than 0x8000 of the SmartLogger (recommended value: 0x7000; a smaller value indicates a higher bridge priority). For details about how to configure the RSTP and bridge priority of the switch, contact the vendor.
- The PPC communicates with the SACU ring network through the southbound control switch of the EMS. In the PV+ESS solution, it is recommended that the southbound PV control switch and southbound ESS control switch be planned in the same subnet for PPC southbound control. If the IP addresses cannot be on the same subnet, configure routes to ensure network accessibility.
- For the networks shown in **Figure 1-13**, four additional S5735I-S8T4SN-V2 network switches need to be configured for each ESS array to form ring networks. These networks apply only to third-party transformer stations. Reserve installation positions for the network switches in the transformer stations. Use network cables or optical fibers to connect these network switches to the SFP1 and SFP2 optical ports on the SmartLogger based on the actual situation. (If network cables are used, the optical-to-electrical conversion modules as shown in **Figure 1-14** shall be configured for the SmartLogger.)
- Optical fibers can also be used for PPC southbound and northbound communication.

Figure 1-14 Optical-to-electrical conversion module



1.3 O&M Methods

Table 1-7 O&M methods

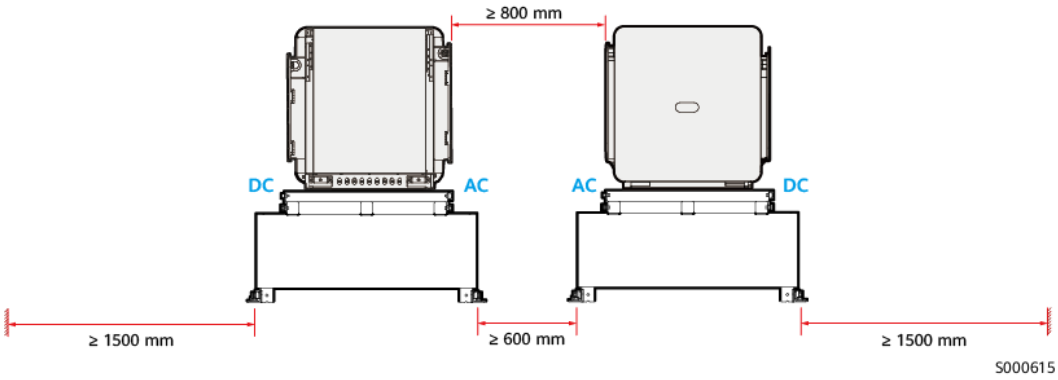
Method	Description	Main Application Scenario
SmartLogger Web	A PC is connected to the SmartLogger in the SACU to manage the ESSs, PCSs, and STSs in the array.	Deployment and commissioning
SEMS2000 Web	An integrated energy management system for power plants (PV-only, ESS-only, PV+ESS, and microgrid).	The SEMS2000 works with the SPPC2000 to implement real-time energy scheduling and power control.

Copyright © Huawei Technologies Co., Ltd.

Method	Description	Main Application Scenario
SPPC2000 Web	The SPPC detects and calculates the current, voltage, power, and frequency at the common coupling and grid connection point of the plant. Based on upper-level commands or local adjustment policies, the SPPC controls the active and reactive power as well as power ramp rate, and disconnects the power supply or stops power generation in real time.	
Local app	The app connects to a device locally to implement local management.	• Modifying the parameters of a single device locally • Upgrading the software version of a single device locally

1.4 ESS Array Layout Principles

- The layout must meet the requirements of local fire protection regulations and relevant specifications of power plant design.
- If PCSs need to be deployed side by side, the distance between the AC sides of two adjacent PCSs must be at least 800 mm (the distance between adjacent base supports must be at least 600 mm). To facilitate cable connection and maintenance, it is recommended that a clearance of at least 1500 mm be reserved on the DC side of a PCS.

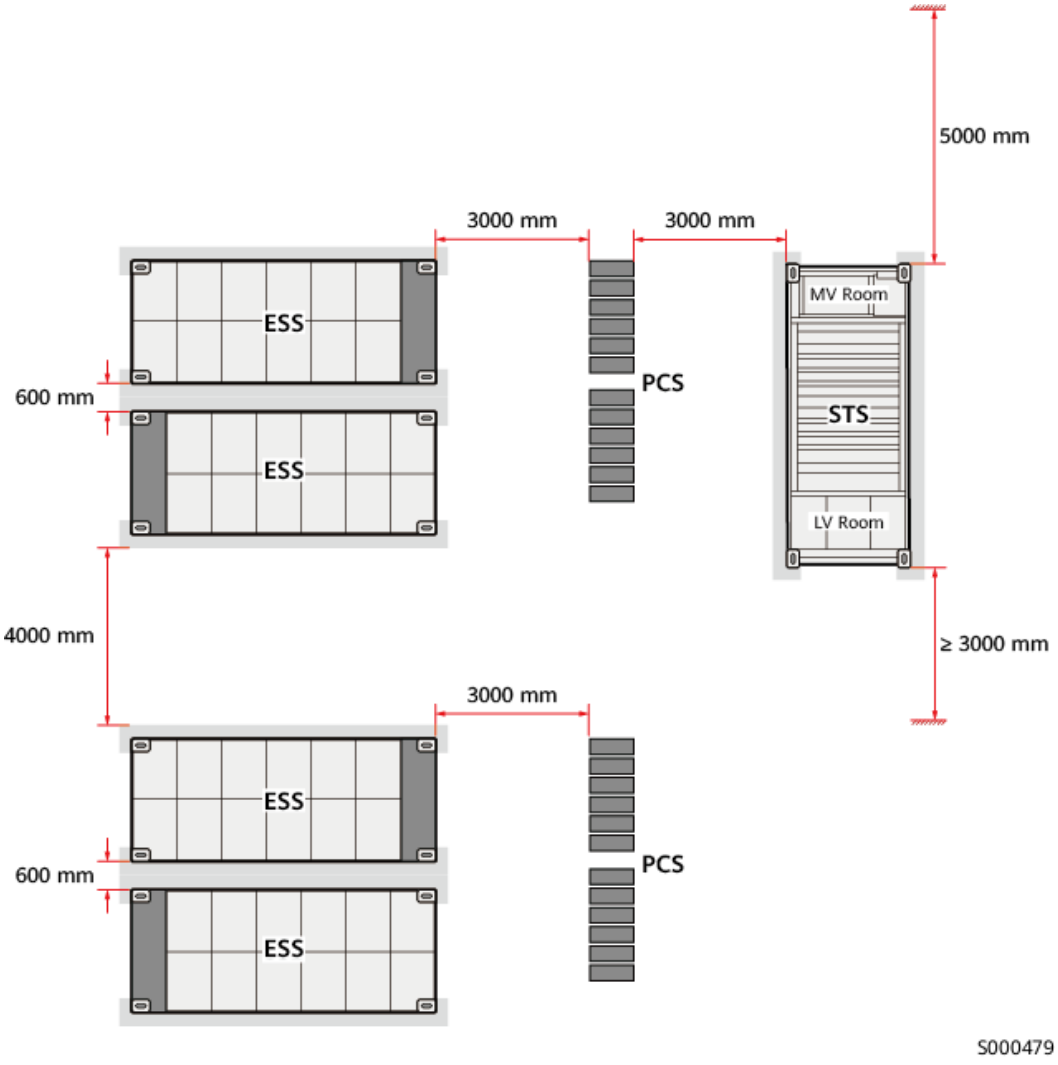


- The distance between ESSs depends on the layout mode. For details, see section **Clearance and Ground Requirements** in the ESS user manual.
- If a plant requires a centralized UPS (for example, a UPS is required to supply power to critical loads in the black start scenario), it is recommended that an installation position be reserved for the UPS (purchased by the customer) in each array.
- The STS layout must comply with fire protection standards, and the maintenance distance must comply with local standards.

Figure 1-15 shows a typical example of the array layout. The clearances in this example are for reference only. For details, see the design solution provided by the design institute.

Copyright © Huawei Technologies Co., Ltd.

Figure 1-15 Typical array layout example



 Copyright © Huawei Technologies Co., Ltd.

2 Installation and Cable Connections

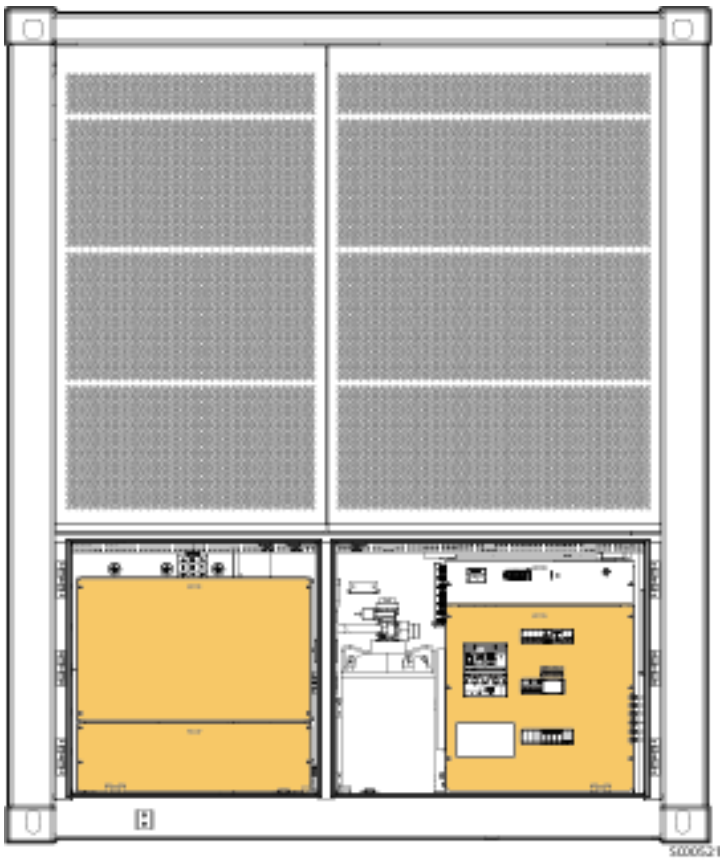
This section describes the process, precautions, and connections for installing devices and connecting cables in the solution. For details, see the user manuals or quick guides of the corresponding devices. To obtain the documents, see **A Reference Documents**.

2.1 Installation

Table 2-1 Device installation process

Step	Task	Precaution
1	Installing the STS	N/A

Copyright © Huawei Technologies Co., Ltd.

Step	Task	Precaution
2	Installing the ESS	Before hoisting, ensure that the foundation levelness meets the requirements (deviation ≤ 5 mm). Both the main ground bar in the control unit cabin and the ESS enclosure must be grounded. Before powering on the ESS, ensure the covers are removed from the control unit cabin (as shown in the following figure) and then proceed to take out angle steel brackets, connect cables, and apply for startup authorization. To avoid repeated removal and installation and improve construction efficiency, you can reinstall the covers before power-on.  **NOTICE** Perform the following operations before the construction is completed: • Remove the compressor bracket inside the LTMS and ensure that all switches in the electric control box are turned on. • Remove the blue protective film from the exterior of the container. • In the weight reduction transportation scenario, perform the DC withstand voltage test and insulation resistance test after installing battery packs. For details, see the ESS user manual.

Copyright © Huawei Technologies Co., Ltd.

Step	Task	Precaution
3	Installing the DTS and SPPC	N/A
4	Installing the PCS	• The PCS is installed on a base support. • The ground points of all PCSs in the same array must be connected to the ground grid to ensure equipotential bonding of the PE cables.
5	Installing the PV inverter	N/A
6	Installing the SACU	For solutions that use the STS with built-in SACU, skip this step.

2.2 Cable Connections

Table 2-2 Device cable connection process

Step	Task	Precaution
1	Installing PE cables	All devices shall be connected to the nearest grounding points, and the grounding methods shall comply with local electrical safety regulations. Devices in the same array shall be equipotentially bonded. To enhance the corrosion resistance of a ground terminal, apply silicone grease or paint on it after connecting the ground cable. If a third-party DTS is used, the neutral wire connected to the ESS auxiliary power supply must be reliably connected, and the neutral wire on the DTS side must be reliably grounded. Otherwise, the equipment may be damaged.
2	Filling the ESS fire cylinder with extinguishant	Comply with the requirements, such as the required extinguishant type, quantity, purity, and cylinder pressure, described in section **Filling the Fire Cylinder with Extinguishant** in the ESS user manual.

Copyright © Huawei Technologies Co., Ltd.

Step	Task	Precaution
3	Installing power cables for battery packs in the ESS	Before connecting cables, ensure that the RCM circuit breaker Q1 is off. Wear PPE and use dedicated insulated tools to avoid electric shocks or short circuits. **CAUTION** After connecting battery pack power cables, ensure that the connector buckles are properly locked to eliminate any risk of loosening, and mark lines one by one.
4	Installing DC power cables	For details about the cable connections, see **1.1 Networking Architecture**. The DC power cable length between the ESS and the PCS is 5–50 m.
5	Installing AC power cables	For details about the cable connections, see **1.1 Networking Architecture**. The AC power cable length from the PCS to the STS low-voltage side shall be ≥ 5 m. **CAUTION** When connecting AC power cables, do not mix the neutral wire with the live wire. Otherwise, the device may be damaged during power-on.
6	Installing communications cables	For details about the cable connections, see **1.2.1 Array-Level Communication Logic**. The maximum length of an Ethernet cable is 100 m. The communications cable length between the ESS and the PCS is 5–50 m. For the SmartLogger and network switches, use the gigabit single-mode optical modules. When connecting CAN communications cables between the ESS and PCSs, ensure that the CAN communications cables are connected correctly based on the DC power cable connections between battery racks and PCSs. **CAUTION** After installing the RJ45 connector of a network cable or splicing an optical fiber, check the communication between the two ends of the cable. Coil the excess pigtails within the fiber splice tray inside the device. For the pigtail wiring sequence, refer to the electrical schematic diagram provided with the device.

NOTE

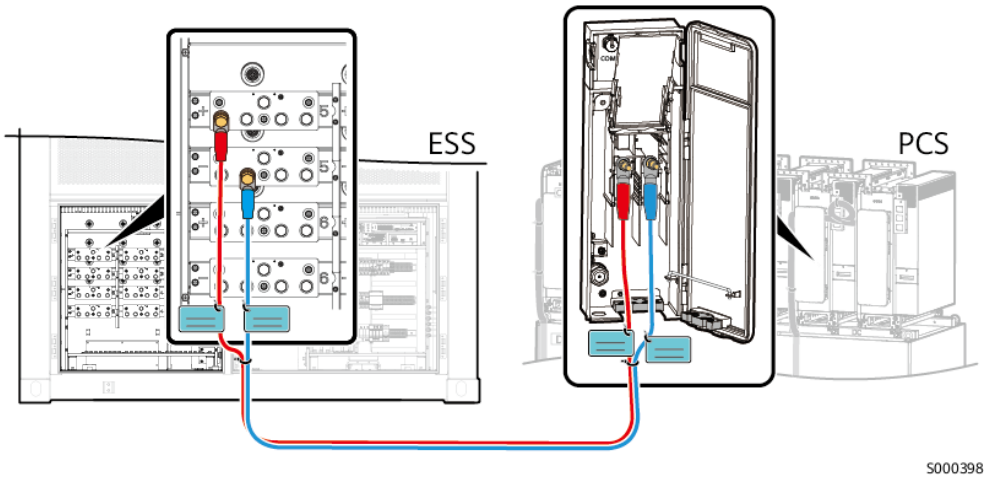
After connecting cables, use fireproof putty to seal all cable holes to prevent foreign objects like insects, mice, and snakes from getting in.

Copyright © Huawei Technologies Co., Ltd.

2.3 Suggestions on Preventing Incorrect Cable Connection

To avoid incorrect connection of DC power cables and Ethernet cables between the ESS and the PCS, take the following measures before installing the cables:

1. If you use single-core cables, bind the positive and negative DC power cables connected to the same PCS together at both ends.
2. Make cable labels at both ends of the DC power cables and Ethernet cables to specify the connection positions of the terminals.



NOTE

The materials of the cable labels and label ties must meet the basic insulation requirements.

You are advised to design the cable labels by referring to the following examples.

Examples of DC Power Cable Labels

Start	Area No.-Array No.-ESS No.**#ESS** Rack No. Positive (+) or negative (–) terminal For example, 1-2-3#ESS 4+ indicates that the start point of the power cable is connected to the positive terminal of the fourth battery rack of ESS 3, array 2, area 1.
End	Area No.-Array No.-ESS No.-PCS No.**#PCS** Positive (+) or negative (–) terminal For example, 1-2-3-4#PCS+ indicates that the end point of the power cable is connected to the positive terminal of the fourth PCS corresponding to ESS 3, array 2, area 1.

Copyright © Huawei Technologies Co., Ltd.

Examples of Ethernet Cable Labels

Start	Area No.-Array No.-ESS No.**#ESS** Network port No. For example, 1-2-3#ESS 4 indicates that the start point of the network cable is connected to network port 4 of ESS 3, array 2, area 1.
End	Area No.-Array No.-ESS No.-PCS No.**#PCS** For example, 1-2-3-4#PCS indicates that the end point of the network cable is connected to the fourth PCS corresponding to ESS 3, array 2, area 1.

Copyright © Huawei Technologies Co., Ltd.

3 Deployment and Commissioning

3.1 Array Power-On

3.1.1 Preparations

Step 1 Perform the check before power-on by referring to the "Check Before Power-On" section in the user manual of each device.

Step 2 Check cable connections and switch status.

Device	Requirement
STS	The switches on the medium-voltage and low-voltage sides are turned off.
DTS	All MCCBs are turned off.
ESS	• Control unit cabin: All switches are turned off. The covers in the cabin are installed properly. Lead-acid batteries are installed in the extinguishant control panel and cables are connected. (Note that the cover of the C050SZEG extinguishant control panel shall be connected to a PE cable.) • Liquid cooling unit cabin: The liquid cooling compressor bracket is removed, and all switches in the electric control box are turned on. • Battery cabin: The battery pack power cables and signal cables are connected properly.

Step 3 Apply for startup authorization.

The following table describes how to apply for startup authorization for different roles.

 Copyright © Huawei Technologies Co., Ltd.

Role	Operation Guide
Huawei engineer	**Utility-Scale ESS Power-On Tool Training (Power-Sales)**
Partner engineer	**Utility-Scale ESS Power-On Tool Training (Power-Partner)**

----End

3.1.2 (Optional) Powering On the PV Array

In the PV+ESS scenario, power on the devices in the PV array by following the procedure in this section. In the ESS-only scenario, skip this section.

Step	Operation
1	1. Turn on the power supply switch on the STS medium-voltage side. 2. Turn on the AC switch on the STS low-voltage side that connects to the inverter. 3. Turn on the auxiliary power supply switch on the STS low-voltage side that connects to the SACU. For solutions that use the STS with built-in SACU, skip this step.
2	• SACU built in the STS: 1. Turn on the general switch 3FB for the auxiliary power supply. 2. Turn on the general switch 3FB2 for the UPS and low-power auxiliary power supply. 3. Turn on switch 3FB3. • Separate SACU: 1. Turn on the single-phase switch 3FB3 on the STS side that controls the power supply to the SACU. 2. Turn on the SACU single-phase input switch QF03. 3. Turn on the three-phase input switches FU01 and FU02 of the SACU. 4. Turn on the SmartPID switches QF01 and QF02 of the SACU.
3	Turn on the corresponding switch of the inverter by referring to the inverter user manual.

Copyright © Huawei Technologies Co., Ltd.

3.1.3 Powering On the ESS Array

Step	Task	Power-On Operation
1	Powering on the STS (including the STS auxiliary transformer)	For the STS provided by the Company, see the corresponding STS user manual. For the transformer station provided by a third-party vendor, see the related documents supplied by the vendor.
2	Powering on the DTS	Turn on the MCCB. For details, see the DTS user manual.
3	Powering on the ESS	For details, see the ESS user manual. 1. Turn on the mains SPD specific disconnector 3FC and check that the SPD status display window is green. 2. Turn on the UPS input switch 2FC. 3. Turn on the general input switch 1QA for the AC auxiliary power. **CAUTION** • Before turning on the general input switch 1QA for the AC auxiliary power, ensure that the neutral wire is correctly connected. Otherwise, devices such as the air conditioner may be damaged. • After turning on switch 1QA, immediately check that the L1, L2, and L3 phase voltages are 220 V AC/230 V AC using the multimeter. If the phase voltage displayed on the multimeter is 400 V or other values, the L1, L2, L3, and neutral wires may be incorrectly connected and you need to check the cables. 4. Turn on all switches in the power distribution system of the ESS. a. Turn on the 12 V adapter input switch 2FC1 and extinguishant control panel input switch 2FC2. After the extinguishant control panel is powered on, set the display time to the current time. b. Turn on the single-phase mains general switch 1FC, PSU AC input switch 1FC1, motorized air damper switch 1FC2, and ATS mains input switch 1FC3. 5. Turn on the Rack Control Module (RCM) circuit breaker Q1. **CAUTION** The ESS can be powered on only when the battery cabin doors and the left door of the control unit cabin are closed.

Copyright © Huawei Technologies Co., Ltd.

Step	Task	Power-On Operation
4	Powering on the SACU	• SACU built in the STS: 1. Turn on the general switch 3FB for the auxiliary power supply. 2. Turn on the general switch 3FB2 for the UPS and low-power auxiliary power supply. 3. Turn on switch 3FB3. • Separate SACU: 1. Turn on the single-phase switch 3FB3 on the STS side that controls the power supply to the SACU. 2. Turn on the SACU single-phase input switch QF03. 3. Turn on the three-phase input switches FU01 and FU02 of the SACU. 4. Turn on the SmartPID switches QF01 and QF02 of the SACU.
5	Powering on the PCS	After the STS and ESS are powered on, the AC and DC sides of the PCS are powered on respectively. 1. Check that the DC voltage is within the normal range on the FusionSolar app. 2. Send a startup command on the FusionSolar app or SmartLogger, and wait for the system soft start. 3. Observe the LED indicators on the PCS to check whether the PCS is running properly. **NOTE** If the STS does not meet the conditions for powering on the AC side of the PCS, you can perform deployment and commissioning when the PCS has only DC power supply. Do not send a startup command to the PCS before the PCS is connected to the power grid. Otherwise, the PCS may be connected to the power grid unexpectedly.
Note 1: For details about the switch layout and power-on operations of the devices prepared by the customer, see the documents provided by the vendors. Note 2: After the device is powered on, you are advised to wait for about 10 minutes before performing subsequent operations to ensure that each internal component is started. Note 3: After the ESS auxiliary power supply is powered on, perform the acceptance test by referring to the ESS acceptance test guide.		

Copyright © Huawei Technologies Co., Ltd.

3.2 Basic Service Commissioning

This section uses ESS arrays as an example to describe the commissioning on the SmartLogger. The deployment operations for PV arrays are similar, but do not involve ESS commissioning items.

3.2.1 Preparations and WebUI Login

Context

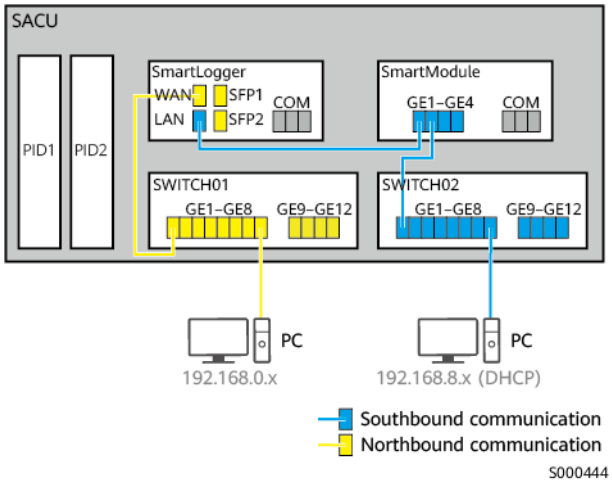
The SACU has a built-in SmartLogger, which allows you to perform commissioning and O&M operations on devices in an array. Both the WAN and LAN ports of the SmartLogger can be used for login. The default IP addresses of the two ports are listed in **Table 3-1**.

Table 3-1 Default settings of the SmartLogger network ports

Port	Function	IP Address Information
WAN	Northbound communication (SEMS, NMS, PC, etc.)	• IP address: 192.168.0.10 • Subnet mask: 255.255.255.0
LAN	Southbound communication (ESS, PCS, STS, etc.)	• IP address: 192.168.8.10 • Subnet mask: 255.255.255.0 • DHCP service: enabled

During deployment and commissioning, you can log in to the SmartLogger through the WAN or LAN port, as shown in **Figure 3-1**. To facilitate operations and prevent you from forgetting the IP address, you are advised to log in through an idle network port on the network switch connected to the LAN port.

Figure 3-1 Logging in to the SmartLogger on a PC for the first time



Copyright © Huawei Technologies Co., Ltd.

Procedure

This section describes how to log in to the SmartLogger and perform initial operations when the PC is connected to the LAN port.

Step 1 Use a network cable to connect the PC to an idle network port on the network switch connected to the LAN port.

Step 2 Set the IP address and browser proxy for the PC.

1. Set the IP address to be automatically obtained.

   If the PC is connected to the WAN port, set the IP address of the PC to be in the same network segment as that of the WAN port on the SmartLogger, for example, 192.168.0.11.

2. Set the browser proxy.

   Disable the browser proxy or add the network segment 192.168.*.* where the SmartLogger is located to the list of addresses that do not use a proxy server.

Step 3 Use a browser to access the IP address of the SmartLogger and log in to the SmartLogger.

For details about the account and password, see section **Preparations and WebUI Login** in the *SmartLogger3000 User Manual*.

If a security risk warning is displayed, click **Continue to this website**.

Step 4 Choose **Maintenance** > **Software Upgrade** and upgrade the SmartLogger to the target software version.

Download the SmartLogger software package from the following link. For details about the version mapping and upgrade guide, see the *release documentation*.

https://support.huawei.com/enterprise/en/fusionsolar/smartlogger-pid-21294677/software

1. Select the target file and click **Upload**.
2. Select the target device and click **Software Upgrade**.

Step 5 Choose **Maintenance** > **Device Mgmt.** > **Device List**, check the ESS connection status, and change the ESS name based on its location.

The SN barcode of the CMU is corresponding to its SN in the device list. To facilitate subsequent management, change the device name based on the site location, array number, and container number. For example, name the ESS in container 2 of array 1 in area A as **ESS_A_1_2**. After the settings are complete, click **Modify Device Info**.

If no ESS is connected, contact technical support to load the certificate for the SmartLogger to connect southbound devices.

Step 6 Choose **Maintenance** > **Software Upgrade** and upgrade the ESS to the target software version.

Download the ESS software package from the following link. For details about the version mapping and upgrade guide, see the *release documentation*.

https://support.huawei.com/enterprise/en/fusionsolar/luna2000c-pid-255740933/software

Copyright © Huawei Technologies Co., Ltd.

1. Select the target file and click **Upload**.
2. Select the target device and click **Software Upgrade**.

NOTE

Before upgrading the ESS, ensure that the battery rack SOC is greater than 15%. Otherwise, the upgrade may fail. If the SOC is less than or equal to 15%, charge the battery by referring to section **Battery Overdue Storage and Charging** in the ESS user manual.

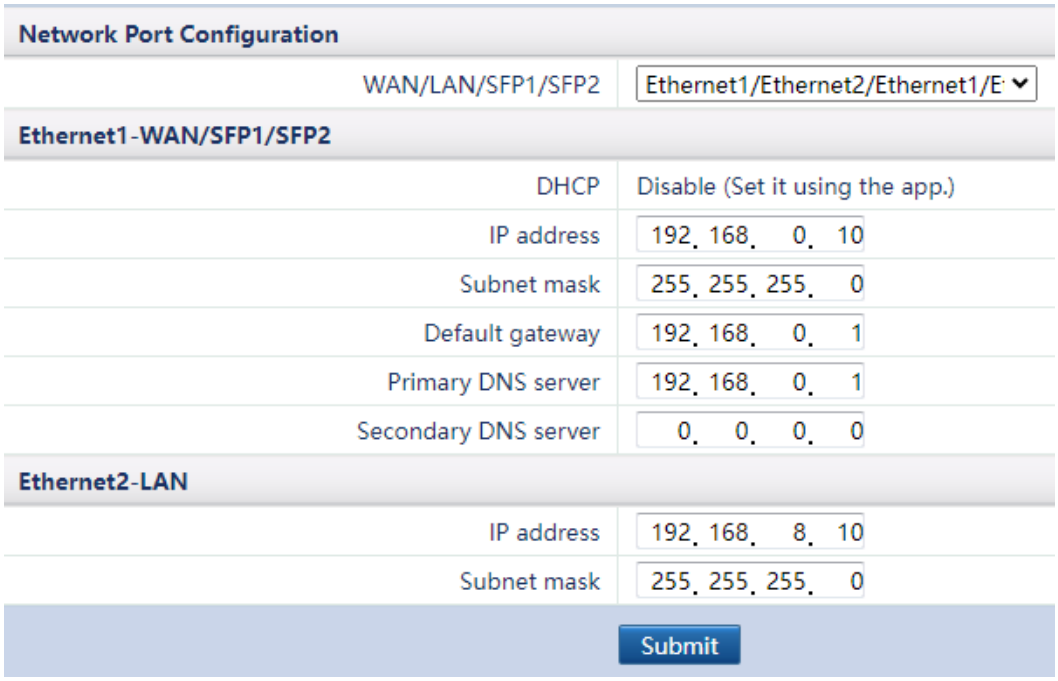
Step 7 Click the alarm icon in the upper right corner of the page and clear **major** active alarms as prompted.

You do not need to handle PCS connection alarms. After you perform the cable connection check in **Commissioning Using the Deployment Wizard**, these alarms will be automatically cleared.

Step 8 Modify network settings.

Choose **Settings** > **Comm. Param.** > **Wired Network**, and modify the wired port allocation and IP address information based on the network plan.

If the IP address of the network port is changed, use the new IP address to log in again.



----End

3.2.2 Commissioning Using the Deployment Wizard

NOTICE

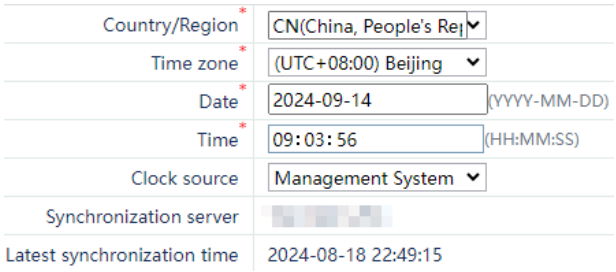
After setting parameters on each page of the deployment wizard, you need to click **Next** to save the settings.

Copyright © Huawei Technologies Co., Ltd.

Step 1 Choose **Deployment Wizard** > **Basic parameters** and set basic parameters.

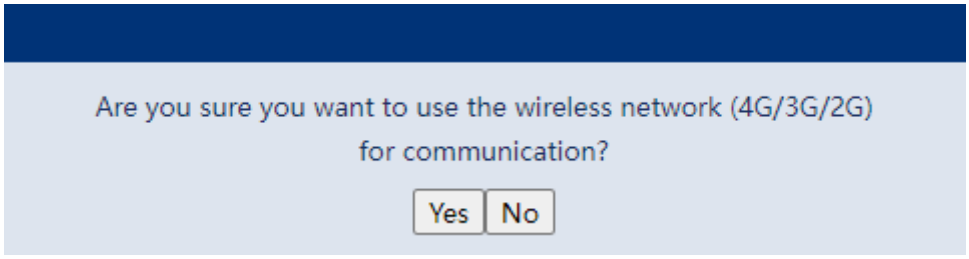
1. Set basic parameters.

Figure 3-2 Setting basic parameters

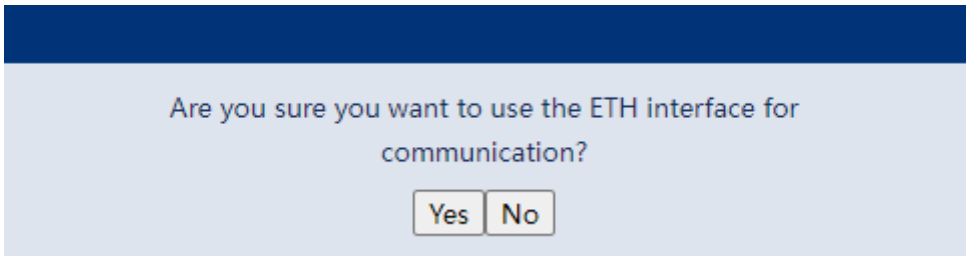


2. Configure the SACU upstream network.

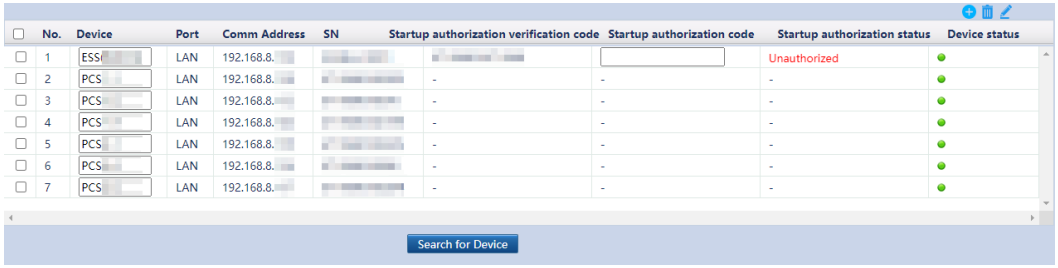
   To use the wireless network, click **Yes** in the following dialog box and set dial-up parameters based on the network plan.



   To use the wired network, click **Yes** in the following dialog box and check the IP address information based on the network plan.



Step 2 Search for devices and check cable connections.



1. Click **Search for Device**.

   The system starts to search for devices (not applicable to third-party devices) and automatically allocates IP addresses to the found devices.

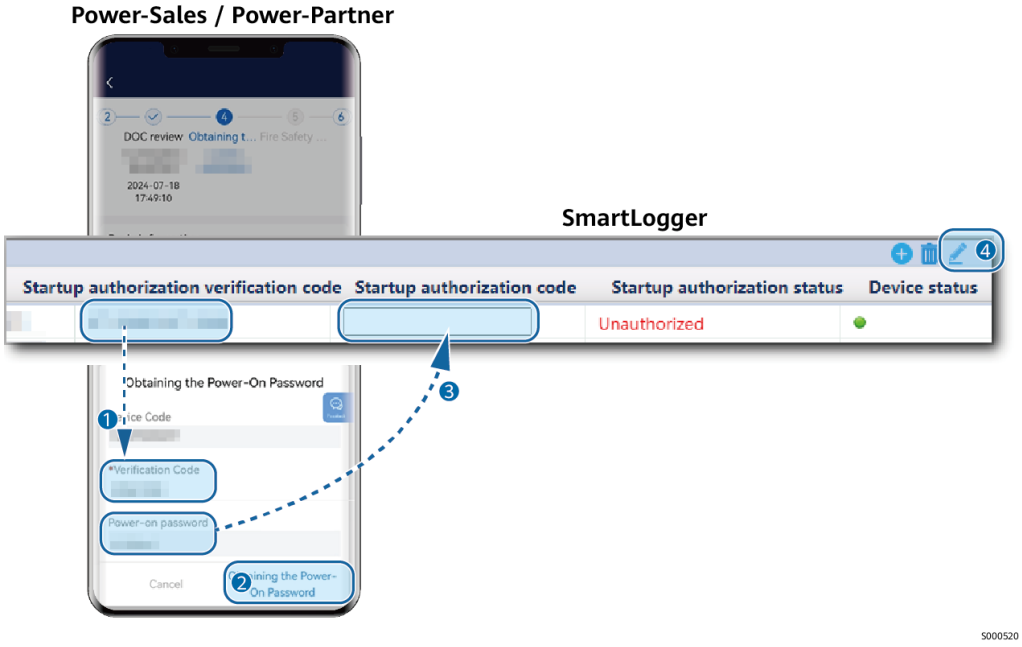
 Copyright © Huawei Technologies Co., Ltd.

NOTE

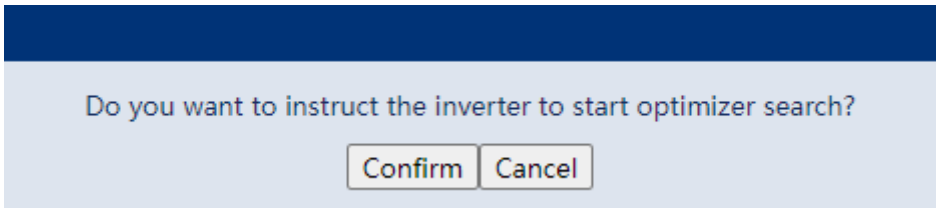
By default, the DHCP client function is enabled for southbound devices (ESS, PCS, and STS) of the SmartLogger so that they can dynamically obtain IP addresses from the SmartLogger. To prevent IP address conflicts, do not use both the dynamic allocation and static configuration modes on the same network.

2. Perform startup authorization for the ESS.

   Enter **Startup authorization verification code** of the ESS on the deployment wizard page of the SmartLogger in the device-level work order of the Power-Sales or Power-Partner app, fill the generated **Startup authorization code** in the deployment wizard page of the SmartLogger, and click to complete the startup authorization.



3. In the dialog box that is displayed, click **Cancel**.



4. Click **Wiring inspection** and enter the password as prompted. The system starts to check cable connections.

   After the cable connection check is complete, click to view the mapping between the device network topology and battery racks.

 Copyright © Huawei Technologies Co., Ltd.

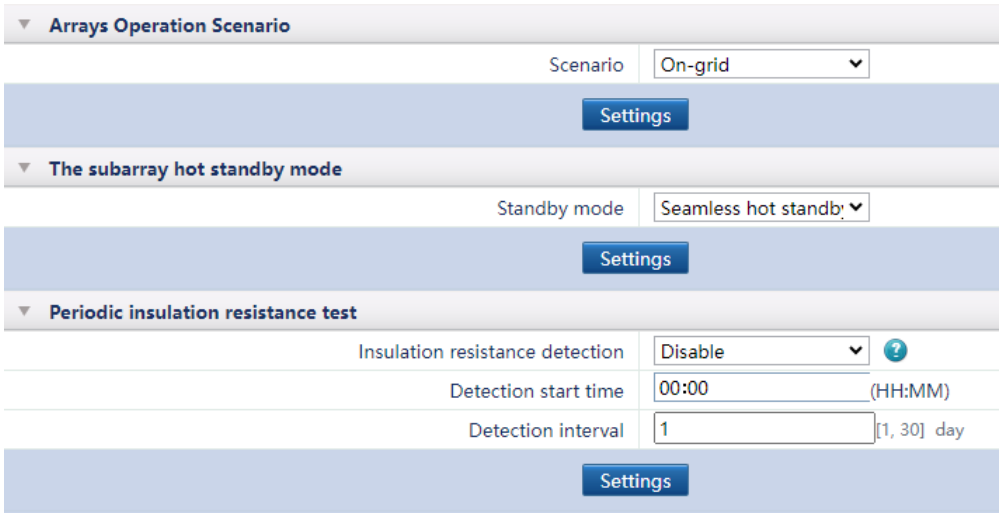
NOTICE

After the cable connection is checked, the ESS automatically starts to supply power to the DC side of the PCSs and triggers the PCSs to start. After the PCSs are started, absolute zero feed-in at the grid connection point cannot be ensured. Therefore, you are advised to shut down the PCSs in batches after checking the cable connections. (After the PCSs are shut down, subsequent commissioning operations can still be performed.)

NOTE

- Do not perform the upgrade during device search.
- If **Cable connection detection status** is **Failure**, click the alarm icon to view the alarm information. After the fault is rectified, check the cable connections again.
- If you need to check the cable connections again after manually stopping the check, wait for at least 20 seconds.
- After adding or deleting a device, you need to perform this step again under **Maintenance** > **Device Mgmt.** > **Wiring inspection**. Otherwise, the topology will not be updated.

Step 3 Set array parameters.



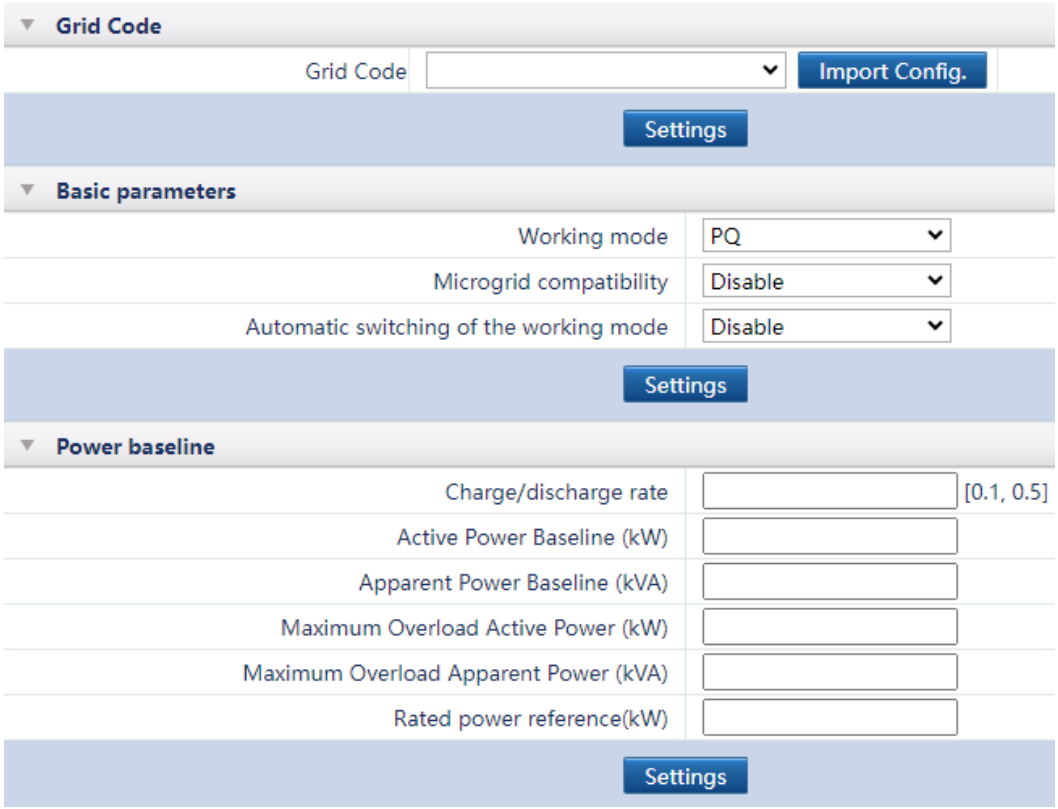
Parameter	Description
Arrays Operation Scenario	
Scenario	Select **On-grid**.
The subarray hot standby mode	

 Copyright © Huawei Technologies Co., Ltd.

Parameter	Description
Standby mode	• Zero-power operation When the Smart PCS does not receive power dispatch commands, it continues operating, drawing a small amount of electricity from the power grid to maintain the battery SOC while remaining responsive to power dispatch commands in real time. This mode applies to scenarios where power can be obtained from the power grid to maintain the SOC. • Seamless hot standby When the Smart PCS does not receive power dispatch commands, it enters the hot standby state, consuming minimal power to remain ready for operation. The relay on the AC side remains connected, allowing the Smart PCS to respond promptly upon receiving power dispatch commands. This mode applies to scenarios where the system efficiency needs to be improved and the standby loss of the Smart PCS needs to be reduced, or scenarios where power is not allowed to be obtained from the power grid when the Smart PCS does not receive power dispatch commands. The hot standby reactive power compensation function increases the system standby loss, but the loss is still much lower than that in **Zero-power operation** mode. If the reactive power of the AC local port needs to be strictly controlled to 0, set **Hot standby reactive power compensation** to **Enable**. The system will automatically compensate for the reactive power of the Smart PCS AC port.
Periodic insulation resistance test	
Insulation resistance detection	Enable or disable the insulation resistance detection function based on the business plan.
Detection start time	Set the start time for insulation resistance detection.
Detection interval	Set the insulation resistance detection interval.

Step 4 Set parameters for the entire ESS.

 Copyright © Huawei Technologies Co., Ltd.



Parameter	Description
Grid Code	
Grid Code	Set the grid code of the country or region where the devices are used. **NOTICE** Setting the grid code will trigger the PCS to restart. Wait until the PCS is restarted and then set other parameters and perform subsequent steps.
Basic parameters	
Working mode	• In the GFM scenario, set this parameter to **VSG**. • In the GFL scenario, set this parameter to **PQ**.
Microgrid compatibility	Disable
Automatic switching of the working mode	Disable
Power baseline	
Charge/ discharge rate	Set the charge/discharge rate based on site requirements.
Active Power Baseline (kW)	After the charge and discharge rate is set, the system automatically calculates the recommended value.

 Copyright © Huawei Technologies Co., Ltd.

Parameter	Description
Apparent Power Baseline (kVA)	
Maximum Overload Active Power (kW)	
Maximum Overload Apparent Power (kVA)	
Rated operating capacity of the equipment (kW)	

NOTICE

Incorrect parameter settings may cause reactive power overload, which may cause PCS or STS faults.

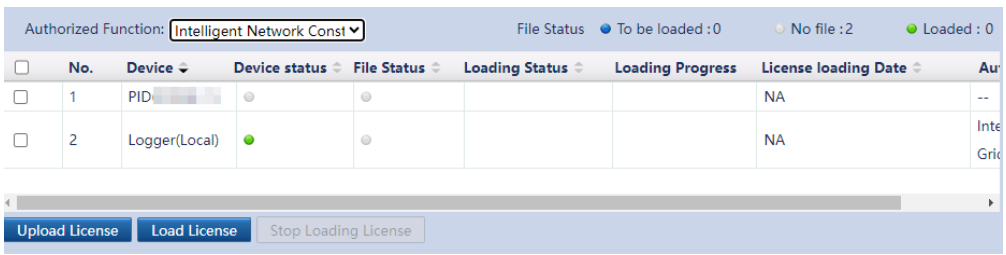
Step 5 (Optional) Load the license.

To ensure that related features are available, load the corresponding license. If no license is required, skip this step.

Feature	Authorized Function Name
IMD insulation monitoring	Smart insulation monitoring
GFM	Intelligent Network Construction Features - Grid-tied

1. Set conditions to filter the types of authorized functions to be loaded.

   For example, before loading the GFM license, set **Authorized Function** to **Intelligent Network Construction Features - Grid-tied**.



 Copyright © Huawei Technologies Co., Ltd.

2. Click **Upload License**. In the dialog box that is displayed, select a local license file and click **Upload License**.
3. Select the target device and click **Load License**.

Step 6 (Optional) Set power meter parameters.

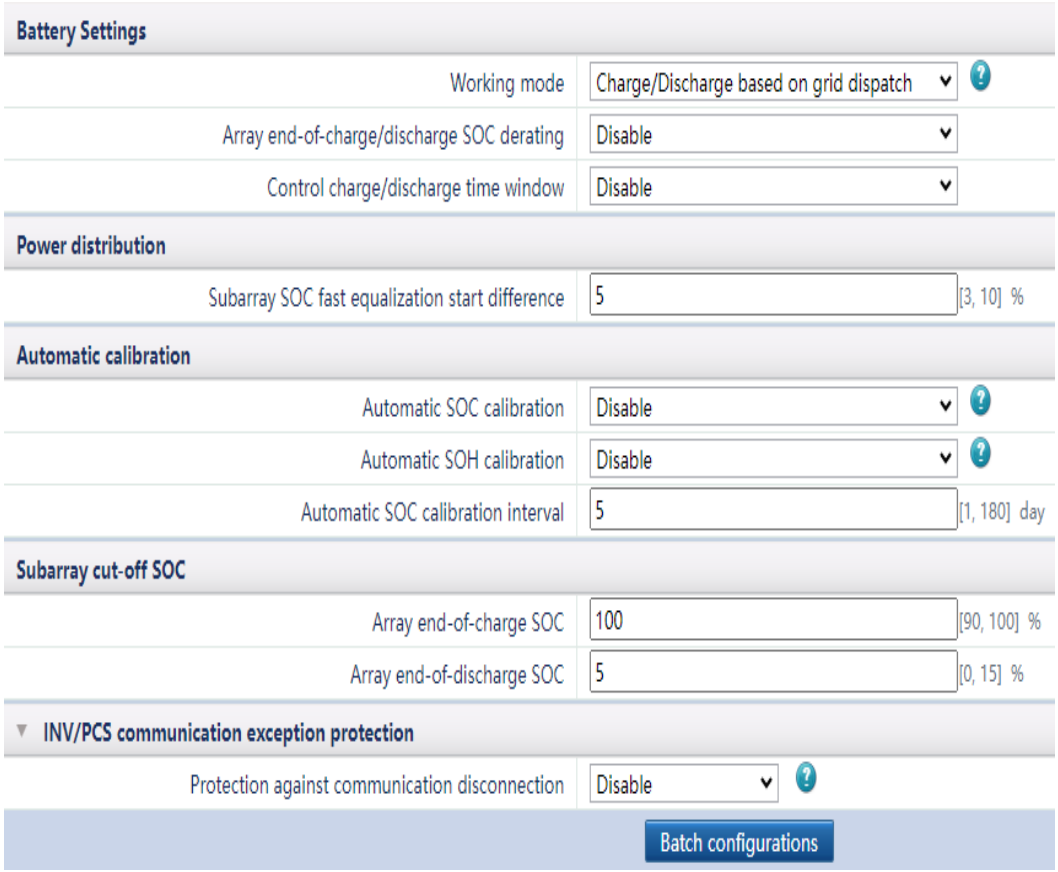
If there is no power meter, click **Skip**.

Step 7 (Optional) Set parameters for the environmental monitoring instrument (EMI).

If there is no EMI, click **Skip**.

Step 8 Set ESS running parameters.

Figure 3-3 Setting ESS running parameters



Parameter	Description
Battery Settings	
Working mode	Set this parameter to **Charge/Discharge based on grid dispatch**.

 Copyright © Huawei Technologies Co., Ltd.

Parameter	Description
Array end-of-charge/discharge SOC derating	After array end-of-charge/discharge SOC power derating is enabled, the SmartLogger performs derating based on the preset gradient to prevent abrupt power change of the array at the end-of-charge/discharge SOC. The default value **Disable** is recommended. Set this parameter as required.
Control charge/discharge time window	You can set the time segment for charge forbidden, discharge forbidden, charge, and discharge only after **Control charge/discharge time window** is set to **Enable**. The default value **Disable** is recommended. Set this parameter as required.
Power distribution	
Subarray SOC fast equalization start difference	When the SOC difference between racks in the array is greater than the value of **Subarray SOC fast equalization start difference**, the rapid equalization algorithm is enabled. The default value **5%** is recommended. Set this parameter as required.
Automatic calibration	
Automatic SOC calibration	During deployment and commissioning, set this parameter to **Disable**. After this function is enabled, the ESS periodically calibrates the SOC rack by rack. During the calibration, the end-of-charge SOC and end-of-discharge SOC settings will be overridden so that the ESS can be fully charged or discharged. **NOTE** This function will cause SOC inconsistency between battery racks, which is normal. Before using this function, contact technical support engineers to evaluate the impact of SOC inconsistency between battery racks during automatic calibration on the use of the ESS.

Copyright © Huawei Technologies Co., Ltd.

Parameter	Description
Automatic SOH calibration	During deployment and commissioning, set this parameter to **Disable**. After this function is enabled, the ESS periodically calibrates the SOH rack by rack. During the calibration, the end-of-charge SOC and end-of-discharge SOC settings will be overridden so that the ESS can be fully charged or discharged. Then, the battery capacity will be calculated. The charge and discharge response will be affected during the calibration. Suggestion: During SOH calibration, after the system is fully charged, maintain the charge command for 30 to 60 minutes. After the discharge is complete, maintain the discharge command for 30 to 60 minutes. **NOTE** This function will cause SOC inconsistency between battery racks, which is normal. Before using this function, contact technical support engineers to evaluate the impact of SOC inconsistency between battery racks during automatic calibration on the use of the ESS.
Automatic SOC calibration interval	Set the automatic SOC calibration interval. This parameter is displayed when **Automatic SOC calibration** is set to **Enable**. ● If the battery SOC stays in the range of 10% to 90% most of the time, for example, in the microgrid scenario, the recommended calibration interval is less than or equal to 30 days. ● If the battery SOC stays in the range of 40% to 60% most of the time, for example, in the frequency regulation scenario, the recommended calibration interval is less than or equal to 180 days. ● If the battery SOC stays below 10% or at 100% most of the time, for example, in the peak shaving scenario, the recommended calibration interval is less than or equal to 180 days.
Subarray cut-off SOC	
Array end-of-charge SOC	This parameter indicates the end-of-charge SOC for the battery pack with the highest SOC of an ESS in the array. The default value **100%** is recommended. Set this parameter as required. In the GFM scenario, set this parameter to **95%**.
Array end-of-discharge SOC	This parameter indicates the end-of-discharge SOC for the battery pack with the lowest SOC of an ESS in the array. The default value **5%** is recommended. Set this parameter as required. In the GFM scenario, set this parameter to **5%**.
INV/PCS communication exception protection	

Copyright © Huawei Technologies Co., Ltd.

Parameter	Description
Protection against communication disconnection	The default value **Disable** is recommended. Set this parameter as required.

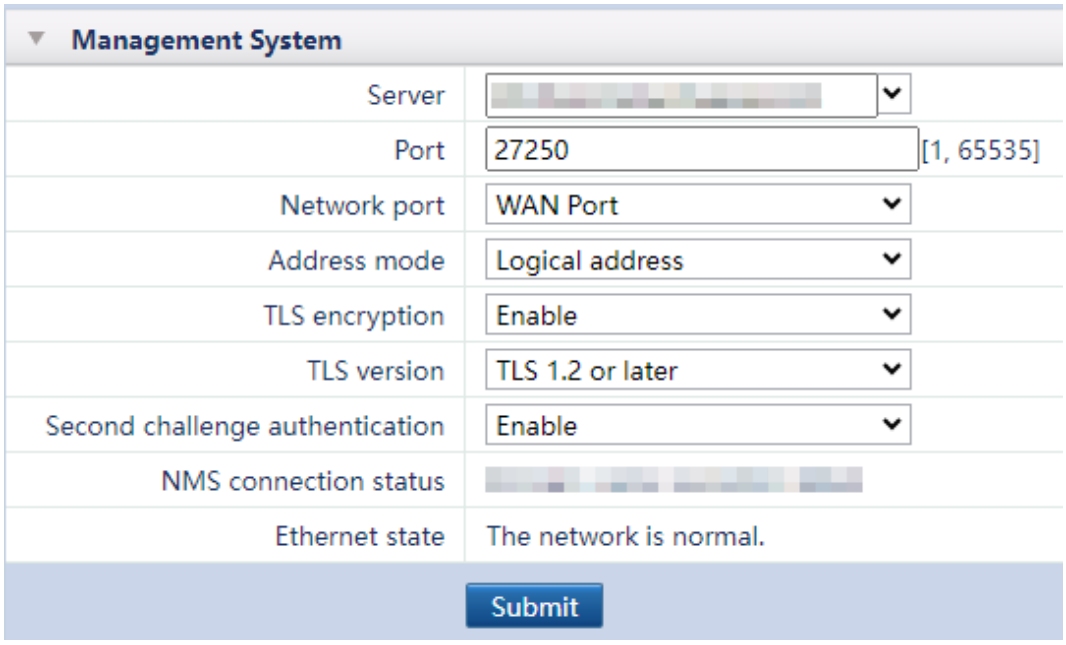
NOTICE

It is recommended that the interval between two charge/discharge cycles be less than or equal to five days to ensure that the ESS is in the optimal state.

Step 9 Set parameters for connecting to the management system.

Set related parameters by referring to section **Setting Parameters for Connecting to the Management System** in the *SmartLogger3000 User Manual*.

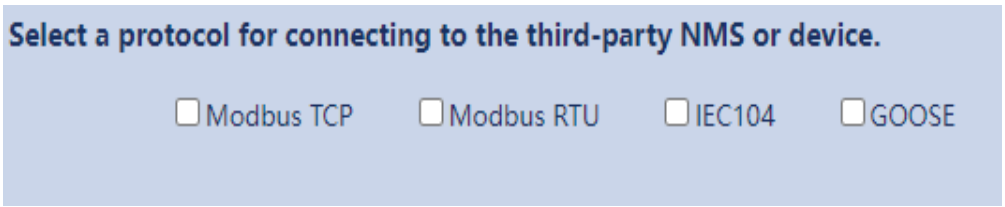
Figure 3-4 Management system



Step 10 Set parameters for connecting to a third-party management system.

1. Select a protocol used for interconnection between the SmartLogger and the third-party NMS.

Figure 3-5 Third-party NMS



Copyright © Huawei Technologies Co., Ltd.

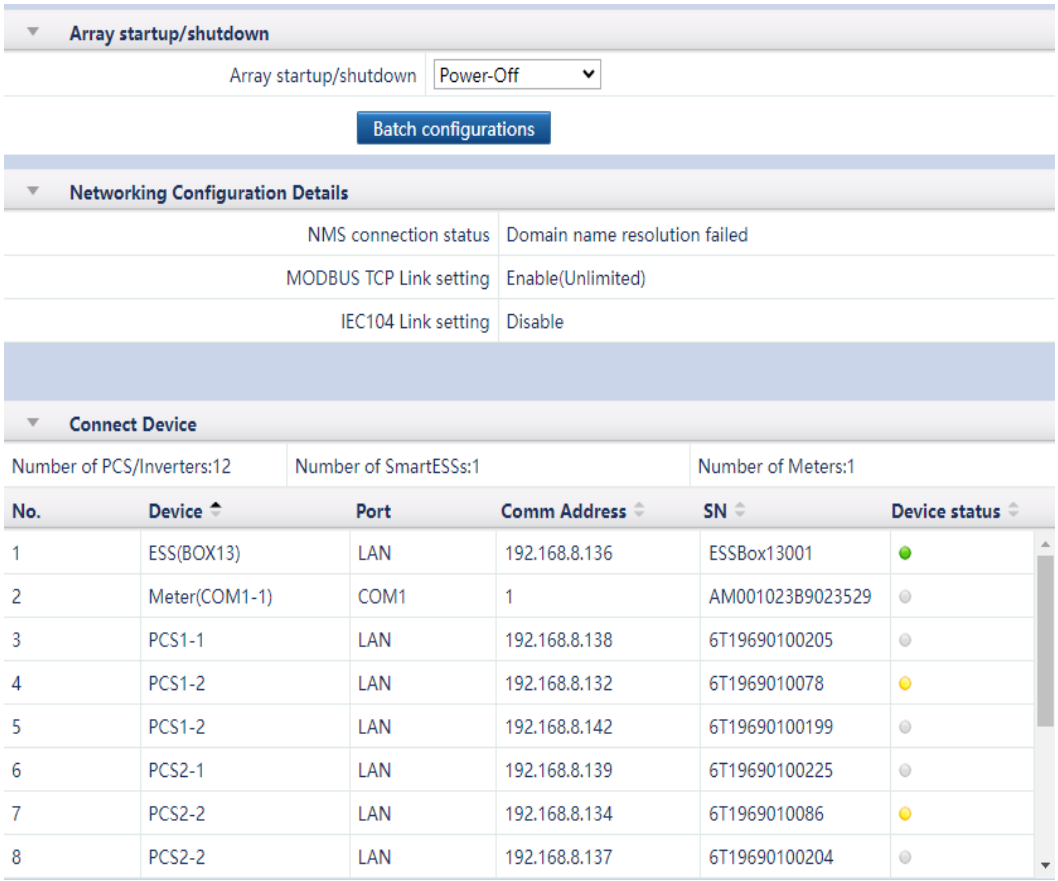
2. Set the parameters based on the actual protocol.
   - IEC 104 or Modbus TCP protocol: See section **Setting Parameters for Connecting to the Management System** in the *SmartLogger3000 User Manual*.
   - GOOSE protocol: Set the VLAN protocol for the switch by referring to the related switch documents, and then see section **Setting GOOSE Communications Parameters** in the *SmartLogger3000 User Manual*.
3. Send a command on the third-party NMS to adjust the parameter values (for details, see the point list definitions released with the SmartLogger version), and check whether the SmartLogger can respond properly.

Step 11 (Optional) Set parameters for connecting to third-party devices.

If there is no third-party device, click **Skip**.

Step 12 Complete the configuration.

Figure 3-6 Completing the configuration



----End

3.2.3 Follow-up Procedure for the PCS

Context

Upgrade the PCS software version and change the device name based on the corresponding battery rack.

 Copyright © Huawei Technologies Co., Ltd.

Prerequisites

- Before upgrading the PCS, ensure that the DC side of the PCS is powered on.
- Before changing the PCS name, ensure that the DC or AC side of the PCS is powered on.

Procedure

Step 1 Choose **Maintenance** > **Software Upgrade** and upgrade the PCS to the target software version.

Download the PCS software package from the following link. For details about the version mapping and upgrade guide, see the *release documentation*.

https://support.huawei.com/enterprise/en/fusionsolar/pcs2000ha-pid-255740941/software

1. Select the target file and click **Upload**.
2. Select the target device and click **Software Upgrade**.

Step 2 Choose **Maintenance** > **Device Mgmt.** > **Device List** and change the PCS name.

To facilitate subsequent log export and fault locating, change the PCS name based on the corresponding battery rack. For example, change the name of the fourth PCS corresponding to battery rack 3 of the ESS in container 2 of array 1 in area A to **PCS_A_1_2_3_4**.

After the settings are complete, click **Modify Device Info**.

----End

3.3 Shutdown and Power-Off

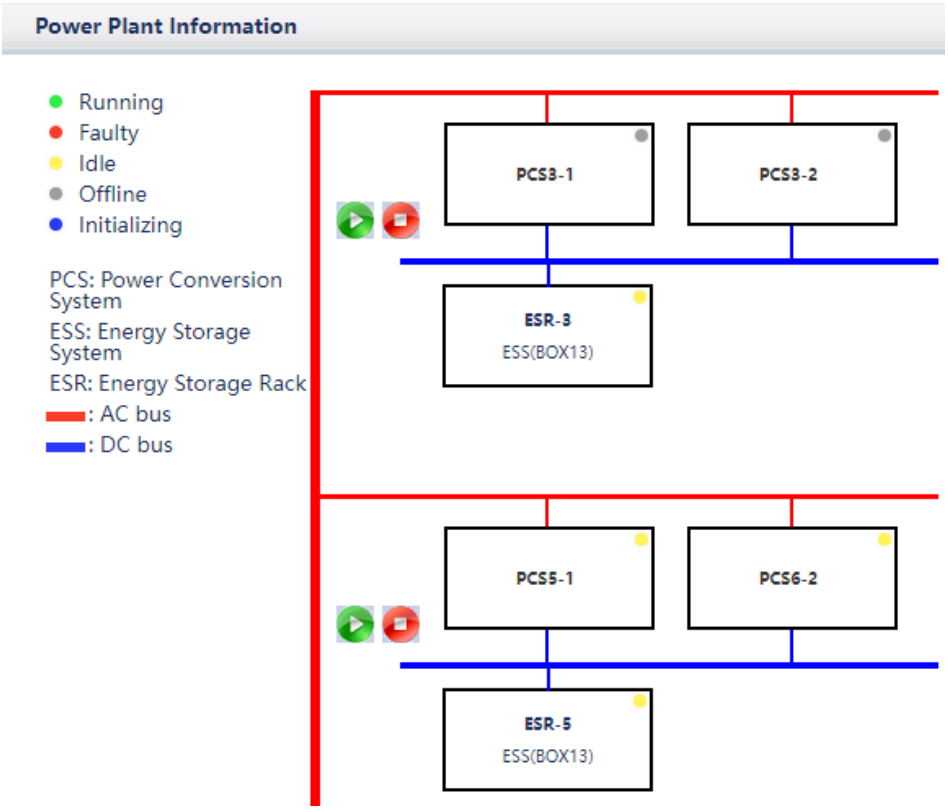
After power-on and commissioning are complete, you can power off the system as required, and power it on and start devices when the system needs to be put into use.

1. Send a shutdown command.
   a. Log in to the SmartLogger WebUI and send a shutdown command to the PCS and ESS.

      Method 1 (array-level): Choose **Maintenance > Device Mgmt.** > **Connect Device**. In the upper right corner of the page, click to send a shutdown command.

      Method 2 (rack-level): Choose **Overview** > **Plant Running Info**, click to expand the topology, and click to send a shutdown command.

Copyright © Huawei Technologies Co., Ltd.



b. On the top menu bar, click **Monitoring**. In the navigation pane, select the target device. On the **Running Info** tab page, check whether the device is shut down according to the device status.

   PCS: If **Device status** is **Standby: No DC input**, the device is shut down.

   ESR: If **Working status** is **Shutdown: command shutdown**, the device is shut down.

2. Turn off the main power switches and then the auxiliary power switches of the devices by referring to the operations of **3.1.2 (Optional) Powering On the PV Array** and **3.1.3 Powering On the ESS Array** in the reverse order.

Copyright © Huawei Technologies Co., Ltd.

4 System Startup and Operation

Prerequisites

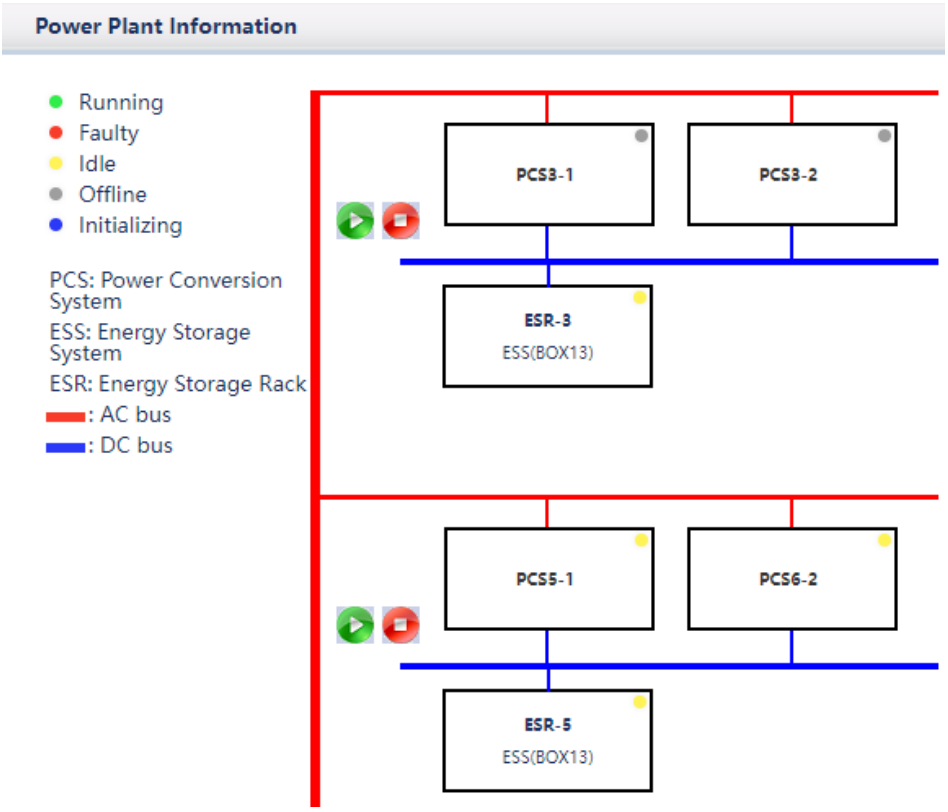
Install a solenoid valve for the ESS before putting the system into operation.

Procedure

1. Power on the devices by referring to **3.1.2 (Optional) Powering On the PV Array** and **3.1.3 Powering On the ESS Array**.
2. Send a startup command.
   a. Log in to the SmartLogger WebUI.
   b. Send a startup command to the PCS and ESS.
   Method 1 (array-level): Choose **Maintenance > Device Mgmt.** > **Connect Device** and click to send a startup command.

   Method 2 (rack-level): Choose **Overview** > **Plant Running Info**, click to expand the topology, and click to send a startup command.

 Copyright © Huawei Technologies Co., Ltd.



 Copyright © Huawei Technologies Co., Ltd.

5 FAQ

5.1 Why Does the ESS Still Fail to Discharge When Its SOC Is Higher Than the End-of-discharge SOC?

For the LUNA2000-(4472, 5015) series ESS, if the SOC of any battery pack is less than or equal to **Array end-of-discharge SOC** during discharge, the ESS stops discharging. To prevent the ESS from frequently switching between starting and stopping discharging due to the active balancing mechanism between battery packs, the ESS enters the discharge protection state. The ESS can continue discharging only after you decrease the value of **Array end-of-discharge SOC** by 2% or more or charge the ESS by 2% or more.

 Copyright © Huawei Technologies Co., Ltd.

A Reference Documents

Device/ Product Name	Document
ESS	• HUAWEI LUNA2000-(4472, 5015) Series Smart String ESS User Manual • HUAWEI LUNA2000-(4472, 5015) Series Smart String ESS Maintenance Manual • HUAWEI LUNA2000-(4472, 5015) Series Smart String ESS Alarm Reference • HUAWEI LUNA2000-(4472, 5015) Series Smart String ESS Quick Guide
PCS	• HUAWEI LUNA2000-213KTL-H0 Smart Power Control System User Manual • HUAWEI LUNA2000-213KTL-H0 Smart Power Control System Quick Guide
SACU	SmartACU2000D-D-(08-11) Series Smart Array Controller User Manual
SmartLogger	SmartLogger3000 User Manual
DTS	• DTS-200K-D0 Distribution Transformer User Manual • DTS-200K-D0 Distribution Transformer Quick Guide

 Copyright © Huawei Technologies Co., Ltd.

Device/ Product Name	Document
STS	• HUAWEI JUPITER-(3000K, 6000K, 9000K)-H1 Smart Transformer Station User Manual (with Built-In SACU) • HUAWEI JUPITER-(3000K, 6000K, 9000K)-H1 Smart Transformer Station Installation Guide (with Built-In SACU) • HUAWEI JUPITER-3000K-H1-GF Smart Transformer Station User Manual • HUAWEI JUPITER-9000K-H0 Smart Transformer Station User Manual • HUAWEI JUPITER-9000K-H0 Smart Transformer Station Installation Guide • STS-(3000K, 6000K)-H1 Smart Transformer Station User Manual • STS-(3000K, 6000K)-H1 Smart Transformer Station Installation Guide
SEMS	• SEMS2000 User Manual • SEMS2000 Quick Guide • SEMS2000 Product Documentation
SPPC	• SPPC2000 Smart Power Plant Controller User Manual • SPPC2000 Smart Power Plant Controller Quick Guide
FusionSolar app	FusionSolar App User Manual
Power-Partner app	Utility-Scale ESS Power-On Tool Training (Power-Partner)

Copyright © Huawei Technologies Co., Ltd.

B Contact Information

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

https://digitalpower.huawei.com

Path: **About Us** > **Contact Us** > **Service Hotlines**

To ensure faster and better services, we kindly request your assistance in providing the following information:

- Model
- Serial number (SN)
- Software version
- Alarm ID or name
- Brief description of the fault symptom

 Copyright © Huawei Technologies Co., Ltd.

NOTE

EU Representative Information: Huawei Technologies Hungary Kft.
Add.: HU-1133 Budapest, Váci út 116-118., 1. Building, 6. floor.
Email: hungary.reception@huawei.com

 Copyright © Huawei Technologies Co., Ltd.

C Acronyms and Abbreviations

C

CMU	central monitoring unit

E

ESR	energy storage rack (battery rack)
ESS	energy storage system

F

FE	fast Ethernet

P

PCS	power control system
PSU	power supply unit

R

RSTP	Rapid Spanning Tree Protocol

 Copyright © Huawei Technologies Co., Ltd.

S

SACU	Smart Array Controller
SEMS	Smart Energy Management System
SOC	state of charge
SOH	state of health
SPPC	Smart Power Plant Controller
STS	Smart Transformer Station

 Copyright © Huawei Technologies Co., Ltd.