Commercial and Industrial Microgrid Energy Storage Solution

Quick Guide

Issue	02
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About This Document

Purpose

This document describes the networking architecture, communication logic, and operation and maintenance (O&M) methods of the commercial and industrial (C&I) microgrid energy storage solution, as well as the installation, cable connection, check and preparation before power-on, system power-on commissioning, power-off, and power-on operations.

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**.

Intended Audience

The 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.

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.

Symbol	Description
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 in earlier issues.

Issue 02 (2023-06-25)

Modified **1.1.1 On/Off-Grid PV+ESS System**.

Modified **1.2 Communication Logic**.

Modified **4.2.2 Commissioning Using the Deployment Wizard**.

Added **B ESS Software Upgrade Solution for the Off-Grid PV+ESS System**.

Issue 01 (2023-06-05)

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

Contents

1 Solution Introduction

1.1 Networking Architecture

The C&I microgrid energy storage solution has three networking architectures: on/off-grid PV+ESS system, off-grid PV+ESS+DG system, and off-grid PV+ESS system.

NOTICE

In off-grid scenarios, the load requirements are as follows:

1. The instantaneous peak current (basic current + inrush current) upon load connection shall not exceed 1.1 times of the PCS rated current.
2. The load of direct on line (DOL) motors shall not exceed 11% of the PCS rated power. If there are other types of loads, the load proportion of DOL motors shall be reduced. The load of other variable-frequency or soft-start motors shall not exceed 2/3 of the PCS rated power.
3. The total rated capacity of all loads shall not exceed 2/3 of the PCS rated capacity.
4. The transformer on the load side shall not be powered on after the PCS is started. It is recommended that the transformer on the load side be powered on simultaneously when the PCS is started.

1.1.1 On/Off-Grid PV+ESS System

The on/off-grid PV+ESS system applies to C&I campuses where the power grid capacity is insufficient, capacity expansion is difficult, and power is limited during peak hours.

In this system, the ESS is AC-coupled with the PV system through an isolation transformer. The microgrid system is connected to or disconnected from the power grid through an on/off-grid switch. When the system is off-grid, the ESS functions as the main power supply to support the power grid, and also supplies power together with the PV system to critical loads.

Figure 1-1 shows the networking architecture of the on/off-grid PV+ESS system. **Table 1-1** shows the components.

Figure 1-1 Networking architecture of the on/off-grid PV+ESS system

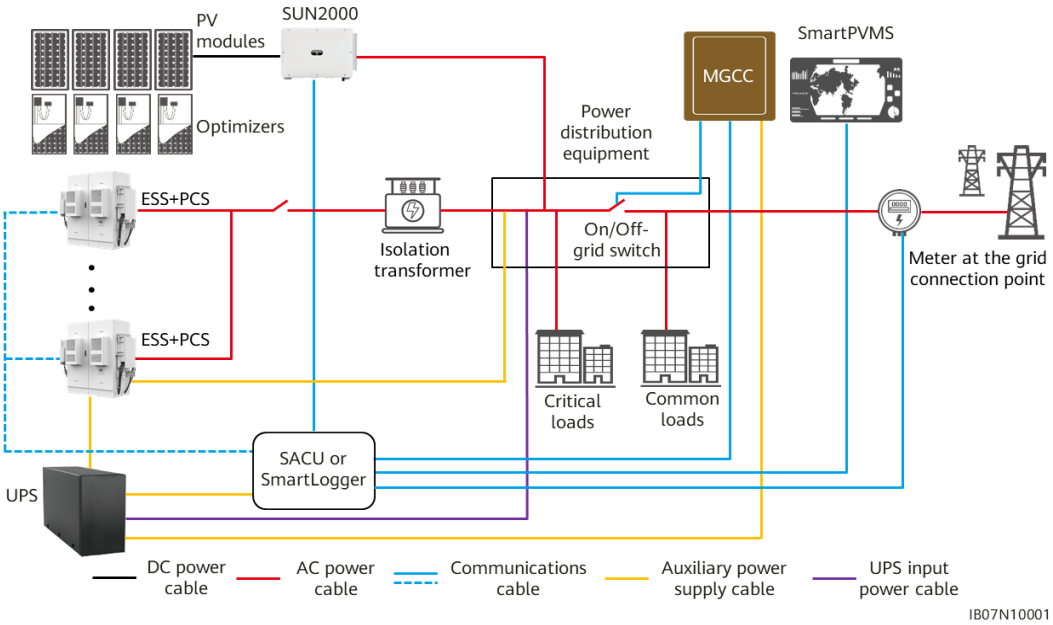


Table 1-1 Components of the on/off-grid PV+ESS system

Name	Model/ Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	LUNA2000-200KWH-2H1	≤ 5	Purchased from the Company
Smart Power Control System (PCS)	LUNA2000-100KTL-M1	≤ 5	Purchased from the Company. The ratio of PCS to ESS is 1:1.
Smart PV inverter (SUN2000)	• SUN2000-50KTL-M3 • SUN2000-100KTL-M1 • SUN2000-100KTL-M2 • SUN2000-110KTL-M2 • SUN2000-115KTL-M2	Depending on the PV-to-storage ratio	Purchased from the Company. Different models shall not be used together. When the SUN2000 is running off-grid, the maximum capacity ratio of the SUN2000 to the PCS is 2:1.

Name	Model/ Specifications	Quantity	Remarks
Smart PV Optimizer (SUN2000P)	• SUN2000-450W-P • SUN2000-450W-P2 • SUN2000-600W-P • MERC-1300W-P • MERC-1100W-P	Depending on the actual number of PV modules	Purchased from the Company (optional). The SUN2000P is supported only by the SUN2000-50KTL-M3.
SmartLogger3000 (SmartLogger)	SmartLogger3000A	1	Purchased from the Company. Choose either SmartLogger or SACU. The SACU contains the SmartLogger, which can be used to manage devices in an array over the web user interface (WebUI) of the SmartLogger.
Smart Array Controller (SACU)	SmartACU2000D-D-00	1	
Meter at the grid connection point	DTSU666-HW or YDS60-80	1	Purchased from the Company
FusionSolar Smart PV Management System (SmartPVMS)	iMaster NetEco V600R023C00CP2101 and later versions	1	Purchased from the Company (optional)
Power distribution equipment (including the on/off-grid switch)	Supporting remote signal feedback	1	Prepared by the customer
Microgrid central controller (MGCC)	Supporting the IEC 104 or Modbus TCP communication protocol	1	Prepared by the customer
Isolation transformer	400/400 V, Dyn11, 1.1 times long-term operation, 50 Hz/60 Hz	1	Prepared by the customer

Name	Model/ Specifications	Quantity	Remarks
UPS	• 1–3 kVA, online UPS, 220 V • Power backup duration ≥ 1 hour	1	Prepared by the customer

1.1.2 Off-Grid PV+ESS+DG System

The off-grid PV+ESS+DG system applies to off-grid scenarios where a diesel generator (DG) supplies power. The ESS is AC-coupled with the PV system and DG system through an isolation transformer.

In this system, the ESS, PV system, and DG system are controlled and coordinated to improve PV power consumption and reduce fuel usage. The DG system and ESS can run in parallel and switch main power supplies, reducing noise and electricity costs.

Figure 1-2 shows the networking architecture of the off-grid PV+ESS+DG system. Table 1-2 shows the components.

Figure 1-2 Networking architecture of the off-grid PV+ESS+DG system

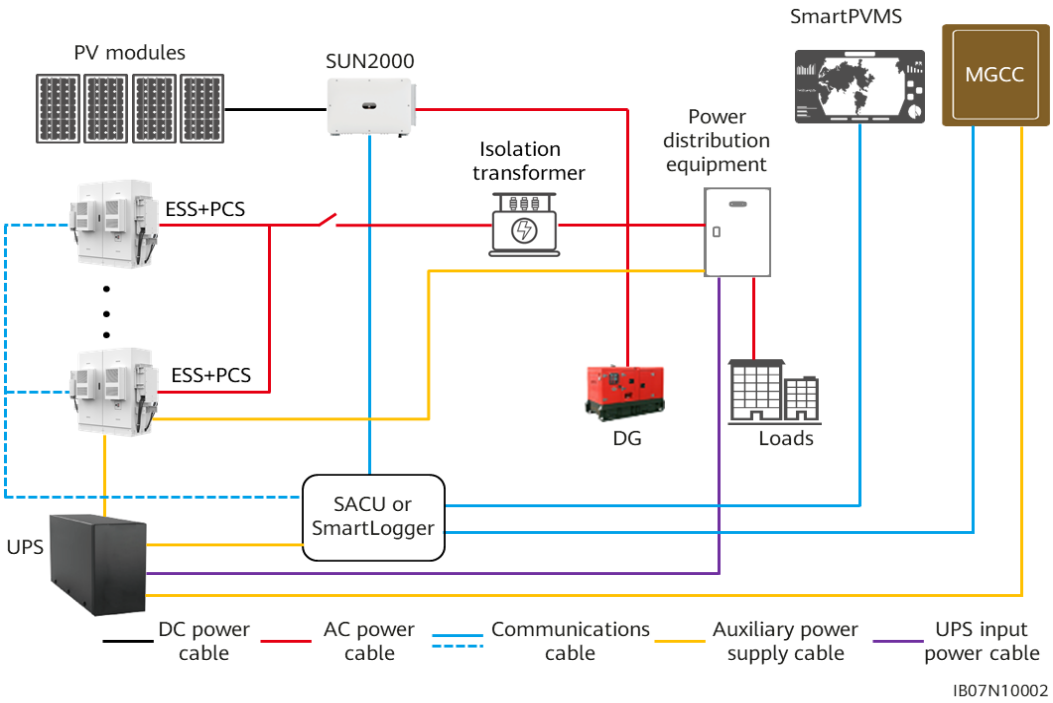


Table 1-2 Components of the off-grid PV+ESS+DG system

Name	Model/ Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	LUNA2000-200KWH-2H1	≤ 5	Purchased from the Company
Smart Power Control System (PCS)	LUNA2000-100KTL-M1	≤ 5	Purchased from the Company. The ratio of PCS to ESS is 1:1.
Smart PV inverter (SUN2000)	• SUN2000-50KTL-M3 • SUN2000-100KTL-M1 • SUN2000-100KTL-M2 • SUN2000-110KTL-M2 • SUN2000-115KTL-M2	Depending on the PV-to-storage ratio	Purchased from the Company. Different models shall not be used together. When the SUN2000 is running off-grid, the maximum capacity ratio of the SUN2000 to the PCS is 2:1.
SmartLogger3000 (SmartLogger)	SmartLogger3000A	1	Purchased from the Company. Choose either SmartLogger or SACU. The SACU contains the SmartLogger, which can be used to manage devices in an array over the web user interface (WebUI) of the SmartLogger.
Smart Array Controller (SACU)	SmartACU2000D-D-00	1	
FusionSolar Smart PV Management System (SmartPVMS)	iMaster NetEco V600R023C00CP2101 and later versions	1	Purchased from the Company (optional)
Power distribution equipment	-	1	Prepared by the customer
Microgrid central controller (MGCC)	Supporting the IEC 104 or Modbus TCP communication protocol	1	Prepared by the customer
Isolation transformer	400/400 V, Dyn11, 1.1 times long-term operation, 50 Hz/60 Hz	1	Prepared by the customer

Name	Model/ Specifications	Quantity	Remarks
UPS	• 1–3 kVA, online UPS, 220 V • Power backup duration ≥ 1 hour	1	Prepared by the customer
DG	• Three-phase, supporting synchronization • DG power ≥ ESS power, and ≥ 1.5 times peak load	-	Prepared by the customer

1.1.3 Off-Grid PV+ESS System

The off-grid PV+ESS system applies to remote areas and islands without electricity. The ESS and PV system are controlled and coordinated to supply power.

In this system, the ESS is AC-coupled with the PV system through an isolation transformer. The ESS functions as the main power supply for grid forming, and also supplies power together with the PV system to loads. When the ESS is overdischarged, the DG charges the ESS.

Figure 1-3 shows the networking architecture of the off-grid PV+ESS system. **Table 1-3** shows the components.

Figure 1-3 Networking architecture of the off-grid PV+ESS system

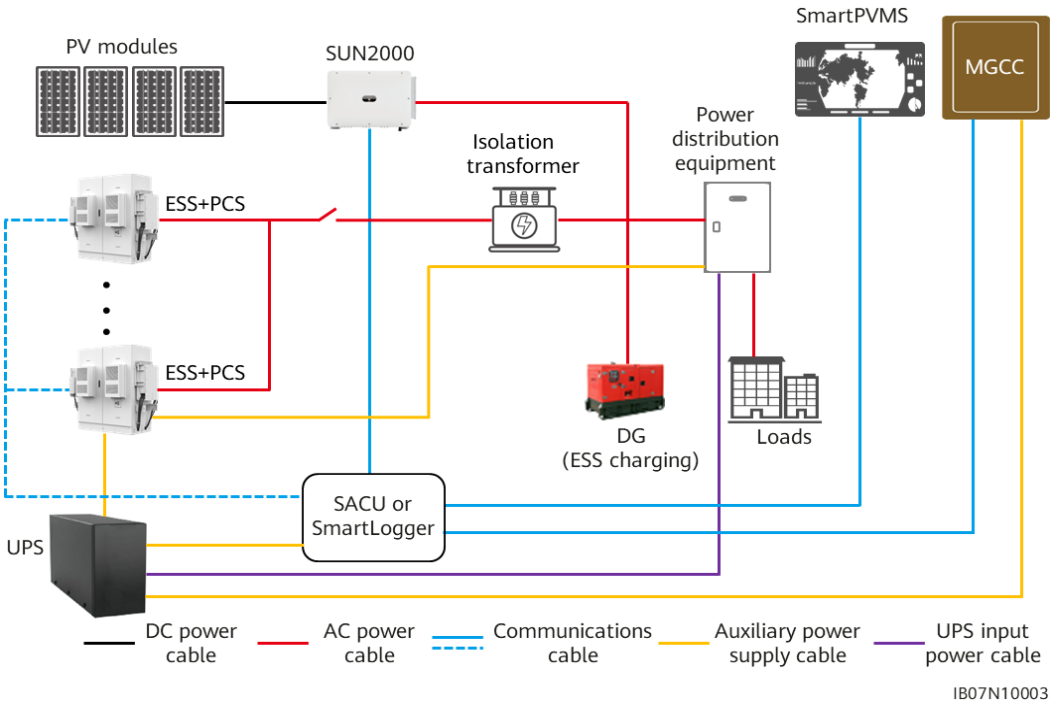


Table 1-3 Components of the off-grid PV+ESS system

Name	Model/ Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	LUNA2000-200KWH-2H1	≤ 5	Purchased from the Company
Smart Power Control System (PCS)	LUNA2000-100KTL-M1	≤ 5	Purchased from the Company. The ratio of PCS to ESS is 1:1.
Smart PV inverter (SUN2000)	• SUN2000-50KTL-M3 • SUN2000-100KTL-M1 • SUN2000-100KTL-M2 • SUN2000-110KTL-M2 • SUN2000-115KTL-M2	Depending on the PV-to-storage ratio	Purchased from the Company. Different models shall not be used together. When the SUN2000 is running off-grid, the maximum capacity ratio of the SUN2000 to the PCS is 2:1.
SmartLogger3000 (SmartLogger)	SmartLogger3000A	1	Purchased from the Company. Choose either SmartLogger or SACU. The SACU contains the SmartLogger, which can be

Name	Model/ Specifications	Quantity	Remarks
Smart Array Controller (SACU)	SmartACU2000D-D-00	1	used to manage devices in an array over the web user interface (WebUI) of the SmartLogger.
FusionSolar Smart PV Management System (SmartPVMS)	iMaster NetEco V600R023C00CP2101 and later versions	1	Purchased from the Company (optional)
Power distribution equipment	-	1	Prepared by the customer
Microgrid central controller (MGCC)	Supporting the IEC 104 or Modbus TCP communication protocol	1	Prepared by the customer
Isolation transformer	400/400 V, Dyn11, 1.1 times long-term operation, 50 Hz/60 Hz	1	Prepared by the customer
UPS	• 1–3 kVA, online UPS, 220 V • Power backup duration ≥ 1 hour	1	Prepared by the customer
DG	Three-phase	-	Prepared by the customer

1.2 Communication Logic

One SACU or SmartLogger manages multiple ESSs, PCSs, SUN2000s, and one meter to form an array. Intra-array:

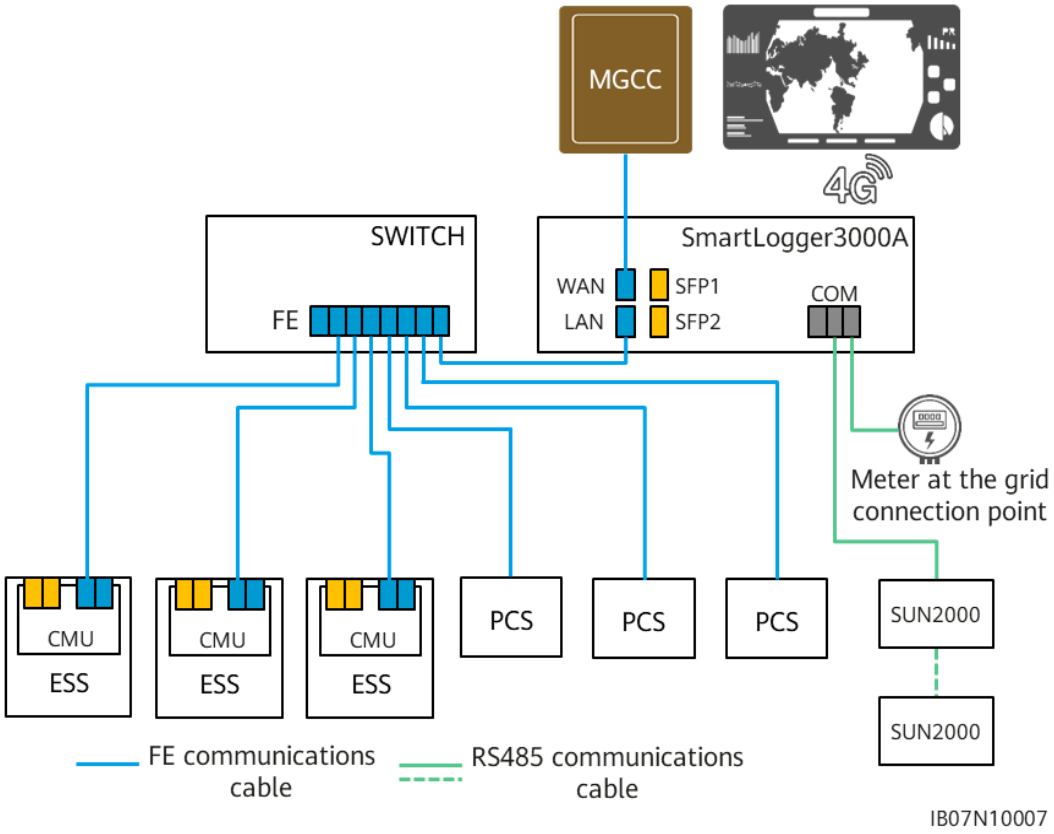
- The SUN2000s communicate with the SACU or SmartLogger and the meter communicates with the SACU or SmartLogger over RS485.
- The ESSs communicate with the SACU or SmartLogger over FE in star or chain topology.
- The PCSs communicate with the SACU or SmartLogger over FE in star or ring topology.

Select either of the following topologies based on the number of ESSs and PCSs in the array as well as the deployment of optical fibers.

(Recommended) Typical Scenario 1: SmartLogger+ESS Star+PCS Star Topology

In this scenario, the SmartLogger3000A is configured, and the customer needs to prepare one switch (number of 10M/100M autonegotiation Ethernet ports ≥ 8). One array can connect to a maximum of three ESSs and three PCSs.

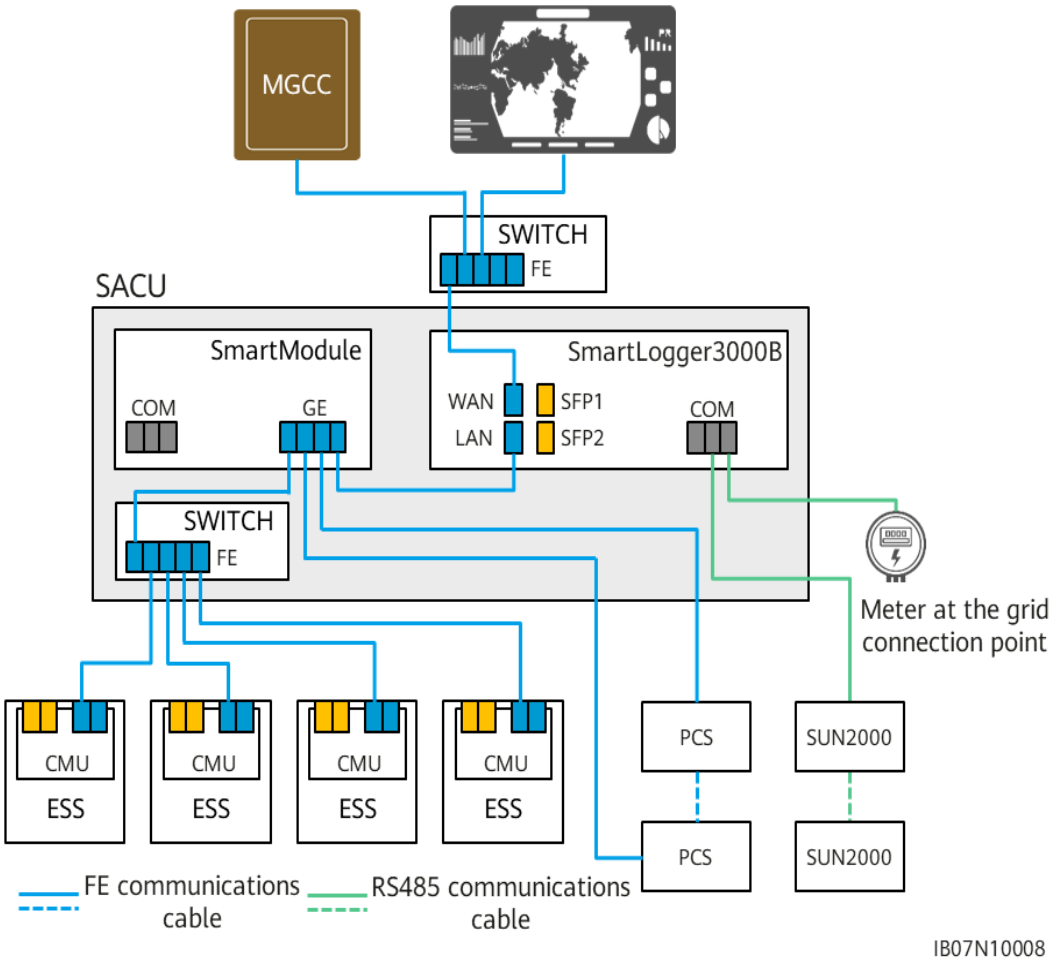
Figure 1-4 SmartLogger+ESS star+PCS star topology



Typical Scenario 2: SACU+ESS Star+PCS Ring Topology

In this scenario, the SmartACU2000D-D-00 is configured, and the SmartModule needs to be configured in the SACU. One array can connect to a maximum of four ESSs and four PCSs.

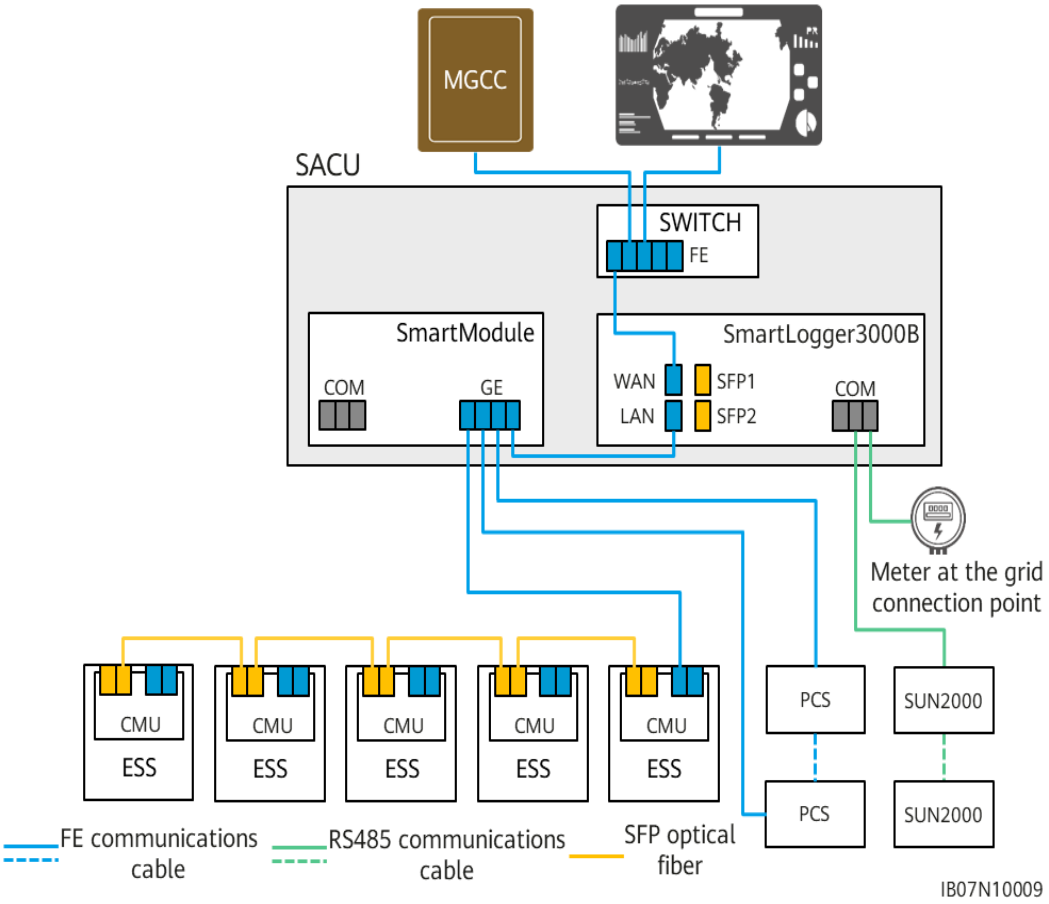
Figure 1-5 SACU+ESS star+PCS ring topology



Typical Scenario 3: SACU+ESS Chain+PCS Ring Topology

In this scenario, the SmartACU2000D-D-00 is configured, and the SmartModule needs to be configured in the SACU. The SACU communicates with the first ESS through FE, and ESSs communicate with each other through SFP optical fiber cascading. One array can connect to a maximum of five ESSs and five PCSs.

Figure 1-6 SACU+ESS chain+PCS ring topology



1.3 O&M Methods

Table 1-4 O&M methods

O&M Method	Description	Main Application Scenario	Reference Document
SmartLogger WebUI	A PC is connected to the SmartLogger in the SACU to manage the ESSs, PCSs, SUN2000s, and meters in the array.	Deployment commissioning	SmartLogger3000 User Manual
SmartPVMS	The SmartPVMS is deployed on a public network. It displays the current and historical running status of power plants and supports intelligent alarm reporting, analysis, diagnosis, and O&M.	Viewing plant information and manage devices at a site after deployment and commissioning	iMaster NetEco V600R023C00 FusionSolar SmartPVMS User Manual

O&M Method	Description	Main Application Scenario	Reference Document
Local app	The app is locally connected to the PCS, the CMU of the ESS, and the SUN2000 to locally manage a single PCS, ESS, and SUN2000.	• Modifying the parameters of a single device locally • Upgrading the software version of a single device locally	**FusionSolar App User Manual**

2 Installation and Cable Connection

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**.

Table 2-1 Device installation and cable connection process

Step	Task	Precaution
1	Installing the ESS	• Ensure that the foundation levelness meets the requirements (deviation ≤ 3 mm). • You are advised to use a forklift and battery installation tray kit to install battery packs. The kit is not delivered with the product and needs to be purchased separately from the Company. • When installing battery copper bars: – Manually insert the nut into the screw plate, and then use an insulated torque socket wrench with an extension rod to completely secure the nut in place. This prevents the screw thread from being stuck or stripped due to the deviation of the nut position. – Preinstall nuts with the recommended torque of 27 N·m. – After installing nuts, check that the torque is 27 N·m. Use a marker to mark the nuts after the torque is verified.
2	Installing the PCS	Install the PCS on the side of the ESS using the delivered mounting brackets (including M12 bolt assemblies).
3	Installing the SUN2000 and SUN2000P	N/A

Step	Task	Precaution
4	Installing the DTSU666-HW	N/A
5	Installing the SACU or SmartLogger	N/A
6	Installing PE cables	• The ground point inside the ESS must be connected, and the ground point outside the ESS is optional. • The ground point in the AC maintenance compartment of the PCS serves only as the equipotential bonding point of the PE point and cannot replace the PE point of the enclosure. • The ground points of all PCSs in the same array need to be connected to ensure equipotential bonding to ground cables. • To enhance the corrosion resistance of a ground terminal, you are advised to apply silicone grease or paint on it after connecting the ground cable.
7	Installing DC power cables	• DC power cables (with corrugated pipes) between the ESS and PCS are delivered with the ESS. • Reserve sufficient length for the DC power cables between the ESS and the PCS, and add angle steel in the middle of the foundation to support the cables and reduce the stress on the cables.
8	Installing AC power cables	• For the following models, an AC power cable from the SUN2000 to the PV and ESS coupling point must be longer than 15 m (multi-core cable) or 7 m (single-core cable). – SUN2000-100KTL-M0 – SUN2000-100KTL-M1 – SUN2000-110KTL-M2 – SUN2000-115KTL-M2 • An AC power cable from the PCS to the PV and ESS coupling point must be longer than 20 m (multi-core cable) or 10 m (single-core cable). • AC power cables must be connected in the correct phase sequence. Ensure that the phase sequence of the AC power cables of the PCS is consistent with that of the isolation transformer and power grid. Otherwise, the system may fail to run properly.
9	Installing communications cables	For details about the cable connections, see **1.2 Communication Logic**.

3 Check and Preparation Before Power-On

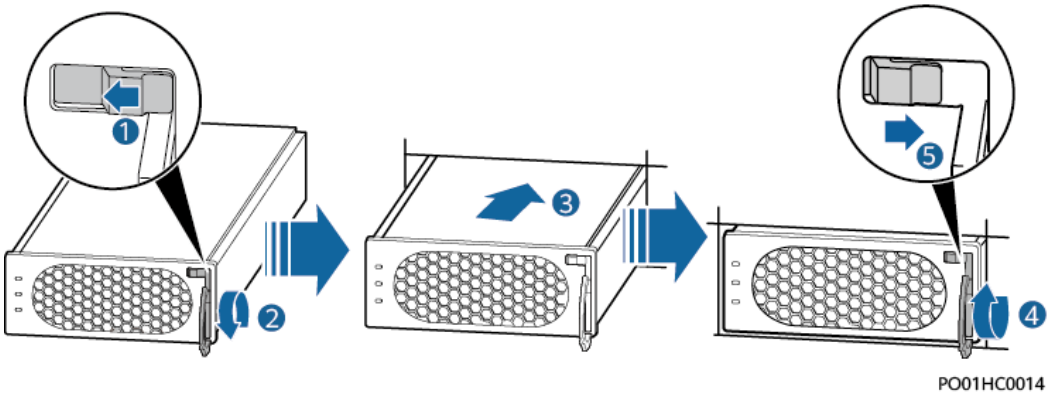
Step 1 Perform the check before power-on by referring to the "Check Before Power-On" section in the user manual of each device.

Step 2 Check whether the phase sequence of the AC power cables between the PCS and the isolation transformer is consistent. If not, adjust the wiring sequence of the AC power cables.

Step 3 Install the PSU in the ESS.

> **CAUTION**
>
> In an outdoor scenario, you are advised to power on the PSU within 24 hours after unpacking. If the PSU cannot be powered on in time, place it in a dry indoor environment without corrosive gas.

Figure 3-1 Installing the PSU



Step 4 Check the switch status.

1. Check that the switches on both sides of the isolation transformer are off.
2. Check that the switch between the PCS AC side and the isolation transformer and that the switch between the SUN2000 AC side and the isolation transformer are turned off.

Step 5 Perform the ESS fire suppression system acceptance test.

CAUTION

System power-on and commissioning can be performed only after the ESS fire suppression system passes the acceptance test.

1. Remove foreign objects from the ESS, collect auxiliary materials, and take away flammable objects such as cardboards.
2. Perform the following steps to power on the ESS auxiliary power supply:
   - On-grid scenario: The power grid supplies power to the UPS, and the UPS supplies power to the CMU of the ESS and SACU or SmartLogger.
   - Off-grid scenario: The UPS supplies power to the CMU of the ESS and SACU or SmartLogger.
3. Log in to the SACU or SmartLogger WebUI. The following alarms shall not be generated. If any of the following alarms is generated, clear the alarm according to the alarm handling suggestions:
   - 3826 Combustible Gas Alarm
   - 3832 Fire Alarm
   - 3831 Built-in Fire Suppression Module Pressure Low
   - 3847 Built-in Fire Suppression Pressure Low for Extended Periods
   - 3838 T/H Sensor Communication Failure
   - 3840 CO Sensor Communication Failure
   - 3850 Combustible Gas Detection Malfunction
4. Check whether the reading of the pressure gauge on the rack mounted fire extinguishing system is normal.
5. Remove the communications cables between the rack mounted fire extinguishing system and the CMU. The SACU or SmartLogger WebUI shall report related alarms.

----End

4 System Power-On and Commissioning

CAUTION

During the power-on procedure, power off the batteries immediately if any fault is detected. Rectify the fault before proceeding with the procedure.

4.1 Device Power-On

4.1.1 On/Off-Grid PV+ESS System

Power on the on/off-grid PV+ESS system when an external power supply is available.

Figure 4-1 Power-on process of the on/off-grid PV+ESS system

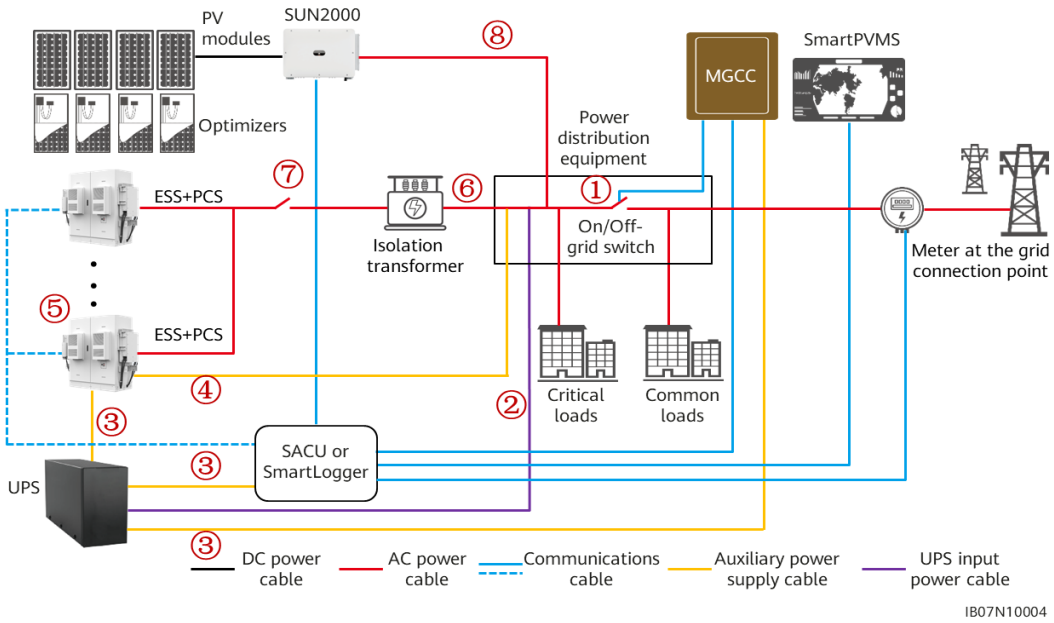


Table 4-1 Power-on process description of the on/off-grid PV+ESS system

Step	Task	Power-On Operation
1	Powering on the power distribution equipment	Turn on the on/off-grid switch in the power distribution equipment.
2	Powering on the UPS	1. Turn on the UPS power switch on the power distribution equipment side. 2. Start the UPS.
3	Powering on the UPS-ESS auxiliary power supply (for black start)	1. Turn on the ESS power switch on the UPS side. 2. Turn on the UPS cable inlet switch 5FCB in the ESS.
	Powering on the auxiliary power supply of the UPS-SACU or SmartLogger	1. Turn on the SACU or SmartLogger power switch on the UPS side. 2. Turn on the switch on the SACU or SmartLogger side: ● If the SACU is configured, turn on the SACU input switch QF03 and the three-phase input switch FU01 in the SACU. ● If the SmartLogger3000A is configured, turn on the power switch (if any) between the SmartLogger3000A and the UPS based on site requirements.
	Powering on the auxiliary power supply of the UPS-MGCC	1. Turn on the power supply switch of the MGCC on the UPS side. 2. Turn on the power supply switch on the MGCC side.

Step	Task	Power-On Operation
4	Powering on the ESS auxiliary power supply (such as for the air conditioners)	1. Turn on the ESS auxiliary power switch on the power distribution equipment side. 2. Use a multimeter to check that the AC voltage is within the allowed range (220 V ±10%). Then turn on the main AC switch 1FCB in the ESS. 3. Turn on the switches of the ESS power distribution system. a. Turn on the 12 V adapter switch 1FCB1. b. Turn on the PSU switch 1FCB2. c. (Optional) Turn on the 220 V maintenance socket switch 1FB1. d. On the embedded power subrack (SK1), turn on the DC/DC switch 2FCB1, DC light power switch 2FCB2, TCUE power switch 2FCB3, fan 1 switch 2FCB6, fan 2 switch 2FCB7, air conditioner 1 switch 2FCB8, and air conditioner 2 switch 2FCB9 in sequence. e. Use a multimeter to check that the output voltage of the embedded power subrack (SK1) is 53 V±5 V.
5	Powering on the ESS-Smart Rack Controller	Turn on DC switch 1Q1 in the ESS (on the battery rack side).
	Powering on the Smart Rack Controller-PCS	Turn on DC switch 1Q2 in the ESS.
6	Powering on the isolation transformer	For details, see the documents provided by the vendor.
7	Powering on the PCS	Turn on the AC switch between the PCS and the isolation transformer.

Step	Task	Power-On Operation
8	Powering on the SUN2000	**SUN2000-50KTL-M3:** 1. Set the DC SWITCH to ON. When you hear a click, the switch is completely turned on. 2. The indicator is not steady red. **Other SUN2000 models:** 1. Set the DC SWITCH 1 (MAIN SWITCH) to ON. When you hear a click, the switch is completely turned on. 2. Check the status of the PV connection indicator. If it is steady green, set DC SWITCH 2 and DC SWITCH 3 to ON. 3. Check that other indicators are not steady red.
Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.		

4.1.2 Off-Grid PV+ESS+DG System

Power on the off-grid PV+ESS+DG system when the DG system is running and the power distribution equipment has power supply.

Figure 4-2 Power-on process of the off-grid PV+ESS+DG system

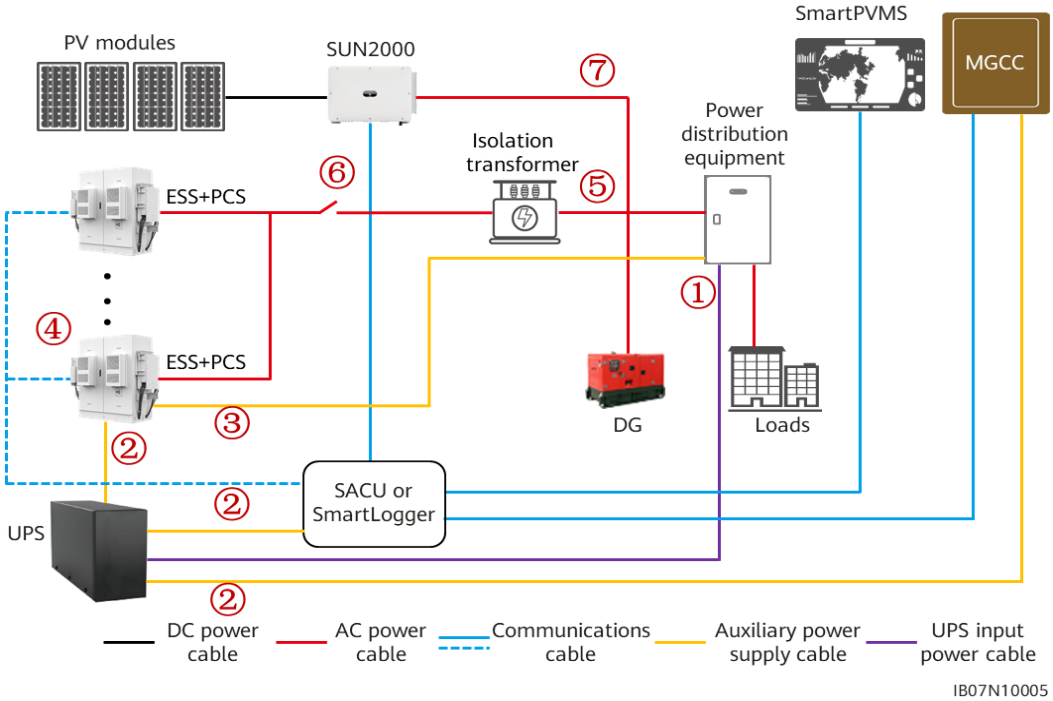


Table 4-2 Power-on process description of the off-grid PV+ESS+DG system

Step	Task	Power-On Operation
1	Powering on the UPS	1. Turn on the UPS power switch on the power distribution equipment side. 2. Start the UPS.
2	Powering on the UPS-ESS auxiliary power supply (for black start)	1. Turn on the ESS power switch on the UPS side. 2. Turn on the UPS cable inlet switch 5FCB in the ESS.
	Powering on the auxiliary power supply of the UPS-SACU or SmartLogger	1. Turn on the SACU or SmartLogger power switch on the UPS side. 2. Turn on the switch on the SACU or SmartLogger side: ● If the SACU is configured, turn on the SACU input switch QF03 and the three-phase input switch FU01 in the SACU. ● If the SmartLogger3000A is configured, turn on the power switch (if any) between the SmartLogger3000A and the UPS based on site requirements.
	Powering on the auxiliary power supply of the UPS-MGCC	1. Turn on the ESS power switch on the UPS side. 2. Turn on the UPS cable inlet switch 5FCB in the ESS.

Step	Task	Power-On Operation
3	Powering on the ESS auxiliary power supply (such as for the air conditioners)	1. Turn on the ESS auxiliary power switch on the power distribution equipment side. 2. Use a multimeter to check that the AC voltage is within the allowed range (220 V ±10%). Then turn on the main AC switch 1FCB in the ESS. 3. Turn on the switches of the ESS power distribution system. a. Turn on the 12 V adapter switch 1FCB1. b. Turn on the PSU switch 1FCB2. c. (Optional) Turn on the 220 V maintenance socket switch 1FB1. d. On the embedded power subrack (SK1), turn on the DC/DC switch 2FCB1, DC light power switch 2FCB2, TCUE power switch 2FCB3, fan 1 switch 2FCB6, fan 2 switch 2FCB7, air conditioner 1 switch 2FCB8, and air conditioner 2 switch 2FCB9 in sequence. e. Use a multimeter to check that the output voltage of the embedded power subrack (SK1) is 53 V±5 V.
4	Powering on the ESS-Smart Rack Controller	Turn on DC switch 1Q1 in the ESS (on the battery rack side).
	Powering on the Smart Rack Controller-PCS	Turn on DC switch 1Q2 in the ESS.
5	Powering on the isolation transformer	For details, see the documents provided by the vendor.
6	Powering on the PCS	Turn on the AC switch between the PCS and the isolation transformer.

Step	Task	Power-On Operation
7	Powering on the SUN2000	**SUN2000-50KTL-M3:** 1. Set the DC SWITCH to ON. When you hear a click, the switch is completely turned on. 2. The indicator is not steady red. **Other SUN2000 models:** 1. Set the DC SWITCH 1 (MAIN SWITCH) to ON. When you hear a click, the switch is completely turned on. 2. Check the status of the PV connection indicator. If it is steady green, set DC SWITCH 2 and DC SWITCH 3 to ON. 3. Check that other indicators are not steady red.
Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.		

4.1.3 Off-Grid PV+ESS System

Power on the off-grid PV+ESS system when the UPS can supply power, the DG is not running, and the power distribution equipment has no power supply.

Figure 4-3 Power-on process of the off-grid PV+ESS system

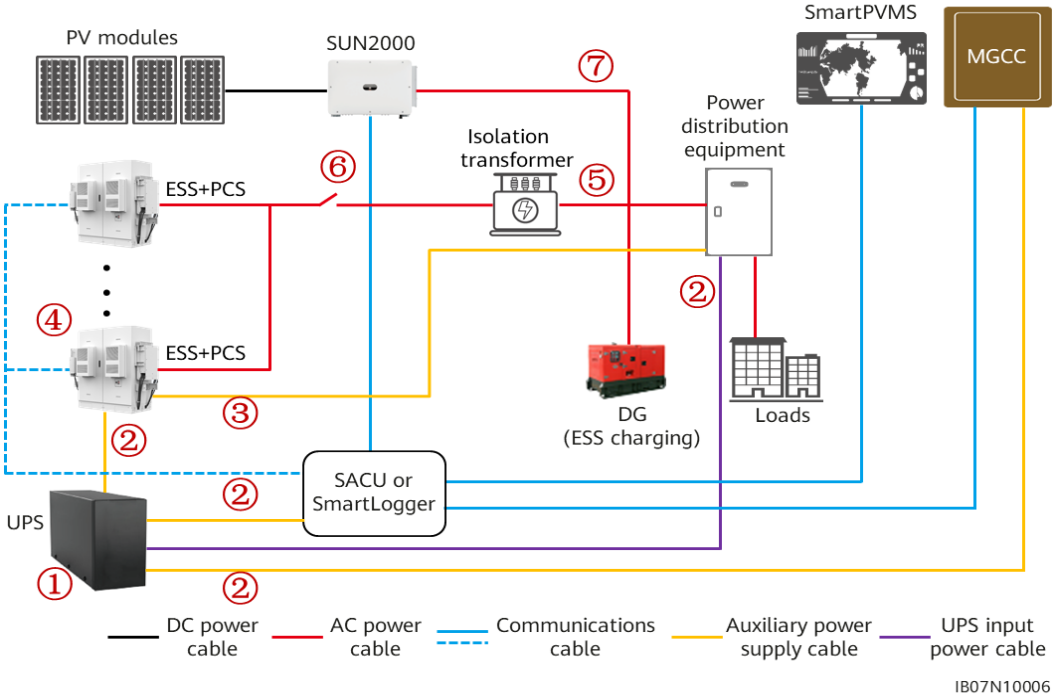


Table 4-3 Power-on process description of the off-grid PV+ESS system

Step	Task	Power-On Operation
1	Starting the UPS	For details, see the documents provided by the vendor.
2	-	Turn on the UPS power switch on the power distribution equipment side.
	Powering on the UPS-ESS auxiliary power supply (for black start)	1. Turn on the ESS power switch on the UPS side. 2. Turn on the UPS cable inlet switch 5FCB in the ESS.
	Powering on the auxiliary power supply of the UPS-SACU or SmartLogger	1. Turn on the SACU or SmartLogger power switch on the UPS side. 2. Turn on the switch on the SACU or SmartLogger side: ● If the SACU is configured, turn on the SACU input switch QF03 and the three-phase input switch FU01 in the SACU. ● If the SmartLogger3000A is configured, turn on the power switch (if any) between the SmartLogger3000A and the UPS based on site requirements.
	Powering on the auxiliary power supply of the UPS-MGCC	1. Turn on the power supply switch of the MGCC on the UPS side. 2. Turn on the power supply switch on the MGCC side.
3	Powering on the ESS auxiliary power supply (such as for the air conditioners)	1. Turn on the ESS auxiliary power switch on the power distribution equipment side. 2. Turn on the switches of the ESS power distribution system. a. Turn on the 12 V adapter switch 1FCB1. b. Turn on the PSU switch 1FCB2. c. (Optional) Turn on the 220 V maintenance socket switch 1FB1. d. On the embedded power subrack (SK1), turn on the DC/DC switch 2FCB1, DC light power switch 2FCB2, TCUE power switch 2FCB3, fan 1 switch 2FCB6, fan 2 switch 2FCB7, air conditioner 1 switch 2FCB8, and air conditioner 2 switch 2FCB9 in sequence.
4	Powering on the ESS-Smart Rack Controller	Turn on DC switch 1Q1 in the ESS (on the battery rack side).

Step	Task	Power-On Operation
	Powering on the Smart Rack Controller-PCS	Turn on DC switch 1Q2 in the ESS.
5	Powering on the isolation transformer	For details, see the documents provided by the vendor.
6	Powering on the PCS	Turn on the AC switch between the PCS and the isolation transformer.
7	Powering on the SUN2000	**SUN2000-50KTL-M3:** 1. Set the DC SWITCH to ON. When you hear a click, the switch is completely turned on. 2. The indicator is not steady red. **Other SUN2000 models:** 1. Set the DC SWITCH 1 (MAIN SWITCH) to ON. When you hear a click, the switch is completely turned on. 2. Check the status of the PV connection indicator. If it is steady green, set DC SWITCH 2 and DC SWITCH 3 to ON. 3. Check that other indicators are not steady red.
Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.		

4.2 Deployment Commissioning

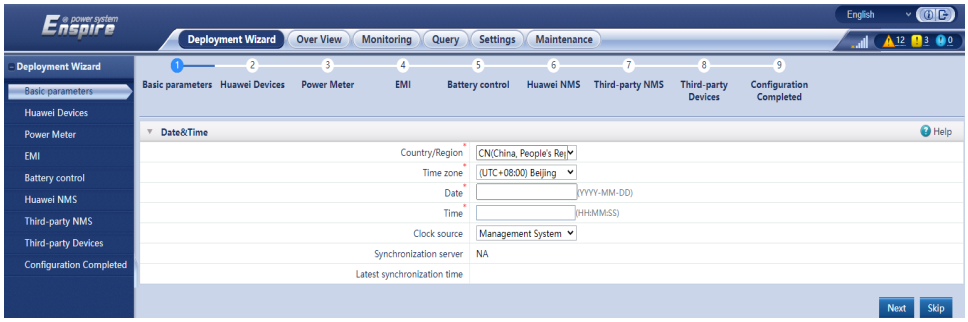
4.2.1 Preparations and WebUI Login

The SmartLogger WebUI is used for power-on and commissioning. For details about the preparations and WebUI login, see the **SmartLogger3000 User Manual**.

4.2.2 Commissioning Using the Deployment Wizard

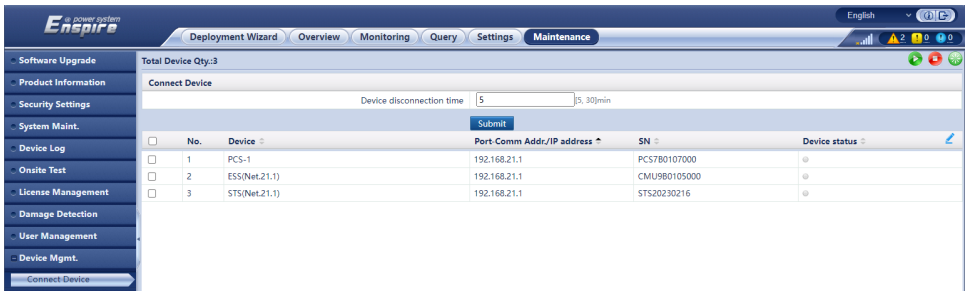
Step 1 Set basic parameters.

Figure 4-4 Setting basic parameters



Step 2 Click **Maintenance**, choose **Device Mgmt.** > **Connect Device**, and check that the devices are connected.

Figure 4-5 Checking device connection



1. Check whether the number of devices connected to the SmartLogger is correct.

   If not all devices are connected, check and ensure that the cascading cables between devices, the connection positions of the communications cables between devices and the SmartLogger, and the indicator status are normal. Then click **Auto. Search**.

2. Check whether the **Device status** of each device is normal.
   - For the on/off-grid PV+ESS system and off-grid PV+ESS+DG system: During initial connection, the **Device status** of the PCS is yellow, and the **Device status** of the ESS is green.
   - For the off-grid PV+ESS system: During initial connection, the **Device status** of the PCS is gray, and the **Device status** of the ESS is green (the CMU is green and the ESU is gray in **Monitoring**).

3. Click **Monitoring** and choose **ESS** > **ESU** > **ESR** > **ESM**. The number of ESMs is 12 and the ESM indicators are not red.

   If the number of ESMs is incorrect:

   a. Check whether the communications cables to the battery packs are correctly and securely connected.

   b. Delete invalid modules under **Running Param.** on the ESU page. Then, choose **Maintenance** > **Device Mgmt.** > **Connect Device** and click **Auto. Search**.

   If an ESM indicator is red, clear the ESM alarm according to the alarm handling suggestions.

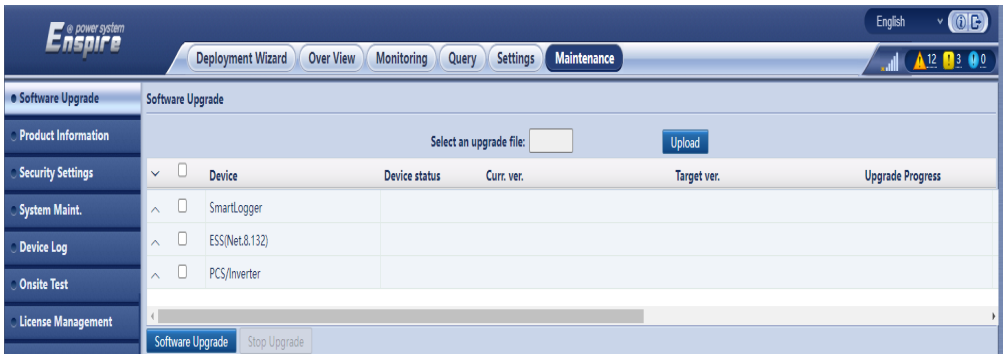
Step 3 Upgrade the software version.

NOTICE

- For the off-grid PV+ESS system, perform the subsequent commissioning steps first to ensure that the UPS has sufficient power for completing deployment commissioning. After the power supply and communication of the system are normal, upgrade the software version. For details about the ESS software upgrade, see **B ESS Software Upgrade Solution for the Off-Grid PV+ESS System**.
- Before upgrading the ESS, check whether an ESU alarm is generated. If yes, clear the alarm by referring to the alarm handling suggestions and then perform the upgrade.
- Before upgrading the ESS, ensure that the SOC of the battery rack is greater than 30%. Otherwise, the delayed upgrade function may be triggered (only software is loaded without performing the upgrade). If the SOC is less than or equal to 30%, choose **Maintenance** > **Device Mgmt.** > **Force Start** to charge the battery rack.

1. Log in to the Support-E website and search for the latest software versions of the SmartLogger, PCS, ESS, and SUN2000 in **FusionSolar Software Download**.
2. Choose **Maintenance** > **Software Upgrade** to check the software versions of the SmartLogger, PCS, ESS, and SUN2000. If the software version of each device is the latest version on the Support-E website, go to **Step 4**. Otherwise, go to the next step.
3. Click **Choose File**, select the target software package, and click **Upload**. After the upload is complete, click **Software Upgrade**.

Figure 4-6 Upgrading software

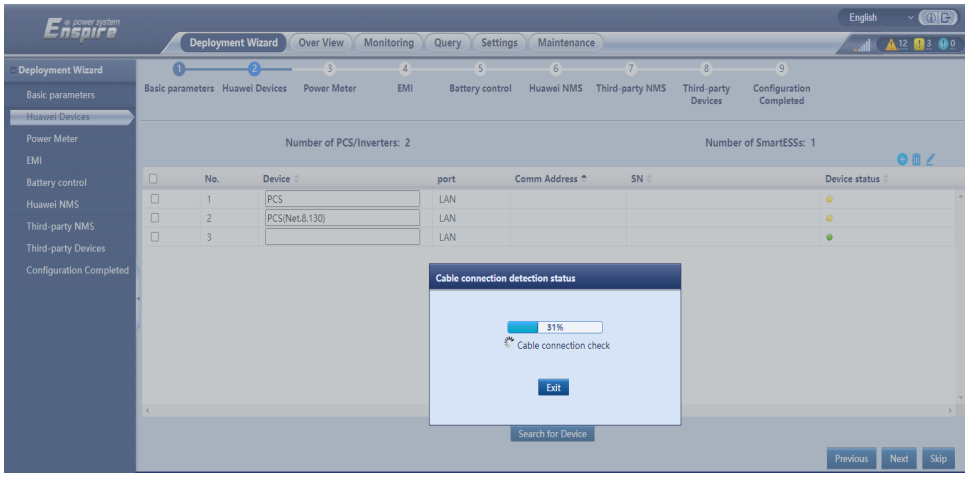


Step 4 Clear alarms.

Clear the alarms that affect topology identification by referring to **C List of Alarms Affecting Topology Identification**, and then search for the devices.

Step 5 Click **Search for Device** to check the cable connections and allocate addresses.

Figure 4-7 Searching for devices

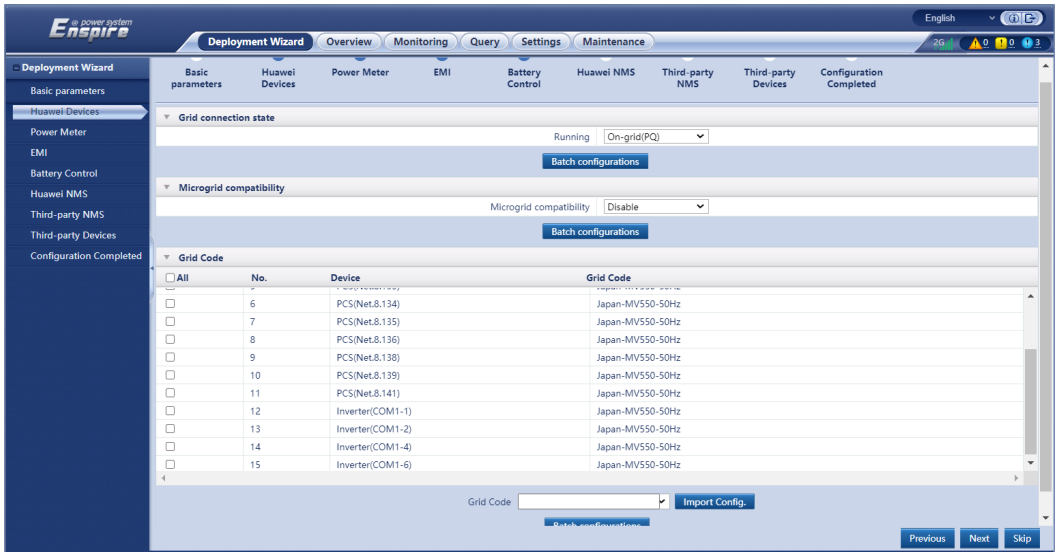


NOTE

- During the process of **Search for Device**, do not perform upgrade operations (such as upgrading through the app, 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, click **Search for Device** again to check the cable connections. For details about alarms, see **C List of Alarms Affecting Topology Identification**.
- 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 in **Deployment Wizard**. Otherwise, the system topology will not be updated.

Step 6 After searching for devices, set the **Microgrid compatibility**, **Grid connection state**, and **Grid Code** based on the site requirements.

Figure 4-8 Parameter settings after device search

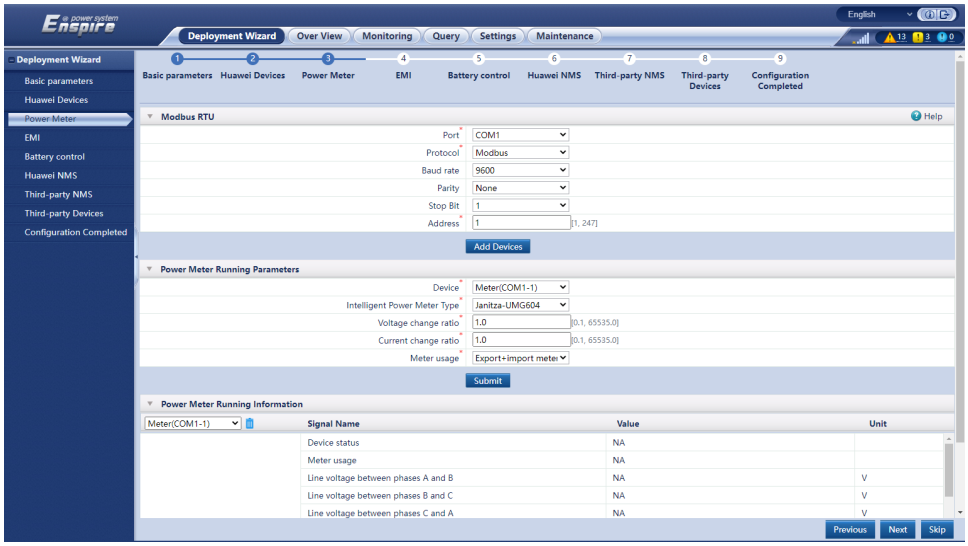


Parameter	Description
Running under **Grid connection state**	• In the on-grid scenario, set this parameter to **On-grid(PQ)**. • In the off-grid scenario, set this parameter to **Off-grid(VSG)**. When the PCS is connected to an external power grid, set the **Running** parameter of the PCS to **On-grid(PQ)**. When the PCS is disconnected from the external power grid (or there is no external power grid), set the **Running** parameter of the PCS to **Off-grid(VSG)**. When the PCS and the DG system are running in parallel, set the **Running** parameter of the PCS to **On-grid(PQ)** or **Off-grid(VSG)**. If the PCS needs to carry loads independently, set the **Running** parameter of the PCS to **Off-grid(VSG)**.
Microgrid compatibility	• In the on-grid scenario, set this parameter to **Disable**. • In the off-grid scenario, set this parameter to **Enable**.
Grid Code	Set this parameter based on the grid code of the country or region where the devices are used.

Step 7 (Optional) Connect to power meters.

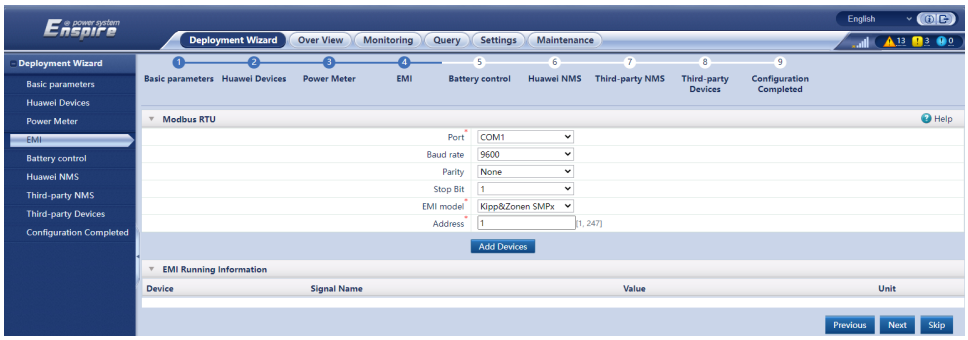
Set related parameters by referring to "**Setting Meter Parameters**" in the *SmartLogger3000 User Manual*.

Figure 4-9 Connecting to power meters



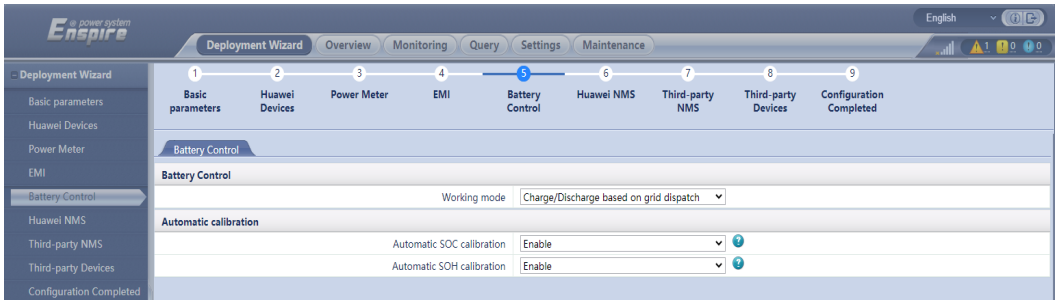
Step 8 (Optional) Connect to environment monitoring instruments (EMIs).

Figure 4-10 Connecting to EMIs



Step 9 Set battery control parameters.

Figure 4-11 Setting battery control parameters



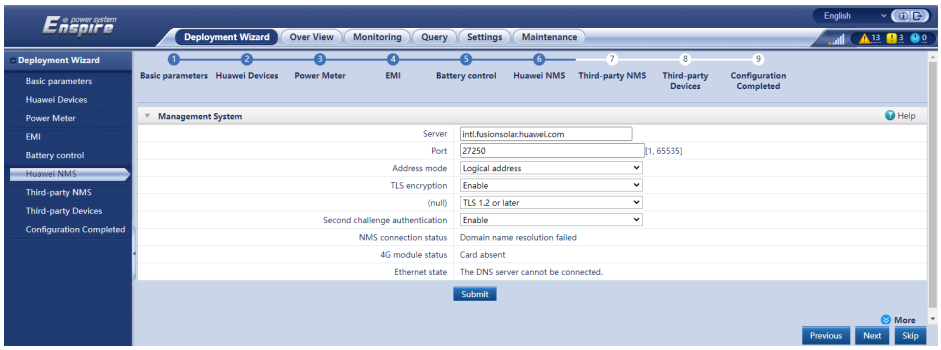
Parameter	Description
Working mode	Set this parameter to **Charge/Discharge based on grid dispatch**.

Parameter	Description
Automatic SOC calibration	• If this parameter is set to **Disable**, automatic SOC calibration is not allowed for battery racks. • If this parameter is set to **Enable**, automatic charge calibration is allowed for battery racks. During calibration, the cut-off SOC settings will be ineffective and the response of the charge and discharge power may be impacted temporarily.
Automatic SOH calibration	• If this parameter is set to **Disable**, automatic SOH calibration is not allowed for battery racks. • If this parameter is set to **Enable**, the ESS automatically calibrates the SOH precision and fully charges and discharges each battery rack in turn.

Step 10 Connect to a Huawei network management system (NMS).

Set related parameters by referring to "**Setting Parameters for Connecting to the Management System**" (content related to a Huawei NMS) in the *SmartLogger3000 User Manual*.

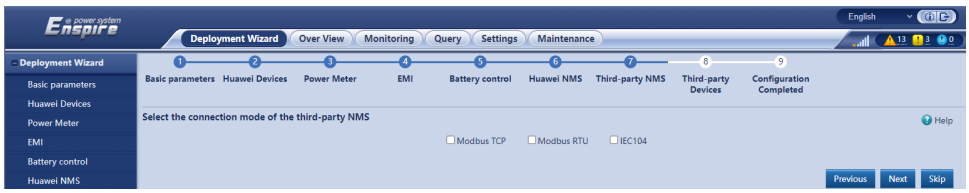
Figure 4-12 Connecting to a Huawei NMS



Step 11 Connect to a third-party NMS.

1. Select **IEC104** or **Modbus TCP** based on the protocol used by the SmartLogger to connect to the third-party NMS.

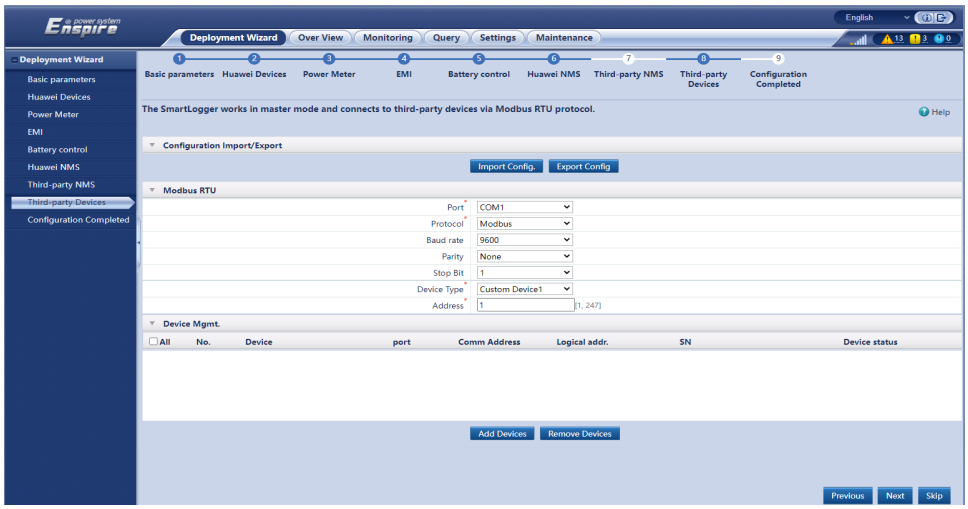
   Figure 4-13 Connecting to a third-party NMS

2. Set related parameters by referring to "**Setting Parameters for Connecting to the Management System**" (content related to a third-party NMS) in the *SmartLogger3000 User Manual*.
3. Send a command on the third-party NMS (for example, adjusting the settings of **Microgrid compatibility**) and check whether the SmartLogger can respond properly.

Step 12 Connect to third-party devices.

Figure 4-14 Connecting to third-party devices

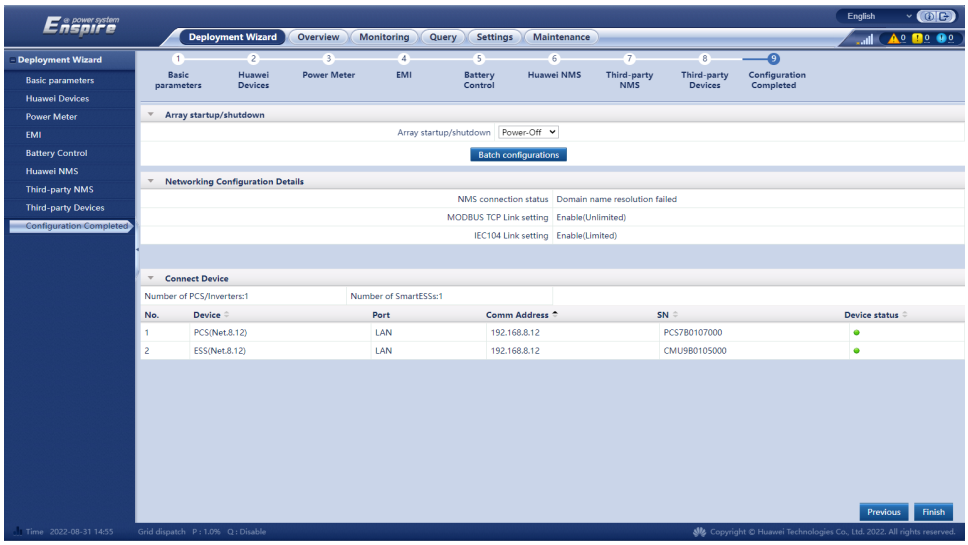


Step 13 Click **Finish**.

NOTICE

Do not click **Batch configurations** shown in the following figure to send the array startup/shutdown command, because this will affect the phase sequence check.

Figure 4-15 Completing the configuration



----End

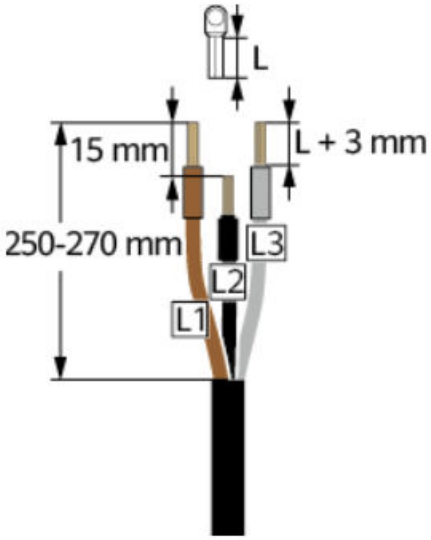
4.2.3 Checking the Phase Sequence

Phase sequence check is to confirm whether the phase sequence of AC power cables of the PCS is consistent with that of the transformer and power grid. If the phase sequences are inconsistent, off-grid operation may be abnormal.

Step 1 Log in to the SmartLogger WebUI, choose **Overview** > **Active Alarm**, and check whether the PCS reports a **Reverse Phase Sequence on AC Side** alarm.

Step 2 If the PCS reports a **Reverse Phase Sequence on AC Side** alarm:

1. Shut down the PCS, and turn off the power switches on the AC and DC sides of the PCS.
2. Correct the wiring sequence of the PCS AC power cables. If the PCS AC power cable is a multi-core cable, you are advised to exchange L1 and L3 shown in the following figure to meet the stripping length requirement.



3. Turn on the power switches on the AC and DC sides of the PCS.
4. Restart the PCS. Check and ensure that no **Reverse Phase Sequence on AC Side** alarm is reported.

----End

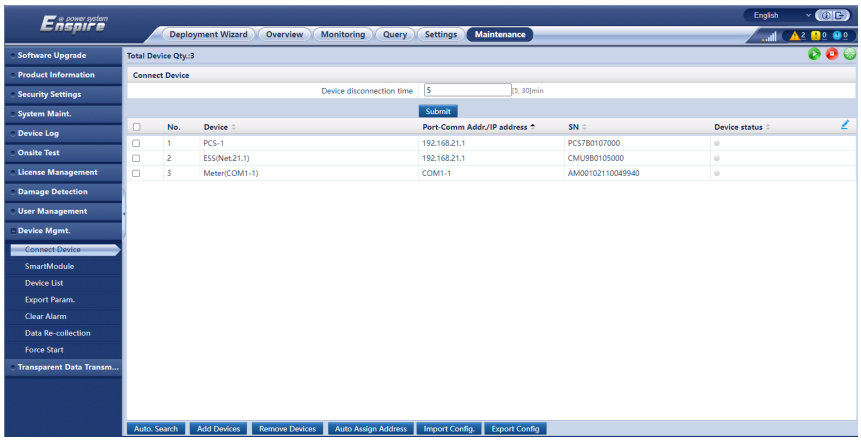
5 System Operations

Starting the Array on the SmartLogger WebUI in On-Grid Mode

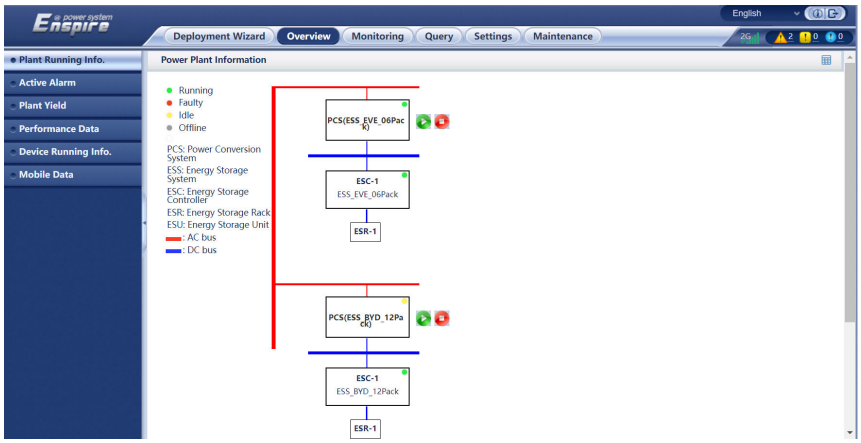
Step 1 Log in to the SmartLogger WebUI. Set **Running** under **Grid connection state** to **On-grid(PQ)** for the PCS, and set **Microgrid compatibility** to **Disable** for the SUN2000.

Step 2 Send a startup command to the SUN2000, PCS, and Smart Rack Controller.

Method 1 (array-level): Choose **Maintenance** > **Connect Device**, and click  .



Method 2 (bus-level): Choose **Overview** > **Plant Running Info.**, and click  .



Step 3 On the MGCC side, send the startup, shutdown, and **Running** setting changing commands to check that the communication between the MGCC and SmartLogger is normal.

Step 4 Perform charge and discharge tests on the MGCC side.

1. Send a power command on the MGCC side and check whether the feedback information sent by the SmartLogger to the MGCC is normal.
2. Choose **Overview** > **Plant Running Info.** on the SmartLogger and check whether the meter power, ESS power, and PV power match.

----End

NOTE

The preceding steps **Step 1** and **Step 2** have been completed after deployment commissioning. If a power failure occurs after deployment commissioning, perform steps **Step 1** and **Step 2** to start the array.

Starting the Array Using the Black Start Function in Off-Grid Mode

NOTICE

- The plant design shall ensure that the inrush current of each load line does not cause overcurrent protection after black start is successful.
- The control logic of black start is implemented by the MGCC, and the power supply for startup is the ESS.
- During black start, the secondary circuits such as the SACU and the CMU of the ESS shall have a power supply, which can be provided by the UPS.
- During black start, the ESS array shall have adequate dischargeable power for the black start (depending on the isolation transformer specifications and inrush current in the system).
- To prevent PCS protection caused by the excitation inrush current when the isolation transformer is switched on during black start, the isolation transformer and lines also need to be started simultaneously.
- If forced dehumidification of the ESS is triggered during the black start, the black start function cannot take effect properly. Therefore, before the black start, ensure that the ESS cabinet doors are closed in a timely manner and there is no condensation in the ESS (for example, there is no water drop in the ESS).
- In off-grid scenarios, it is recommended that the EMS control the ESS charge and discharge SOC within the range of 10% to 90% to ensure that the black start function works properly.

Table 5-1 Starting the array using the black start function in off-grid mode

Task	Procedure
Checking parameter settings	1. Log in to the SmartLogger WebUI. 2. Check that **Microgrid compatibility** is set to **Enable** for the SUN2000. 3. Check that the **Running** parameter under **Grid connection state** is set to **Off-grid(VSG)** for the PCS.
Triggering black start	Trigger black start on the MGCC.
Determining the black start capability of the ESS	Use the MGCC to determine whether the ESS meets the black start conditions based on the dischargeable power and capacity of the ESS before power-off.
Preparing for ESS array black start	Use the MGCC to send a black start preparation command to the SACU.

Task	Procedure
Setting up the AC voltage	After ensuring that the MGCC receives the state of black start preparation success, send a black start voltage setup command to the SACU. **NOTE** If the AC voltage is not set up within a certain period of time, the MGCC reports the black start failure. After the MGCC reports the black start failure, start the procedure from "Determining the black start capability of the ESS" again.
Starting the SUN2000	After the black start is successful (the SmartLogger reports that the black start voltage setup is complete), the MGCC starts the SUN2000.

6 On/Off-Grid Switching

NOTICE

If the system experiences a power failure for more than 5 minutes and does not need to transfer to off-grid operation, you are advised to manually shut down the UPS to ensure sufficient power for the UPS. Start the UPS before the system restarts.

On/Off-Grid PV+ESS System

Table 6-1 On/Off-grid switching of the on/off-grid PV+ESS system

Scenario	Command and Operation for MGCC and Devices
From on-grid to off-grid (power failure lasting for 10 minutes or less)	1. Turn off the on/off-grid switch. 2. On the SmartLogger WebUI, set **Microgrid compatibility** to **Enable** for the SUN2000. 3. The MGCC sends a command to change the **Running** parameter settings from **On-grid(PQ)** to **Off-grid(VSG)** for the PCS. 4. The MGCC sends a command to start the ESS and PCS. 5. The MGCC sends a command to start the SUN2000. 6. The MGCC sends a PV power scheduling command. The PV active power percentage can be set to 100%.

Scenario	Command and Operation for MGCC and Devices
From on-grid to off-grid (power failure lasting for more than 10 minutes)	1. Turn off the on/off-grid switch. 2. On the SmartLogger WebUI, set **Microgrid compatibility** to **Enable** for the SUN2000. 3. Trigger black start on the MGCC. The system automatically sets up the DC voltage and AC voltage. 4. The MGCC sends a command to change the **Running** parameter settings from **On-grid(PQ)** to **Off-grid(VSG)** for the PCS. 5. The MGCC sends a command to start the ESS and PCS. 6. The MGCC sends a command to start the SUN2000. 7. The MGCC sends a PV power scheduling command. The PV active power percentage can be set to 100%.
From off-grid to on-grid	1. The MGCC sends a command to shut down the SUN2000. 2. The MGCC sends a command to shut down the ESS and PCS. 3. Turn on the on/off-grid switch. **NOTICE** The on/off-grid switch must support interlocking to prevent the PCS from being damaged after the power grid recovers. 4. On the SmartLogger WebUI, set **Microgrid compatibility** to **Disable** for the SUN2000. 5. The MGCC sends a command to change the **Running** parameter settings from **Off-grid(VSG)** to **On-grid(PQ)** for the PCS. 6. The MGCC sends a command to start the ESS and PCS. 7. The MGCC sends a command to start the SUN2000. 8. The MGCC sends PV and ESS power scheduling commands.

Off-Grid PV+ESS+DG System

NOTE

It is not recommended that the DG system and ESS run in parallel for a long time. If the DG system and ESS need to run in parallel for a long time, it can be considered as an on-grid scenario. In this case, set the **Running** parameter under **Grid connection state** to **On-grid(PQ)** for the PCS.

Table 6-2 On/Off-grid switching of the off-grid PV+ESS+DG system

Scenario	Description
Replacing the DG system with the ESS	1. The MGCC sends a command to set the **Running** parameter under **Grid connection state** to **Off-grid(VSG)** for the PCS. 2. The MGCC sends an ESS startup command to start the ESS array. 3. After the ESS is connected, the DG system shuts down and the branch switch of the DG system is turned off.
Replacing the ESS with the DG system	1. Turn on the branch switch of the DG system to start the DG system. The DG system is connected to the microgrid system through the DG synchronization function. 2. The MGCC sends a command to shut down the ESS array.

7 System Power-Off

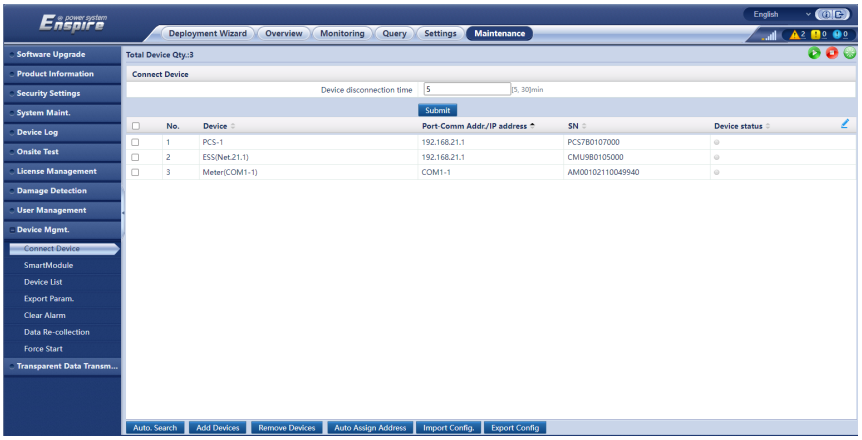
If you need to power off the system during maintenance, use the SmartLogger or MGCC to power off the system.

Using the SmartLogger

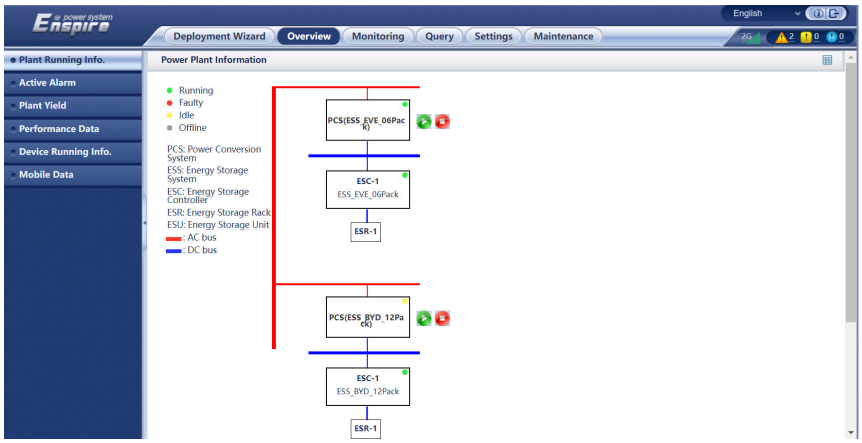
Step 1 Send a shutdown command.

1. Log in to the SmartLogger WebUI and send a shutdown command to the SUN2000, PCS, and Smart Rack Controller.

   Method 1 (array-level): Choose **Maintenance** > **Connect Device**, and click  .



   Method 2 (bus-level): Choose **Overview** > **Plant Running Info.**, and click  .



2. Choose **Monitoring** > **Inverter** > **Running Info.** Check **Device status** and **Active power** to verify that the shutdown is successful.
3. Choose **Monitoring** > **PCS** > **Running Info**. Check **Device status**, **Active power**, and **DC voltage** to verify that the shutdown is successful.
4. Choose **Monitoring** > **CMU** > **Running Info**. Check **Rated power** and **Total output voltage of rectifiers** to verify that the shutdown is successful.

Step 2 Power off the devices: Turn off the main power switches and then the auxiliary power switches of the devices by referring to the operations of **4.1 Device Power-On** in the reverse order.

NOTE

To prevent local operations on switches during subsequent power-on, you are advised not to turn off the auxiliary power switches.

----End

Using the MGCC

Step 1 The MGCC sends a command to shut down the SUN2000, PCS, and Smart Rack Controller.

Step 2 Power off the devices: Turn off the main power switches and then the auxiliary power switches of the devices by referring to the operations of **4.1 Device Power-On** in the reverse order.

NOTE

To prevent local operations on switches during subsequent power-on, you are advised not to turn off the auxiliary power switches.

----End

A Reference Documents

Device	Document
ESS	• LUNA2000-200KWH-2H1 Smart String ESS User Manual • LUNA2000-200KWH-2H1 Smart String ESS Maintenance Manual • LUNA2000-200KWH-2H1 Smart String Energy Storage System Quick Guide
PCS	• LUNA2000-100KTL-M1 Smart Power Control System User Manual • LUNA2000-100KTL-M1 Smart Power Control System Quick Guide
SUN2000	• SUN2000-(50KTL-ZHM3, 50KTL-M3) User Manual • SUN2000-(50KTL-ZHM3, 50KTL-M3) Quick Guide • SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) Series User Manual • SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) Series Quick Guide • SUN2000-(100KTL, 110KTL, 115KTL)-M2 User Manual • SUN2000-(100KTL, 110KTL)-M2 Quick Guide (STAUBLI) • SUN2000-(75KTL-M1, 100KTL-M2, 110KTL-M2, 115KTL-M2) Quick Start Guide (AMPHENOL)

Device	Document
SUN2000P	• **MERC Smart PV Optimizer User Manual** • **MERC-(1300W, 1100W)-P Smart PV Optimizer Quick Guide** • **SUN2000 Smart PV Optimizer User Manual** • **SUN2000-(600W-P, 450W-P2) Smart PV Optimizer Quick Guide** • **SUN2000-450W-P Smart PV Optimizer Quick Guide**
SACU	• **SmartACU2000D Smart Array Controller User Manual (with No PID Module)** • **SmartACU2000D Smart Array Controller Quick Guide (with No PID Module)**
SmartLogger	• **SmartLogger3000 User Manual** • **SmartLogger3000 Quick Guide**
DTSU666-HW	**DTSU666-HW Smart Power Sensor Quick Guide**
FusionSolar app	**FusionSolar App User Manual**
iMaster NetEco	**iMaster NetEco V600R023C00 FusionSolar SmartPVMS User Manual**

B ESS Software Upgrade Solution for the Off-Grid PV+ESS System

Multiple ESSs in an Array

Start one ESS and upgrade the software of the other ESSs. After the other ESSs are upgraded, then upgrade the software of the ESS that is not upgraded.

Only One ESS in an Array

Prerequisites:

The customer needs to prepare a temporary mobile power supply (such as a UPS or DG) and related cables to power the auxiliary power supply for the ESS air conditioners. The requirements for the temporary power supply are as follows:

- Voltage: 220 V AC
- Power: ≥ 5 kVA
- Power backup duration: ≥ 30 minutes

Procedure:

Step 1 Prepare the upgrade software package. Log in to the Support-E website and search for the latest ESS software version in **FusionSolar Software Download**.

Step 2 Prepare a temporary power supply, cables, and wiring tools.

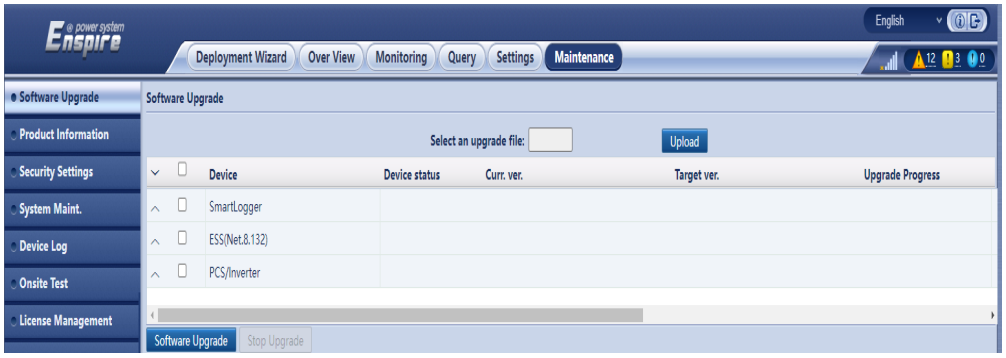
Step 3 Turn off the load switch.

Step 4 Shut down the ESS and PCS on the SmartLogger WebUI or MGCC.

Step 5 Connect the temporary power supply and the 220 V AC input terminals of the auxiliary power supply for the ESS air conditioners. (You are advised to connect the temporary power supply to the power distribution equipment.)

Step 6 To upgrade the software on the SmartLogger WebUI, click **Choose File**, select the target software package, and click **Upload**. After the upload is complete, click **Software Upgrade**.

Figure B-1 Upgrading software



Step 7 After the upgrade is complete, remove the temporary power supply and related cables, and restore the cable connections on the power distribution equipment.

Step 8 Start the ESS and PCS on the SmartLogger WebUI or MGCC.

Step 9 Turn on the load switch.

----End

C List of Alarms Affecting Topology Identification

Alarm ID	Alarm Name	Cause ID
1140	Array Black Start Failed	2, 3, 4, 6, 7, 8
3013	Battery Pack Communication of Rack Controller Abnormal	2
3014	Rack Controller Abnormal	3
3015	Battery Side Overvoltage on Rack Controller	1
3016	Battery Side Undervoltage on Rack Controller	1
3017	Battery Side Short Circuit on Rack Controller	1
3018	Battery Side Reverse Polarity on Rack Controller	1
3019	Bus Side Overvoltage on Rack Controller	1
3020	Bus Side Reverse Polarity on Rack Controller	1
3021	Insulation Resistance of Rack Controller Abnormal	1
3022	Rack Controller Temperature High	1
3023	Battery Terminal Overtemperature on Rack Controller	1

Alarm ID	Alarm Name	Cause ID
3024	Bus Terminal Overtemperature on Rack Controller	1
3025	Rack Controller Version Mismatch	1
3027	Battery Pack Monitoring Board Abnormal	1, 21
3028	Battery Pack Abnormal	1, 6
3029	Battery Pack Locked	1, 2, 5
3030	Battery Pack Fan Fault	1
3032	Battery Pack Overvoltage	1
3034	Rack Controller Cable Connection Abnormal	1, 2
3035	Battery Pack Positions of Rack Controller Abnormal	1
3036	Optimization Unit of Battery Pack Abnormal	1
3037	Overtemperature on Optimization Unit of Battery Pack	1
3038	Overtemperature on Optimization Unit Terminal of Battery Pack	1
3039	Battery Pack Optimization Unit Version Mismatch	1
3040	Incorrect Bus Connection on Rack Controller	1
3041	Loose Connection of Battery Pack Copper Bar	1
3042	Rapid Shutdown Cable Connection of Battery Pack Abnormal	1, 2, 3
3044	Battery Pack Overcurrent	1
3045	Battery Pack Temperature High	1
3046	Battery Pack Temperature Low	1
3047	Battery Pack Undervoltage	4
3052	External DC Auxiliary Power Supply of Rack Controller Fault	1

Alarm ID	Alarm Name	Cause ID
3054	Rack Controller Temperature Abnormal	2
3056	Emergency Power-Off	1
3058	Version Incompatible Between Rack Controller and Battery Packs	1
3060	Incompatible ESM	1
3800	Water Alarm	1, 2
3801	Door Status Alarm	1, 2, 3, 4, 5, 6
3826	Combustible Gas Alarm	1
3827	Ambient Temperature High	1, 2
3830	Temperature and Humidity Control Malfunction	1
3849	Air Exhaust Malfunction	1, 2
3850	Combustible Gas Detection Malfunction	1
3856	Battery Fault Protection	1, 2
3858	48 V DC Auxiliary Power Supply Faulty	1
3859	Forced Dehumidification Started	1

D Acronyms and Abbreviations

C	
CMU	Central Monitoring Unit
E	
ESS	Energy Storage System
F	
FE	Fast Ethernet
M	
MGCC	Microgrid Central Controller
P	
PCS	Power Control System
PSU	Power Supply Unit
S	
SACU	Smart Array Controller

SFP	Small Form-factor Pluggable
SOC	State of Charge
SOH	State of Health

U

UPS	Uninterruptible Power Supply