

LUNA2000-215-2S10 Commercial and Industrial Microgrid Energy Storage Solution

User Manual

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About This Document

Purpose

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

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 [B Reference Documents](#).




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.

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	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 (2025-02-08)

Updated [1.3 Technical Specifications](#).

Updated [3 Installation and Cable Connection](#).

Updated [6.3 Commissioning Using the Deployment Wizard](#).

Updated [8 Microgrid Control](#).

Issue 01 (2025-01-23)

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

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1 Solution Introduction

NOTICE

- In the microgrid scenario, the AC output side must use the TN system.
- When the microgrid control function implemented by the SmartLogger is enabled, it is not recommended that northbound dispatch be delivered during operation.
- When the microgrid control function implemented by the SmartLogger is enabled, the SOC during charge/discharge operations shall range from 10% to 90% in VSG mode.
- When the microgrid control function implemented by the SmartLogger is enabled in the on/off-grid (VSG) scenario, the synchronous switching from off-grid to on-grid may fail if the steady-state frequency fluctuation of the grid exceeds ± 0.2 Hz.
- When the microgrid control function implemented by the SmartLogger is enabled, only one grid connection point and one SmartLogger are supported.
- This microgrid solution does not provide the system-level redundancy backup function. If a device fails or the ESS reaches the end-of-charge/discharge SOC, the microgrid may collapse. As this solution does not provide professional UPSs, it is not applicable to scenarios that have high requirements on uninterruptible power supply.

1.1 Networking Architecture

The C&I microgrid energy storage solution has the following networking architectures: on/off-grid PV+ESS (PQ/VSG) system, on/off-grid PV+ESS (VSG) system, and off-grid PV+ESS system.

1.1.1 On/Off-Grid PV+ESS (PQ/VSG) System

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

In this system, the microgrid implements on-grid and off-grid operations 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 (PQ/VSG) system. **Table 1-1** lists the components.

Figure 1-1 Networking architecture of the on/off-grid PV+ESS (PQ/VSG) system

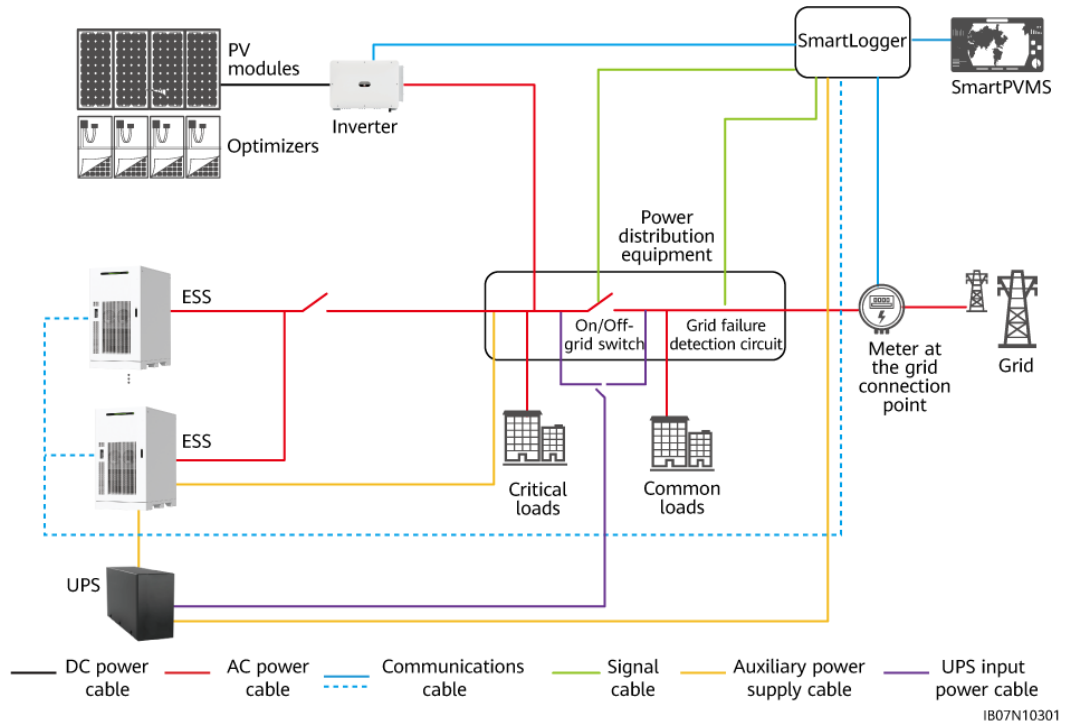


Table 1-1 Components of the on/off-grid PV+ESS (PQ/VSG) system

Name	Model/Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	<ul style="list-style-type: none"> LUNA2000-215-2S10 	≤ 20	Purchased from the Company Different models shall not be used together.

Name	Model/Specifications	Quantity	Remarks
Smart PV inverter (inverter)	<ul style="list-style-type: none"> • SUN2000-29.9KTL-M3 • SUN2000-30KTL-M3 • SUN2000-36KTL-M3 • SUN2000-40KTL-M3 • SUN2000-50KTL-M3 • SUN2000-50KTL-ZHM3 • SUN2000-50KTL-M0 • SUN2000-60KTL-M0 • SUN2000-75KTL-M1 • SUN2000-100KTL-M1 • SUN2000-100KTL-M2 • SUN2000-110KTL-M2 • SUN2000-115KTL-M2 • SUN2000-150K-MG0-ZH • SUN2000-150K-MG0 • SUN5000-150K-MG0-ZH • SUN5000-150K-MG0 	≤ 30	Purchased from the Company. The maximum capacity ratio of inverter to ESS is 2:1. <ul style="list-style-type: none"> • Different models shall not be used together. • Inverters from the Company shall not be used together with those from other vendors.
Smart PV Optimizer (SUN2000P)	<ul style="list-style-type: none"> • SUN2000-450W-P2 • SUN2000-600W-P • MERC-1300W-P • MERC-1100W-P 	Depending on the actual quantity of PV modules	Purchased from the Company (optional). SUN2000P is supported only by SUN2000-29.9KTL-M3, SUN2000-30KTL-M3, SUN2000-36KTL-M3, and SUN2000-40KTL-M3. MERC-1300W-P or MERC-1100W-P is supported by SUN2000-50KTL-M3 and SUN2000-50KTL-ZHM3.
SmartLogger	SmartLogger3000	1	Purchased from the Company.

Name	Model/Specifications	Quantity	Remarks
SmartModule	SmartModule1000A01	Depending on the actual networking architecture	Purchased from the Company (optional). The SmartModule is used with the SmartLogger.
Meter at the grid connection point	<ul style="list-style-type: none">• DTSU666-HW• YDS60-80	1	Purchased from the Company
FusionSolar Smart PV Management System (SmartPVMS)	SmartPVMS 24.8.0 and later	1	Purchased from the Company

Name	Model/Specifications	Quantity	Remarks
Power distribution equipment (including the on/off-grid switch and grid failure detection circuit)	<ul style="list-style-type: none"> • The on/off-grid switch supports remote signal feedback and remote control. An intermediate relay is required for communication with the SmartLogger through the DO port. (The SmartLogger DO port supports a maximum of 12 V signal voltage.) • The grid failure detection circuit supports remote signal feedback and is used to detect the voltage on the grid side. When the grid fails, the dry contact is closed after a delay. 	1	<p>Prepared by the customer. The on/off-grid switch shall meet the local power distribution requirements. It can be a 3-pole or 4-pole switch. If a 4-pole switch is required (that is, the neutral wire must be disconnected), the on/off-grid switch must be linked with the internal grounding switch.</p> <p>If On/Off-grid switching mode is set to Manual or No control, the on/off-grid switch does not need to be remotely controlled and the grid failure detection circuit does not need to be configured.</p>
UPS	<ul style="list-style-type: none"> • Power: ≥ 1 kVA, online UPS, 220 V AC • Power backup duration ≥ 1 hour • To ensure reliable power supply to the UPS, the UPS power supply shall be provided from either side of the on/off-grid switch, whichever side is available. The UPS power supply is controlled by the relay. 	1	<p>Prepared by the customer. If long-term off-grid operation will occur, the UPS power backup duration shall be greater than 48 hours.</p>

1.1.2 On/Off-Grid PV+ESS (VSG) System

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

In this system, the microgrid implements on-grid and off-grid operations through an on/off-grid switch controlled by a relay protection device. 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 1-2 shows the networking architecture of the on/off-grid PV+ESS (VSG) system. **Table 1-2** lists the components.

Figure 1-2 Networking architecture of the on/off-grid PV+ESS (VSG) system (with genset controlled by ATS)

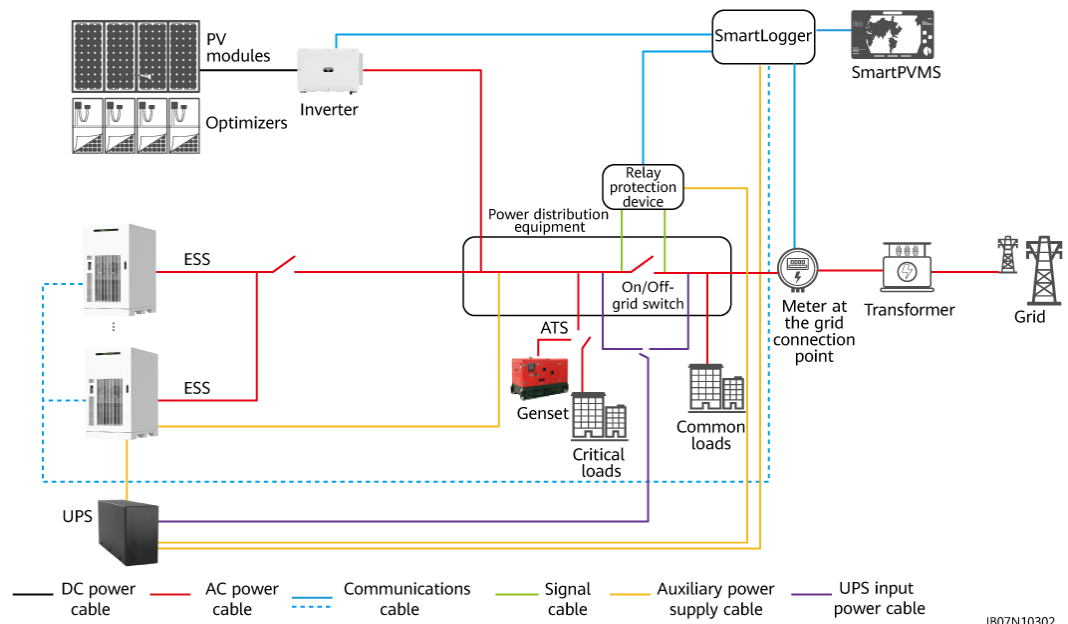


Table 1-2 Components of the on/off-grid PV+ESS (VSG) system

Name	Model/ Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	<ul style="list-style-type: none"> LUNA2000-215-2 S10 	≤ 20	Purchased from the Company Different models shall not be used together.

Name	Model/ Specifications	Quantity	Remarks
Smart PV inverter (inverter)	<ul style="list-style-type: none"> ● SUN2000-29.9KTL-M3 ● SUN2000-30KTL-M3 ● SUN2000-36KTL-M3 ● SUN2000-40KTL-M3 ● SUN2000-50KTL-M3 ● SUN2000-50KTL-ZHM3 ● SUN2000-50KTL-M0 ● SUN2000-60KTL-M0 ● SUN2000-75KTL-M1 ● SUN2000-100KTL-M1 ● SUN2000-100KTL-M2 ● SUN2000-110KTL-M2 ● SUN2000-115KTL-M2 ● SUN2000-150K-MG0-ZH ● SUN2000-150K-MG0 ● SUN5000-150K-MG0-ZH ● SUN5000-150K-MG0 	≤ 30	<p>Purchased from the Company. For the SUN2000-50KTL-M0 and SUN2000-60KTL-M0 inverters, the maximum capacity ratio of inverter to ESS is 1:1. For other models of inverters, the maximum capacity ratio of inverter to ESS is 2:1.</p> <ul style="list-style-type: none"> ● Different models shall not be used together. ● Inverters from the Company shall not be used together with those from other vendors.

Name	Model/ Specifications	Quantity	Remarks
Smart PV Optimizer (SUN2000P)	<ul style="list-style-type: none"> • SUN2000-450W-P2 • SUN2000-600W-P • MERC-1300W-P • MERC-1100W-P 	Dependent on the actual quantity of PV modules	Purchased from the Company (optional). SUN2000P is supported only by SUN2000-29.9KTL-M3, SUN2000-30KTL-M3, SUN2000-36KTL-M3, and SUN2000-40KTL-M3. MERC-1300W-P or MERC-1100W-P is supported by SUN2000-50KTL-M3 and SUN2000-50KTL-ZHM3.
SmartLogger	SmartLogger3000	1	Purchased from the Company.
SmartModule	SmartModule1000A01	Dependent on the actual networking architecture	Purchased from the Company (optional). The SmartModule is used with the SmartLogger.
Meter at the grid connection point	<ul style="list-style-type: none"> • DTSU666-HW • YDS60-80 	1	Purchased from the Company
FusionSolar Smart PV Management System (SmartPVMS)	SmartPVMS 24.8.0 and later	1	Purchased from the Company
Relay protection device	<ul style="list-style-type: none"> • Schneider: Easergy P3U30-5AAA3BB A • Two groups of potential transformers (PTs) are required. 	1	Prepared by the customer

Name	Model/ Specifications	Quantity	Remarks
Power distribution equipment (including the on/off-grid switch)	-	1	Prepared by the customer. The on/off-grid switch shall meet the local power distribution requirements. It can be a 3-pole or 4-pole switch. If a 4-pole switch is required (that is, the neutral wire must be disconnected), the on/off-grid switch must be linked with the internal grounding switch.
UPS	<ul style="list-style-type: none"> • Power: ≥ 1 kVA, online UPS, 220 V AC • Power backup duration ≥ 1 hour • To ensure reliable power supply to the UPS, the UPS power supply shall be provided from either side of the on/off-grid switch, whichever side is available. The UPS power supply is controlled by the relay. 	1	Prepared by the customer. If long-term off-grid operation will occur, the UPS power backup duration shall be greater than 48 hours.
Genset	Three-phase	1	Prepared by the customer (optional).
Automatic transfer switch (ATS)	Dual power supply switching device	1	Prepared by the customer (optional)
Transformer	Capacity of the transformer and its power distribution switches $> 1.2 \times \text{MAX} [(\text{Total ESS rated capacity} + \text{Total rated load peak}), (\text{Total ESS rated power} + \text{Total inverter rated capacity})]$	1	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 the PV system are controlled and coordinated to supply power.

In this system, the ESS functions as the primary power supply to implement grid forming, and the PV system and ESS supply power to loads.

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

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

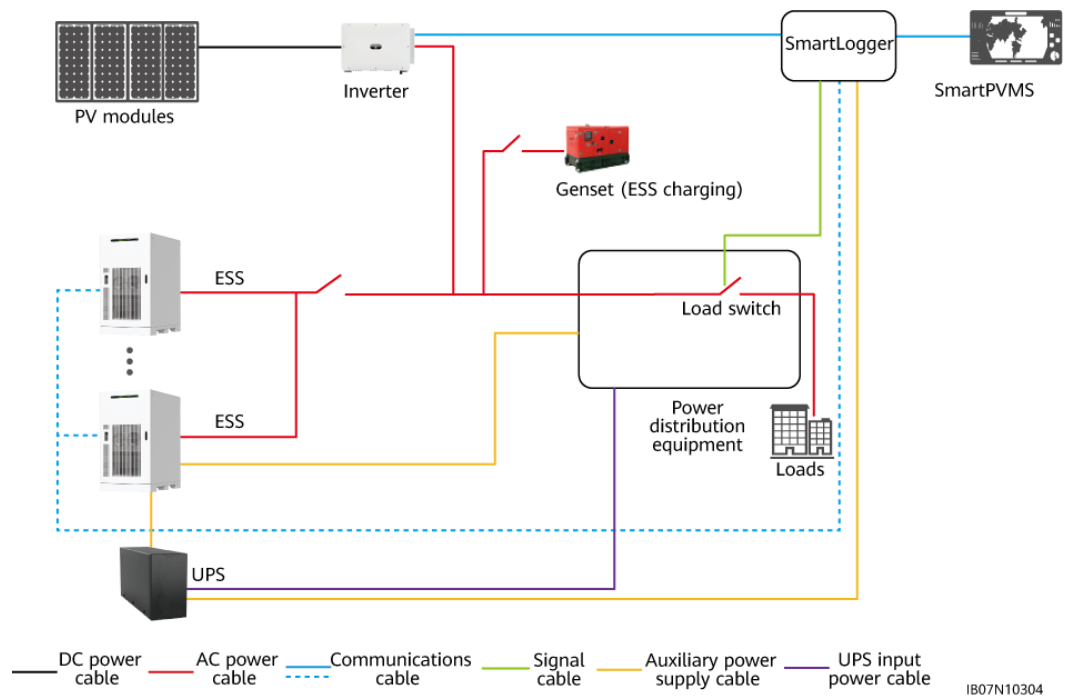


Table 1-3 Components of the off-grid PV+ESS system

Name	Model/Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	<ul style="list-style-type: none"> LUNA2000-215-2S10 	≤ 20	Purchased from the Company Different models shall not be used together.

Name	Model/Specifications	Quantity	Remarks
Smart PV inverter (inverter)	<ul style="list-style-type: none"> ● SUN2000-29.9KTL-M3 ● SUN2000-30KTL-M3 ● SUN2000-36KTL-M3 ● SUN2000-40KTL-M3 ● SUN2000-50KTL-M3 ● SUN2000-50KTL-ZHM3 ● SUN2000-50KTL-M0 ● SUN2000-60KTL-M0 ● SUN2000-75KTL-M1 ● SUN2000-100KTL-M1 ● SUN2000-100KTL-M2 ● SUN2000-110KTL-M2 ● SUN2000-115KTL-M2 ● SUN2000-150K-MG0-ZH ● SUN2000-150K-MG0 ● SUN5000-150K-MG0-ZH ● SUN5000-150K-MG0 	≤ 30	<p>Purchased from the Company. The maximum capacity ratio of inverter to ESS is 2:1.</p> <ul style="list-style-type: none"> ● Different models shall not be used together. ● Inverters from the Company shall not be used together with those from other vendors. ● The inverters shall not be used together with optimizers.
SmartLogger	SmartLogger3000	1	Purchased from the Company.
SmartModule	SmartModule1000A01	Depending on the actual net working architecture	Purchased from the Company (optional). The SmartModule is used with the SmartLogger.
FusionSolar Smart PV Management System (SmartPVMS)	SmartPVMS 24.8.0 and later	1	Purchased from the Company

Name	Model/Specifications	Quantity	Remarks
Power distribution equipment (including the load switch)	The load switch supports remote signal feedback and remote control.	1	Prepared by the customer
UPS	<ul style="list-style-type: none"> Power: ≥ 1 kVA, online UPS, 220 V AC Power backup duration ≥ 48 hour 	1	Prepared by the customer For details about the capacity configuration, see A Off-Grid UPS Capacity Configuration .
Genset	Three-phase	-	Prepared by the customer (optional)

1.2 Communication Logic

One SmartLogger manages multiple ESSs and inverters, and one meter to form an array. In the array:

- The inverters communicate with the SmartLogger and the meter communicates with the SmartLogger over RS485.
- The ESSs communicate with the SmartLogger over FE in star or ring topology.

The maximum communication distance of the SmartLogger is as follows:

- RS485: 1000 m
- FE: 100 m

Select any of the following topologies based on the quantities of ESSs in the array and the deployment of optical fibers.

Typical Scenario 1: SmartLogger+ESS FE Ring Topology

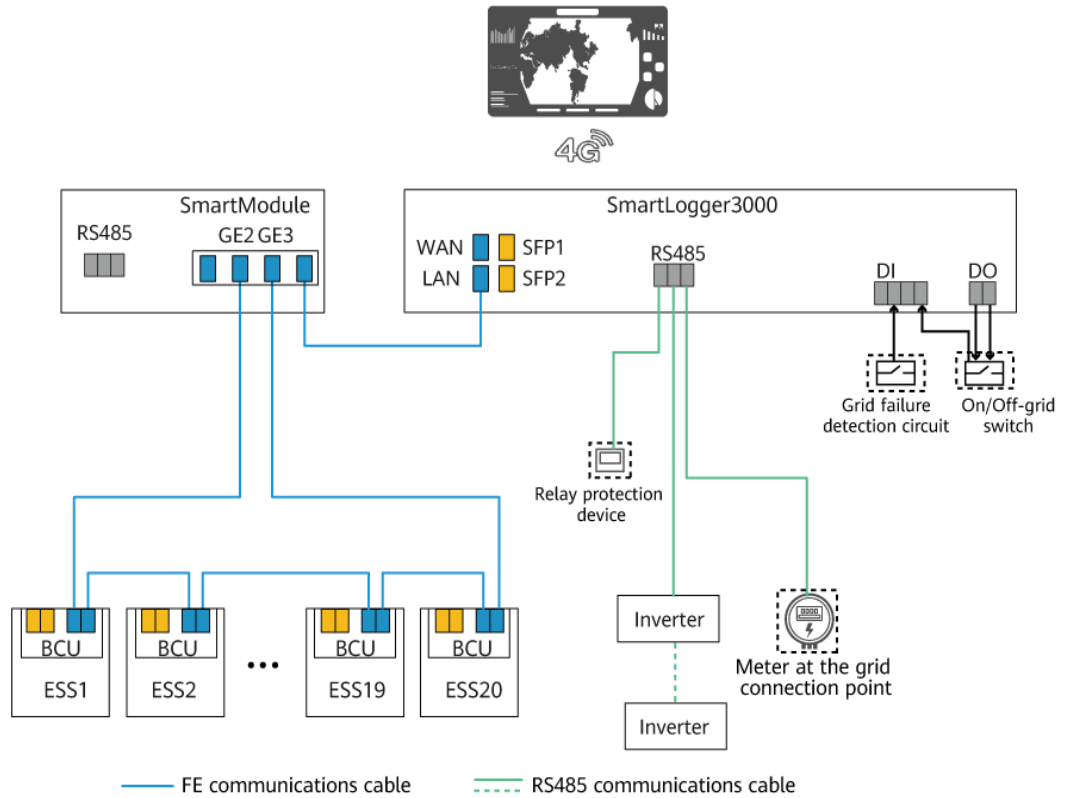
In this scenario, the SmartLogger3000 and SmartModule are configured.

- One FE ring network supports a maximum of 20 ESSs.
- One SmartLogger can connect to a maximum of 20 ESSs.
- If more than 20 ESSs are connected, multiple SmartLoggers are required. These SmartLoggers are controlled by a third-party controller.

NOTICE

If the ESS FE ring topology is implemented through the SmartModule, the ESS must be connected to the GE2 and GE3 ports of the SmartModule. Otherwise, the SmartLogger cannot communicate with the ESS properly.

Figure 1-4 SmartLogger+ESS FE ring topology (the devices in the dotted boxes are optional)



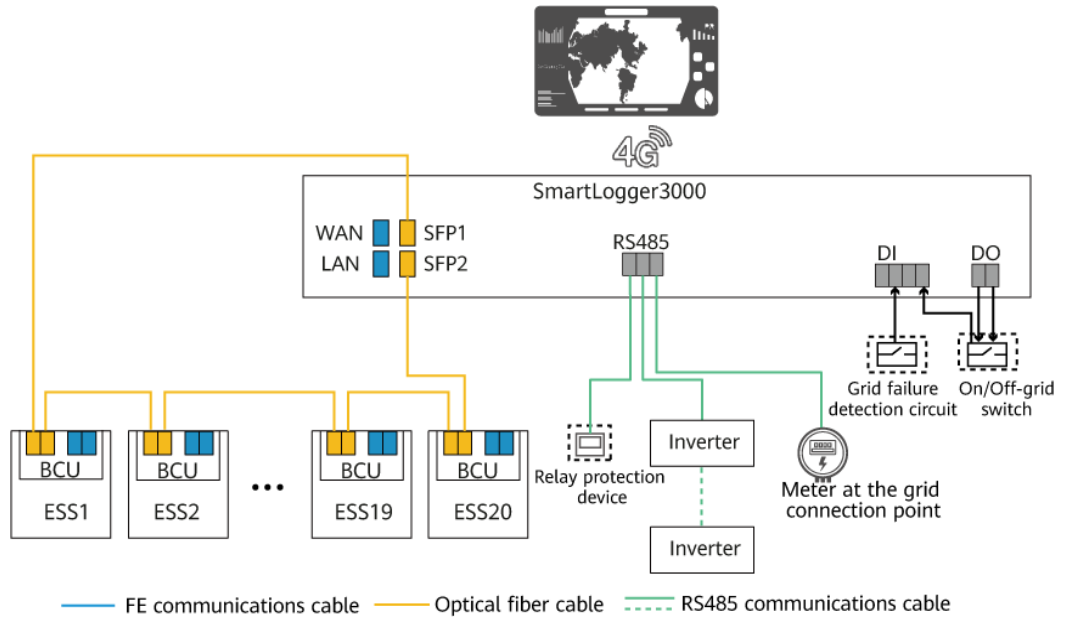
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Typical Scenario 2: SmartLogger+ESS Fiber Ring Topology

In this scenario, the SmartLogger3000 is configured.

- One fiber ring network supports a maximum of 20 ESSs.
- One SmartLogger can connect to a maximum of 20 ESSs.
- If more than 20 ESSs are connected, multiple SmartLoggers are required. These SmartLoggers are controlled by a third-party controller.

Figure 1-5 SmartLogger+ESS fiber ring topology (the devices in the dotted boxes are optional)



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1.3 Technical Specifications

Function	Technical Specifications	Remarks
Parallel connection of multiple devices	One SmartLogger supports a maximum of 20 ESSs and 30 inverters connected in parallel.	-
PV+ESS low-voltage coupling	<ul style="list-style-type: none"> Low-voltage coupling of the ESS and inverter is supported. The cable length from the ESS and the inverter to the power distribution cabinet shall be greater than or equal to 5 m, respectively. 	For details about the supported inverter models, see Table 1-1 .
ESS health diagnosis	Supported	This feature needs to be used on the FusionSolar SmartPVMS.
SmartDesign	Supported	-
ESS safety black box	Supported	-
Off-grid operation	Supported	-

Function		Technical Specifications	Remarks
Off-grid THDu		2%	-
Earthing system		TN-C/TN-S/TN-C-S	-
PV-to-ESS capacity ratio		< 2:1	For details about the supported inverter models, see Table 1-1 .
ESS black start		Supported	-
On/Off-grid switching		<ul style="list-style-type: none"> Manual on/off-grid (PQ/VSG) switching Automatic on/off-grid (PQ/VSG) switching <ul style="list-style-type: none"> Switching time for one ESS: 3s Switching time for multiple ESSs: 10s On/Off-grid (VSG) switching: The switching time is 150 ms. 	<ul style="list-style-type: none"> The ESS manufactured in and before December 2024 does not support this feature. On/Off-grid (PQ/VSG) switching time: from the time when the on/off-grid switch is turned off to the time when the AC power is formed. The on/off-grid (VSG) switching function has restrictions. For details, contact the Company's engineers.
On-grid scheduling feature ^a	Maximum self-consumption	Supported	<ul style="list-style-type: none"> On/Off-grid (PQ/VSG) scenario: Only one feature can be selected. On/Off-grid (VSG): Only Maximum self-consumption and TOU are supported, and only one of them can be selected. TOU (fixed power) applies only to ESS-only systems.
	TOU	Supported	
	TOU (fixed power)	Supported	

Function		Technical Specifications	Remarks
	Peak shaving	Supported	This feature is supported only in the on/off-grid (PQ/VSG) scenario. It can be used together with maximum self-consumption or TOU.
	Power boost limit	Supported	This feature is supported only in the on/off-grid (PQ/VSG) scenario. It can be used together with maximum self-consumption or TOU.
	Export limitation (including zero feed-in)	Supported	This feature is supported only in the on/off-grid (PQ/VSG) scenario. It can be used together with maximum self-consumption, TOU, and capacity control.
	Phase-level power limit control	Supported	<ul style="list-style-type: none"> • The ESS manufactured in and before December 2024 does not support this feature. • This feature can be enabled only in export limitation mode. • This feature is supported only in the on/off-grid (PQ/VSG) scenario. It can be used together with maximum self-consumption, TOU, and capacity control.

Function		Technical Specifications	Remarks
	Power factor/ Reactive power control for the grid connection point	Supported	This feature is supported only in the on/off-grid (PQ/VSG) scenario.
Loading capacity (based on the rated ESS capacity Pn)	Total load	$\leq (2/3) \times P_n$	<ul style="list-style-type: none"> • Single-phase rated capacity = $(1/3) \times P_n$ • Load of each phase $\leq (2/3) \times$ Single-phase rated capacity, that is, Load of each phase $\leq (2/3) \times (1/3) \times P_n$
	Non-linear load	<ul style="list-style-type: none"> • Half-wave rectification load $\leq (1/20) \times P_n$ • The total current harmonics of loads comply with specifications or standards. 	-
	Unbalanced load	<ul style="list-style-type: none"> • No load to two phases: $\leq (2/3) \times (2/3) \times P_n$ • No load to one phase: $\leq (2/3) \times (1/3) \times P_n$ 	<ul style="list-style-type: none"> • Single-phase rated capacity = $(1/3) \times P_n$ • Load of each phase $\leq (2/3) \times$ Single-phase rated capacity, that is, Load of each phase $\leq (2/3) \times (1/3) \times P_n$

Function		Technical Specifications	Remarks
	Motor load	<ul style="list-style-type: none"> • Load of motors that use direct on line (DOL) starters or star-delta starters $\leq 1/10$ • Load of motors that use star-delta starters $\leq 1/5$ • Load of motors that use variable frequency drives $\leq 2/3$ 	<ul style="list-style-type: none"> • If there are other basic loads, the load of motors to be connected and disconnected shall be decreased accordingly in the same proportion. (The inrush current of the asynchronous motor startup shall be $\leq 8 \times$ Rated current. Otherwise, you are advised to add a frequency converter or soft-start device.) • If there are asynchronous motor loads and common non-impact loads in the system, the load capacity is calculated as follows: $[A \times 10 + (3/2) \times B] \leq P_n$. <ul style="list-style-type: none"> - A: load capacity of the asynchronous motor - B: other common load capacity
	Capacity of transformer switch-on/off	$\leq 1/2$	-
<p>Note a: The off-grid scenario does not involve the on-grid scheduling feature and on/off-grid switching.</p>			

2 O&M Methods

Table 2-1 O&M methods

O&M Method	Description	Main Application Scenario	Reference Document
SmartLogger WebUI	A PC is connected to the SmartLogger to manage the ESSs, inverters, and the meter 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 managing devices at a site after deployment and commissioning	<ul style="list-style-type: none"> • SmartPVMS FusionSolar SmartPVMS User Manual (Owner) • SmartPVMS FusionSolar SmartPVMS User Manual (Installer)
Local app	The app is locally connected to an ESS or an inverter to locally manage the ESS or the inverter.	<ul style="list-style-type: none"> • Modifying the parameters of a single device locally • Upgrading the software version of a single device locally 	FusionSolar App User Manual

3 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 [B Reference Documents](#).

NOTICE

- For the TN-S, TN-C, and TN-C-S systems, the neutral wires of the ESS and inverter must be connected to the power grid.
- The power distribution and electrical connections of the PV+ESS system must comply with the installation regulations of the devices and the country or region where the devices are located.

Table 3-1 Device installation and cable connection process

Step	Task	Precaution
1	Installing the ESS	Ensure that the foundation levelness meets the requirements (height difference ≤ 3 mm). For details about the site selection requirements, see LUNA2000-(107-215) Series Smart String ESS User Manual .
2	Installing the inverter and SUN2000P	N/A
3	Installing the power meter	N/A
4	Installing the SmartLogger	N/A

Step	Task	Precaution
5	Installing PE cables	<ul style="list-style-type: none"> The device enclosure shall be reliably grounded. Ensure that the PE cable is reliably connected. 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.
6	Installing AC power cables	AC power cables must be connected in the same phase sequence for all ESSs, inverters, power distribution cabinets, and transformers in the array.
7	Installing communications cables	For details about the cable connections, see 1.2 Communication Logic .

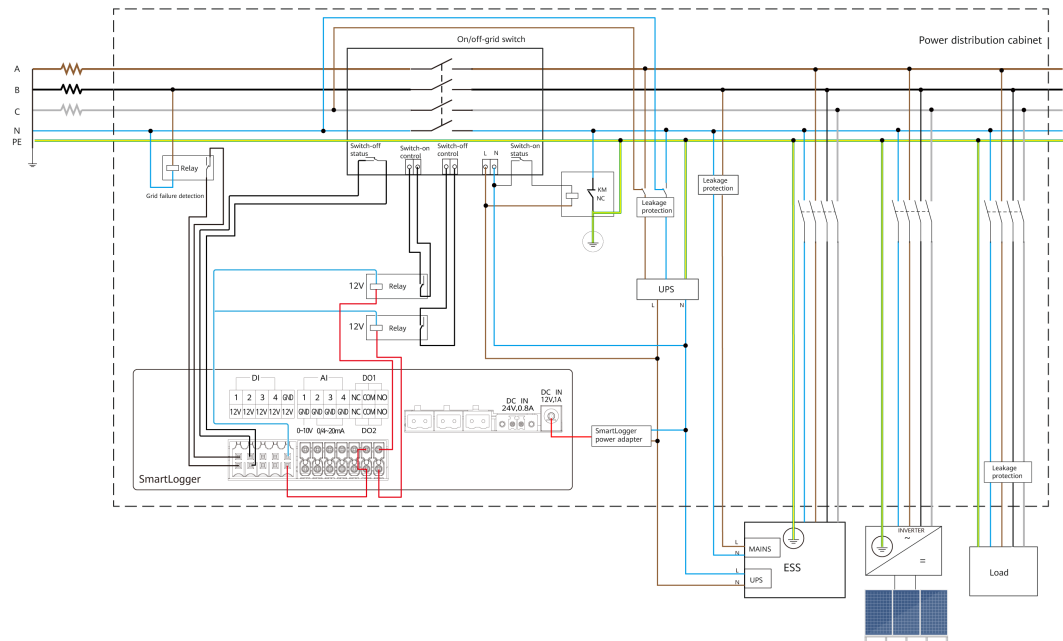
Electrical networking of the on/off-grid PV+ESS (PQ/VSG) system

In off-grid operation:

- If the neutral wire must not be disconnected from the grid (for details, see the local grid requirements), use a 3-pole on/off-grid switch. If a 4-pole switch is used, the neutral wire shall not be connected to this switch.
- If the neutral wire must be disconnected from the grid (for details, see the local grid requirements), use a 4-pole on/off-grid switch. After the on/off-grid switch is turned off, the internal neutral wire grounding switch is turned on. After the on/off-grid switch is turned on, the internal neutral wire grounding switch is turned off. That is, the on/off-grid switch is linked with the internal grounding switch.

Figure 3-1 is only a simplified electrical diagram. For details, see the actual electrical diagram of the power distribution cabinet.

Figure 3-1 Electrical networking diagram of the on/off-grid PV+ESS (PQ/VSG) system (using a 4-pole switch as an example)



The electrical networking diagram of the on/off-grid PV+ESS (PQ/VSG) system is described as follows:

- The SmartLogger detects the running status of the grid failure detection relay through the DI port to control the on/off-grid switching or operation of the PV+ESS system.
- The DI port of the SmartLogger receives the actual working status of the on/off-grid switch to monitor the grid connection point status (on-grid or off-grid).
- The SmartLogger DO1 and DO2 control the on/off-grid switch to switch on and off.
- The two power supplies are automatically switched to ensure the power supply of the UPS in on-grid and off-grid operations.
- The PV and ESS general power ports are connected to the mains, including the neutral wires.

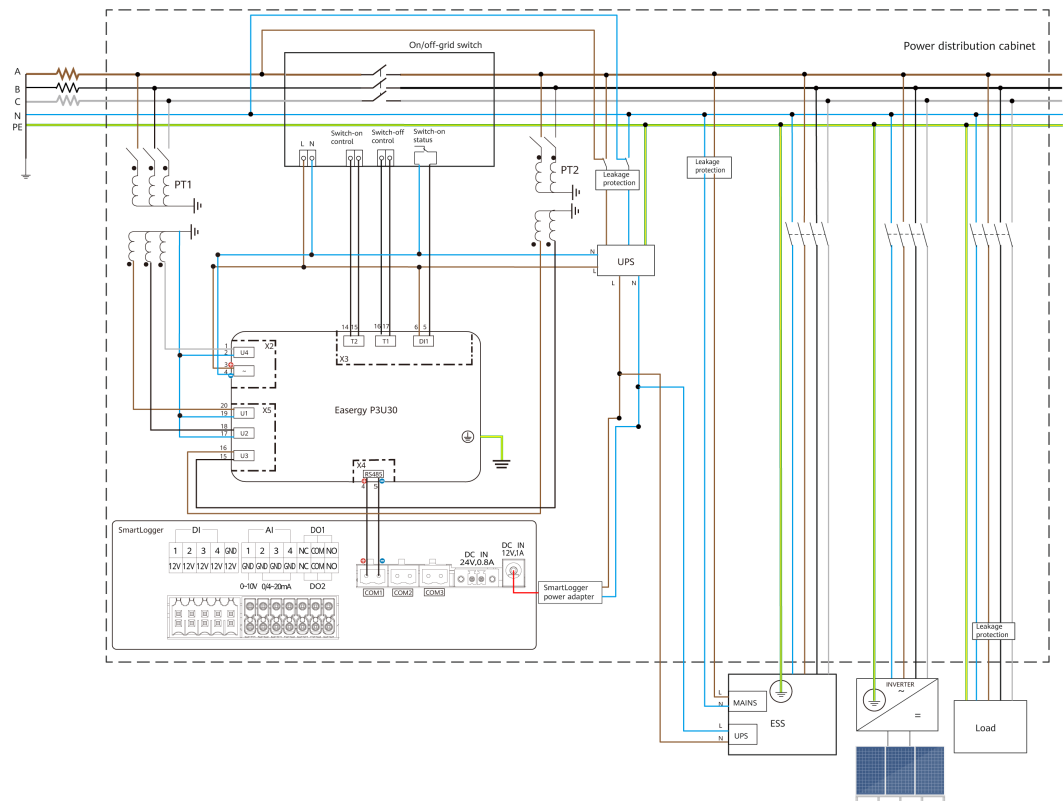
Electrical Networking of the On/Off-Grid PV+ESS (VSG) System

In off-grid operation:

- If the neutral wire must not be disconnected from the grid (for details, see the local grid requirements), use a 3-pole on/off-grid switch. If a 4-pole switch is used, the neutral wire shall not be connected to this switch.
- If the neutral wire must be disconnected from the grid (for details, see the local grid requirements), use a 4-pole on/off-grid switch. After the on/off-grid switch is turned off, the internal neutral wire grounding switch is turned on. After the on/off-grid switch is turned on, the internal neutral wire grounding switch is turned off. That is, the on/off-grid switch is linked with the internal grounding switch.

Figure 3-2 is only a simplified electrical diagram. For details, see the actual electrical diagram of the power distribution cabinet.

Figure 3-2 Electrical networking diagram of the on/off-grid PV+ESS (VSG) system (using a 3-pole switch as an example)



The electrical networking diagram of the on/off-grid PV+ESS (VSG) system is described as follows:

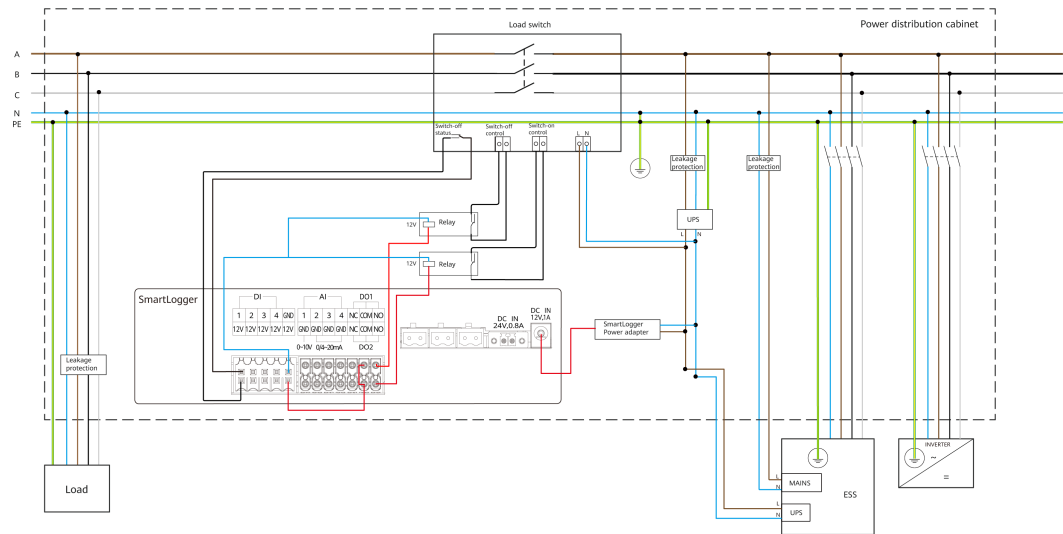
- The SmartLogger is connected to the Schneider P3U30 relay protection device through the RS485 port to control the grid connection point, thereby controlling the on/off-grid switching or operation of the PV+ESS system.
- The P3U30 relay protection device uses two groups of potential transformers (PTs) to directly collect the voltages on both sides of the on/off-grid switch. In this way, the relay protection device can detect whether the voltage or frequency is abnormal in real time and quickly determine whether to trigger unplanned seamless switching.
- The P3U30 relay protection device controls the on/off-grid switch to switch on and off through the T1 and T2 ports.
- The P3U30 relay protection device receives the switch-off status of the on/off-grid switch through the DI1 port to monitor the grid connection point status (on-grid or off-grid).
- The two power supplies are automatically switched to ensure the power supply of the UPS in on-grid and off-grid operations.
- The PV and ESS general power ports are connected to the mains, including the neutral wires.

Electrical Networking of the Off-Grid PV+ESS System

In off-grid operation, the neutral wire of the power distribution system must be reliably grounded at the power supply side. It is recommended that the system grounding be configured in the power distribution cabinet to form a TN system for external power supply.

Figure 3-3 is only a simplified electrical diagram. For details, see the actual electrical diagram of the power distribution cabinet.

Figure 3-3 Electrical networking diagram of the off-grid PV+ESS system



The electrical networking diagram of the off-grid PV+ESS system is described as follows:

- The SmartLogger is used as a controller to control the off-grid operation of the PV+ESS system.
- The DI port of the SmartLogger receives the actual working status of the load switch to monitor whether the loads have power supply.
- The SmartLogger DO1 and DO2 control the load switch to switch on and off to reduce and restore loads.
- The PV and ESS general power ports are connected to the mains, including the neutral wires.

4 Check and Preparation Before Power-On

NOTICE

Do not open the cabinet door when the humidity is high (relative humidity $\geq 80\%$ continuously), for example, on rainy days. If the cabinet door is open for 0.5 hour or longer when the humidity is high, manually perform forced dehumidification. Otherwise, the equipment may fail or the microgrid may collapse. Perform dehumidification as follows:

1. Check that the auxiliary AC power supply to the ESS is powered on. In off-grid scenarios, the genset or other external auxiliary power supply is used. In on/off-grid scenarios, the power grid supplies auxiliary power when available.
2. Log in to the SmartLogger WebUI and choose **Monitoring > ESS > Running Param..** The page for setting running parameters is displayed.
3. Choose **Basic Parameters** and set **Forced dehumidification control** to **Start-up**.
4. Click **Submit**. After the setting is successful, the manual dehumidification starts. View the alarm information to check that the system has started forced dehumidification. The alarm will be automatically cleared after the dehumidification is complete, which takes more than 10 minutes.

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

NOTICE

Ensure that all cables are properly connected and insulated, and meet specifications.

-
- Step 2** Check whether the phase sequence of the AC power cables between the ESS and the power distribution equipment is consistent. If not, adjust the wiring sequence of the AC power cables.

- Step 3** Check the switch status: Ensure that the switch between the ESS AC side and the power distribution equipment is turned off, and the switch between the inverter AC side and the power distribution equipment is turned off.

Step 4 Perform acceptance tests for the ESS thermal runaway suppression system.

 **CAUTION**

You can perform system power-on and commissioning only after the acceptance tests for the ESS thermal runaway suppression system are passed.

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 ESS and the SmartLogger.
 - Off-grid scenario: The UPS supplies power to the ESS and the SmartLogger.
3. Log in to the SmartLogger WebUI or the FusionSolar app. The following alarms shall not be generated. If any of the following alarms is generated, clear the alarm according to the alarm handling suggestions:
 - 3884 Smoke Detector Alarm
 - 3890 Heat Detector Alarm
 - 3885 High Concentration of Combustible Gas
 - 3886 Combustible Gas Detector Communication Failed
 - 3887 Combustible Gas Detector Faulty
 - 3888 Temperature and Humidity Sensor Communication Failed
 - 3889 Temperature and Humidity Sensor Faulty
 - 3893 Fire Alarm

----End

5 Device Power-On

 **DANGER**

Wear insulated gloves and use insulated tools to prevent electric shocks or short circuits.

 **CAUTION**

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

5.1 On/Off-Grid PV+ESS (PQ/VSG) System

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

Figure 5-1 Power-on process of the on/off-grid PV+ESS (PQ/VSG) system

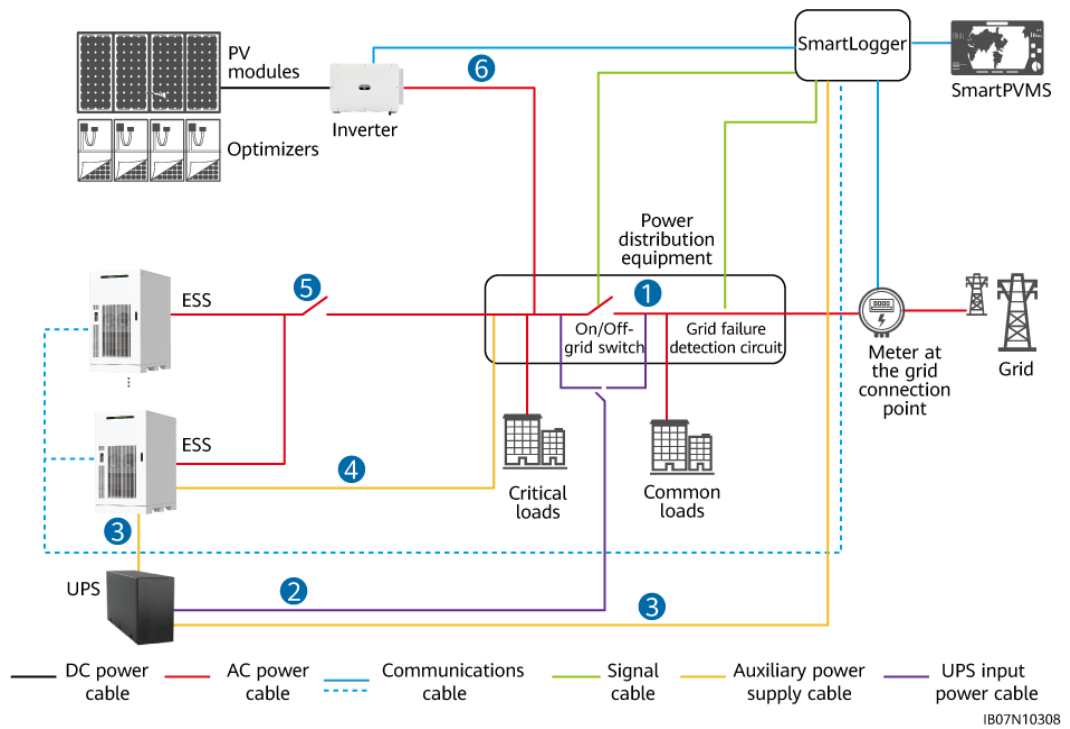


Table 5-1 Power-on process description of the on/off-grid PV+ESS (PQ/VSG) system

Step	Task	Power-On Operation
1	Powering on the power distribution equipment	1. Turn on the on/off-grid switch in the power distribution equipment. 2. Turn on the switch of the grid failure detection circuit 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-SmartLogger auxiliary power supply	1. Turn on the SmartLogger power switch on the UPS side. 2. Turn on the switch on the SmartLogger side: Turn on the power switch (if any) between the SmartLogger and the UPS based on site requirements.
	Powering on the UPS-ESS auxiliary power supply (for black start)	For details, see Power-On Operations .

Step	Task	Power-On Operation
4	Powering on the ESS auxiliary power supply (for LTMS and other devices)	
5	Powering on the ESS AC side	
6	Powering on the inverter	<p>Select a power-on method based on the inverter model.</p> <p>Method 1:</p> <ol style="list-style-type: none"> 1. Set the DC SWITCH to ON. When you hear a click, the switch is completely turned on. 2. Check that the indicators are not steady red. <p>Method 2:</p> <ol style="list-style-type: none"> 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.
<p>Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.</p>		

5.2 On/Off-Grid PV+ESS (VSG) System

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

Figure 5-2 Power-on process of the on/off-grid PV+ESS (VSG) system

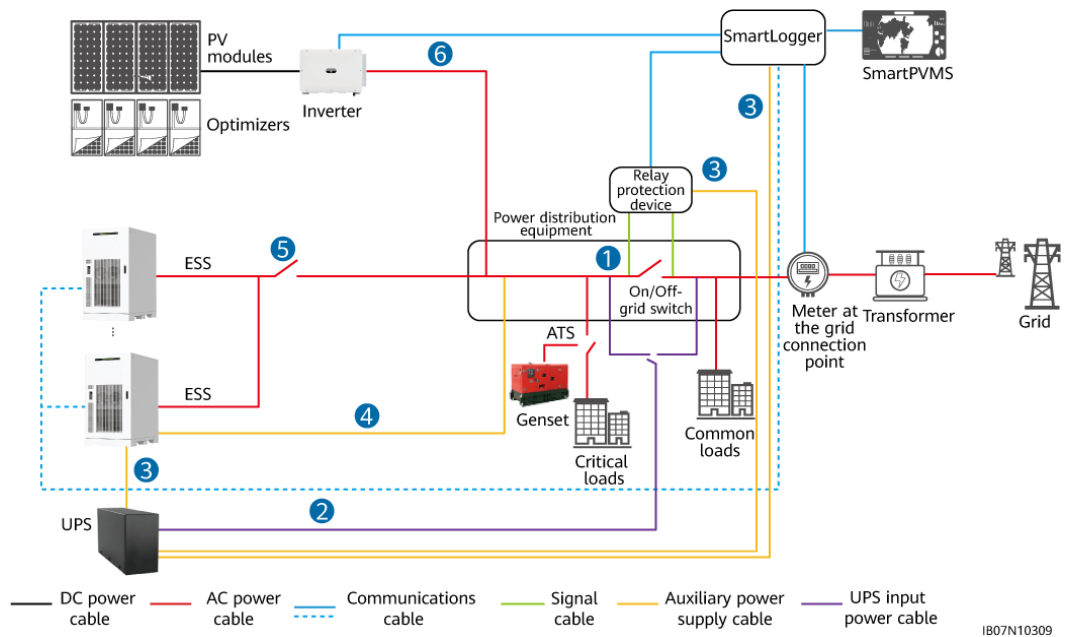


Table 5-2 Power-on process description of the on/off-grid PV+ESS (VSG) system

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	<ol style="list-style-type: none"> 1. Turn on the UPS power switch on the power distribution equipment side. 2. Start the UPS.
3	Powering on the UPS-SmartLogger auxiliary power supply	<ol style="list-style-type: none"> 1. Turn on the SmartLogger power switch on the UPS side. 2. Turn on the switch on the SmartLogger side: Turn on the power switch (if any) between the SmartLogger and the UPS based on site requirements.
	Powering on the UPS-relay protection device auxiliary power supply	Turn on the power switch of the relay protection device on the UPS side.
	Powering on the UPS-ESS auxiliary power supply (for RCM and other devices)	For details, see Power-On Operations .

Step	Task	Power-On Operation
4	Powering on the ESS auxiliary power supply (for LTMS and other devices)	
5	Powering on the ESS AC side	
6	Powering on the inverter	<p>Select a power-on method based on the inverter model.</p> <p>Method 1:</p> <ol style="list-style-type: none"> 1. Set the DC SWITCH to ON. When you hear a click, the switch is completely turned on. 2. Check that the indicators are not steady red. <p>Method 2:</p> <ol style="list-style-type: none"> 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.
<p>Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.</p>		

5.3 Off-Grid PV+ESS System

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

Figure 5-3 Power-on process of the off-grid PV+ESS system

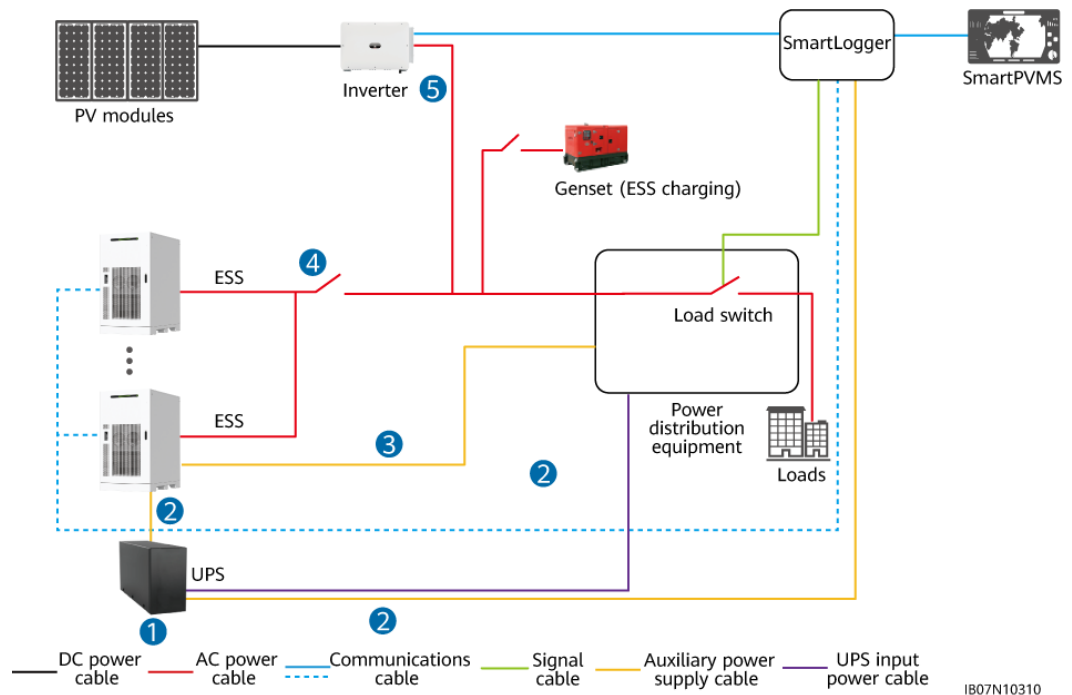


Table 5-3 Power-on process description of the off-grid PV+ESS system

Step	Task	Power-On Operation
1	Starting the UPS	For details, see the documents provided by the vendor.
2	Powering on the UPS-SmartLogger auxiliary power supply	1. Turn on the SmartLogger power switch on the UPS side. 2. Turn on the switch on the SmartLogger side: Turn on the power switch (if any) between the SmartLogger and the UPS based on site requirements.
	Powering on the UPS-ESS auxiliary power supply (for black start)	For details, see Power-On Operations .
3	Powering on the ESS auxiliary power supply (for LTMS and other devices)	
4	Powering on the ESS AC side	

Step	Task	Power-On Operation
5	Powering on the inverter	<p>Select a power-on method based on the inverter model.</p> <p>Method 1:</p> <ol style="list-style-type: none">1. Set the DC SWITCH to ON. When you hear a click, the switch is completely turned on.2. Check that the indicators are not steady red. <p>Method 2:</p> <ol style="list-style-type: none">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.
<p>Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.</p>		

6 System Commissioning (Web)

6.1 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](#).

6.2 Preparations Before Deployment

Step 1 Set **Startup authorization code** of the ESS. Otherwise, the ESS cannot be started.

1. Use **Startup authorization verification code** to apply for **Startup authorization code**.

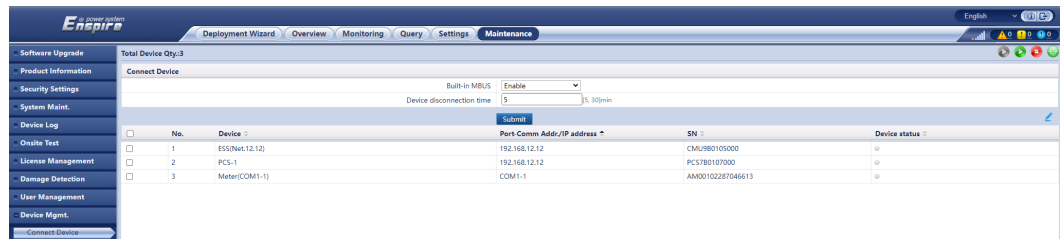
 **NOTE**

Contact the device vendor or its authorized supervision service provider to apply for a startup authorization code through the Power Partner app.

- Method 1: Choose **Monitoring > ESS > Running Info. > Basic Information** to view **Startup authorization verification code**.
 - Method 2: Choose **Deployment Wizard > Connect Device** to view **Startup authorization verification code**.
2. Set **Startup authorization code** of the ESS.
 - Method 1: Choose **Deployment Wizard > Connect Device**, and set **Startup authorization code**.
 - Method 2: Choose **Monitoring > ESS > Running Param. > Basic Parameters**, and set **Startup authorization code**.

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

Figure 6-1 Checking device connection



1. Check whether the quantity 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 **Device status** of each device is normal.

- For the on/off-grid PV+ESS (PQ/VSG) or (VSG) system: During initial connection, **Device status** of the ESS is yellow.
- For the off-grid PV+ESS system: During initial connection, the UPS auxiliary power supply must be connected, and **Device status** of the ESS is yellow.

Step 3 Upgrade the software version.

1. Log in to the Support-E website and search for the latest software versions of the SmartLogger, ESS, and inverter in [FusionSolar Software Download](#).
2. Choose **Maintenance > Software Upgrade** to check the software versions of the SmartLogger, ESS, and inverter. 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**.

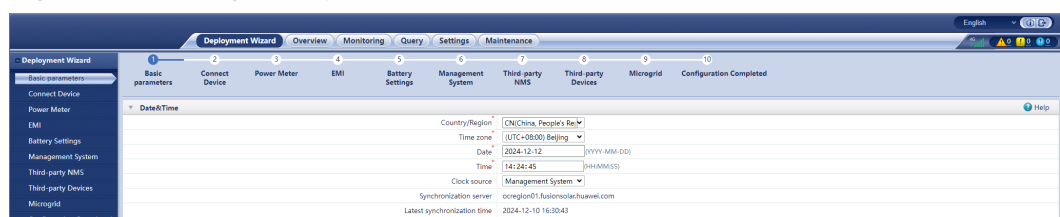
Step 4 Clear alarms.

-----End

6.3 Commissioning Using the Deployment Wizard

Step 1 Set basic parameters.

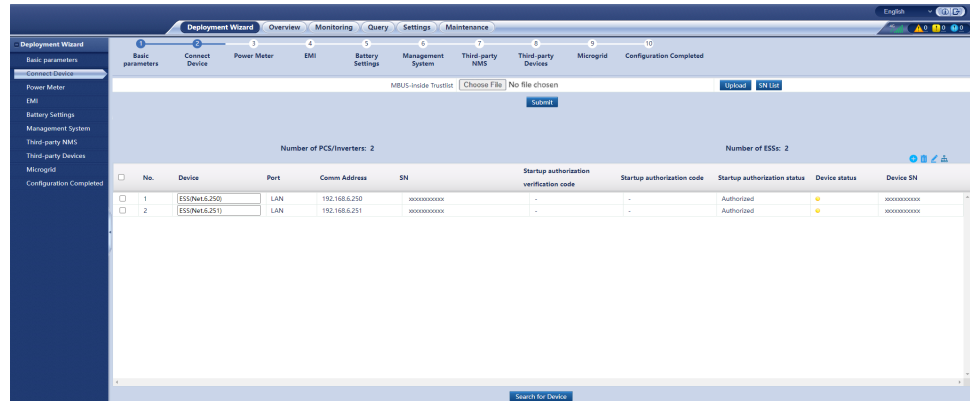
Figure 6-2 Setting basic parameters



Step 2 Connect to devices.

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

Figure 6-3 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**, device search will be started (not applicable to third-party devices), and device addresses will be automatically allocated.
2. Click **Next** and click **Confirm** in the dialog box **Do you want to instruct the inverter to start optimizer search?** based on the actual scenario.
 3. Set array parameters.

Parameter	Description
Scenario under Arrays Operation Scenario	<ul style="list-style-type: none"> - In the Off-grid scenario, set this parameter to Off-grid. The PV +ESS system has an independent microgrid to supply power to loads and does not need the grid supply. - In the On-grid/Off-grid (VSG) or On-grid/Off-grid (PQ/VSG) scenario, set this parameter to On-grid/Off-grid. The PV+ESS system can run in on-grid or off-grid mode. The system supports bidirectional switching between the two modes. The grid supply is required in this scenario.

4. Set inverter parameters.

Parameter	Description
Grid Code	Set the inverter grid code of the country or region where the devices are used.
Working mode	Set this parameter to PQ .
Microgrid compatibility	<ul style="list-style-type: none"> - In the Off-grid or On-grid/Off-grid (VSG) scenario, set this parameter to Enable. - In the On-grid/Off-grid (PQ/VSG) scenario: <ul style="list-style-type: none"> ▪ When the array is running in on-grid mode, set this parameter to Disable. ▪ When the array is running in off-grid mode, set this parameter to Enable.

5. Set battery parameters.

Parameter	Description
Grid Code	Set the ESS grid code of the country or region where the devices are used.
Working mode	<ul style="list-style-type: none"> - In the Off-grid or On-grid/Off-grid (VSG) scenario, set this parameter to VSG. - In the On-grid/Off-grid (PQ/VSG) scenario: <ul style="list-style-type: none"> ▪ When the array is running in on-grid mode, set this parameter to PQ. ▪ When the array is running in off-grid mode, set this parameter to VSG.
Microgrid compatibility	Set this parameter to Disable .
Automatic switching of the working mode	Set this parameter to Disable .

6. For license loading, click **Skip**.

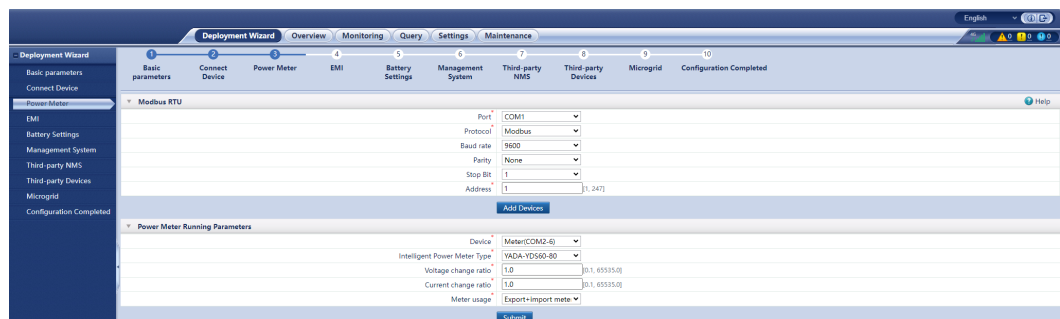
Step 3 (Optional) Connect to power meters.

Set related parameters by referring to "[Setting Meter Parameters](#)" in the *SmartLogger3000 User Manual*.

Parameter	Description	Remarks
Current change ratio	If the power meter does not have a current transformer (CT), set this parameter to 1 . If the power meter has a CT, set this parameter based on the actual CT ratio of the power meter.	<ul style="list-style-type: none"> ● If both the power meter and the SmartLogger support the settings of the PT ratio and CT ratio, you can only set them either on the power meter or the SmartLogger. You are advised to set these parameters on the power meter. ● Examples: <ul style="list-style-type: none"> – Scenario 1: When the voltage of the grid connection point is 400 V, the power meter must be connected to a CT, and the CT ratio is 400:5. <ul style="list-style-type: none"> ▪ Set Voltage change ratio of the power meter to 1. ▪ Set Current change ratio of the power meter to 80. – Scenario 2: When the voltage of the grid connection point is 10 kV, the power meter must be connected to both the CT and PT. The CT ratio is 400:5, and the PT ratio is 10000:100. <ul style="list-style-type: none"> ▪ Set Voltage change ratio of the power meter to 100. ▪ Set Current change ratio of the power meter to 80.
Voltage change ratio	If the power meter does not have a potential transformer (PT), set this parameter to 1 . If the power meter has a PT, set this parameter based on the actual PT ratio of the power meter.	

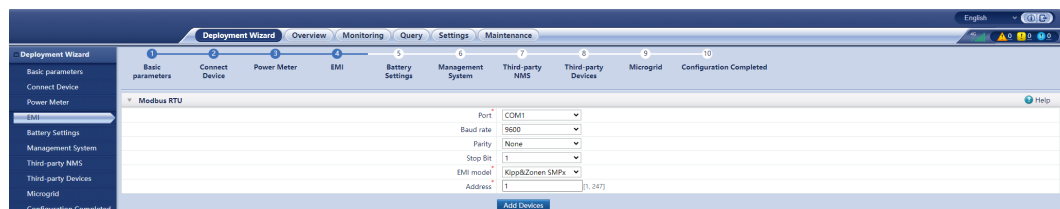
Parameter	Description	Remarks
		<p>NOTE</p> <ul style="list-style-type: none"> The DTSU666-HW and YDS60-80 support a CT ratio range of 1–6553 and a PT ratio range of 0.1–999.9. If the power meter connects to a transformer, set SPEC of the power meter to 0, indicating that the power meter connects to the system through a transformer. If Export Limitation(kW) is set to Single-phase power or Feed-in at limited current is used, the power meter must collect the current and voltage of each phase independently.

Figure 6-4 Connecting to power meters



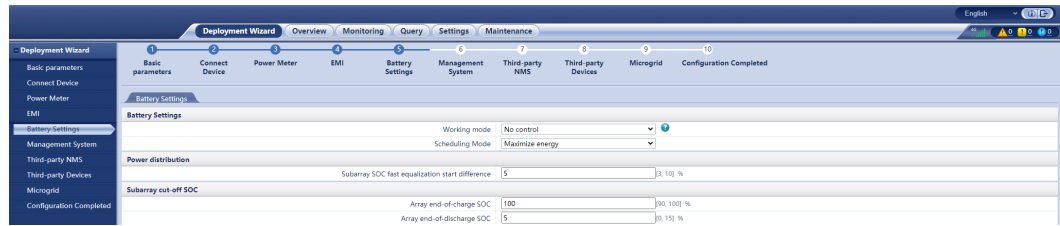
Step 4 (Optional) Connect to environment monitoring instruments (EMIs).

Figure 6-5 Connecting to EMIs



Step 5 Set parameters for battery settings.

Figure 6-6 Battery settings



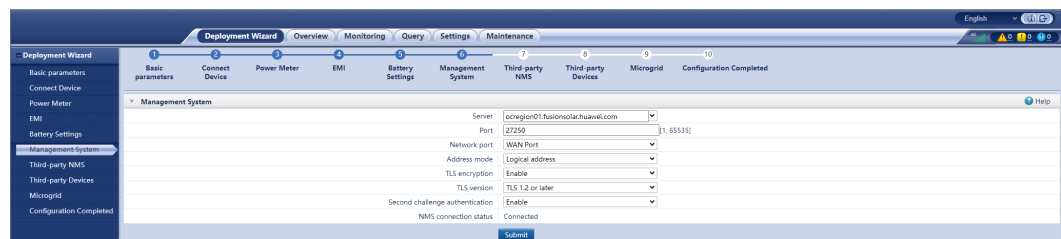
Parameter	Description
Working mode	<p>Set this parameter based on the actual application scenario. Set parameters by referring to Setting Battery Control Parameters in the <i>SmartLogger3000 User Manual</i>.</p> <ul style="list-style-type: none"> On-grid/Off-grid (PQ/VSG) or On-grid/Off-grid (VSG): <ul style="list-style-type: none"> On-grid operation: Set Maximum self-consumption, TOU, or TOU (fixed power) based on the actual application scenario. TOU (fixed power) applies only to ESS-only systems. No control is used only for commissioning. Off-grid operation: Set this parameter to No control. Off-grid: Set this parameter to No control.
Scheduling Mode	<p>The default value is Maximize energy.</p> <ul style="list-style-type: none"> Maximize energy: If ESSs with different C-rates are used together in C&I scenarios, the power is allocated based on the minimum C-rate of all ESSs in the array. Maximize power: If ESSs with different C-rates are used together in C&I scenarios, the power is allocated based on the C-rate of each ESS.
Difference threshold for starting array SOC rapid equilibrium	<p>The default value is 5%. The default value is recommended. Set this parameter as required. When the SOC difference between racks in the array is greater than the value of Difference threshold for starting array SOC rapid equilibrium, the rapid equilibrium algorithm is enabled.</p>
Automatic SOC calibration	<p>Set this parameter to Enable. Automatic charge and discharge calibration is enabled for battery racks. 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: For the charge calibration, the end-of-charge SOC will be extended to 100%; for the discharge calibration, if the end-of-discharge SOC is set to greater than 10%, it will be extended to 10%.</p> <ul style="list-style-type: none"> On-grid scenario: Automatic charge calibration is allowed for battery racks. Off-grid scenario: Automatic discharge calibration is allowed for battery racks.

Parameter	Description
Automatic SOC calibration interval	Set this parameter to 30 . This parameter is displayed when Automatic SOC calibration is set to Enable .
Automatic SOH calibration	<ul style="list-style-type: none"> If this parameter is set to Enable, 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. If this parameter is set to Disable, automatic SOH calibration is disabled for battery racks.
Array end-of-charge SOC	The default value is 100%. You are advised to retain the default value. This parameter indicates the end-of-charge SOC for the battery pack with the highest SOC of an ESS in the array.
Array end-of-discharge SOC	The default value is 5%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [0, 5]. This parameter indicates the end-of-discharge SOC for the battery pack with the lowest SOC of an ESS in the array.

Step 6 Connect to the management system.

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*.

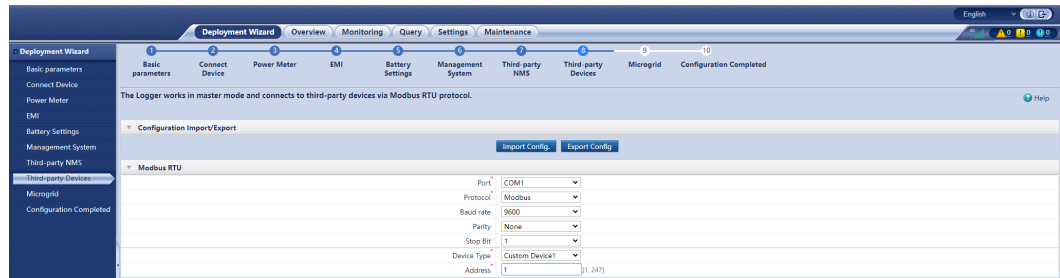
Figure 6-7 Management system



Step 7 Click **Skip** for third-party NMS access. Connecting to a third-party NMS is not recommended. If you forcibly enable both the MGCC mode and the Modbus TCP, IEC 104, and GOOSE settings of a third-party NMS, the microgrid may be unstable.

Step 8 Connect to third-party devices (if any).

Figure 6-8 Connecting to third-party devices



Step 9 Set microgrid parameters.

1. Select **Yes** or **No** in the **Do you want to connect the relay protection device?** dialog box based on the actual situation. In the on/off-grid PV+ESS (VSG) scenario, a relay protection device must be connected. Select **Yes** and set relay protection device parameters. In other scenarios, the relay protection device is not required. For details about other operations on the relay protection device, see the manual of the relay protection device.

Table 6-1 Relay protection device parameters

Parameter	Description
Port	Set the COM port connected to Relay protection device based on the actual cable connections.
Baud rate	Set the baud rate, check mode, parity, stop bit, and address of Relay protection device to be consistent with the communications parameters of the relay protection device.
Parity	
Stop Bit	
Address	
Device Type	Set this parameter to Relay protection device .
Device model	Set this parameter to Easergy P3U30 .

2. Setting microgrid parameters

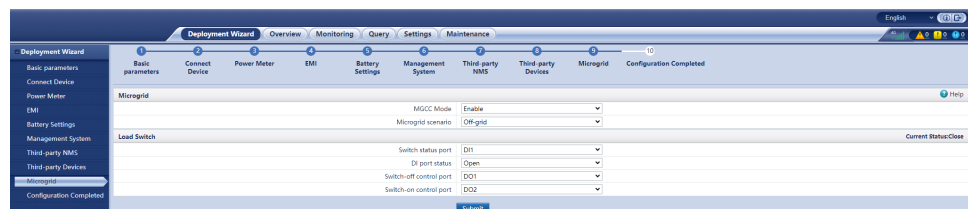


Table 6-2 Microgrid parameters

Parameter	Description
MGCC Mode under Microgrid	Set this parameter to Enable . When MGCC Mode is enabled, Modbus TCP, IEC 104, and GOOSE settings are disabled and the SmartLogger does not respond to scheduling commands from the EMS. (Set Working mode to Charge/Discharge based on grid dispatch on the Battery Control tab page and set Active power control mode to Remote communication scheduling on the Power Adjustment tab page.) Enable this function only when the EMS is not required. If you forcibly enable both the MGCC mode and the Modbus TCP, IEC 104, and GOOSE settings, the microgrid may be unstable. By default, this parameter is set to Disable .
Microgrid scenario under Microgrid	<ul style="list-style-type: none"> - In the off-grid scenario, set this parameter to Off-grid. - In the on/off-grid (PQ/VSG) scenario, set this parameter to On-grid/Off-grid (PQ/VSG). - In the on/off-grid (VSG) scenario, set this parameter to On-grid/Off-grid (VSG). On-grid/Off-grid (VSG) can be set only after the relay protection device is successfully connected. <p>NOTE</p> <ul style="list-style-type: none"> - If Microgrid scenario is set to Off-grid, Scenario under Arrays Operation Scenario shall be set to Off-grid. - If Microgrid scenario is set to On-grid/Off-grid (PQ/VSG) or On-grid/Off-grid (VSG), Scenario under Arrays Operation Scenario shall be set to On/Off-grid.

- If **Microgrid scenario** is set to **On-grid/Off-grid (PQ/VSG)**, refer to the following parameter description.

Parameter	Description
Switch status port under On/Off-grid switch	Set these parameters based on the actual cable connections.
DI port status under On/Off-grid switch	<p>DI port status can be set to Open and Close. If the actual status of the on/off-grid switch is inconsistent with Status, change the setting of DI port status.</p> <ul style="list-style-type: none"> ▪ If the on/off-grid switch status reported to the SmartLogger is switch-on and the switch is actually turned on, set DI port status to Close. ▪ If the on/off-grid switch status reported to the SmartLogger is switch-off and the switch is actually turned off, set DI port status to Open.
Switch-off control port under On/Off-grid switch	Set the DO port for turning off the on/off-grid switch based on the actual cable connections.
Switch-on control port under On/Off-grid switch	Set the DO port for turning on the on/off-grid switch based on the actual cable connections.
DI port under Grid Failure Detection	Set these parameters based on the actual cable connections.
DI port status under Grid Failure Detection	
On/Off-grid switching mode under On/Off-grid switching	<p>You are advised to set this parameter to Auto.</p> <ul style="list-style-type: none"> ▪ No control: All the operations involved in the on/off-grid switching are manually performed. If the customer needs to repair the equipment, you are advised to set this parameter to No control. ▪ Auto: The on/off-grid switching will be performed automatically based on the status of the mains power. When you set On/Off-grid switching mode to this mode, an immediate on/off-grid switching may be triggered, depending on the status of the mains power. ▪ Manual: You need to manually turn on or off the on/off-grid switch at the grid connection point.

- If **Microgrid scenario** is set to **On-grid/Off-grid (VSG)**, refer to the following parameter description.

Parameter	Description
Genset start/stop control port under Genset	Set this parameter to No . It is recommended that the genset be controlled by the ATS.
Auto switching to on-grid under Automatic Off-grid to On-grid Switching	<ul style="list-style-type: none"> ▪ Enable: If the mains voltage is stable, the system automatically switches from off-grid to on-grid state after the synchronization of the relay protection device is successful. ▪ Disable: Disable the function of automatic switching from off-grid to on-grid state.

- If **Microgrid scenario** is set to **Off-grid**, refer to the following parameter description.

Parameter	Description
Switch status port under Load Switch	Set these parameters based on the actual cable connections. If you need to modify the parameters after the settings are submitted, the automatic control function of the load switch may fail. This function can be restored only after the SmartLogger is restarted or the black start is successful in the off-grid scenario. DI port status can be set to Open and Close . If the actual status of the load switch is inconsistent with Status , change the setting of DI port status .
DI port status under Load Switch	
Switch-off control port under Load Switch	Set the DO port for turning off the load switch based on the actual cable connections.
Switch-on control port under Load Switch	Set the DO port for turning on the load switch based on the actual cable connections.

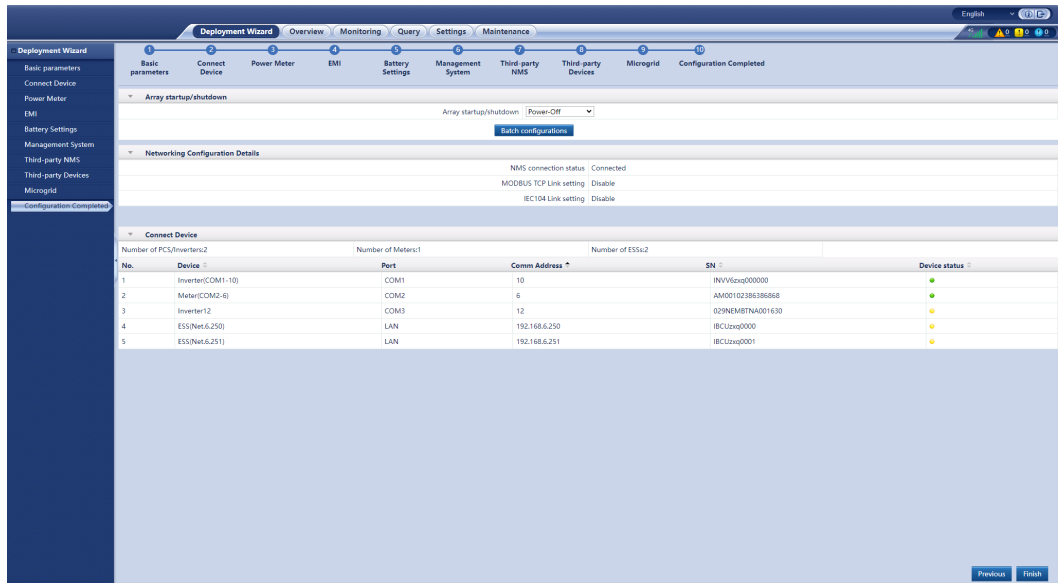
- After the microgrid parameter settings are complete, click **Submit**.

Step 10 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 wire sequence detection.

Figure 6-9 Completing the configuration



Step 11 (Optional) Detect the wire sequence. This function applies only to the C&I liquid-cooled ESS in the scenario with multiple ESSs.

- In the off-grid scenario, ensure that the loads have been disconnected and then click **Starting up**.
- In the on/off-grid scenario, click **Starting up**.

Parameter	Description
Wire sequence detection status	<p>Check the status of wire sequence detection.</p> <ul style="list-style-type: none"> • Not detected • Testing • Detection failed: The wire sequence detection has failed. In this case, check the Abnormal Wire Sequence alarm and rectify the fault based on the handling suggestions. • If the wire sequence is consistent, no action is required. • If the wire sequence is inconsistent, rectify the cable connection. <ol style="list-style-type: none"> 1. Check the phase sequence detection result. The phase sequences of multiple ESSs shall be Positive. If not, rectify the cable connection. 2. If the phase sequences of multiple ESSs are Positive, check the phase again. If the phase difference between ESSs is greater than 60°, rectify the cable connection.
Wire sequence detection time	Check the time when the wire sequence detection is complete.
Wire sequence check progress	Check the wire sequence detection progress.

Parameter	Description
Phase Sequence	Check the phase sequence detection result. The detection result can be Positive or Negative .
Phase	Check the phase detection result. The detection result range is $[0, 360]^\circ$.

Step 12 Set **Output mode** for the inverter and ESS.

- For the inverter: Choose **Monitoring > Inverter > Running Param. > Grid Parameters**, and set **Output mode** for the inverter to **Three-phase four-wire**.
- For the ESS:
 - In the **On-grid/Off-grid (VSG)** or **On-grid/Off-grid (PQ/VSG)** scenario, choose **Monitoring > ESS > Running Param. > Grid Parameters**, and set **Output mode** for the ESS to **Three-phase four-wire**.
 - In the **Off-grid** scenario, disconnect loads and perform black start. Then choose **Monitoring > ESS > Running Param. > Grid Parameters**, and set **Output mode** for the ESS to **Three-phase four-wire**.

Step 13 Check whether **Grid Code** and **Working mode** of the ESS are correctly set. If not, correct the settings.

- Choose **Monitoring > ESS > Running Param. > Grid Parameters**, and check the setting of **Grid Code**.
- Choose **Monitoring > ESS > Running Param. > Feature Parameters**, and check the setting of **Working mode**.

----End

6.4 On/Off-grid (VSG) Protection Parameter Settings

The on/off-grid (VSG) switching involves the coordination and cooperation of multiple devices, including the protection parameter settings of the relay protection device and ESS. Each component must comply with the preset rules to implement the target functions.

NOTE

- For details about how to configure protection parameters for the relay protection device, see the manual of the relay protection device.
- To set ESS protection parameters, choose **Monitoring > ESS > Running Param. > Protection Parameters**.

Table 6-3 Grid code parameter settings for level-2 protection

Working Condition		Relay protection device	ESS
Overvoltage protection	Level-1 OV protection (V)	$1.1 \times U_n^a$	$1.2 \times U_n^a$
	Level-1 OV protection time (ms)	10000	10500
	Level-2 OV protection (V)	$1.3 \times U_n^a$	$1.3 \times U_n^a$
	Level-2 OV protection time (ms)	100	300
Undervoltage protection	Level-1 UV protection (V)	$0.9 \times U_n^a$	$0.9 \times U_n^a$
	Level-1 UV protection time (ms)	10000	10000
	Level-2 UV protection (V)	$0.8 \times U_n^a$	$0.8 \times U_n^a$
	Level-2 UV protection time (ms)	0	1000
Frequency protection	Level-1 OF protection (Hz)	$f_n^b + 2$	$1.1 \times f_n^b$
	Level-1 OF protection time (ms)	500	10000
	Level-1 UF protection (Hz)	$f_n^b - 2$	$0.9 \times f_n^b$
	Level-1 UF protection time (ms)	500	10000
	Frequency change rate (Hz/s)	5	/
	Minimum delay (s)	0.14	/
Note a: Rated voltage of the power grid. Note b: Rated frequency of the power grid.			

If the protection level of the actual grid code is level 1, the level-1 overvoltage and undervoltage protection settings are the same as the level-1 settings in [Table 6-3](#).

If the protection level of the actual grid code is greater than or equal to level 3:

- The level-1 overvoltage and undervoltage protection settings are the same as the level-1 settings in [Table 6-3](#).
- The level-2 overvoltage and undervoltage protection settings are the same as the level-2 settings in [Table 6-3](#).
- The level-3 or higher overvoltage and undervoltage protection settings are the same as the level-2 settings in [Table 6-3](#).
- The level-2 or higher overfrequency and underfrequency protection settings are the same as the level-1 settings in [Table 6-3](#).

6.5 Switch Inspection

Switch inspection is to manually turn on and off the on/off-grid switch or load switch in order to check whether the switch or relay protection device is correctly configured.

DANGER

- Ensure that the equipment is not damaged before you operate the on/off-grid switch or load switch. Otherwise, electric shocks or fire may occur.
 - When operating the on/off-grid switch or load switch, wear insulated gloves and use insulated tools to prevent electric shocks or short circuits.
 - Non-standard and improper operations may result in fire or electric shocks.
 - Prevent foreign matter from entering the equipment during operations. Otherwise, short circuits, equipment damage, load power derating, power failure, or personal injury may occur.
-

On-grid/Off-grid (PQ/VSG)

Step 1 Choose **Settings** > **Microgrid Control** > **On/Off-grid switching** > **General Configuration**, and set **On/Off-grid switching mode** to **No control**.



Step 2 Choose **Maintenance** > **Device Mgmt.** > **Connect Device** and click .

Step 3 Manually turn on or off the on/off-grid switch onsite. Then, on the SmartLogger WebUI, choose **Settings** > **Microgrid Control** > **General Configuration** > **On/Off-grid switch** and check whether **Status** changes. If yes, the DI cable connection is normal. If no, check whether the DI cable to **Switch status port** of the on/off-grid switch is properly connected.

Step 4 Choose **Settings** > **Microgrid Control** > **General Configuration** > **On/Off-grid switch** and check whether **Status** is consistent with the actual on/off-grid switch status. If no, change the setting of **DI port status** to ensure that the status is consistent.

- Step 5** Choose **Settings > Microgrid Control > On/Off-grid switching > On/Off-grid switch control** and click **Open**. Then check onsite whether the actual status of the on/off-grid switch is off. If the actual status of the on/off-grid switch is not off, check whether **Switch-off control port** is configured. If yes, check the DO cable connection to **Switch-off control port**.
- Step 6** Choose **Settings > Microgrid Control > On/Off-grid switching > On/Off-grid switch control** and click **Close**. Then check onsite whether the actual status of the on/off-grid switch is on. If the actual status of the on/off-grid switch is not on, check whether **Switch-on control port** is configured. If yes, check the DO cable connection to **Switch-on control port**.
- Step 7** After the on/off grid switch inspection is complete, choose **Settings > Microgrid Control > On/Off-grid switching > General Configuration**, and set **On/Off-grid switching mode** to **Auto**.
- End

On-grid/Off-grid (VSG)

- Step 1** Choose **Settings > Microgrid Control > On/Off-grid switching**. On the **On-grid to Off-grid** tab page, set **Switch to Off-grid** to **Disable**. On the **Off-grid to On-grid** tab page, set **Off-grid to on-grid** to **Disable**.
- Step 2** Choose **Maintenance > Device Mgmt. > Connect Device** and click .
- Step 3** Choose **Settings > Microgrid Control > On/Off-grid switching > On/Off-grid switch control** and click **Open**. Then check whether **Status of switch at grid connection point** is consistent with the actual status of the on/off-grid switch. If no, check whether the configuration or cable connection of the relay protection device is correct.
- Step 4** Choose **Settings > Microgrid Control > On/Off-grid switching > On/Off-grid switch control** and click **Close**. Then check whether **Status of switch at grid connection point** is consistent with the actual status of the on/off-grid switch. If no, check whether the configuration or cable connection of the relay protection device is correct.
- Step 5** After the on/off grid switch inspection is complete, choose **Maintenance > Device Mgmt. > Connect Device** and click .
- Step 6** Choose **Settings > Microgrid Control > On/Off-grid switching**. On the **On-grid to Off-grid** tab page, set **Switch to Off-grid** to **Enable**. On the **Off-grid to On-grid** tab page, set **Off-grid to on-grid** to **Enable**.
- Step 7** Choose **Monitoring > RELAY > Telemetry**, and check whether the cable connection for the potential transformer of the relay protection device is normal based on the analog parameters on the grid side and microgrid side.
1. Check whether the values of **UA of Grid**, **UB of Grid**, and **UC of Grid** are consistent with the rated voltages of the local power grid. If they are inconsistent, check whether the cable connection for the potential transformer is normal.
 2. Check whether the values of **UAB of Grid**, **UBC of Grid**, and **UAC of Grid** are consistent with the rated voltages of the local power grid. If they are

inconsistent, check whether the cable connection for the potential transformer is normal.

3. Check whether the value of **UAB of Microgrid** is consistent with that of **UAB of Grid** for the ESS. If they are inconsistent, check whether the cable connection for the potential transformer is normal.
4. Check whether the value of **Frequency of Microgrid** is consistent with that of **Frequency of Grid** for the ESS. If they are inconsistent, check whether the cable connection for the potential transformer is normal.

----End

Off-grid

Step 1 Choose **Maintenance > Device Mgmt. > Connect Device** and click .

Step 2 Manually turn on or off the load switch onsite. Then, on the SmartLogger WebUI, choose **Settings > Microgrid Control > General Configuration > Load Switch** and check whether **Status** changes. If yes, the DI cable connection is normal. If no, check whether the DI cable connection to **Switch status port** is normal.

Step 3 Choose **Settings > Microgrid Control > General Configuration > Load Switch** and check whether **Status** is consistent with the actual load switch status. If no, change **DI port status** to ensure that the status is consistent.

Step 4 Choose **Settings > Microgrid Control > General Configuration > Load control** and check whether the **Open** button is available. If yes, click **Open** and then check onsite whether the actual status of the load switch is off. If no, check whether the DO cable connection to **Switch-off control port** is normal.

Step 5 Choose **Settings > Microgrid Control > General Configuration > Load control** and check whether the **Close** button is available. If yes, click **Close** and then check onsite whether the actual status of the load switch is on. If no, check whether the DO cable connection to **Switch-on control port** is normal.

Step 6 After the load switch inspection is complete, choose **Settings > Microgrid Control > Black Start** and click **Starting**.

----End

7 System Commissioning (App)

For details about how to commission the system (app), see [FusionSolar App Quick Guide \(SmartLogger\)](#).

8 Microgrid Control

8.1 On-grid/Off-grid (PQ/VSG)

- Step 1** Set **MGCC Mode** to **Enable**. This parameter can be modified only under **Deployment Wizard > Microgrid > Microgrid**.
- Step 2** Set **Microgrid scenario** to **On-grid/Off-grid (PQ/VSG)**. This parameter can be modified only under **Deployment Wizard > Microgrid > Microgrid. Scenario** under **Arrays Operation Scenario** shall be set to **On/Off-grid**
- Step 3** Choose **Settings > Microgrid Control > General Configuration** and set general configuration parameters.

Table 8-1 General configuration parameters

Parameter	Description
Switch status port under On/Off-grid switch	Set these parameters based on the actual cable connections.
DI port status under On/Off-grid switch	DI port status can be set to Open and Close . If the actual status of the on/off-grid switch is inconsistent with Status , change the setting of DI port status . <ul style="list-style-type: none">• If the on/off-grid switch status reported to the SmartLogger is switch-on and the switch is actually turned on, set DI port status to Close.• If the on/off-grid switch status reported to the SmartLogger is switch-off and the switch is actually turned off, set DI port status to Open.
Switch-off control port under On/Off-grid switch	Set the DO port for turning off the on/off-grid switch based on the actual cable connections.
Switch-on control port under On/Off-grid switch	Set the DO port for turning on the on/off-grid switch based on the actual cable connections.

Parameter	Description
DI port under Grid Failure Detection	Set these parameters based on the actual cable connections.
DI port status under Grid Failure Detection	

Step 4 Choose **Settings > Microgrid Control > Dispatch Control** to set dispatch control parameters.

Table 8-2 Dispatch control parameters

Tab	Parameter	Description
Control Policy	Automatic black start after irradiance restoration	Specifies whether to enable automatic black start after irradiance restoration. <ul style="list-style-type: none"> • Enable: During off-grid operation, automatic black start is performed after the irradiance restores. • Disable: Automatic black start is not performed after the irradiance restores.
	Automatic PCS recovery	Specifies whether to enable the function of automatic recovery in case of abnormal PCS shutdown. <ul style="list-style-type: none"> • Enable: During off-grid operation, when the SmartLogger detects that the PCS shuts down abnormally and causes power failure, the SmartLogger automatically attempts to black start to restore the power supply. • Disable: When the PCS shuts down abnormally, the SmartLogger does not perform automatic black start.
Control Policy	End-of-charge SOC (off-grid)	Set the maximum SOC for charge in off-grid mode. The default value is 90%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [85, 95] and this parameter must be \geq (Array end-of-charge SOC - 5%).
	End-of-discharge SOC (off-grid)	Set the minimum SOC for discharge in off-grid mode. The default value is 10%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [10, 15] and this parameter must be \geq (Array end-of-discharge SOC + 5%).

Tab	Parameter	Description
	Min PV voltage for black start	This parameter is displayed when Automatic black start after irradiance restoration is set to Enable . After the solar irradiance recovers, the inverter PV voltage increases. If the PV1 voltage of an inverter is greater than or equal to Min PV voltage for black start , the black start function may be enabled.
	Minimum estimated power for black start	This parameter is displayed when Automatic black start after irradiance restoration is set to Enable . Set this parameter to a percentage of the ESS rated power. The default value is 70% of the ESS rated power. The default value is recommended. When the irradiance is restored, if the estimated PV output power of the inverter is greater than the minimum estimated power of the black start, the black start is automatically performed. To ensure stable operation after the black start is successful, the minimum estimated power for black start must be greater than the actual load power.
Off-grid charging control	Real-time SOC (%)	The output power of the inverter is controlled based on the current battery SOC to meet the battery charge power adjustment target. The value of Allowed Charge Power (%) ranges from 0 to 70. The value of SOC ranges from End-of-discharge SOC (off-grid) to End-of-charge SOC (off-grid) .
	Allowed Charge Power (%)	
Power Backup	Off-grid power backup	Set this parameter to Enable . The off-grid power backup function is enabled. When the SOC is less than or equal to Min. SOC for off-grid power backup , the ESS stops discharging to maintain sufficient power for off-grid operation.
	Min. SOC for off-grid power backup (%)	In on-grid mode, set Min. SOC for off-grid power backup . The default value is 40%. The value range is [20, 90]. The precision of the off-grid backup power SOC is 1%. This parameter is displayed when Off-grid power backup is set to Enable .
	Prioritize off-grid power backup	When this function is enabled, if the current ESS SOC is \leq (Min. SOC for off-grid power backup - 3%), the ESS will be charged preferentially by the PV system or the grid.

Tab	Parameter	Description
	Draw power from grid for off-grid power backup	This parameter is displayed when Prioritize off-grid power backup is set to Enable . <ul style="list-style-type: none"> • Disable: The ESS is not allowed to obtain power from the grid for off-grid power backup. • Allow: The ESS is allowed to obtain power from the grid for off-grid power backup.
	Charge power for off-grid power backup (kW)	This parameter is displayed when Draw power from grid for off-grid power backup is set to Allow . Set the power for charging the ESS by the grid for off-grid power backup. The default value is 100 kW, and the value range is [0.0, 50000.0].

 NOTE

Array end-of-charge SOC > End-of-charge SOC (off-grid) ≥ Backup power SOC for peak shaving ≥ Min. SOC for off-grid power backup > End-of-discharge SOC (off-grid) > Array end-of-discharge SOC

Step 5 Choose **Settings > Microgrid Control > On/Off-grid switching**, and set on/off-grid switching parameters.

Table 8-3 On/Off-grid switching parameters

Tab	Parameter	Description
General Configuration	Automatic microgrid adaptability control	You are advised to set this parameter to Enable . <ul style="list-style-type: none"> • Enable: When the system switches from on-grid to off-grid mode, the microgrid adaptability of the inverter is automatically enabled. When the system switches from off-grid to on-grid mode, the microgrid adaptability of the inverter is automatically disabled. • Disable: The automatic microgrid adaptability control function is disabled. The microgrid adaptability of the inverter is not automatically set during on/off-grid switching.

Tab	Parameter	Description
	On/Off-grid switching mode	<p>You are advised to set this parameter to Auto.</p> <ul style="list-style-type: none"> ● No control: All the operations involved in the on/off-grid switching are manually performed. If the customer needs to repair the equipment, you are advised to set this parameter to No control. ● Auto: The on/off-grid switching will be performed automatically based on the status of the mains power. When you set On/Off-grid switching mode to this mode, an immediate on/off-grid switching may be triggered, depending on the status of the mains power. ● Manual: You need to manually turn on or off the on/off-grid switch at the grid connection point.
Off-grid to On-grid	Off-grid to on-grid under Manual On-grid/Off-grid Switching	<p>If On/Off-grid switching mode is set to Manual, click Off-grid to on-grid before switching from off-grid to on-grid mode. After the PV+ESS system shuts down, turn on the on/off-grid switch locally. After the switch is turned on, the PV+ESS system automatically restarts.</p>
On/Off-grid switch control	On/Off-grid switch control	<p>This function is used only to check the status of the on/off-grid switch. Before the check, the array shall be shut down.</p> <ul style="list-style-type: none"> ● Close: The on/off-grid switch is turned on, switching the system from off-grid to on-grid state. Click Off-grid to on-grid before switching on. ● Open: The on/off-grid switch is turned off, switching the system from on-grid to off-grid state. <p>NOTE</p> <ul style="list-style-type: none"> ● In the on/off-grid (PQ/VSG) scenario, the on/off-grid switching will be performed according to the status of the on/off-grid switch only when On/Off-grid switching mode is set to Auto or Manual. ● In the on/off-grid (PQ/VSG) scenario, the Close and Open buttons are available only when the DO ports of Switch-off control port and Switch-on control port under On/Off-grid switch are configured. ● When the on/off-grid switch is on, the Close button is grayed out, and the Open button is available. ● When the on/off-grid switch is in invalid state, the Close and Open buttons are grayed out.

Table 8-4 On/Off-grid switching mode (automatic)

Scenario	Command and Operation Between the SmartLogger and Devices
From on-grid to off-grid	<ol style="list-style-type: none"> 1. Grid failure is detected. 2. The on/off-grid switch is automatically turned off. 3. The SmartLogger sends a command to set Working mode from PQ to VSG under Monitoring > ESS > Running Param. > Feature Parameters to start the ESS. 4. The SmartLogger sends a command to set Microgrid compatibility to Enable under Monitoring > Inverter > Running Param. > Feature Parameters. 5. The SmartLogger sends a command to start the inverter and ESS.
From off-grid to on-grid	<ol style="list-style-type: none"> 1. Grid recovery is detected. 2. The SmartLogger sends a command to shut down the inverter and ESS. 3. The SmartLogger sends a command to turn on the on/off-grid switch and receives the switch-on status. 4. The SmartLogger sends a command to set Working mode from VSG to PQ under Monitoring > ESS > Running Param. > Feature Parameters. 5. The SmartLogger sends a command to set Microgrid compatibility to Disable under Monitoring > Inverter > Running Param. > Feature Parameters. 6. The SmartLogger sends a command to start the inverter and ESS.

Table 8-5 On/Off-grid switching mode (manual)

Scenario	Command and Operation Between the SmartLogger and Devices
From on-grid to off-grid	<ol style="list-style-type: none"> 1. The user turns off the on/off-grid switch locally. 2. The SmartLogger detects that the on/off-grid switch is turned off. 3. The SmartLogger sends a command to shut down the inverter and ESS. 4. The SmartLogger sends a command to black-start the ESS. During the black start, the SmartLogger sets Working mode from PQ to VSG under Monitoring > ESS > Running Param. > Feature Parameters. 5. After the black start is complete, the ESS starts. 6. The SmartLogger sends a command to set Microgrid compatibility to Enable under Monitoring > Inverter > Running Param. > Feature Parameters. 7. The SmartLogger sends a command to start the inverter.
From off-grid to on-grid	<ol style="list-style-type: none"> 1. Click the Off-grid to on-grid button on the SmartLogger WebUI to shut down the PV+ESS system. 2. The user turns on the on/off-grid switch locally. 3. The SmartLogger detects that the on/off-grid switch is turned on and the system connects to the power grid. 4. The SmartLogger sends a command to set Working mode from VSG to PQ under Monitoring > ESS > Running Param. > Feature Parameters. 5. The SmartLogger sends a command to start the ESS. 6. The SmartLogger sends a command to set Microgrid compatibility to Disable under Monitoring > Inverter > Running Param. > Feature Parameters. 7. The SmartLogger sends a command to start the inverter.

----End

8.2 On-grid/Off-grid (VSG)

Step 1 Set **MGCC Mode** to **Enable**. This parameter can be modified only under **Deployment Wizard > Microgrid > Microgrid**.

Step 2 Set **Microgrid scenario** to **On-grid/Off-grid (VSG)**. This parameter can be modified only under **Deployment Wizard > Microgrid > Microgrid. Scenario** under **Arrays Operation Scenario** shall be set to **On/Off-grid**

Step 3 Choose **Settings > Microgrid Control > General Configuration** and set general configuration parameters.

Table 8-6 General configuration parameters

Parameter	Description
Genset start/stop control port under Genset	Set this parameter to No . It is recommended that the genset be controlled by the ATS.

Step 4 Choose **Settings > Microgrid Control > Dispatch Control** to set dispatch control parameters.

Table 8-7 Dispatch control parameters

Tab	Parameter	Description
Control Policy	Automatic black start after irradiance restoration	Specifies whether to enable automatic black start after irradiance restoration. <ul style="list-style-type: none"> • Enable: During off-grid operation, automatic black start is performed after the irradiance restores. • Disable: Automatic black start is not performed after the irradiance restores.
	Automatic PCS recovery	Specifies whether to enable the function of automatic recovery in case of abnormal PCS shutdown. <ul style="list-style-type: none"> • Enable: During off-grid operation, when the SmartLogger detects that the PCS shuts down abnormally and causes power failure, the SmartLogger automatically attempts to black start to restore the power supply. • Disable: When the PCS shuts down abnormally, the SmartLogger does not perform automatic black start.
Control Policy	End-of-charge SOC (on-grid)	Set the maximum SOC for charge in on-grid mode. The default value is 90%.
	End-of-charge SOC (off-grid)	Set the maximum SOC for charge in off-grid mode. The default value is 90%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [85, 95] and this parameter must be \geq (Array end-of-charge SOC - 5%).

Tab	Parameter	Description
	End-of-discharge SOC (off-grid)	Set the minimum SOC for discharge in off-grid mode. The default value is 10%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [10, 15] and this parameter must be \geq (Array end-of-discharge SOC + 5%).
	Min PV voltage for black start	This parameter is displayed when Automatic black start after irradiance restoration is set to Enable . After the solar irradiance recovers, the inverter PV voltage increases. If the PV1 voltage of an inverter is greater than or equal to Min PV voltage for black start , the black start function may be enabled.
	Minimum estimated power for black start	This parameter is displayed when Automatic black start after irradiance restoration is set to Enable . Set this parameter to a percentage of the ESS rated power. The default value is 70% of the ESS rated power. The default value is recommended. When the irradiance is restored, if the estimated PV output power of the inverter is greater than the minimum estimated power of the black start, the black start is automatically performed. To ensure stable operation after the black start is successful, the minimum estimated power for black start must be greater than the actual load power.
Off-grid charging control	Real-time SOC (%)	The output power of the inverter is controlled based on the current battery SOC to meet the battery charge power adjustment target. The value of Allowed Charge Power (%) ranges from 0 to 70. The value of SOC ranges from End-of-discharge SOC (off-grid) to End-of-charge SOC (off-grid) .
	Allowed Charge Power (%)	
Genset Control	Genset Auto Control	Set this parameter to Disable to disable the automatic control of genset startup and shutdown.
Power Backup	Off-grid power backup	Set this parameter to Enable . The off-grid power backup function is enabled. When the SOC is less than or equal to Min. SOC for off-grid power backup , the ESS stops discharging to maintain sufficient power for off-grid operation.

Tab	Parameter	Description
	Min. SOC for off-grid power backup (%)	In on-grid mode, set Min. SOC for off-grid power backup . The default value is 40%. The value range is [20, 90]. The precision of the off-grid backup power SOC is 1%. This parameter is displayed when Off-grid power backup is set to Enable .
	Prioritize off-grid power backup	When this function is enabled, if the current ESS SOC is \leq (Min. SOC for off-grid power backup - 3%), the ESS will be charged preferentially by the PV system or the grid.
	Draw power from grid for off-grid power backup	This parameter is displayed when Prioritize off-grid power backup is set to Enable . <ul style="list-style-type: none"> • Disable: The ESS is not allowed to obtain power from the grid for off-grid power backup. • Allow: The ESS is allowed to obtain power from the grid for off-grid power backup.
	Charge power for off-grid power backup (kW)	This parameter is displayed when Draw power from grid for off-grid power backup is set to Allow . Set the power for charging the ESS by the grid for off-grid power backup. The default value is 100 kW, and the value range is [0.0, 50000.0].

 NOTE

Array end-of-charge SOC > End-of-charge SOC (on-grid) or End-of-charge SOC (off-grid) \geq Backup power SOC for peak shaving \geq Min. SOC for off-grid power backup > End-of-discharge SOC (off-grid) > Array end-of-discharge SOC

Step 5 Choose **Settings > Microgrid Control > On/Off-grid switching**, and set on/off-grid switching parameters.

Table 8-8 On/Off-grid switching parameters

Tab	Parameter	Description
On-grid to Off-grid	Switch to Off-grid under Planned switching control	After the planned switching control is started, the on/off-grid switch is turned off and the system enters off-grid state.

Tab	Parameter	Description
Off-grid to On-grid	Auto switching to on-grid under Automatic Off-grid to On-grid Switching	<ul style="list-style-type: none"> • Enable: If the mains voltage is stable, the system automatically switches from off-grid to on-grid state after the synchronization of the relay protection device is successful. • Disable: Disable the function of automatic switching from off-grid to on-grid.
	Setting value of high voltage under Criteria of Stable Grid	Set the allowed error range of the mains voltage. If the voltage is within [Setting value of high voltage, 110]% of the rated voltage, the voltage is considered stable.
	Continuous power available for under Criteria of Stable Grid	Set the minimum time for which the mains voltage remains stable.
	Max switching time under Conditions for Off-grid to On-grid Switching	Set the maximum time for switching from off-grid to on-grid. Max switching time must be greater than the maximum duration for the synchronization check of the relay protection device.
	Off-grid to on-grid under Manual On-grid/Off-grid Switching	Set Auto switching to on-grid to Disable . To switch from off-grid to on-grid, click Off-grid to on-grid first. When the mains voltage is stable, synchronization will be performed. After the synchronization is successful, the on/off-grid switch is turned on and the system enters on-grid state.

Tab	Parameter	Description
On/Off-grid switch control	On/Off-grid switch control	<p>This function is used only to check the status of the on/off-grid switch. Before the check, the array shall be shut down.</p> <ul style="list-style-type: none"> ● Close: The on/off-grid switch is turned on and the system checks whether the relay protection device has correctly controlled the switch-on. ● Open: The on/off-grid switch is turned off and the system checks whether the relay protection device has correctly controlled the switch-off. <p>NOTE</p> <ul style="list-style-type: none"> ● In the on/off grid (VSG) scenario, if the relay protection device is offline, the Close and Open buttons are grayed out. ● When the on/off-grid switch is off, the Close button is available, and the Open button is grayed out. ● When the on/off-grid switch is on, the Close button is grayed out, and the Open button is available. ● When the on/off-grid switch is in invalid state, the Close and Open buttons are grayed out.

Table 8-9 From on-grid to off-grid

Scenario	Command and Operation Between the SmartLogger and Devices
Unplanned switching from on-grid to off-grid	<ol style="list-style-type: none"> 1. The grid fails. 2. When detecting the grid failure, the relay protection device automatically turns off the on/off-grid switch. 3. The SmartLogger sends a command to set Microgrid compatibility to Enable under Monitoring > Inverter > Running Param. > Feature Parameters. 4. The SmartLogger receives the switch-off signal from the on/off-grid switch and switches to the off-grid mode.
Planned switching from on-grid to off-grid	<ol style="list-style-type: none"> 1. Click the Switch to Off-grid button on the SmartLogger WebUI. 2. The SmartLogger sends a command to adjust the power at the grid connection point. 3. The SmartLogger sends a command to set Microgrid compatibility to Enable under Monitoring > Inverter > Running Param. > Feature Parameters. 4. The SmartLogger checks whether the power adjustment at the grid connection point is successful. If yes, the SmartLogger sends a command to the relay protection device to turn off the on/off-grid switch and the system enters off-grid state. If no, the switching failed, an alarm is reported, and on-grid operation continues.

Table 8-10 Off-grid to on-grid

Scenario	Command and Operation Between the SmartLogger and Devices
Auto switching to on-grid	<ol style="list-style-type: none"> 1. Set Auto switching to on-grid to Enable on the SmartLogger WebUI. 2. The SmartLogger checks that the mains voltage is stable. 3. The SmartLogger checks whether the ESS is shut down. If all ESSs are shut down: <ol style="list-style-type: none"> a. The SmartLogger checks whether the genset is connected. If yes, the SmartLogger sends a command to shut down the genset. b. The SmartLogger sends a command to the relay protection device to turn on the on/off-grid switch. c. The SmartLogger sends a command to start the PV+ESS system. If a PCS is not shut down: <ol style="list-style-type: none"> a. The SmartLogger sends a command to the relay protection device to start the synchronous switch-on and the secondary adjustment of the voltage and frequency. b. The SmartLogger checks whether the synchronous switch-on of the relay protection device is successful. If yes, go to Step 5.4. If no, go back to Step 5.3.a. 4. The SmartLogger checks whether the on/off-grid switch is turned on successfully. If yes, the switching from off-grid to on-grid is successful. If no, a switching failure alarm is reported.

Scenario	Command and Operation Between the SmartLogger and Devices
Manual switching to on-grid	<ol style="list-style-type: none"> 1. Click the Off-grid to on-grid button on the SmartLogger WebUI. 2. The SmartLogger checks that the mains voltage is stable. 3. The SmartLogger checks whether the ESS is shut down. If all ESSs are shut down: <ol style="list-style-type: none"> a. The SmartLogger checks whether the genset is connected. If yes, the SmartLogger sends a command to shut down the genset. b. The SmartLogger sends a command to the relay protection device to turn on the on/off-grid switch. c. The SmartLogger sends a command to start the PV+ESS system. If a PCS is not shut down: <ol style="list-style-type: none"> a. The SmartLogger sends a command to the relay protection device to start the synchronous switch-on and the secondary adjustment of the voltage and frequency. b. The SmartLogger checks whether the synchronous switch-on of the relay protection device is successful. If yes, go to Step 5.4. If no, go back to Step 5.3.a. 4. The SmartLogger checks whether the on/off-grid switch is turned on successfully. If yes, the switching from off-grid to on-grid is successful. If no, a switching failure alarm is reported.

Step 6 Choose **Monitoring > ESS > Running Info. > Basic Information** and obtain the actual grid voltage based on the average of **AB/BC/CA line voltage of grid**. Choose **Monitoring > ESS > Running Param. > Grid Parameters** and view the voltage level and grid code voltage.

If the absolute deviation between the actual grid voltage and the grid code voltage ranges is [2%, 5%] for a long time, the MGCC will fail to adjust the PCS voltage, and the reactive power of the PCS will occupy the active power of the

PCS. To solve this problem, choose **Monitoring > ESS > Running Param. > Feature Parameters**, and set **VSG output voltage correction coefficient** to adjust the PCS output voltage. If the absolute deviation between the actual grid voltage and the grid code voltage is greater than 5% for a long time, you are not advised to set **Microgrid scenario** to **On-grid/Off-grid (VSG)**.

Table 8-11 Adjustment scheme for the VSG output voltage correction coefficient

Deviation Between the Actual Grid Voltage and the Grid Code Voltage (%)	VSG Output Voltage Correction Coefficient (%)
-5	95
-4	96
-3	97
-2	98
2	102
3	103
4	104
5	105

----End

8.3 Off-grid

- Step 1** Set **MGCC Mode** to **Enable**. This parameter can be modified only under **Deployment Wizard > Microgrid > Microgrid**.
- Step 2** Set **Microgrid scenario** to **Off-grid**. This parameter can be modified only under **Deployment Wizard > Microgrid > Microgrid**.
- Step 3** Choose **Settings > Microgrid Control > General Configuration** and set general configuration parameters.

Table 8-12 General configuration parameters

Parameter	Description
Switch status port under Load Switch	Set these parameters based on the actual cable connections. If you need to modify the parameters after the settings are submitted, the automatic control function of the load switch may fail. This function can be restored only after the SmartLogger is restarted or the black start is successful in the off-grid scenario. DI port status can be set to Open and Close . If the actual status of the load switch is inconsistent with Status , change the setting of DI port status .
DI port status under Load Switch	
Switch-off control port under Load Switch	Set the DO port for turning off the load switch based on the actual cable connections.
Switch-on control port under Load Switch	Set the DO port for turning on the load switch based on the actual cable connections.

Step 4 Choose **Settings > Microgrid Control > Off-grid Control** to set off-grid control parameters.

Table 8-13 Off-grid control parameters

Tab	Parameter	Description
Control Policy	Automatic load connection/shedding	<ul style="list-style-type: none"> • Enable: The automatic load connection/shedding function is enabled. • Disable: The automatic load connection/shedding function is disabled.
	Automatic black start after irradiance restoration	Specifies whether to enable automatic black start after irradiance restoration. <ul style="list-style-type: none"> • Enable: During off-grid operation, automatic black start is performed after the irradiance restores. • Disable: Automatic black start is not performed after the irradiance restores.
	Automatic PCS recovery	Specifies whether to enable the function of automatic recovery in case of abnormal PCS shutdown. <ul style="list-style-type: none"> • Enable: During off-grid operation, when the SmartLogger detects that the PCS shuts down abnormally and causes power failure, the SmartLogger automatically attempts to black start to restore the power supply. • Disable: When the PCS shuts down abnormally, the SmartLogger does not perform automatic black start.

Tab	Parameter	Description
Control Policy	End-of-charge SOC (off-grid)	Set the maximum SOC for charge in off-grid mode. The default value is 90%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [85, 95] and this parameter must be \geq (Array end-of-charge SOC - 5%).
	SOC threshold for stopping load shedding	This parameter is displayed when Automatic load connection/shedding is set to Enable . The default value is 30%. The value range is [26, 40]. If the current ESS SOC is greater than or equal to SOC threshold for stopping load shedding , the load switch is automatically turned on to supply power to loads. If you manually turn on or off the load switch, the automatic control function of the load switch will be automatically disabled. This function can be restored only after the SmartLogger is restarted or the black start is successful in the off-grid scenario.
	SOC threshold for starting load shedding	This parameter is displayed when Automatic load connection/shedding is set to Enable . The default value is 20%. The value range is [10, 25]. If the SOC is less than or equal to SOC threshold for starting load shedding , the load switch is automatically turned off to reduce the ESS discharge power. If you manually turn on or off the load switch, the automatic control function of the load switch will be automatically disabled. This function can be restored only after the SmartLogger is restarted or the black start is successful in the off-grid scenario.
	End-of-discharge SOC (off-grid)	Set the minimum SOC for discharge in off-grid mode. The default value is 10%. Set the parameter based on the actual situation. To ensure reliable operations of the microgrid, the recommended value range is [10, 15] and this parameter must be \geq (Array end-of-discharge SOC + 5%).
	Min PV voltage for black start	This parameter is displayed when Automatic black start after irradiance restoration is set to Enable . After the solar irradiance recovers, the inverter PV voltage increases. If the PV1 voltage of an inverter is greater than or equal to Min PV voltage for black start , the black start function may be enabled.

Tab	Parameter	Description
	Minimum estimated power for black start	This parameter is displayed when Automatic black start after irradiance restoration is set to Enable . Set this parameter to the percentage of the ESS rated power. The default value is 10% of the ESS rated power. When the irradiance is restored, if the estimated irradiance power of the inverter is greater than the minimum estimated power of the black start, the inverter automatically performs black start.
Off-grid charging control	Real-time SOC (%)	The output power of the inverter is controlled based on the current battery SOC to meet the battery charge power adjustment target. The value of Allowed Charge Power (%) ranges from 0 to 70. The value of SOC ranges from End-of-discharge SOC (off-grid) to End-of-charge SOC (off-grid) .
	Allowed Charge Power (%)	
Load control	Manual Load Control	<p>This function is used only for load switch status detection.</p> <ul style="list-style-type: none"> ● Close: Loads are connected. ● Open: Loads are disconnected. <p>NOTE</p> <ul style="list-style-type: none"> ● In the off-grid scenario, the Close and Open buttons are available only when the DO ports of Switch-off control port and Switch-on control port under Load Switch are configured. ● When the load switch is off, the Close button is available, and the Open button is grayed out. ● When the load switch is on, the Close button is grayed out, and the Open button is available. ● When the load switch is in invalid state, the Close and Open buttons are grayed out.

 **NOTE**

Array end-of-charge SOC > End-of-charge SOC (off-grid) ≥ SOC threshold for stopping load shedding > SOC threshold for starting load shedding > End-of-discharge SOC (off-grid) > Array end-of-discharge SOC

Table 8-14 Off-grid PV+ESS system (description of the load shedding and automatic recovery process)

Scenario	Command and Operation Between the SmartLogger and Devices
Off-grid	<ol style="list-style-type: none"> 1. The ESS is off-grid and running properly. 2. If the current battery SOC is less than or equal to SOC threshold for starting load shedding, the SmartLogger sends a command to turn off the load switch, powering off all loads. 3. After load shedding, if PV power is generated to charge the ESS and the SOC is greater than or equal to SOC threshold for stopping load shedding, the SmartLogger sends a command to turn on the load switch, supplying power to loads. 4. If no PV power is available to charge the ESS and the SOC is less than or equal to End-of-discharge SOC (off-grid), the ESS is shut down within 5 minutes. 5. After the ESS is shut down, if the following conditions are met, the ESS will be black-started and the PV+ESS system will resume operation: <ul style="list-style-type: none"> - The PV1 voltage on the DC side of an inverter is greater than or equal to Min PV voltage for black start for at least 1 hour. - Estimated array PV output power \geq Minimum estimated power for black start - ESS SOC \geq Array end-of-discharge SOC 6. If the SOC is less than the Array end-of-discharge SOC, the PV+ESS system shuts down and remote black start cannot be performed. In this case, technical engineers are required to handle the problem onsite.

----End

9 System Operations

NOTICE

- If you start and shut down the ESS and then need to start or black-start it again, you are advised to wait for a period of time greater than or equal to **Device disconnection time** (choose **Maintenance > Device Mgmt. > Connect Device** to view **Device disconnection time**) before startup or black start. Otherwise, the ESS may fail to be started or black-started.
- In the **On-grid/Off-grid (VSG)** scenario, if the ESS SOC is less than **Array end-of-discharge SOC**, perform the following operations to start the ESS:
 - For the on-grid operation:
 - If the ESS SOC is greater than 0%, set **Array end-of-discharge SOC** to a value within the range of [0, ESS SOC) and then start the ESS. After it is started, restore the value of **Array end-of-discharge SOC**.
 - If the ESS SOC is 0%, charge the ESS and then start it after the ESS SOC is greater than **Array end-of-discharge SOC**.
 - For the off-grid operation:
 - If the ESS SOC is greater than 0%, start the ESS through the array black start.
 - If the ESS SOC is 0%, charge the ESS and then start it through the array black start.

Starting the Array on the SmartLogger WebUI for the On-Grid Operation

Prerequisites:

- The mains supply is stable.
- The on/off-grid switch is turned on.

Procedure:

Step 1 Log in to the SmartLogger WebUI.

- In the **On-grid/Off-grid (PQ/VSG)** scenario, choose **Monitoring > ESS > Running Param. > Feature Parameters** and set **Working mode** to **PQ**. Choose **Monitoring > Inverter > Running Param. > Feature Parameters** and set **Microgrid compatibility** to **Disable**.

- In the **On-grid/Off-grid (VSG)** scenario, choose **Monitoring > ESS > Running Param. > Feature Parameters** and set **Working mode** to **VSG**. Choose **Monitoring > Inverter > Running Param. > Feature Parameters** and set **Microgrid compatibility** to **Enable**.

Step 2 Send a startup command to the inverter and ESS.

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

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

Step 3 Choose **Overview > Plant Running Info.** on the SmartLogger and check whether the meter power, ESS power, and PV power match.

----End

 **NOTE**

If [Step 1](#) and [Step 2](#) are complete after deployment commissioning, skip them. If a power failure occurs after deployment commissioning, perform [Step 1](#) and [Step 2](#) to start the array.

Starting the Array Using the Black Start Function for the Off-Grid Operation (When the UPS Has Power)

Prerequisites:

- Turn off the load switch, that is, disconnect the loads.
- It is recommended that black start be performed only when the ESS SOC is greater than 2%. Otherwise, the black start may fail. If the ESS SOC is 0%, charge the ESS first.
- 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 SmartLogger and the auxiliary power supplies of the ESS shall have a power supply source, which can be provided by the UPS.
- During black start, the ESS array shall have adequate dischargeable energy and power for the black start (depending on the load transformer specifications and inrush current in the system).
- To prevent PCS protection caused by the excitation inrush current when the load transformer is switched on during black start, the load transformer and lines also need to be started simultaneously.
- In off-grid scenarios, it is recommended that the SOC during ESS charge/discharge operations in the scenario where the microgrid control is implemented by the SmartLogger range from 10% to 90% to ensure that the black start function works properly.
- 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 that there is no condensation in the ESS (for example, there is no water drop in the ESS).

Procedure:

Choose **Settings > Microgrid Control > Black Start** to view the black start status and perform black start manually.

Parameter	Description
Current Battery SOC	View the current battery SOC.
Black Start Progress	View the black start progress.

Parameter	Description
Status	<ul style="list-style-type: none"> ● Black start failed. Cause: All ESSs are offline. ● Black start failed. Cause: No ESS is available for black start. ● Black start failed. Cause: No PCS is available for black start. ● Black start failed. Cause: No PCS is prepared for black start. ● Black start failed. Cause: No PCS has established the voltage for black start. ● Manual black start in progress ● Automatic black start in progress: The current battery SOC is higher than Array end-of-discharge SOC. <ul style="list-style-type: none"> – When MGCC Mode is set to Enable, Microgrid scenario is set to On-grid/Off-grid (PQ/VSG), and On/Off-grid switching mode is set to Auto, black start is automatically triggered if the mains triggers the on/off-grid switching. – When MGCC Mode is set to Enable, Microgrid scenario is set to On-grid/Off-grid (PQ/VSG), and On/Off-grid switching mode is set to Manual, black start is automatically triggered if you turn off on/off-grid switch locally to trigger the on/off-grid switching manually. – When MGCC Mode and Automatic PCS recovery are both set to Enable, if the voltage on the ESS AC side is abnormal (less than 30% of the rated voltage on the ESS AC side) and the PCS in the ESS shuts down abnormally, black start is automatically triggered. – When MGCC Mode is set to Enable and Microgrid scenario is set to Off-grid, if the solar irradiance recovers for inverters and no PCS is running, turn off the load switch and then the black start is automatically triggered. ● Black start succeeded.

Starting the ESS by Pressing the Local Black Start Button for the Off-Grid Operation (When the UPS Has No Power)

Prerequisites:

- Turn off the load switch, that is, disconnect the loads.
- Before the first deployment, turn off the AC switch of the ESS.
- It is recommended that black start be performed only when the ESS SOC is greater than 2%. Otherwise, the black start may fail. If the ESS SOC is 0%, charge the ESS first.
- 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 that there is no condensation in the ESS (for example, there is no water drop in the ESS).

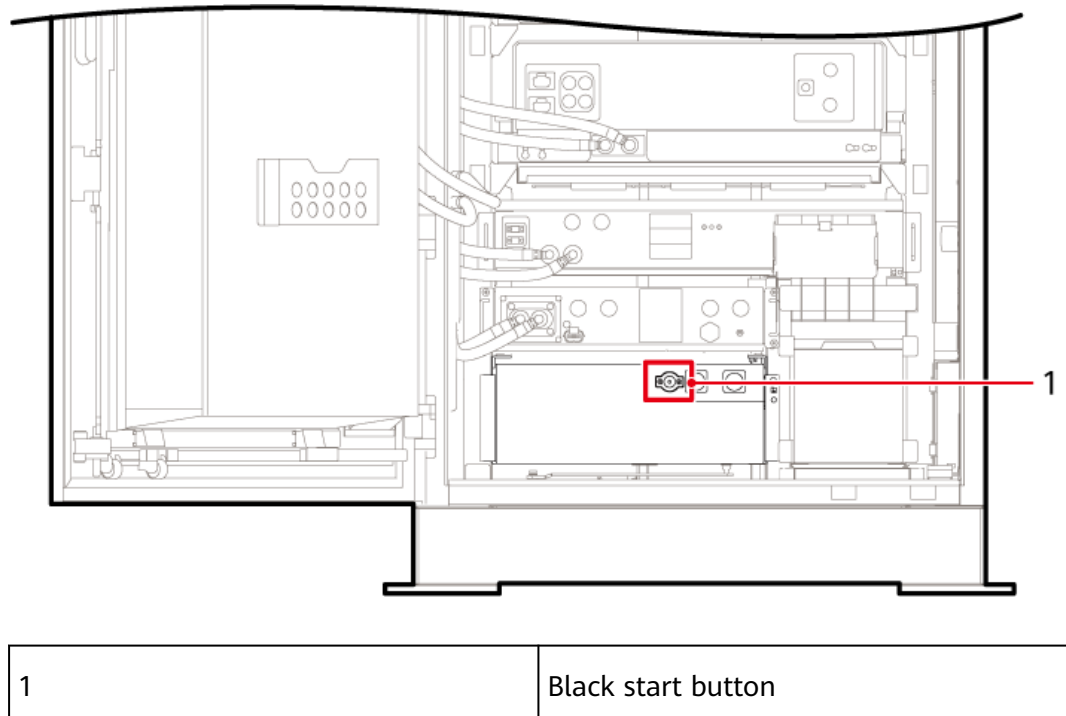
Procedure:

Open the door of the ESS, and hold down the black start button on the RCM in the ESS for more than 10s.

NOTICE

Press the black start button twice at an interval of at least 1 minute.

Figure 9-1 Black start button



10 System Power-Off

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

Step 1 Send a shutdown command.

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

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** to verify that the shutdown is successful.
3. Choose **Monitoring** > **ESS** > **Running Info.** Check **Device status** 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 [5 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 Off-Grid UPS Capacity Configuration

ESS Quantity	UPS Battery Capacity ^a (kWh)	12 V Battery Ampere-Hour ^b (Ah)	24 V Battery Ampere-Hour ^c (Ah)
1	2.88	240	120
4	7.2	600	300
8	12.96	1080	540
12	18.72	1560	780
16	24.48	2040	1020
20	30.24	2520	1260

Note a: Battery capacity = (15 W + 15 W x ESS quantity) x 48 x 2/1000
Note b: 12 V battery ampere-hour = Battery capacity x 1000/12
Note c: 24 V battery ampere-hour = Battery capacity x 1000/24

B Reference Documents

Device	Document
ESS	<ul style="list-style-type: none"><li data-bbox="715 824 1362 891">• LUNA2000-(107-215) Series Smart String ESS User Manual<li data-bbox="715 902 1362 969">• LUNA2000-(107-215) Series Smart String ESS Quick Guide

Device	Document
Inverter	<ul style="list-style-type: none"> • SUN2000-(20KTL, 29.9KTL, 30KTL, 36KTL, 40KTL)-M3 Series User Manual • SUN2000-(20KTL, 29.9KTL, 30KTL, 36KTL, 40KTL)-M3 Series Quick Guide • SUN2000-(50KTL-ZHM3, 50KTL-M3, 50KTL-BRM3) User Manual • SUN2000-(50KTL-ZHM3, 50KTL-M3, 50KTL-BRM3) Quick Guide • SUN2000-(50KTL, 60KTL, 65KTL)-M0 User Manual • SUN2000-(50KTL, 60KTL, 65KTL)-M0 Quick Guide • SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) Series User Manual • SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) Series Quick Guide • SUN2000-(75KTL-M1, 100KTL-M2, 110KTL-M2, 115KTL-M2) User Manual • SUN2000-(100KTL, 110KTL)-M2 Quick Guide (STAUBLI) • SUN2000-(75KTL-M1, 100KTL-M2, 110KTL-M2, 115KTL-M2) Quick Guide (Amphenol) • SUN2000-(50K, 75K, 80K, 150K)-MG Series User Manual • SUN2000-(50K, 75K, 80K, 150K)-MG Series Quick Guide • SUN5000-(150K-MG0-ZH,150K-MG0) User Manual • SUN5000-(150K-MG0-ZH, 150K-MG0) Quick Guide
SUN2000P	<ul style="list-style-type: none"> • 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
SmartLogger	<ul style="list-style-type: none"> • SmartLogger3000 User Manual • SmartLogger3000 Quick Guide
Power meter	<ul style="list-style-type: none"> • DTSU666-HW Smart Power Sensor Quick Guide • YDS60-80 Smart Power Sensor Quick Guide
FusionSolar app	FusionSolar App User Manual

Device	Document
SmartPVMS	<ul style="list-style-type: none"><li data-bbox="715 300 1428 367">• SmartPVMS FusionSolar SmartPVMS User Manual (Owner)<li data-bbox="715 376 1428 443">• SmartPVMS FusionSolar SmartPVMS User Manual (Installer)

C Digital Power Customer Service



<https://digitalpower.huawei.com/robotchat/>

D 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

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E Acronyms and Abbreviations

A

ATS Automatic Transfer Switch

C

CMU Central Monitoring Unit

E

ESS Energy Storage System

F

FE Fast Ethernet

P

PCS Power Control System

S

SFP Small Form-factor
Pluggable

SOC State of Charge

SOH State of Health

U

UPS Uninterruptible Power
Supply