Commercial and Industrial On-Grid Energy Storage Solution

Quick Guide (Based on 215KWH Series ESS)

Issue 01

Date 2024-08-12

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About This Document

Purpose

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

The safety precautions, product introduction, site selection requirements, and maintenance information of the devices involved in the solution are described in the user manuals or maintenance manuals of the corresponding devices. For details, see **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
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Symbol	Description
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

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

Issue 01 (2024-08-12)

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

Contents

1 Solution Introduction

1.1 Networking Architecture

The C&I on-grid energy storage solution has two networking architectures: ESS-only and PV+ESS.

1.1.1 ESS-Only System

The ESS-only system is mainly used for peak staggering and peak shaving at the grid connection point through scheduled charge and discharge. Fixed-power charge and discharge without meters is supported. **Figure 1-1** shows the networking architecture of the ESS-only system. **Table 1-1** lists the components.

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

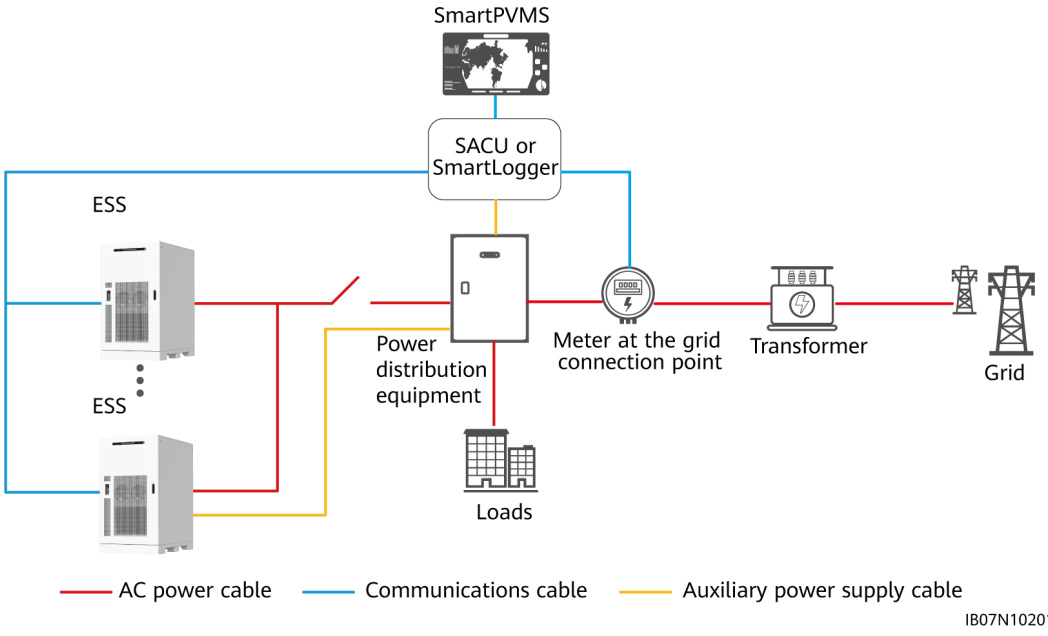


Table 1-1 Components of the ESS-only system

Name	Model/ Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	• LUNA2000-215-2S10 • LUNA2000-215-2S12	≤ 50	Purchased from the Company. • A transformer supports a maximum of 50 ESSs running in parallel. In this scenario, at least three SmartLoggers are required. These SmartLoggers are controlled by a third-party controller. • One SmartLogger can connect to a maximum of 20 ESSs.
SmartLogger3000 (SmartLogger)	SmartLogger3000	1	Purchased from the Company. Choose either SmartLogger or SACU.
Smart Array Controller (SACU)	• SmartACU2000D-D-05CN • SmartACU2000D-D-06	1	
SmartModule	SmartModule1000A01	Depending on the actual networking architecture	Purchased from the Company (optional). The SmartModule is used with the SmartLogger or SACU.
Meter at the grid connection point	DTSU666-HW or YDS60-80	1	Purchased from the Company (optional)

Name	Model/ Specifications	Quantity	Remarks
Network switch with four optical ports and eight electrical ports	S5735I-S8T4SN-V2 • Eight 10/100/1000BASE-T Ethernet ports • Four GE SFP ports • Dual redundant 9.6–60 V DC power supplies	Depending on the actual networking architecture	Purchased from the Company (optional)
FusionSolar Smart PV Management System (SmartPVMS)	SmartPVMS 24.6.0 and later	1	Purchased from the Company (optional)
Power distribution equipment	Specifications of the circuit breaker connected to the ESS: three-phase AC switch, rated voltage ≥ 380 V AC (depending on the actual power grid voltage level), rated current 250 A	1	Prepared by the customer
Transformer at the grid connection point	The voltage level depends on the actual grid voltage.	1	Prepared by the customer (optional)

1.1.2 PV+ESS

The PV+ESS system is mainly used for maximum PV self-consumption as well as peak staggering and peak shaving at the grid connection point. **Figure 1-2** shows the networking architecture of the PV+ESS system. **Table 1-2** lists the components.

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

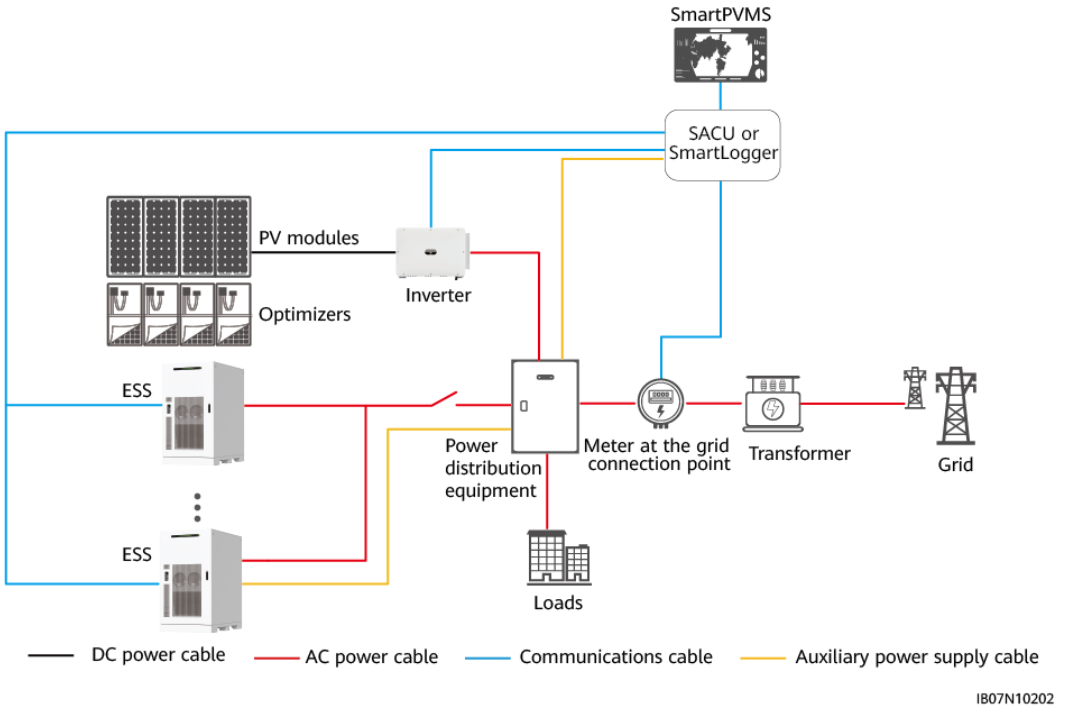


Table 1-2 Components of the PV+ESS system

Name	Model/ Specifications	Quantity	Remarks
Smart String Energy Storage System (ESS)	• LUNA2000-215-2S10 • LUNA2000-215-2S12	≤ 20	Purchased from the Company

Name	Model/ Specifications	Quantity	Remarks
Smart PV inverter (inverter)	• 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

Name	Model/ Specifications	Quantity	Remarks
Smart PV Optimizer (SUN2000P)	• 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. MERC-1300W-P or MERC-1100W-P is mandatory for SUN5000-150K-MG0 and SUN5000-150K-MG0-ZH.
SmartLogger3000 (SmartLogger)	SmartLogger3000	1	Purchased from the Company. Choose either SmartLogger or SACU.
Smart Array Controller (SACU)	• SmartACU2000D-D-05CN • SmartACU2000D-D-06	1	
SmartModule	SmartModule1000A01	Depending on the actual networking architecture	Purchased from the Company (optional). The SmartModule is used with the SmartLogger or SACU.

Name	Model/ Specifications	Quantity	Remarks
Network switch with four optical ports and eight electrical ports	S5735I-S8T4SN-V2 • Eight 10/100/1000BASE-T Ethernet ports • Four GE SFP ports • Dual redundant 9.6–60 V DC power supplies	Depending on the actual networking architecture	Purchased from the Company (optional)
FusionSolar Smart PV Management System (SmartPVMS)	SmartPVMS 24.6.0 and later	1	Purchased from the Company (optional)
Power distribution equipment	Specifications of the circuit breaker connected to the ESS: three-phase AC switch, rated voltage ≥ 380 V AC (depending on the actual power grid voltage level), rated current 250 A	1	Prepared by the customer
Transformer at the grid connection point	The voltage level depends on the actual grid voltage.	1	Prepared by the customer (optional)

1.2 Communication Logic

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

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

Maximum communication distance of the SACU or SmartLogger:

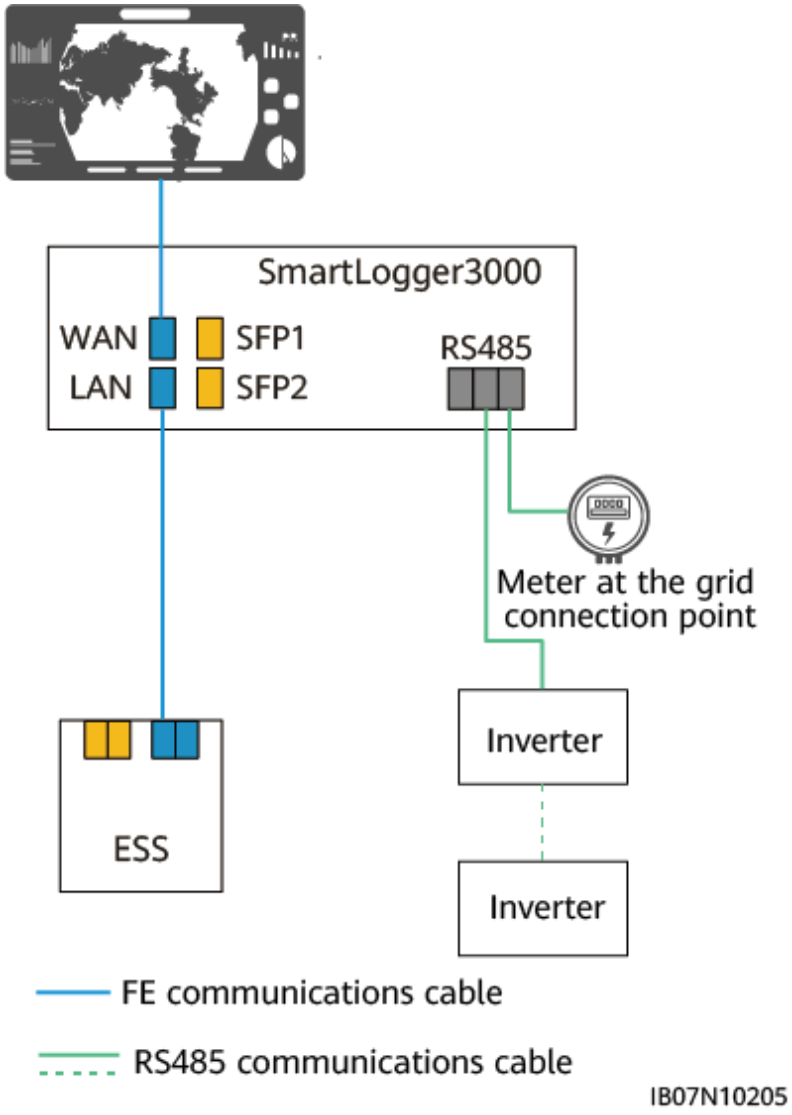
- RS485: 1000 m
- FE: 100 m

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 Star Topology (One ESS)

In this scenario, the SmartLogger3000 is configured. In the scenario with one ESS, the SmartLogger can be installed inside the ESS.

Figure 1-3 SmartLogger+ESS FE star topology



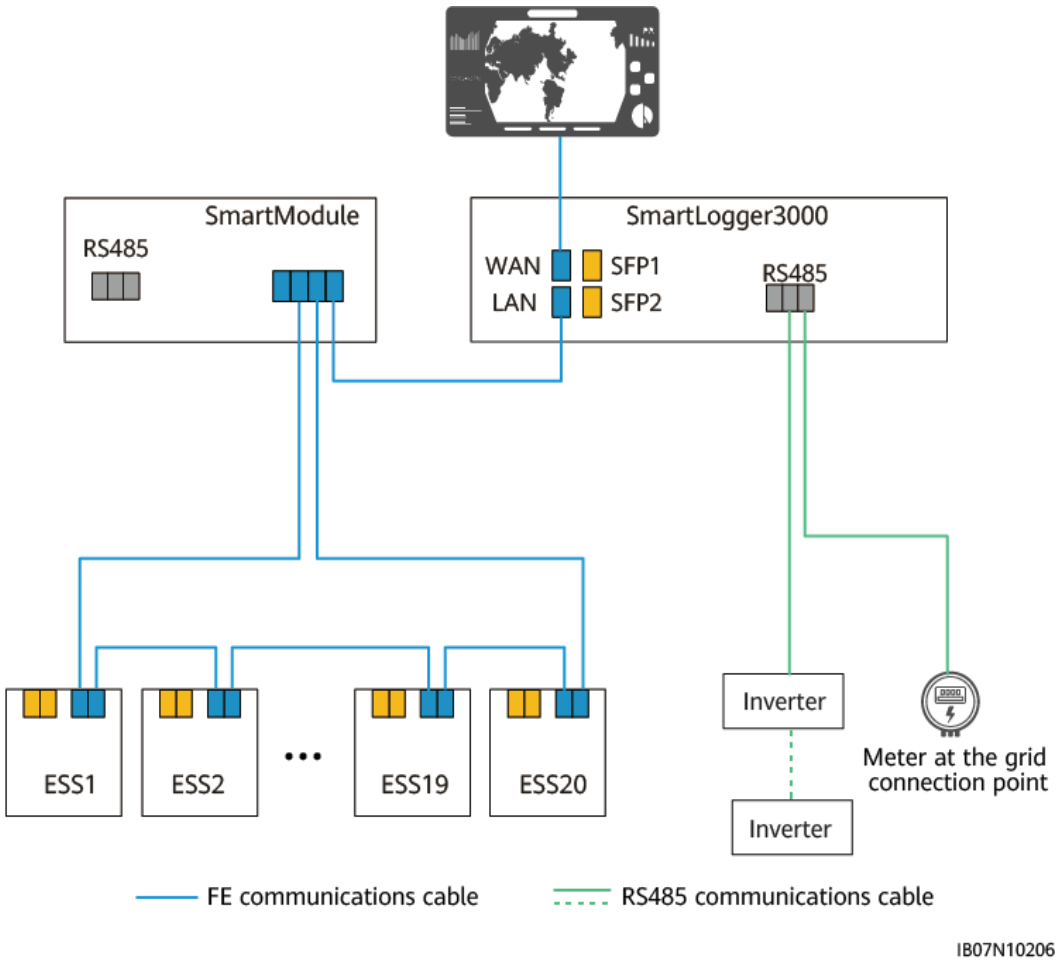
Typical Scenario 2: SmartLogger+ESS FE Ring Topology (2–20 ESSs)

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.

Figure 1-4 SmartLogger+ESS FE ring topology

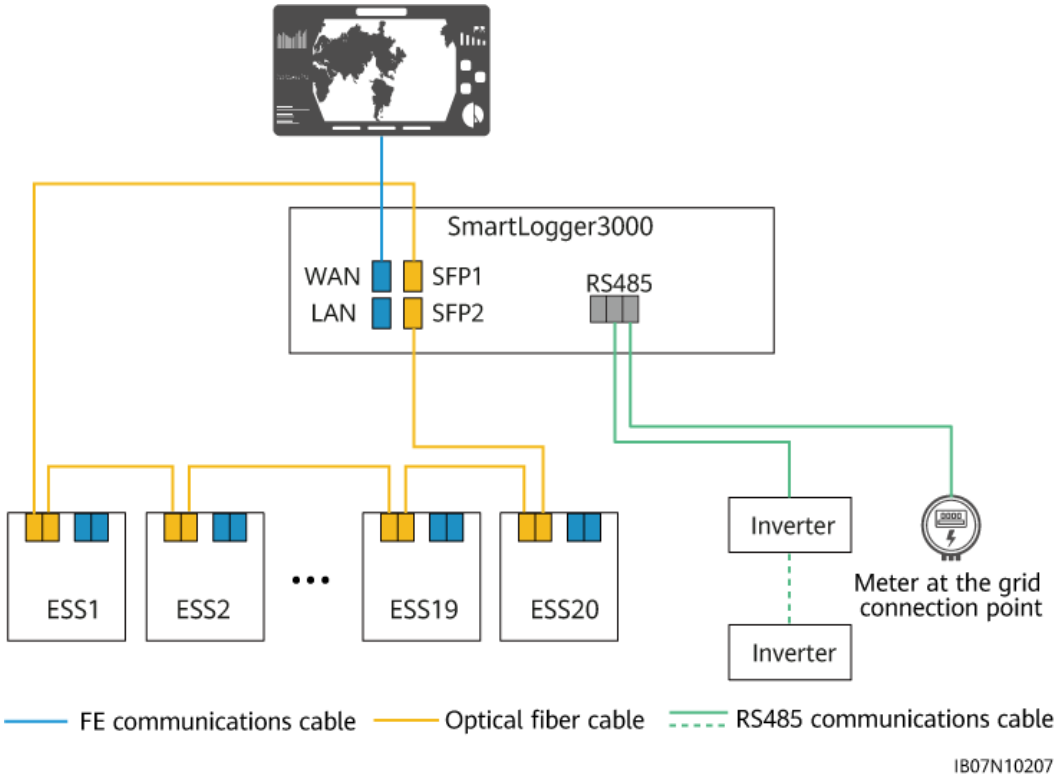


Typical Scenario 3: SmartLogger+ESS Fiber Ring Topology (2–20 ESSs)

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



1.3 O&M Methods

Table 1-3 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 and 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	**iMaster NetEco V600R023C00 FusionSolar SmartPVMS User Manual**

O&M Method	Description	Main Application Scenario	Reference Document
FusionSolar app	The app is locally connected to an ESS or an inverter to locally manage the ESS or the inverter.	• Modifying the parameters of a single device locally • Upgrading the software version of a single device locally	FusionSolar App User Manual

2 Installation and Cable Connection

This section describes the process, precautions, and connection relationships 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**.

Table 2-1 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-(215-2S10, 215-2S12) Smart String ESS User Manual**.
2	Installing PE cables	• The ground point outside the ESS must be 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 cables.
3	Installing AC power cables	AC power cables must be connected in the correct phase sequence. Ensure that the phase sequence of the AC power cables of the ESS is consistent with that of the isolation transformer and power grid. Otherwise, the system may fail to run properly.
4	Installing communications cables	For details about the cable connections, see **1.2 Communication Logic**.
5	Installing the inverter and SUN2000P	N/A

Step	Task	Precaution
6	Installing the power meter	N/A
7	Installing the SACU or SmartLogger	N/A

3 Check and Preparation Before Power-On

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

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.

1. Ensure that the switches on both sides of the power distribution equipment are turned off.
2. 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 the ESS fire suppression system acceptance test.

⚠ CAUTION

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

1. Remove foreign objects from the ESS, collect auxiliary materials, and take away flammable objects such as cardboards.
2. Log in to the SACU or 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
- 3931 Fire Suppression System Alarm

----End

4 System Power-On

DANGER

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

CAUTION

During the power-on procedure, monitor the system for faults. If you detect any faults, power off the ESS, rectify the faults, and then continue with the procedure.

4.1 On-Grid ESS-Only System

Figure 4-1 Power-on process of the on-grid ESS-only system

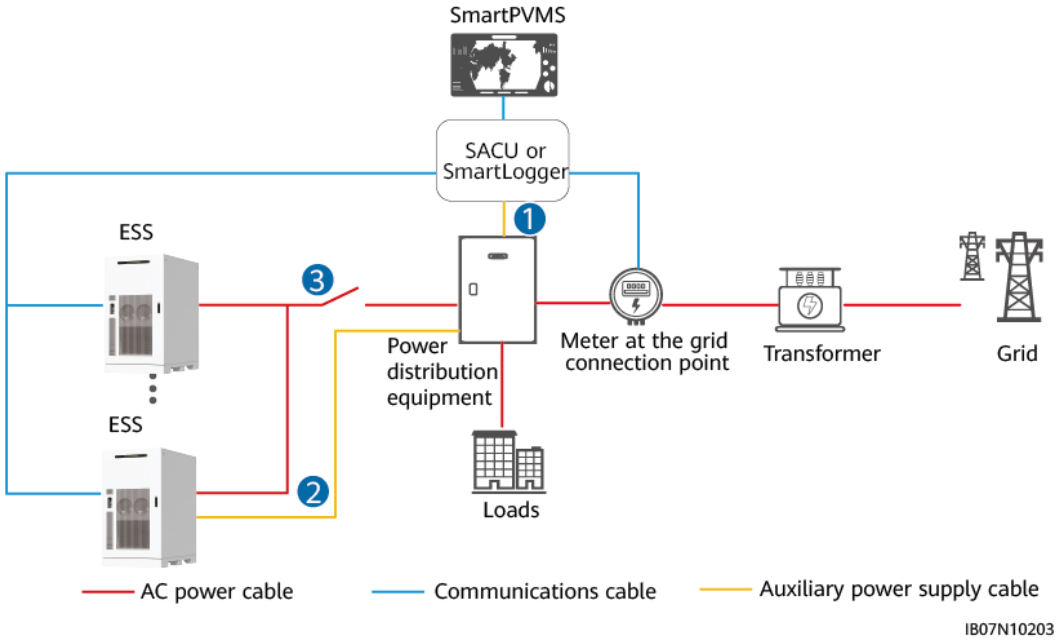


Table 4-1 Power-on process description of the on-grid ESS-only system

Step	Task	Power-On Operation
1	Powering on the SACU or SmartLogger auxiliary power supply	1. Turn on the SACU or SmartLogger power switch on the power distribution equipment side. 2. Turn on the switch on the SACU or SmartLogger side.
2	Powering on the ESS auxiliary power supply (for LTMS and other devices)	1. Turn on the auxiliary power switch of the power distribution equipment. 2. Turn on the RCCB on the RCM. 3. Check that the AC voltages of the mains input terminals (MAINS), UPS input terminals (UPS), and PCS input terminals in sequence are within the normal ranges using a multimeter. 4. Turn on the mains AC input switch QF1 on the RCM. 5. (Optional) Turn on the UPS AC input switch QF2 on the RCM. Perform this operation when a UPS is configured. 6. (Optional) Turn on the disconnector on the RCM. This operation is required when a disconnector is configured. 7. (Optional) Turn on the ESS power switch on the UPS side. This operation is required when a UPS is configured.
3	Powering on the ESS AC side	1. Turn on the general power distribution switch of the power distribution equipment. 2. Turn on the AC switch between the ESS and the power distribution equipment.
Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.		

4.2 On-Grid PV+ESS System

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

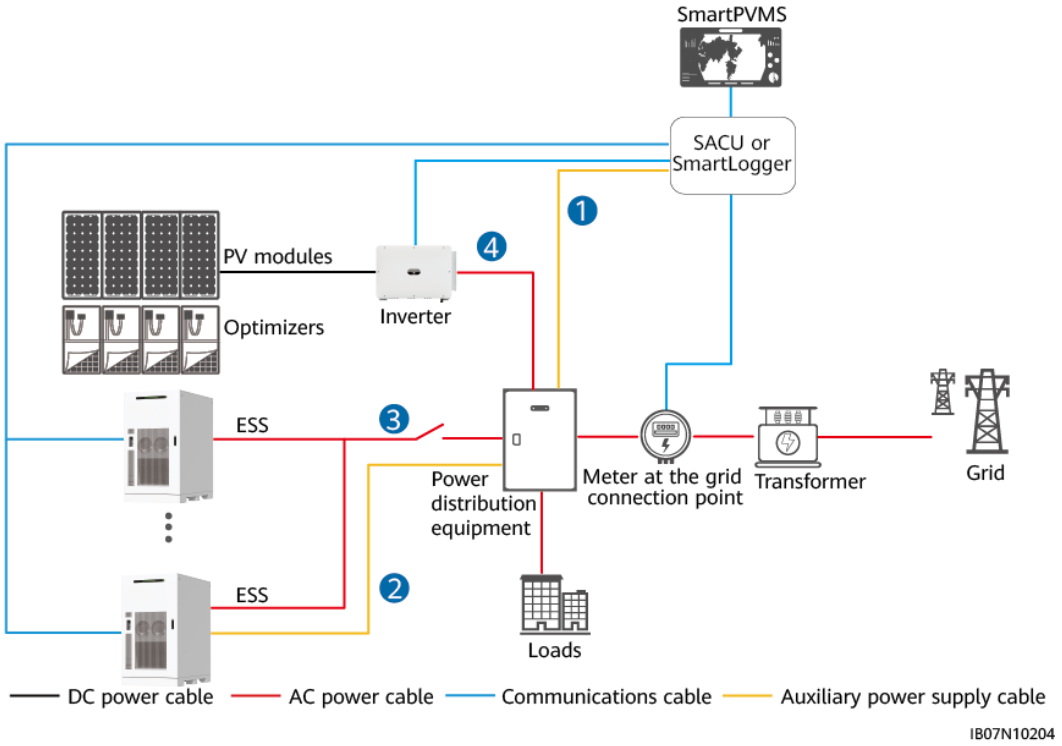


Table 4-2 Power-on process description of the on-grid PV+ESS system

Step	Task	Power-On Operation
1	Powering on the SACU or SmartLogger auxiliary power supply	1. Turn on the SACU or SmartLogger power switch on the power distribution equipment side. 2. Turn on the switch on the SACU or SmartLogger side.

Step	Task	Power-On Operation
2	Powering on the ESS auxiliary power supply (for LTMS and other devices)	1. Turn on the auxiliary power switch of the power distribution equipment. 2. Turn on the RCCB on the RCM. 3. Check that the AC voltages of the mains input terminals (MAINS), UPS input terminals (UPS), and PCS input terminals in sequence are within the normal ranges using a multimeter. 4. Turn on the mains AC input switch QF1 on the RCM. 5. (Optional) Turn on the UPS AC input switch QF2 on the RCM. Perform this operation when a UPS is configured. 6. (Optional) Turn on the disconnector on the RCM. This operation is required when a disconnector is configured. 7. (Optional) Turn on the ESS power switch on the UPS side. This operation is required when a UPS is configured.
3	Powering on the ESS AC side	1. Turn on the general power distribution switch of the power distribution equipment. 2. Turn on the AC switch between the ESS and the power distribution equipment.
4	Powering on the inverter	**Select a power-on method based on the inverter model.** **Method 1:** 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. **Method 2:** 1. Set the DC SWITCH 1 (MAIN SWITCH) to ON. When you hear a click, the switch is completely turned on. 2. Check the status of the PV connection indicator. If it is steady green, set DC SWITCH 2 and DC SWITCH 3 to ON. 3. Check that other indicators are not steady red.
Note: For details about the switch layout and operations of the devices prepared by the customer, see the documents provided by the vendors.		

5 System Commissioning (Web)

CAUTION

During the power-on procedure, monitor the system for faults. If you detect any faults, power off the ESS, rectify the faults, and then continue with the procedure.

5.1 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**.

5.2 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

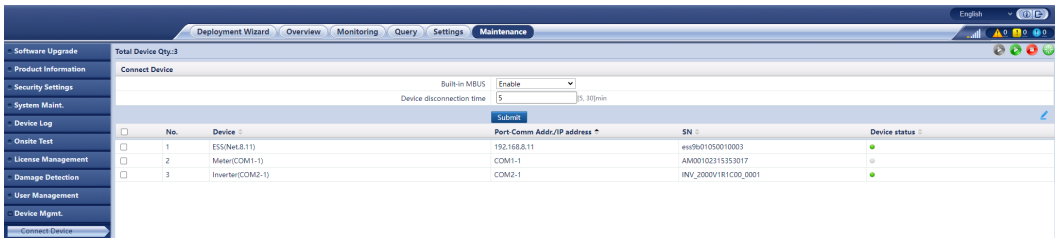
   Contact the device vendor or its authorized supervision service provider to apply for a startup authorization code through the Power Partner app.

   - 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 5-1 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. During initial connection, **Device status** of the ESS is green.

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 5**. 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 Choose **Monitoring** > **ESS** > **Running Param.** > **Grid Parameters**, and set **Output mode** based on the earthing system.

Earthing System	Description
TN-S	Select **Three-phase four-wire**.
TN-C	
TN-C-S	
TT	
IT	Select **Three-phase three-wire**.

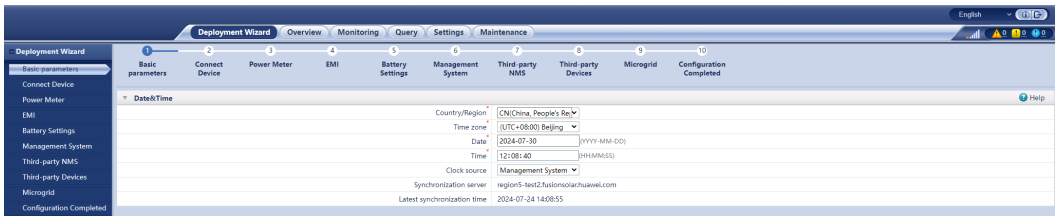
Step 5 Clear alarms.

----End

5.3 Commissioning Using the Deployment Wizard

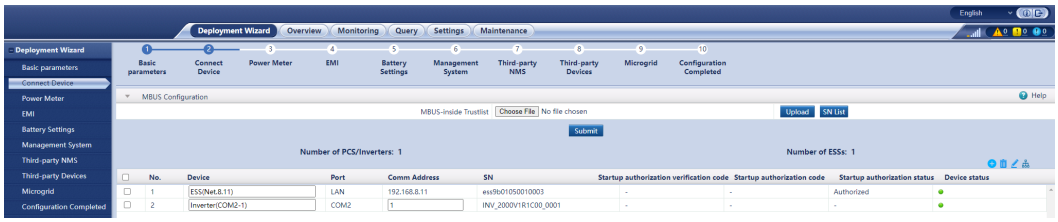
Step 1 Set basic parameters.

Figure 5-2 Setting basic parameters



Step 2 Click **Search for Device** to check the cable connections and allocate addresses.

Figure 5-3 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**, cable connections (DC and AC) will be checked before device search (not applicable to third-party devices), and device addresses will be automatically allocated.
- After the cable connection check and device search are complete, if a cable connection alarm is generated, you can click the alarm icon to view the corresponding alarm information.
- If an alarm is generated when the cable connection check fails, click the alarm icon to view the alarm cause and handling suggestions. After the fault is rectified, click **Search for Device** again to check the cable connections.
- If the SmartLogger in the array connects to the inverter and the quantity of ESSs changes, click **Search for Device** again.

Step 3 After searching for devices, set the **Microgrid compatibility**, **Grid connection state**, and **Grid Code** based on the site requirements.

Table 5-1 Parameter settings after device search

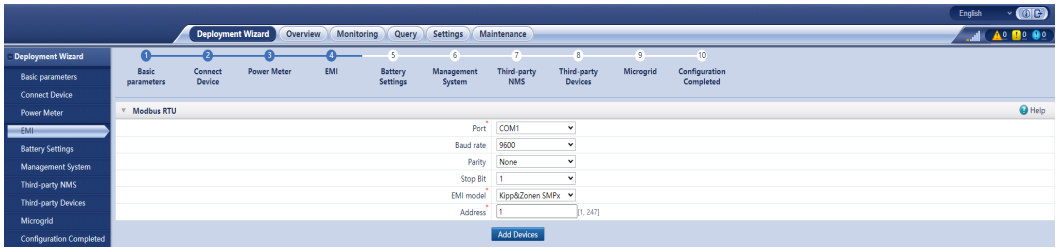
Parameter	Description
Scenario under **Arrays Operation Scenario**	Set this parameter to **On-grid**.
Grid Code	Set the ESS and inverter grid code of the country or region where the devices are used.
Working mode under **Parameter Configuration**	This parameter needs to be set only for the ESS. Set this parameter to **PQ**.

Parameter	Description
Microgrid compatibility under **Parameter Configuration**	This parameter needs to be set only for the inverter. Set this parameter to **Disable**.
Active Power Baseline (kW) under **Parameter Configuration**	Set the ESS rated power to **108**.
Apparent Power Baseline (kVA) under **Parameter Configuration**	You are advised to retain the default value.

Step 4 (Optional) Connect to the meter. For details about how to connect cables to the meter at the grid connection point and set parameters, see **A Meter Cable Connection and Parameter Settings**.

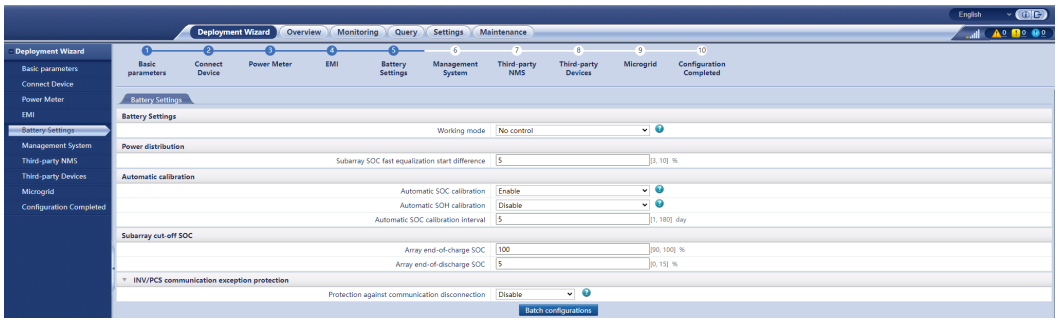
Step 5 (Optional) Connect to environment monitoring instruments (EMIs).

Figure 5-4 Connecting to EMIs



Step 6 Set parameters for battery settings.

Figure 5-5 Battery settings



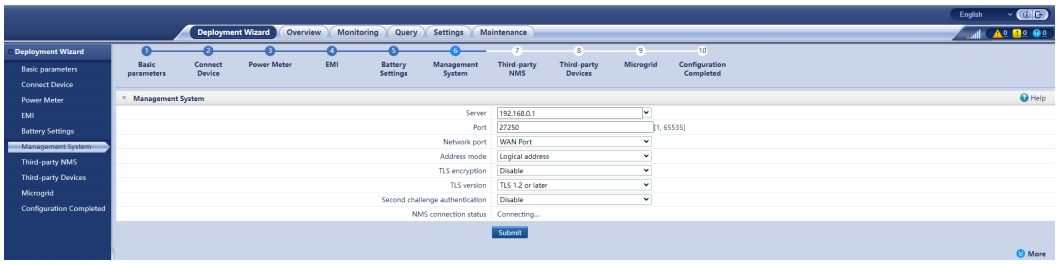
Parameter	Description
Working mode	Select a working mode based on the actual application scenario. For details, see **5.4.1 Working Mode**.

Parameter	Description
Automatic SOC calibration	• If this parameter is set to **Disable**, automatic charge and discharge calibration is disabled for battery racks. • If this parameter is set to **Enable**, automatic charge and discharge calibration is enabled for battery racks. The ESS periodically calibrates the SOC rack by rack. During calibration, the end-of-charge SOC and end-of-discharge SOC settings will be ineffective and the response of the charge and discharge power may be impacted temporarily. – On-grid scenario: Automatic charge calibration is allowed for battery racks. – Off-grid scenario: Automatic discharge calibration is allowed for battery racks.
Automatic SOH calibration	• 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	Set the SOC threshold for stopping array charging. The default value is 100%. The default value is recommended. Set this parameter as required.
Array end-of-discharge SOC	Set the SOC threshold for stopping array discharging. The default value is 5%. The default value is recommended. Set this parameter as required.

Step 7 Connect to a Huawei network management system (NMS).

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

Figure 5-6 Connecting to a Huawei NMS



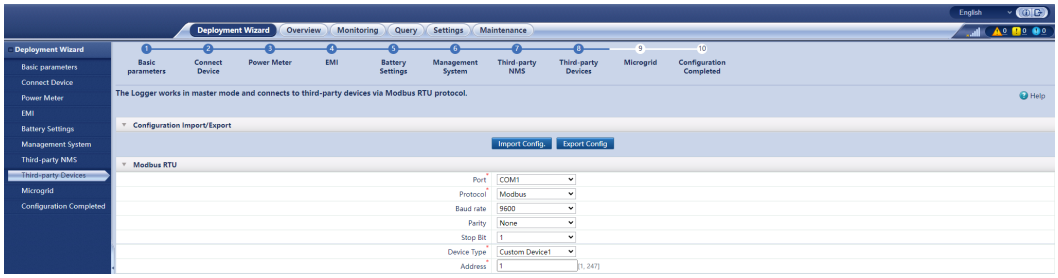
Step 8 Connect to a third-party network management system (NMS).

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

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

Step 9 Connect to third-party devices. Skip this step if third-party devices are not involved.

Figure 5-7 Connecting to third-party devices



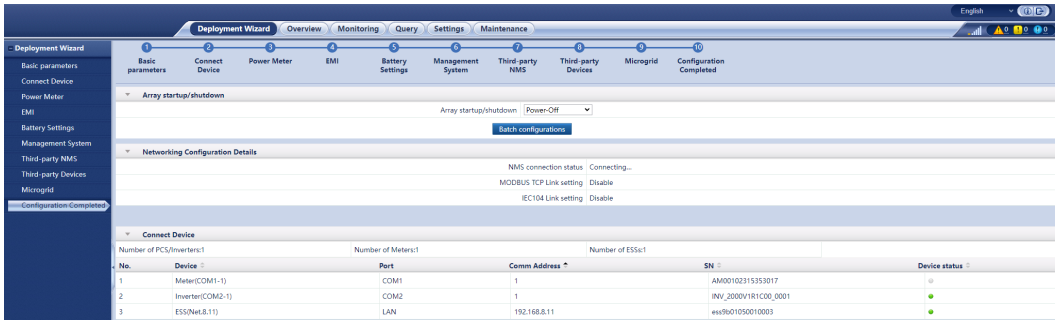
Step 10 Set microgrid parameters. Skip this step because microgrid parameters are not involved.

Step 11 Click **Finish**.

NOTICE

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

Figure 5-8 Completing the configuration



----End

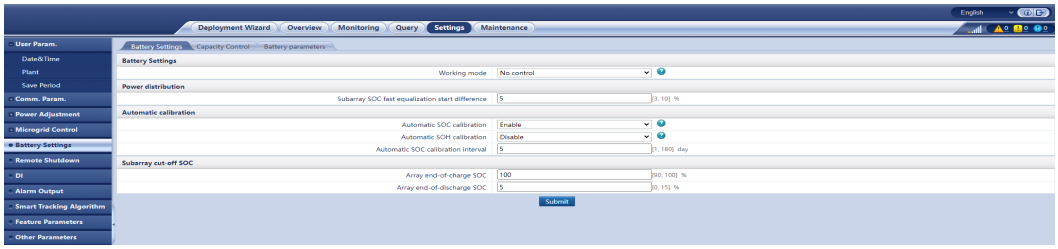
5.4 Battery Commissioning

5.4.1 Working Mode

The on-grid ESS has the following battery control working modes: no control, maximum self-consumption, TOU, TOU (fixed power), and charge/discharge based on grid dispatch.

Choose **Settings** > **Battery Settings** > **Battery Settings** and set parameters such as the working mode.

Figure 5-9 Working mode



No Control

The SmartLogger directly delivers the external scheduling power limit. No other power scheduling control is performed. The power is automatically controlled by the device.

Maximum Self-Consumption

- This mode applies to PV+ESS systems in scenarios where the PV-to-ESS ratio is high, the PV power generated is adequate for loads, the electricity price is high, and the feed-in-tariff (FIT) subsidy is low or unavailable.
- PV power is preferentially supplied to loads, and the surplus PV power is used to charge the ESS. If the ESS is fully charged or being charged at full power, the surplus PV power is fed to the power grid. The grid cannot charge the ESS but can supply power to loads.
  - PV energy supply priority: load > ESS > power grid
  - Load power consumption priority: PV > ESS > power grid
- Example of maximum self-consumption (ESS capacity: 800 kWh/400 kW)

Figure 5-10 Example of maximum self-consumption

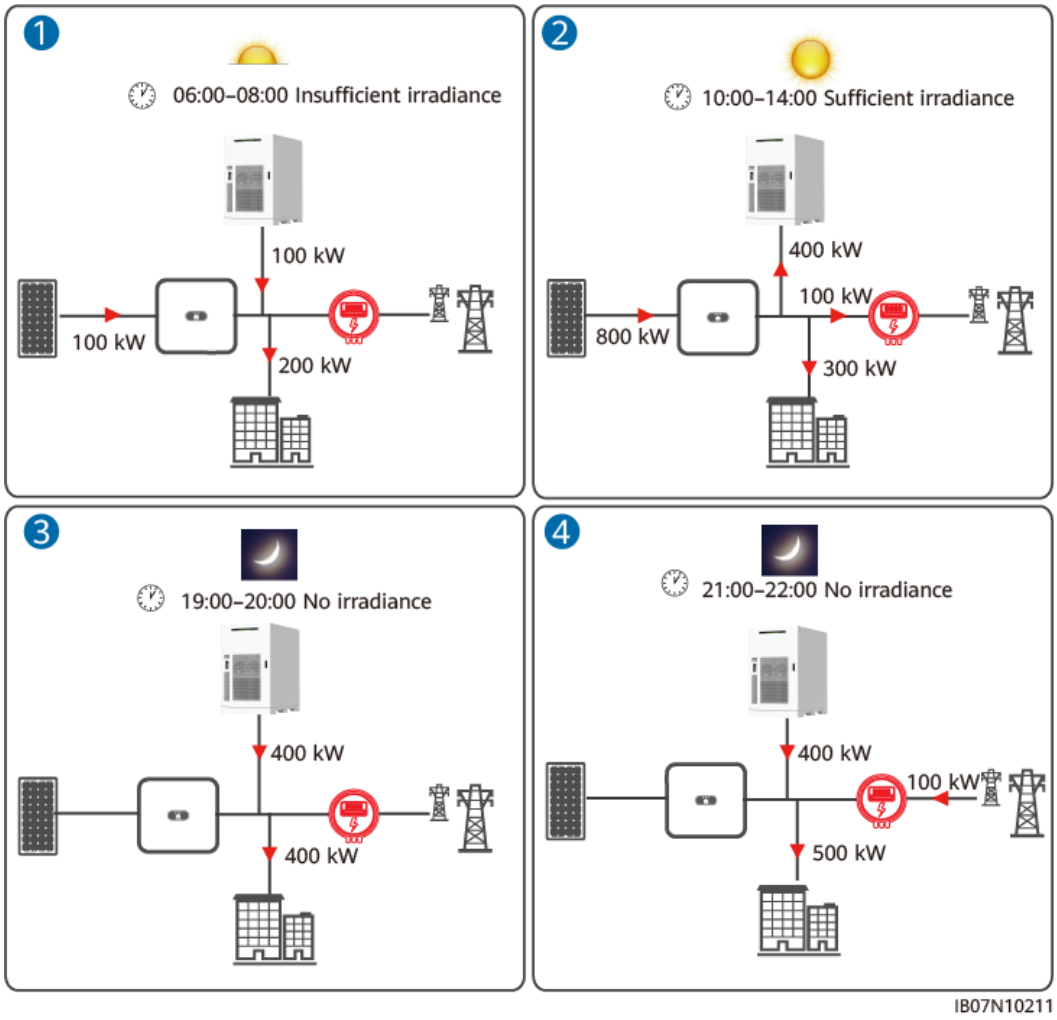


Table 5-2 Running parameters for maximum self-consumption

Parameter	Description
Working mode	Set this parameter to **Maximum self-consumption**.
Active power threshold of grid during battery discharge	Set the grid power threshold at the grid connection point for loads when the load power is greater than the PV power. When the power purchased from the grid exceeds the preset threshold, the ESS starts discharging. The default value is 0. For example, if this parameter is set to 50 W and the load power is 40 W, 40 W power is purchased from the grid and the ESS does not discharge. If the load power is 100 W, 50 W power is purchased from the grid, and the ESS discharge power is 50 W.

Parameter	Description
Adjustment deadband	Set the precision of the grid power at the grid connection point. This parameter affects the power value range at the grid connection point. If the actual grid power threshold at the grid connection point is within this range, i.e. [Active power threshold of grid during battery discharge – Adjustment deadband, Active power threshold of grid during battery discharge + Adjustment deadband], the grid power requirement at the grid connection point is met.
Adaptive adjustment parameters	Set the adjustment period and step parameters for raising the inverter power. You are advised to set this parameter to **Enable**. ● **Enable**: The adjustment period and step set in the SmartLogger are used. Generally, the adjustment period and step are calculated based on the number of devices connected to the port and device specifications. ● **Disable**: Use this value based on site requirements.
Adjustment period	This parameter is displayed after **Adaptive adjustment parameters** is set to **Disable**. You can set this parameter based on site requirements. In this case, battery control is performed based on the preset period.
PV adjustment step	This parameter is displayed after **Adaptive adjustment parameters** is set to **Disable**. You can set this parameter based on site requirements. In this case, the PV rise step for PV+ESS equalization is the preset value.
Difference threshold for starting array SOC rapid equilibrium	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. The default value is 5%.

TOU

- This mode applies to PV+ESS or ESS-only systems in scenarios where the price difference is large between peak and off-peak hours and power meters are used. During off-peak hours, the grid supplies power to charge the ESS. During peak hours, the ESS discharges to supply power to loads.
- In this mode, at least one charge or discharge period for the ESS needs to be set. For example, if you set the low electricity price period at night as the charge period, the system charges the ESS at the maximum power during this period. If you set the high electricity price period as the discharge period, the ESS can discharge energy only during the discharge period based on the actual load power, reducing electricity costs.
- In some countries, the grid is not allowed to charge the ESS. In this case, this mode cannot be used.
- Example of TOU (ESS capacity: 800 kWh/400 kW; **Preferred use of surplus PV power** is set to **Charge**)

Figure 5-11 Example of TOU

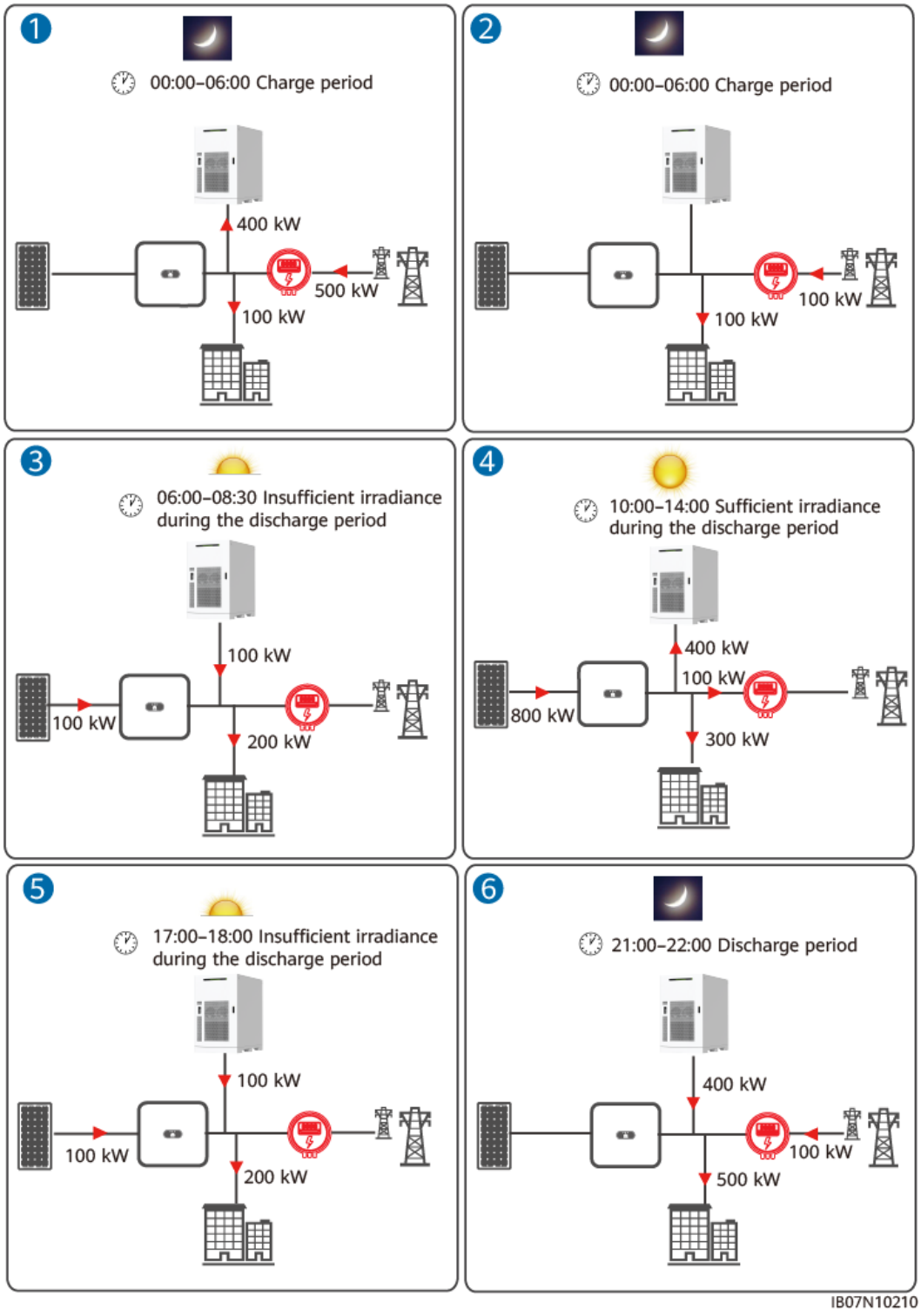


Table 5-3 Running parameters for TOU

Parameter	Description
Working mode	Set this parameter to **TOU**.

Parameter	Description
Preferred use of surplus PV power	• **Charge**: When the PV power is greater than the load power, the surplus PV power is preferentially used to charge the ESS. If the ESS is fully charged or being charged at full power, the surplus PV power is fed to the power grid. This mode is a combination of TOU and maximum self-consumption. • **Fed to grid**: When the PV power is greater than the load power, the surplus PV power is preferentially fed to the power grid. If the surplus PV power reaches the maximum power for charging batteries from the grid, the surplus PV power is used to charge the ESS. This setting is applicable to the scenario where the FIT is higher than the electricity purchase price and the grid cannot charge the ESS.
Maximum power for charging batteries from grid	Maximum charge power allowed by the grid. The value is determined by the local grid company. If there is no requirement, the value is the maximum charge power of the ESS by default.
Active power threshold of grid during battery discharge	Set the grid power threshold at the grid connection point for loads when the load power is greater than the PV power. When the power purchased from the grid exceeds the preset threshold, the ESS starts discharging. The default value is 0. For example, if this parameter is set to 50 W and the load power is 40 W, 40 W power is purchased from the grid and the ESS does not discharge. If the load power is 100 W, 50 W power is purchased from the grid, and the ESS discharge power is 50 W.
Adjustment deadband	Set the precision of the grid power at the grid connection point. This parameter affects the power value range at the grid connection point. If the actual grid power threshold at the grid connection point is within this range, i.e. [Active power threshold of grid during battery discharge – Adjustment deadband, Active power threshold of grid during battery discharge + Adjustment deadband], the grid power requirement at the grid connection point is met.
Adaptive adjustment parameters	Set the adjustment period and step parameters for raising the inverter power. You are advised to set this parameter to **Enable**. • **Enable**: The adjustment period and step set in the SmartLogger are used. Generally, the adjustment period and step are calculated based on the number of devices connected to the port and device specifications. • **Disable**: Use this value based on site requirements.

Parameter	Description
Adjustment period	This parameter is displayed after **Adaptive adjustment parameters** is set to **Disable**. You can set this parameter based on site requirements. In this case, battery control is performed based on the preset period.
PV adjustment step	This parameter is displayed after **Adaptive adjustment parameters** is set to **Disable**. You can set this parameter based on site requirements. In this case, the PV rise step for PV+ESS equalization is the preset value.
Difference threshold for starting array SOC rapid equilibrium	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. The default value is 5%.
Start time	Set the start time and end time of charge and discharge. A maximum of 14 time segments can be set. You can set a weekly cycle by clicking the buttons corresponding to **Mon.** through **Sun.** in the **Repeat** box. The buttons are blue by default, indicating being selected. After you click it, the button turns gray.
End time	
Charge/Discharge	
Repeat	

Table 5-4 Charge/Discharge time window

Charge/ Discharge Time Window	Charge Preference	Fed to Grid
Discharge time window	The ESS can discharge power. When the PV power is greater than the load power, the ESS can be charged with the PV power but cannot be charged from the power grid. When the PV power is lower than the load power, the ESS can discharge power to loads but cannot feed power to the power grid. ● PV energy supply priority: load > ESS > power grid ● Load power consumption priority: PV > ESS > power grid	The ESS can discharge power. When the PV power is greater than the load power, the surplus PV power is fed to the power grid. If the surplus PV power cannot be fully fed to the power grid due to feed-in power limit, the ESS can be charged with the surplus PV power but cannot be charged from the power grid. When the PV power is lower than the load power, the ESS can discharge power to loads but cannot feed power to the power grid. ● PV energy supply priority: load > power grid > ESS ● Load power consumption priority: PV > ESS > power grid
Charge time window	The ESS can be charged but cannot discharge. The PV power is preferentially charged to the ESS. If the PV power is insufficient, the ESS is charged from the power grid. ● PV energy supply priority: ESS > load > power grid ● Load power consumption priority: PV > power grid	The ESS can be charged but cannot discharge. The PV power is preferentially charged to the ESS. If the PV power is insufficient, the ESS is charged from the power grid. ● PV energy supply priority: ESS > load > power grid ● Load power consumption priority: PV > power grid
Non-charge/ discharge time window	The ESS cannot discharge or be charged from the power grid. However, when the PV power is greater than the load power, the surplus PV power can be charged to the ESS. ● PV energy supply priority: load > ESS > power grid ● Load power consumption priority: PV > power grid	The ESS cannot discharge or be charged from the power grid. However, when the PV power is greater than the load power, the surplus PV power can be charged to the ESS. ● PV energy supply priority: load > power grid > ESS ● Load power consumption priority: PV > power grid

TOU (Fixed Power)

- This mode applies to PV+ESS or ESS-only systems in scenarios where the price difference is large between peak and off-peak hours and no power meters are used. During off-peak hours, the grid supplies power to charge the ESS. During peak hours, the ESS discharges to supply power to loads.
- In this mode, at least one charge or discharge period for the ESS needs to be set. For example, if you set the low electricity price period at night as the charge period, the system charges the ESS at the fixed power during this period. If you set the high electricity price period as the discharge period, the ESS can discharge energy only during the discharge period at the fixed power, reducing electricity costs.
- In some countries, the grid is not allowed to charge the ESS. In this case, this mode cannot be used.

Table 5-5 Running parameters for TOU (fixed power)

Parameter	Description
Working mode	Set this parameter to **TOU (fixed power)**.
Difference threshold for starting array SOC rapid equilibrium	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. The default value is 5%.
Start time	Set the start time and end time of charge and discharge. A maximum of 14 time segments can be set. You can set a weekly cycle by clicking the buttons corresponding to **Mon.** through **Sun.** in the **Repeat** box. The buttons are blue by default, indicating being selected. After you click it, the button turns gray. • Discharge time window: The ESS is discharged at the fixed power. • Charge time window: The ESS is charged at the fixed power. • Non-charge/discharge time window: The ESS cannot be charged or discharge power.
End time	
Charge/Discharge	
Repeat	

Charge/Discharge based on Grid Dispatch

- This mode applies to scenarios where the northbound controller delivers active power scheduling instructions.
- The purpose of scheduled discharge is to meet the active power scheduling target value at the grid connection point. PV energy is preferred. If the generated PV energy is insufficient, the ESS discharges energy and the energy is fed to the grid based on the active power scheduling target value. If the generated PV energy is sufficient, the energy is fed to the grid based on the active power scheduling target value, and the surplus PV energy is used to charge the ESS.

- The purpose of scheduled charge is to meet the active power scheduling target value at the grid connection point. If the ESS charge power is insufficient or the Smart PCS limits the power, the grid charges the ESS with the maximum capability. If the ESS is not fully charged when the scheduling target value is met, the PV energy is used to charge the ESS.

Table 5-6 Running parameters in each battery control working mode

Parameter	Description
Working mode	Set this parameter to **Charge/Discharge based on grid dispatch**.
Adaptive adjustment parameters	Set the adjustment period and step parameters for raising the inverter power. • **Enable**: The adjustment period and step set in the SmartLogger are used. Generally, the adjustment period and step are calculated based on the number of devices connected to the port and device specifications. • **Disable**: Use this value based on site requirements.
Adjustment period	This parameter is displayed after **Adaptive adjustment parameters** is set to **Disable**. You can set this parameter based on site requirements. In this case, battery control is performed based on the preset period.
PV adjustment step	This parameter is displayed after **Adaptive adjustment parameters** is set to **Disable**. You can set this parameter based on site requirements. In this case, the PV rise step for PV+ESS equalization is the preset value.
Array end-of-charge/ discharge SOC derating	The default value is **Disable**. The default value is recommended. Set this parameter as required. After array end-of-charge/discharge SOC power derating is enabled, the SmartLogger performs derating based on the preset gradient to prevent abrupt power change of the array at the end-of-charge/discharge SOC.
Difference threshold for starting array SOC rapid equilibrium	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. The default value is 5%.
Control charge/ discharge time window	The default value is **Disable**. The default value is recommended. Set this parameter as required. You can set the time segment for charge forbidden, discharge forbidden, charge, and discharge only after **Control charge/discharge time window** is set to **Enable**.

Parameter	Description
Start time	Set the start time, end time, and power of charge forbidden, discharge forbidden, charge, and discharge. A maximum of 14 time segments can be set. You can set a weekly cycle by clicking the buttons corresponding to **Mon.** through **Sun.** in the **Repeat** box. The buttons are blue by default, indicating being selected. After you click it, the button turns gray.
End time	
Charge/Discharge	
Charge/Discharge power (kW)	
Repeat	

5.4.2 Capacity Control

Context

- **Peak shaving** limits the maximum peak power at the grid connection point. In some areas, electricity fees consist of both volumetric charge and demand charge. The **Peak shaving** function allows you to lower the peak demand purchased from the grid during peak hours, reducing electricity fees. **Peak shaving** applies to areas where demand charges are collected. The peak shaving function allows you to lower the peak power purchased from the grid in **Maximum self-consumption** or **TOU** mode during peak hours, reducing electricity fees.
- **Power boost limit** is designed to limit the maximum peak current at the grid connection point. By doing so, it ensures that the electric current purchased from or sold to the grid does not exceed the maximum peak current at the grid connection point. This control is essential because if the electric current exceeds the maximum peak current, it may trigger the system's overcurrent protection mechanism, potentially causing the transformer to trip.

NOTICE

The **Power boost limit** function is unavailable during the SmartLogger and ESS upgrade. After the upgrade is complete, this function will be automatically restored.

Procedure

Choose **Settings** > **Battery Settings** > **Capacity Control** and set related parameters.

Table 5-7 Capacity control parameters

Parameter	Description
Peak shaving	• **No control**: The peak shaving function is disabled. • **Active power limit**: The active power purchased from the grid cannot exceed the preset capacity limit. • **Apparent power limit**: The apparent power purchased from the grid cannot exceed the preset capacity limit.
Power boost limit	• **No control**: The power boost limit function is disabled. • **Current Limit**: The current of electricity purchased from or sold to the grid cannot exceed the preset current limit.
Maximum Peak Current	This parameter is displayed when **Power boost limit** is set to **Current Limit**. Specifies the maximum peak current at the grid connection point. The default value is 30000 A. Set this parameter based on the maximum peak current for power purchase or sales at the grid connection point.
Backup power SOC for capacity control	Specifies the backup power SOC for capacity control. The value of this parameter affects the peak shaving capability. A larger value indicates stronger peak shaving capability.
PV power limit when power meter fails	Specifies the active power limit of the inverter when the export+import meter communication is abnormal. You can manually change the active power percentage of the inverter as required.
PCS power limit when power meter fails	Specifies the active power limit of the PCS when the export+import meter communication is abnormal. You can manually change the active power percentage of the PCS as required.
Start time	• Set the peak power range based on the start time and end time. The peak power is configured based on electricity prices in different time segments. You are advised to set the peak power to a low value when the electricity price is high. • A maximum of 14 time segments can be set.
End time	
Maximum Power	

5.4.3 Multi-mode Overlay

Multi-mode overlay is a combination of multiple on-grid scheduling policies.

Combination 1: Maximum Self-Consumption + Capacity Control

Step 1 Choose **Settings** > **Battery Settings** > **Battery Settings** and set **Working mode** to **Maximum self-consumption**. For details about how to set other parameters, see **Maximum Self-Consumption**.

Step 2 Choose **Settings** > **Battery Settings** > **Capacity Control** and set the parameters by referring to **5.4.2 Capacity Control**.

----End

Combination 2: TOU + Maximum Self-Consumption

Step 1 Choose **Settings** > **Battery Settings** > **Battery Settings** and set **Working mode** to **TOU**.

Step 2 Set **Preferred use of surplus PV power** to **Charge**. For details about how to set other parameters, see **TOU**.

----End

Combination 3: TOU + Maximum Self-Consumption + Capacity Control

Step 1 Choose **Settings** > **Battery Settings** > **Battery Settings** and set **Working mode** to **TOU**.

Step 2 Set **Preferred use of surplus PV power** to **Charge**. For details about how to set other parameters, see **TOU**.

Step 3 Choose **Settings** > **Battery Settings** > **Capacity Control** and set the parameters by referring to **5.4.2 Capacity Control**.

----End

Combination 4: TOU + Capacity Control

Step 1 Choose **Settings** > **Battery Settings** > **Battery Settings** and set **Working mode** to **TOU**.

Step 2 Set **Preferred use of surplus PV power** to **Fed to grid**. For details about how to set other parameters, see **TOU**.

Step 3 Choose **Settings** > **Battery Settings** > **Capacity Control** and set the parameters by referring to **5.4.2 Capacity Control**.

----End

6 System Commissioning (App)

For details about how to commission the system (app), see **FusionSolar App Quick Guide (SmartLogger)**.

7 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 or FusionSolar app 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** and **Active power** to verify that the shutdown is successful. Skip this step for an ESS-only system.
3. Choose **Monitoring** > **ESS** > **Running Info.** Check **Rated power** and **Total output voltage of rectifiers** to verify that the shutdown is successful.

Step 2 Power off the devices: Turn off the main power switches and then the auxiliary power switches of the devices by referring to the operations of **4 System Power-On** in the reverse order.

DANGER

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

NOTE

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

----End

A Meter Cable Connection and Parameter Settings

Meter Cable Connection Position

The meter at the grid connection point must be connected to the metering point where the customer purchases electricity.

Figure A-1 Example of the correct cable connection position

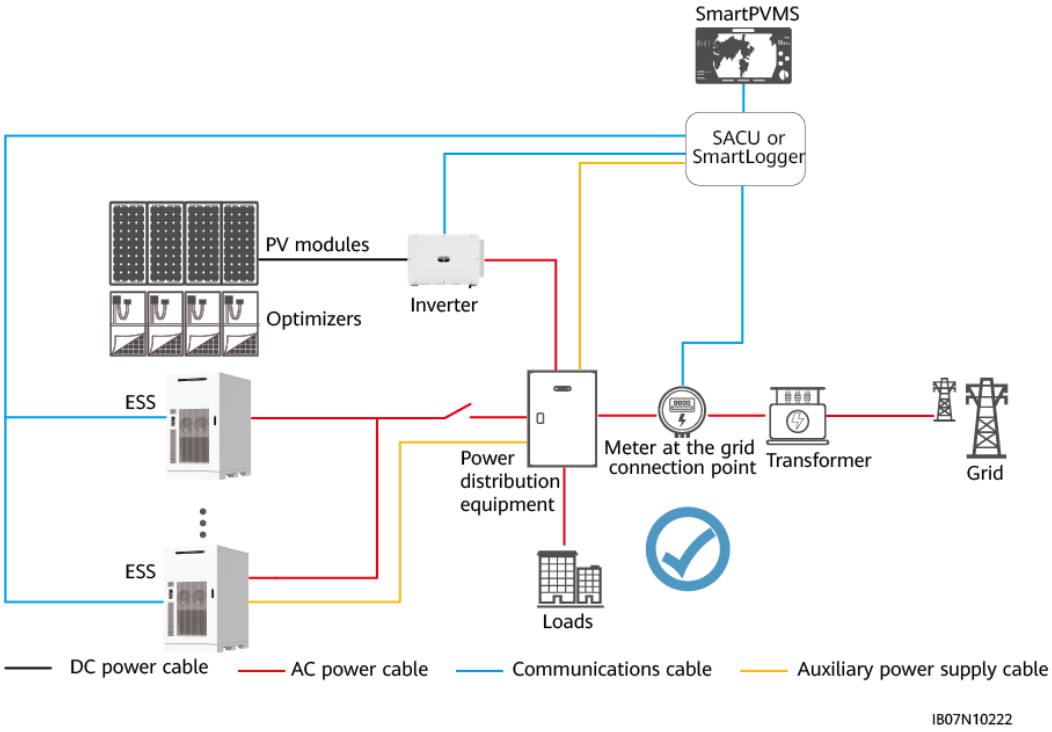
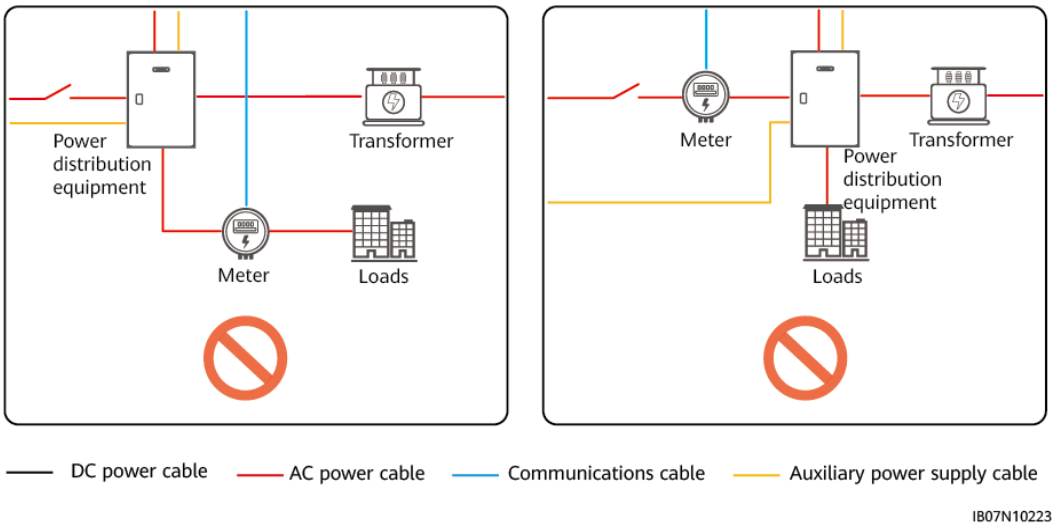


Figure A-2 Examples of incorrect cable connection positions



Meter Cable Connection Description

NOTICE

Cables must be connected to the meter in correct polarities. If the cables are reversely connected, power off the meter, rectify the physical cable connection, and then set **Meter access direction** to **Positive**.

When the meter is connected correctly, the power flows from the grid to the load. For details about correct meter connection, see **Figure A-3** and **Figure A-4**.

Figure A-3 Example 1 of correct meter connection

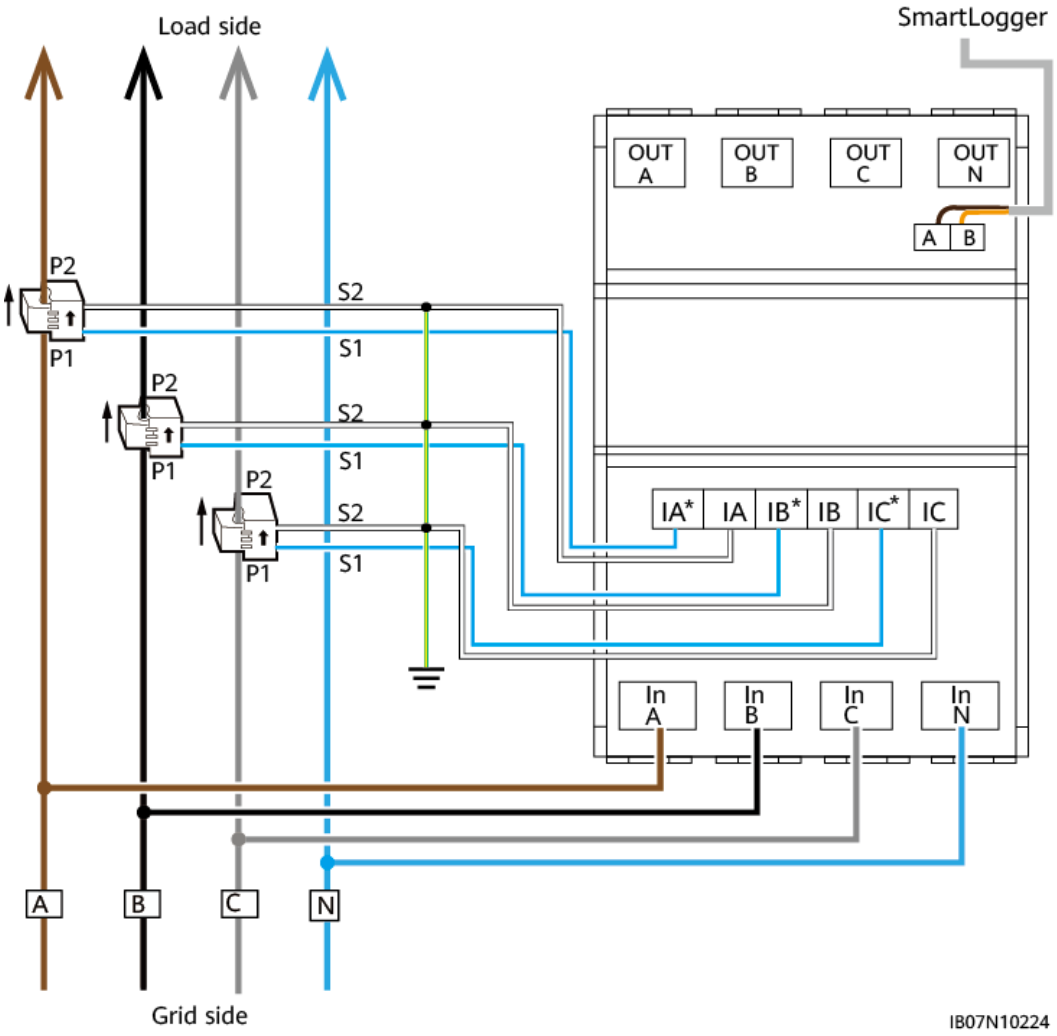
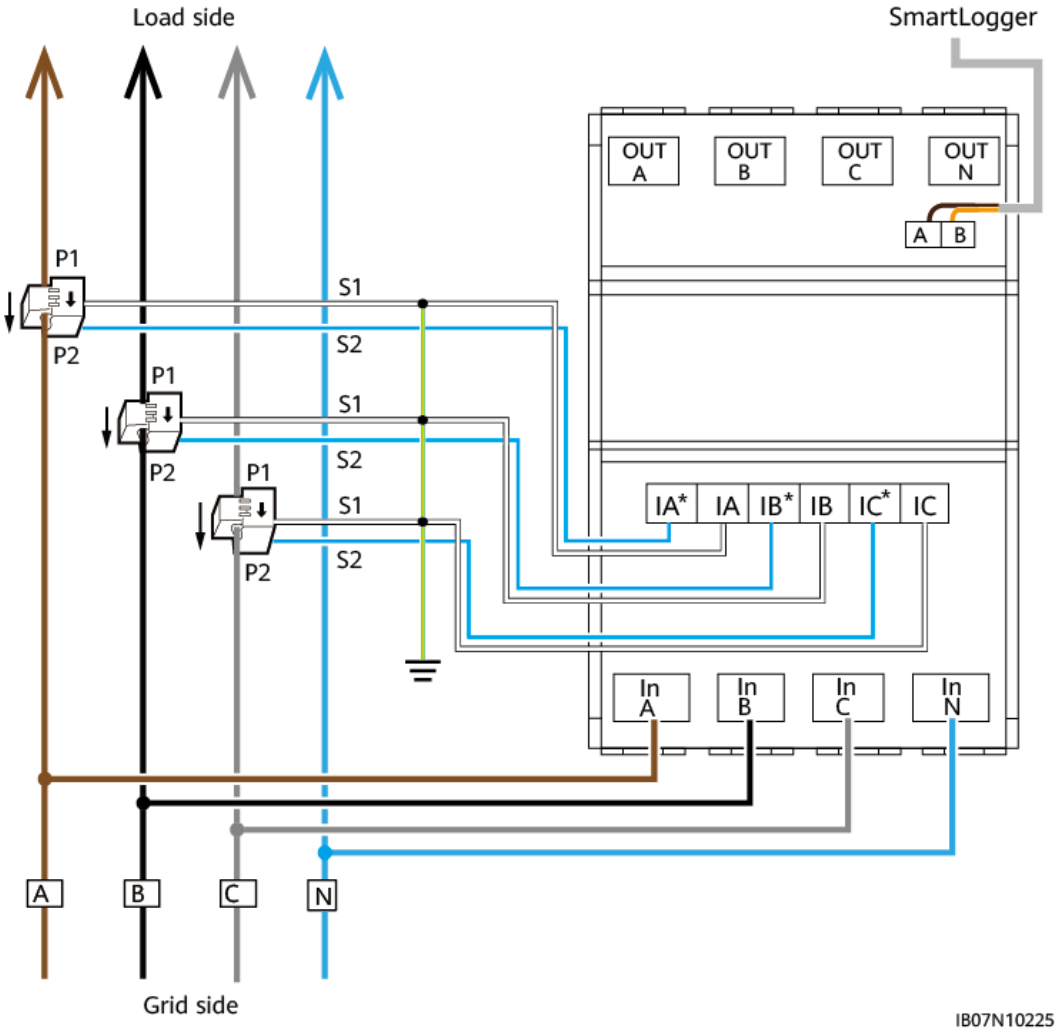
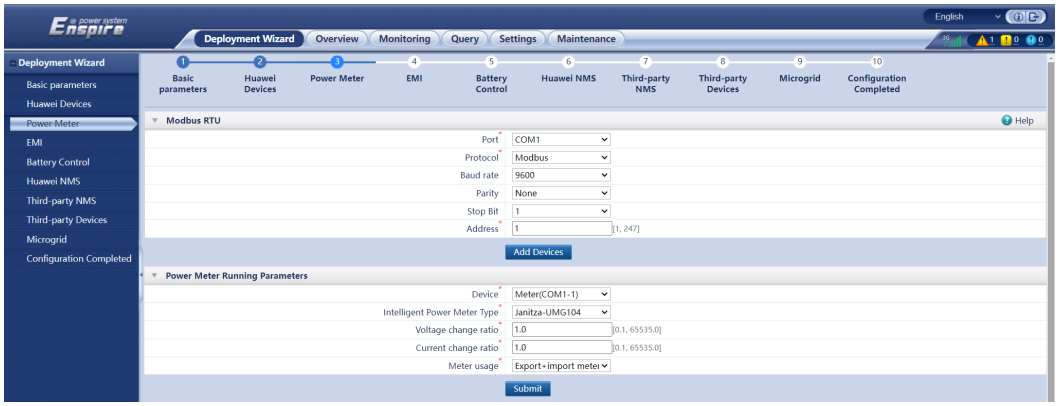


Figure A-4 Example 2 of correct meter connection



Meter Parameter Settings

Step 1 Connect to the meter. Choose **Deployment Wizard** > **Power Meter**.



1. After setting meter access parameters, click **Add Devices**.

Parameter	Description
Port	Set this parameter based on the COM port connected to the meter.
Protocol	Set this parameter to **Modbus-RTU**.

2. Set running parameters for the meter.

Parameter	Description
Device	**Meter**
Intelligent Power Meter Type	– If the power meter model is DTSU666-HW, select **DTSU666-HW**. – If the power meter model is YDS60-80, select **YADA-YDS60-80**.
Voltage change ratio Current change ratio	– 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: ▪ Scenario 1: When the voltage of the grid connection point is 400 V, the power meter must be connected to a current transformer (CT), and the CT ratio is 400:5. ○ 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 potential transformer (PT). The CT ratio is 400:5, and the PT ratio is 10000:100. ○ Set **Voltage change ratio** of the power meter to 100. ○ Set **Current change ratio** of the power meter to 80. **NOTE** – 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.
Meter usage	**Export+import meter**: used for grid connection point control.

Step 2 Choose **Monitoring > Meter > Running Param.**, set **Meter access direction**, and click **Submit**.

Parameter	Description
Meter access direction	Set this parameter to **Positive**. **NOTICE** Cables must be connected to the meter in correct polarities. If the cables are reversely connected, power off the meter, rectify the physical cable connection, and then set **Meter access direction** to **Positive**.

Step 3 (Optional) Set **Electric meter power direction** only when **Active Power Control** uses export limitation.

1. Choose **Settings** > **Power Adjustment** > **Active Power Control**.
2. Set **Active power control mode** to **Export Limitation(kW)**.
3. Set **Electric meter power direction** to **Positive**.

Step 4 (Optional) Set **Electric meter power direction** only when **Reactive Power Control** uses **Power factor closed-loop control**.

1. Choose **Settings** > **Power Adjustment** > **Reactive Power Control**.
2. Set **Reactive power control mode** to **Power factor closed-loop control**.
3. Set **Electric meter power direction** to **Positive**.

----End

B Reference Documents

Device	Document
ESS	**LUNA2000-(215-2S10, 215-2S12) Smart String ESS User Manual**
Inverter	• **SUN2000-(20KTL, 29.9KTL, 30KTL, 36KTL, 40KTL)-M3 User Manual** • **SUN2000-(20KTL, 29.9KTL, 30KTL, 36KTL, 40KTL)-M3 Quick Guide** • **SUN2000-(50KTL-ZHM3, 50KTL-M3) User Manual** • **SUN2000-(50KTL-ZHM3, 50KTL-M3) Quick Guide** • **SUN2000-(50KTL, 60KTL, 65KTL)-M0 Quick Guide** • **SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) Series User Manual** • **SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) Series Quick Guide** • **SUN2000-(100KTL, 110KTL, 115KTL)-M2 User Manual** • **SUN2000-(100KTL, 110KTL)-M2 Quick Guide (STAUBLI)** • **SUN2000-(75KTL-M1, 100KTL-M2, 110KTL-M2, 115KTL-M2) Quick Guide** • **SUN2000-(150K-MG0-ZH,150K-MG0) User Manual** • **SUN2000-(150K-MG0-ZH, 150K-MG0) Quick Guide** • **SUN5000-(150K-MG0-ZH,150K-MG0) User Manual** • **SUN5000-(150K-MG0-ZH, 150K-MG0) Quick Guide**
SUN2000P	• **MERC Smart PV Optimizer User Manual** • **MERC-(1300W, 1100W)-P Smart PV Optimizer Quick Guide** • **SUN2000 Smart PV Optimizer User Manual** • **SUN2000-(600W-P, 450W-P2) Smart PV Optimizer Quick Guide** • **SUN2000-450W-P Smart PV Optimizer Quick Guide**

Device	Document
SACU	• **SmartACU2000D Smart Array Controller User Manual (with No PID Module)** • **SmartACU2000D Smart Array Controller Quick Guide (with No PID Module)** • **SmartACU2000D Smart Array Controller User Manual (Dual Opto-Electronic Ethernet Switches)** • **SmartACU2000D Smart Array Controller Quick Guide (Dual Opto-Electronic Ethernet Switches)**
SmartLogger	• **SmartLogger3000 User Manual** • **SmartLogger3000 Quick Guide**
Power meter	• **DTSU666-HW Smart Power Sensor Quick Guide** • **YDS60-80 Smart Power Sensor Quick Guide**
FusionSolar app	**FusionSolar App User Manual**
iMaster NetEco	**iMaster NetEco V600R023C00 FusionSolar SmartPVMS User Manual**

C Digital Power Customer Service

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

D Contact Information

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

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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

NOTE

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E Acronyms and Abbreviations

E	
ESS	energy storage system
F	
FE	fast Ethernet
S	
SACU	Smart Array Controller
SOC	state of charge
SOH	state of health
U	
UPS	uninterruptible power supply

