

# PowerFusion 2.0 Commissioning Guide

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TAIHAO Technology (Shenzhen) Power Technology Co., Ltd.

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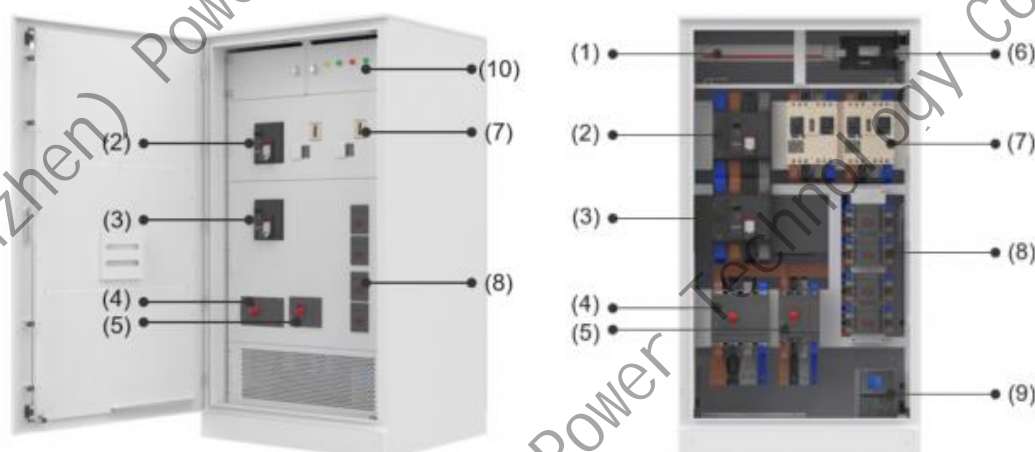
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## 1 PowerFusion Cabinet Test

The PowerFusion commercial and industrial integrated control cabinet (hereinafter referred to as the "integrated cabinet") has the following appearance and main components:



- |                      |                            |                   |                     |
|----------------------|----------------------------|-------------------|---------------------|
| (1) Auxiliary switch | (2) Mains switch           | (3) Bypass switch | (4) Inverter switch |
| (5) Load switch      | (6) SmartMGC               | (7) Fast switch   | (8) ESS switch      |
| (9) UPS              | (10) Mains power indicator |                   |                     |

After the integrated cabinet is in place and fixed, and the equipment wiring is completed and checked for accuracy, the cabinet test can be conducted. The cabinet test of the integrated cabinet mainly involves the UPS, fast switch, air conditioner, or fan inside the cabinet, to verify that the electrical equipment inside the cabinet is functioning properly. The test sequence and operation methods can be referenced in the following sections.

### 1.1 Power-on procedure for PowerFusion

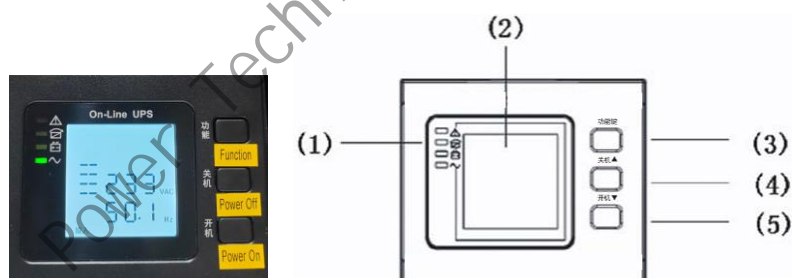
Before powering on the integrated cabinet, all switches must first be set to the off position. Then, follow the steps below to perform the power-on operation:

1. Switching range and sequence: External upper-level municipal power switch → Internal mains switch;

2. Observe whether the municipal power indicator on the cabinet is displaying the power supply status of the municipal power normally.

## 1.2 UPS Test

Figure 1.1 UPS LCD Operation Panel



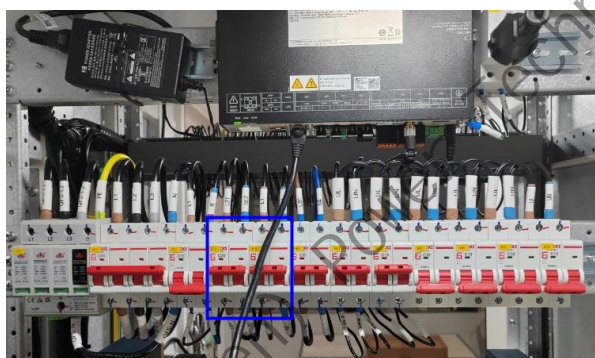
- (1) LED (from top to bottom: alarm, bypass, battery, inverter)      (2) LCD display screen  
 (3) Function button      (4) Power off/Up selection button      (5) Power on/Down selection button

Button	Function
Power button	<ul style="list-style-type: none"> <li>➤ <b>Starting the UPS:</b> Press and hold the power button for more than 2 seconds, and the UPS will start.</li> <li>➤ <b>Next Option:</b> In UPS setup mode, the power button is used to select the next option.</li> <li>➤ <b>Exiting Setup Mode:</b> In UPS setup mode, if you are already at the last option, press the power button again. The UPS will save the setup variables and exit setup mode.</li> </ul>
Power Off Button	<ul style="list-style-type: none"> <li>➤ <b>Shutting Down the UPS:</b> In battery mode, press and hold the power off button for more than 2 seconds to shut down the UPS.</li> <li>➤ <b>Switching to Bypass Mode:</b> In utility mode, press and hold the shutdown button for more than 2 seconds. The UPS will then switch to bypass mode (bypass setting allowed). If the utility power exceeds the bypass setting range, the UPS will not enter bypass mode.</li> <li>➤ <b>Previous Selection:</b> In UPS setup mode, the shutdown button is used to select the previous option.</li> </ul>
Select/Mute Button	<ul style="list-style-type: none"> <li>➤ <b>Switching LCD Display Information:</b> Press the select button to switch the information displayed on the LCD (input voltage, input frequency, battery voltage, output voltage, output frequency, load,</li> </ul>

	etc.). ➤ <b>Mute:</b> In battery/utility mode, press and hold the select/mute button for more than 10 seconds to turn the mute function on or off. ➤ <b>Self-Test Mode:</b> In mains mode, press the selection button for more than 2 seconds to enter the UPS self-test mode.
Turn off + function button	➤ <b>Setting Mode:</b> Simultaneously press the selection and power-off buttons for more than 5 seconds to enter the setting mode.

The UPS test content and steps are as follows:

1. The UPS input power auxiliary switches UFB1 and UFB2 should be closed (the switch numbers can be found in the specific project drawings).



2. Check whether the main input socket and the main output socket of the UPS power supply are securely connected.



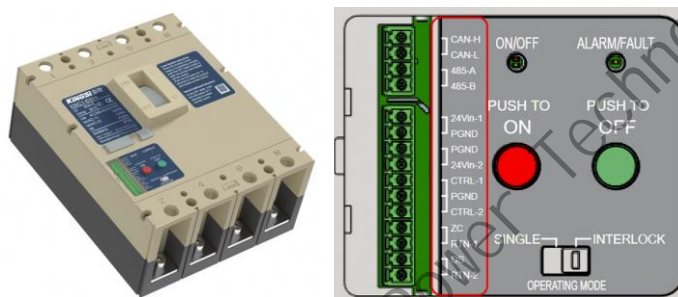
3. Press and hold the power button on the UPS panel for 2 seconds. The UPS will then power on.
4. Set the UPS operating parameters. Factory default settings: Operating mode: Normal mode; Output voltage: 220 V AC; Output frequency: 50 Hz. If you need to modify the above or other parameters, refer to the "UPS User Manual" for operation.

- If there is no alarm information, the UPS commissioning is complete. If there is an alarm, refer to the **"UPS User Manual"** for handling. If the issue cannot be resolved, please contact the integrated cabinet supplier for assistance.

### 1.3 Fast Switch Closing and Opening Test

This test is conducted on the fast switch model KSiC1-603A. By using the local electric buttons for closing and opening on the fast switch operation panel, the test aims to verify whether the fast switch can smoothly and unobstructedly perform closing and opening operations.

Figure 1.2 Partial View of the Fast Switch Operation Panel



- Closing Test:** Push the red button **ON** for 15 seconds, then release to trigger the closing operation. After the closing is successful, remote control will be enabled.
- Opening Test:** Push the green button **OFF** briefly to open the product and disable remote control. In the OFF state, push the button **OFF** for 3 seconds to enable remote control.
- ON/OFF Light:** The red light is on when closing, and the green light is on when opening.  
**ALARM/FAULT Light:** The yellow light is an alarm light.
- If the fault alarm light appears, the commissioning process is complete. If a fault alarm occurs, refer to **"KSiC1 Product User Manual"** for handling. If the issue cannot be resolved, contact the integrated cabinet supplier for assistance.

Common light signals are as follows (listed in order of display priority from highest to lowest):

Light Language Status	The meaning of light language signals
Dual-light Quick Flash (Yellow Light + Red or Green Light)	Incorrect mode selection. Internal communication lost in series or parallel mode. Or N phase connected to ABC phase in error.
Yellow light flashing quickly	Disable remote control.

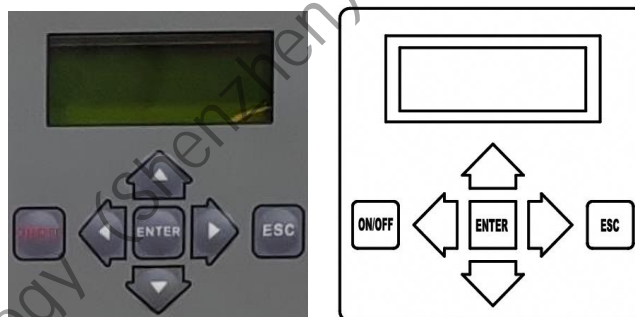


(lit for 0.25 seconds, off for 0.25 seconds)	
Yellow light flashes slowly (on for 1 second, off for 1 second)	Alarm for forbidding to close.
Yellow light always on.	General alarm, allowing on/off commands.
Green light flashing, yellow light always on.	Relay drive fault or feedback fault. SCR damage or current sampling fault.

## 1.4 Air Conditioning Test

This test is conducted for the air conditioning model MC06HDNC1A. The MC06HDNC1A is a product designed for 220 V AC, 50/60 Hz power supply systems. It features functions such as cooling, heating, dehumidification, and automatic restart upon power restoration. The product's operation panel is as follows.

Figure 1.3 LCD Operation Panel of the Air Conditioner



The panel buttons are described as follows:

- ON/OFF: Power on/off button. Pressing this button will turn the unit on or off.
- ↑: Up arrow key, used to move up and select the previous record/menu or to increase the setting value (only for passwords).
- ↓: Down arrow key, used to move down and select the next record/menu or to decrease the setting value (only for passwords).
- ←: Left arrow key, used to increase the setting value or, when performing password operations, to select the previous data.

- →: Right arrow key, used to decrease the setting value or, when performing password operations, to select the next data.
- ENTER: Enter key, used to confirm input.
- ESC: Exit key, returns to the previous screen menu.

The operating password for the unit is "0001". On the normal display interface, press Enter to enter the password input interface. Use the left/right arrow keys to select the position where the input is required.

The steps for the air conditioner startup test are as follows:

1. Close the AC input power switch, wait for 30 seconds, and the internal circulation fan of the air conditioner will start. If the internal circulation temperature meets the operating condition, the cooling system will start.
2. **Cooling parameter settings.** Cooling start-up point = cooling point. When the temperature inside the cabinet exceeds the cooling start-up point, the cooling will start. Cooling stop point = cooling point - cooling sensitivity. When the temperature inside the cabinet is lower than the cooling stop point, the cooling will stop. The default factory settings for the cooling point parameters are 35°C, and the default hysteresis is 5°C. If modifications are required, enter the password 0001 on the air conditioner's LCD operation panel to make the changes.

Table 1.1 Cooling parameter setting point

Parameter	Default value	Setting range	Description
Cooling point	35°C	[15~50] °C	The temperature point of the cooling start-up
Cooling sensitivity	5°C	[1~10] °C	The sensitivity of the temperature control

3. **Heating parameter settings.** Heating start point = heating point - heating sensitivity. When the temperature inside the cabinet is lower than the heating start point, the heating will start. Heating stop point = heating point + heating sensitivity. When the temperature inside the cabinet is higher than the heating stop point, the heating will stop. The default factory settings for the heating point parameters are 15°C, and the

default hysteresis is 5°C. If modifications are required, enter the password 0001 on the air conditioner's LCD control panel to make the changes.

Table 1.2 Heating parameter setting point

Parameter	Default value	Setting range	Description
Heating point	15°C	[-15~25] °C	The temperature point of the heating start-up
Heating sensitivity	5°C	[1~10] °C	The sensitivity of the temperature control

4. **Dehumidifier parameter settings.** Dehumidification start point = dehumidification point + sensitivity. When the ambient temperature inside the cabinet is higher than the dehumidification start point, the dehumidifier will operate. When the ambient temperature inside the cabinet is lower than the dehumidification point, the dehumidifier will stop operating. The default factory setting for the dehumidification point is 60%, and the default hysteresis is 10%. If modifications are required, enter the password 0001 on the air conditioner's LCD control panel to make the changes.

Table 1.3 Dehumidifier parameter setting point

Parameter	Default value	Setting range	Description
Dehumidification Point	60%	[40~90] %	The point when the dehumidifier stops working
Sensitivity	10%	[1~30]%	Sensitivity of Controlling Humidity

5. If there is no alarm information, the air conditioning commissioning is complete. If there is an alarm, refer to the "Envicool MC Series Air Conditioner User Manual" for handling. If the issue cannot be resolved, contact the integrated cabinet supplier for assistance.

## 2 System Joint Commissioning

After the integrated cabinet passes the test, you can perform joint system commissioning. System joint commissioning mainly involves the SmartMGC deployment, switchover, and black start test. For the automatic parallel off-grid optical storage system (PQ/VSG) switchover system, perform the following steps:

### 2.1 Commissioning Preparation

The SmartMGC5000B supports only mobile app-based deployment, not web-based deployment. This section describes the mobile app-based deployment process. Before the deployment, download and install the Huawei SmartPV App on your mobile phone by referring to the “[Huawei Smart PV App Quick Guide \(SmartLogger5000B&SmartMGC5000B\)](#)”, and register the installer and owner accounts.

#### 2.1.1 Power-On Procedure

Power on the devices in the following sequence: Turn on the upper-level mains switch outside PowerFusion → Turn on the mains switch inside PowerFusion → Fast switch → SmartMGC5000B auxiliary switch inside PowerFusion → ESS auxiliary switch → ESS switch → Inverter switch.

#### 2.1.2 Setting ESS Startup Authorization

Prerequisites:

- Before connecting to the WLAN of the ESS, ensure that the ESS is powered on and the WLAN is enabled.
- The WLAN function has been enabled on the mobile phone.
- Keep the mobile phone within 5 m away from the device. Otherwise, the communication signal quality between the app and the device may be affected.

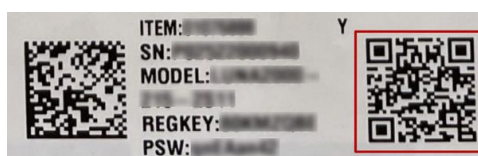
The ESS startup authorization procedure is as follows:



1. Obtain a verification code.

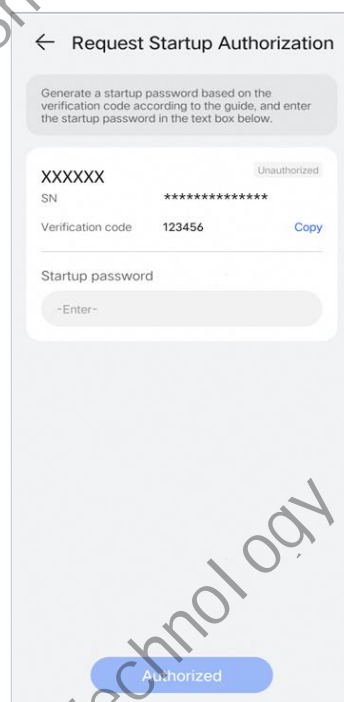
- 1) Log in to the app, scan the WLAN QR code on the ESS (the QR code on the right side of the SN on the device), and connect to the WLAN of the ESS.

Figure 2.1 QR code example



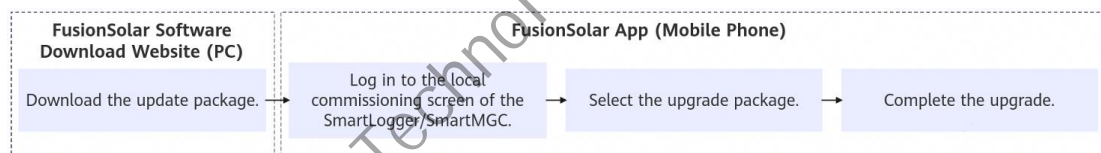
- 2) Log in to the local commissioning screen of the ESS as the **installer** user, and obtain **Verification code**.
2. Apply for **Startup password**. To apply for the **Startup password**, contact the device vendor or its authorized supervision service provider on the Power-Partner app.
3. Enter the **Startup password** to complete the ESS startup authorization. Use the app to scan the WLAN QR code on the ESS to log in to the local commissioning screen of the ESS as the **installer** user, enter the **Startup password**, and tap **Authorized**.

Figure 2.2 ESS Startup Authorization



### 2.1.3 Updating the Software Version

Software upgrades involve the software versions of devices such as the SmartMGC5000B, ESS, and inverter. The procedure is as follows:

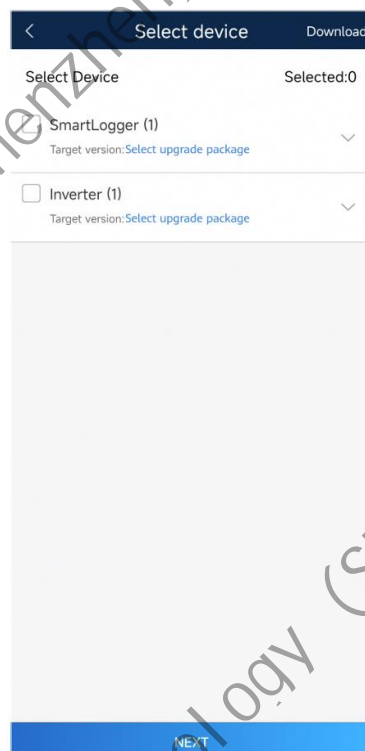


#### 1. Download the Upgrade Package

- 1) Log in to the **FusionSolar Software Download** website using the product customer account on a PC and download the latest software packages of the SmartMGC, ESS, and inverter.  
(<https://support.huawei.com/enterprise/en/category/fusionsolar-pid-1600073963553?submodel=software>)
- 2) After downloading the software packages from the website, import them from the PC to the mobile phone where the upgrade is to be performed.

#### 2. Upgrading the Device Version (App)

Figure 2.3 Device upgrade



- 1) Log in to the app, scan the WLAN QR code on the SmartMGC, and **connect to the WLAN of the SmartMGC**.

- 2) Log in to the local commissioning screen of the SmartMGC and choose **Maintenance > Upgrade**.
- 3) Tap **Select upgrade package** under the title of the device to be upgraded on the **Select device** screen, and select the upgrade package as prompted.
  - iOS mobile phone: After downloading the upgrade package from the website and storing it on the mobile phone, hold down the file to share it to the app. Then the upgrade package is directly displayed on the screen for selecting the upgrade package.
  - Android mobile phone: Choose **Select upgrade package > From a local directory** to access the phone folder and manually select the upgrade package.
- 4) Tap **Finish** to return to the **Select device** screen.
- 5) Select the device with the upgrade package imported, tap **NEXT**, and upgrade the device as prompted.

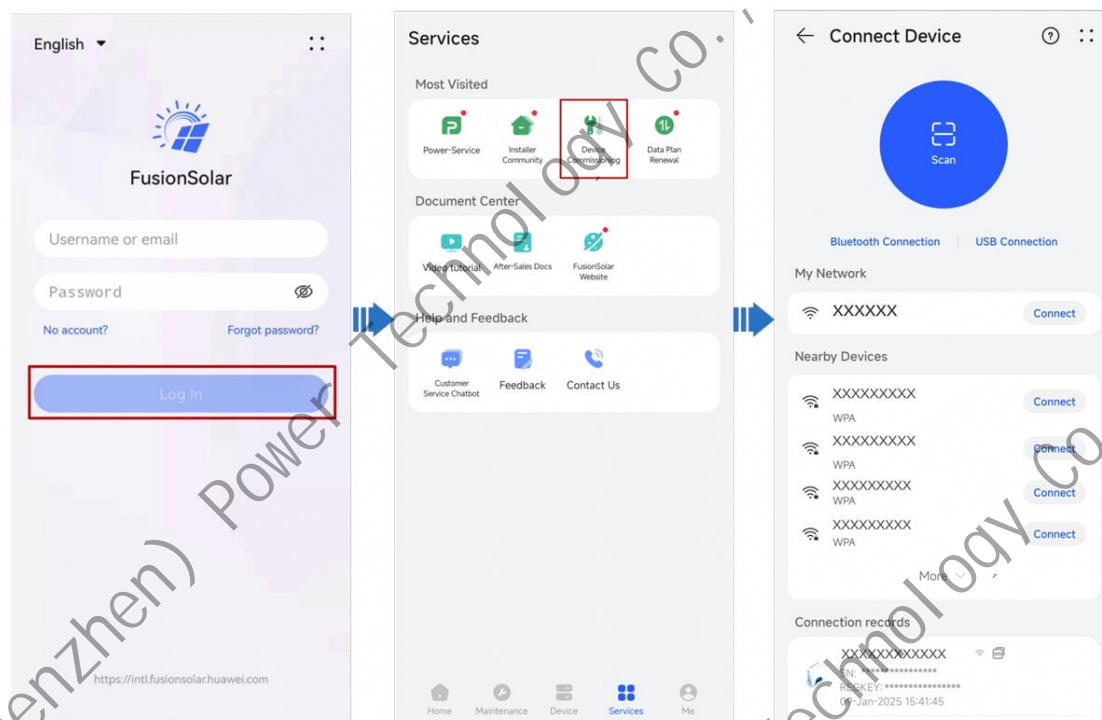
## 2.2 Commissioning Using the Deployment Wizard

### 2.2.1 Connecting Devices

Follow the steps below to search for and connect to the device:

1. Tap "Device Commissioning" on the Services screen, scan the QR code on the SmartMGC, and connect to the WLAN of the device as prompted. (The WLAN name of the device consists of "device name-device SN". For the first connection, log in with the initial password. You can obtain the initial WLAN password from the device label, that is, the characters following "PSW".))

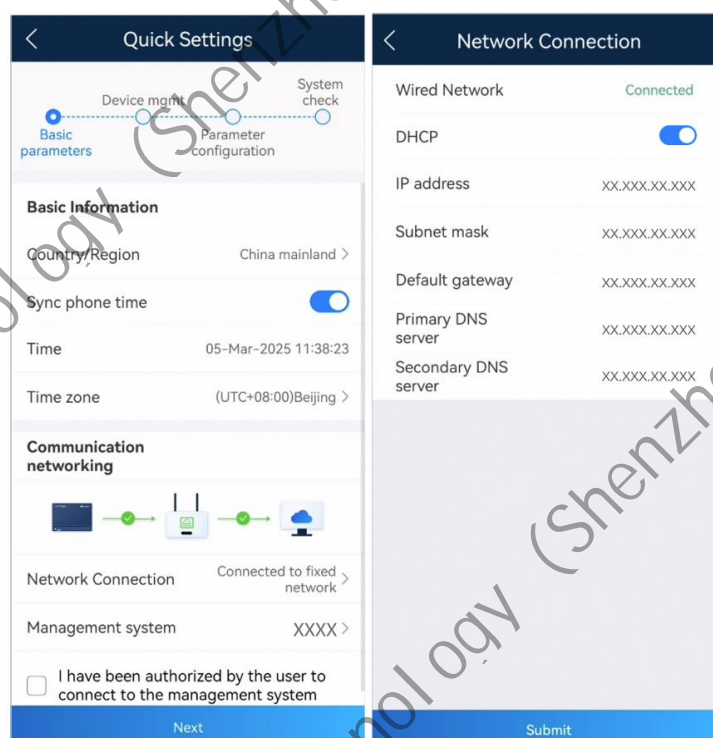
Figure 2.4 Connecting to the device WLAN



2. Log in to the local commissioning screen as the **Installer** user and access **Quick Settings**. (Set the password as prompted during the first login.)

## 2.2.2 Basic Parameters

Figure 2.5 Basic Parameters Screen



1. Fill in the "Basic Information" according to the project situation.



## 2. Network Connection:

After the **Quick Settings** screen is displayed, the system automatically connects to the network (for connecting to the management system). Tap the option area on the right of **Network Connection** to set related parameters of **Wired Network** or **Mobile network**.

Table 2-1 Network connection parameters

Connection Method	Description
Wired Network	The WAN port of the SmartLogger (or SmartMGC) supports IP address obtaining using DHCP and automatic registration.  If the router does not support DHCP, disable DHCP and manually assign an IP address.
Mobile network	<p><b>Network mode:</b> Set this parameter based on the SIM card network mode.</p> <p><b>APN mode:</b> The default value is <b>Automatic</b>.  If Internet access using dial-up is not supported in Automatic mode, set this parameter to <b>Manual</b>. In this case, set the parameters related to the SIM card with the information obtained from the carrier.</p>

## 3. Management system:

The system automatically displays the default domain name. Tap the option area on the right of **Management system** and set related parameters as required. Select **I have been authorized by the user to connect to the management system**, and tap **Next** to connect to the management system.

Table 2-2 Management system connection parameters

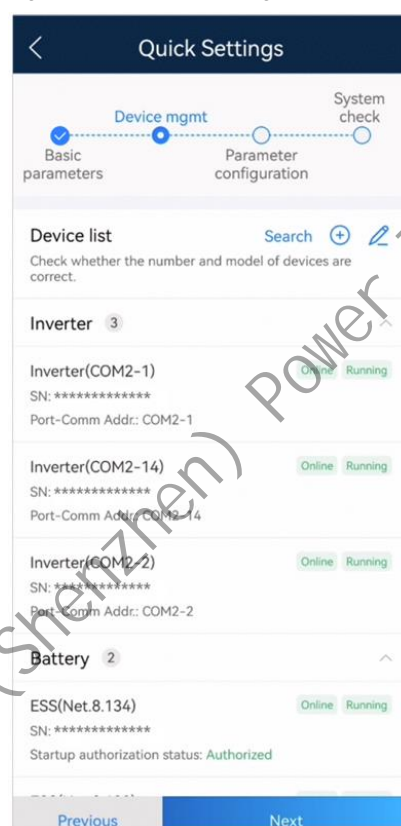
Parameter	Description
Domain Name	Set the IP address or domain name.  Domain name: intl.fusionsolar.huawei.com
Third-party EMS Parameters	To connect a third-party management system, select a protocol based on the third-party management system

	protoco.
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### 2.2.3 Device management

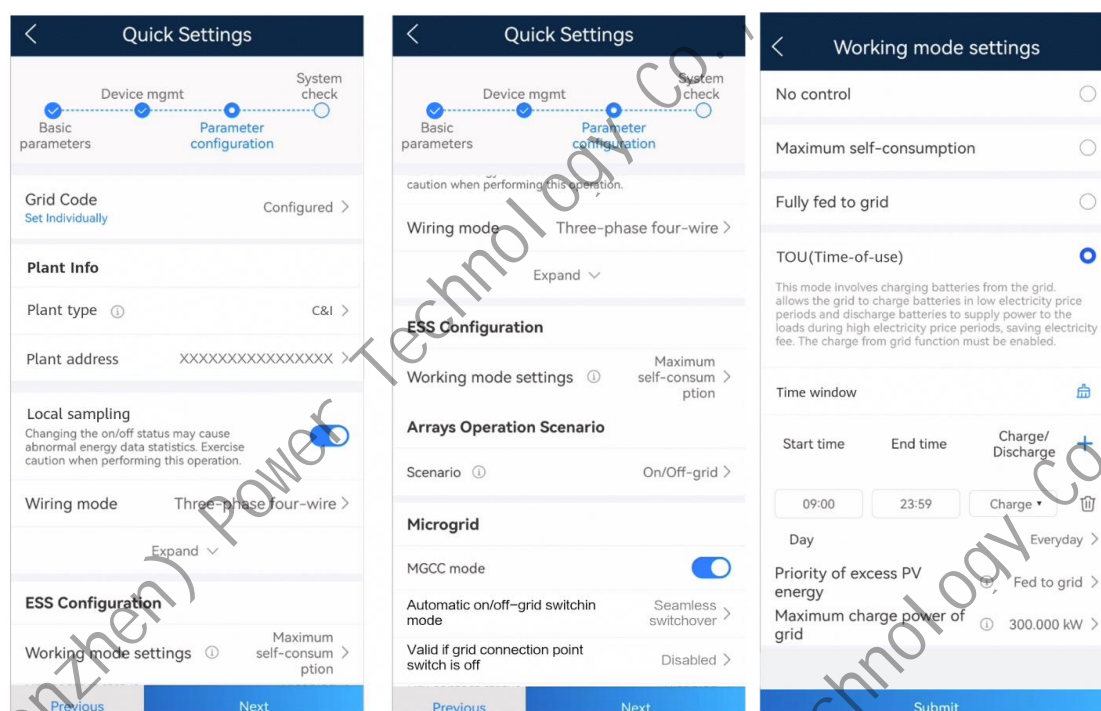
Tap **Search** to discover the device. Auto discovery does not apply to third party whitelisted devices, such as the EMI and power meter. You need to tap **+** to add them manually. For details about the supported EMI and power meter models, see the **SmartMGC5000 User Manual**.

Figure 2.6 Device management screen



### 2.2.4 Parameter configuration

Figure 2.7 Parameter configuration screen



## 1. Basic configuration

Table 2-3 Basic configuration

Category	Parameter	Description
Grid Code	Grid Code	Select the local grid code.
Plant Info	Plant type	Set this parameter to C&I.
	Plant postal code	Set this parameter to the local postal code of the plant.
	Plant address	Plant address is displayed when Plant type is set to C&I. Set this parameter to the address of the plant.
ESS Configuration	Working mode settings	<ul style="list-style-type: none"> <li>On-grid operation: Set this parameter to <b>Maximum self consumption, Time-of-use (TOU)</b>, or <b>No control</b> (only for commissioning) based on the actual application scenario.</li> <li>Off-grid operation: Set this parameter to <b>No control</b>.</li> </ul>
Arrays Operation Scenario	Scenario	<ul style="list-style-type: none"> <li>In the off-grid scenario, set this parameter to Off-grid. The PV+ESS system forms an independent microgrid to supply power to loads</li> </ul>

		<p>and does not need the grid supply.</p> <ul style="list-style-type: none"> <li>In the Seamless switchover or Seamed switching scenario, set this parameter to On/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.</li> </ul>
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## 2. Grid connection point sampling configuration

Table 2-4 Grid connection point sampling configuration

Parameter	Description
<b>Local sampling</b>	Specify whether to enable the function of current and voltage direct sampling at the grid connection point. After it is enabled, it can be used as a grid connection point meter with CT and PT sampling cables connected.
<b>Wiring mode</b>	Set <b>Output mode</b> based on the actual cable connection.
<b>Primary voltage of grid PT(V)</b>	<p>These parameters are displayed when <b>Local sampling</b> is enabled and <b>Scenario</b> is set to <b>On-grid</b> or <b>On/Off-grid</b>. The voltage is collected through the U_AC1 port.</p> <ul style="list-style-type: none"> <li>If no PT is used, the primary and secondary voltages on the power grid side are set based on the rated voltage on the power grid side.</li> <li>If a PT is used, the primary and secondary voltages on the power grid side are set based on the actual specifications of the PT.</li> </ul>
<b>Secondary voltage of grid PT(V)</b>	
<b>Primary voltage of genset PT (V)</b>	<p>These parameters are displayed when <b>Scenario</b> is set to <b>Off-grid</b> and <b>Local sampling</b>, <b>MGCC mode</b>, and <b>Genset control</b> are enabled.</p> <p>The voltage is collected through the U_AC1 port.</p>
<b>Secondary voltage of genset PT (V)</b>	

	<ul style="list-style-type: none"> <li>If no PT is used, the primary and secondary voltages on the genset are set based on the rated voltage on the genset.</li> <li>If a PT is used, the primary and secondary voltages on the genset are set based on the actual specifications of the PT.</li> </ul>
<b>Primary current of CT (A)</b>	This parameter is displayed when <b>Local sampling</b> is enabled.
<b>Secondary current of CT (A)</b>	The CT is connected to the I_AC port to collect current data. Set these parameters based on the actual specifications of the CT.

### 3. Set microgrid parameters (Seamless switching)

Table 2-5 microgrid parameters

Category	Parameter	Description	Remarks
Microgrid	<b>MGCC mode</b>	This parameter is disabled by default. In the microgrid scenario, if this parameter is enabled, the microgrid control function is enabled. When the microgrid is off-grid, the SmartEMO function and functions involved in power adjustment and ESS control will be invalid.	This parameter is displayed when <b>Scenario</b> is set to <b>On/Off-grid</b> or <b>Offgrid</b> .
	<b>Automatic on/offgrid switching mode</b>	<ul style="list-style-type: none"> <li><b>Not controlled:</b> The system does not perform any operation. The user manually controls on/off-grid switching.</li> <li><b>Seamed switching:</b> The system automatically switches off the circuit breaker at the grid connection point and performs the corresponding sequence control process. This switching mode usually takes a certain period of time and</li> </ul>	This parameter is displayed when <b>Scenario</b> is set to <b>On/Off-grid</b> and <b>MGCC mode</b> is enabled.

		<p>may result in a short-time power supply interruption.</p> <ul style="list-style-type: none"> <li>• <b>Seamless switching:</b> The system can quickly complete the on/off-grid switching without causing a power supply interruption. If rapid on/off-grid switching is required, set <b>Status of rapid power loss detection<sup>[1]</sup></b> to <b>Enable</b>.</li> </ul>	
	<b>Valid if grid connection point switch is off</b>	<p>– If the switch-off terminal (NO) or switch-on terminal (NC) of the circuit breaker at the grid connection point is connected, set this parameter to <b>Enabled</b>. If the switch-off terminal (NC) or switch-on terminal (NO) of the circuit breaker at the grid connection point is connected, set this parameter to <b>Enabled</b>.</p> <p>– System cable connections:</p> <ul style="list-style-type: none"> <li>▪ DI4 (HV): reports the Off state of the switch at the grid connection point.</li> <li>▪ DO7 (HV): turns on the switch at the grid connection point.</li> <li>▪ DO8 (HV): turns off the switch at the grid connection point (fast port); needs to connect to the DC power supply.</li> <li>▪ DO4 (HV): turns off the switch at the grid connection point (common port); supports the DC or AC power supply.</li> </ul>	<p>This parameter is displayed when Scenario is set to On/Off grid and MGCC mode is enabled.</p> <p>For the <b>20 ms on-grid/off-grid switchover solution</b>, the circuit breaker at the grid connection point is controlled by <b>DO8 (HV)</b>.</p>
<b>Genset control</b>	<b>Genset control</b>	Set whether to enable <b>Genset control</b> . If the genset needs to be directly controlled, set	This parameter is displayed when <b>Automatic on/off-grid</b>

		this parameter to <b>Enable</b> .	<b>switching mode</b> is set to <b>Seamless switchover</b> .
	<b>Genset control mode</b>	Set this parameter based on the genset startup/shutdown control mode. – Pulse: DO5 (HV): starts the genset. DO6 (HV): shuts down the genset. – Level: DO5 (HV): starts the genset at high level. DO6 (HV): shuts down the genset at low level.	This parameter is displayed when <b>Genset control</b> is enabled.
	<b>Genset rated active power (kW)</b>	Set the rated active power of the genset. <b>NOTE</b> Ensure that the value is the same as the rated active power on the genset nameplate.	This parameter is displayed when <b>Genset control</b> is set to <b>Enable</b> and <b>Automatic on/off-grid switching mode</b> is set to <b>Seamless switchover</b> .
	<b>Valid if grid-side switch is off</b>	– Set this parameter to <b>Disabled</b> or <b>Enabled</b> . If the grid-side switch-on terminal of the transfer switch is connected, set this parameter to <b>Disabled</b> . If the grid-side switch-off terminal of the transfer switch is connected, set this parameter to <b>Enabled</b> .	This parameter is displayed when <b>Genset control</b> is enabled.

		<ul style="list-style-type: none"> <li>DI1 (HV): grid-side switch-off status feedback.</li> </ul>	
	<b>Valid if genset-side switch is off</b>	<ul style="list-style-type: none"> <li>Set this parameter to <b>Disabled</b> or <b>Enabled</b>. If the genset-side switch-on terminal of the transfer switch is connected, set this parameter to <b>Disabled</b>. If the genset-side switch-off terminal of the transfer switch is connected, set this parameter to <b>Enabled</b>.</li> </ul> DI2 (HV): genset-side switchoff status feedback.	
	<b>Valid if grid power recovers</b>	<ul style="list-style-type: none"> <li>Set this parameter to <b>Disabled</b> or <b>Enabled</b>. If the normally open (NO) terminal of the power failure detection relay is connected, set this parameter to <b>Disabled</b>. If the normally closed (NC) terminal of the power failure detection relay is connected, set this parameter to <b>Enabled</b>.</li> <li>DI3 (HV): grid power recovery status feedback.</li> </ul>	
[1]: This parameter is set on the Settings > Microgrid Parameters > On/Off-grid Switching.			

### 2.2.5 System Check

After the current screen is displayed, the system automatically checks **Networking status**, **Alarm status**, **Device status**, and **Version check**. After the check is complete, you can tap Check Again to perform the check again. You need to tap **Start test** to trigger **Connection Test**. After the check is complete, you can tap **Try Again** to perform the



check again.

Figure 2.8 System check

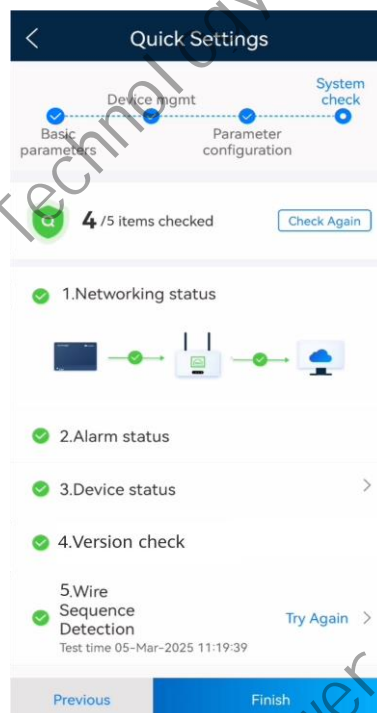


Table 2-6 System check

Check Type	Description
<b>Networking status</b>	Check whether the management system is successfully connected and whether the mobile network signal is weak.
<b>Alarm status</b>	Check whether there are active alarms.
<b>Device status</b>	Check whether <b>Running status</b> is set to <b>Faulty</b> or <b>communication status</b> is set to <b>Offline</b> .
<b>Version check</b>	<p>Check whether all devices in the device list need to be updated.</p> <p><b>NOTE</b></p> <p>After the update is complete, you can return to the <b>System check</b> screen to continue the deployment. However, if the SmartMGC is restarted during the update, the app will be disconnected from the WLAN of the device. As a result, the deployment cannot continue.</p>
<b>Connection Test</b>	Check whether the communication between devices is normal, whether the PT/CT cable connection and the A/B/C wire sequences of the PCS AC

	<p>cables are normal, and identify possible faults. You can identify and rectify faults by viewing rectification suggestions to ensure that the system runs properly.</p> <p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>This function applies only to the C&amp;I Hybrid Cooling Grid Forming ESS and is displayed in the scenario with multiple cabinets.</li> </ul>
--	---

Tap **Finish**, set **Array Startup/Shutdown** as required, and perform function commissioning as required.

---End

Set and confirm the following parameters after the deployment is complete.

- Set the **Output mode** for the inverter and ESS.
  - Inverter: Tap **Device Monitoring**, select the inverter, choose **Set > Grid Parameters**, and set the **Output mode** based on the actual cable connection mode of the inverter.
  - ESS: Tap **Device Monitoring**, select the ESS, choose **Set > Power Parameters > Grid parameters**, and set the **Output mode** of the ESS to **Three-phase four-wire**.
- Check whether Grid code of the ESS are correctly set. If not, correct it.
  - Tap **Monitor**, select the ESS, and choose **Set > Power Parameters > Grid parameters**. Check the **Grid code** parameter and configure the local grid code as required.

## 2.3 Protection Parameter Detection (Optional)

The implementation of the target function involves the coordination of multiple devices.

Parameters of each component must be set according to the rules. It is recommended that default settings be retained for protection parameters of the SmartMGC and ESS. To change the settings, contact the Company's engineers. Check the protection parameters through the SmartMGC WebUI.

- Check the protection parameters of the SmartMGC: Choose **Settings > Microgrid**

**Control > Advanced Control Configuration > Protective Relay Configuration**

and check whether the protection parameters of the SmartMGC are the same as those in Table 2-7. If not, modify the parameters according to Table 2-7. The protection parameters of the SmartMGC are used only in the seamless switching scenario.

2. Check the off-grid protection parameters of the ESS: Choose **Monitoring > ESS > Running Parameters** and check whether the off-grid protection parameters are the same as those in Table 2-7. If not, modify the parameters according to Table 2-7.

Table 2-7 Protection parameter description

Working Condition	SmartMGC		ESS	
Overvoltage protection	Threshold for triggering section I overvoltage protection	$1.1 \times U_n^a$	Off-grid level-1 overvoltage protection threshold	$1.1 \times U_n^a$
	Delay of section I overvoltage protection	10000	Duration threshold for off-grid level-1 overvoltage protection	15000
	Threshold for triggering section II overvoltage protection	$1.2 \times U_n^a$	Off-grid level-2 overvoltage protection threshold	$1.2 \times U_n^a$
	Delay of section II overvoltage protection	200	Duration threshold for off-grid level-2 overvoltage protection	10500
	/	/	Off-grid level-3 overvoltage protection threshold	$1.3 \times U_n^a$
	/	/	Duration threshold for off-grid level-3 overvoltage protection	300
	/	/	Off-grid level-4	$1.3 \times U_n^a$

			overvoltage protection threshold	
	/	/	Duration threshold for off-grid level-4 overvoltage protection	300
Undervoltage protection	Threshold for triggering section I undervoltage protection	$0.9 \times U_n^a$	Off-grid level-1 undervoltage protection threshold	$0.85 \times U_n^a$
	Delay of section I undervoltage protection	10000	Duration threshold for off-grid level-1 undervoltage protection	10500
	Threshold for triggering section II undervoltage protection	$0.8 \times U_n^a$	Off-grid level-2 undervoltage protection threshold	$0.75 \times U_n^a$
	Delay of section II undervoltage protection	0	Duration threshold for off-grid level-2 undervoltage protection	1000
	/	/	Off-grid level-3 undervoltage protection threshold	$0.75 \times U_n^a$
	/	/	Duration threshold for off-grid level-3 undervoltage protection	1000
	/	/	Off-grid level-4 undervoltage protection threshold	$0.75 \times U_n^a$
	/	/	Duration threshold for off-grid level-4 undervoltage protection	1000

Overfrequency protection	Threshold for triggering section I overfrequency protection	$f_n^{b+2}$	Off-grid level-1 overfrequency protection threshold	$1.08*f_n^b$
	Delay of section I overfrequency protection	500	Duration threshold for off-grid level-1 overfrequency protection	1000
	/	/	Off-grid level-2 overfrequency protection threshold	$1.09*f_n^b$
	/	/	Duration threshold for off-grid level-2 overfrequency protection	800
	/	/	Off-grid level-3 overfrequency protection threshold	$1.1*f_n^b$
	/	/	Duration threshold for off-grid level-3 overfrequency protection	700
	/	/	Off-grid level-4 overfrequency protection threshold	$1.1*f_n^b$
	/	/	Duration threshold for off-grid level-4 overfrequency protection	700

Underfrequency protection	Threshold for triggering section I overfrequency protection	$f_n^{b-2}$	Off-grid level-1 Underfrequency protection threshold	$0.92*f_n^b$
	Delay of section I overfrequency protection	500	Duration threshold for off-grid level-1 Underfrequency protection	1000
	/	/	Off-grid level-2 Underfrequency protection threshold	$0.91*f_n^b$
	/	/	Duration threshold for off-grid level-2 Underfrequency protection	800
	/	/	Off-grid level-3 Underfrequency protection threshold	$0.9*f_n^b$
	/	/	Duration threshold for off-grid level-3 Underfrequency protection	700
	/	/	Off-grid level-4 Underfrequency protection threshold	$0.9*f_n^b$
	/	/	Duration threshold for off-grid level-4 Underfrequency protection	700

Frequency change rate protection	Threshold for triggering section I protection if ROCOF increases	5	/	/
	Threshold for triggering section I protection if ROCOF decreases	5	/	/
	Delay of section I protection if ROCOF increases	140	/	/
	Delay of section I protection if ROCOF decreases	140	/	/
Rapid power loss detection	Threshold for triggering rapid power loss detection	80	/	/
Note a: Rated voltage of the power grid.				
Note b: Rated frequency of the power grid.				

## 2.4 Switch Inspection Under No-Load Condition

Switch inspection is to manually turn on and off the on/off-grid switch in order to check whether the switch is correctly configured. Switch inspection is performed on the WebUI.

For details about the operations on the WebUI, see the **SmartMGC5000 User Manual**.

1. Choose **Settings > Microgrid Control > General Basic Settings > Microgrid Settings** and set **Microgrid scenario** to **On/Off-grid (PQ/VSG)**. Set **Automatic on/off-grid switching mode** to **Not controlled**.
2. Choose **Maintenance > Device Management > Startup/Shutdown**, click **Shut Down**, click **All array devices** from the drop-down list to shut down the devices.

3. Check whether the DI4(HV) cable is properly connected for the switch-off status feedback port of the on/off-grid switch. Manually turn on or off the on/off-grid switch onsite, and choose **Overview > Sampling Info** to check whether the DI4 status changes.
4. Check onsite that the on/off-grid switch is turned on and that **On/Off-grid status** is **On-grid** under **Settings > Microgrid Control > On/Off-Grid Switching > Switching Control**.
5. Choose **Settings > Microgrid Control > On/Off-Grid Switching > Switching Control** and click **Switch to off-grid**. Then check onsite whether the on/off-grid switch is actually turned off. If the on/off-grid switch is not turned off, check the DO4(HV)/DO8(HV) cable connection for the switch-off control port of the on/off-grid switch. DO8 (HV) is used for switching within 20 ms, and DO4 (HV) is used for switching within 60 ms or 150 ms.
6. Choose **Settings > Microgrid Control > On/Off-Grid Switching > Switching Control** and click **Switch to on-grid**. Then check onsite whether the on/off-grid switch is actually turned on. If the on/off-grid switch is not turned on, check the DO7(HV) cable connection for the switch-on control port of the on/off-grid switch.
7. **(Optional)** Check the following parameters only when the genset is connected through the ATS on the mains side. Choose **Settings > Microgrid Control > General Basic Settings** and check whether **Valid if grid-side switch is off** and **Valid if genset-side switch is off** are normal. Example:
  - 1) Valid if grid-side switch is off:
    - If the actual status of the ATS I switch is Off and the DI1(HV) port status is **Open** in **Overview > Sampling Info**, set this parameter to **Open**.
    - If the actual status of the ATS I switch is Off and the DI1(HV) port status is **Closed** in **Overview > Sampling Info**, set this parameter to **Closed**.
    - If the actual status of the ATS I switch is On and the DI1(HV) port status is **Open** in **Overview > Sampling Info**, set this parameter to **Closed**.
    - If the actual status of the ATS I switch is On and the DI1(HV) port status is **Closed** in **Overview > Sampling Info**, set this parameter to **Open**.



2) Valid if genset-side switch is off:

- If the actual status of the ATS II switch is Off and the DI2(HV) port status is **Open** in **Overview > Sampling Info**, set this parameter to **Open**.
- If the actual status of the ATS II switch is Off and the DI2(HV) port status is **Closed** in **Overview > Sampling Info**, set this parameter to **Closed**.
- If the actual status of the ATS II switch is On and the DI2(HV) port status is **Open** in **Overview > Sampling Info**, set this parameter to **Closed**.
- If the actual status of the ATS II switch is On and the DI2(HV) port status is **Closed** in **Overview > Sampling Info**, set this parameter to **Open**.

----End

## 2.5 No-Load Automatic On/Off-Grid Switching

After the switch detection is passed, a no-load automatic on/off-grid switching test can be performed.

Test Preparation:

1. Turn on the ESS and the inverter.
2. In the integrated cabinet, the on-grid/off-grid switch is closed, the inverter switch is closed, the energy storage switch is closed, and the load switch is open.
3. Log in to the SmartMGC WebUI, navigate to **Monitoring > Logger > Running Parameters > Scenario**, and ensure that **Scenario** is set to **On/Off-grid** and **MGCC mode** is set to **Enable**. Set the parameter of **Automatic on/off grid switching mode** to **Seamless switching**.

Then, perform the following steps for testing:

1. The upper-level grid power switch in the integrated cabinet is opened. Observe whether the on-grid/off-grid switch inside the integrated cabinet automatically opens successfully.
2. The integrated cabinet's upper-level mains switch performs a closing operation. Observe whether the on/off grid switch inside the integrated cabinet automatically closes successfully.

----End

## 2.6 No-Load ESS Black Start Test

Test preparation:

1. Inverter is shutdown.
2. The fast switch is open. The inverter switch is open. The ESS switch is closed.  
The load switch is open.

Then follow the steps below for testing:

1. Log in to the SmartMGC Web interface and issue a command to shut down the ESS.
2. Command for one-click black start.

## 2.7 On-Load Automatic On/Off-Grid Switching

Before conducting the automatic on/off-grid switching test under load, it is necessary to first evaluate the load-bearing capacity of the microgrid's PV and ESS systems.

Test Preparation:

1. Turn on the ESS and inverter.
2. Inside the integrated cabinet, close the on/off-grid switch, the inverter switch, the ESS switch, and the load switch.
3. Log in to the SmartMGC WebUI, navigate to Monitoring > Logger > Running Parameters > Scenario, and ensure that Scenario is set to On/Off-grid and MGCC mode is set to Enable. Set the parameter of Automatic on/off grid switching mode to Seamless switching.

Then, perform the test according to the following steps:

1. Open the fast switch in the PowerFusion by operating the upstream utility power switch. Observe whether fast switch inside the PowerFusion automatically opens successfully.
2. Close the fast switch in the PowerFusion by operating the upstream utility power switch. Observe whether the fast switch inside the PowerFusion automatically closes successfully.

----End

## 2.8 On-Load ESS Black Start Test

Test Preparation:

1. The inverter is shut down.
2. In the integrated cabinet, the fast switch is open, the inverter switch is open, the ESS switch is closed, and the load switch is closed.

Then, perform the test according to the following steps:

1. Log in to the SmartMGC Web interface and issue a command to shut down the ESS.
2. The command initiates a one-click black start.

### 3 Common Issue Resolution Methods

This section provides troubleshooting measures for common issues encountered during the commissioning process of integrated cabinet sites.

1. When the UPS is powered on, the LCD panel displays a fault alarm code "cod 33," and the UPS fails to supply power normally.

**Problem Analysis:** The fault alarm code "cod 33" indicates "no battery." The possible causes are incorrect connection methods for external/internal batteries, or the battery is depleted.

**Handling Measures:** Power on the UPS to charge the batteries.

2. On the web interface, complete the quick switch detection. The switch operates normally. However, during the automatic on-grid/off-grid switching test, the quick switch fails to open or close, and the yellow indicator light flashes rapidly (on for 0.25s, off for 0.25s)).

**Problem Analysis:** The meaning of the indicator light is "remote control for long-distance shielding."

**Handling Measures:** Log in to the SmartMGC web interface, click "Settings > Microgrid Control > General Basic Settings > Microgrid Settings," and set "Microgrid Scenario" to "On-Grid/Off-Grid (PQ/VSG)". Set "Automatic On-Grid/Off-Grid Switching Mode" to "Seamless Switching".