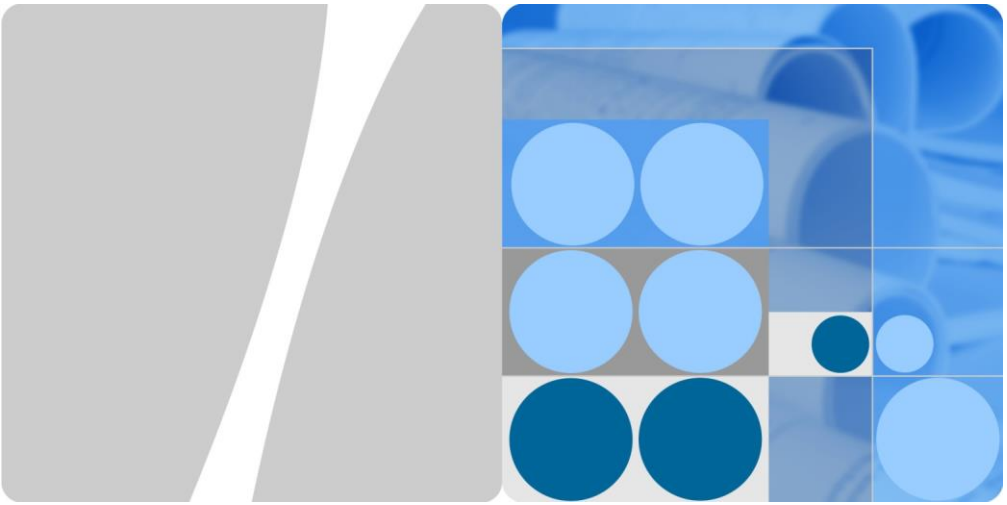


SmartPSB2000L Smart PV Safety Box
Quick Guide

Issue: 03
Part Number: 31509508
Date: 2018-05-18

HUAWEI TECHNOLOGIES CO., LTD.

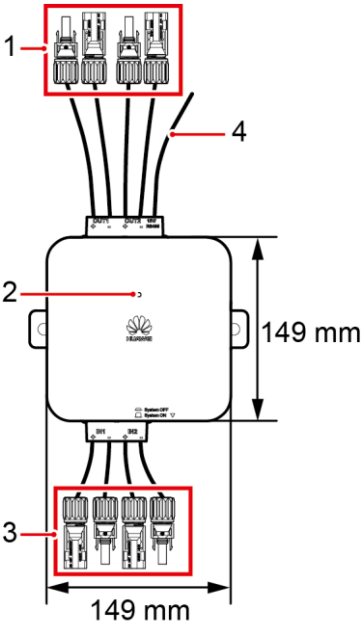
HUAWEI

NOTICE

- The information in this document is subject to change due to version upgrades or other reasons. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.
- Only qualified and trained electrical technicians are allowed to operate the device.
- Carefully read this document and the precautions before installing the device. Failure to comply with the storage, installation, and operation regulations specified in this document may cause device damage, which is not covered by Huawei's warranty.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Use insulated tools when installing the device. For personal safety, wear proper personal protective equipment (PPE).

1 Overview

The SmartPSB2000L smart PV safety box (safety box for short) is a key component that implements rapid shutdown and module monitoring for Huawei SUN2000P-375W smart PV optimizers. The safety box is easy to install, operate, and maintain.



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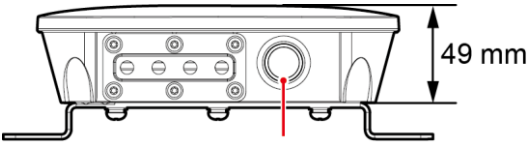

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Rapid shutdown means that the power generation system consisting of optimizers, smart PV safety boxes, and inverters decreases the DC voltage to the safe voltage range (≤ 30 V) within the specified period (≤ 30s).

Prerequisites	An optimizer is installed for each PV module, and the rapid shutdown function of the safety box is enabled.
Trigger by button press	If the shutdown button (▬) is pressed, the safety box enters the rapid shutdown state. The LED indicator is steady red, and the inverter turns off the AC output. This product cannot be used as a substitute for the emergency stop switch.
	If the shutdown button (■) is released, the safety box exits the rapid shutdown state. The LED indicator is steady red within 10 minutes. The output voltages of the optimizer and inverter are restored 10 minutes later. The LED indicator of the safety box changes from steady red to steady green.
Trigger by power failure	If the AC power fails, the safety enters the rapid shutdown state. The inverter and optimizer stop output and communication. The LED indicators of the safety box and inverter are off.
	If the AC power resumes, the inverter, optimizer, and safety box restore to the normal state.

No.	Description
1	Two routes of output terminals, cable length (including terminals) 250 mm
2	An LED indicator showing the running status of the safety box
3	Two routes of input terminals, cable length (including terminals) 150 mm
4	RS485 communication, PE, and 12 V power cables, 340 mm long

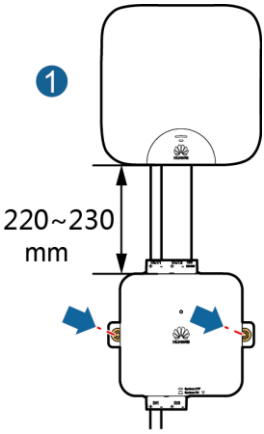
2 Installation and Cable Connections

1. Install the safety box under or on a side of an inverter with the delivered M6x60 expansion bolts. It is recommended that an M8 drill bit be used to drill holes. The torque should be 4.5–5.5 N·m.
2. Connect the RS485 communications, PE, and 12 V power cables from the safety box to the corresponding port on the inverter.
3. Connect the output terminals of the safety box to the DC input ports of the inverter (one route is used as an example in the right figure).
4. Connect the input terminals of the safety box to the output ports of the optimizer string (one route is used as an example in the right figure).

NOTE

1. Each input of the safety box supports serial connection of up to 15 optimizers, and the string voltage should be less than 600 V DC.
2. After the cord end terminal is removed, the PE cable of the safety box and the communication PE cable of the power meter can be connected together to the communication terminal (pin 8) of the inverter.

Installation Mode 1 (Recommended Distance)



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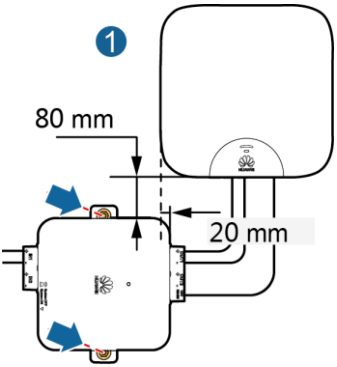
Installation Mode 2 (Recommended Distance)



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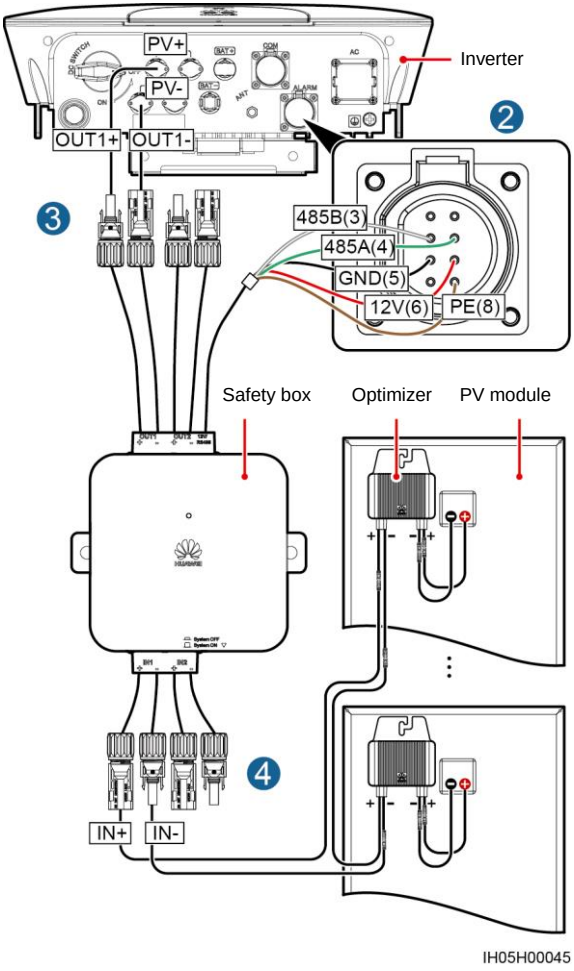
Wiring Diagram



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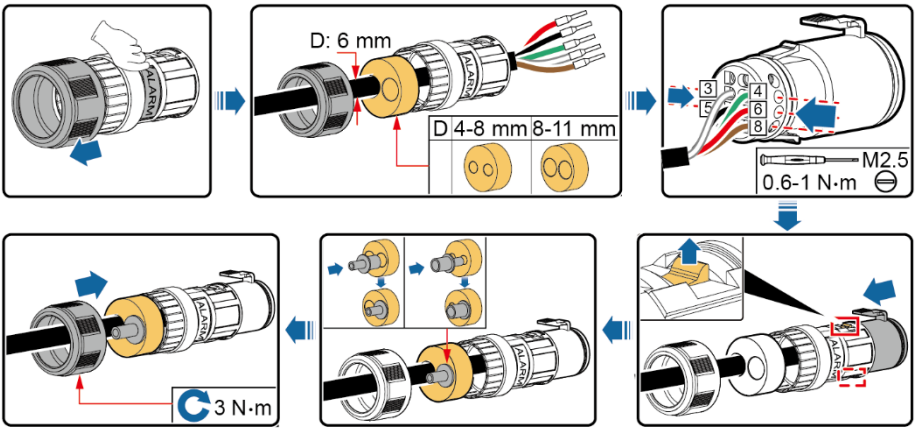
NOTE

Depending on the inverter model, the RS485 communications, PE, and 12 V power cables need to be connected to the COM or ALARM port of the inverter. The pins are wired in the same way.

Port	Inverter Model
COM	SUN2000L-3KTL-CN, SUN2000L-4KTL-CN, SUN2000L-5KTL-CN
ALARM	SUN2000L-2KTL, SUN2000L-3KTL, SUN2000L-3.68KTL, SUN2000L-4KTL, SUN2000L-4.6KTL, SUN2000L-5KTL

COM or ALARM Terminal Connection



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3 Powering On the Safety Box

NOTICE

1. Check whether all cables to the safety box are properly connected.
2. Input and output terminals are correctly paired, and no crossover exists.

1. Switch on the AC circuit breaker between the inverter and the power grid (the AC voltage of the power grid should be in the range allowed by the inverter).
2. Turn the DC switch at the bottom of the inverter to the ON position.
3. Observe the LED indicator on the safety box. The status change sequence should be: blinking green at long intervals > blinking green at short intervals. If the LED indicator is abnormal, check whether cables are connected correctly and securely.

LED Status	Description
Blinking green at long intervals	Power on self test.
Blinking green at short intervals	Communicating with the inverter properly and not communicating with the optimizer.
Steady green	Communicating with the inverter and optimizer properly.
Steady red	Shutdown.
Blinking green at long intervals: on for 1s and then off for 1s Blinking green at short intervals: on for 0.2s and then off for 0.2s	

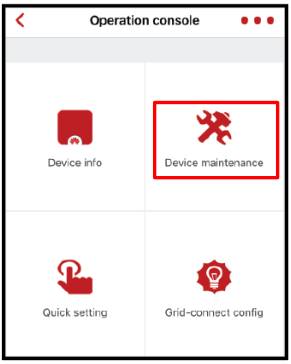
4 FusionHome App

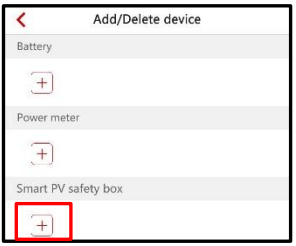
NOTE

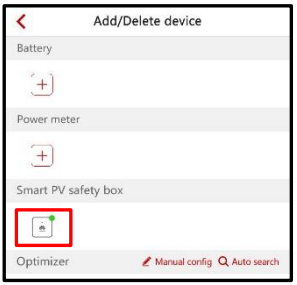
1. The near-end FusionHome app (app for short) is a mobile phone app that locally communicates with the inverter over WiFi for alarm query, parameter configuration, routine maintenance, and commissioning.
2. Requirements for the mobile phone operating system: Android 4.4 or later, iOS 8.0 or later.
3. For details about app connection and login, see the inverter manual available onsite. User interfaces (UIs) on the Android system are used as an example. The actual UIs prevail. Log in to http://solar.huawei.com and choose **SERVICES** > **Download Center** to obtain the latest document.
4. The inverter and safety box cannot perform any commissioning tasks when the AC power is disconnected.

4.1 Adding the Safety Box

1. Log in to the app and access the **Operation console** screen.
2. Choose **Device maintenance** > **Add/Delete device** and tap **Smart PV safety box**.
3. After the safety box is added successfully, the safety box icon is displayed.







NOTE

1. If the safety box icon is green, the safety box is running properly.
2. If the safety box icon is yellow, the safety box is in self test state.
3. If the safety box icon is gray, the safety box is abnormal in communication. Check whether its cable connections and communications parameters are correct.
4. If the safety box icon is red, the safety box has shut down.

4.2 Adding Optimizers

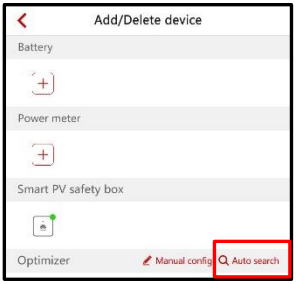
Add optimizers by automatic search or manual configuration.

Automatic search: Automatically search for optimizer SNs and string numbers. You need to manually modify device names and locations.

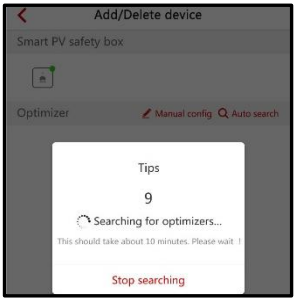
Manual configuration: Manually configure the SNs, string numbers, device names, and locations of optimizers.

Automatic Search

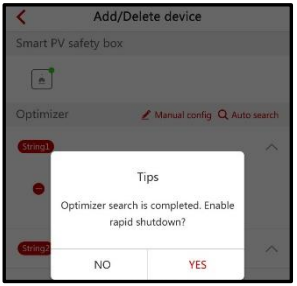
1. Tap **Auto search**.



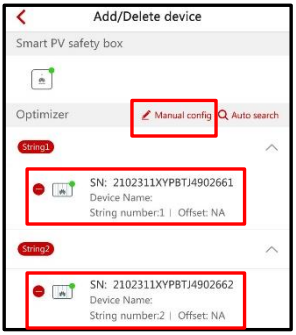
2. The optimizer search takes about 10 minutes. If you tap **Stop searching**, the information of the optimizers already found will be saved.



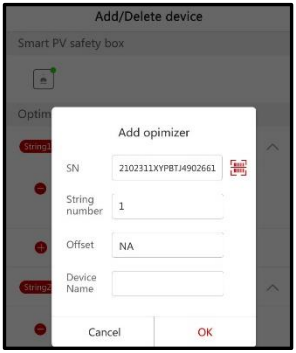
3. After the search is canceled or completed, the screen for enabling **Rapid shutdown** is displayed (see section 4.3).



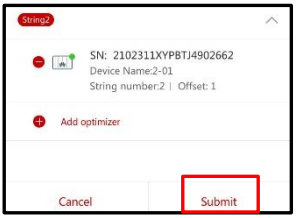
4. If you tap **No** in the previous step, the screen for adding devices is displayed. Tap **Manual config** and tap the optimizer to modify optimizer information.



5. Modify optimizer information.



6. Tap **Submit** and the screen for enabling **Rapid shutdown** is displayed (see step 3).

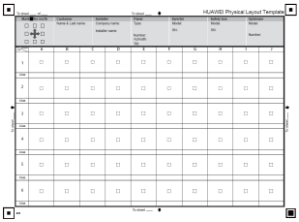


NOTE

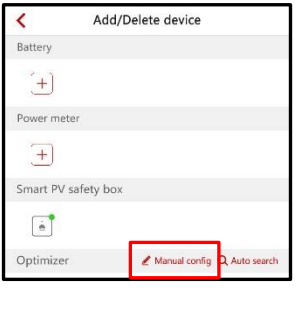
For details about the optimizer icon, see section 5.1.

Manual Configuration

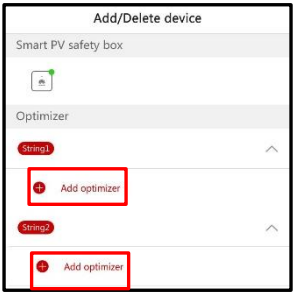
1. When installing optimizers, remove the SN bar codes and attach them to their respective positions on the same layout form. For details, see the usage instructions on the rear of the form.



2. Tap **Manual config**.



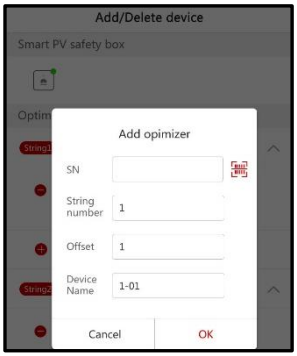
3. By default, two strings are configured. Tap **Add optimizer**.

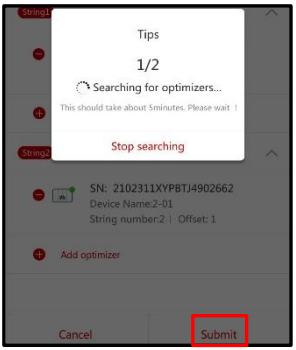


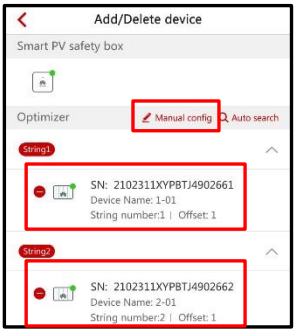
4. Enter optimizer information to add all optimizers in sequence by scanning their QR codes or manually entering their SNs.

5. Tap **Submit**. Automatic search for optimizers begins and will last about 5 minutes. After the search is completed, the screen for enabling **Rapid shutdown** is displayed (see section 4.3).

6. If you stop the searching, the entered optimizer information is saved. You can tap **Manual config** to add a new optimizer or tap the optimizer to modify optimizer information.





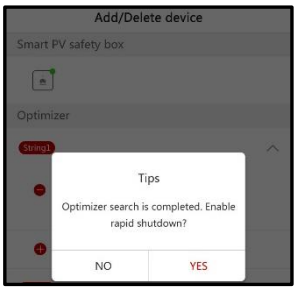


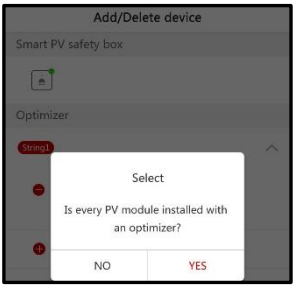
4.3 Performing Rapid Shutdown Check

1. After optimizer search is complete, the screen for enabling **Rapid shutdown** is displayed automatically.

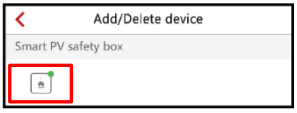
2. If you enable **Rapid shutdown**, check whether an optimizer is installed for each PV module. If you tap **No**, the screen for adding devices is displayed.

3. After **Rapid shutdown** is enabled, a dialog box for performing rapid shutdown check is automatically displayed. Even if you tap **No**, the rapid shutdown function is still valid.





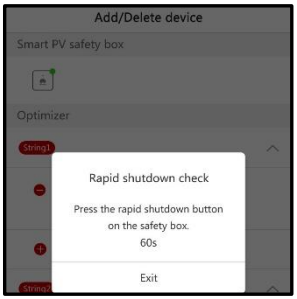
4. If you did not enable **Rapid shutdown** or perform rapid shutdown check, you can still tap the shutdown box icon to access the screen for enabling **Rapid shutdown** or performing rapid shutdown check.



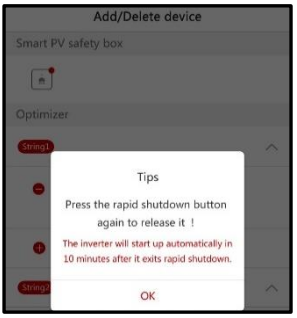
NOTE

1. You need to enable **Rapid shutdown** and start **Rapid shutdown check** only if an optimizer is installed for each PV module. To support the rapid shutdown function, enable **Rapid shutdown** (disabled by default) for the safety box. If **Rapid shutdown** is disabled, the rapid shutdown function is ineffective.
2. If optimizers are installed only for certain PV modules, the rapid shutdown function is ineffective no matter whether you enable **Rapid shutdown** or press the shutdown button.
3. **Rapid shutdown check** is displayed only if **Rapid shutdown** is enabled.

5. Press the Rapid shutdown button within 60s as prompted. If you tap **Exit**, the screen for adding devices is displayed.



6. After rapid shutdown succeeds, release the button as prompted. The inverter will start in 10 minutes.



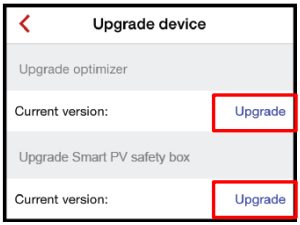
4.4 (Optional) Upgrading the Software

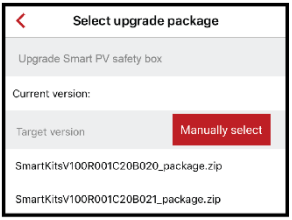
NOTE

1. Obtain the upgrade file from your dealer or Huawei engineers.
2. On the Android system, you can copy the upgrade file to the mobile phone. The upgrade file name extension must be .zip, the file can be flexibly stored, and **Manually select** is supported.
3. On the iOS system, you can import the upgrade file to the app through a mailbox. The upgrade file name extension must be .zip, and **Manually select** is not supported.
4. Upgrading the safety box or optimizer lasts for 10–20 minutes.

1. Choose **Upgrade device** on the **Operation console** screen to upgrade the optimizer or smart PV safety box.

2. Select the appropriate upgrade package and finish the upgrade.



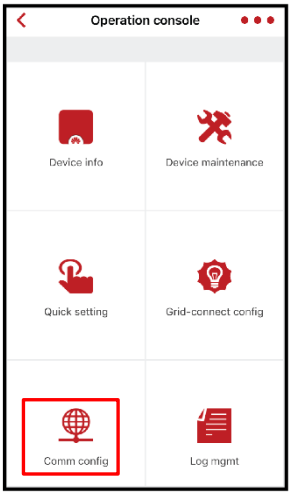


5 Maintenance

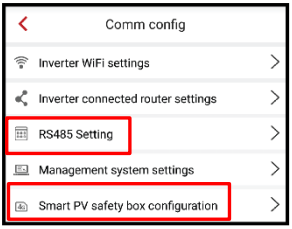
5.1 Communication Fault

1. If the LED indicator of the safety box is blinking green slowly (at 0.5 Hz), check whether its communications cable is connected correctly or check its communications parameter settings. The same RS485 baud rate should be set for the safety box, inverter, power meter, and battery that implement RS485 communication.
2. If setting safety box communications parameters fails, set the inverter baud rate to 9600 bps, and then perform three cycles of press + release operations on the shutdown button within 1 minute. Then, the RS485 communications parameters of the safety box are restored to default values, and the LED indicator blinks red and green (red for 0.25s, green for 0.25s, lasts for 20s).
3. If the message "The PLC frequency band is congested. Switch the frequency band." is displayed on the app, change the PLC frequency band. The change process takes about 3 minutes. Do not power off the safety box.

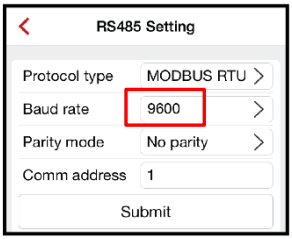
1. Log in to the app, access the **Operation console** screen, and then choose **Comm config**.

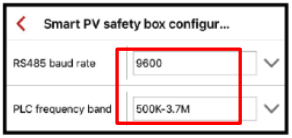


2. Choose **Smart PV safety box configuration**. Then set **RS485 baud rate** and **PLC frequency band**.

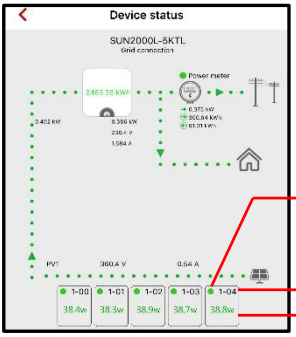


3. Choose **RS485 Setting**, and then set the **Baud rate** for the inverter.





Baud rate	9600 (default), 19200
Frequency band	500K-3.7M (default), 1.5M-4.7M



4. After communication is successful, the optimizer information is displayed in **Device info** on the **Operation console** screen.

Green	The optimizer is running properly.
Gray	The optimizer runs abnormally. Check whether its SN and position information are correct. Then search the optimizer again.
Red	The optimizer is faulty. Troubleshoot according to the optimizer manual.

5.2 Replacing the Safety Box

Replace the safety box if any of the following faults occurs.

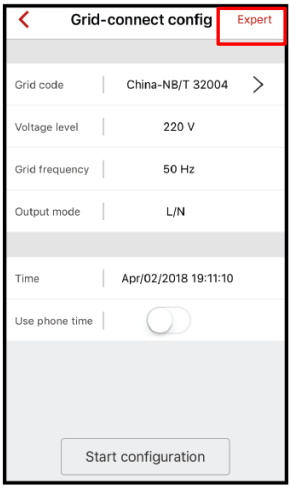
- The appearance is seriously damaged.
- Cables are seriously damaged.
- The LED indicator status does not match the actual status.
- The key button is damaged and fails.
- The key button is not damaged, but the shutdown function fails.

NOTICE

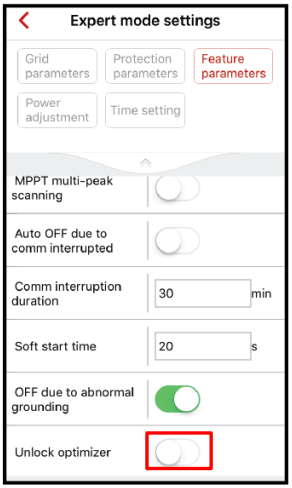
- Obtain the user's consent before replacing the safety box, as the inverter may have no output during the replacement.
- The safety box can be replaced only 30 seconds after you turn off the DC input switch on the inverter and the switch on the AC output loop.

1. Turn off the DC input switch on the inverter and the switch on the AC output loop.
2. Remove the old safety box.
3. Install a new safety box, as shown in the chapter 2.
4. Turn on the DC input switch on the inverter and the switch on the AC output loop.
5. Log in to the FusionHome app, add the safety box (see section 4.1), unlock optimizers (as shown in the following figure), and then add the optimizers again (see sections 4.2 and 4.3). You need to perform this step when replacing the safety box, optimizer, or inverter.

(1) Log in to the app and access the **Operation Console** screen. Choose **Grid-connect config > Expert**.



(2) Choose **Feature parameters** and enable **Unlock optimizer**. Unlock optimizer exits automatically after unlocking is complete.



6 Technical Specifications

Item	Specifications
Maximum input voltage	600 V DC
Maximum input current	15 A
Maximum short-circuit current	15 A
Maximum number of inputs	2
Maximum output voltage	600 V DC
Maximum output current	15 A
Maximum number of outputs	2
DC power supply	12 V DC
Protection level	IP65
Power consumption	< 3 W
Noise	< 35 dB
Cooling mode	Natural cooling
Display	LED
Installation mode	Wall-mounted
Dimensions	149 mm x 149 mm x 49 mm (excluding cables)
Weight	0.8 kg (including cables)
Input and output terminals	H4 x 2/H4 x 2
Operating temperature	–30°C to +55°C
Operating humidity	5%–95% RH
Operating altitude	0–4000 m (≥ 2000 m: 1°C/200 m derating)
Storage temperature	–40°C to +70°C
Storage humidity	5%–95% RH
Networking mode	PLC, RS485
Safety compliance	IEC62109
Electromagnetic compatibility (EMC)	IEC61000-6-2, IEC61000-6-3
Mean time between failures (MTBF)	500,000 hours
Design life	25 years (excluding field replaceable parts)
Environmental protection	RoHS

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