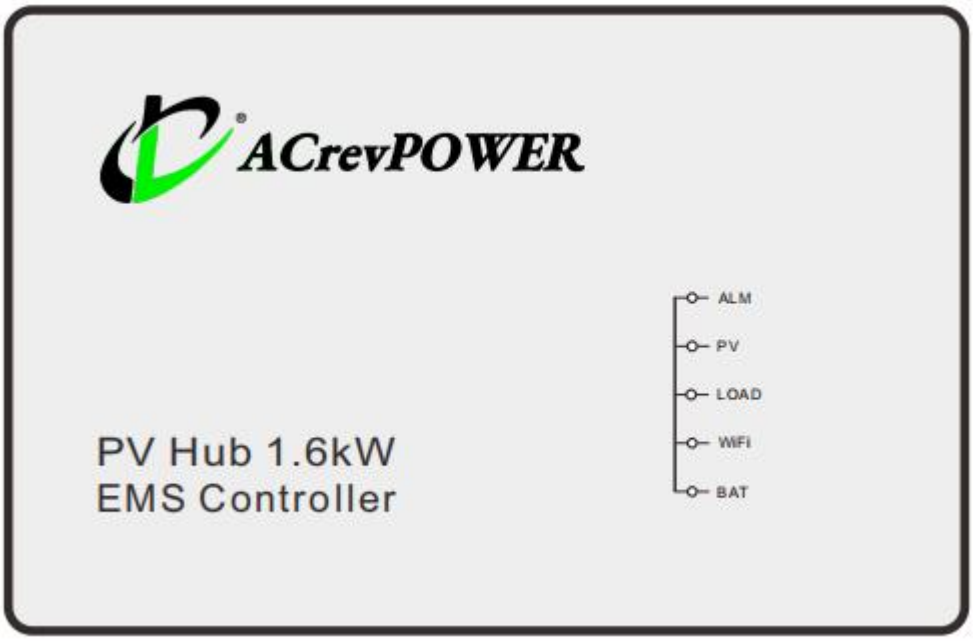
EMS Controller User's Manual

V 1.0



EMS Controller
Model

SPD-EMS 1.6kW

Foreword

Before using this product, read this document carefully to understand and use it correctly.

Keep this document in a safe place for future reference.

Improper operation may cause injury or damage.

By using this product, you agree to the terms and conditions in this document.

The Company is not liable for damages due to improper use.

The Company has the final interpretation of this document and related documents.

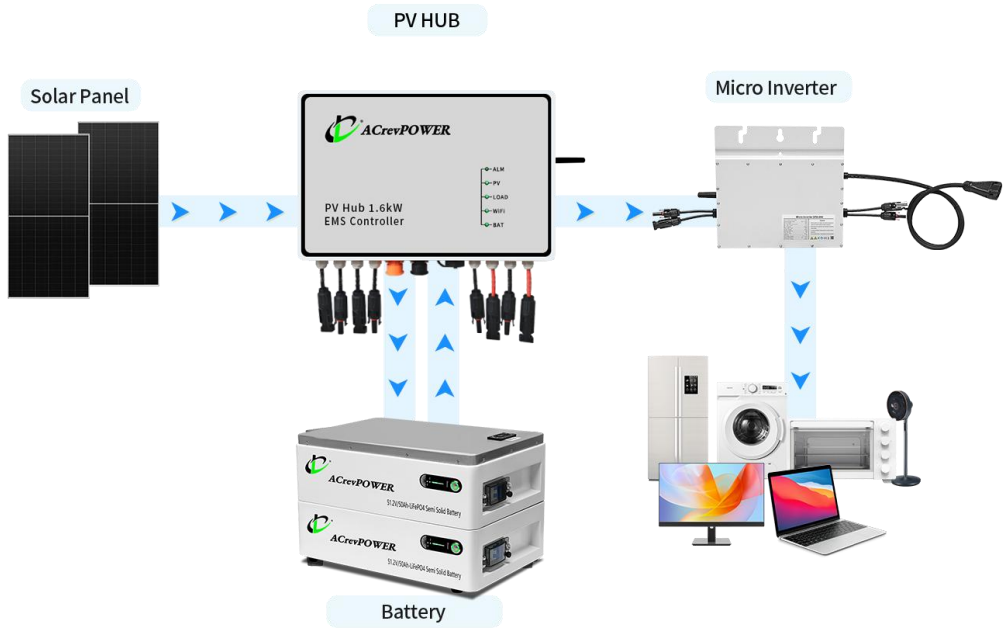
Check the official website for updates to this document.

Catalogue

1. Introduction

1.1. About PV Hub

We normally call the energy storage controller as PV Hub, which is used in balcony photovoltaic energy storage system, to manage the energy flow among PV, battery and micro inverter, the following devices are needed for energy storage system building, PV panel, PV Hub, Battery pack and micro inverter, the PV Hub is playing the key role.



1.2. About the manual

This manual contains important instructions for the PV Hub, user shall read it carefully before installation and operation. For safety reasons, only qualified personnel who has received the appropriate training shall install this energy storage system under the guidance of this manual.

2. Important information

The following symbols appear on the product label and are described here:

Symbols	Explanation
	Danger: Refer to the safety instructions
	Danger: Risk of electrical shock

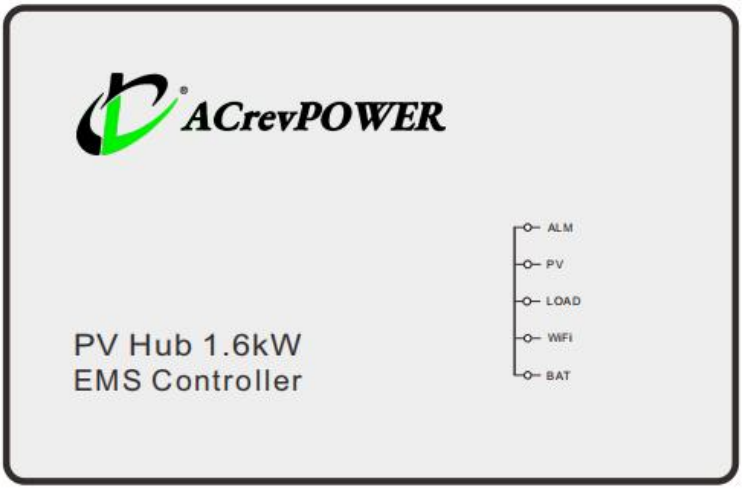
	Warning: Hot surface
	The Micro Inverter is covered by the EU WEEE directive.
	The CE mark confirms the compliance of the Micro Inverter with the European Low Voltage and EMC Directives
	The RoHS mark confirms the compliance of the Micro Inverter with European directive on “the restriction of the use of certain Hazardous substances in Electrical and Electronic devices”.
	The Micro Inverter complies with the FCC requirements.
	Grounding Protection: prior to operation you must make sure that grounding protection is properly connected.
	Please read the user’s manual firstly before installation, operation and maintenance.
	This indicates information that is very important for optimal system operation. Follow instructions closely.

3. SPD-EMS Controller

3.1. Product Overview

The SPD-EMS Controller is equipped with the remarkable capability to simulate the voltage-current curve of solar panels. With both manual and automated modes, it exerts precise control over the microinverter's power output to the power grid, guided by real-time energy consumption data. Notably, it provides an elegant solution to the persistent challenge of efficiently storing surplus solar energy within batteries. Furthermore, the device seamlessly interfaces with smart meters via WiFi connectivity, facilitating meticulous recording of power import and export interactions with the public grid. This transparent data acquisition empowers users to maintain a vigilant eye on the operational state and performance metrics while also facilitating the effortless transmission of PV curves to the device. All of these dynamic functionalities are efficiently managed through the user-friendly APP.

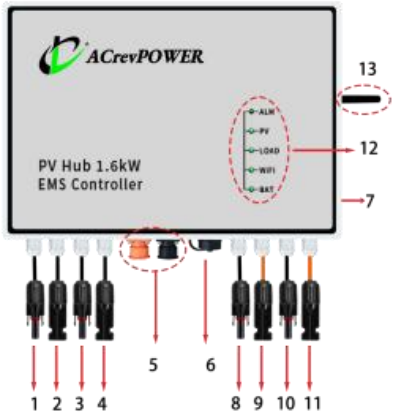
The SPD-EMS controller exemplifies the pinnacle of innovation in the realm of microinverter storage systems, ushering in a new era of efficiency, control, and seamless integration.



3.2. Main Features

a. Module-level MPPT trackers, safe and easy to monitor each individual panel's performance.
b. Independence MPPT trackers, peak conversion efficiency >99%, maximize each solar panel's output.
c. Simulate the solar panel's output voltage-current curve, which can match most brands microinverter.
d. Manually or automatically control the output power for microinverters, to meet different users' requirements.
e. Integrated the BMS, communicates with the battery in real-time, more safe and efficient for managing your battery.
f. Overcharge, over-discharge and overload protection, keep your battery in a safe situation.
g. Flexibly remote monitor your solar harvest via APP in rural places.

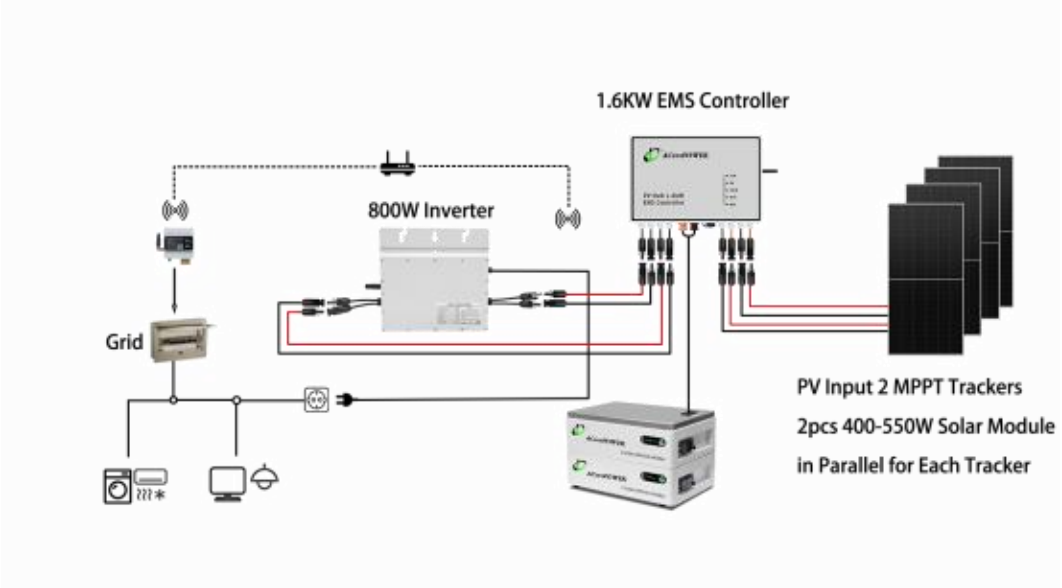
3.3. Connection Ports



1.Output 1-
2.Output 1+
3.Output 2-
4.Output 2+
5.48V Battery Connector
6.RS485
7.On/Off
8.Input 2-
9.Input 2+
10. Input 1-
11.Input 1+
12.LED indicator
13.wifi

3.4. Connection Diagram

The SPD-EMS controller, compatible with microinverters from various brands, operates as a hybrid power generation system. It receives DC power from PV panels, directing it to the microinverter, then the battery for storage, microinverter feed in the main grid for load requirements, the surplus power can be exported to the main grid (on-grid). The device can be paired with a smart meter via WiFi to record both the export and import of power with the main grid.



4. Installation Preparation

Note

This controller must be paired with a microinverter (supporting most brands) to establish a hybrid solar storage system. Consequently, it is essential to install one or more microinverters in conjunction with this controller.

4.1. Physical Damage Checking

After received the controller, please carefully check if any physical damages that may have occurred during transportation. Examine the components thoroughly for visible cracks or other damages. If any such damage is detected, please contact your local dealer immediately for further assistance and guidance. We prioritize the safety and integrity of our products, and prompt action in the case of any physical damage will ensure a smooth and reliable installation process.

4.2. Packing List

The packing list is shown as in below picture, please check if anything is missing, and contact your local dealer if need.

4.3. Tools Required for Installation

① Crimping pliers, ② Wire strippers, ③ Screwdriver, ④ Nut drivers, ⑤ Manual Wrench, ⑥ Power drill/driver etc.

4.4. Devices and Components for Entire System

① Controller, ② Microinverters (optional), ③ PV Panels (not provided), ④ Battery (optional), ⑤ Mounting Brackets (not provided), ⑥ CT Meter (optional), ⑦ Y type MC4 cable (not provided), ⑧ Battery Cable (not provided), ⑨ Battery communication cable (not provided)

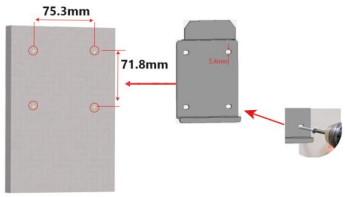
Note

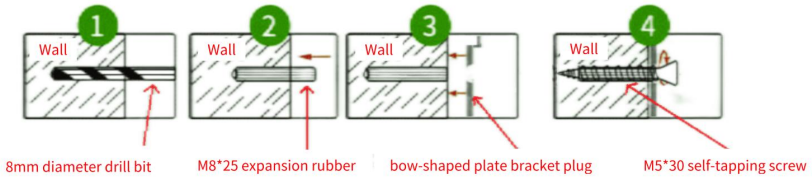
Battery cable and battery communication cable are provided with battery together when battery is purchased.

5. Start Installation

Step 1: Mark the drilling positions on the wall, use an 8mm-diameter drill bit to drill 4 holes with the depth of 35mm. Insert M8*25 expansion rubber plugs into the holes.

Step 2: Use M5 cap screws to fix the bow-shaped plate bracket onto the wall.





Step 3: Use M5*6 cross screws to lock the bow-shaped bar bracket at the reserved groove position on the backside of the PV HUB.

Step 4: Hang the PV HUB on the bracket.

5.1. Wiring Introduction

Please check following issues before wiring.

5.1.1. Wiring connection with the PV panel

a. The maximum voltage of each connected PV panel should not exceed 60V.

b. The polarity and model of the outgoing terminal of the PV panel should match with the device.

c. The PV panel cannot be input in parallel. That is, PV1+, PV1- cannot be directly connected to PV2+, PV2-.

5.1.2. Wiring connection with the micro-inverter

a. The micro-inverter operates properly.

b. The input voltage and power comply with the PV HUB system parameters.

c. Never artificially connect or disconnect the wiring terminal between the micro-inverter and the device when the device is powered on.

d. When the AC plug of the micro-inverter is connected to the power grid, it is necessary to ensure that the ground terminal in the AC plug can be reliably grounded. Otherwise, it will affect the device communication and cause abnormal operation of the system.

5.1.3. Wiring connection with the battery pack

a. The battery pack functions properly, and the battery pack is equipped with a BMS. The BMS communication protocol has been connected in advance to the PV HUB.

b. The battery and the charge/discharge power and other parameters of the battery pack are in accordance with the parameters of the PV HUB system.

c. Battery cable preparation: Separate the three components of the DC cable connector provided with accessories, following the provided picture. Strip off about half an inch of insulation from both ends of the cable using cable strippers. Carefully insert the stripped cable ends into the appropriate crimp terminals of the connector. Use a crimping tool to securely crimp the terminals onto the cable strands

d. Polarity and correct connections: Ensure that you connect the positive (+) terminal of the battery to the positive (+) terminal of the controller, and likewise for the negative (-) terminals. Reversing the polarity can lead to equipment damage and safety risks.

Warning

For safe operation and regulation compliance, it is strongly recommended to install a separate DC over-current protector or disconnect device between the battery and controller, especially when the current is more than 100 amps.

All wiring must be conducted by qualified personnel. Using appropriate cable for battery connection is crucial for system safety and efficient operation.

Recommended cable

Model	Cable size	Battery voltage
SPD-EMS controller	2x8AWG	48V/51.2V

5.2. System Installation Sequence

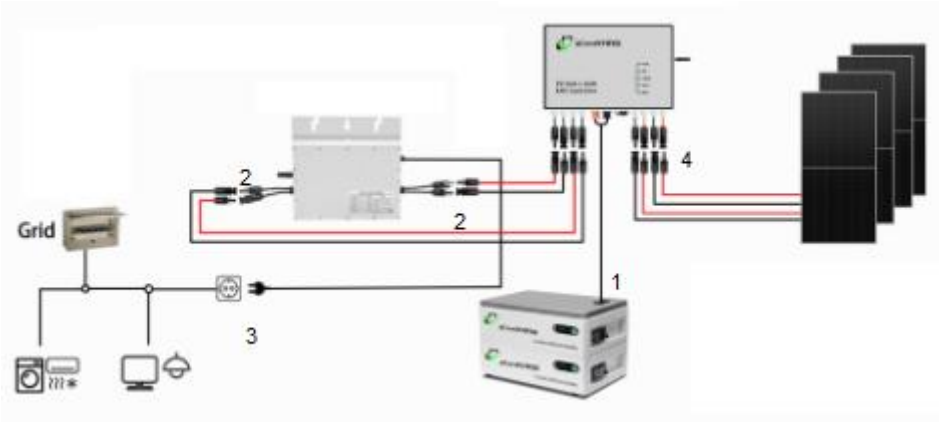
① Connect the battery to the device.

② Connect the micro-inverter to the INV1 and INV2 ports.

③ Connect the grid-connected plug of the micro-inverter to the household socket.

④ Connect the PV panel to the PV1 and PV2 ports.

⑤ Press the battery power switch to start the system.



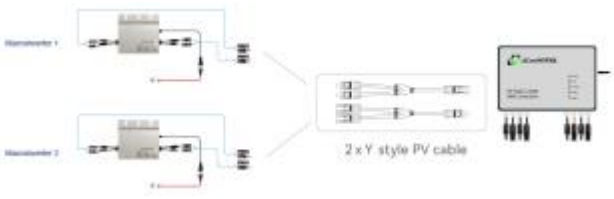
Note

a. For a 1.6kW controller, connect the maximum of two microinverters with 800W power output each.

b. For DC connections, users need suitable connectors compatible with the microinverters and the Controller, Common connectors MC4 connectors.

c. If you plan to install one microinverter with 2 independent MPPT inputs, it is recommended to use Inverter-1 to connect MPPT1 input, and Inverter-2 to connect MPPT 2.

d. If connect with >2pcs microinverter, please buy following Y type PV cable, we suggest you need change it into t he solid core pin MC4 connector.



e. When the PV panels are correctly connected, the system will start automatically and begin to operate normally.

f. After the solar panels are connected, if the battery switch is not turned on within more than 1 minute, the system will bypass the output of PV1 to INV1 and the output of PV2 to INV2. The system will not start to operate normally until the battery is turned on.

5.3. System Disassembly Sequence

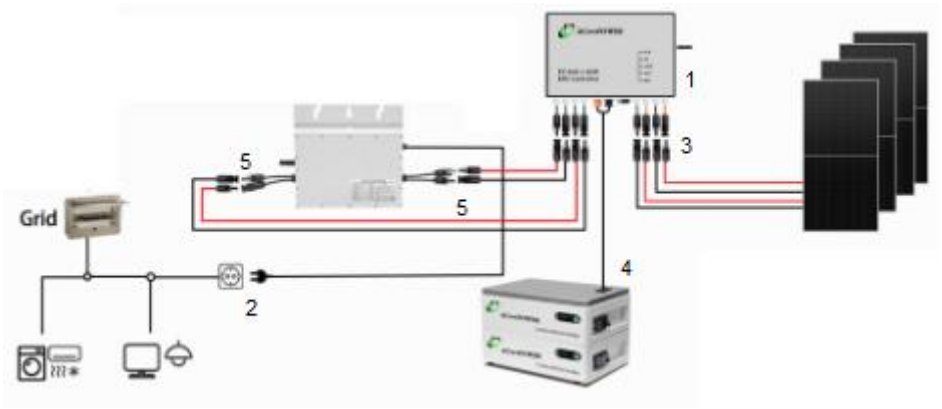
① Set the solar power system to the standby status through the APP, or press the power button on the machine for 3 seconds to turn it off.

② Unplug the cables between the inverter and house to disconnect the household power grid.

③ Unplug the cables between the PV panels and the machine to disconnect from the PV panels.

④ Unplug the cable between the battery pack and the device to disconnect from the battery.

⑤ Unplug the cable between the micro-inverter and the device to disconnect from the micro-inverter.



Note:

Please keep all the parts well for re-installation if necessary.

6. System Operation Instructions

6.1. System Startup

a. When the EMS controller is first time powered on or restarted, EMS controller will immediately enter the self-check status, first is battery checking, then PV input and DC output checking.

b. After finish self-check, EMS controller will enters normal operation according to the battery power, power consumption plan and output connection mode.

c. Every morning and evening, EMS controller will detect the open-circuit voltage of the PV panel once each, during open-circuit voltage detecting, the charging and discharging will

be paused for about 15 seconds, the operation will be continued when detecting is finished.

6.2. Configure the output connection scheme

After the system installation is completed and the device is powered on, use the "Smart Life" or "Tuya Smart" APP to connect with the device.

Configure the output connection scheme through the APP, and set the power of the two output terminals of the device connected to the micro-inverters according to the actual situation. Otherwise, there will be a large deviation between the output power and the actual preset power. It should be noted that the set power is the maximum power of the corresponding output.

When configuring the output connection scheme, the default power for the two DCs connected to the micro-inverter is 800W. If the power of either DC is set to "not connected", the output of that DC will be turned off.

After the configuration is completed, the system will allocate the preset power proportionally according to the configured output connection scheme.

6.3. Instructions for Configuring Power Consumption Schemes

After configuring the output connection scheme, configure the power consumption scheme according to user’s power consumption needs. The device supports two modes, namely the custom mode and the intelligent mode. For details on how to configure the power consumption scheme through the APP.

6.3.1. Custom Mode

In the custom mode, it is possible to set the default grid-connected power or customize and set the grid-connected power for 10 time periods. When the grid-connected time has not reached the set time period, the device operates according to the default grid-connected power. When the grid-connected time reaches the set time period, the device operates according to the grid-connected power of the that time period.

When the grid-connected power is 0W, the device will turn off the output and only charge the battery. If the battery power is lower than a certain threshold (the default is 98%), the charging power will not exceed the maximum charging current requested by the BMS; if the battery

power is higher than a certain threshold (the default is 98%) but has not reached 100%, the single-channel limit of the charging power is 200W, and the total power limit is 200W. After the battery is fully charged, when the power drops to 98%, charging will be restarted; otherwise, it will remain in a status of neither charging nor discharging.

When the grid-connected power is not 0W, the device will discharge according to the power preset by the user. If there is surplus PV power, it will charge the battery. After the battery is fully charged, all the PV power will supply power to the micro-inverter. When the PV power is not surplus, the battery will supply supplementary power until the battery power is lower than the low-power threshold (the default is 10%).

6.3.2. Smart Mode

Smart mode requires the use of a smart power meter. The smart mode requires users to add a smart power meter in the "Smart Life" or "Tuya Smart" APP for setting, and the smart power meter must be in the same Wi-Fi network as the device. For detailed information and usage instructions about the smart energy meter, please refer to the user manual of the smart energy meter.

In smart mode, there is no need for users to set the discharge power and discharge time. The output power of the micro-inverter can be adjusted in real-time by the smart power meter to detect the household power consumption, so that the grid power is reduced to 0W, thereby achieving the goal of smart control and maximizing the use of energy saving and power saving of the solar power system.

Device Status Description

Status	Description
Standby	Device stops charging and discharging.
Self-Check	In the self-check status, the device will check the battery and PV connection status.
Running	The running status refers to the normal operation status. In this status, it operates according to the connection scheme and the power consumption scheme.

Status	Description
Low Battery	When the battery power is lower than the low-power threshold (10%), it will enter the low-power status. In this status, the device stops discharging the battery. If the PV input power is lower than the power consumption demand at this time, it will be bypassed and output to the micro-inverter. If the PV input power is higher than the power consumption demand at this time, after about one minute, the surplus PV power will be used to charge the battery. When the battery power is lower than the ultra-low power (5%), the output will be turned off and all the PV power will be used for charging until the battery is charged to 10%.
Calibration	When the device detects that there is a large deviation between the battery power and the actual displayed status of charge (SOC), it will prompt the user to calibrate the battery. When the user sets the calibration, the device enters the calibration status. In the calibration status, the device will turn off the output and give priority to charging the battery. It will automatically exit the calibration status only when the battery is fully charged. The user can also actively exit the calibration status on the APP.
Fault	When it is detected that the battery is suddenly disconnected or the PV input is bridged, the device will enters fault status. Turn off the device, restore the normal connection, and restart the device to return to normal.

6.4. Indicator Light Information

The PV HUB is equipped with 5 LED indicators to indicate the current operating status of the PV HUB. The definitions of the indicators are presented in the table below:

Indicator	Status	Description	Solution
ALM	On	System Failure/Protection	Turn off the device operation and then turn it on again to see if it can be restored. If it cannot be restored, power off the system and restart it. If the restart fails to restore, please contact the after-sales technical support.
	Slow Flashing	Alarm	Under normal circumstances, the device will recover automatically. If the device fails to recover automatically, turn off the device operation and then turn it on again, and it can return to normal.
	Off	No system failure/alarm	
PV	On	PV input power is greater than 30W	
	Slow Flashing	PV is under self-check	
	Off	PV input power is less than 30W	

Indicator	Status	Description	Solution
LOAD	On	Output power of the micro-inverter greater than 20W	
	Slow Flashing	Micro-inverter self-check	
	Off	Output power of the micro-inverter less than 20W	
Wi-Fi	On	Device successfully configured with network	
	Slow Flashing	Device not connected to network and in STA mode	
	Double Flashing	Device not connected to the network and in STA mode	
BAT	On	Battery normally connected	
	Slow Flashing	Abnormal communication between battery and device	
	Off	Battery not connected	

6.5. Button Control

The PV HUB features one control button. Different triggering methods can yield diverse control effects. The specific definitions are presented in the table below:

Button	Control Mode	Description
Power Button	Press and hold for 3 seconds or more	Device power on/off
	Press consecutively for 5 times or more	Clear Wi-Fi network configuration
	Press consecutively for 3 times or more	Switch Wi-Fi network configuration mode (effective in the unconfigured network mode)

6.6. Status Information

The device periodically reports the status information of the system operation to the APP, including the operation status information of the device itself, the PV power generation module, the household power supply module and the battery pack module. Refer to the table below for details:

Module	Status Messages	Unit
Solar Power Generation	PV1 voltage	V
	PV1 current	A
	PV1 power	W
	PV2 voltage	V
	PV2 current	A
	PV2 power	W
	Total PV power	W
Household Power Supply	INV1 voltage	V
	INV1 current	A
	INV1 power	W
	INV2 voltage	V
	INV2 current	A
	INV2 power	W
	Total INV power	W
Battery Pack	battery voltage	V
	battery current	A
	battery charging and discharging power	W
	Battery capacity	%
Device	device switch	--
	device temperature	℃
	device alarm	--

7. Install APP and Monitor Your System

7.1. Download and Installation of the APP

Use the "Smart Life" APP to add devices, view and control the operating status of devices. Users can search for "Smart Life" in the Apple App Store and major Android application markets or scan the following QR code to download this app.

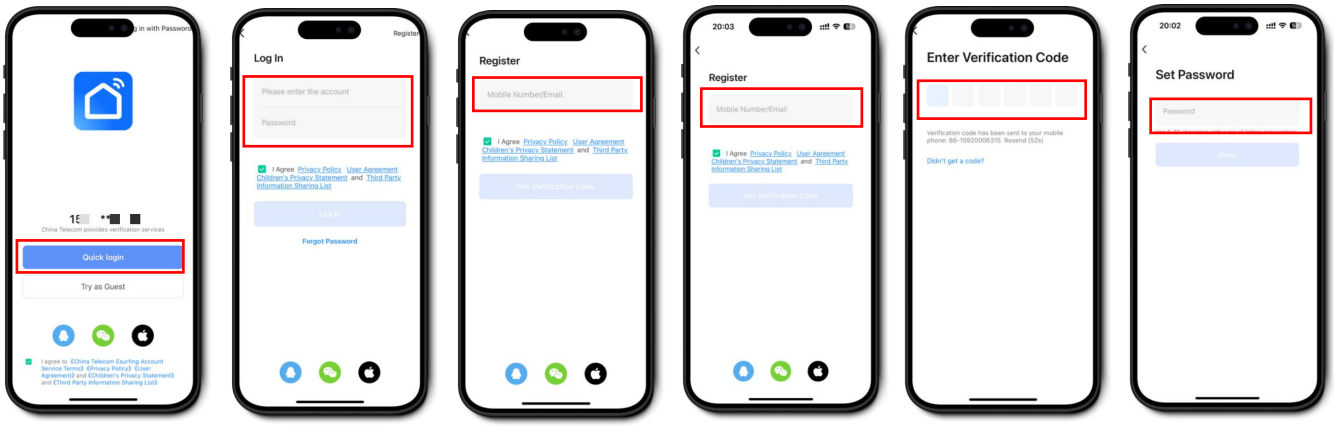
7.2. Register an account

a. Click "Password Login" in the upper right corner, click "Register" to enter the registration

page.

b. Input a mobile phone number or email address and obtain a verification code for registration.

c. Set a password and click "done" to complete the registration.



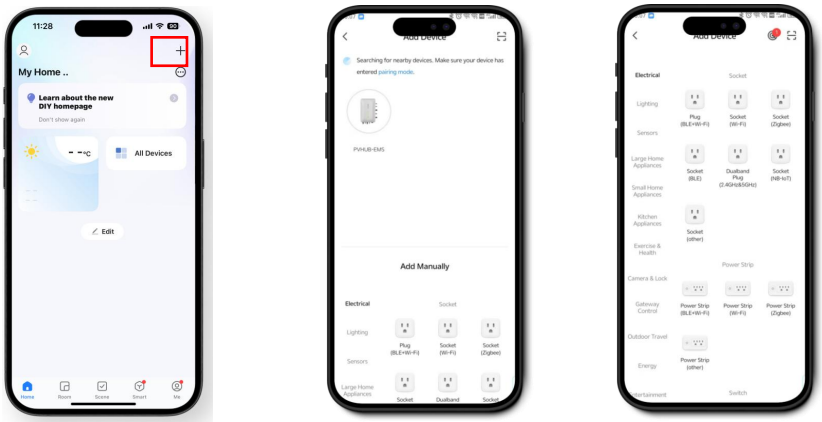
7.3. Adding the Device

a. Click the "+" button in the upper right corner, and then select the "Add Device" button to add a device automatically.

b. When using this function, allow the app to enable the permissions of Wi-Fi and Bluetooth. If the Wi-Fi permission is not turned on, Wi-Fi devices cannot be searched. If the Bluetooth permission is not turned on, nearby Bluetooth devices cannot be searched.

c. After searching for the device, click Add and enter the router name and password.

d. Wait patiently for the addition to be completed.



7.4. App operation interface

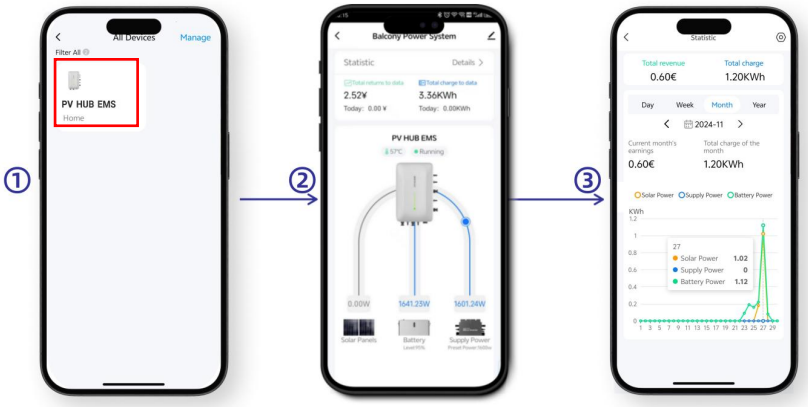
7.4.1. Main interface and statistics interface

a. After device addition, view the added device under "All Devices". Click it to enter the main

interface.

b. On the main interface, the PV input power, battery power, charging and discharging power and the power output from the device to micro-inverter can be viewed. When a smart meter is connected to the same Wi-Fi network, the power of the power grid can also be checked.

c. Clicking "View Details" in data statistics to view the statistical data of solar power generation, the power discharged from the device to the micro-inverter and battery charging.



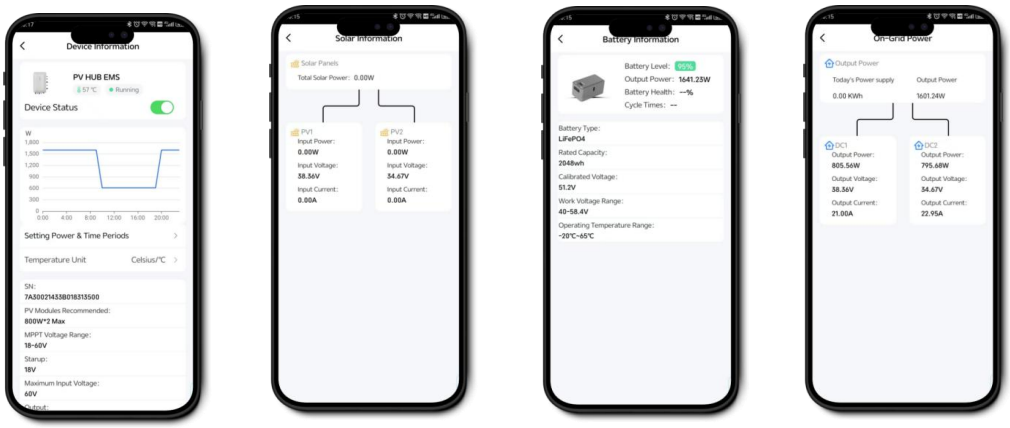
7.4.2. View system device details

a. Click the device icon to view information such as the device status, temperature, and specification parameters of the device.

b. Click the icon of the PV panel to view information such as the input power, input voltage, and input current of the PV panel.

c. Click the battery icon to view information such as battery power, charge and discharge power, battery life, and cycle times.

d. Click the micro-inverter icon to view information such as the output power, output voltage, and output electricity at the output end of device.

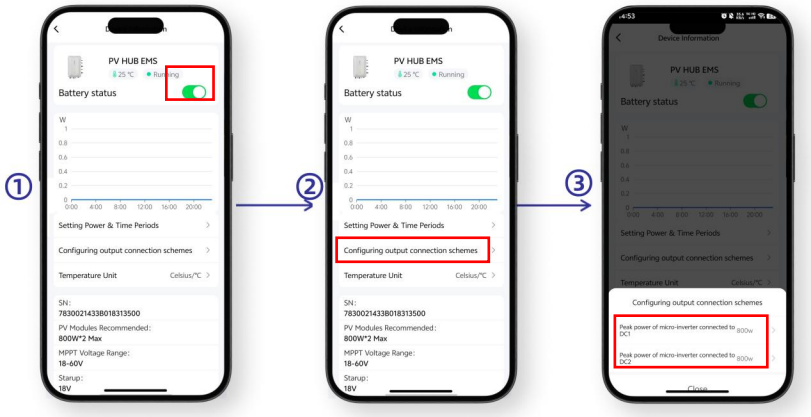


7.4.3. Configuration connection scheme

a. Click the device icon and click the switch of the device status to turn on and off the charging and discharging of device.

b. Click "Configuring output connection schemes" to set the connection mode of the micro-inverters at the output end.

c. Select the peak power of the micro-inverters connected to the output end.



7.4.4. Custom Mode

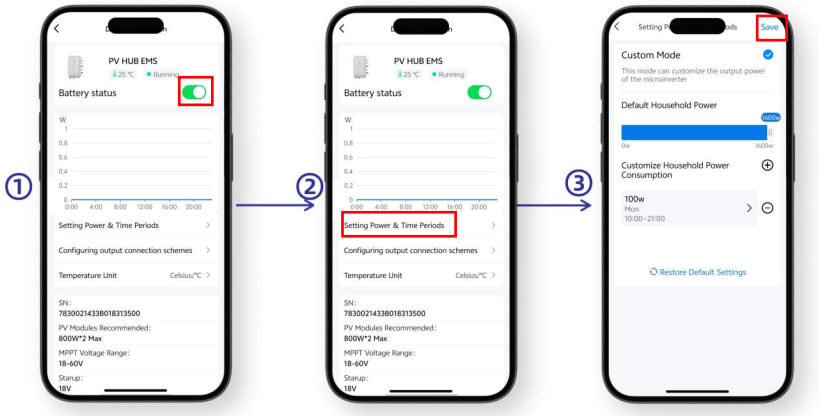
a. Click the device icon on the main interface and click the switch of the device status to turn on and off the charging and discharging of device.

b. Click "Setting Power & Time Period" to set the charging and discharging of device.

c. Drag the Default Household Power progress bar to set the default household power.

d. Click the "+" sign on the right side of "Customize Household Power Consumption" to add a discharge time period.

e. After setting is completed, click "Save".



7.4.5. Smart Mode

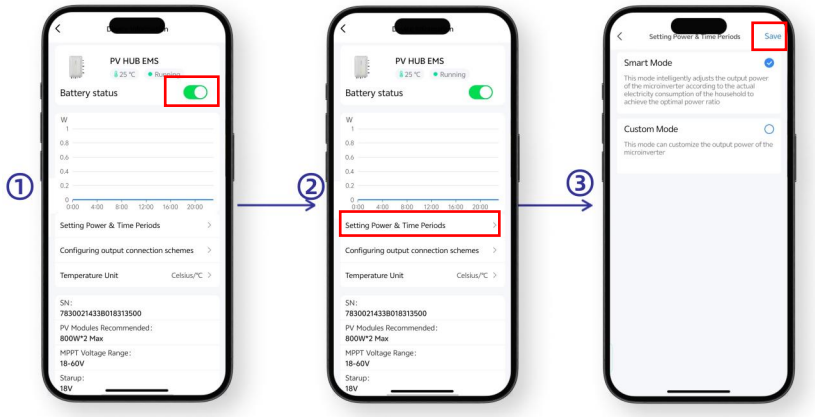
The smart mode can be used when the smart power meter and the device are connected to the same Wi-Fi network. Please refer to the user manual of the smart power meter for its usage. The setting method of the smart mode is as follows:

a. Click the device icon on the main interface and click the switch of the device status to turn on and off the charging and discharging of device.

b. Click "Setting Power & Time Period" to set the charging and discharging of device.

c. Tick “Smart Mode” and click “Save” to enter the smart mode.

d. After setting is completed, click "Save".

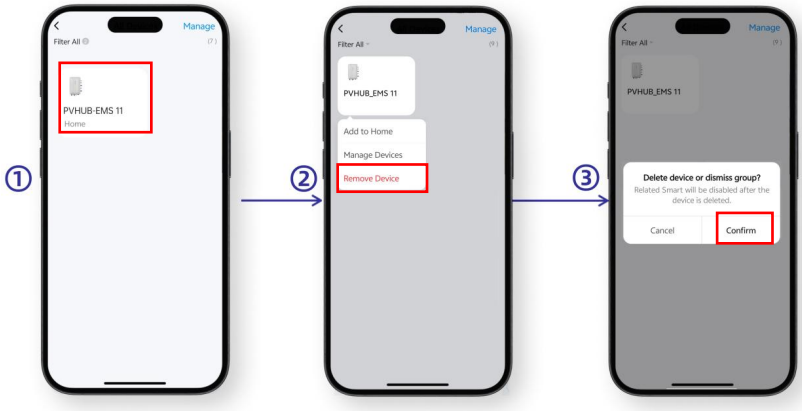


7.4.6. Device Removing

a. On the "All Devices" interface, select and long-press the device to be removed.

b. Select "Remove Device" in the pop-up prompt window.

c. Click the "Confirm" button to remove the device.



8. Technical Data Sheet

Model	EMS 1.6kW-pro
MPPT Solar Charger	
Number of MPPT Trackers	2
PV Operating Voltage	20-60V

MPPT Operating Voltage Range	25-50V
Max. PV Open Circuit Voltage	60Vdc
Max. PV Array Power	2 x 1 Tracker 800W
MPPT Tracking Efficiency	99%
Conversion Efficiency	98%
PV over voltage Protection	> 60V
DC Output	
DC Output Power	Controlled by APP
DC Output Port	2(Independent)
DC Output Voltage Range	18~55V
DC Output Max. Power	2x800W
Battery	
Battery Voltage Range	40V-58.4V
Battery Charging Overvoltage Protection Value	60V
Battery Discharge Voltage Protection Value	44V
Battery Short-circuit Protection Current	66A
Communication	
Communication Port	RS485 with battery
WiFi	For APP Remote Monitoring
Energy Management	
Output Power to Microinverter	1600W
Qty of Microinverter	2pcs 800W Microinverter
Limited the Output Power to Microinverter	Set up by APP or Automatically Controlled By the EM
Customized the Output Power at Different Time	Set up By APP
Mechanical	
Net Weight	3.2KG
Dimensions	340*213*67mm
Cooling	Natural Convection-No Fans
Enclosure	IP65
Environment	
Operating Ambient Temperature Range	-20 °C to +65 °C
Storage Temperature	-40 °C to +85 °C
Humidity	100% Non-Condensing
Warranty	10 Years(Except for vulnerable structural parts (such as terminal blocks, panels, external wiring materials, etc.)
Compliance	
Safety standard	EN62109-1/-2, UL1741, IEEE 1547
EMC	EN61000-3-2/-3, EN61000-6-1/-2/-3/-4, EN301489-3/-17

9. Troubleshooting

Phenomenon	Probable Cause	Countermeasure
Red light alarm, no output for micro inverter	Battery short circuit protection, Output over current protection.	Press on/off button on machine or use the APP to turn off and restart the device.
Unable to power on.	Unable to start after PV connection.	Check whether the PV wiring harness is properly connected.
PV is connected, but battery cannot be charging or discharging, the battery indicator light is not light up.	Poor contact of battery cable, or abnormal communication of the battery pack.	Check whether battery wiring harness is properly connected.
The device can not be found.	Abnormal query of WiFi device.	Check the mobile phone network and the device to determine if it has been bound by other devices.

Note: 

Please contact local dealer if the problem is still not yet solved.