EMS for PowerHill (143-215kWh)

User Manual

V_1.0 Date 2024/09/30

Notice

This manual contains important safety instructions, installation, electrical connections, commissioning, maintenance, and troubleshooting of the equipment.

Save the manual

This manual must be stored carefully and be available at all times.

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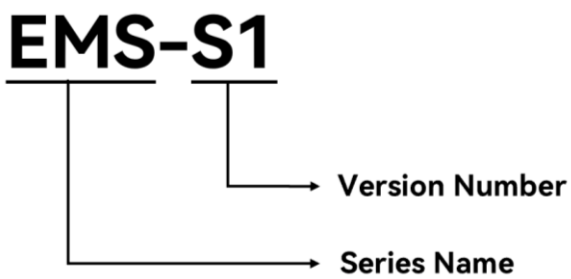
Content

About This Manual

Overview

Please read the product manual carefully before installation, operation, or maintenance of the EMS series. This manual contains important installation instructions that must be followed during installation and maintenance of the equipment.

Designation explanation of the EMS series:



No.	Meaning	Description
1	Series Name	EMS: Energy Management System
2	Version Number	S1 S2 S3

Intended Audience

This manual is intended for technical professionals for installation, commissioning and maintenance of the product. The technical personnel have to be familiar with the product, local standards, and electric systems.

Change History

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

Issue 01 (2024-09-30)

This issue is used for first application

1 Overview

1.1 Summary

EMS is a lightweight on-site control and energy management system, mainly used in application scenarios containing battery storage devices, through which the application of the system can achieve on-site multi-storage device power distribution, multi-energy (load, photovoltaic, generators, etc.) complementary monitoring and energy management.

1. Covers a wide range of energy storage application scenarios, including energy storage, photovoltaic, grid and other multi-energy complementary scenarios. There are three EMS versions based on different application scenarios, each with specific functions as follows:

EMS Model	Application Scenarios
EMS-S1	PQ module, accepts scheduling from upper-level EMS
EMS-S2	Photovoltaic DC coupling, peak-valley arbitrage, distribution capacity enhancement
EMS-S3	Photovoltaic AC coupling, with strategic control capabilities

2. Supports access to cloud and third-party monitoring systems.
3. System operation logs are traceable.
4. Integrate multiple energy management strategies.

1.2 EMS Unit

Figure 1-1 EMS Appearance

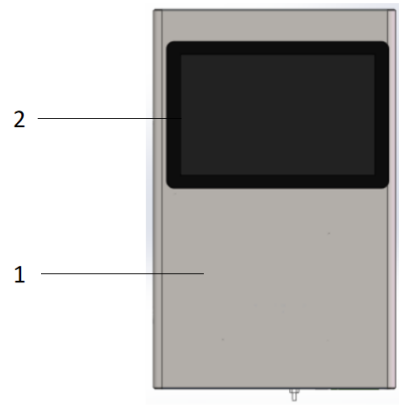


Table 1-1 EMS Appearance

No.	Name	Function
1	EMS cabinet	Cabinet
2	Display	Display EMS interface information

Figure 1-2 EMS Internal structure diagram

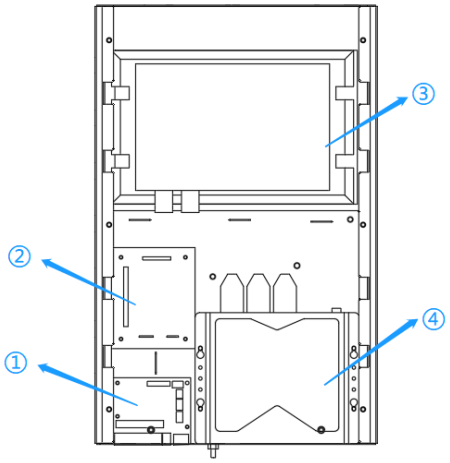


Table 1-2 EMS Internal structure diagram

No.	Name	Function
①	Wiring Adapter Boards	Line adapter, external interface
②	Monitor Controller	/
③	Displays	User Interface Display

④	EMS Industrial Controller	Microcomputer mainframe

1.3 EMS Parameters

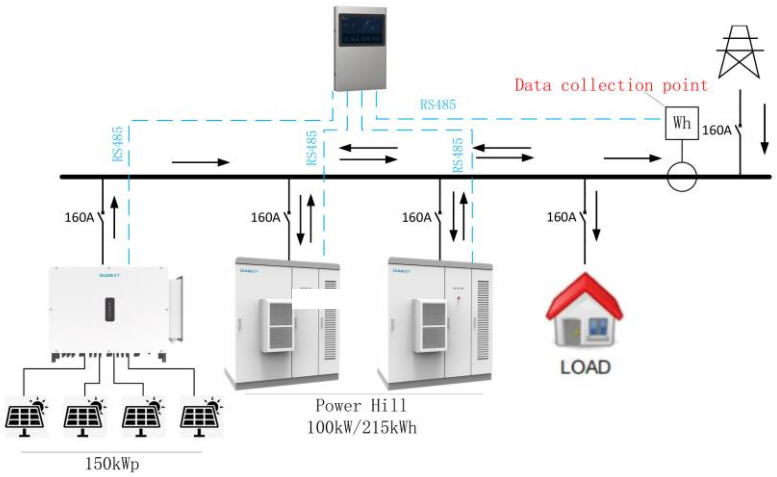
The detailed EMS parameters are shown below:

Table 1-3 EMS parameters

Item	Parameters	Description
Control Functions	P/Q Scheduling, Smooth PV	/
User Interface	Display Interface, Ethernet	/
Communication Interface	1-way Ethernet	/
Communication Protocol	Ethernet: Modbus TCP	/
Power supply input	DC12V,120W	/
Operating Temperature	-20 ~ 55℃	/
Altitude	≤2000m	/
Ambient relative humidity	5 ~ 95%	Non-condensing
Protection class	IP21	/
Width, Height, Depth	320mm*500mm*60mm	/
Weight	9.3kg	/
Installation	Indoor, hanging	/

1.4 System Application

Figure 1-3 System Grid Connection Application



1.5 Function List

Table 1-4 Function List

No.	Function	Description
1	Start stop control	Control the start and stop of the entire system
2	Charging and discharging control	Charging and discharging of control system
3	Power allocation	Maximizing power based on the operating status of the system
4	Photovoltaic spontaneous self use	EMS prioritizes photovoltaic power supply to the load and charges the remaining energy storage based on the data of photovoltaic power, load, and energy storage
5	Peak valley mode	EMS control system operates according to preset time periods and power to achieve profit from electricity price differences
6	Backup mode	Maintain EMS control system above a certain SOC to achieve standby power state
7	Local data storage	EMS can store system data locally, duration: 3 months, frequency: 15s

2 Product Introduction

2.1 Main Page

The main page of the EMS control box can view the total real-time operation information and situation of the system, and can issue commands for system start/stop, working mode, system charging/discharging power and so on, as shown below:

Figure 2-1 Main Page

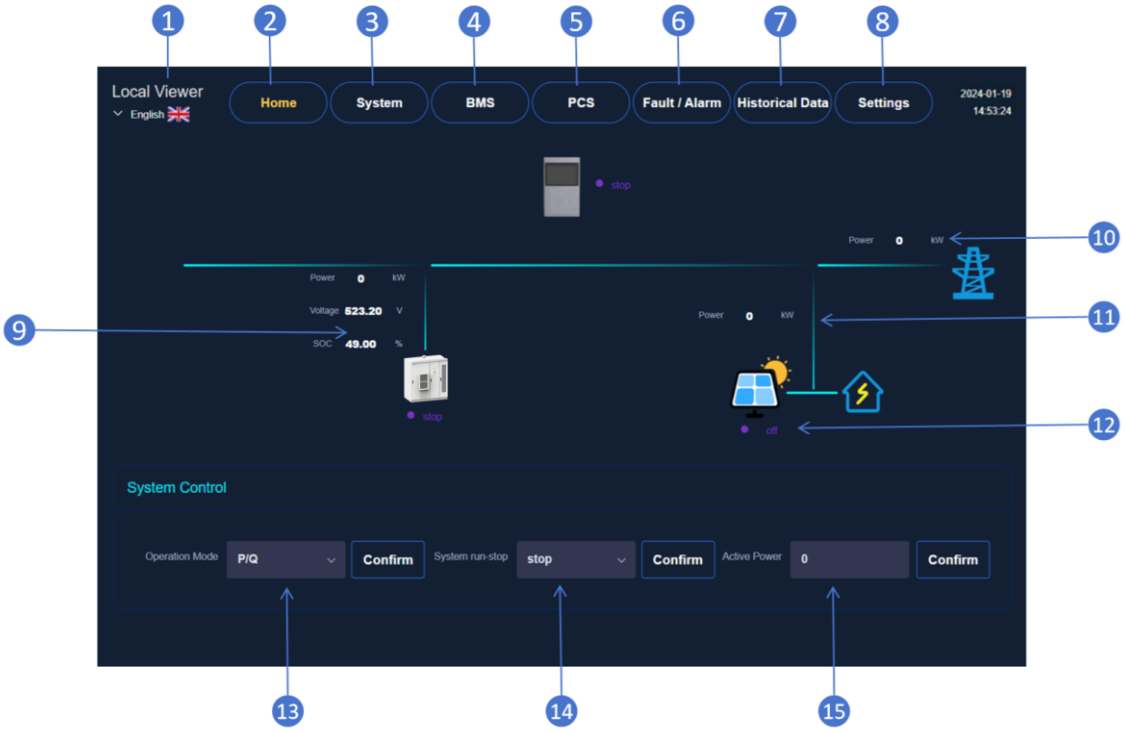


Table 2-1 Main Page

Position	Name	Description
1	Language Switch Button	Click on the button to switch the language of the system page.
2	Home Button	Click on the button to jump to the system home page
3	System Information Page Button	Click on the button to jump to the system information page
4	BMS Information Page Button	Click on the button to jump to the BMS information page
5	Battery Cabinet Information Page Button	Click on the button to jump to the battery cabinet information page
6	Fault Alarm Page Button	Click the button to jump to the system fault alarm information page.
7	Historical Data Page Button	Click on the button to jump to the historical data page
8	System Settings Page Button	Click the button to jump to the system settings page
9	Energy Storage Cabinet Information Display	Real-time display of the operating status and basic parameters of the storage cabinet.
10	Grid Backflow Prevention Meter Power Display	Real-time display of the power information of the grid antireflux meter.
11	Photovoltaic and load power information display	Real-time display of power information of PV and loads
12	PV operation status display	Real-time display of PV operating status information
13	Operating mode drop-down box	Click the drop-down box to select the working mode

14	System start/stop drop-down box	Click on the drop-down box to select the system start and stop.
15	Power control information box	Click on the information box to enter the power

2.2 System Information Page

Click the "System" button to enter the system information page, you can view the current operating status of the energy storage system, SOC, 24-hour power - SOC curve and other operating parameters, as shown below.

Figure 2-2 System Information Page

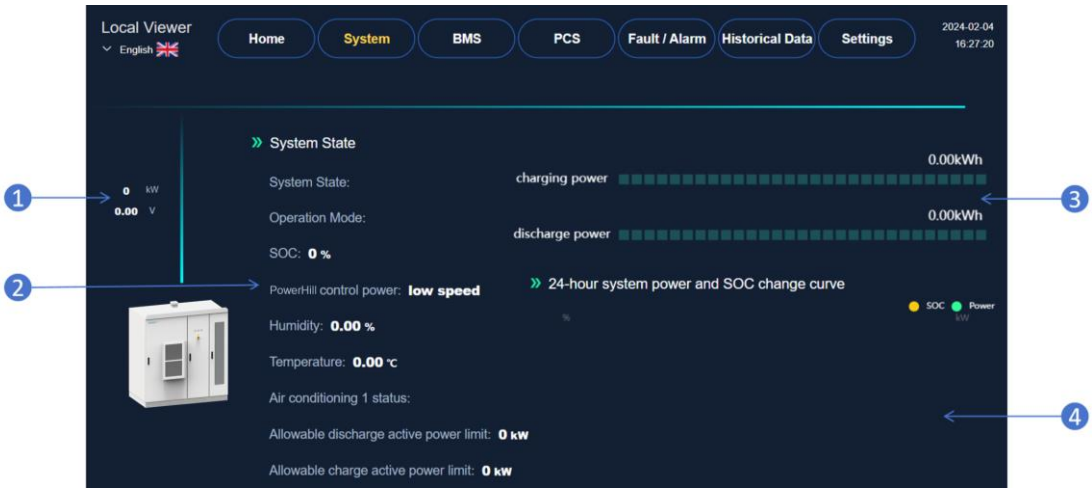


Table 2-2 System Information Page

Position	Name	Description
1	PowerHill Information Display	Real-time display of PowerHill power and DC voltage information
2	System information display	Real-time display of system operation information
3	Cumulative charging and discharging quantity display	Real-time display of accumulated charging and discharging information

4	Energy storage power-SOC curve display	Real-time display of energy storage power-SOC change curve in the last 24 hours.

2.3 BMS Information page

Click the "BMS" button to enter the BMS information page, you can view the detailed operating parameters of a single battery cabinet, as shown below:

Figure 2-3 BMS Information Page

Table 2-3 BMS Information Page

Position	Name	Description
1	Battery Cabinet Information Display	Battery cabinet information display, such as SOC, SOH, voltage, current, power
2	Battery Voltage Chart	Real-time display of all cell voltage information, and labeled with the highest and lowest voltage.

3	Battery Cabinet Cell Temperature Chart	Real-time display of all cell temperature information, and labeled with the highest and lowest temperature

2.4 PCS Information Page

Select and click the "PCS" button to enter the PCS information page, you can view the PCS operation parameter information, as shown below:

Figure 2-4 PCS Information Page

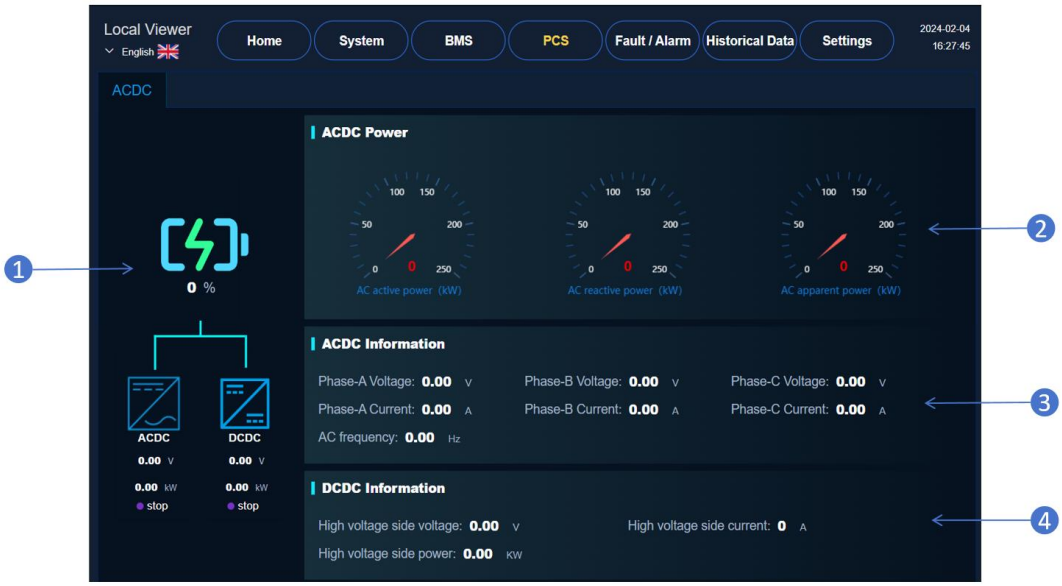


Table 2-4 PCS Information Page

Position	Name	Description
1	Energy Storage System Infographic	Display battery cabinet SOC and operating status, as well as ACDC./DCDC status, voltage, power
2	ACDC Data Display	Display the power information of ACDC
3	ACDC Data Display	Display the voltage, current, etc. of ACDC
4	DCDC Data Display	Display the voltage, current, etc. of DCDC

2.5 Fault/Alarm Information Page

Click "Fault/Alarm" to enter the system fault alarm information page, you can view the current system fault alarm information, click "Viewing Historical Information" to enter the historical alarm page. Click "Viewing Historical Information" to enter the historical fault alarm page. Click "Viewing Historical Information" to enter the Historical Fault Alarm page.

Figure 2-5 Fault/Alarm Information Page

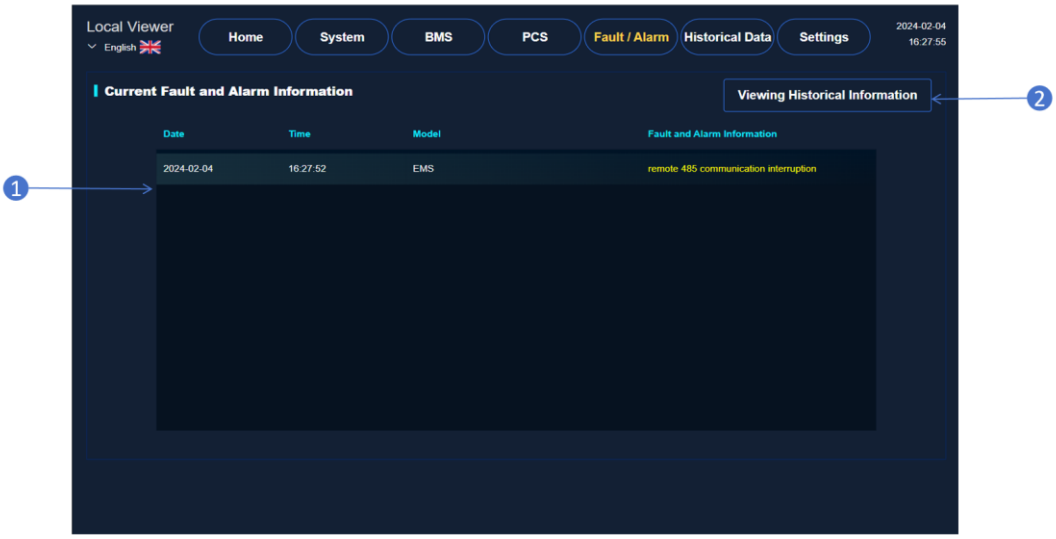


Table 2-5 Fault/Alarm Information Page

Position	Name	Description
1	Date selection box	Input the fault alarm information for the selected display time period
2	Historical Fault Alarm Information	Display the fault alarm information of the system operation during the time period.
3	Current Fault Alarm Page Switch Button	Click the button to jump to the current fault alarm information page of the system

2.6 Historical Data Information Page

Into the historical data page you can select the module, module number, date, start time, end time to view the range of historical data, and you can export the table data to a specified location, as shown below:

Figure 2-6 Historical Data Information Page

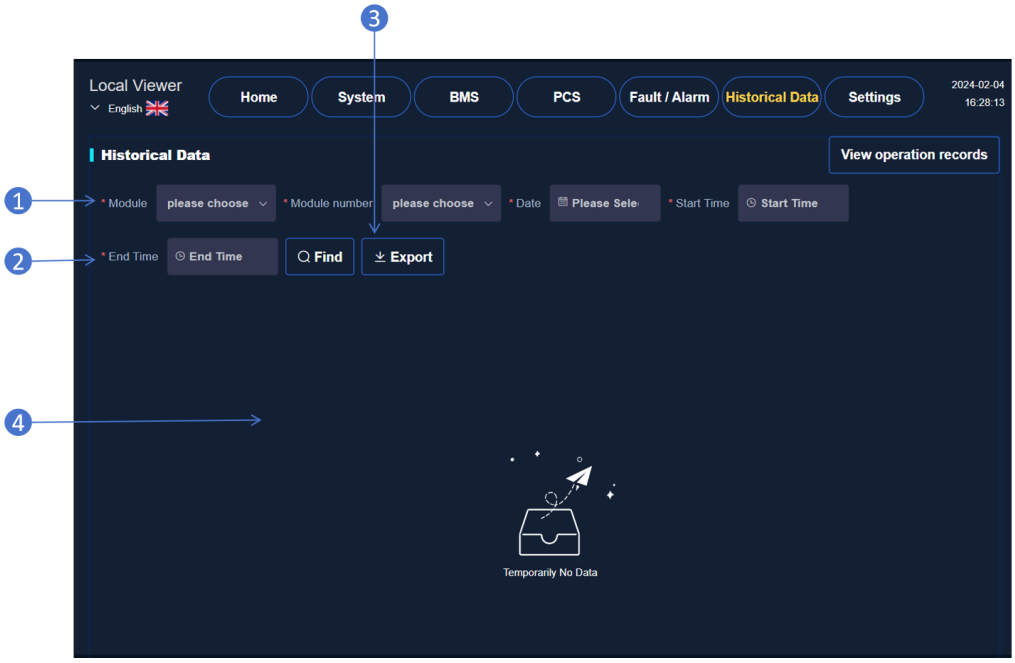


Table 2-6 Historical Data Information Page

Position	Name	Description
1	Historical Data Filter Box	Historical data filter box, such as module, module number, date, start time, end time
2	Historical Data Search Button	Click the button to search the filtered data
3	Historical Data Export Button	Click the button to export the historical data of the form to a specified location.
4	Historical Data Display	Display the historical data of the system operation within the filter conditions

2.7 Settings Information Page

Click the Setup button on the main page, click the Enter Edit button, the password input page will pop up, enter the correct password to enter the setup page; Initial password: 88888888, the password must be an 8-digit number.

Figure 2-7 Settings Page

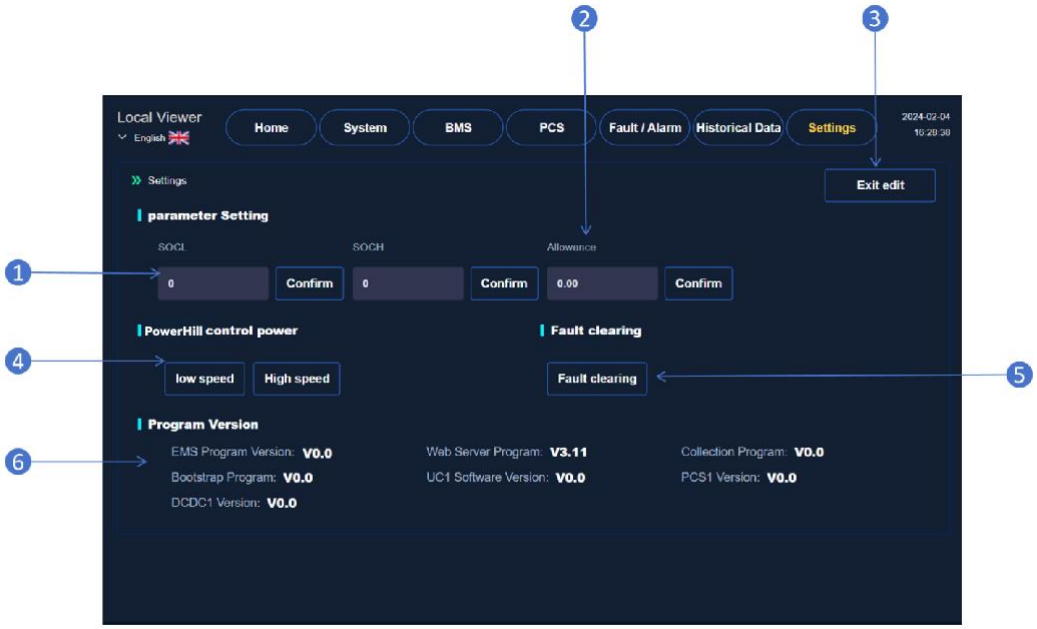


Table 2-7 Settings Page

Position	Name	Description
1	SOCL, SOCH setting	SOCL and SOCH can be set
2	Allowance setting	Click to set the allowance
3	Exit Edit Button	Click to exit editing
4	System Control	Click to modify the control mode
5	Fault Clear	You can clear the faults that have been recovered so far.
6	System version number display	Display the program version information of each module of the system

3 Instructions for Use

3.1 EMS External Interface

Figure 3-1 EMS External Interface

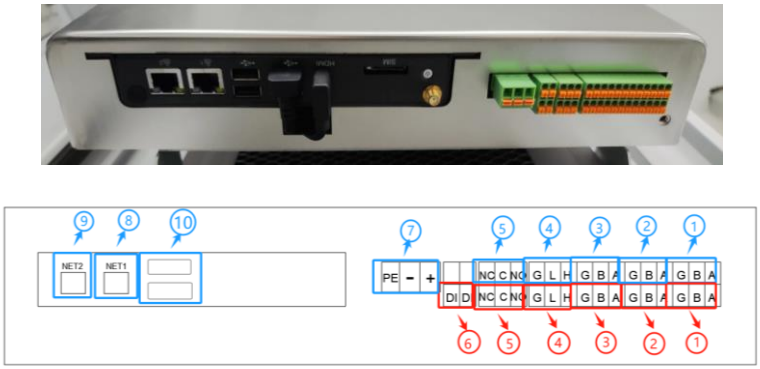


Table 3-1 EMS External Interface

No.	Name	Function	Remark
①	PowerHill 485 communication interface	PowerHill 485 communication	PowerHill 485 communication is connected to this interface, EMS can obtain PowerHill information and control PowerHill.
②	Grid backflow meter 485	Grid backflow prevention meter 485 communication	485 communication of external grid

			backflow prevention meter is connected to this interface.
③	Reserved 485 interface	Reserved 485 communication	/
④	CAN1	External CAN communication	/
⑤	NO/NC interface	External dry contact, control of circuit breaker opening and closing / external PV side meter pickup	SOCL and SOCH can be set on EMS, NO is closed and NC is disconnected when energy storage SOC is greater than SOCH, NO is disconnected and NC is closed when energy storage SOC is less than SOCL.
⑥	DI interface	/	/
⑦	DC12V power input	EMS power supply	The power supply line is connected to this interface, when it is connected, it will power up and run, when it is disconnected, it will power down and stop.
⑧	NET1	Customer network cable communication interface	/
⑨	NET2	EMS networking interface	/
⑩	USB interface	Wireless WIFI interface	/

3.2 External Meter Installation

The EMS PV self-generation and self-consumption operation strategy must use an external meter, and each EMS (energy storage system) must correspond to a meter, so in the first step first confirm that the meter is installed and working properly.

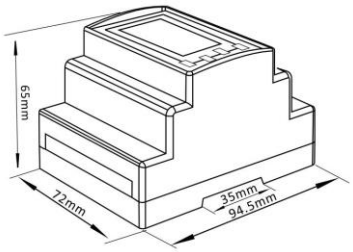
3.2.1 External Meter Selection

Meter Recommendation: SDM630MCT-40mA

Meter installation: rail installation

Figure 3-2 SDM630MCT-40mA

Figure 3-3 Dimensional Drawing

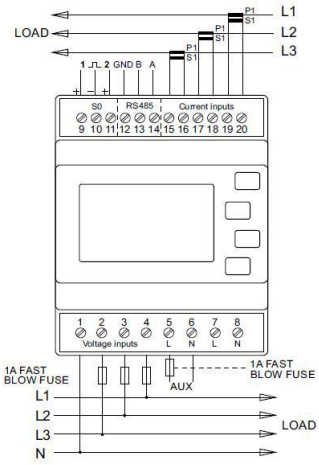


3.2.2 Wiring Method

In the grid input bus access to the total meter, taking into account that this connection method needs to disconnect the total power supply of the station, which will affect the station production power; so in order to access the meter without breaking the power supply we recommend the following method, monitor the total meter transformer current, and then calculate the total meter current.

This wiring method is to clamp the open current transformer of SDM630MCT-40mA meter on the secondary line of the load current sensor in the distribution box, so as to realize the access without breaking the power supply; after accessing, it is necessary to set the current coefficient of SDM630MCT-40mA meter according to the ratio coefficient of the total meter transformer.

Figure 3-4 Voltage and current wiring diagrams



3.2.3 Meter Location

Voltage sampling wiring can be connected to the grid L1, L2, L3, N according to the actual situation.

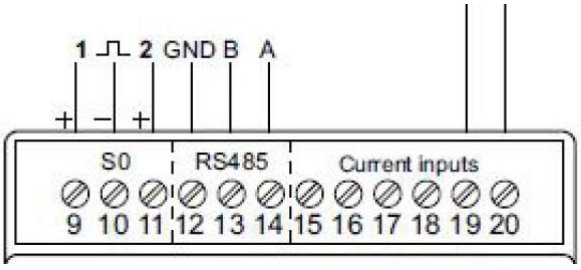
Current sampling wiring: connected to the secondary line of the current sensor of the master meter of the low-voltage switchgear, i.e., the collected current contains the currents of the energy storage system, the load, and the photovoltaic system.

3.2.4 Meter Communication Connections

The meter uses RS485 communication, connecting the 14 (A) and 13 (B) interfaces, see the following figure;

Baud rate: 9600, address: 002; see the attached meter manual for setting method.。

Figure 3-5 Schematic diagram of meter communication connection legs



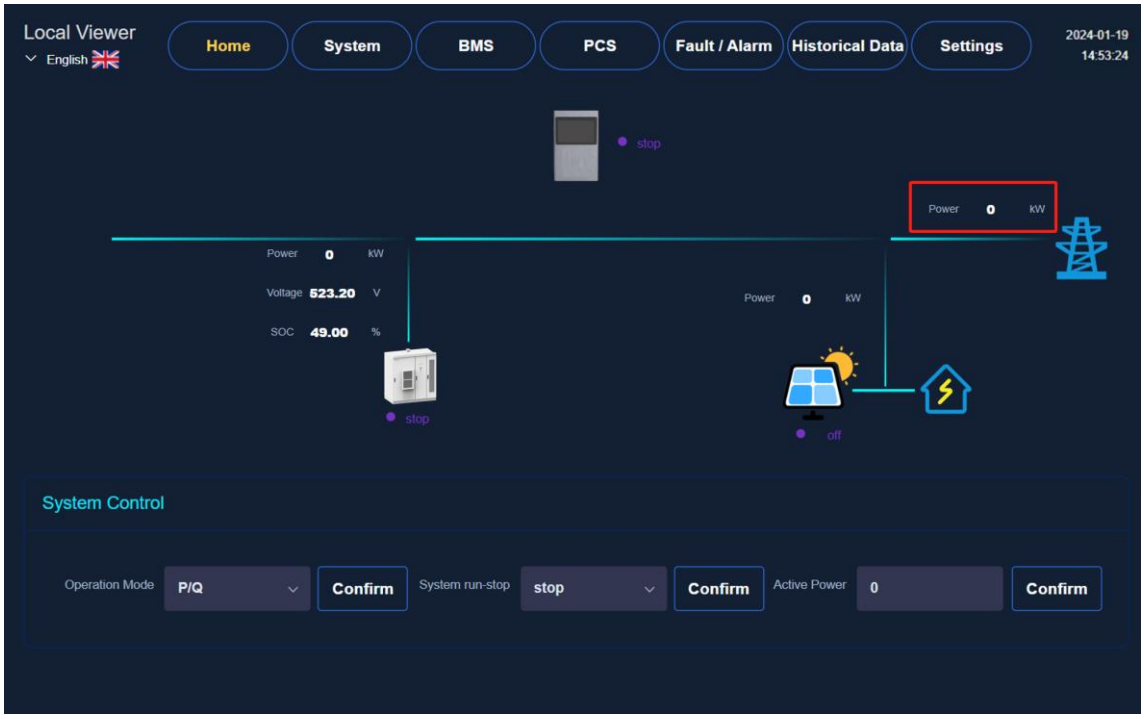
3.2.5 Meter Ratio Setting

The meter ratio needs to be set to match the ratio setting of the total transformer of the field station, the setting method is shown in the attached meter instruction manual.

3.2.6 Meter Data Confirmation

After the meter setup is complete, it must be confirmed that the grid power read by the EMS is close to the actual, the home page has the total power of the external grid (see below) and the data is confirmed with the total power of the distribution room, the data must be close.

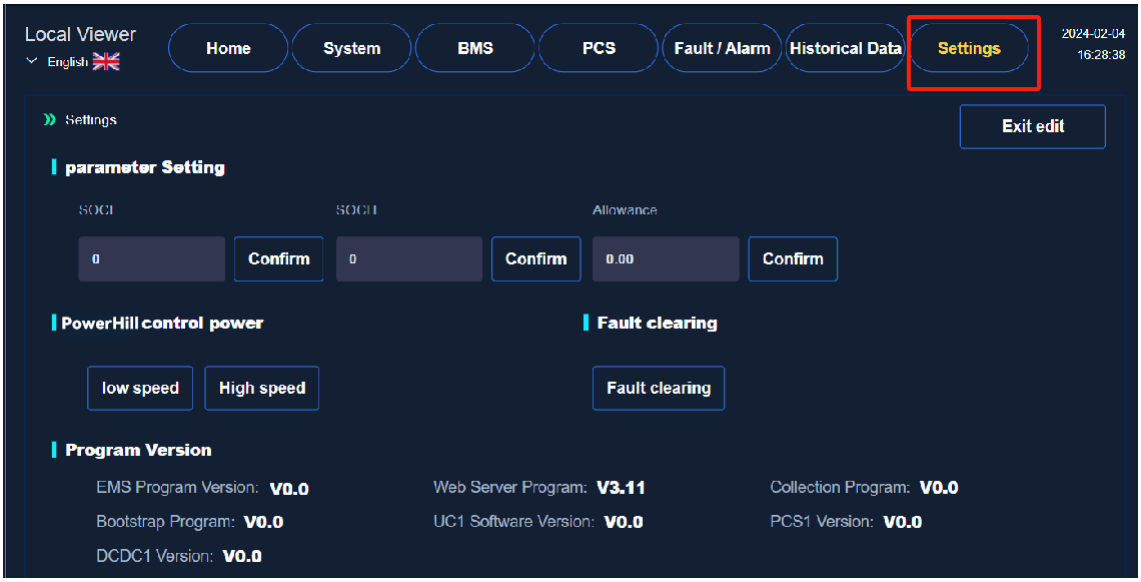
Figure 3-6 External Meter Power Confirmation



3.3 EMS Parameter Settings

The parameter setting page is accessed through the "Parameter Setting" button on the EMS homepage, and you need to enter the correct password after clicking on the parameter to confirm the issuance.

Figure 3-7 Setting Button

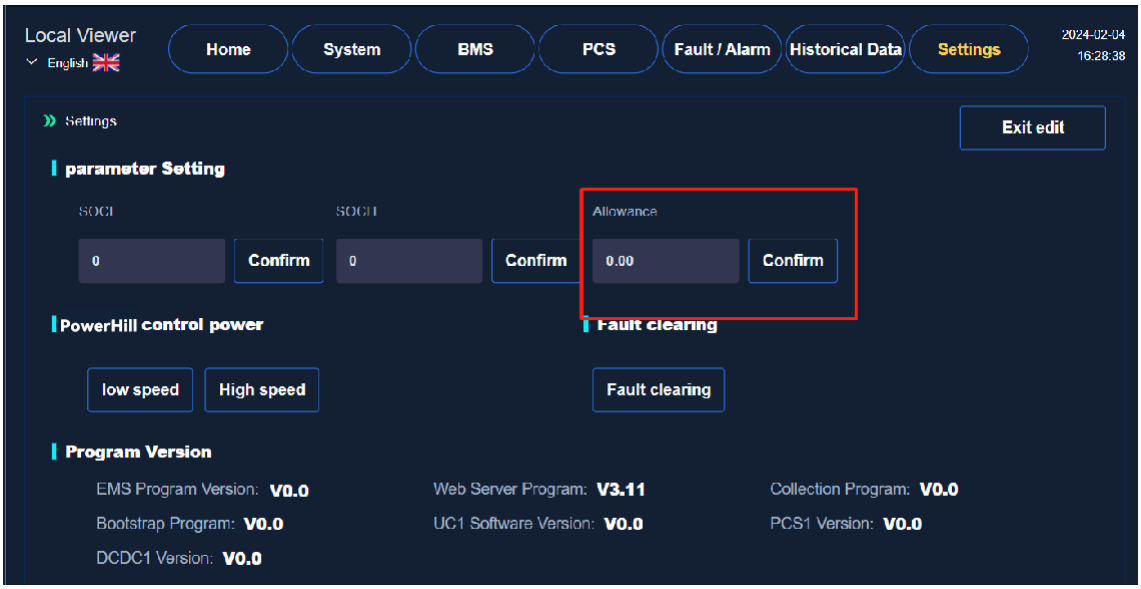


3.3.1 Allowance Configuration

To configure the allowance, click on the item you want to modify, the keypad will pop up, enter the modified value, and then click the "Confirm" button.

The allowance value is the power allowed to be charged by the grid to the energy storage, the recommended value is 0.

Figure 3-8 Allowance Configuration

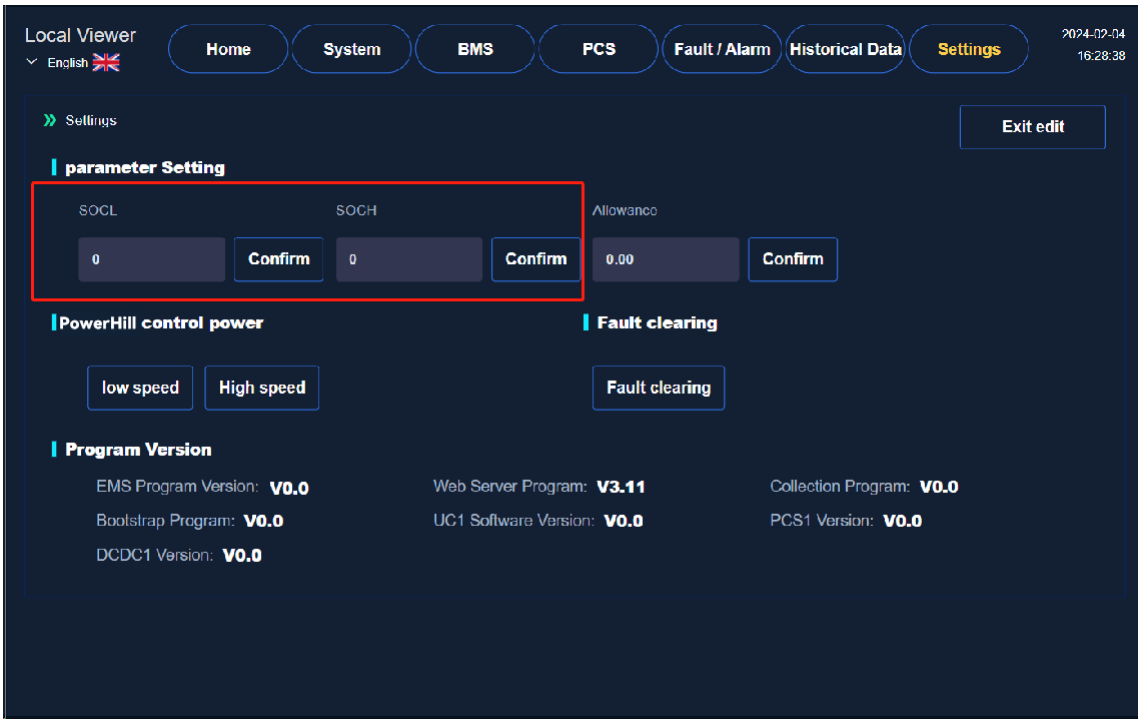


3.3.2 SOCH, SOCL Configuration

For SOCH and SOCL configuration, click on the item you want to modify, the keypad will pop up, input the modified value, and then click ‘Confirm’ button.

When the energy storage SOC is greater than SOCH, the external NO interface of EMS is closed and the external NC interface is disconnected; when the energy storage SOC is less than SOCL, the external NO interface of EMS is disconnected and the external NC interface is closed.

Figure 3-9 SOCL\SOCH Configuration

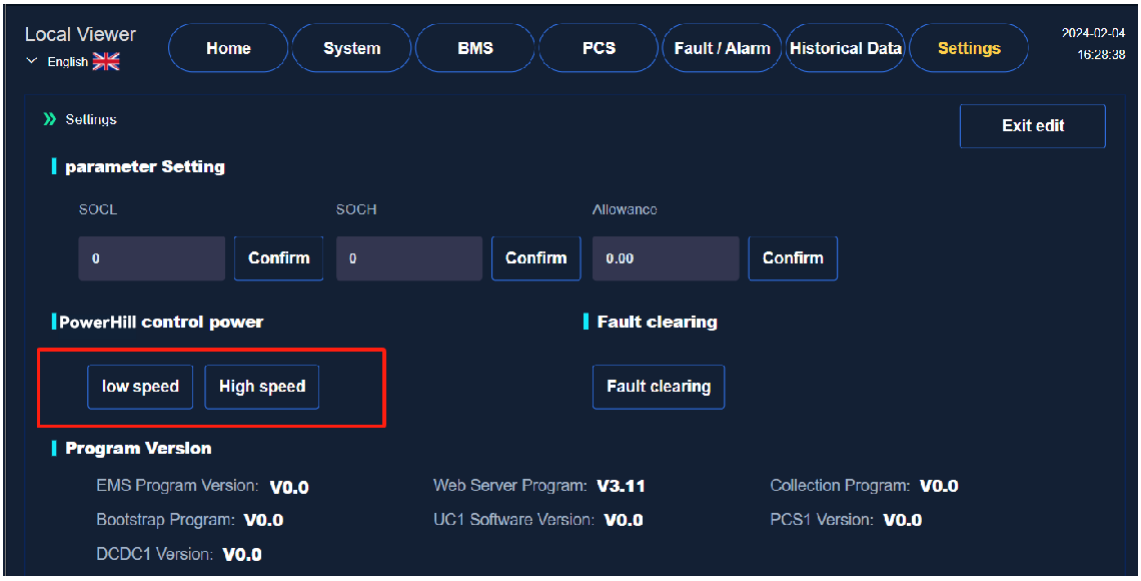


3.3.3 Control Power Configurations

Control power configuration, click on the item you want to select, and then click on the ‘Confirm’ button.

When Low speed is selected, the EMS control of PowerHill is invalid for debugging purpose, when High speed is selected, the EMS control of PowerHill is valid;

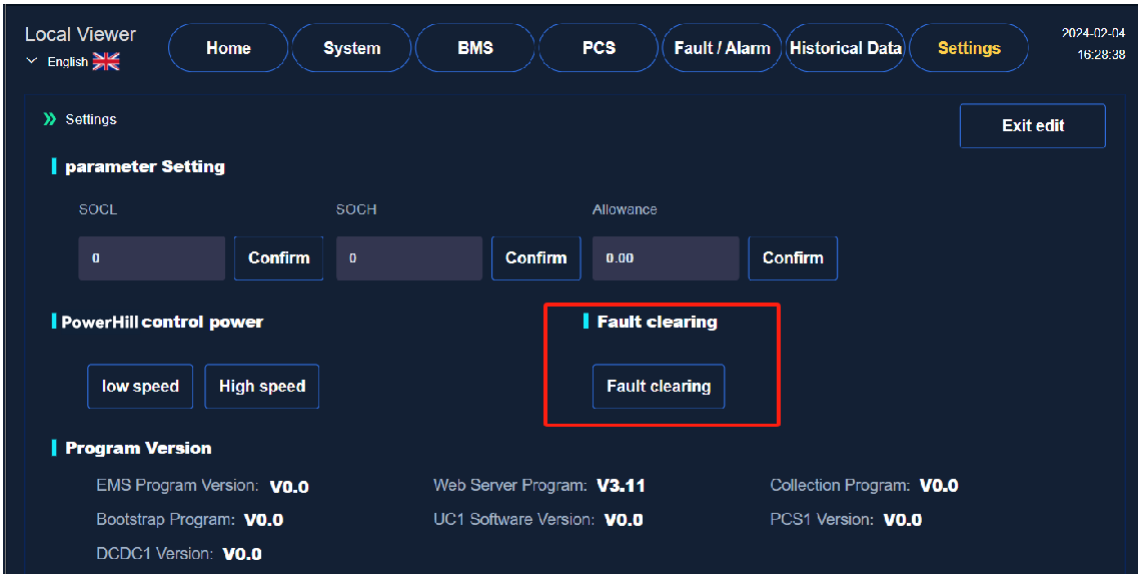
Figure 3-10 Control power Configuration



3.3.4 Fault Clearing

When Fault clearing is selected, faults that are not currently persisting can be cleared.

Figure 3-11 Fault Clearing



3.4 Operating Mode Control

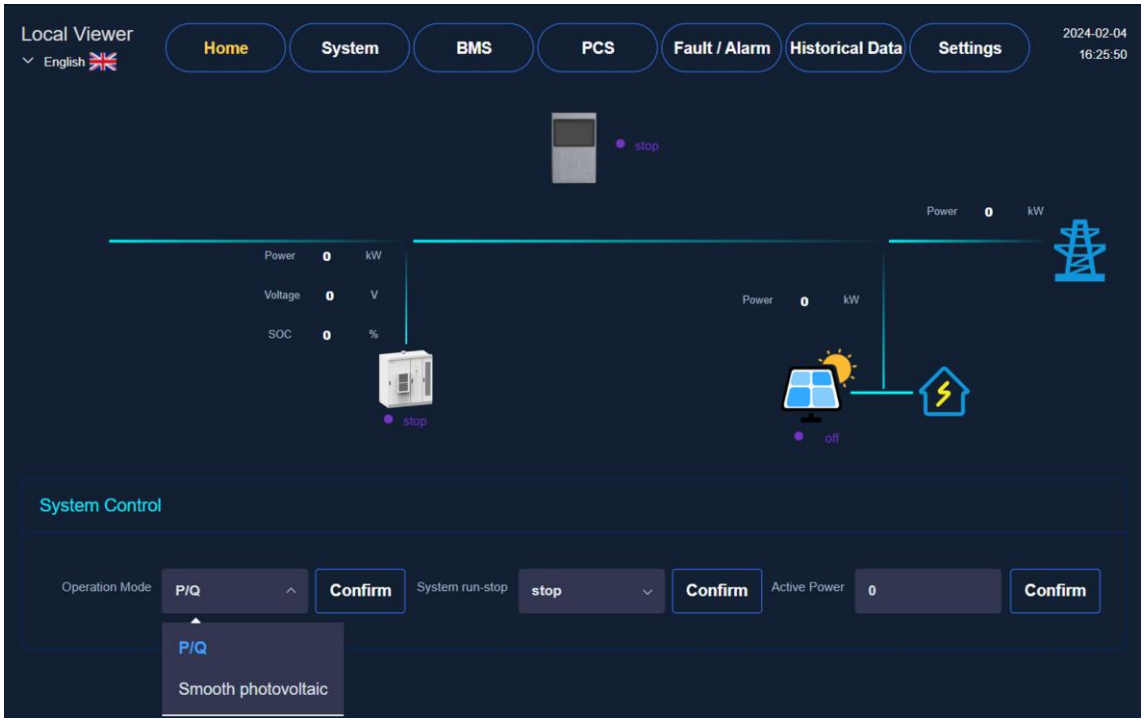
Operating modes are categorized into "grid-connected" and ‘smooth PV’ modes;

The ‘grid-connected’ mode refers to the mode of operation in which the system is connected to the grid and operates by receiving instructions from the user's dispatch;

In ‘Smooth PV’ mode, the system starts and operates automatically. In the PV power generation time period, the storage capacity is not full, the PV power generation is prioritized for the load, and the remaining power is charged to the storage capacity. During the time period of abundant PV power generation, when the storage battery is full, the EMS controls the circuit breaker to disconnect (or disconnect the external PV meter), and the load is supplied by the energy storage and the grid until the storage SOC reaches the set threshold, and the EMS controls the circuit breaker to close (or make the external PV meter work); during the time period of little or no PV power generation, when the demand power of the load is greater than that of the PV power, the PV power generation is supplied to the load as a priority, and the remaining demand power of the load is supplied to the load by the storage and the PV meter, and the remaining power is supplied to the load by the storage and the PV meter. The remaining load demand power is supplemented by energy storage and grid.

Checking the operating mode drop-down box can switch between ‘P/Q’ and ‘Smooth PV’ modes.

Figure 3-12 Working modes

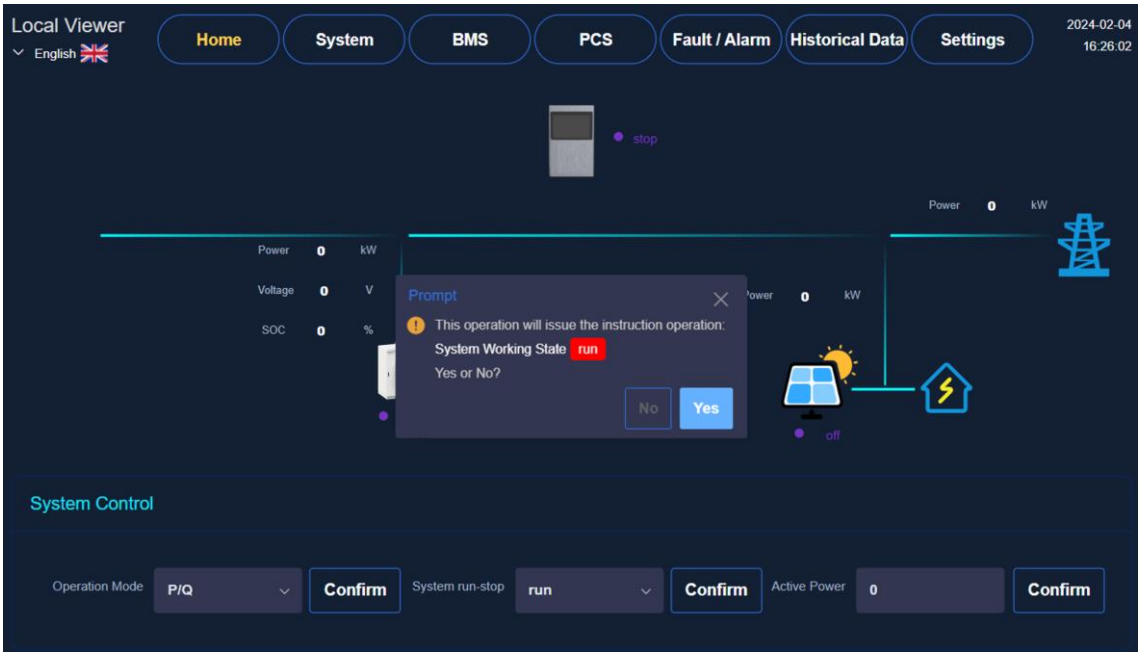


3.5 Start-stop Control

The start/stop control button can only be used in "P/Q" mode, to use this function, you must first confirm the mode.

Clicking the Start/Stop button can start and stop the system, after clicking the button, a dialog box will pop up to remind whether to confirm the control, this is an anti-touch reminder, after clicking the OK button, the EMS will execute the control process.

Figure 3-13 Start-stop control



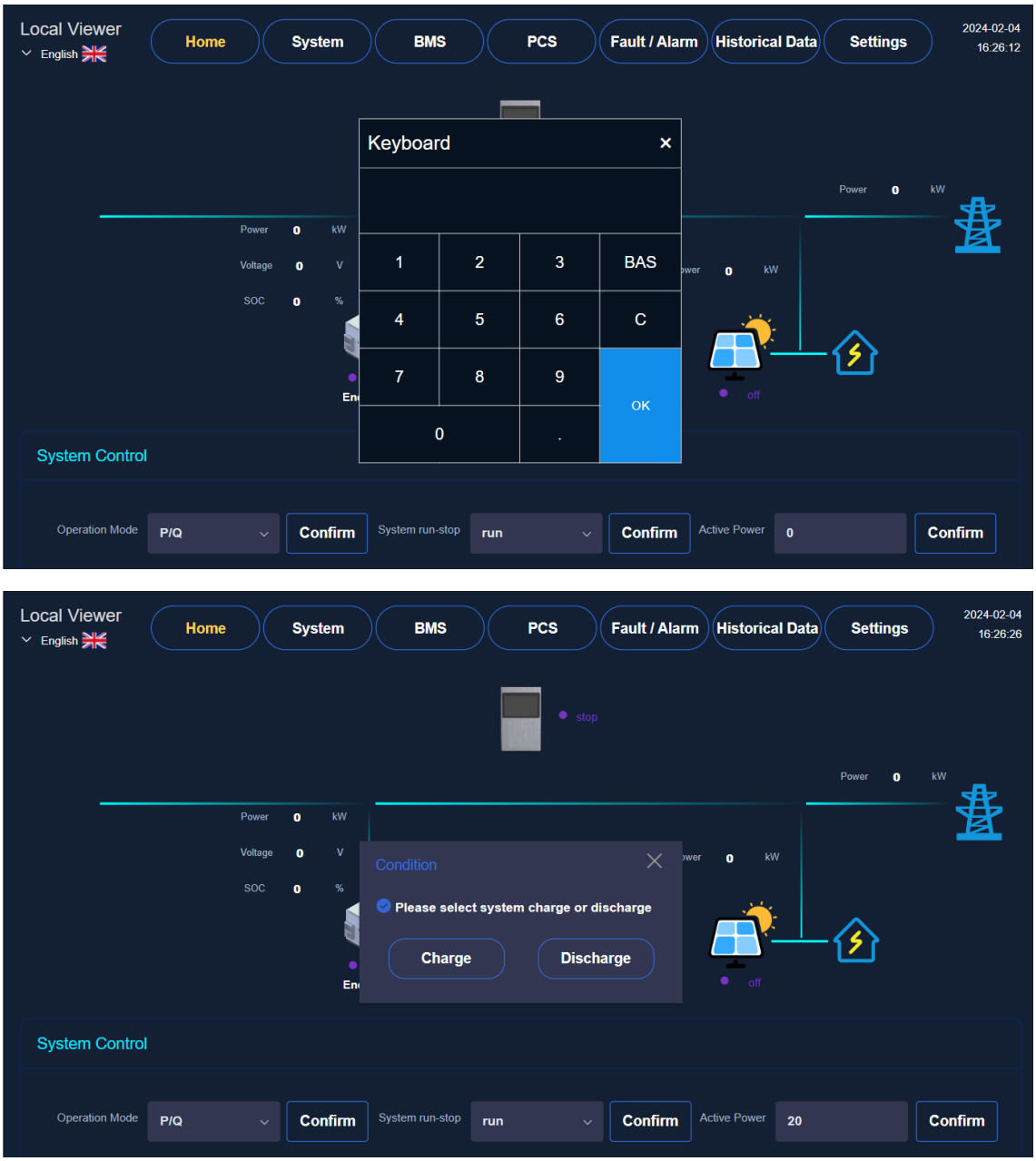
3.6 Power Control

The power control button is only available in "P/Q" mode, and the mode must be confirmed before using this function.

Power control is divided into two steps, the first step is to input the power value, the second step is to click the power down button.

Power input: click the power command box, the numeric keypad will pop up, click the keypad to input the power to be executed (only positive value can be input), after determining the power, click the send button to select the charging and discharging direction.

Figure 3-14 Power Command Inputs



3.7 Normal Operation

Normal operation in ‘Grid-connected’ mode: After start-up by ‘Start-Stop’ control, the system can be charged and discharged normally by "Power" control.

Normal operation in ‘Smooth PV’ mode: EMS will automatically control the charging and discharging of the system.

4 Attachments

4.1 Meter Setting Instructions

4.1.1 Button Description

1		Selects the Voltage and Current display screens In Set-up Mode, this is the "Left" or "Back" button.
2		Select the Frequency and Power factor display screens In Set-up Mode, this is the "Up" button
3		Select the Power display screens In Set-up Mode, this is the "Down" button
4		Select the Energy display screens In Set-up mode, this is the "Enter" or "Right" button

4.1.2 Menu Option Selection

1. Use the  and  buttons to select the required item from the menu.

   Selection does not roll over between bottom and top of list

2. Press  to confirm your selection

3. If an item flashes, then it can be adjusted by  the  and buttons. If not, there may be a further layer.

4. Having selected an option from the current layer, press  to confirm your selection.

5. Having completed a parameter setting, press  to return to a higher menu level. You will be able to use the  and  buttons for further menu selection.

6. On completion of all setting-up, press  repeatedly until the measurement screen is restored.

Number Entry Procedure

When setting up the unit, some screens require the entering of a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually, from left to right. The procedure is as follows:

1. The current digit to be set flashes and is set using the  and  buttons.

2. Press  to confirm each digit setting.

3. After setting the last digit, press  to exit the number setting routine.

4.1.3 Setup Menu Description

RS485 Address

(The range is from 001 to 247)

1		From the Set-up menu, use M and P buttons to select the Address ID
2		Press E button to enter the selection routine. The current setting will be flashing.
3		Use M and P buttons to choose Modbus Address (001 to 247)
On completion of the entry procedure, press E button to confirm the setting and press U/I ESC button to return the main set-up menu.		

Baud Rate

1		From the Set-up menu, use M and P buttons to select the Baud Rate option.
2		Press E to enter the selection routine. The current setting will flash.

3		Use M and P buttons to choose Baud rate 2.4k. 4.8k, 9.6k, 19.2k, 38.4k Default is 9.6k
On completion of the entry procedure, press E button to confirm the setting and press U/I ESC button to return the main set-up menu.		

Parity

1		From the Set-up menu, use M and P buttons to select the Parity option.
2		Press E to enter the selection routine. The current setting will flash.
3		Use M and P buttons to choose Parity (EVEN / ODD/ NONE) Default is NONE.
On completion of the entry procedure, press E button to confirm the setting and press U/I ESC button to return the main set-up menu.		

Stop bits

1		From the Set-up menu, use M and P buttons to select the Stop Bit option.

2		Press E to enter the selection routine. The current setting will flash.
3		Use M and P buttons to choose Stop Bit (2 or 1)
On completion of the entry procedure, press E button to confirm the setting and press U/I ESC button to return the main set-up menu.		

CT

The CT option sets the primary current of the current transformer (CT) that wires to the meter. CT2 is fixed with 40mA

1		From the Set-up menu, use M and P buttons to select the CT option. Its default is 300A, and ranged from 0005 to 9999.
2		Secondary CT(CT2) It's fixed 40mA, and cannot be set.

PT

The PT option sets the secondary voltage (PT2 100 to 500V) of the Voltage transformer (PT) that the meter

1		From the Set-up menu, use M and P buttons to select the PT option. The screen will show the voltage PT secondary voltage value. The default value is 400V
2		Secondary PT setting Press E to enter the PT secondary voltage selection routine. The range is from 100 to 500V
3		Set PT ratios value Press E to enter the PT ratio screen. The range is from 0001 to 2000
Example: if set the ratio to be 100, it means the primary voltage equals secondary voltage x 100		

Pulse output

This option allows you to configure the pulse output. The output can be set to provide a pulse for a defined amount of energy active or reactive.

Use this section to set up the pulse output 1—Units: Total kWh, Total kVArh

1		From the Set-up menu, use M and P buttons to select the Pulse output option.

2		Press E to enter the selection routine. The unit symbol will flash.
3		Use M and P buttons to choose kWh or kVArh.
On completion of the entry procedure, press E to confirm the setting and press U/I ESC to return to the main set up menu.		

Pulse rate

Use this to set the energy represented by each pulse. Rate can be set to 1 pulse per 0.01kWh/0.1kWh/1kWh/10kWh/100/1000kWh.

(It shows pulse width of 200ms)

1		From the Set-up menu, use M and P buttons to select the Pulse Rate option.
2		Press E to enter the selection routine. The current setting will flash. 0.01/0.1/1/10/100/1000kWh/kVArh per pulse
Use M and P buttons to choose pulse rate. On Completion of the entry procedure, press E to confirm the setting and press U/I ESC to return to the		

main set up menu.

Pulse Duration

The energy monitored can be active or reactive and the pulse width can be 200, 100 or 60ms.

(It shows pulse width of 200ms)

1		From the Set-up menu, use M and P buttons to select the Pulse width option.
2		Press E to enter the selection routine. The current setting will flash. Use M and P buttons to choose pulse width.
On completion of the entry procedure, press E to confirm the setting and press U/I ESC to return to the main set up menu.		

DIT Demand Integration Time

This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement. The options are: off, 5, 8, 10, 15,20, 30, 60 minutes

1		From the set-up menu, use and P buttons to select the DIT option. The screen will

		show the currently selected integration time.
2		Press E to enter the selection routine. The current time interval will flash
3		Use M and P buttons to select the time required.
4		Press E to confirm the selection. SET indicator will appear.
Press U/I ESC to exit the DIT selection routine and return to the menu.		

Backlit set-up

The meter provides a function to set the blue backlit lasting time.

1		The backlit lasting time is settable Default lasting time is 60minutes. For example, if it's set as 5, the backlit will be off in 5minutes from the last time operation on the meter. Notes: If it's set as 0, the backlit will always be on.
2		Press E to enter the selection routine. The current time interval will flash

		The options can be: 0/5/10/30/60/120minutes
Use M and P buttons to select the time required. Then press E to confirm the set-up		

Supply System

1		From the Set-up menu, use M and P buttons to select the System option. The screen will show the currently selected power supply.
2		Press E to enter the selection routine. The current selection will flash
3		Use M and P buttons to select the required system option:1P2(W),3P3(W) ,3P4(W)
4		Press E to confirm the selection. SET indicator will appear.
Press U/I ESC to exit the system selection routine and return to the menu. SET will disappear and you will be returned to the main Set-up Menu		

CLR

The meter provides a function to reset the maximum demand value of current and power.

1		From the Set-up menu, use M and P buttons to select the reset option.
2		Press E to enter the selection routine. The MD will flash.
Press E to confirm the setting and press U/I ESC to return to the main set up menu.		

Change password

1		Use the M and P to choose the change password option
2		Press the E to enter the change password routine. The new password screen will appear with the first digit flashing
3		Use M and P to set the first digit and press E to confirm your selection. The next digit will flash.
4		Repeat the procedure for the remaining three digits

5		After setting the last digit, SET will show.
Press U/I ESC to exit the system selection routine and return to the menu. SET will disappear and you will be returned to the main Set-up Menu		

Reverse connected current inputs correction set-up

1		use M and P buttons to select page "SET sys cont"
2		Press to E enter Phase A, the default is Frd (forward)
3		use M and P buttons to Phase B or C setting pages

How to operate if phase A is reversely connected

1		Go to phase A setting page
2		Press E to enter the selection routine. The Frd will flash. Use P button to change Frd to Rev.

Press  to confirm the setting and press  to return to the main set up menu.

DUNEXT

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