

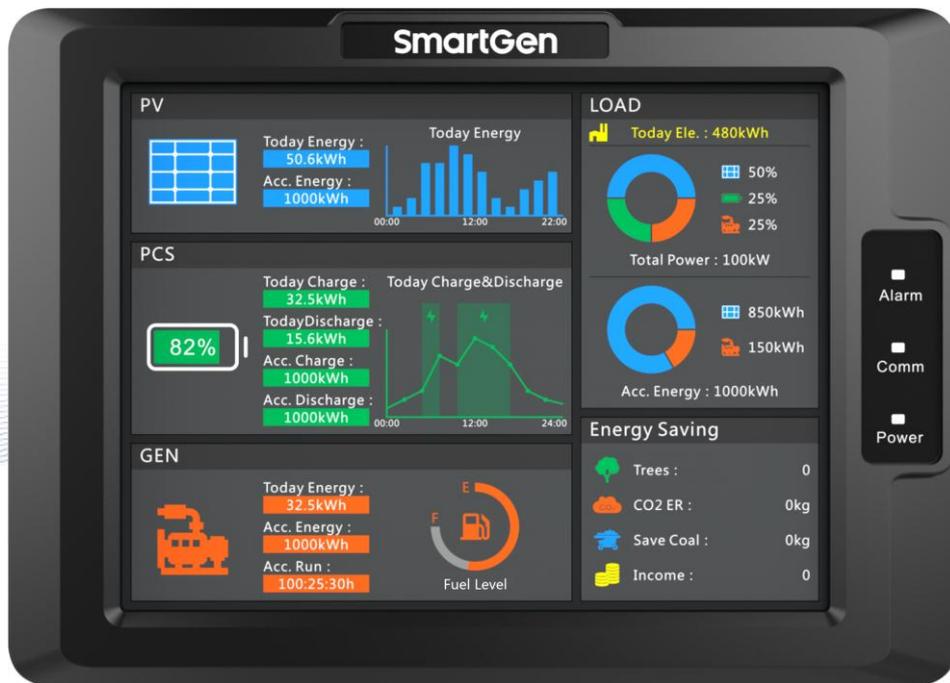
SmartGen

MAKING CONTROL SMARTER

HMU8-9570

HYBRID ENERGY CONTROLLER

USER MANUAL



郑州众智科技股份有限公司
SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

SmartGen众智 Chinese trademark

SmartGen English trademark

SmartGen – make your generator *smart*

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Table 1 Software Version

Date	Version	Note
2021-10-09	1.0	Original release.
2022-06-11	1.1	Change manual logo.

Table 2 Symbol Instruction

Symbol	Instruction
 NOTE	Highlights an essential element of a procedure to ensure correctness.
 CAUTION	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
 WARNING	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

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1 OVERVIEW

HMU8-9570 Hybrid Energy Controller is used for micro grid management system composed of solar energy, wind energy, energy storage battery and genset, which can monitor data via RS485 port. It can also control the start and stop of gensets in system according to load or storage battery SOC, and control output power by setting genset voltage, frequency center point and droop percentage. In addition, it has economy and power maintaining running modes.

HMU8-9570 Hybrid Energy Controller applies 8-inch 800*600 resolution capacitive touch screen with Chinese and English display. It is simple to operate and reliable to run.

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2 PERFORMANCE AND CHARACTERISTICS

HUM8-9570 hybrid energy controller can be used for data monitoring and control of inverter, converter and genset, which is suitable for micro grid hybrid energy system composed of photovoltaic, storage energy and genset, also for hybrid energy system composed of storage energy and genset.

Main characteristics are as below:

- Display module adopts 8-inch LCD screen with 800x600 resolution, HMI display, capacitive touch screen operation. Optional Chinese and English interface can be chosen on site, making commissioning convenience for factory personnel;
- With power indicator, communication indicator and alarm indicator;
- The module has 10-level brightness, can be adjusted according to different environments;
- The homepage of display module can display PV current day power bar chart, current day charge/discharge curve diagram of energy storage battery, load power and accumulated energy pie chart;
- Display energy-saving and emission reduction parameters;
- Set genset frequency, voltage center point and droop percentage;
- Set RS485 communication port parameters on the module, which cannot be lost even in case of power outage. All module parameters can be adjusted through upper computer software via PC;
- Two running modes: economy and power maintaining;
- With 4 RS485 ports, 1 CANBUS port, 1 ETHERNET port;
- Displayed photovoltaic inverter parameters:

Table 3 Photovoltaic Inverter Parameters

Name	Unit	Name	Unit
PV Working Status	/	PV Output Active Power	kW
PV Today Accumulated Generating Power	kWh	PV Output Reactive Power	kvar
PV Accumulated	kWh	PV Output Frequency	Hz
PV Input Voltage	V	PV Phase Voltage	V
PV Input Current	A	PV 3-phase Current	A
PV Input Power	kW	PV Power Factor	/

- Displayed converter parameters:

Table 4 Converter Parameters

Name	Unit	Name	Unit
Working Mode	/	Reactive Power	kvar
Working Status	/	Battery Status	/
Daily Grid-connected Run Time	min	Daily Charge	kWh
Total Grid-connected Run Time	h	Daily Discharge	kWh

Name	Unit	Name	Unit
Battery Voltage	V	Total Charge	kWh
Battery Current	A	Total Discharge	kWh
Battery Power	kW	Daily Battery Charge Time	min
Power Grid Frequency	Hz	Daily Battery Discharge Time	min
Line Voltage	V	Total Battery Charge Time	h
3-phase Current	A	Total Battery Discharge Time	h
Power Factor	/	Battery SOC	%
Active Power	kW		

- Displayed genset parameters:

Table 5 Genset Parameters

Name	Unit	Name	Unit
Genset Mode	/	Each Phase Active Power	kW
Genset Working Status	/	Total Active	kW
Genset Accumulated Run Time	min	Each Phase Reactive Power	kvar
Genset Today Generating Power	kWh	Total Reactive Power	kvar
Genset Total Generating Power	kWh	Each Phase Apparent Power	kVA
Gen 3-phase Phase Voltage	V	Each Phase Power Factor	/
Gen 3-phase Line Voltage	V	Average Power Factor	/
Gen Frequency	Hz	Fuel Level	%

- Wide power supply range DC(10~35)V, suitable for different starting battery voltage environment;
- USB equipment port for upgrading display module firmware;
- USB master port for upgrading screen picture and word stock of display module;
- IP65 waterproof level is achieved with the help of rubber-ring gasket between shell and control panel;
- Controller is fixed by metal clips;
- Modular structure design, pluggable terminal, built-in mounting, compact structure with easy installation.

3 SPECIFICATION

Table 6 Technical Specification

Parameter	Details
Working Voltage	Range: DC10V~DC35V, DC reverse connection protection
Overall Consumption	<6W
RS485	Isolated, half-duplex, 9600/19200/38400/57600/115200bps baud rate, maximum communication length 1000m (under 9600bps).
Ethernet	Self-adapting 10/100Mbit
CAN BUS	Isolated, maximum communication length 250m; use Belden 9841 cable or equivalence.
Vibration Test	5-8Hz: ± 7.5 mm 8-500Hz: 2g IEC 60068-2-6
Shock Test	50g, 11ms, half-sine, complete shock test from three directions, and 18 times shock for each test IEC 60068-2-27
Bump Test	25g, 16ms, half-sine IEC 60255-21-2
Case Dimensions	221mm x 163mm x 51mm
Panel Cutout	205mm x 147mm
Working Temperature	(-25~+70) $^{\circ}$ C
Working Humidity	(20~93)%RH
Storage Temperature	(-30~+80) $^{\circ}$ C
Protection Level	Front Enclosure: IP65 when rubber-ring gasket is installed between the enclosure and the control panel Rear Enclosure: IP20
Weight	1.3kg

4 OPERATION

4.1 CONTROLLER PANEL



Fig.1 HMU8-9570 Indication

Table 7 Indicators Description

Indicator	Description
Alarm Indicator	Warning alarm: slow flashes (1 time/s); Fault alarm: fast flashes (5 times/s); No alarm: extinguishes.
Comm. Indicator	It always illuminates when controller communicates with inverter, converter, genset normally; It extinguishes when communication is abnormal.
Power Indicator	It always illuminates after controller is powered on and working; It extinguishes after controller stops working.

NOTE: Mute the sounds by sliding touch screen.

4.2 DISPLAY INTERFACE AND OPERATION

4.2.1 ILLUSTRATION

The controller has 6 interfaces, including homepage, photovoltaic, PCS, genset, load and setting. The interface can be switched by sliding the touch screen.

4.2.2 HOMEPAGE INTERFACE

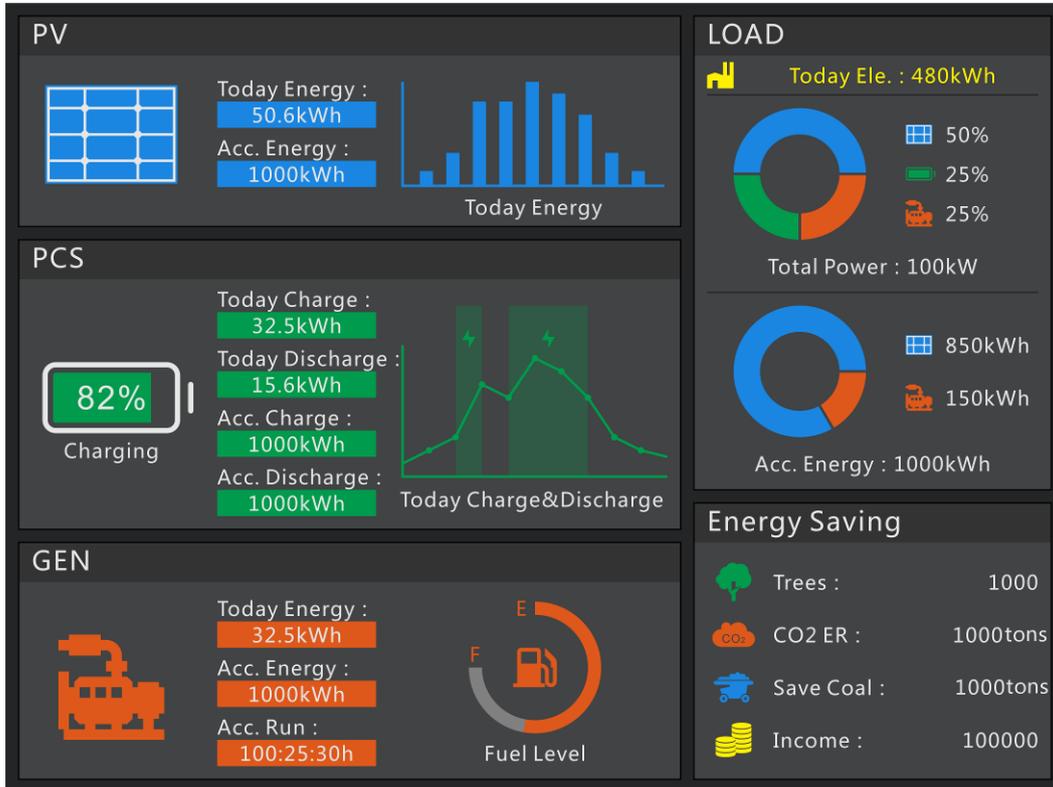


Fig.2 Homepage Interface

This interface displays some parameter information of photovoltaic, energy storage battery, genset, load, energy saving and emission reduction. When photovoltaic inverter, energy storage converter and genset have alarm information, alarm information will be displayed in corresponding title bar.

4.2.3 PV INTERFACE

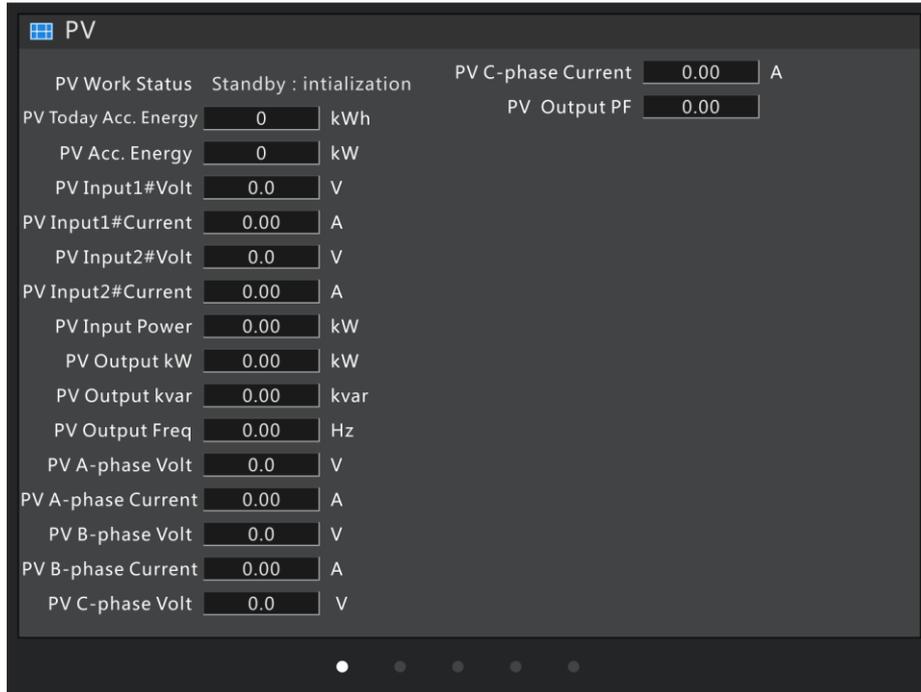


Fig.3 PV Interface

This interface displays working status of photovoltaic inverter, accumulated generating power, input DC voltage, current, output AC voltage, current information.

4.2.4 PCS INTERFACE

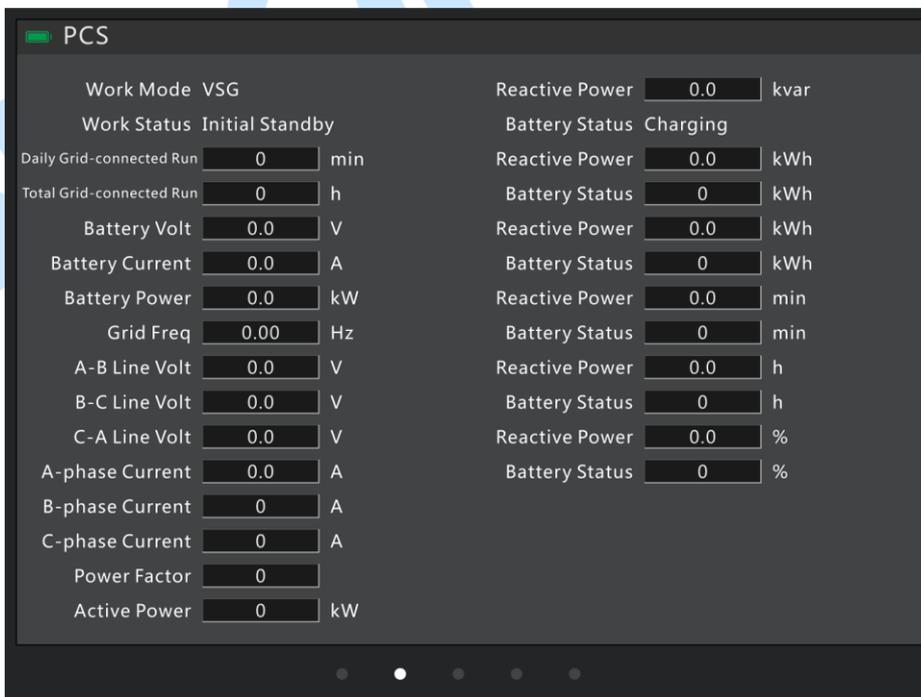


Fig.4 PCS Interface

This interface displays converter working mode, working status, running time, battery pack information, output AC voltage, current, power, etc.

4.2.5 GENSET INTERFACE

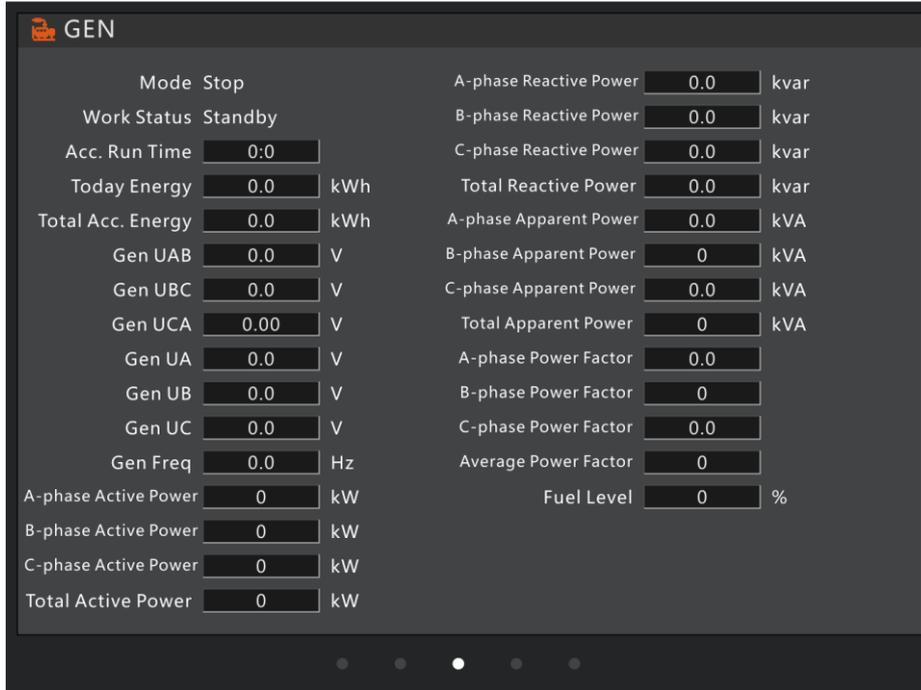


Fig.5 Genset Interface

This interface displays genset controller mode, working status, running time, generating power, output AC voltage, current, power, etc.

4.2.6 LOAD INTERFACE



Fig.6 Load Interface

This interface displays system application model, power consumption, energy saving and emission reduction, etc.

4.2.7 SETTING INTERFACE

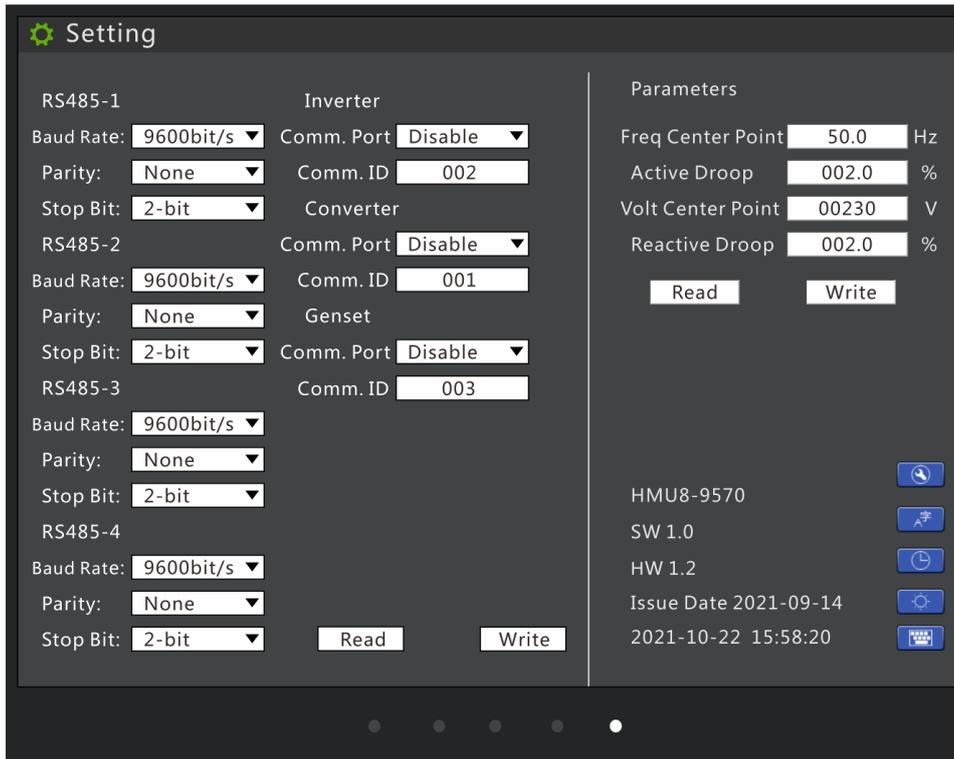


Fig.7 Setting Interface

Table 8 Key Description

Icon	Key	Description
	Parameter Setting	Press it, accumulated information can be cleared by inputting password.
	Language	Press it can set display module language as Chinese or English.
	Date and Time	Press it can set module date and time.
	Brightness	Press it can adjust module screen brightness and make lamp test, time is 2s.
	Numeric Keypad	When the parameter needs to be changed, press it can pop up numeric keypad.

Controller parameter setting steps:

- 1) Select parameter items need to be configured;
- 2) Parameters with parameter list boxes selects corresponding configurations by clicking the list;
- 3) If you want to change the parameter of text box, please press the numeric keypad to pop up it;
- 4) Click “Write” button, parameter save dialog box will pop up, then save parameters according to hints.

NOTE: Controller password needs to be inputted when configuring parameters, then you can save parameters.

4.3 RUNNING MODE DESCRIPTION

4.3.1 PCS + GENSET SYSTEM

PCS supplies power for load in VSG (Virtual Synchronous Genset) mode. When storage loading power is greater than start power of scheduled genset or battery pack SOC is lower than cutoff discharge SOC, genset will start. If genset and storage battery pack share the load, when load power is lower than allowed storage charge power, genset will charge the battery pack with constant voltage and frequency of storage rated charge power. When battery pack SOC is greater than cutoff charge SOC, genset will not charge for battery pack, genset and storage battery pack share the load (**NOTE:** Converter droop and genset droop should be set as same). When load power is lower than stop power of scheduled genset, genset will stop.

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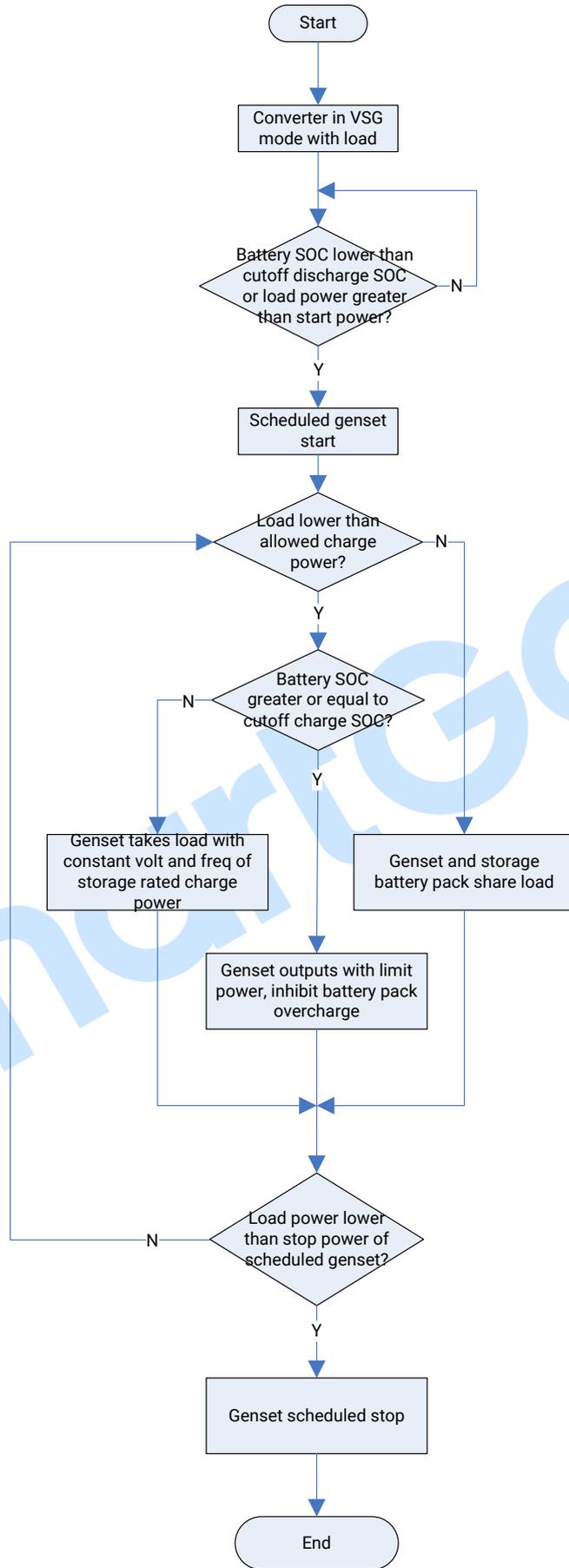


Fig.8 PCS + Genset Running Flowchart

4.3.2 PV + PCS + GENSET SYSTEM

● ECONOMY MODE

If solar energy and storage energy supply power for load, when storage power is greater than start power of scheduled genset or battery pack SOC is lower than cutoff discharge SOC, genset will start. If PV outputs with max power, converter and genset share left load, when load power is lower than PV output power, PV output power is limited, genset reverse power is prevented and storage battery pack overcharge is prohibited. The solar energy takes load first, only supplies power for storage battery pack when solar energy is sufficient. When load power is lower than stop power of scheduled genset and battery pack SOC is greater than cutoff charge SOC, genset will stop.

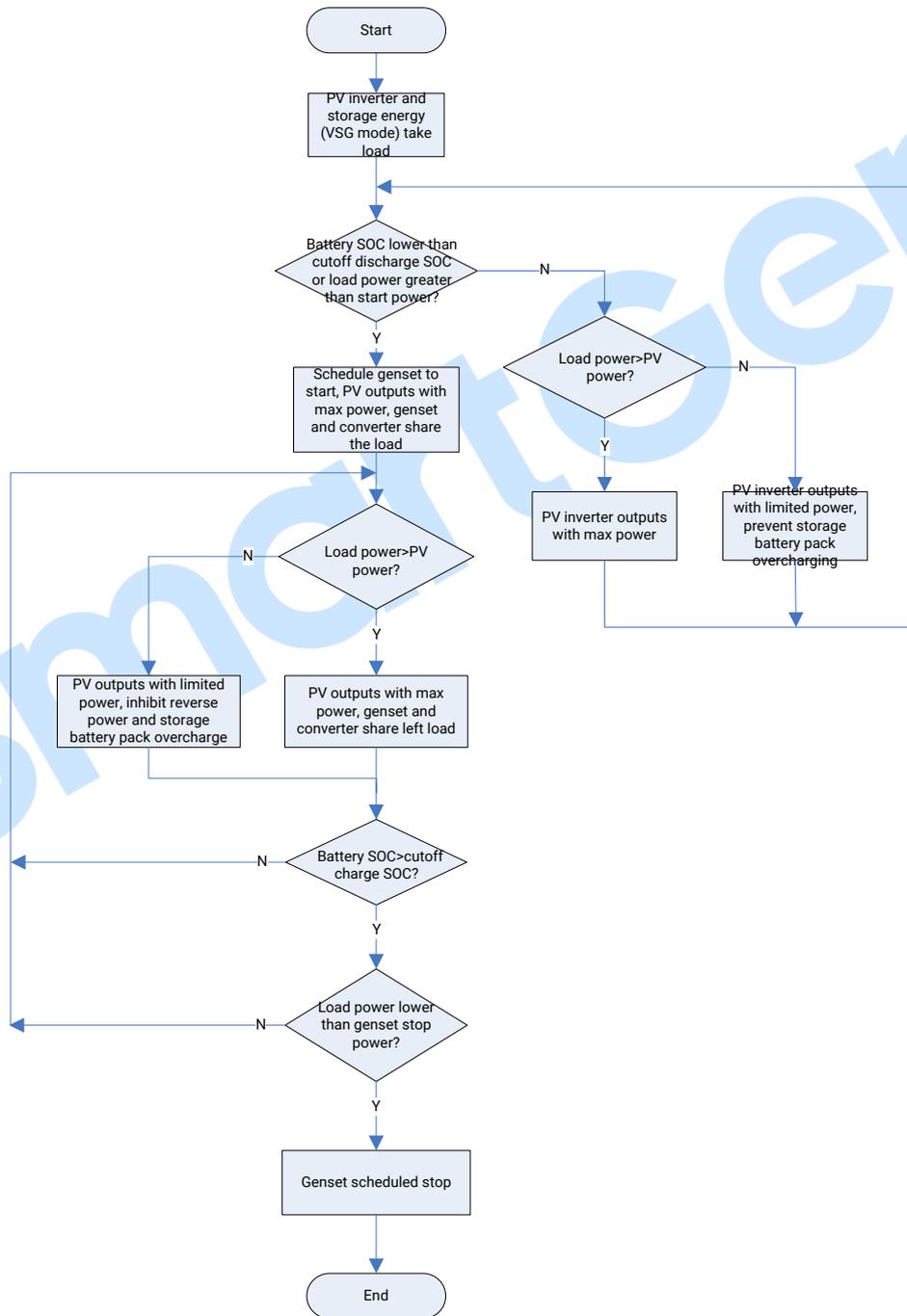


Fig.9 Economy Mode Running Flowchart

● **POWER MAINTAINING MODE**

If solar energy and storage energy supply power for load, when storage power is greater than start power of scheduled genset or battery pack SOC is lower than cutoff discharge SOC, genset will start. If PV outputs with max power, storage converter and genset share load, when load power is lower than storage allowed charge power, genset will charge the storage battery pack with constant voltage and frequency of storage rated charge power; otherwise, when load power is greater than PV power, PV outputs with max power, genset and storage share left load. When load power is lower than PV output power, PV output power is limited, genset reverse power is prevented and storage battery pack overcharge is prohibited. When load power is lower than stop power of scheduled genset and battery pack SOC is greater than cutoff charge SOC, genset will stop.

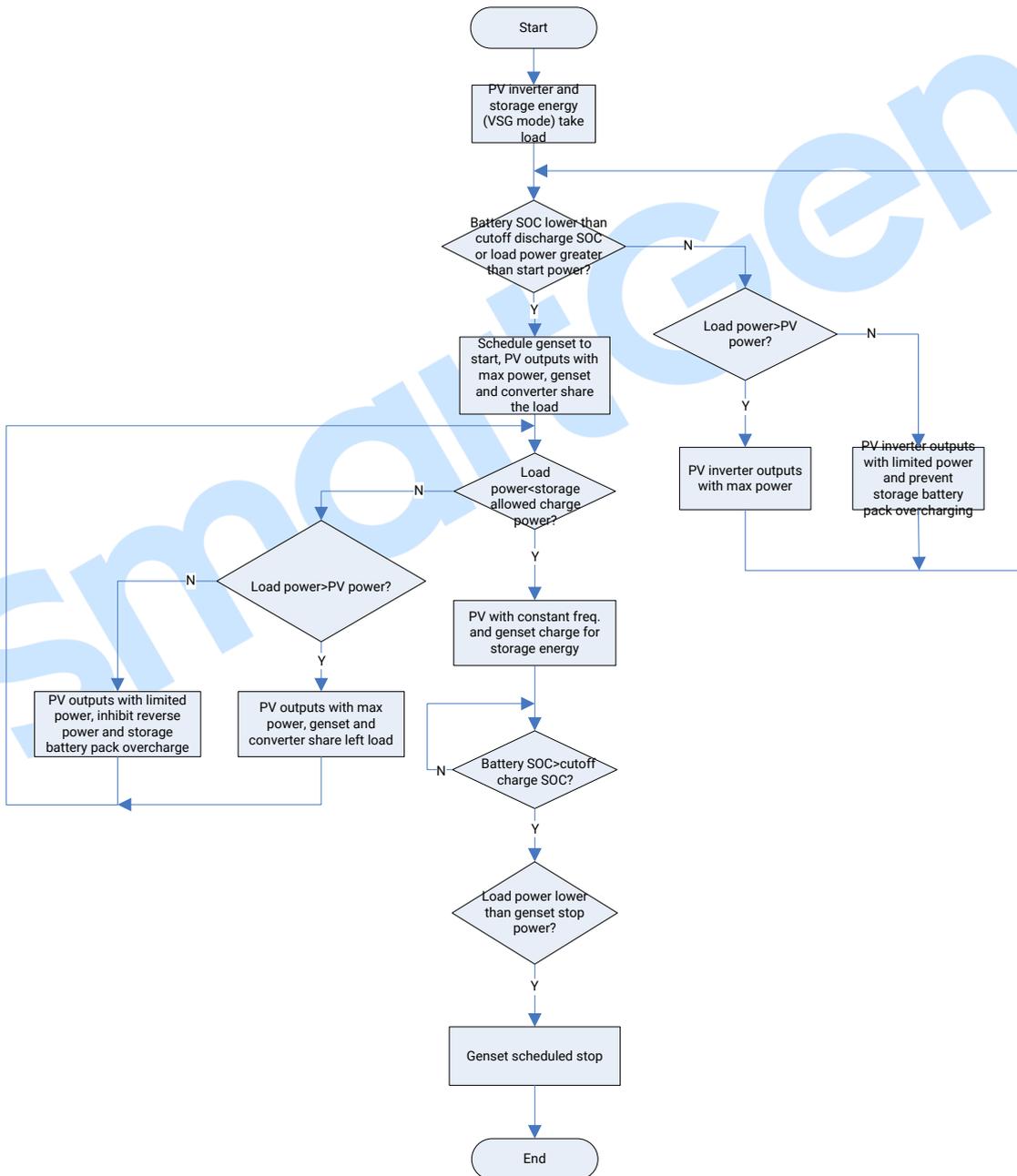


Fig.10 Power Maintaining Mode Running Flowchart

5 PROTECTIONS

5.1 WARNING ALARMS

When controller detects the warning alarm, it only issues warning.

Table 9 Warning Alarms

No.	Type	Description
1	PV Comm. Failure	When inverter communication port is enabled and action type selects "Warning", if controller cannot receive inverter communication data, it will send a warning alarm signal.
2	Converter Comm. Failure	When converter communication port is enabled and action type selects "Warning", if controller cannot receive converter communication data, it will send a warning alarm signal.
3	Genset Comm. Failure	When genset communication port is enabled and action type selects "Warning", if controller cannot receive genset communication data, it will send a warning alarm signal.
4	PV Common Warning	When controller receives inverter common warning alarm data, it will send a warning alarm signal.
5	Converter Common Warning	When controller receives converter common warning alarm data, it will send a warning alarm signal.
6	Genset Common Warning	When controller receives genset common warning alarm data, it will send a warning alarm signal.

5.2 FAULT ALARMS

When controller detects fault alarms, it will send fault alarm.

Table 10 Fault Alarms

No.	Type	Description
1	PV Comm. Failure	When inverter communication port is enabled and action type selects "Fault", if controller cannot receive inverter communication data, it will send a fault alarm signal.
2	Converter Comm. Failure	When converter communication port is enabled and action type selects "Fault", if controller cannot receive converter communication data, it will send a fault alarm signal.
3	Genset Comm. Failure	When genset communication port is enabled and action type selects "Fault", if controller cannot receive genset communication data, it will send a fault alarm signal.
4	PV Common Fault	When controller receives inverter common fault alarm data, it will send a fault alarm signal.
5	Converter Common Fault	When controller receives converter common fault alarm data, it will send a fault alarm signal.
6	Genset Common Shut.	When controller receives genset common shutdown alarm data, it will send a fault alarm signal.

NOTE: When controller receives common alarm common shutdown alarm, common warning alarm, common trip and stop alarm, common trip alarm, common safety trip and stop alarm, common safety trip alarm, common block alarm, corresponding common alarm information will be displayed on current homepage genset information bar.

6 WIRING CONNECTION



Fig. 11 Controller Rear Panel

Table 15 Terminal Connection Description

No.	Function		Size	Remark
1	B-		1.0mm ²	Connect starting battery negative.
2	B+		1.0mm ²	Connect starting battery positive.
3	PE			Protection earth.
4	CAN	Terminal Matching Resistor (120Ω)	0.5mm ²	Reserved port. 120Ω twisted shielding line is recommended to use with its single end grounded. Short connect terminal 4 and 6, then connect 120Ω terminal resistor.
5		CAN L	0.5mm ²	
6		CAN H	0.5mm ²	
7		PE1		
8	RS485-1	Terminal Matching Resistor (120Ω)	0.5mm ²	120Ω twisted shielding line is recommended to use with its single end grounded. Short connect terminal 8 and 10, then connect 120Ω terminal resistor.
9		B(-)	0.5mm ²	
10		A(+)	0.5mm ²	
11		PE2		
12	RS485-2	Terminal Matching Resistor (120Ω)	0.5mm ²	120Ω twisted shielding line is recommended to use with its single end grounded. Short connect terminal 12 and 14, then connect 120Ω terminal resistor.
13		B(-)	0.5mm ²	
14		A(+)	0.5mm ²	
15		PE3		
16	RS485-3	Terminal Matching Resistor (120Ω)	0.5mm ²	120Ω twisted shielding line is recommended to use with its single end grounded. Short connect terminal 16 and 18, then connect 120Ω terminal resistor.
17		B(-)	0.5mm ²	
18		A(+)	0.5mm ²	
19		PE4		
20	RS485-4	Terminal Matching Resistor (120Ω)	0.5mm ²	120Ω twisted shielding line is recommended to use with its single end grounded. Short connect terminal 20 and 22, then connect 120Ω terminal resistor.
21		B(-)	0.5mm ²	
22		A(+)	0.5mm ²	
23		PE5		

NOTE1: Slave USB port on the controller side is used for upgrading controller firmware.

NOTE2: Master USB port on the controller side is used for updating controller display pictures and word stock.

NOTE3: ETHERNET port on the controller side is reserved port.

7 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

Table 12 Parameter Contents and Scopes

No.	Item	Range	Default	Description	
Timer Setting					
1	Start Delay	(0-3600)s	1	Time from storage battery SOC is lower than cutoff discharge SOC or load power is greater than scheduled start percentage to genset start.	
2	Stop Delay	(0-3600)s	1	Time from storage battery SOC is greater than cutoff charge SOC or load power is lower than scheduled stop percentage to genset stop.	
Module Setting					
1	Module Address	(1-254)	1		
2	Language	(0-1)	0	0: Simplified Chinese; 1: English	
3	Password	(0-65535)	00318		
4	RS485 -1	Baud Rate	(0-2)	1	0: 4800bps; 1: 9600bps; 2: 19200bps
5		Parity	(0-2)	0	0: None; 1: Odd Parity; 2: Even Parity
6		Stop Bit	(0-1)	0	0: 2bit; 1: 1bit
7	RS485 -2	Baud Rate	(0-2)	1	0: 4800bps; 1: 9600bps; 2: 19200bps
8		Parity	(0-2)	0	0: None; 1: Odd Parity; 2: Even Parity
9		Stop Bit	(0-1)	0	0: 2bit; 1: 1bit
10	RS485 -3	Baud Rate	(0-2)	1	0: 4800bps; 1: 9600bps; 2: 19200bps
11		Parity	(0-2)	0	0: None; 1: Odd Parity; 2: Even Parity
12		Stop Bit	(0-1)	0	0: 2bit; 1: 1bit
13	RS485 -4	Baud Rate	(0-2)	1	0: 4800bps; 1: 9600bps; 2: 19200bps
14		Parity	(0-2)	0	0: None; 1: Odd Parity; 2: Even Parity
15		Stop Bit	(0-1)	0	0: 2bit; 1: 1bit
System Setting					
System Application					
1	Application Mode	(0-1)	0	0: Economy Mode; 1: Power Maintaining Mode.	
Converter Setting					
1	Rated Active Power	(0-6000)kW	500	PCS rated active power.	
2	Rated Reactive Power	(0-6000)kvar	500	PCS rated reactive power.	
3	Converter Model	(0-49)	0	0: SC50HV	
4	Communication ID	(1-254)	1	Converter communication address.	

No.	Item	Range	Default	Description
5	Comm. Failure Delay	(0-3600)s	5	Delay time from the module cannot receive monitoring data to controller issues communication failure alarm during communication.
6	Comm. Failure Action	(0-2)	1	0: None; 1: Warning; 2: Fault alarm.
7	Communication Port	(0-4)	0	0: Not used 1: RS485(1) 2: RS485(2) 3: RS485(3) 4: RS485(4)
8	Storage Charge Power	(0-100)%	50	Storage battery charge power.
9	Cutoff Discharge SOC	(0-100)%	30	When storage battery SOC is lower than cutoff discharge SOC, genset will start.
10	Cutoff Charge SOC	(0-100)%	100	When storage battery SOC is greater than cutoff charge SOC, storage battery pack charge is over.
Inverter Setting				
1	Rated Active Power	(0-6000)kW	500	Rated active power of inverter.
2	Rated Reactive Power	(0-6000)kvar	500	Rated reactive power of inverter.
3	Inverter Model	(0-50)	0	0: First Running.
4	Inverter ID	(1-254)	2	Inverter communication address.
5	Comm. Failure Delay	(0-3600)s	5	Delay time from the module cannot receive monitoring data to controller issues communication failure alarm during communication.
6	Comm. Failure Action	(0-2)	1	0: None; 1: Warning; 2: Fault alarm.
7	Communication Port	(0-4)	0	0: Not used 1: RS485(1) 2: RS485(2) 3: RS485(3) 4: RS485(4)
8	DC Channel	(1-4)	2	DC input channel of PV inverter.
Genset Setting				
1	Rated Active Power	(0-6000)kW	500	Rated active power of genset.
2	Rated Reactive Power	(0-6000)kvar	500	Rated reactive power of genset.
3	Genset ID	(1-254)	3	Genset communication address.
4	Comm. Failure Delay	(0-3600)s	5	Delay time from the module cannot receive monitoring data to controller issues communication failure alarm during communication.
5	Comm. Failure Action	(0-2)	1	0: None; 1: Warning; 2: Fault alarm.

No.	Item	Range	Default	Description
6	Communication Port	(0-4)	0	0: Not used 1: RS485(1) 2: RS485(2) 3: RS485(3) 4: RS485(4)
7	Scheduled Stop Power	(0-100)%	30	When storage capacity is greater than cutoff charge SOC and load power is lower than this value, schedule genset to stop.
8	Scheduled Start Power	(0-100)%	80	When storage load power is greater than this value, schedule genset to start.
9	Freq. Center Point	(10.0-75.0) Hz	50.0	Droop frequency center point of genset active power.
10	Active Droop	(0-200.0)%	2.0	Genset active droop percentage.
11	Volt Center Point	(30-30000)V	230	Droop frequency center point of genset reactive power.
12	Reactive Droop	(0-200.0)%	2.0	Genset reactive droop percentage.
13	Min. Load Power	(0-100)%	10	Genset allowed min. load power.
14	Allowed Storage Charge Power	(0-100)%	80	When load power is lower than allowed storage charge power, it will charge for battery pack.
Energy Saving and Emission Reduction Setting				
1	Equivalent Tree Plant Factor	(0-9.9999)	5.023 g/day	The average daily amount of CO ₂ absorbed by an ordinary tree.
2	Reduce CO ₂ Factor	(0-9.9999)	0.785 kWh/kg	CO ₂ emission reduction amount for every 1kWh generated by PV.
3	Save Standard Coal Factor	(0-9.9999)	0.123 kg	The standard coal amount required for every 1kWh power.
4	Equivalent Economic Factor	(0-9.9999)	0.700 yuan/kWh	Price of 1kWh power.

8 SYSTEM STRUCTURE TOPOLOGY

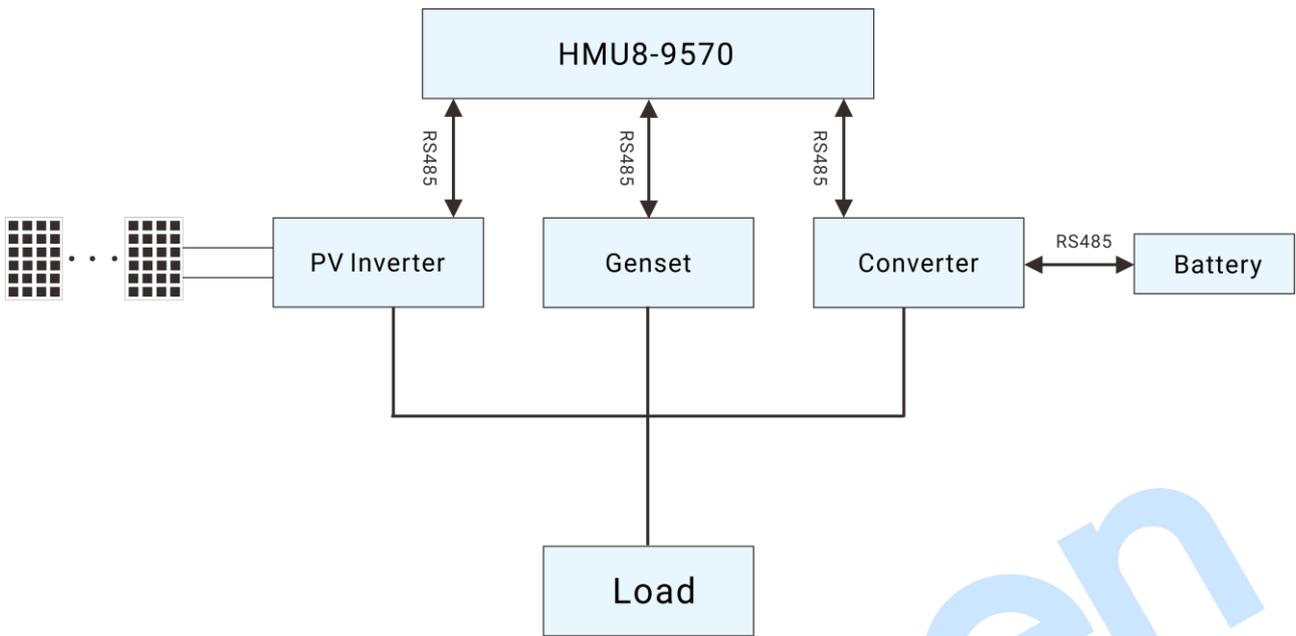
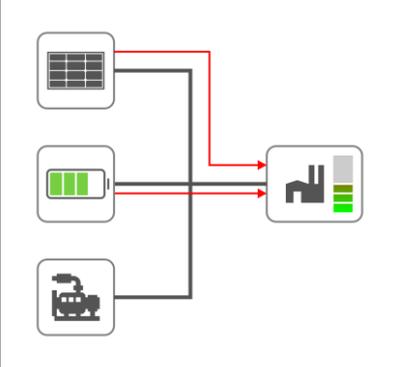
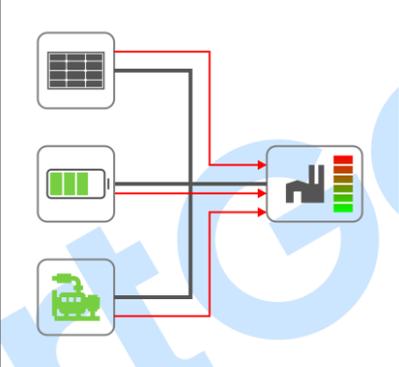
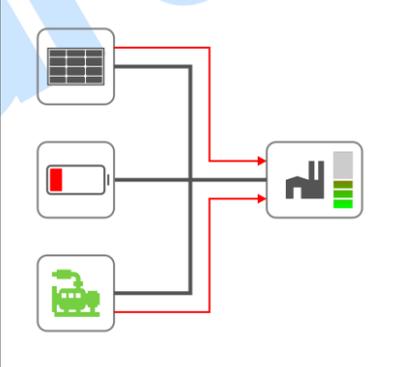
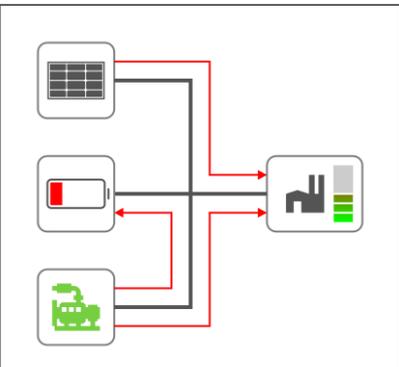
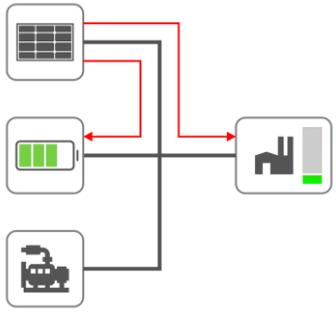
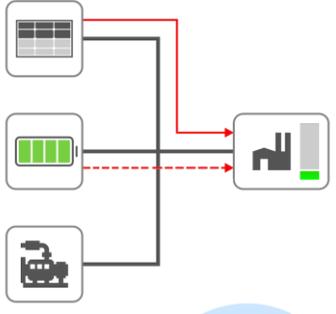


Fig.12 System Structure Topology

HMU8-9570 can perform data monitoring and communication with PV inverter, genset and converter via RS485 port. BMS and PCS can make data communication via RS485.

Table 13 System Running Example

Status	Diagram
<p>When load power is lower than genset scheduled start power and storage battery pack SOC is greater than cutoff discharge SOC, solar energy and storage energy will supply power for load.</p>	
<p>When load power is greater than genset scheduled start power, genset will start, solar energy, storage battery and genset will supply power for load.</p>	
<p>When load power is lower than scheduled start power, storage battery SOC is lower than cutoff discharge SOC, solar energy and genset supply power for load.</p> <p>In economy mode, genset will not charge for storage battery.</p> <p>In power maintaining mode, genset will charge for storage battery.</p>	<div style="display: flex; flex-direction: column; align-items: center;">  <p>Economy Mode</p>  <p>Power Maintaining Mode</p> </div>

<p>When load power is lower than scheduled stop power, storage battery SOC is greater than cutoff discharge SOC, genset will stop, solar energy will supply power for load and charge for storage battery.</p>	 <p>The diagram shows three components on the left: solar panels, a battery with a high state of charge (SOC), and a genset. On the right is a load. Solid red arrows indicate power flow from the solar panels to the battery and from the battery to the load. A solid black arrow shows power from the genset to the load. A dashed red arrow points from the battery to the load, indicating that solar power is also contributing to the load's power supply.</p>
<p>When load power is lower than scheduled stop power, storage battery SOC is greater than cutoff charge SOC, genset will stop, solar energy will supply power for load. When solar energy power is too large, its power needs to be limited.</p>	 <p>The diagram shows the same three components on the left and the load on the right. Solid red arrows show power from the solar panels to the load. A dashed red arrow points from the battery to the load, indicating limited power flow. A solid black arrow shows power from the genset to the load. A dashed red arrow also points from the battery to the solar panels, indicating that the battery is limiting the solar power that can be used.</p>

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10 COMMISSIONING

Before formal running, please make the following checking:

- 1) Check whether all connection wires are correct and diameter is suitable;
- 2) Check whether DC power has fuse, connect it to power's positive and negative, turn on the supply switch;
- 3) Check whether battery pack and storage converter is correctly connected, then turn on the master switch of battery pack, press "Start" key;
- 4) Turn on the DC input switch and AC output switch of storage converter, set converter as VSG mode, start the converter through converter operation software and wait for normal running;
- 5) Turn off the PV inverter and grid switch, turn on the inverter DC switch and wait PV inverter enter normal running;
- 6) Set HES9570 genset controller in auto mode;
- 7) View whether each monitoring parameter of controller is normal;
- 8) View system running conditions with load;
- 9) If there is any question, please contact our service personnel in time.

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11 INSTALLATION

11.1 FIXING CLIPS

- This controller is panel-mounted and fixed by clips;
- Withdraw the fixing clip screw (turn anticlockwise) until it reaches proper position;
- Pull the fixing clip backwards (towards the back of the module) and ensure four clips are inside their allotted slots;
- Turn the fixing clip screws clockwise until they are fixed on the panel;
- Care should be taken not to over tighten the screws of fixing clips, torque is 2.75kgf.cm (0.27N.m).

11.2 CASE DIMENSION AND PANEL CUTOUT

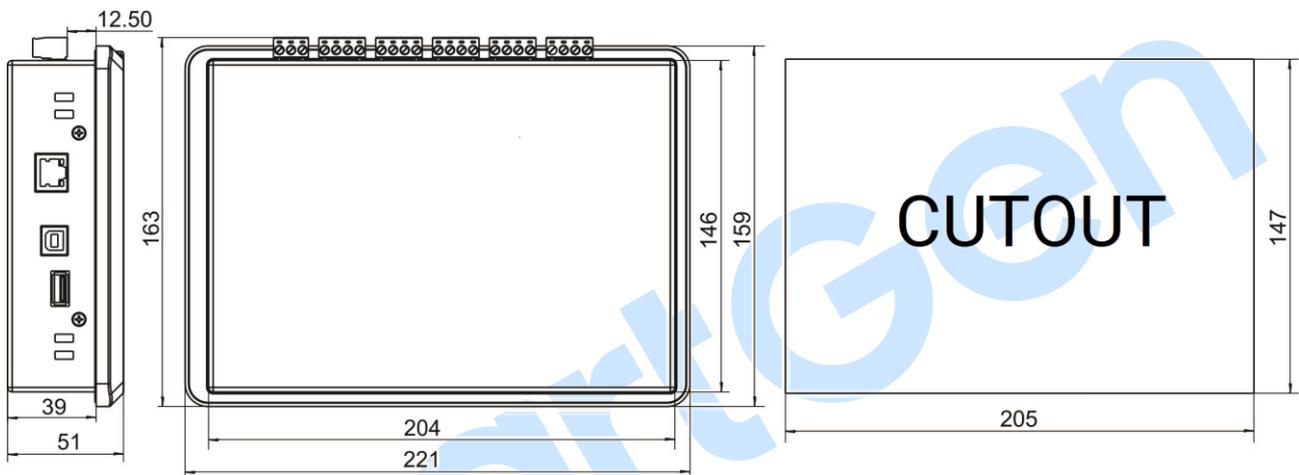


Fig.13 Case Dimension and Panel Cutout

12 FAULT FINDING

Table 14 Fault Finding

Symptoms	Possible Solutions
Controller no response for power	Check starting voltage; Check controller connection wires; Check DC fuse.
PV inverter comm. abnormal Converter comm. abnormal Genset comm. abnormal	Check connection wires; Check settings of COM port is correct or not; Check RS485's A and B connections is reversely connected or not; Check 120Ω terminal resistor of communication line is matched or not.

