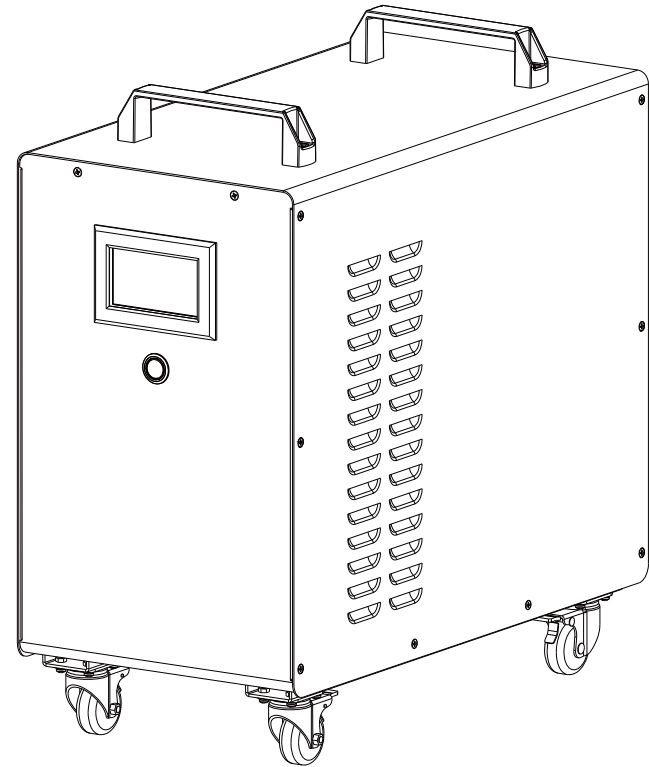


PV Off-grid ESS User's Manual



Contents

1. Brief Introduction	1
1.1 Foreword	1
1.2 Applicable Personnel	1
1.3 Safety Precautions	1
2. Product Overview	1
2.1 Function Overview	1
2.2 Naming Rules	2
2.3 Appearance	2
2.4 Outer Dimension(mm)	3
3. Design Principle	3
3.1 System Sketch	3
3.2 System Energy Distribution	3
3.3 Working Mode	4
3.3.1 PV Mode	4
3.3.2 UPS Mode	5
3.3.3 Peak-Avoid Mode	5
4. Technical Specifications	6
5. Product Functions	7
5.1 Power On/Off	7
5.2 Battery Charge Function	7
5.3 Display Function	8
5.4 Output Protection& Alarm	8
5.5 System Settings	8
6. Installation&Operation	9
6.1 Product Installation	9
6.2 Power On/Off	10
6.3 System Operation	10
6.3.1 Main Operation Interface	10
6.3.2 PV Input Information	11
6.3.3 Grid Input Information	11
6.3.4 Load/Output Information	11
6.3.5 Battery Information	12
6.3.6 System Setting	12
6.3.7 Failure Information	18
6.3.8 Language Setting	18
7. Troubleshooting	19
8. Maintenance	21
9. Packing List	21

1. Brief Introduction

1.1 Foreword

This manual will offer detailed product information and instructions for PV off-grid Energy Storage System(ESS) series product. Please read this manual carefully before using this product and safe keep the manual where easily to get when needed by user and maintainer.

1.2 Applicable Personnel

After reading the manual carefully, user can use PV off-grid ESS quickly, and troubleshoot and build communication system.

If there is any question during installation, Please contact the local technical supporter.

1.3 Safety Precautions

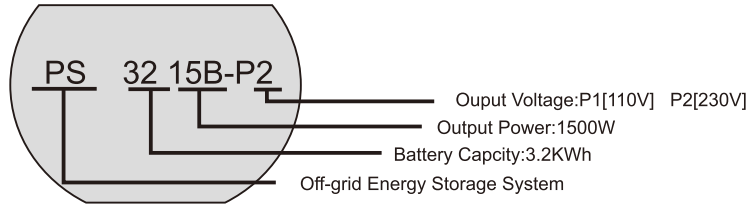
- 1) Please read the "Safety Precautions" before using to ensure right and safe operation and safe keep the manual. We have the rights of not offering quality assurance if the product fails because user doesn't follow this manual.
- 2) Please notice the warning marks and follow the manual during operation.
- 3) Keep the product away from sun, rain and humid conditions.
- 4) Keep the product away from heat source, like electric warming oven, furnace, etc.
- 5) Keep a safety distance around it for ventilation and follow the manual when installing.
- 6) Please wipe the product cabinet by dry things for cleaning.
- 7) Once a fire, please use dry powder extinguisher because fluid extinguisher may cause electric shock hazard.
- 8) Except the wiring terminal, please don't disassemble any part inside housing.
- 9) Please contact the local appointed installer or maintainer when maintenances needed.
- 10) All electrical installation and maintenance shall be conducted by licensed electrician and shall comply with national wiring rules.

2. Product Overview

2.1 Function Overview

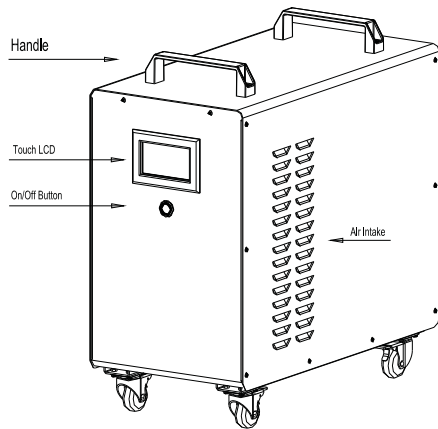
PV off-grid ESS is a small off grid household energy storage system. It's integrated with solar charge controller, system controller, inverter and lithium ion battery with BMS (Battery Management System), converts the cleaning solar energy to output household power and meets the basic house electricity needs. This system is suitable for energy shortage area or electricity unstable area, supplying cleaning energy or backup power supply; it's also suitable for disaster emergency or non-electrified area, like islet, frontier sentry, etc. The system is reliable, safe and easy to use, and performance stably.

2.2 Naming Rules

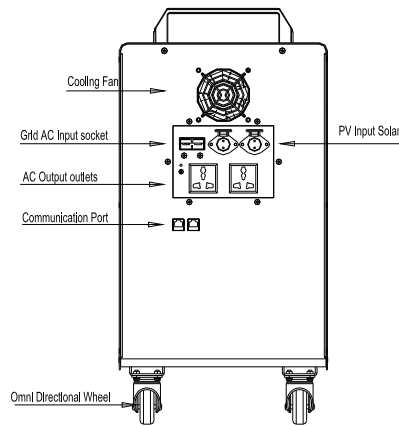


PS3215B-P2 stands for off grid energy storage system with 3.2KWh Li-ion battery energy and AC230V 1500W output.

2.3 Appearance

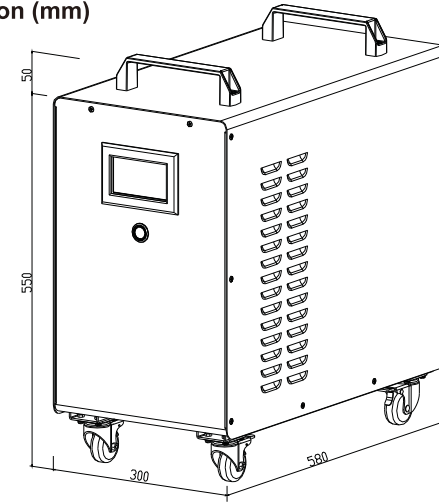


P1: Front&Side



P2: Back

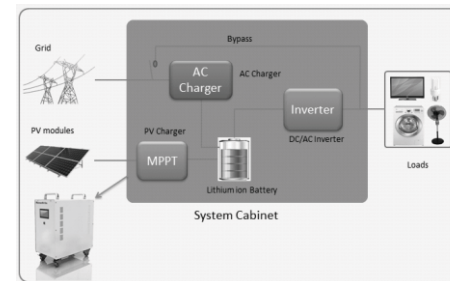
2.4 Outer Dimension (mm)



P3: Structure Dimension

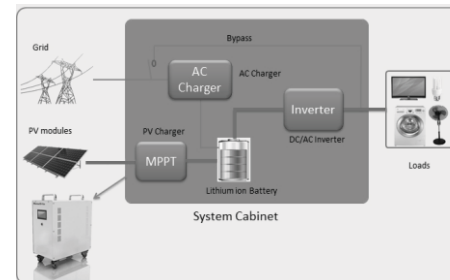
3. Design Principle

3.1 System Sketch



3.2 System Energy Distribution

➤ Inverter Output

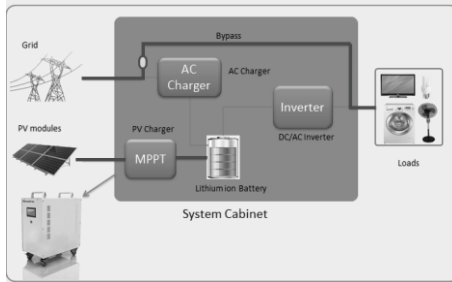


Inverter outputs when battery capacity is sufficient or no mains supply

1) When the solar power exceeds needs of load and the battery is not fully charged, solar energy powers the load and charges battery by redundant energy at the same time.

2) When solar energy is insufficient or no solar energy, battery and solar panels offer energy for inverter simultaneously until battery runs out.

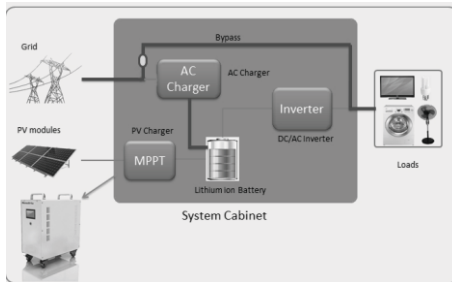
➤ Grid Powers Loads&Solar Charges Battery



Grid powers loads when it's forced or battery capacity is insufficient.

- 1) PV modules charge battery until reaches the conditions for inverter switching.
- 2) When battery is forced to charge, grid and PV modules charge battery simultaneously until it's fully charged.

➤ Grid Powers Loads&No Solar



Grid powers loads when it's forced or battery capacity is insufficient.

- 1) Battery needs to be charged by grid when its capacity is too low.
- 2) Grid supplies power first and battery capacity is lower than its set minimum retention percent.
- 3) When battery is forced to charge, grid charges battery until it's fully charged.

3.3 Working Mode

There are three working modes to meet user's needs: PV mode, UPS mode, peak-avoiding mode. The switch of operating conditions under a certain mode depends on the system judgments of real-time outer working conditions and it's automatically without human intervention. Working mode detail as below (Eb= minimum battery capacity retention percent):

Note: Eb stands for the same parameter of "SOC" on LCD for system setting. SOC: Save of Charge(Battery level)

3.1.1 PV Mode

System gets energy from solar first for load, then redundant energy for charging battery

Set customized parameter: minimum battery capacity retention percent---X; parameter setting range 30%~50%; default 30%

Condition 1: PV on or PV off, AC on

When $E_b > X$, battery and inverter output;

When $E_b < X - 10\%$, grid outputs;

When $E_b < 10\%$, grid charge battery until 15% of capacity retention;

Condition 2: PV on or PV off, AC off

Inverter outputs until $E_b < 10\%$, then cuts off output; if no PV or AC charge, system turns off in 10 minutes automatically

3.3.2 UPS Mode

System gets energy from grid for load and charging battery under normally. Once main supply fails, system offers energy automatically for uninterrupted power supply.

Set customized parameter of minimum battery capacity retention percent ---Y; parameter setting range 50%~90%; default 80%

Condition 1: PV on or PV off, AC on

When $E_b > Y + 10\%$, battery and inverter output;

When $E_b < Y$, grid output;

When $E_b < Y - 10\%$, grid charge battery;

When $E_b > Y$, charge stop

Condition 2: PV on or PV off, AC off

Inverter outputs until $E_b < 10\%$, then cuts off output; if no PV or AC charge, system turns off in 10 minutes automatically.

3.3.3 Peak-Avoid Mode

This mode is suitable for the area with different electricity prices for different period per day. This mode allows user to store the electricity into the system when electricity is cheaper and use the stored energy when electricity is expensive.

Set customized parameter:

Charge Period: Start T1; Stop T2

Discharge Period: Start T3; Stop T4

Condition 1: PV on or PV off, AC on

Forced Charge: in the setting charge period, PV and AC charge battery until fully, grid output before fully;

Forced Discharge: inverter outputs until $E_b < 15\%$, then grid outputs;

Out of forced charge period, PV charges only when PV on(AC charge off);

Grid charges until 12% of battery capacity when $E_b < 10\%$ but no PV;

During forced discharge period, PV charges until $E_b > 30\%$, then output changes from grid to inverter;

Condition 2: PV on or PV off, AC off

Forced Charge: inverter outputs; when $E_b < 10\%$, output cuts off;

Forced Discharge: inverter output; when $E_b < 10\%$, output cuts off;

When $E_b < 10\%$, PV charges until $E_b > 15\%$ after output cuts off, then inverter outputs again.

4. Technical Specifications

Model	PS3215 B	PS4020 B
Battery Capacity	3.2KWh	4.0KWh
OUTPUT		
Rated Output Power	1500 W	2000 W
Peak Output Power(10s)	2200 W	3000 W
Rated Output Voltage	200Vac-240Vac	200Vac-240Vac
Frequency	50/60Hz	50/60Hz
Power Factor	1	1
THDV	<3%	<3%
Overload Ability	120%<load<130% @10min; 130%<load<145% @10s	120%<load<130% @10min; 130%<load<166% @10s
Quiescent Dissipation(No Load)	<20W	<20W
Maximum Efficiency(>70% Load)	92%	92%
AC CHARGE		
Input Voltage Range	230Vac; 200~264Vac	230Vac; 200~264Vac
Maximum Charge Power	600W	600W
Maximum Efficiency	>92%	>92%
PV CHARGE		
Maximum Input Power	1200W	1500W
Start-up Voltage	75Vdc	75Vdc
MPPT Input Amount	2	2
MPPT Voltage Range	75-140 Vdc	75-140 Vdc
Maximum Input Voltage	150 Vdc	150 Vdc
MPPT Efficiency	99.50%	99.50%
Maximum Efficiency	>96%	>96%
Solar Charge Controller	MPPT	MPPT
Isc. PV	15A	20A
I-Feedback	0A	0A

BATTERY		
Rated Voltage	51.8Vdc	51.8 Vdc
Rated Capacity	65Ah	78Ah
Battery Type	Li-ion	Li-ion
Maximum Charge Voltage	58.5V	58.5V
Discharge Cut-off Voltage	42.0V	42.0V
Charge Temperature	0℃~45℃	0℃~45℃
Discharge Temperature	-20℃~60℃	-20℃~60℃
GENERAL		
IP Protection	IP21	
Communication	RS485	
Working Conditions	Relative Humidity :5%~90%	
	Temperature :0~40℃	
Warranty	5 Years	
Cooling	Fan Cooling	
Dimensions(mm)	580×300×600 mm (Product Size)	
	657×375×645 mm (Packing Size)	
Weight(Kg)	47Kg (N.W.)	59Kg (N.W.)
	50Kg (G.W.)	62Kg (G.W.)

5. Product Functions

5.1 Power On/Off

The Main Function of On/Off Button:

- 1) ON: press the button over 3 seconds, button LED lights and system power on;
- 2) OFF: press the button over 3 seconds, button LED lights and system power off;
- 3) Automatic On/Off: system cuts off automatically when battery capacity is less than 10% and no PV or grid charge; after PV works, system charge battery automatically until battery capacity is more than 15%, then system turns on automatically; after grid works, system charge battery automatically and system turns on automatically.

NOTE: If the system is turned off by human when battery capacity is less than 10%, system will charge battery automatically, but the system won't turn on automatically.

5.2 Battery Charge Function

5.2.1 Charge Battery after Power-On

When system is powered on, PV and grid charge battery automatically based on the setting working mode and battery capacity state.

5.2.2 Charge Battery after Power-Off

When system is powered off, PV and grid charge battery automatically based on the setting working mode and battery capacity state.

5.3 Display Function

The system holds one touch LCD to display the information of grid, PV, battery, loads, etc. User can touch the related area on LCD to see system information in real time.

5.4 Output Protection&Alarm

The system will stop output when over-load, over-voltage, low-voltage, over temperature, etc until trouble eliminated or system restarted. When system alarms or fails, the related information will be displayed on LCD or buzzes, and user can find the failure information on LCD and analysis the cause.

5.5 System Settings

5.5.1 Working Mode

User can choose one from PV mode, UPS mode and peak-avoiding mode. The system works automatically in different modes and switches power source based on PV input on/off, grid on/off and battery remaining capacity, etc.

5.5.2 Output Voltage

System output voltage can be set on LCD. PS3215B-P1 outputs voltage setting range is 100V~130V; while PS3215B-P2 outputs 200V~240V.

5.5.3 Automatical Output Frequency Identification

The system will identify and set the output frequency automatically based on the input frequency of local AC power.

5.5.4 System Time

User can set the system based on local time and the system runs automatically on set time.

5.5.5 System Language

There are three optional system languages: 中文, English, 日本

5.5.6 Buzzer

User can turn on or off the buzzer and it will buzz if it's turn on and alarm happens.

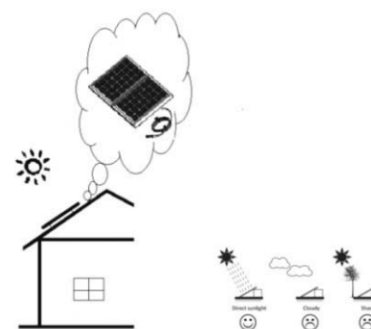
6. Installation&Operation

6.1 Product Installation

6.1.1 Installation Attention

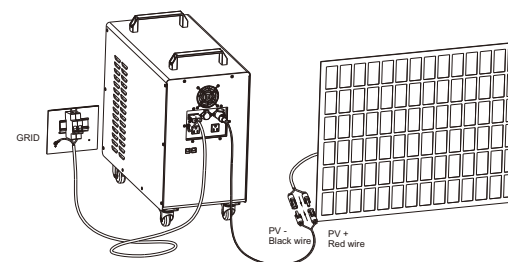
- 1) The installation environment should conform to specifications, well ventilated, away from water, combustible gas, corrosive and other hazardous objects.
- 2) Keep ventilated for air outlet on housing back panel and air inlet on housing side panel.
- 3) There may be condensed water droplets at low temperatures and please must wait for installation or disassembly until the product dries both outside and inside; otherwise shock hazard may happen.
- 4) When using UPS function, please put the product near grid input outlet; in case of any emergency, please pull off the grid input plug and make sure all outlets connect with earth wire.
- 5) Please only use this product indoor.
- 6) All electrical installation and maintenance shall be conducted by licensed electrician and shall comply with national wiring rules.
- 7) This product is in the protection of the surge equipment level is very low, the installation of the PV into the line at the end of the increase in lightning protection device.

6.1.2 Cable Connection

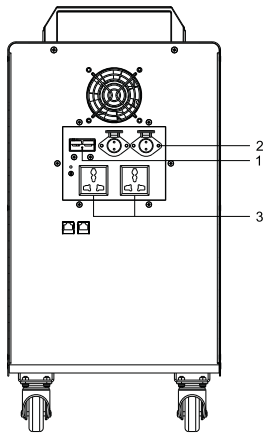


1) PV Module Installation

Please install the PV module in suitable position fixedly and firmly; the solar panels should be towards sunlight and avoid tree shade or other shelters. There must install reliable lightning protection device at solar panel before input to this product.



There must install reliable lightning protection device at solar panel before input to this product.



2) Cable Connection

Power off the system before connection

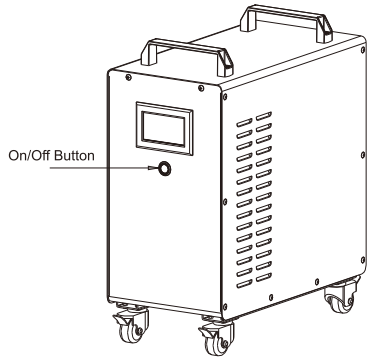
- AC input cable to Socket 1
- PV input cable to Socket 2
- AC Loads to Outlet 3

Note: all wires should be used within their rated over load ability.

The alarm icon will flicker when system alarms (touch this icon to set buzzer on/off) and no icon when system is working normally.

- 5) System Time at bottom right
- 6) Working Mode at bottom left

6.2 Power On/Off



1) Power On: Press the On/Off Button for 3 seconds, then LCD and button indicator will light on.


2) Power Off: Press the On/Off Button for 3 seconds, then LCD and button indicator will light off and output stops. Please turn off the load before power off.

6.3.2 PV Input Information

Touch  on main interface to see PV input parameters

PV Input		
Input Voltage	103.5	VDC
Charging Power	1050	W
Charging Temp	50	°C
Generation Sum	5.920	Kwh

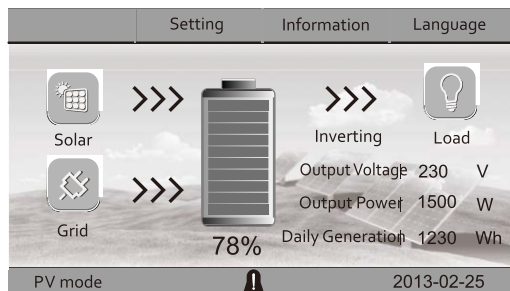
6.3.3 Grid Input Information

Touch  on main interface to see grid input parameters






Grid Input		
Grid Voltage	230	V
Grid Frequency	50	Hz
Charging Temp	30	°C
Charging Power	529	W

6.3 System Operation

6.3.1 System Main Operation Interface



LCD Main Display Interface


- 1) Charging Icon:  No charge: 
- 2) Passby Output Icon: 
- 3) Inverter output Icon: 
- 4) Alarm Icon: 

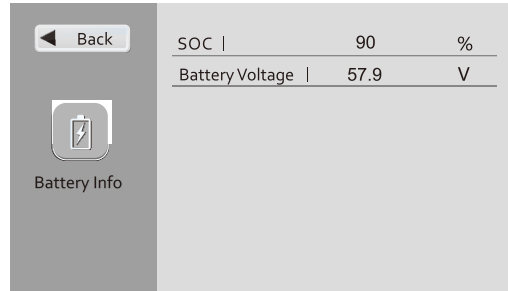
6.3.4 Load/Output Information

Touch  on main interface to see AC output parameters

AC Output		
Output Voltage	230	V
Output Power	1500	W
Output Frequency	50	Hz
Inverter Temp	40	°C
Battery Disc Current	27.3	A
Battery Voltage	57.9	VDC

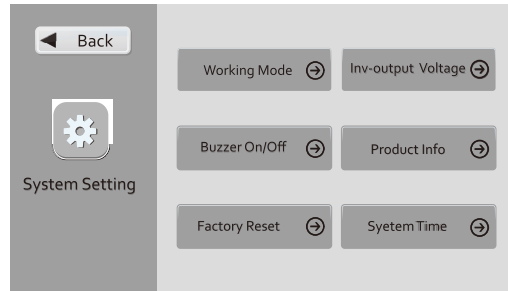
6.3.5 Battery Information

Touch  on main interface to see battery parameters



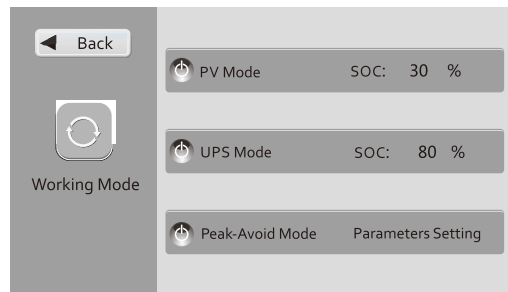
6.3.6 System Setting

Touch "Setting" on main interface to set system parameters



6.3.6.1 Working Mode Setting

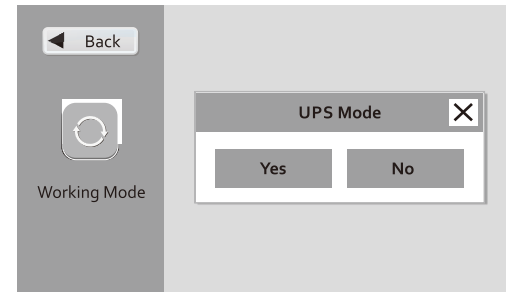
Touch "Working Mode" on main interface to working mode





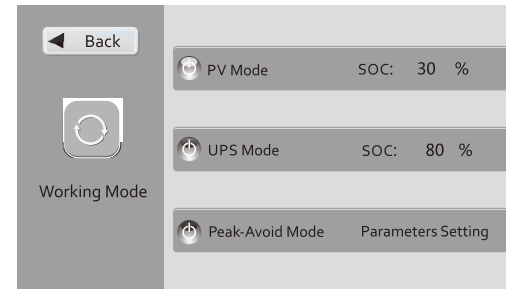
Touch the red number "30" or "80" to set the min battery capacity retention percent on PV and UPS mode based on user's own using conditions.

Note: setting range of min battery capacity retention: PV mode 30%~50%; UPS mode 50%~90%

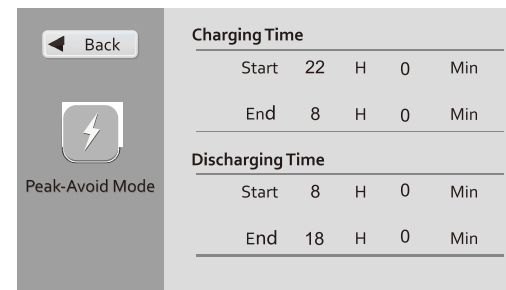
2. Touch , "PV Mode" "UPS Mode" or "Peak-Avoid Mode" to working mode setting page. For example, touch, "UPS Mode" next page as below.



Touch "No" to back and touch "Yes" to set UPS mode. Icon from  to red  means setting working mode successfully and the page as below

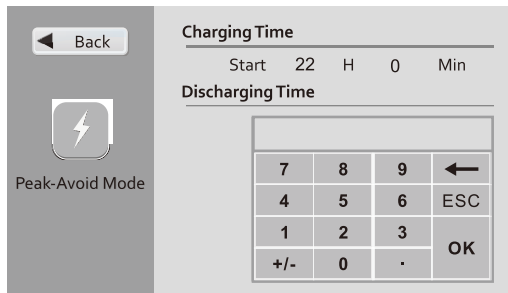


3. Touch "Parameters Setting" behind "Peak-Avoid Mode" to set the charge and discharge time as below.



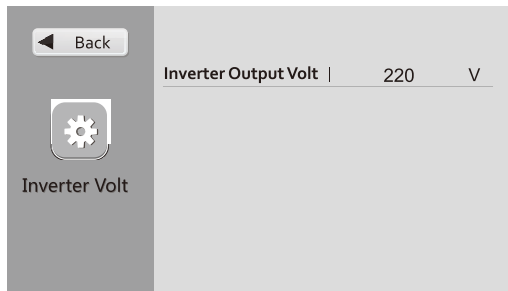
Note: Forced charging is only effective for grid AC charge and PV charge is out of the limits.

Touch the above red number to set charge and discharge time

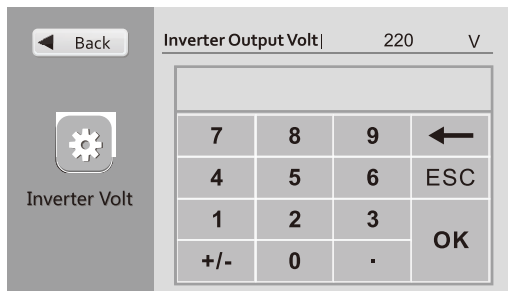


6.3.6.2 Inverter Output Voltage Setting

Touch "Inv Output Voltage" on System Setting Page to set inverter output voltage.
Touch "220" to set output voltage

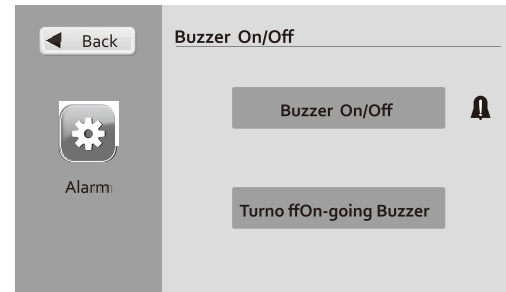


Please note the voltage setting range for two different product series.
110V series: 100V~130V
230V series: 200V~240V

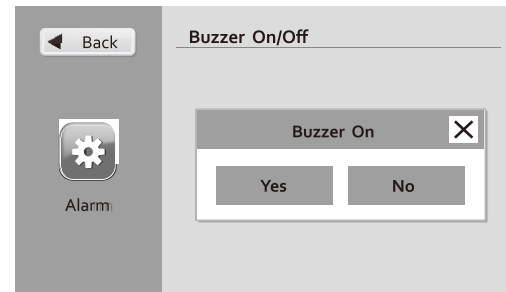


6.3.6.3 Buzzer Setting

Touch "Buzzer On/Off" on System Setting Page to set buzzer on/off



Touch "Buzzer On/Off" and next page as blow



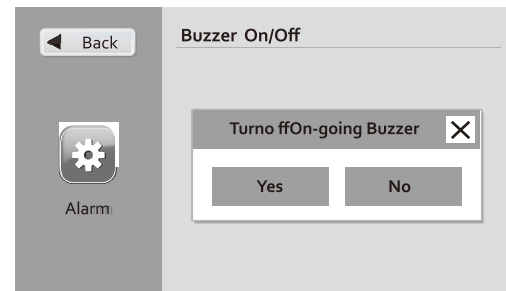
Touch "Yes" to buzzer on and system buzzes when it fails
Touch "No" to buzzer off and no buzz when it fails.

: buzzer on : buzzer off

When buzzer buzzes, user can cancel the sound via first page of buzzer setting, touch, "Turnoff On-going Buzzer" then next page as below.

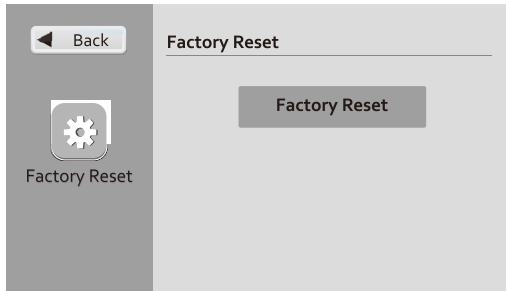
Touch "Yes" to buzzer off Touch "No" to quit buzzer off

Note: When system buzzes, touch on main interface can also enter into Buzzer Setting Page.

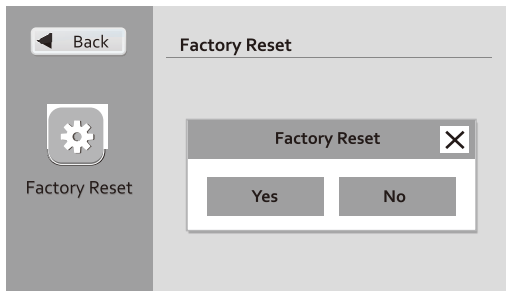


6.3.6.4 Factory Reset

Touch "Factory Reset" on System Setting Page and next page as below



Touch "Factory Reset" in above page and next page as below

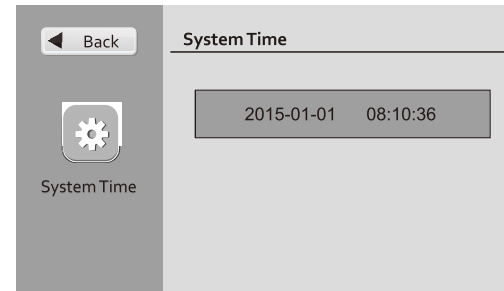


Touch "No" to back; Touch "Yes" to reset and changes as below.

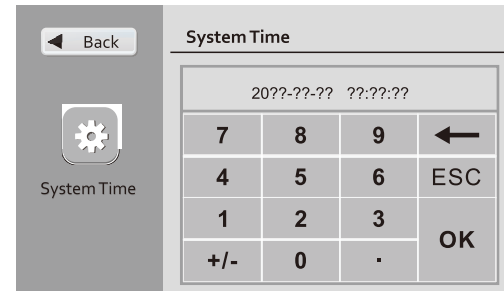
- ◆ Working Mode: PV mode
- ◆ Output Voltage:
1) 110V series: 110V 2) 230V series: 230V
- ◆ PV Daily Generation: 0
- ◆ Charge Time 1) Start: 22:00 2) End: 08:00
- ◆ Discharge Time 1) Start: 08:00 2) End: 16:00

6.3.6.5 System Time Setting

Touch "System Time" on System Setting Page and next page as below



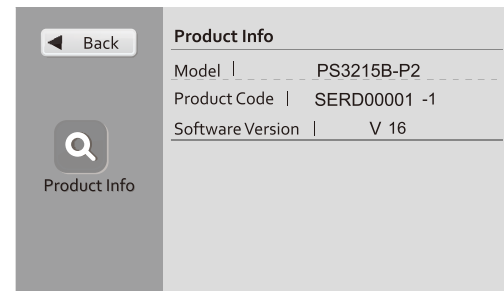
Touch "2015-01-01 08:10:36" and next page as below



Please input the right date and time, then touch OK to confirm; and touch "ESC" to turn back.

6.3.6.6 Product Information

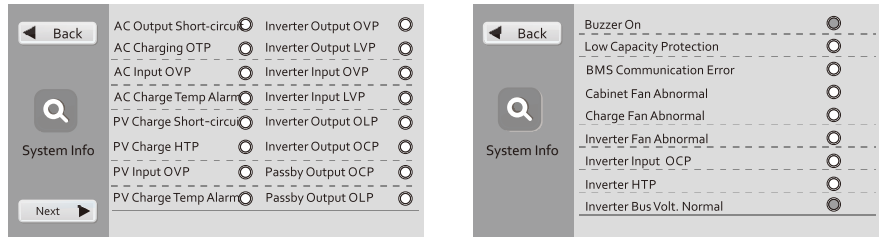
Touch "Product Info" on System Setting Page and next page as below



Product information: Product Model, Product Code and Software Version No.

6.3.7 Failure Information

Touch information on main interface to see system information.



● : Yes ○ : No

6.3.8 Language Setting

Touch "Language " in main interface to set system language: 中文, English or 日本語



7. Troubleshooting

The system has thorough protections and it will cut off output or charge automatically once abnormality or failure happens. User can find the failure information from "System Info" Page and troubleshoot accordingly.

NO	Failures	Cause	Troubleshooting
1	AC Charge Short-circuit	AC charging short-circuit	Contact your supplier
2	AC Charging OTP OTP: over temperature protection	AC charging stops automatically because of temperature over 70 °C	1. Check the ambient temperature if higher than 50 °C. Charging will be start again if charger cools down to 65°C and no need to re-start the system. 2. Contact the supplier if step 1 doesn't work.
3	AC Input OVP OVP: over voltage protection	AC input voltage is too high	1. Cut off AC input and measure AC voltage to see if it's higher than specified parameters and ensure it's lower than it. 2. Contact the supplier if step 1 doesn't work.
4	AC Charge Temp Alarm	AC charging over temperature alarm	Check the ambient temperature; check air intake if well unobstructed; check fan on cabinet if blocked
5	Inverter Output OVP OVP: over voltage protection	Inverter output voltage is too high	1. Cut off the load and restart the system 2. Contact the supplier if step 1 doesn't work.
6	Inverter Output LVP LVP: low voltage protection	Inverter output voltage is too low	1. Cut off the load and restart the system 2. Contact the supplier if step 1 doesn't work.
7	Inverter Input OVP OVP: over voltage protection	High battery voltage	Contact the supplier
8	Inverter Input LVP LVP: low voltage protection	Battery voltage is too low	1. Charge the system soon, inverter output recovers when battery capacity reaches its 10% 2. Contact the supplier if step 1 doesn't work.
9	Inverter Output OLP OLP: over load protection	Inverter's load is higher than its bearable load	1. Check if the load for system is too high and refer the system over load ability from Part 4, then restart. 2. Contact the supplier if step 1 doesn't work.
10	Inverter Output OCP OCP: over current protection	Short-circuit output or over load	1. Check load power or short-circuit output, then restart. 2. Contact the supplier if step 1 doesn't work.
11	Passby Output OCP OCP: over current protection	Short-circuit output or over load	1. Check load power or short-circuit output, then restart. 2. Contact the supplier if step 1 doesn't work.

12	Passby Output OLP OLP: over load protection	Short-circuit output or over load	1. Check load power or short-circuit output, then restart. 2. Contact the supplier if step 1 doesn't work.
13	PV Charging Short-circuit	PV/solar charging short-circuit	Contact the supplier
14	PV Charge HTP OTP: over temperature protection	PV charging stops automatically because of temperature over 80 °C	1. Check the ambient temperature if higher than 50°C. Charging will be start again if charger cools down to 75°C and no need to re-start the system. 2. Contact the supplier if step 1 doesn't work.
15	PV Input OVP OVP: over voltage protection	High PV voltage	1. Cut off PV input and measure PV voltage to see if it's higher than specified parameters and ensure it's lower than it. 2. Contact the supplier if step 1 doesn't work.
16	PV Charge Temp Alarm	High PV charging temperature	Check the ambient temperature; check air intake if well unobstructed; check fan on cabinet if blocked
17	Low Capacity Protection	Low battery capacity	1. Charge the system soon 2. Contact the supplier if step 1 doesn't work.
18	BMS Communication Error	Abnormal BMS communication	Restart and contact the supplier if it still doesn't work.
19	Cabinet Fan Abnormal		1. Check if the cabinet fan is stuck and clear it. 2. Contact the supplier if step 1 doesn't work.
20	Charger Fan Abnormal		Contact the supplier
21	Inverter Fan Abnormal		1. Check if the cabinet fan is stuck and clear it. 2. Contact the supplier if step 1 doesn't work.

8. Maintenance

In order to ensure the stable performance, please maintenance the product frequently.

1) Please keep the product away from corrosive, dusty, high-temperature surroundings and specially keep any metal out of the cabinet.

2) Check the wires to see if it's outworn regularly and check the wire connection to confirm its fastening and safety.

3) Clean the cooling fan and check its normal regularly.

4) Before opening the cabinet, the power source should be cut off thoroughly and reset at least 10 minutes or longer until capacitors discharge completely (there are large capacitors in this system). During disassembly, please try the best not to damage any part or component and note the wiring steps. Specific maintenance steps as below.

- Clean the dust and sundries inside cabinet
- Check the fastening of wiring terminals and screw inside cabinet
- Check if there is any burning mark or damage part or component that may be caused by over heat.

5) If the cabinet is opened, please pilot run the system before use again to ensure the system's stable power supply.

6) When the product doesn't work, please deal with according to this manual. If the problem can't be solved within this manual, please contact the distributor or manufacturer as soon as possible. And never disassemble the product by yourself!

9. Packing List

The product has been through strict inspection before delivery, but it may be damaged during shipment. So please carefully check if the product model, battery capacity, input voltage, output voltage, etc are conform to your requirements after unpacking. Anything abnormal or unconformable please contact the distributor shortly.

No.	Item	Amount
A	PV Off Grid Energy Storage System	1
B	AC Input Cable	1
C	Solar Input Cable	2
D	Manual	1
E	Quality Guarantee Book	1