Solar charger inverter

User Manual



Product model:

SPH302460A

Important safety instructions

Please keep this manual for future use.

This manual contains all safety, installation and operating instructions for the SPH series solar storage inverter.

Please read all instructions and precautions in the manual carefully before installation and use.

- Non-safety voltage exists inside the solar storage inverter. To avoid personal injury, users shall not disassemble the solar storage inverter themselves. Contact our professional maintenance personnel if their is a need for repair.
- Do not place the solar storage inverter within the reach of children.
- Do not install the solar storage inverter in harsh environments such as moist, oily, flammable or explosive, or heavily dusty areas.
- The mains input and AC output are high voltage, so please do not touch the wiring terminals.
- The housing of the solar storage inverter is hot when it is working. Do not touch it.
- Do not open the terminal protective cover when the solar storage inverter is working.
- It is recommended to attach proper fuse or circuit breaker to the outside of the solar storage inverter.
- Always disconnect the fuse or circuit breaker near the terminals of PV array, mains and battery before installing and adjusting the wiring of the solar storage inverter.
- After installation, check that all wire connections are tight to avoid heat accumulation due to poor connection, which is dangerous.
- The solar storage inverter is off-grid. It is necessary to confirm that it is the only input device for load, and it is forbidden to use it in parallel with other input AC power to avoid damage.

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1. General information

1.1 Product overview and features

SPH series is a new solar storage inverter, which integrates solar energy storage & mains charging energy storage and AC sine wave output. Thanks to DSP control and advanced control algorithm, it has high response speed, high reliability and high industrial standard. Four charging modes are optional, i.e. Only Solar, Mains Priority, Solar Priority and Mains & Solar hybrid charging; and two output modes are available, i.e. Inverter and Mains, to meet different application requirements.

The solar charging module applies the latest optimized MPPT technology to quickly track the maximum power point of the PV array in any environment and obtain the maximum energy of the solar panel in real time.

Through a state of the art control algorithm, the AC-DC charging module realizes fully digital voltage and current double closed loop control, with high control precision in a small volume. Wide AC voltage input range and complete input/output protections are designed for stable and reliable battery charging and protection.

Based on full-digital intelligent design, the DC-AC inverter module employs advanced SPWM technology and outputs pure sine wave to convert DC into AC. It is ideal for AC loads such as household appliances, power tools, industrial equipment, and electronic audio and video equipment.

The product comes with a segment LCD display design which allows real-time display of the operating data and status of the system. Comprehensive electronic protections keep the entire system safer and more stable.

Characteristics:

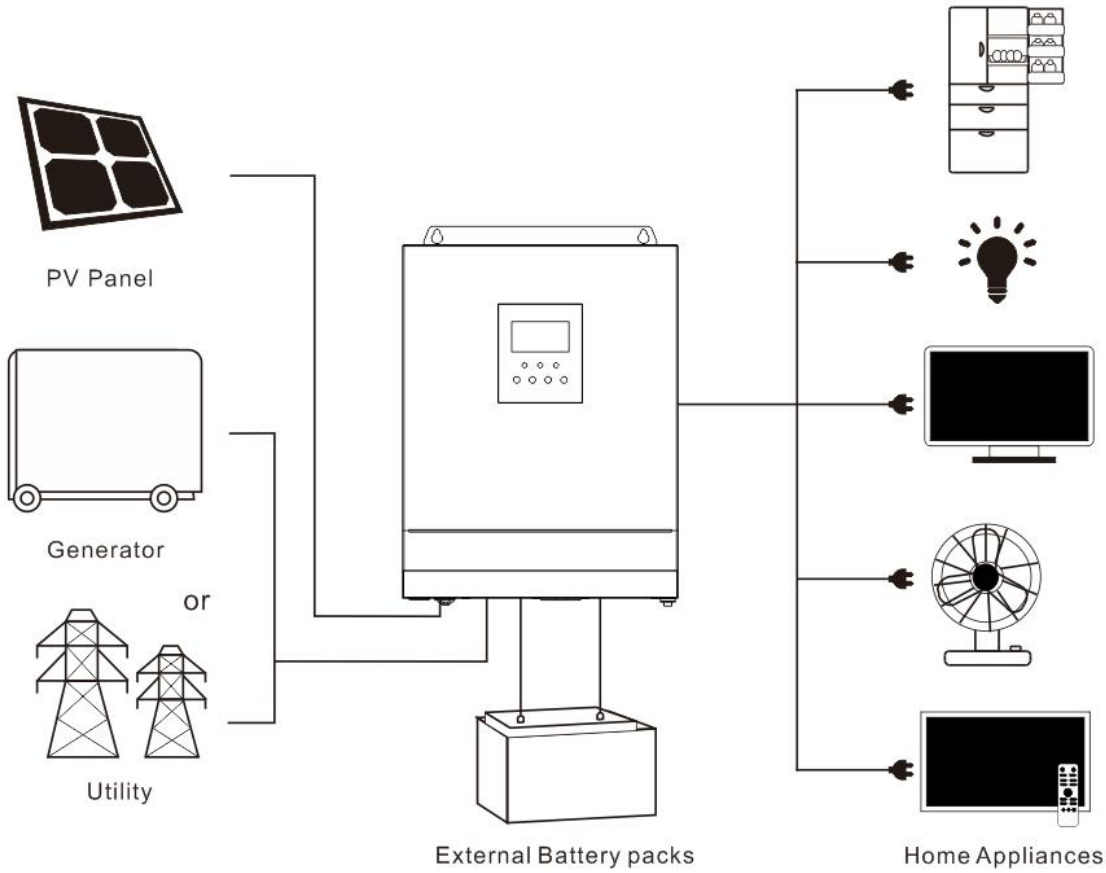
1. Full digital voltage and current double closed loop control, advanced SPWM technology, output of pure sine wave.
2. Two output modes: mains bypass and inverter output; uninterrupted power supply.
3. Available in 4 charging modes: Only Solar, Mains Priority, Solar Priority and Mains & Solar hybrid charging.
4. Advanced MPPT technology with an efficiency of 99.9%.
5. Designed with a LCD screen and 3 LED indicators for dynamic display of system data and operating status.
6. ON/OFF rocker switch for AC output control.
7. Power saving mode available to reduce no-load loss.
8. Intelligent variable speed fan to efficiently dissipate heat and extend system life.
9. Lithium battery activation by PV solar or mains, allowing access of lead-acid battery and lithium battery.
10. 360 ° all-round protection with a number of protection functions.
11. Complete protections, including short circuit protection, over voltage and under voltage protection, overload protection, reverse protection, etc.

1.2 Basic system introduction

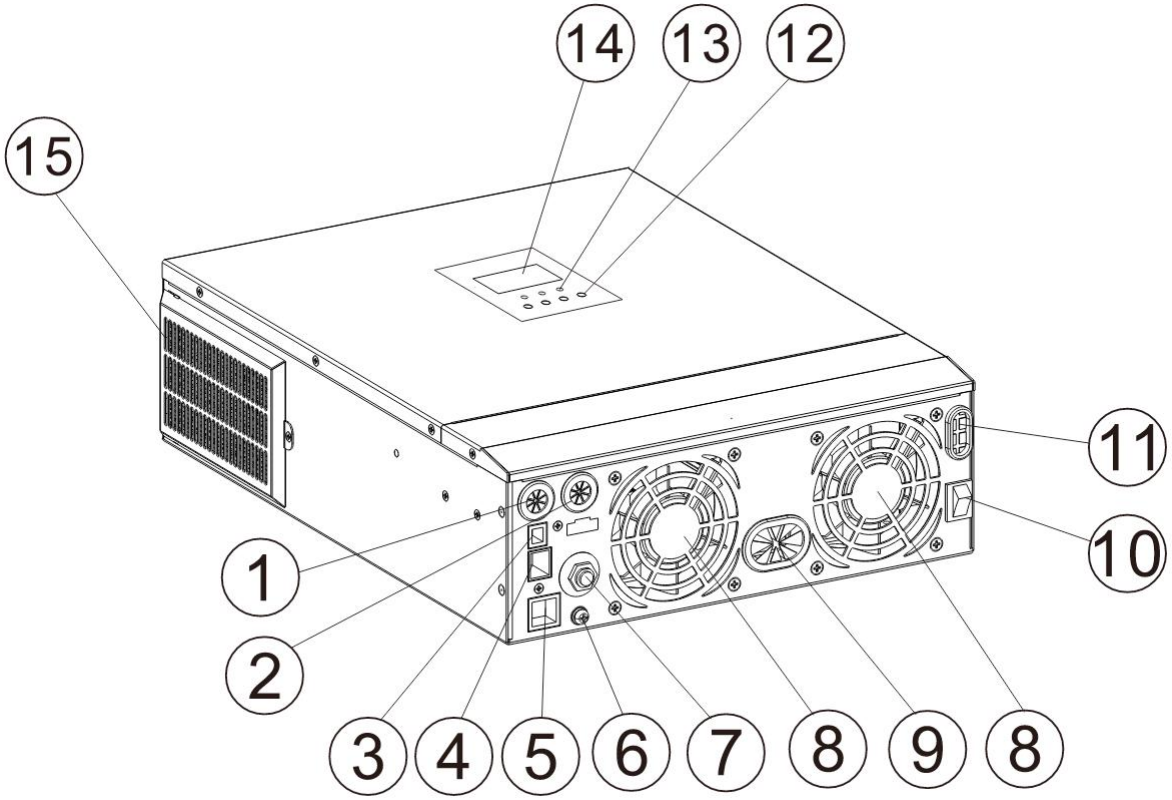
The figure below shows the system application scenario of this product. A complete system consists of the following parts:

1. **PV module:** Convert light energy into DC power, and charge the battery through the solar storage inverter, or directly invert into AC power to drive the load.
2. **Mains or generator:** Connected at the AC input, to power the load while charging the battery. If the mains or generator is not connected, the system can also operate normally, and the load is powered by the battery and PV module.
3. **Battery:** Provided to ensure normal power supply to the system loads when solar energy is insufficient and the Mains is not connected.
4. **Household load:** Allow connection of various household and office loads, including refrigerators, lamps, TVs, fans and air conditioners.
5. **Solar storage inverter:** The energy conversion unit of the whole system.

The specific system wiring mode is determined by the actual application scenario.

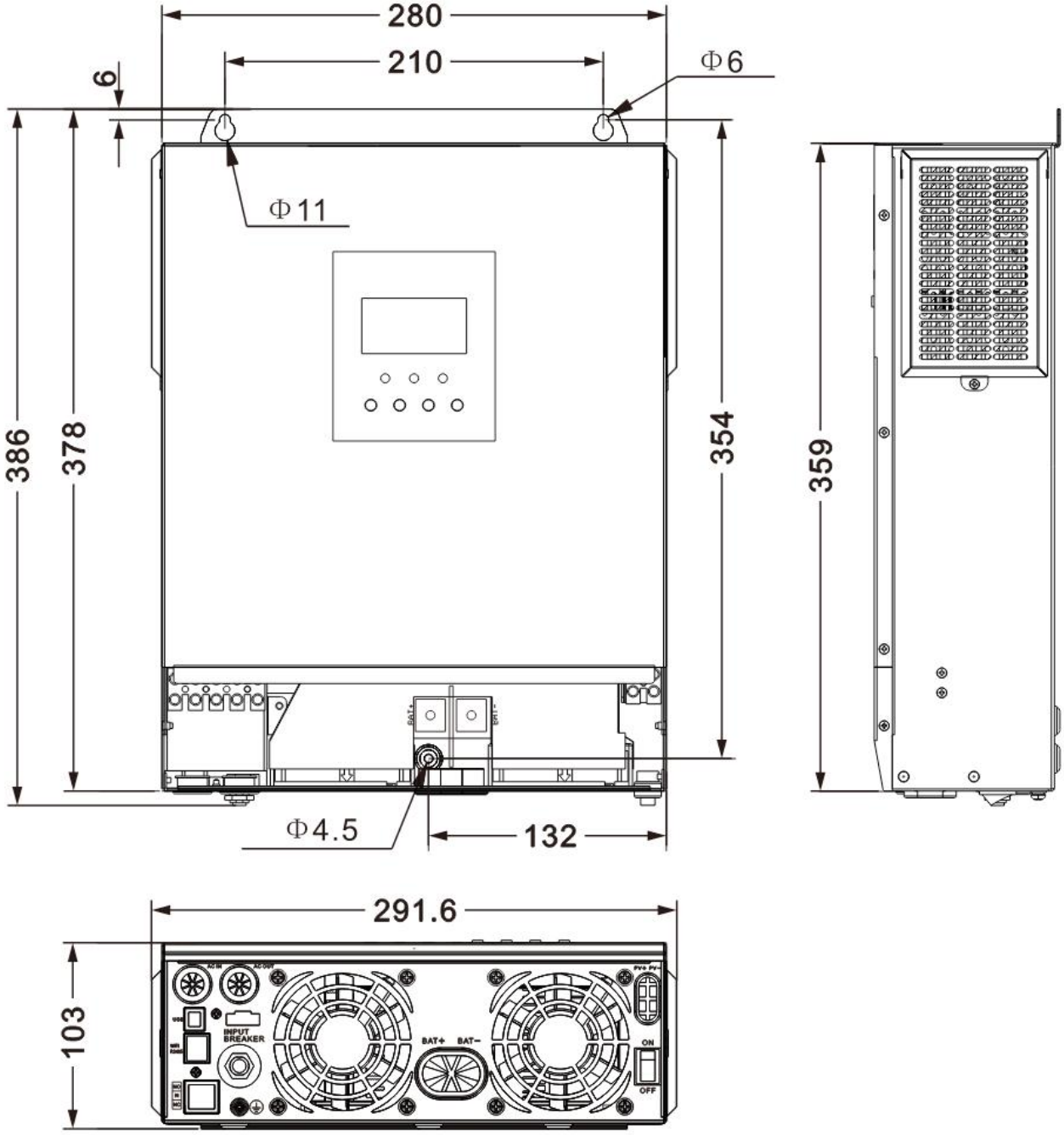


1.3 Appearance



①	AC input port	⑨	Battery port
②	AC output port	⑩	ON/OFF rocker switch
③	USB communication port	⑪	PV port
④	RS485/WIFI communication port	⑫	Setup button
⑤	Dry contact port	⑬	LED Indicator
⑥	Grounding screw hole	⑭	LCD screen
⑦	Overload protector	⑮	Dust net
⑧	Cooling fan		

1.4 Dimension drawing



2. Installation instructions

2.1 Installation precautions

Please read this manual carefully prior to installation to familiarize yourself with the installation steps.

- Be very careful when installing the battery. Wear safety goggles when installing a lead-acid liquid battery. Once coming into contact with the battery acid, rinse with clean water timely.
- Do not place metal objects near the battery to prevent short-circuit of the battery.
- Acid gas may be generated when the battery is charged. So, please ensure good ventilation.
- When installing the cabinet, be sure to leave enough space around the solar storage inverter for heat dissipation. Do not install the solar storage inverter and lead-acid battery in the same cabinet to avoid corrosion by acid gas generated during battery operation.
- Only the battery that meets the requirements of the unit can be charged.
- Poorly connected connections and corroded wires may cause great heat which will melt the wire insulation, burn the surrounding materials, and even cause fires. So, make sure the connectors have been tightened, and the wires are secured with ties to avoid looseness of connections caused by shaking of wires during mobile application.
- The system connection wires are selected according to a current density of not more than 5 A/mm^2.
- Avoid direct sunlight and rainwater infiltration for outdoor installation.
- Even after the power is turned off, there is still high voltage inside the unit. Do not open or touch the internal components, and avoid related operations until the capacitor completely discharges.
- Do not install the solar storage inverter in harsh environments such as moist, oily, flammable or explosive, or heavily dusty areas.
- Polarity at the battery input end of this product shall not be reversed, otherwise it may damage the device or cause unpredictable danger.
- The mains input and AC output are high voltage, so please do not touch the wiring terminals.
- When the fan is working, do not touch it to prevent injury.
- Load equipment input power needs to confirm that this solar storage inverter is the only input device, and it is forbidden to use in parallel with other input AC power to avoid damage. It is necessary to confirm that the solar charge inverter is the only input device for load equipment, and it is forbidden to use it in parallel with other input AC power to avoid damage.

2.2 Wiring specifications and circuit breaker selection

Wiring and installation must comply with national and local electrical codes.

Recommended PV array wiring specifications and circuit breaker selection: Since the output current of the PV array is affected by the type, connection method and illumination angle of the PV module, the minimum wire diameter of the PV array is calculated according to its short-circuit current; refer to the short-circuit current value in the PV module specification (the short-circuit current is constant when the PV modules are connected in series; the short-circuit current is the sum of the short-circuit currents of all PV modules connected in parallel); the short-circuit current of the PV array shall not exceed the maximum input current.

- **Refer to the table below for PV input wire diameter and switch:**

Model	Recommended PV wiring diameter	Maximum PV input current	Recommended air switch or circuit breaker type
SPH302460A	$8mm^2$/8AWG	40A	2P—63A

Note: The voltage in series shall not exceed the maximum PV input open circuit voltage.

- **Refer to the table below for recommended AC input wire diameter and switch:**

Model	Recommended AC input wiring diameter	Maximum bypass input current	Recommended air switch or circuit breaker type
SPH302460A	$8mm^2$/8AWG	40A	2P—63A

- **Recommended battery input wire diameter and switch selection:**

Model	Recommended battery wiring diameter	Rated battery discharge current	Maximum charge current	Recommended air switch or circuit breaker type
SPH302460A	$30mm^2$/2AWG	140A	100A	2P—160A

- **Recommended AC output wiring specifications and circuit breaker selection:**

Model	Recommended AC output wiring diameter	Rated inverter AC output current	Maximum bypass output current	Recommended air switch or circuit breaker type
SPH302460A	$8mm^2$/8AWG	25A	40A	2P—63A

Note: The wiring diameter is for reference only. If the distance between the PV array and the solar storage inverter or the distance between the solar storage inverter and the battery is relatively long, using a thicker wire can reduce the voltage drop to improve system performance.

Note: The above are only recommended wiring diameter and circuit breaker. Please select the appropriate wiring diameter and circuit breaker according to actual situations.

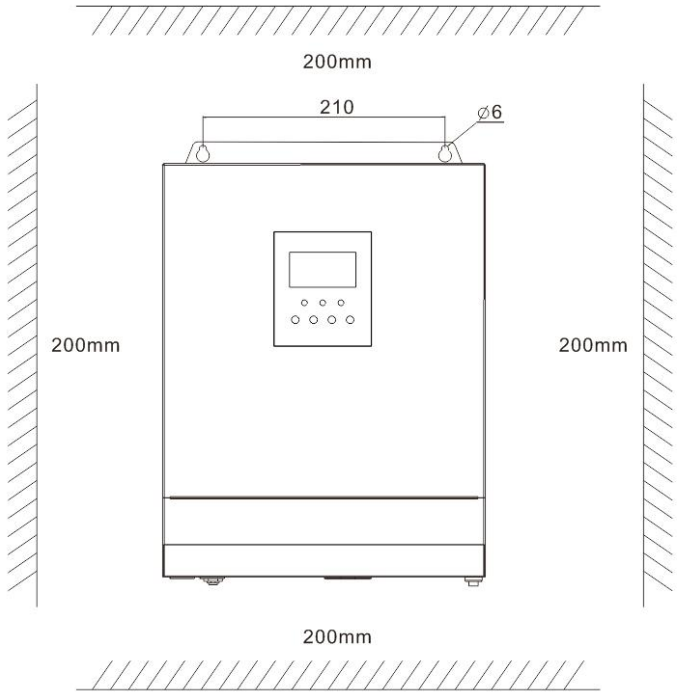
2.3 Installation and wiring

Installation steps:

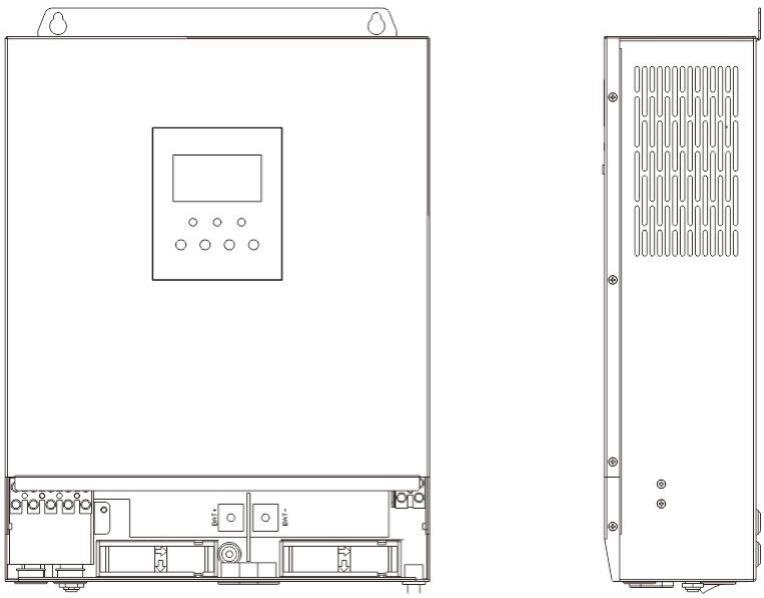
Step 1: Determine the installation position and the space for heat dissipation. Determine the installation position of the solar storage inverter, such as wall surface; when installing the solar storage inverter, ensure that there is enough air flowing through the heat sink, and space of at least 200m to the left and right air outlets of the inverter shall be left to ensure natural convection heat dissipation. Refer to the installation diagram of the whole machine as above.



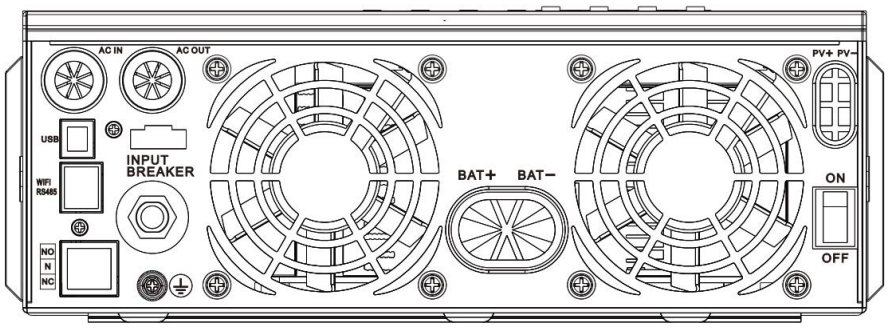
Warning: Danger of explosion! Never install the solar storage inverter and lead-acid battery in the same confined space! Also do not install in a confined place where battery gas may collect.



Step 2: Remove the terminal cover



Step3: Wiring

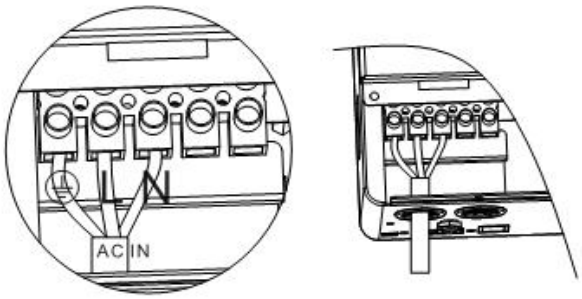


AC input / output wiring method:

① Prior to AC input/output wiring, disconnect the external circuit breaker and confirm that the wire used is thick enough. Please refer to Section 2.2 "Wiring Specifications and Circuit Breaker Selection";

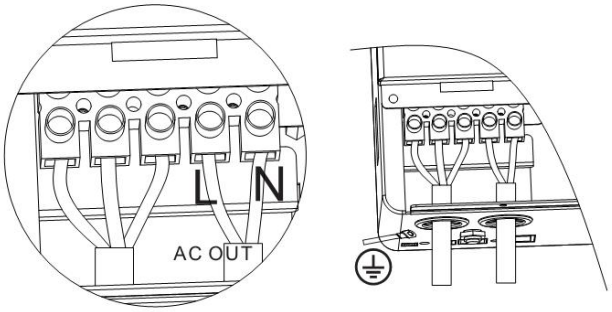
② Properly connect the AC input wire according to the wire sequence and terminal position shown in the figure below. Please connect the ground wire first, and then the live wire and the neutral wire;

⏚ **: Ground L : Live N : Neutral**



③ Properly connect the AC output wire according to the wire sequence and terminal position shown in the figure below. Please connect the ground wire first, and then the live wire and the neutral wire. The ground wire is connected to the grounding screw hole on the cabinet through the O-type terminal.

⏚ **: Ground L : Live N : Neutral**



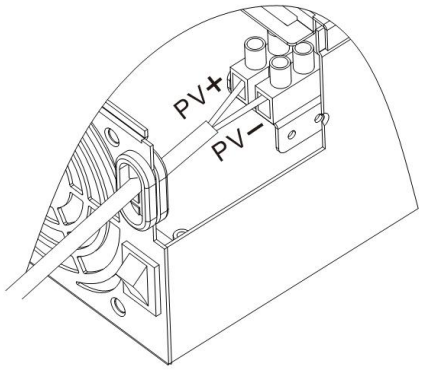
Note: The grounding wire shall be as thick as possible (cross-sectional area is not less than 4mm^2). The grounding point shall be as close as possible to the solar storage inverter. The shorter the grounding wire, the better.

PV input wiring method:

① Prior to wiring, disconnect the external circuit breaker and confirm that the wire used is thick enough. Please refer to Section 2.2 "Wiring Specifications and Circuit Breaker Selection";

② Properly connect the PV input wire according to the wire sequence and terminal position shown in the figure below.

PV+: PV input positive pole **PV-: PV input negative pole**

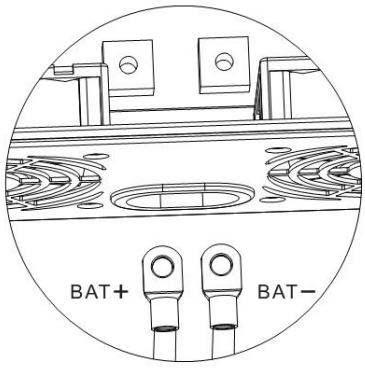


BAT wiring method:

① Prior to wiring, disconnect the external circuit breaker and confirm that the wire used is thick enough. Please refer to Section 2.2 "Wiring Specifications and Circuit Breaker Selection". The BAT wire needs to be connected to the machine through the O-type terminal. The O-type terminal with an inner diameter of 5mm is recommended. The O-type terminal shall firmly press the BAT wire to prevent excessive heat generation caused by excessive contact resistance;

② Properly connect the BAT wire according to the wire sequence and terminal position shown in the figure below.

BAT+: Battery positive electrode **BAT-: Battery negative electrode**



Warnings:

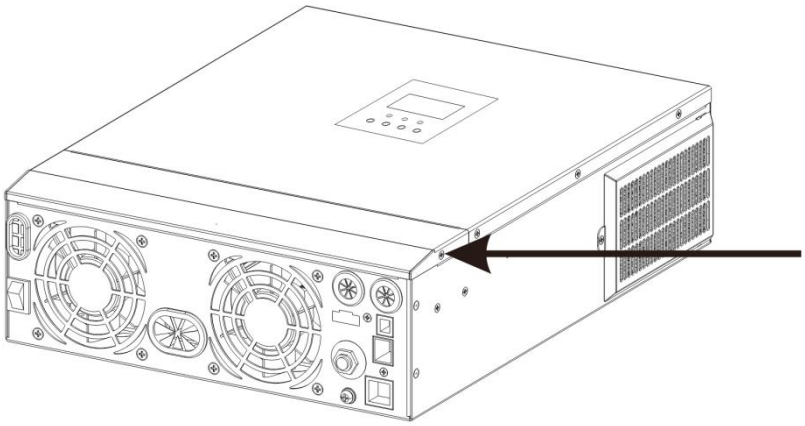
① Mains input, AC output and PV array will generate high voltage. So, before wiring, be sure to disconnect the circuit breaker or fuse;

② Be very careful during wiring; do not close the circuit breaker or fuse during wiring, and ensure that the "+" and "-" pole leads of each component are connected properly; a circuit breaker must be installed at the battery terminal. Refer to Section 2.2 "Wiring Specifications and Circuit

Breaker Selection" to select a right circuit breaker. Before wiring, be sure to disconnect the circuit breaker to prevent strong electric sparks and avoid battery short circuit; if the solar storage inverter is used in an area with frequent lightning, it is recommended to install an external lightening arrester at the PV input terminal.

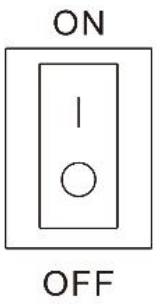
Step 4: Check if the wiring is correct and firm. In particular, check if the battery polarity is reversed, if the PV input polarity is reversed and if the AC input is properly connected.

Step 5: Install the terminals cover



Step 6: Turn on the solar storage inverter

First, close the circuit breaker at the battery terminal, and then turn the rocker switch on the left side of the machine to the "ON" state. The "AC/INV" indicator flashing indicates that the inverter is working normally. Close the circuit breakers of the PV array and the Mains. Finally, turn on AC loads one by one as the AC output is normal to avoid a protection action caused by a large momentary shock due to simultaneous turning on the loads simultaneously. Now, the machine goes into a normal operation according to the set mode.



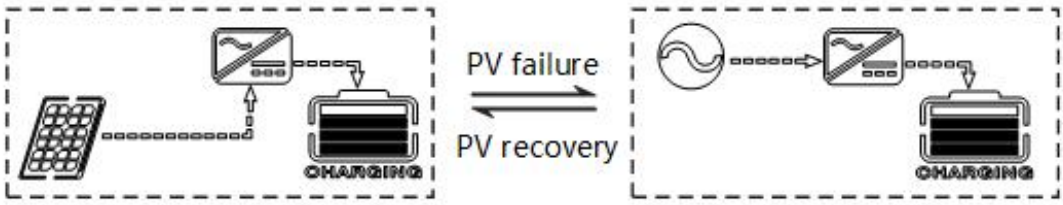
Note: If power is supplied to different AC loads, it is recommended to first turn on the load with a large surge current. After the load is stable, turn on the load with a small surge current.

Note: If the solar storage inverter does not work properly or the LCD or indicator is abnormal, refer to Chapter 6 to handle the exceptions.

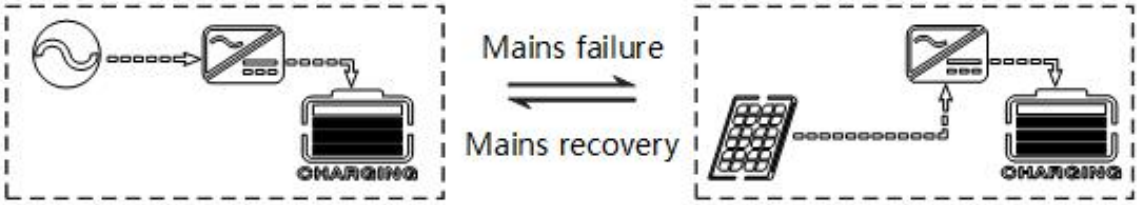
3. Operating modes

3.1 Charging mode

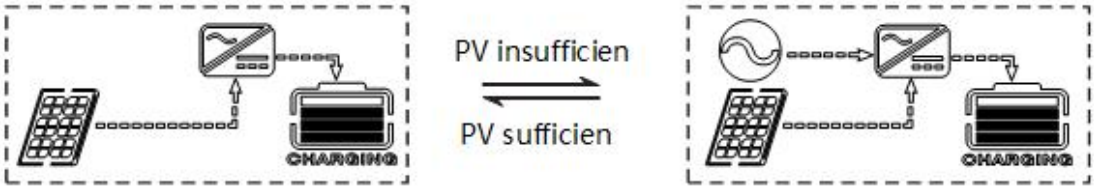
1. **PV priority:** PV module will charge the battery preferentially, and the battery is charged by the Mains only when the PV system fails. During the day, solar energy is fully used to charge, while at night, it converts to the Mains. This can maintain battery level, and is ideal for areas where the grid is relatively stable and electricity price is relatively high.



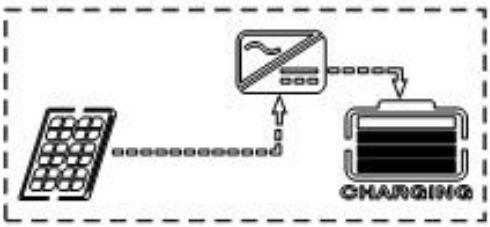
2. **Mains priority:** The Mains supply is preferentially used to charge the battery. Only when the Mains fails, the PV charging can be activated.



3. **Hybrid charging:** PV and mains hybrid charging. PV MPPT charging is a priority, and when PV energy is insufficient, the mains supply supplements. When the PV energy is sufficient again, the mains stops charging. This is the fastest charging mode, suitable for the areas where power grid is unstable, providing sufficient backup power supply at any time.



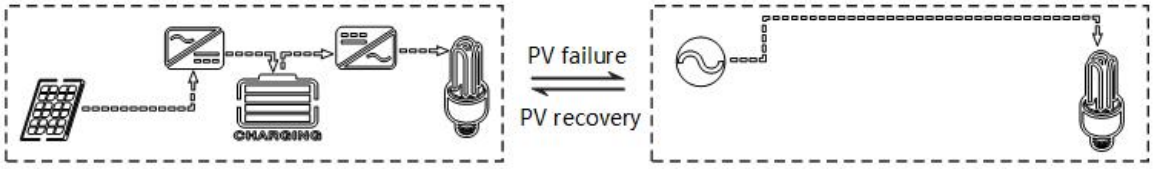
4. **Only Solar (Only Solar):** Only PV charging, without Mains charging. This is the most energy-efficient way in which battery is charged only by solar panels, and is usually used in areas with good lighting conditions.



3.2 Output mode

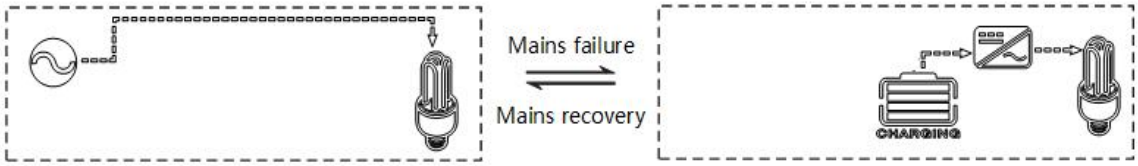
- **PV priority mode:**

  Switch to mains supply when the PV charging fails. This mode maximizes the use of solar energy while maintaining battery power, suitable for use in the areas with relatively stable grid.



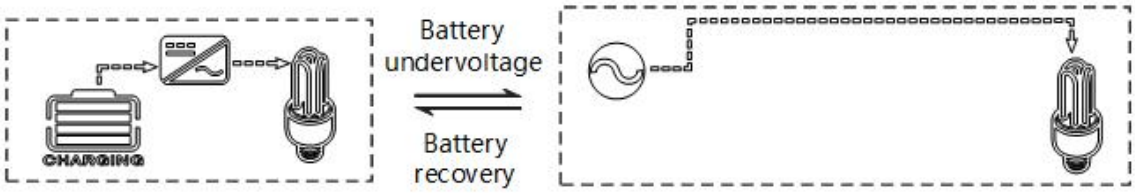
- **Mains priority mode:**

  Switch to inverter only when the mains fails (when there was mains power, switch to mains power for charging and power supply).Then, the unit is equivalent to a backup UPS, suitable for areas with unstable grid. Switching does not affect PV charging.



- **Inverter priority mode:**

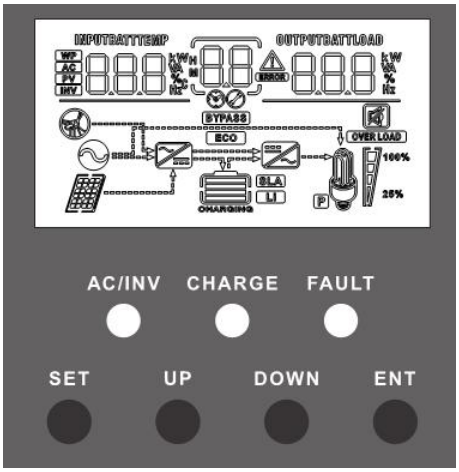
  Switch to mains supply only when the battery discharge undervoltage is lower than the set point (item 04). When the charging battery is higher than the set point of (05 setting item), switch to the battery discharge mode. This can cycle the battery charge and discharge. This mode maximizes the use of DC power and is used in the area with stable grid. Switching does not affect PV charging.



4. LCD screen operating instructions

4.1 Operation and display panel

The operation and display panel is as shown below, including 1 LCD screen, 3 indicators and 4 operation buttons.



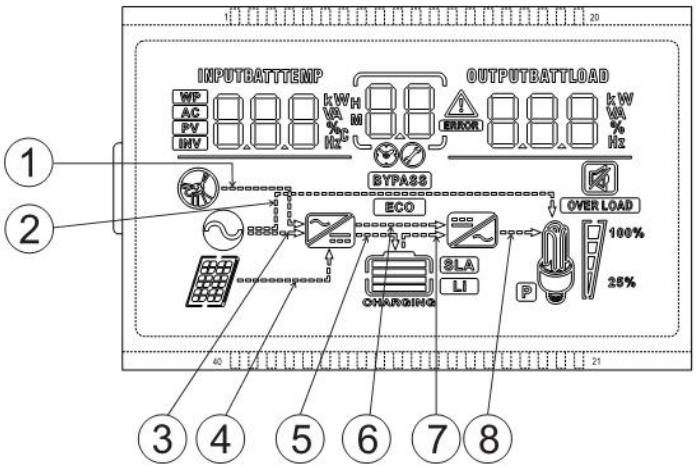
Operation buttons introduction

Function buttons	Description
SET	Enter/Exit Settings menu
UP	Previous choice
DOWN	Next choice
ENT	Confirm/Enter Options under the settings menu

Indicators introduction

Indicator light	Color	Description
AC/INV	Yellow	Steady on: Mains output
		Flash: Inverter output
CHARGE	Green	Flash: Battery charging
		Steady on: Charging completed
FAULT	Red	Flash : Fault state

LCD screen introduction



Icons	Functions	Icons	Functions
	Indicates that the AC input terminal has been connected to the grid		Indicates that the inverter circuit is working
	Indicates that the AC input mode in APL mode (wide voltage range)	BYPASS	Indicates that the machine is in the Mains Bypass mode
	Indicates that the PV input terminal has been connected to the solar panel	OVER LOAD	Indicates that the AC output is in an overload state
	Indicates that the machine has been connected to the battery: indicates that the remaining battery is 0%~24%; indicates that the remaining battery is 25%~49%; indicates that the remaining battery is 50%~74%; indicates that the remaining battery is 75%~100%.		Indicates the percentage of AC output loads: indicates that the load percentage is 0%~24%; indicates that the load percentage is 25%~49%, indicates that the load percentage is 50%~74%, indicates that the load percentage is ≥75%.
LI	Indicates that the battery type of the machine is a lithium battery		Indicates that the buzzer is not enabled
SLA	Indicates that the current battery type of the machine is a lead-acid battery		Indicates that the machine has an alarm
CHARGING	Indicates that the battery is in charging state	ERROR	Indicates that the machine is in a fault condition
	Indicates that the AC/PV charging circuit is working		Indicates that the machine is in setup mode

	Indicates that the AC output terminal has an AC voltage output		The parameters displayed in the middle of the screen: 1. In the non-setup mode, the alarm or fault code is displayed. 2. In the setup mode, the currently set parameter item code is displayed.
Parameters display on the left side of the screen: input parameters			
	Indicates AC input		
	Indicates PV input		
	Indicates inverter circuit		
	This icon is not displayed		
	Display battery voltage, battery charge total current, mains charge power, AC input voltage, AC input frequency, PV input voltage, internal heat sink temperature, software version		
Parameters display on the right side of the screen: Output parameters			
	Indicates output voltage, output current, output active power, output apparent power, battery discharge current, software version; in setup mode, displays the set parameters under the currently set parameter item code		
Arrow display			
①	The arrow is not displayed	⑤	Indicates the charging circuit charging the battery terminal
②	Indicates the grid supplying power to the load	⑥	The arrow is not displayed
③	Indicates grid supplying power to the charging circuit	⑦	Indicates the battery terminal supplying power to the inverter circuit
④	Indicates PV module supplying power to the charging circuit	⑧	Indicates the inverter circuit supplying power to the load

Real-time data viewing method

On the LCD main screen, press the "UP" and "DOWN" buttons to scroll through the real-time data of the machine.

Page	Parameters on the left side of the screen	Parameters in the middle of the screen	Parameters on the right side of the screen
1	INPUT BATT V (Battery input voltage)	Fault code	OUTPUT LOAD V (Output load voltage)
2	PV TEMP ℃ (PV charger heatsink temperature)		PV OUTPUT KW (PV output power)
3	PV INPUT V (PV input voltage)		PV OUTPUT A (PV output current)
4	INPUT BATT A (Input battery current)		OUTPUT BATT A (Battery output current)
5	INPUT BATT KW (Battery input power)		OUTPUT BATT KW (Battery output power)
6	AC INPUT Hz (AC input frequency)		AC OUTPUT LOAD Hz (AC output frequency)
7	AC INPUT V (AC input voltage)		AC OUTPUT LOAD A (AC output load current)
8	INPUT V (For maintain)		OUTPUT LOAD KVA (Load apparent power)
9	INV TEMP ℃ (AC charge or battery discharge heatsink temperature)		INV OUTPUT LOAD KW (Load active power)
10	APP software version		Bootloader software version
11	Model Battery Voltage Rating		Model Output Power Rating
12	Model PV Voltage Rating		Model PV Current Rating

4.2 Setting parameter

Buttons operation instructions: Press the "SET" button to enter the setup menu and exit the setup menu. After entering the setup menu, the parameter number [00] will flash. At this point, press the "UP" and "DOWN" buttons to select the code of parameter item to be set. Then, press the "ENT" button to enter the parameter editing mode, and the value of the parameter is flashing. Adjust the value of the parameter with the "UP" and "DOWN" buttons. Finally, press the "ENT" button to complete the parameter editing and return to the parameter selection state.

No.	Name	Options	Description
00	Exit setting menu	[00] ESC	Exit the setup menu.
01	Work priority mode	[01] SOL	PV priority mode, switching to mains when PV is ineffective or the battery is below the value set in parameter [04].
		[01] UTI **default**	Utility priority mode, switching to inverter only when utility power is not available.
		[01] SBU	Inverter priority mode, switching to mains only when the battery is undervoltage or below the value set in parameter [04].
02	Output frequency	[02] 50.0	Bypass Adaptive, when there is mains power, it automatically adapts to the frequency when it is first connected to the mains. When there is no mains power, you can set the output frequency through this menu. 120V machine default 60HZ.
		[02] 60.0 **default**	
03	AC input voltage range	[03] APL	120V machine mains input range: 90~140V.
		[03] UPS **default**	120V machine mains input range: 90~140V.
04	Battery to mains	[04] 23V **default**	Parameter [01] = SOL/SBU, the battery voltage is lower than this setting value, the output is switched from inverter to mains, the setting range is 20V~27V. It can not be set higher than the value of [14] setting item.
05	Mains to battery	[05] 28V **default**	Parameter [01] = SOL/SBU, the battery voltage is higher than this setting value, the output is switched from mains to inverter, the setting range is 24V~32V. It cannot be set lower than the value of [04] and [35] setting items.
06	Charging mode	[06] CSO	PV priority, mains charging only when PV is not effective.
		[06] CUB	Utility priority, PV charging only activated when utility power is outaged.

		[06] SNU **default**	Hybrid charging with PV and utility, prioritizing PV charging, and when PV energy is insufficient, utility charging supplements. When the PV energy is sufficient, the utility stops charging. Note: Only when the utility bypass supply power to the load can the PV and utility be charged at the same time, when the inverter is working, only the PV charging can be started.
		[06] OSO	PV charging only, no mains charging.
07	Max. charging current	[07] 60A **default**	120V machine setting range 0~100A;
08	Battery type	[08] USE	User-defined. All battery parameters can be set.
		[08] SLd	Sealed lead-acid battery, constant voltage charging voltage is 28.8V, float charging voltage is 27.6V.
		[08] FLd	Flooded lead-acid battery, constant voltage charging voltage is 29.2V, float charging voltage is 27.6V.
		[08] GEL **default**	Gel lead-acid battery, constant voltage charging voltage is 28.4V, float charging voltage is 27.6V.
		[08] LF07/LF08/LF09	LF07/LF08/LF09 lithium iron phosphate batteries, corresponding to lithium iron phosphate batteries 7-series, 8-series and 9-series. The default constant voltage charging voltage of 7-series is 24.8V. The default constant voltage charging voltage of 8-series is 28.4V. The default constant voltage charging voltage of 9-series is 31.8V. They are all adjustable.
		[08] N07/N08	Ternary lithium battery, default constant voltage charging voltage is 28.4V, adjustable.
09	Boost charging voltage	[09] 28.4V default	Boost charging voltage setting, setting range 24V~31.6V, step of 0.2V, valid when battery type is user-defined and lithium battery.
10	Boost charging maximum time	[10] 120 **default**	Boost charging maximum time setting, refers to the constant voltage charging when the voltage reaches the parameter [09] setting voltage maximum charging time, set the range of 5min~900min, step of 5 minutes, valid when battery type is user-defined and lithium battery.
11	Float charging voltage	[11] 27.6V **default**	Float charging voltage, setting range: 24V~29.2V, step of 0.2V, valid when battery type is user-defined.

12	Over-discharge voltage	[12] 21V **default**	Over-discharge voltage, the battery voltage is lower than this judgement point, delay the time set by parameter [13], and then shut down the inverter output. Setting range 20V~28V, step of 0.2 V. Valid when battery type is user-defined and lithium battery.
13	Over-discharge delay time	[13] 5S **default**	Over-discharge delay time, when the battery voltage is lower than the parameter [12], the inverter output will shut down after delaying the time set in this parameter. The setting range is 5S~50S, step of 5S. Valid when battery type is user-defined and lithium battery.
14	Battery under-voltage alarm point	[14] 22V **default**	Battery under-voltage alarm point, when the battery voltage is lower than the judgment point, report under-voltage alarm, the output does not shut down. The setting range is 20V~28V, step of 0.2V. Valid when battery type is user-defined and lithium battery.
15	Battery discharging limit voltage	[15] 20V **default**	Battery discharging limit voltage, battery voltage is lower than this judgment point, the output will shut down immediately. Setting range 20V~27.2V, step of 0.2V. Valid when battery type is user-defined and lithium battery.
16	Equalization charging	[16] DIS **default**	Disable equalization charging.
		[16] ENA	Enable equalization charging, only for open lead-acid batteries and sealed lead-acid batteries
17	Equalize charging voltage	[17] 29.6V **default**	Equalized charging voltage, setting range 24V~31.6V, step 0.2V. Valid when battery type is flooded lead-acid battery and sealed lead-acid battery.
18	Equalize charging time	[18] 120 **default**	Equalized charging time, setting range 5min~900min, step of 5 minutes. Valid when battery type is flooded lead-acid battery and sealed lead-acid battery.
19	Equalize charging delay	[19] 240 **default**	Equalized charging delay, setting range 5min~900min, step of 5 minutes. Valid when battery type is flooded lead-acid battery and sealed lead-acid battery.
20	Equalize charging derating time	[20] 30 **default**	Equalized charging derating time, 0~30days in 1 day steps, valid when battery type is flooded lead-acid battery and sealed lead-acid battery.
21	Equalize charging enable	[21] DIS **default**	Stop equalisation charging immediately.
		[21] ENA	Start equalisation charging immediately.
22	Energy-saving Mode	[22] DIS **default**	Disable energy-saving mode.

		[22] ENA	After enabling the energy-saving mode, if the load is empty or lower than 50W, the inverter output will shut down the output after delaying for a period of time. When the load is higher than 50W, the inverter will start automatically.
23	Automatic overload restart	[23] DIS	Disable automatic overload restart. If an overload occurs shutting down the output, the machine will no longer power up.
		[23] ENA **default**	Enable automatic overload restart. If overload occurs to shut down the output, the machine delays for 3 minutes and then restarts the output. After accumulating 5 times, it will not restart the machine again.
24	Automatic over-temperature restart	[24] DIS	Disable automatic restart in case of over-temperature, if over-temperature occurs to shut down the output the machine will no longer switch on the output.
		[24] ENA **default**	Enable automatic over-temperature restart, if over-temperature occurs to shut down the output, it will restart to switch on the output when the temperature drops down.
25	Buzzer alarm	[25] DIS	Disable alarm.
		[25] ENA **default**	Enable alarm.
26	Mode change alert	[26] DIS	Disable alarm when the state of the main input source changes.
		[26] ENA **default**	Enable alarm when the state of the main input source changes.
27	Inverter overload to bypass	[27] DIS	Disable automatic switching to mains when the inverter is overloaded.
		[27] ENA **default**	Enable automatic switching to mains when inverter is overloaded.
28	Max. AC charging current	[28] 40A **default**	Max. charging current setting for AC charging: 0~40A.
30	Machine address settings	[30] 1	Setting range: 1-254.
32	RS485 communication	[32] SLA **default**	RS485 port for PC and remote monitoring.
		[32] BMS	RS485 port for BMS communication function.
33	BMS communication	When [32] setting item = 485, you need to select the corresponding lithium battery manufacturer's brand for communication.	

	protocols	WOW	SGP=SUNGOLDPOWER，PAC=PACE，RDA=Ritar，AOG=ALLGRANDBATTERY，OLT=OLITER，XWD=SUNWODA, DAQ=DAKING, WOW=SNPOWER, PYL=PYLONTECH，VOL=WEILAN
35	Battery under-voltage recovery point	[35] 26V **default**	When the battery is under-voltage, the battery voltage needs to be greater than this setting to restore the battery inverter AC output.
36	Max. PV charging current	[36] 60A **default**	Max. PV charging current setting range：0~60A.
37	Recharge recovery point after battery is full	[37] 26V **default**	When the battery is fully charged, the inverter stops charging and resumes charging when the battery voltage falls below this voltage value.
38	AC output voltage setting (standby mode only)	[38] 120Vac **default**	100/105/110/120Vac can be set, default 120Vac. AC output power = rated power *(setting voltage value/120)
39	Charging current limiting method	[39]BMS **default**	This mode only takes effect when the inverter communicates successfully with the lithium battery BMS (Battery Management System), and the following options can be set: [SET] When this option is selected, the inverter charging current adopts the value set in item [07], in which case item [07] can be set to any value from 0 to the maximum charging current. [BMS] When this option is selected, the charging limit current transmitted by BMS and the value set in [07] will be compared, and the smaller value will be taken as the current charging current, in this case, the charging current that can be set in [07] can not be greater than the the charging limit current of BMS. After [INV] is selected, it will compare the inverter internal current limit value with the value set in item [07], and take the smaller of them as the current charging current. At this time, charging current can be set in item [07] can not be greater than the inverter internal current limit value, and the logic for the inverter internal current limit value is: 1. When the battery SOC>98%, the charging current is reduced to 1/16 of the rated charging current value of the inverter. 2. When the battery SOC>95%, the charging current is reduced to 1/8 of the rated charging current of the inverter. 3. When the battery SOC>90%, the charging current is

			reduced to the inverter rated charging current value 1/4. 4. When battery SOC>85%, the charging current is reduced to the inverter rated charging current 1/2.
58	Discharge alarm SOC setting	[58] 15% **default**	SOC alarm when capacity is less than this set value (valid when BMS communication is normal)
59	Cut-off discharge SOC Settings	[59] 5% **default**	Stops discharging when the capacity is less than this setting (valid when BMS communication is normal)
60	Cut-off charge SOC Settings	[60]100% **default**	Stops charging when capacity is greater than or equal to this setting (valid when BMS communication is normal)
60	Switch to mains SOC Settings	[61] 10% **default**	Switch to mains when capacity is less than this setting (valid when BMS communication is normal)
62	Switch to inverter output SOC Settings	[62] 100 **default**	Switches to inverter output mode when capacity is greater than or equal to this setting (valid when BMS communication is normal)
63	N-PE bonding automatic switching function	DIS default	Disable automatic switching of N-PE connections.
		ENA	Enable automatic switching of N-PE connections.

4.3 Battery type parameters

For Lead-acid Battery :

Battery type / Parameters	Sealed lead acid battery (SLD)	Gel lead-acid battery (GEL)	Flooded lead acid battery (FLD)	User-defined (User)	Adjustable
Overvoltage disconnection voltage	30V	30V	31V	30V	
Battery fully charged recovery point(setup item [37])	26V	26V	26V	18～30V	√
Equalizing charge voltage	29.2V	-	29.6V	18～30V	√
Boost charge voltage	-	-	-	18～30V	√
Floating charge voltage	27.6V	27.6V	27.6V	18～30V	√
Undervoltage alarm voltage([01] fault)	22.0V	22.0V	22.0V	18～30V	√
Undervoltage alarm voltage recovery point([01] fault)	Undervoltage alarm voltage+0.4V				
Low voltage disconnection voltage([04] fault)	21.0V	21.0V	21.0V	18～30V	√

Low voltage disconnection voltage recovery point ([04] fault)(setup item [35])	26V	26V	26V	26V	√
Discharge limit voltage	-	-	-	18～30V	√
Over-discharge delay time	5s	5s	5s	1～30s	√
Equalizing charge duration	120 minutes	-	120 minutes	0～600minutes	√
Equalizing charge interval	30 days	-	30 days	0～250 days	√
Boost charge duration	-	-	-	10～600 minutes	√

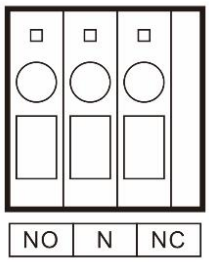
For Lithium Battery :

Battery type / Parameters	Ternary (N07)	Ternary (N08)	LFP (LF07)	LFP (LF08)	LFP (LF09)	Adjustable
Overvoltage disconnection voltage	31.6V	33.0V	30V	30V	33V	
Battery fully charged recovery point(setup item [37])	27.4V	30.4V	23.2V	26.8V	29.8V	√
Equalizing charge voltage	-	-	-	-	-	
Boost charge voltage	28.8V	31.6V	24.6V	28.4V	31.6V	√
Floating charge voltage	28.8V	31.6V	24.6V	28.4V	31.6V	√
Undervoltage alarm voltage([01] fault)	23.4V	26.8V	21.6V	24.8V	27.8V	√
Undervoltage alarm voltage recovery point([01] fault)	Undervoltage alarm voltage+0.4V					
Low voltage disconnection voltage([04] fault)	21.0V	24.0V	21.0V	24.4V	27.0V	√
Low voltage disconnection voltage recovery point ([04] fault)(setup item [35])	26.0V	29.6V	23.8V	27.2V	30.6V	√
Discharge limit voltage	19.6V	22.4V	20.4V	23.2V	26.2V	√
Over-discharge delay time	30s	30s	30s	30s	30s	√
Equalizing charge duration	-	-	-	-	-	√
Equalizing charge interval	-	-	-	-	-	√
Boost charge duration	120 minutes	120 minutes	120 minutes	120 minutes	120 minutes	√

5. Other functions

5.1 Dry node

Working principle: This dry node can control the ON/OFF of the diesel generator to charge the battery.

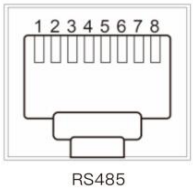


① Normally, the terminals are that the NC-N point is closed and the NO-N point is open;

② When the battery voltage reaches the low voltage disconnection point, the relay coil is energized, and the terminals turn to that the NO-N point is closed while NC-N point is open. At this point, NO-N point can drive resistive loads: 125VAC/1A, 230VAC/1A, 30VDC/1A.

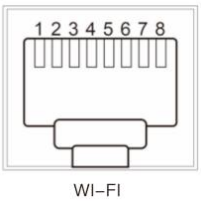
5.2 RS485 communication port

This port is an RS485 communication port ;



This port is an RS485 communication port which comes with two functions:

① It allows direct communication with the optional host computer developed by our company through this port, and enables monitoring of the equipment running status and setting of some parameters on the computer;



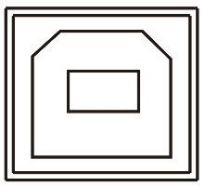
② It also allows direct connection with the optional RS485 to WiFi/GPRS communication module developed by our company through this port. After the module is selected, you can connect the solar storage inverter through the mobile phone WiFi/GPRS APP, on which you can view the operating parameters and status of the device.

As shown in the figure:

Pin 1 is 5V power supply, Pin 2 is GND, Pin 7 is RS485-A, and Pin 8 is RS485-B ;
Pin 5 is CAN-H, and Pin 6 is CAN-L ;

5.3 USB communication port

This is a USB communication port, which can be used for USB communication with the optional PC host software. To use this port, you should install the corresponding "USB to serial chip CH340T driver" and APP in the computer.



6. Protection

6.1 Protections provided

No.	Protections	Description
1	PV current/power limiting protection	When charging current or power of the PV array configured exceeds the PV rated, it will charge at the rated.
2	PV night reverse-current protection	At night, the battery is prevented from discharging through the PV module because the battery voltage is greater than the voltage of PV module.
3	Mains input over voltage protection	When the mains voltage exceeds 140V, the mains charging will be stopped and switched to the inverter mode.
4	Mains input under voltage protection	When the mains voltage is lower than 90V (120V model or APL mode), the mains charging will be stopped and switched to the inverter mode.
5	Battery over voltage protection	When the battery voltage reaches the overvoltage disconnection point, the PV and the mains will be automatically stopped to charge the battery to prevent the battery from being overcharged and damaged.
6	Battery low voltage protection	When the battery voltage reaches the low voltage disconnection point, the battery discharging will be automatically stopped to prevent the battery from being over-discharged and damaged.
7	Load output short circuit protection	When a short-circuit fault occurs at the load output terminal, the AC output is immediately turned off and turned on again after 1 second.
8	Heat sink over temperature protection	When the internal temperature is too high, the machine will stop charging and discharging; when the temperature returns to normal, charging and discharging will resume.
9	Overload protection	Output again 3 minutes after an overload protection, and turn the output off after 5 consecutive times of overload protection until the machine is re-powered. For the specific overload level and duration, refer to the technical parameters table in the manual.
10	PV reverse polarity protection	When the PV polarity is reversed, the machine will not be damaged.
11	AC reverse protection	Prevent battery inverter AC current from being reversely input to Bypass.
12	Bypass over current protection	Built-in AC input overcurrent protection circuit breaker.
13	Battery input over current protection	When the discharge output current of the battery is greater than the maximum value and lasts for 1 minute, the AC input would switched to load.
14	Battery input protection	When the battery is reversely connected or the inverter is short-circuited, the battery input fuse in the inverter will blow out to prevent the battery from being damaged or causing a fire.
15	Charge short protection	When the external battery port is short-circuited in the PV or AC charging state, the inverter will protect and stop the output current.

6.2 Fault code meaning

Fault code	Fault name	Whether it affects the output or not	Description
【01】	BatVoltLow	Yes	Battery undervoltage alarm
【02】	BatOverCurrSw	Yes	Battery discharge average current overcurrent software protection
【03】	BatOpen	Yes	Battery not-connected alarm
【04】	BatLowEod	Yes	Battery undervoltage stop discharge alarm
【05】	BatOverCurrHw	Yes	Battery overcurrent hardware protection
【06】	BatOverVolt	Yes	Charging overvoltage protection
【07】	BusOverVoltHw	Yes	Bus overvoltage hardware protection
【08】	BusOverVoltSw	Yes	Bus overvoltage software protection
【09】	PvVoltHigh	No	PV overvoltage protection
【10】	PvBuckOCSw	No	Buck overcurrent software protection
【11】	PvBuckOCHw	No	Buck overcurrent hardware protection
【12】	bLineLoss	No	Mains power down
【13】	OverloadBypass	Yes	Bypass overload protection
【14】	OverloadInverter	Yes	Inverter overload protection
【15】	AcOverCurrHw	Yes	Inverter overcurrent hardware protection
【17】	InvShort	Yes	Inverter short circuit protection
【19】	OverTemperMppt	No	Buck heat sink over temperature protection
【20】	OverTemperInv	Yes	Inverter heat sink over temperature protection
【21】	FanFail	Yes	Fan failure
【22】	EEPROM	Yes	Memory failure
【23】	ModelNumErr	Yes	Model setting error
【26】	RlyShort	Yes	Inverted AC Output Backfills to Bypass AC Input
【29】	BusLow	Yes	Internal battery boost circuit failure
【30】	BatCapacityLow1	No	Battery capacity below 10% alarm (valid when BMS is enabled)
【31】	BatCapacityLow2	No	Battery capacity below 5% alarm (valid when BMS is enabled)
【32】	BatCapacityLowStop	Yes	Battery low capacity shutdown (valid when BMS is enabled)
【58】	BMS communication fault	NO	Check whether the communication cable is connected correctly and whether item [33] is set to the corresponding lithium battery communication protocol

【60】	BMS battery low-temperature alarm	NO	Li-ion battery BMS low-temperature alarm
【61】	BMS battery over-temperature alarm	NO	Li-ion battery BMS over-temperature alarm
【62】	BMS battery over-current alarm	NO	Li-ion battery BMS over-current alarm
【63】	BMS battery under-voltage alarm	NO	Li-ion battery BMS under-voltage alarm

6.3 Handling measures for part of faults

Fault code	Faults	Handling measures
Display	No display on the screen	Check if the battery air switch or the PV air switch has been closed; if the switch is in the "ON" state; press any button on the screen to exit the screen sleep mode.
【06】	Battery overvoltage protection	Measure if the battery voltage exceeds rated, and turn off the PV array air switch and Mains air switch.
【01】 【04】	Battery undervoltage protection	Charge the battery until it returns to the low voltage disconnection recovery voltage.
【21】	Fan failure	Check if the fan is not turning or blocked by foreign object.
【19】 【20】	Heat sink over temperature protection	When the temperature of the device is cooled below the recovery temperature, normal charge and discharge control is resumed.
【13】 【14】	Bypass overload protection, inverter overload protection	① Reduce the use of power equipment; ② Restart the unit to resume load output.
【17】	Inverter short circuit protection	① Check the load connection carefully and clear the short-circuit fault points; ② Re-power up to resume load output.
【09】	PV overvoltage	Use a multimeter to check if the PV input voltage exceeds the maximum allowable input voltage rated.
【03】	Battery missed alarm	Check if the battery is not connected or if the battery circuit breaker is not closed.
【26】	Inverted AC Output Backfills to Bypass AC Input	Disconnect the AC input,PV input and battery input. After the screen is off, only connect the battery and start up. If fault 26 is reported, it indicates that the AC input relay switch is short-circuited, and you need to contact the manufacturer to replace it.

7. System maintenance

- **In order to maintain the best long-term performance, it is recommended to conduct following checks twice a year.**

1. Make sure that the airflow around the unit is not blocked and remove any dirt or debris from the heat sink.
2. Check that all exposed wires are damaged by exposure to sunlight, friction with other objects around them, dryness, bite by insects or rodents, etc., and the wires shall be repaired or replaced if necessary.
3. Verify for the consistency of indication and display with the operation of the device. Please pay attention to the display of any faults or errors, and take corrective actions if necessary.
4. Check all wiring terminals for corrosion, insulation damage, signs of high temperature or burning/discoloration, and tighten the screws.
5. Check for dirt, nesting insects and corrosion, and clean up as required.
6. If the arrester has failed, replace in time to prevent lightning damage to the unit or even other equipment of the user.

Warning: Danger of electric shock! When doing the above operations, make sure that all power supplies of the machine have been disconnected, and all capacitors have been discharged, and then check or operate accordingly!

- **The company does not assume any liability for damage caused by:**

① Improper use or use in improper site.

② Open circuit voltage of the PV module exceeds the maximum allowable voltage rated.

③ Temperature in the operating environment exceeds the limited operating temperature range.

④ Disassemble and repair the solar storage inverter without permission.

⑤ Force majeure: Damage that occurs in transportation or handling of the solar storage inverter.

8. Technical parameters

Models	SPH302460A
AC mode	
Rated input voltage	110/120Vac
Input voltage range	(90Vac-140Vac) ±2%
Frequency	50Hz/ 60Hz (Auto detection)
Frequency Range	47±0.3Hz ~ 55±0.3Hz (50Hz); 57±0.3Hz ~ 65±0.3Hz (60Hz);
Overload/short circuit protection	Circuit breaker
Efficiency	92%
Conversion time (bypass and inverter)	10ms (typical)
AC reverse protection	Available
Maximum bypass overload current	40A
Inverter mode	
Output voltage waveform	Pure sine wave
Rated output power (VA)	3000
Rated output power (W)	3000
Power factor	1
Rated output voltage (Vac)	120Vac
Output voltage error	±5%
Output frequency range (Hz)	50Hz ± 0.3Hz 60Hz ± 0.3Hz
Maximum Efficiency	92%
Overload protection	(102% < load <110%) : report error and turn off the output after 5 minutes; (110% < load < 125%) : report error and turn off the output after 10 seconds; Load >125% : report error and turn off the output after 5 seconds;
Peak power	6000VA
Loaded motor capability	2HP
Rated battery input voltage	24V (Minimum starting voltage 22V)
Battery voltage range	20.0Vdc~33Vdc ± 0.3Vdc (undervoltage alarm / shutdown voltage / overvoltage alarm / overvoltage recovery... settable on LCD screen)
Power saving mode	Load ≤50W

AC charging	
Battery type	Lead acid or lithium battery
Maximum charge current(can be set)	0-40A
Charge current error	± 5Adc
Charge voltage range	20-33Vdc
Short circuit protection	Circuit breaker and blown fuse
Circuit breaker specifications	40A
Overcharge protection	Alarm and turn off charging after 1 minute
PV charging	
Maximum PV open circuit voltage	108Vdc
PV operating voltage range	30-108Vdc
MPPT voltage range	30-90Vdc
Battery voltage range	20 –33Vdc
Maximum input power	1600W
PV charging current range (can be set)	0-60A
Charging short circuit protection	Blown fuse
Wiring protection	Reverse polarity protection
Hybrid charging Max.charging current specifications (AC charging+PV charging)	
Maximum charging current(can be set)	0-100A
Certified specifications	
Certification	CE(IEC 62109-1、2)
EMC certification level	EN61000, C2
Operating temperature range	-10°C ~ 55°C
Storage temperature range	-25°C ~ 60°C
Humidity range	5% to 95% (Conformal coating protection)
Noise	≤60dB
Heat dissipation	Forced air cooling, variable speed of fan
Communication interface	USB / RS485(WiFi/GPRS)/ Dry contact
Size (L*W*D)	378*280*103mm (1.24*0.92*0.34ft)
Weight (kg)	6.8kg (14.99lb)