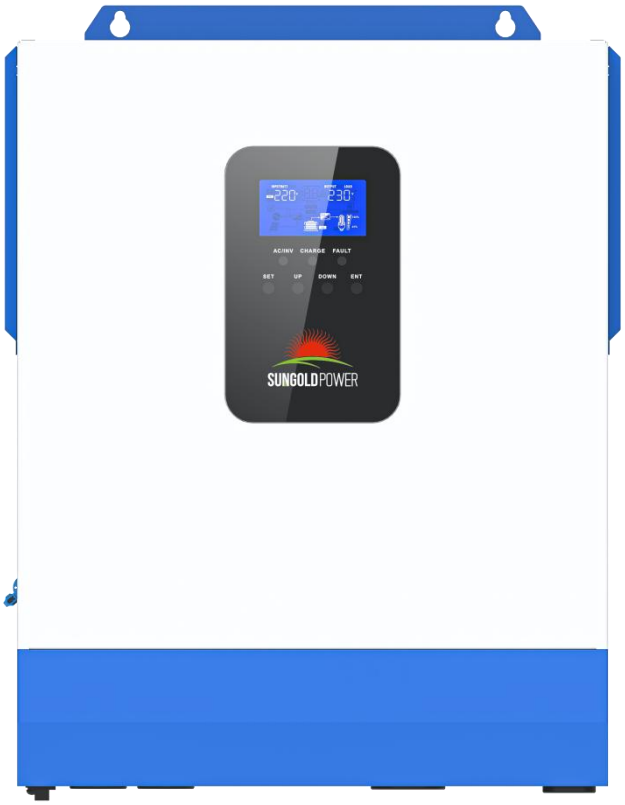
Solar charger inverter

User Manual



Product models:

SPH504880A

Important safety instructions

Please keep this manual for future use.

This manual contains all safety, installation and operating instructions for the SPH Series all-in-one solar charge inverter.

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

- Non-safety voltage exists inside the all-in-one solar charge inverter. To avoid personal injury, users shall not disassemble the all-in-one solar charge inverter themselves. Contact our professional maintenance personnel if there is a need for repair.
- Do not place the all-in-one solar charge inverter within the reach of children.
- Do not install the all-in-one solar charge 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 all-in-one solar charge inverter is hot when it is working. Do not touch it.
- Do not open the terminal protective cover when the all-in-one solar charge inverter is working.
- It is recommended to attach proper fuse or circuit breaker to the outside of the all-in-one solar charge 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 all-in-one solar charge inverter.
- After installation, check that all wire connections are tight to avoid heat accumulation due to poor connection, which is dangerous.
- The all-in-one solar charge 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. Basic Information

1.1 Product overview and characteristics

SPH series is a new type of mixed solar energy storage inverting & control all-in-one machine integrating solar energy storage & municipal power charge storage and AC sine wave output. It adopts DSP control and advanced control algorithm to achieve characteristics of high response speed, high reliability and high industrial standard. There are four charge modes namely only solar power, mains power priority, solar power priority, mains power & solar power; and two optional output modes, namely inverting and mains power to meet different application needs.

The solar charge module adopts the latest optimized MPPT tracking technology, which can quickly track the maximum power point of the photovoltaic array in any environment to obtain the maximum energy of the solar panel in real time with wide voltage range of MPPT.

AC-DC charge module adopts advanced control algorithm to realize full digital double closed-loop control of voltage and current, with high control accuracy and small volume. Battery can be charged and protected stably and reliably with wide AC voltage input range, full input/output protection function.

DC-AC inverter module based on full digital intelligent design adopts advanced SPWM technology, outputs pure sine wave, converts DC into AC. It is suitable for AC loads such as household appliances, electric tools, industrial device, electronic audiovisual, etc. The product adopts the segment LCD display design to display the operation data and state of the system in real time. The comprehensive electronic protection function ensures that safety and stability of the whole system.

Characteristics:

1. Adopt full digital voltage and current double closed-loop control and advanced SPWM technology to output pure sine wave.
2. Two output modes, i.e. mains bypass and inverter output can achieve uninterrupted power supply function.
3. Four optional charge modes: only solar energy, mains priority, solar energy priority and mixed charge.
4. Advanced MPPT technology, with efficiency up to 99.9%.
5. Wide MPPT voltage range.
6. With function of activating lithium battery with solar energy and AC mains power, it supports connection of lead-acid battery and lithium battery.
7. LCD screen design and 3 LED indicator lights dynamically display system data and operation states.
8. ON/OFF rocker switch can control AC output.
9. With power saving mode function, it can reduce no-load loss.
10. Intelligent adjustable speed fan is adopted for efficient heat dissipation and extended system life.
11. Possessing multiple protection functions and 360° comprehensive protection.
12. Possessing complete short circuit protection, overvoltage and undervoltage protection, overload

protection, back filling protection, etc.

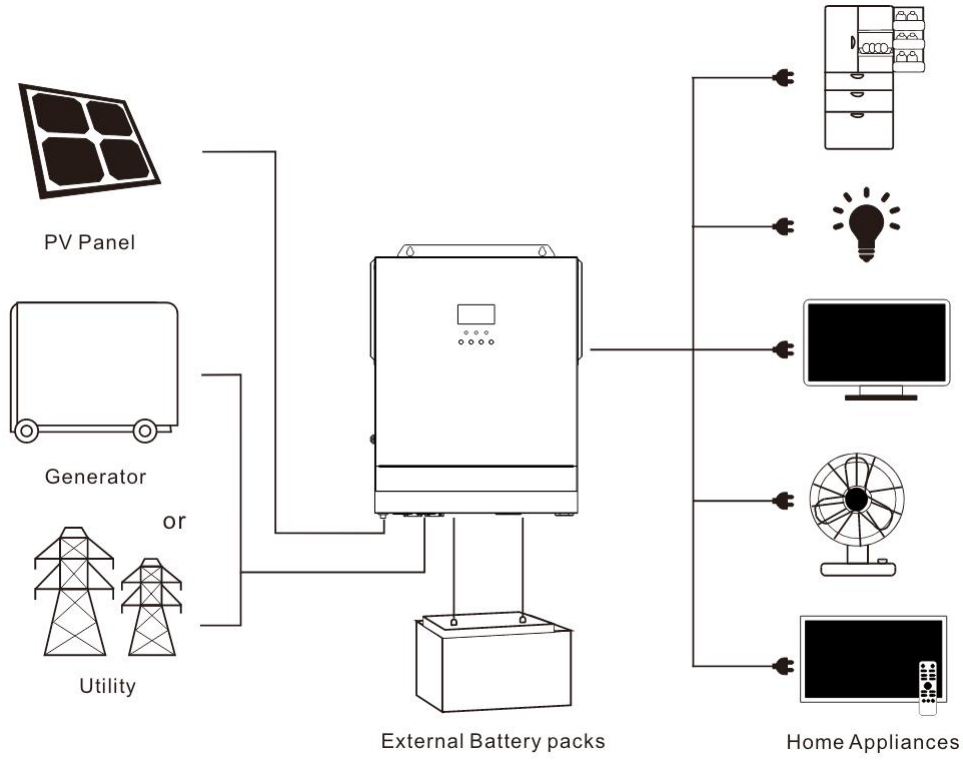
13. It has the function of mixed load: when the battery is not connected, photovoltaic and commercial power can supply power to the load at the same time (if there is no battery, the commercial power must be connected). When the battery is full, it can also enter the mixed load mode, which can make full use of the photovoltaic energy.

1.2 Basic system introduction

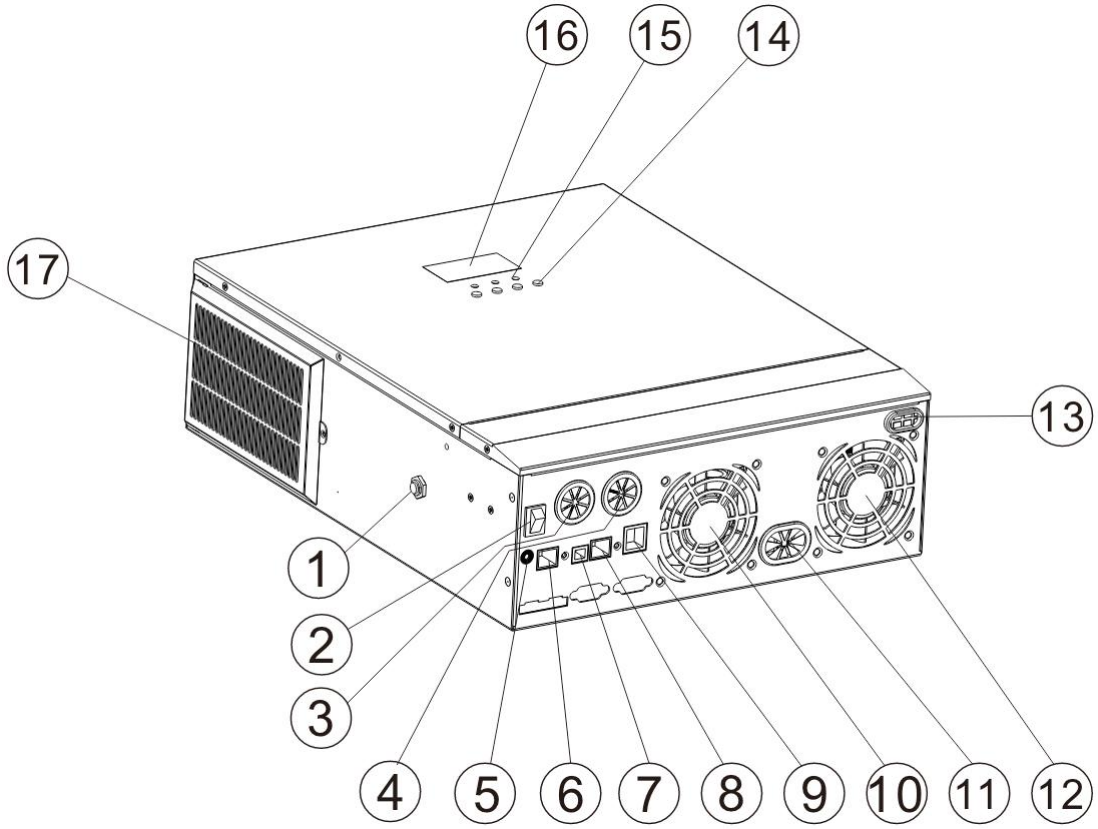
The figure below shows the system application scenario of this product. A complete system includes the following parts:

1. **PV module:** Convert the light energy into direct current energy and then charge the battery via the all-in-one machine, or directly invert the light energy into alternating current to supply power to the load.
2. **Mains or generator:** Connected at the AC input, it can supply power to the load and charge the battery at the same time. If no mains power or generator is connected, the system can also operate normally. At this time, the load power is supplied by the battery and photovoltaic modules.
3. **Battery:** the battery is to ensure the normal power consumption of the system load in case of no sufficient solar energy or mains supply.
4. **Household load:** It can be connected to various household and office loads, including AC loads such as refrigerators, lamps, televisions, fans, air conditioners, etc.
5. **Inverting and control all-in-one machine: t**he energy conversion device of the whole system.

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

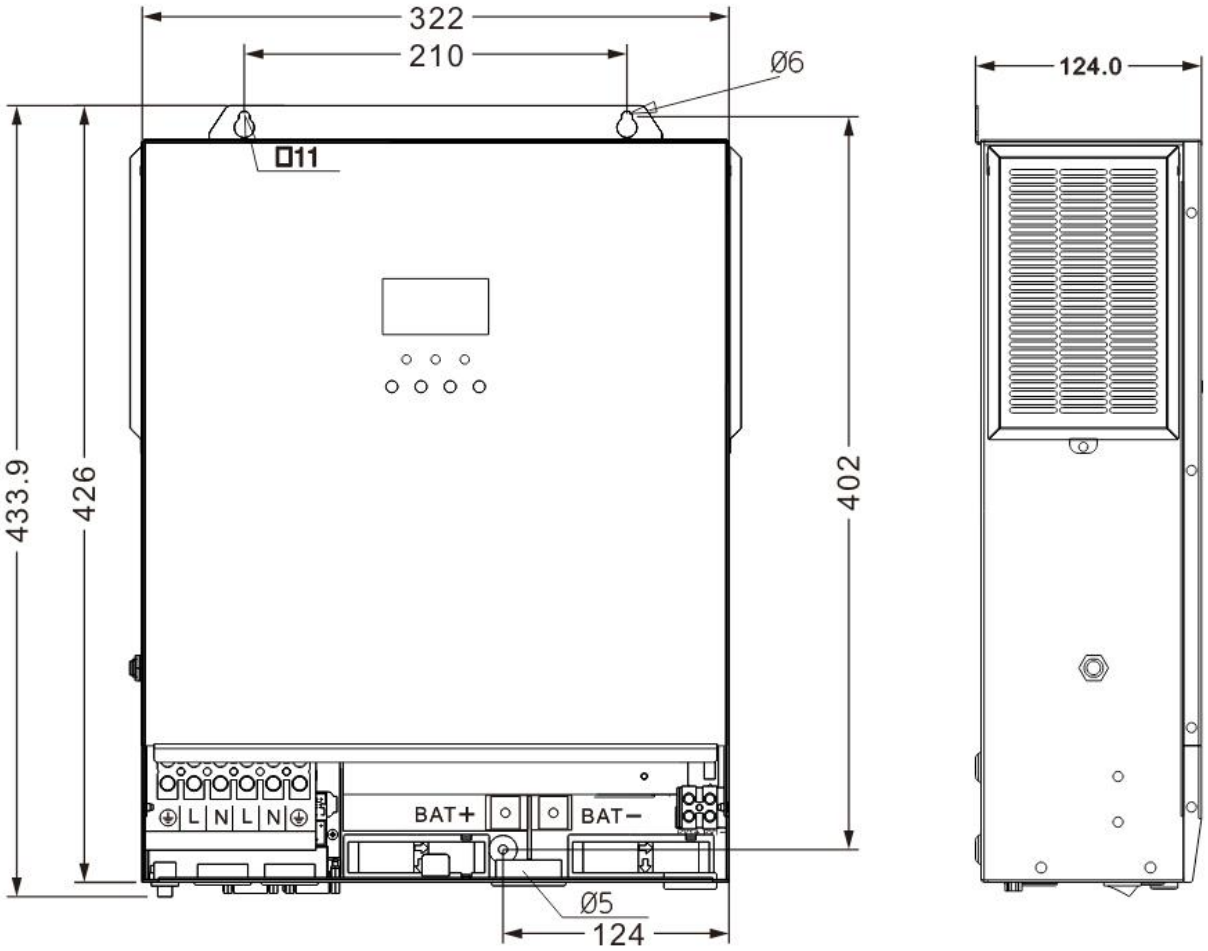


1.3 Product characteristics



①	Overload protector	⑩	Cooling fan
②	ON/OFF rocker switch	⑪	Battery terminal
③	AC input terminal	⑫	Cooling fan
④	AC output terminal	⑬	PV terminal
⑤	Grounding screw hole	⑭	Setup button
⑥	RS485 communication port	⑮	LED Indicators
⑦	USB communication port	⑯	LCD screen
⑧	WIFI communication port	⑰	Dust net
⑨	Dry contact port		

1.4 Dimension drawing



2. Installation Instruction

2.1 Installation notice

Before installation, please carefully read the manual and get familiar with the installation step.

- Take care while installing the battery. When installing the lead-acid liquid battery, it is required to wear goggles. Any body part contacting the battery acid must be washed with clear water in time.
- Don ' t place any metal object beside the battery to prevent short circuit of the battery.
- Acid gas may be generated during battery charge. There fore, it is required to ensure good ventilation around the environment.
- During cabinet installation, sufficient space shall be reserved around the all-in-one machine for heat dissipation; do not install the all-in-one machine and lead-acid liquid battery in the same cabinet to avoid the corrosion of the all-in-one machine by acid gas generated during battery operation.
- Only the battery with type consistent with the all-in-one machine can be charged.

- Loose connection points and corroded wires may cause great heat, thereby melting the insulation layer of wires, burning the surrounding materials, or even causing fire. Therefore, all connectors must be tightened, and the wires must be fixed with ties, so as to avoid the looseness of connectors caused by wire shaking during mobile application.
- Tie conductors are selected based on no greater than 5A/mm^2 current density.
- The machine installed outdoors shall be protected against direct sunlight and rain.
- After the power switch is turned off, there is still high voltage inside the all-in-one machine. Please do not open or touch the internal components, and carry out relevant operation after the capacitor is fully discharged.
- Please do not install the all-in-one machine in a humid, greasy, flammable, explosive or dusty or other severe environments.
- The polarity of the battery input end of this product shall not be reversed, otherwise the device may be damaged easily or there may be some unpredictable dangers.
- AC supply input and AC output are both high voltage, so please do not touch the wires.
- Do not touch the fan in working to prevent injury.
- It is required to confirm that the all-in-one machine is the unique power supply input device for the load device. It is forbidden to use the machine in parallel with other input AC power to avoid damage.

2.2 Wire specification and breaker type

For wiring and installation ways,it is required to observe national and local electrical specification requirements.

Recommended wiring specification and breaker type for photovoltaic array: the output current of the photovoltaic array is affected by the form, connection way and illumination angle of photovoltaic array, therefore the minimum wire diameterof the photovoltaic array is calculated based on the short circuit currentof photovoltaic array. Please refer to the short circuit current value in the specification of photovoltaic array (the short circuit current keeps unchanged for the photovoltaic arrays in series connection; the short circuit current of photovoltaic arrays in parallel connectioni s the sum of short circuit currentof all components connected in parallel); the short circuit current of the array cannot exceed maximumi nput currentof PV.

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

Type	Recommended wire diameter	Maximum PV input current	Recommended circuit breaker type
SPH504880A	6mm^2/10AWG	22A	2P—25A

Note: the voltage in parallel shall not exceed maximum PV input open-circuit voltage.

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

Type	Recommended wire diameter	Maximum bypass input current	Recommended circuit breaker type
SPH504880A	10mm²/7AWG	63A	2P—63A

Note: there is already a corresponding breaker at input connection point of mains supply. There fore, no breaker may be equipped.

- **Recommended input wire diameter and switch type for battery**

Type	Recommended wire diameter	Rated battery discharge current	Maximum charge current	Recommended circuit breaker type
SPH504880A	30mm^2/2AWG	125A	80A	2P—160A

- **Recommended wire specification and breaker type for AC output**

Type	Recommended wire diameter	Rated inverter AC output current	Maximum bypass output current	Recommended circuit breaker type
SPH504880A	10mm²/7AWG	42A	63A	2P—63A

Note: the wire diameter is only for reference. In case of long distance between photovoltaic array and all-in-one machine or between all-in-one machine and battery, use thicker wire to reduce voltage drop and improve system performance.

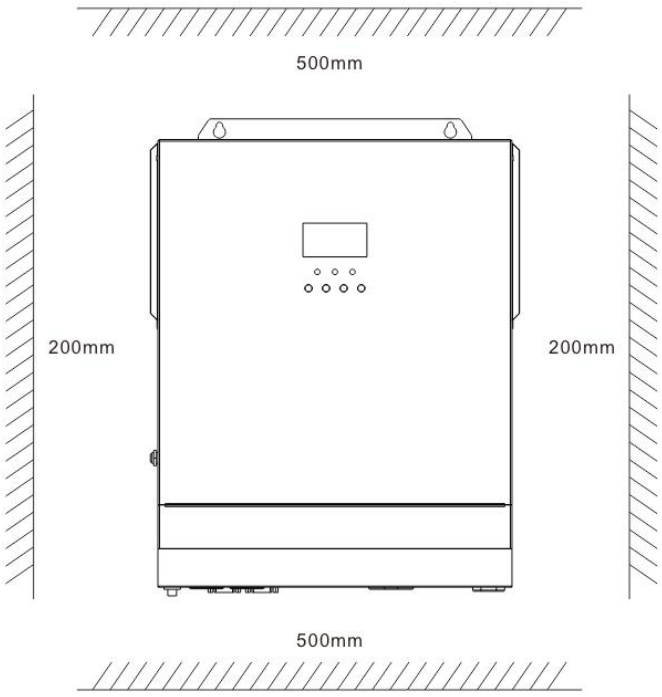
Note: above wire diameter and breaker are only for reference. Please select appropriate wire diameter and breaker based on practical condition.

2.3 Installation and Wiring

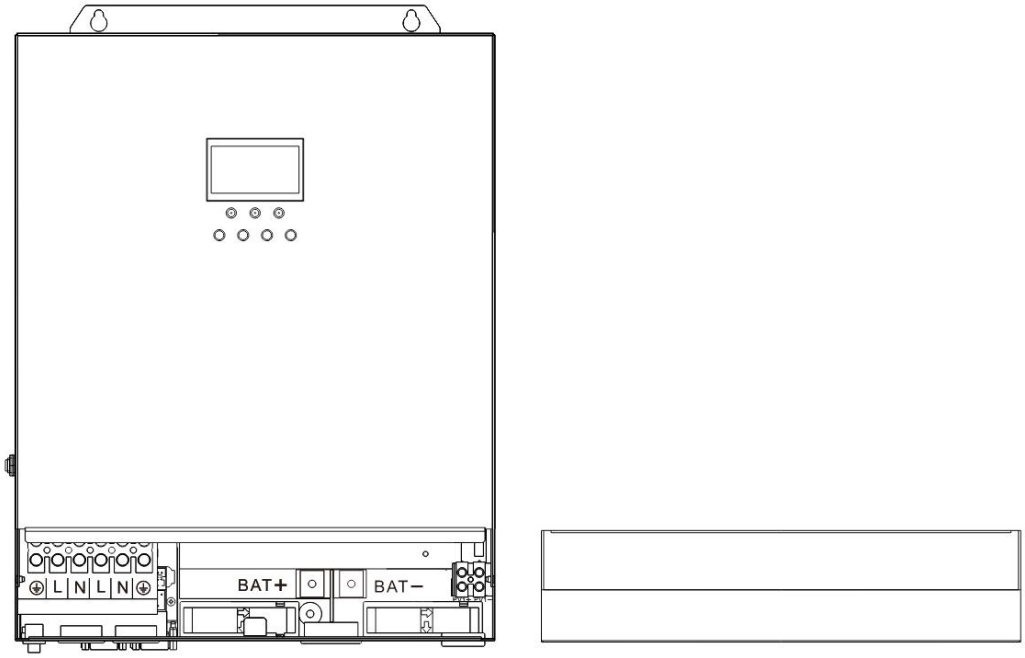
Installation step:

Step 1: confirm the installation position and heat dissipation space, confirm the installation position of all-in-one machine, such as wall surface; to install the all-in-one machine, guarantee there is sufficient air flowing through the cooling fins of all-in-one machine. At least reserve 200mm space at the left and right air outlets of the all-in-one machine to guarantee heat loss through natural convection. Refer to the overall installation schematic above.

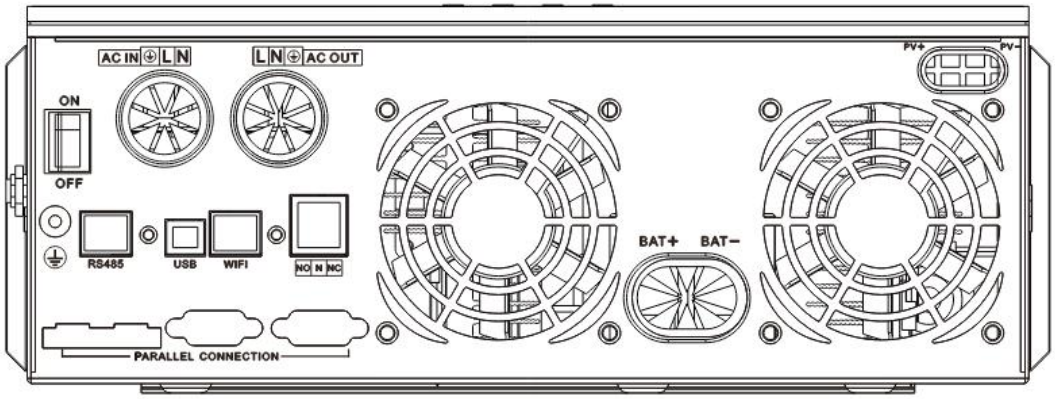
Warning: danger of explosion! Never install the all-in-one machine and lead-acid liquid battery into a same sealed space or in a sealed place with probable accumulation of battery gas.



Step 2: Remove the terminal protection cover



Step 3: wiring

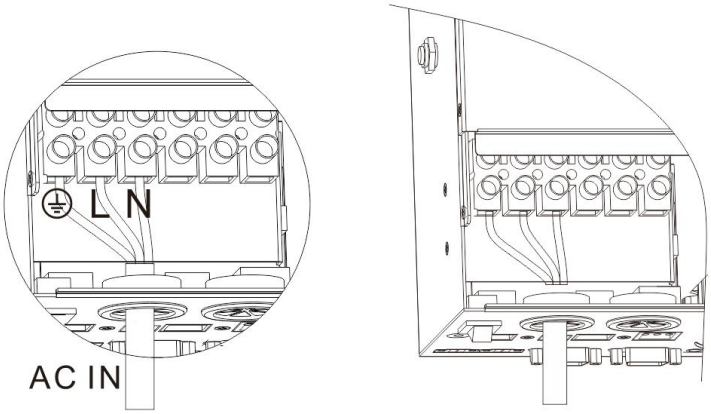


AC input/output wiring method:

① Before AC input/output wiring, disconnect the external breaker at first and then confirm whether the cable used is thick enough. Please refer to chapter " 2.2 Wiring Specification and Breaker type";

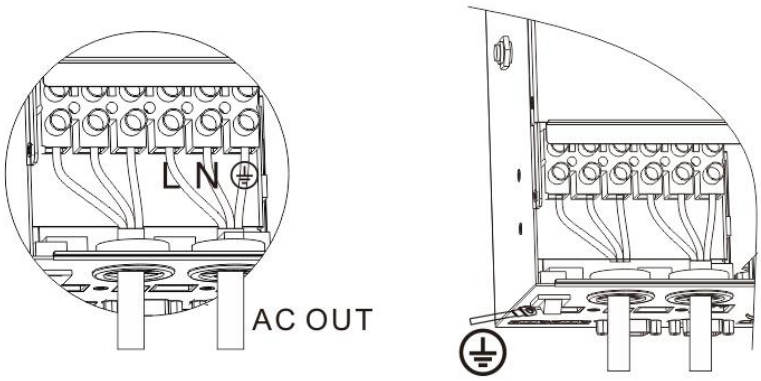
② Correctly connect AC input wire in accordance with cable sequence and terminal position shown in the figure below. Please connect ground lead at first, and then live wire and mull wire;

⏚: **Ground** **L : Live** **N : Neutral**



③ Correctly connect AC output wire in accordance with cable sequence and terminal position shown in the figure below. Please connect the ground wire at first, and then live wire and null wire. The ground wire is connected to the ground screw hold through Oshaped terminal.

⏚: **Ground** **L : Live** **N : Neutral**



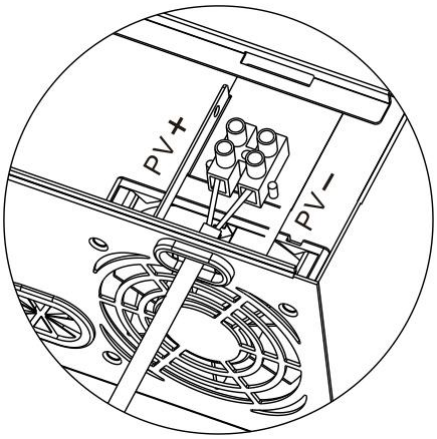
Note: use thick ground cable as far as possible (with cable section not less than 4mm^2), place the ground point to be close to the all-in-one machine as far as possible and choose shorter ground wire to the greatest extent

Wiring method of PV input:

① Before wiring, disconnect external breaker at first, and confirm whether the used cable is thick enough. Please refer to chapter "2.2 Wiring Specification and Breaker Type";

② Correctly connect PV input wire in accordance with cable sequence and terminal position shown in the figure below.

PV+ positive input pole **PV1- negative input pole**

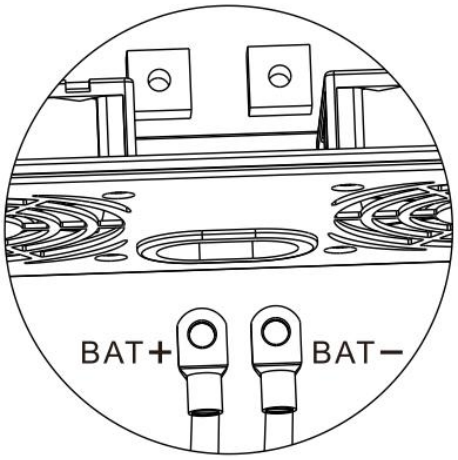


BAT wiring method:

① Before wiring, disconnect external breaker at first, and then confirm whether the used cable is thick enough. Please refer to chapter " 2.2 Wiring Specification and Breaker Type ". BAT wire shall be connected with the machine via O-shaped terminal. It is recommended to use the O-shaped terminal with 6mm inside diameter. The O-shaped terminal must compress BAT wire firmly to prevent excessive heating caused by great contact resistance;

② Correctly connect BAT wire in accordance with cable sequence and terminal position shown in the figure below.

BAT+: positive battery pole **BAT-: negative battery pole**



Warning notice:

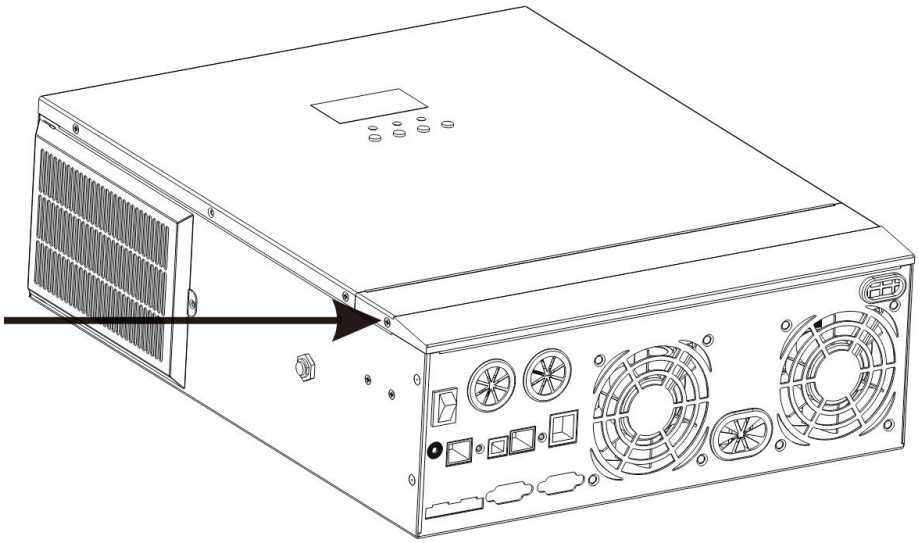
① Input from mains supply, AC output and photovoltaic array may generate high voltage. Before wiring, make sure to break the breaker or fuse;

② During wiring process, make sure to pay attention to the safety; during the wiring process, please don't close the breaker or fuse. At the same time, guarantee that "+" and "-" poles of

different parts are correctly connected with wires; a breaker must be installed at the battery end and selected based on chapter "2.2 Wiring Specification and Breaker Type". Before wiring, make sure to break the breaker to prevent strong electric spark generated during wiring. At the same time, avoid battery short circuit during the wiring process; if the all-in-one machine is in the area with frequent thunder, it is suggested to install an external arrester at PV input terminal.

Step 4: Inspect whether the wires are correctly and firmly connected, especially whether the positive and negative input poles of the battery are correct, whether the positive and negative input poles of PV are correct, whether AC input is inaccurately connected to AC output terminal.

Step 5: install protective cap of terminal



Step 6: Start all-in-one machine

At first close the breaker at the battery end, and then press the rocker switch at the lower left side of the machine to " ON " state, " AC/INV " indicator light flashes, indicating normal operation of inverter. Afterwards, close breakers of photovoltaic array and mains supply. In the end, after AC output is normal, turn on AC load one by one to avoid protection action generated by great instant impact owing to simultaneous turnon of loads. The all-in-one machine operates normally in accordance with set mode.

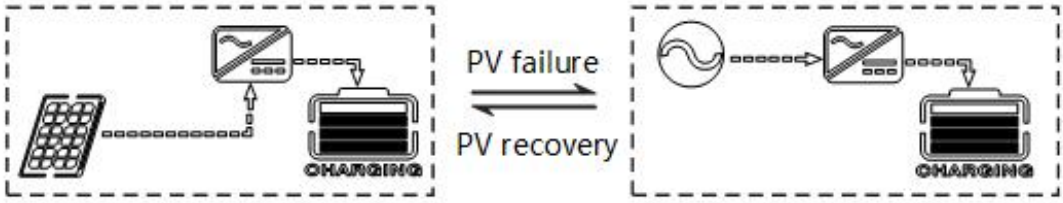
Note: if power is supplied to different AC loads, it is suggested to turn on the loads with great impact current, and then turn on the load with little impact current after the load operates stably.

Note: in case of abnormal operation of all-in-one machine or abnormal display of LCD or indicator light, refer to Chapter 6 for troubleshooting.

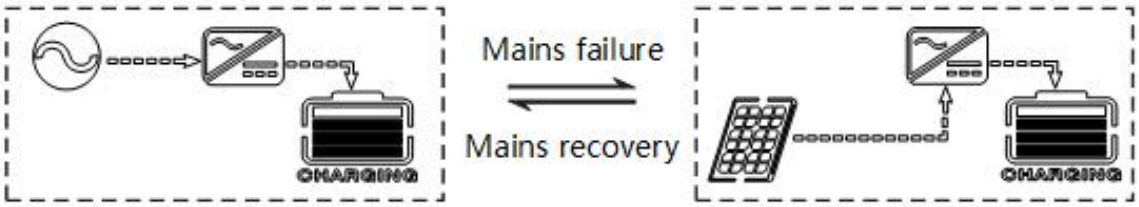
3. Operating Mode

3.1 Charge mode

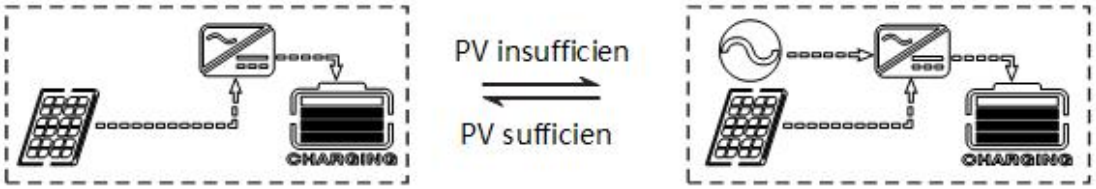
1. **PV priority:** PV module will charge the battery preferentially, and the battery is charged by the Mains only when the PV system fails. During the day, solar energy is fully used to charge, while at night, it converts to the Mains. This can maintain battery level, and is ideal for areas where the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



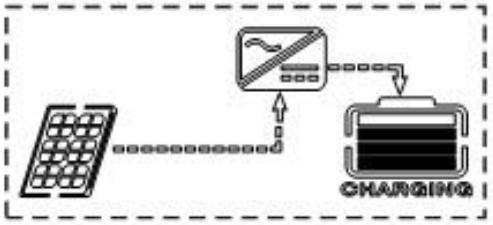
2. **Mains priority:** The Mains supply is preferentially used to charge the battery. Only when the Mains fails, the PV charging can be activated.



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 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.

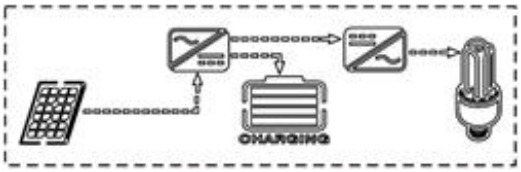


3.2 Output mode

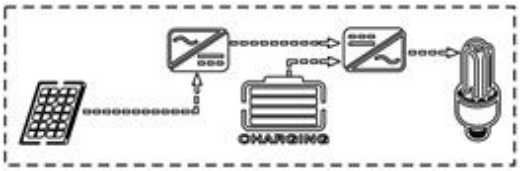
- **PV priority mode:**

Use PV and battery energy to power loads, with PV taking priority.

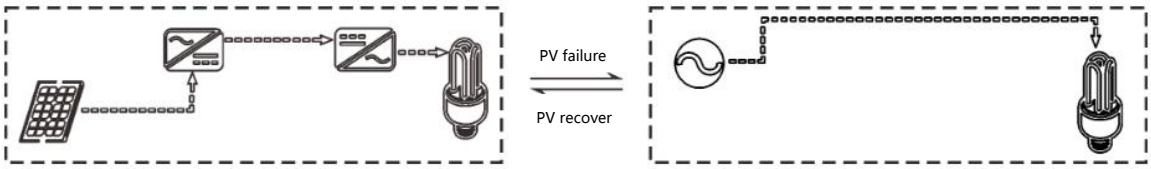
When the PV energy is greater than the load, the excess energy charges the battery:



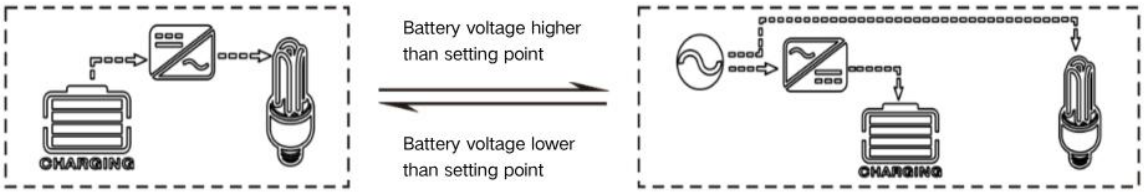
When the PV energy is less than the load, the battery replenish the power supply.



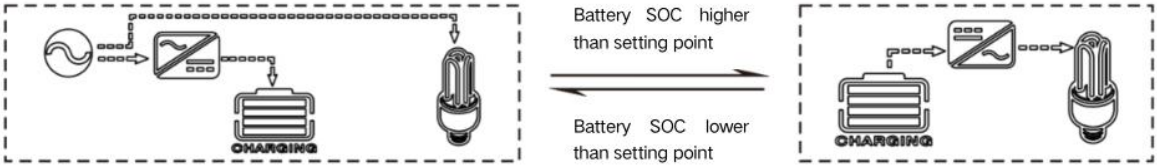
When PV is invalid, switch to mains power supply and charging. When PV is restored, switch back to PV and battery to power the load.



No BMS communication: when the battery voltage is lower than [04] setting item, switch to mains power supply and charging. When the battery voltage is higher than [05] setting item, switch back to PV and battery to supply power to the load.



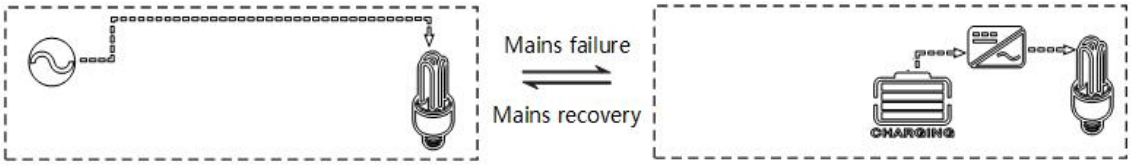
With BMS communication: when the battery SOC is lower than [61] setting items, switch to utility power supply and charging; when the battery SOC is higher than [62] setting items, switch to PV, battery to power the load.



This model maximizes the use of solar energy while maintaining battery power and is suitable for areas with stable power grid.

- **Mains priority mode:**

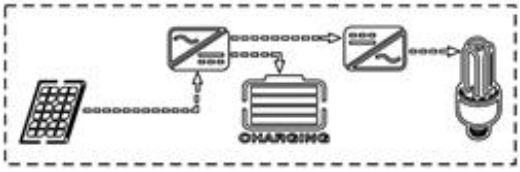
  Switch to inverter power supply only when there is no utility power, and switch to utility power charging and supply when utility power recovery. The equipment is as a backup UPS, used in areas with unstable power grid. Switching does not affect the PV charging.



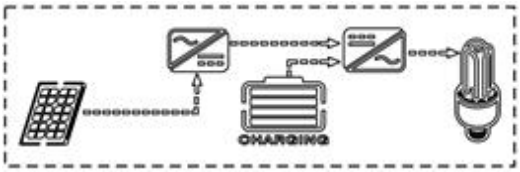
- **Inverter priority mode:**

  Use PV and battery energy to power the load, with PV taking priority.

  When the PV energy is greater than the load, the excess energy charges the battery.

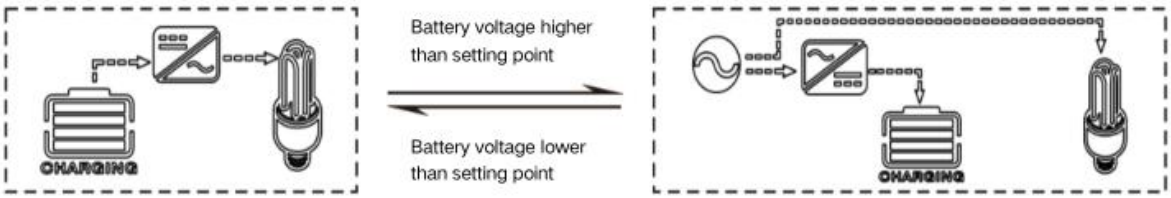


  When the PV energy is less than the load, the battery replenishes power to the load.

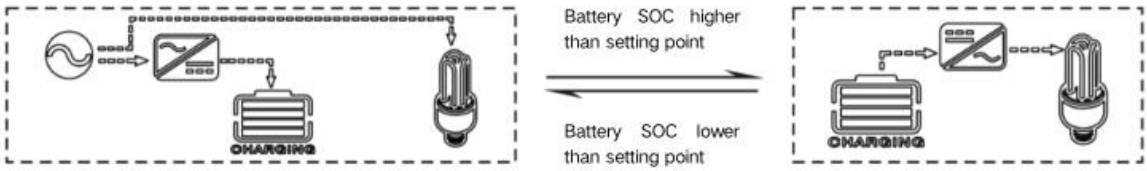


  When the PV is ineffective, the battery power the load. Cycle the battery charge and discharge.

  No BMS communication: When the battery voltage is lower than [04] setting item, switch to mains power supply and charging. When the battery voltage is higher than [05] setting item, switch to PV, battery to power the load.

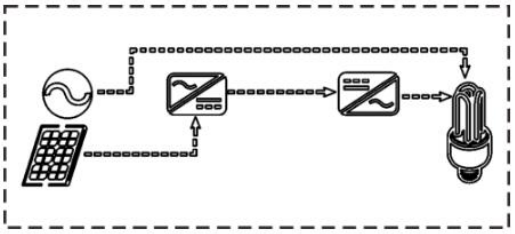


  With BMS communication: when the battery SOC is lower than the [61] setting item, switch to utility power supply and charging; when the battery SOC is higher than the [62] setting item, switch to PV, battery to power the load.



This mode maximizes the use of DC energy and is used in grid stable areas. Does not affect PV charging.

- **Hybrid power supply to loads:**
  When no battery is connected or when the battery is fully charged, the PV and mains power are mixed together to supply the load and the PV is output at its maximum output power.



4. Operation Instruction for LCD Screen

4.1 Operation and display panel

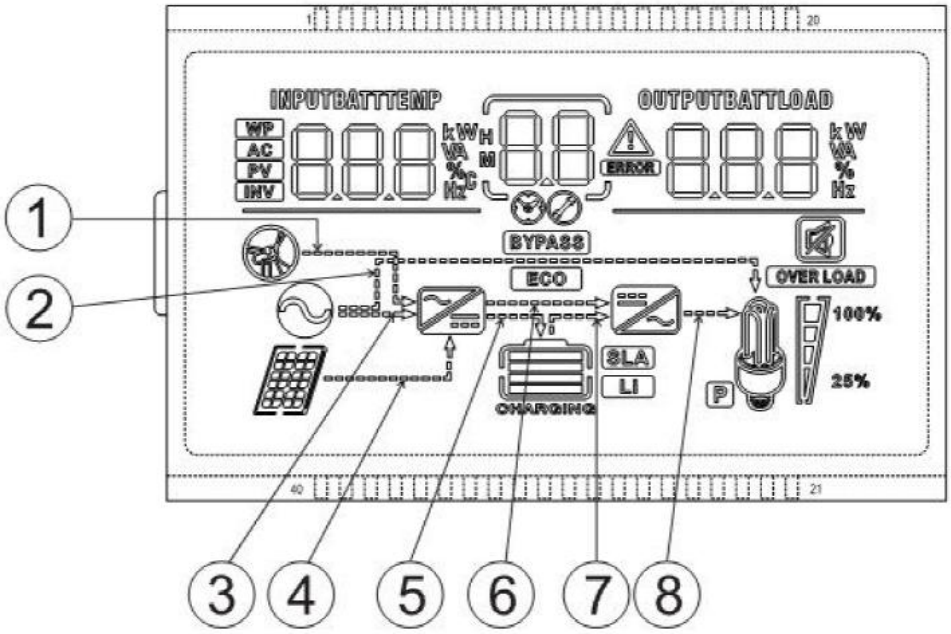
4.2 Introduction to operation keys

Function Key	Description
SET	Enter/exit setting menu
UP	Last option
DOWN	Next option
ENT	Confirm/enter option under setting menu

4.3 Introduction to indicator light

Indicator light	Color	Description
AC/INV	Yellow	Constant on: mains supply output
		Flashing: inverter output
CHARGE	Green	Flashing: battery in charge
		Constant on: charge completed
FAULT	Red	Constant on: fault state

4.4 Introduction to LCD screen



Icon	Function	Icon	Function
	Indicating that AC input end has been connected to power grid		Indicating that inverter circuit is in working
	Indicates that the AC input mode in APL mode (wide voltage range)	BYPASS	Indicating that the machine is in mains supply bypass work mode
	Indicating that PV input end has been connected to solar battery panel	OVER LOAD	Indicating that AC output is in overload state
	Indicating that machine has been connected to battery, indicating 0%~24% battery remaining capacity indicating 25%~49% battery remaining capacity indicating 50%~74% battery remaining capacity indicating 75%~100% battery remaining capacity	100% 25%	Indicating percentage of AC output load, indicating 0%~24% load percentage, indicating 25%~49% load percentage, indicating 50%~74% load percentage, indicating ≥75% load percentage
LI	Indicating that present battery type of the machine is lithium battery		Indicating that buzzer is not enabled
SLA	Indicating that current battery type of machine is lead-acid battery		Indicating alarm of machine
CHARGING	Indicating that the battery is in charge state.	ERROR	Indicating that the machine is in fault state.
	Indicating that AC/PV charge circuit is in working		Indicating that the machine is in setting mode.

	Indicating that AC output end has AC voltage output		Middle parameter display of screen, 1. In non-setting mode, displaying alarm or fault code; 2. In setting mode, displaying code of parameter item under current setting.
Parameter display at left side of screen: input parameter			
	Indicating AC input		
	Indicating PV input		
	Indicating inverter circuit		
	The icon is not displayed		
	Displaying battery voltage, total charge current of battery, charge power of mains supply, AC input voltage, AC input frequency, PV input voltage, temperature of internal radiator, software version		
Parameter display at right side of screen: output parameter			
	Indicating output voltage, output current, output active power, output apparent power, battery discharge current, software version; under setting mode, displaying the setting parameter under the parameter item code set currently		
Arrow display			
①	The arrow is not displayed	⑤	Indicating charge from charge circuit to battery end
②	Indicating power grid power supply to load	⑥	The arrow is not displayed
③	Indicating power grid power supply to charge circuit	⑦	Indicating power supply from battery end to inverter circuit
④	Indicating PV power supply to charge circuit	⑧	Indicating power supply from inverter circuit to load

Real-time data view method

In LCD main screen, press keys "UP" and "DOWN" to turn page and view different real time data of the machine.

Page	Left Parameter of Screen	Middle Parameter of Screen	Right Parameter of Screen
1	Battery input voltage	Fault code	Output voltage
2	PV temperature		PV output KW
3	PV input voltage		PV output current
4	Input battery current		Output battery current
5	Input battery KW		Output battery KW
6	AC input frequency		AC output load frequency
7	AC input voltage		AC output load current
8	Input voltage		Output load KVA
9	INV temperature		INV output load KW
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
13			Customer ID

4.5 Setting parameter

Key operation description: to enter setting menu and exit from setting menu, please press key "SET". After entering the setting menu, parameter number【00】shall flash. At this time, press keys " UP " and " DOWN " to select the parameter item code to be set. Afterwards, press key " ENT" to enter parameter editing state. At this moment, the parameter value can flash. The parameter values are adjusted through keys "UP" and "DOWN". In the end, press key "ENT" to complete parameter editing and return to parameter selection state.

The voltage setting logic:【15】<【12】<【04/14】<【35】<【37】<【05】<【09/11】

No. of Parameter	Parameter name	Setting	Description
00	Exit	[00] ESC	Exit from setting menu.
01	Work priority mode	[01] SOL	At PV priority mode, when PV is invalid or battery value is lower than the parameter 【04】setting value, it shall switch to AC power.
		[01] UTI **default**	Photovoltaic energy priority with the load, photovoltaic is not enough, the grid power and photovoltaic mixed load, photovoltaic energy is enough with the load, the excess energy to charge the battery, the grid power only starts charging when the battery is too discharged (06 Settings as" OSO(only PV)) " , the grid power will not charge), the battery is only discharged when off the grid.
		[01] SBU	Inverter priority mode, switching to mains only when the battery is under-voltage or below the value set in parameter [04]; switching to battery discharge only when the battery is fully charged or above the value set in parameter [05].
		[01] SUB	Solar energy priority charging, insufficient solar energy, grid energy and solar energy hybrid charging (if 06 Settings as" OSO(only PV) " ,the grid energy will not charge) and grid with load, when solar energy is enough to charge,excess energy not enough to load, excess solar energy and grid will hybrid load, the battery is discharged only when off the grid.
02	Output frequency	[02] 50.0	Bypass self-adaption, it automatically adapts to AC frequency in case of AC power; without AC power, the output frequency can be set via the menu.
		[02] 60.0 **default**	
03	AC input voltage range	[03] APL	90~140V AC input range of 120V machine.
		[03] UPS **default**	90~140V AC input range of 120V machine.
04	Battery to bypass	[04] 46V **default**	When parameter【01】=SOL/SBU, the battery voltage is lower than the set value, the output is switched to mains or generator from battery. The setting range is 40V~57.2V.

05	Bypass to battery	[05] 56V **default**	When parameter【01】=SOL/SBU, battery voltage is higher than the set value, the output is switched to battery from mains or generator at 52.4V~60V setting range.
06	Charging mode	[06] SNU **default**	PV and Mains hybrid charging; PV charging is a priority, and when the PV energy is insufficient, the Mains charging supplements. When the PV energy is sufficient, the Mains charging stops. Note: Only when the Mains bypass output is loaded, the PV charging and the mains charging can work at the same time. When the inverter works, only the PV charging can be started.
		[06] OSO	Only PV charging, with the Mains charging not activated.
07	Maximum charge current	[07] 60A **default**	setting range 0~80A.
08	Battery type	[08] USE	For user-defined, all battery parameters can be set.
		[08] SLd	Sealed lead-acid battery, constant voltage charge voltage 57.6V, float charge voltage 55.2V.
		[08] FLd	Flooded lead-acid battery, charge voltage at constant voltage is 58.4V and float charge voltage is 55.2V.
		[08] GEL **default**	Gel lead-acid battery, charge voltage at constant voltage is 56.8V and float charge voltage is 55.2V.
		[08] L14/L15/L16	Lithium iron phosphate battery L14/L15/L16 corresponds to lithium iron phosphate battery 14, 15, 16 strings. 16 strings, constant-voltage charge voltage is 56.8V. 15 strings, constant-voltage charge voltage is 53.2V. 14 strings, constant-voltage charge voltage is 49.2V.
		[08] N13/N14	Ternary lithium battery, which is adjustable. N13, constant-voltage charge voltage is 53.2V. N14, constant-voltage charge voltage is 57.6V.
		[08] NO bat	Without battery
09	Boost charge voltage	[09] 56.8V **default**	The setting range of boost charge voltage is 48V~58.4V with 0.4V step.
10	Boost charge maximum time	[10] 120 **default**	Boost maximum charge time setting means setting of maximum charge time of voltage when the voltage reaches parameter 【09】 from 5min~900min at 5-minute step. It is valid in case of a self-defined or a lithium battery.
11	Float voltage	[11] 55.2V **default**	48V~58.4V setting range of float voltage at 0.4V step.

12	Overdischarge voltage	[12] 42V **default**	So as to overdischarge voltage, when the battery voltage is lower than the judgement point, after delaying for the parameter 【13】 setting time, turn off the inverter output. 40V~48V voltage setting range at 0.4V step is valid in case of a self-defined battery and lithium battery.
13	Overdischarge delay time	[13] 5S **default**	So as to overdischarge delay time, when the battery voltage is lower than parameter 【12】, the inverter output is turned off after delaying the time set with the parameter. 5S~55S setting range at 5S step is valid in case of a self-defined and lithium battery.
14	Battery undervoltage alarm point	[14] 44V **default**	So as to battery undervoltage alarm point, when the battery voltage is lower than the judgement point, an undervoltage alarm is given out and no turnoff is output. 40V~52V setting range at 0.4V step is valid in case of a self-defined and lithium battery.
15	Battery discharge limiting voltage	[15] 40V **default**	So as to battery discharge limiting voltage, when the battery voltage is lower than the judgement point, the output is turned off immediately. 40V~52V setting range at 0.4V step is valid in case of a self-defined and lithium battery.
16	Equalizing charge	[16] DIS **default**	No equalizing charge is permitted.
		[16] ENA	When equalizing charge is enabled, only vented lead-acid battery and sealed lead-acid are valid.
17	Equalizing charge voltage	[17] 56.8V **default**	So as to equalizing charge voltage, 48V~58.4V setting range at 0.4V step is valid in case of a vented lead-acid battery and sealed lead-acid battery.
18	Equalizing charge time	[18] 120 **default**	So as to equalizing charge time, 5min~900min setting range at 5min step is valid in case of a vented lead-acid battery and sealed lead-acid battery.
19	Equalizing charge delay	[19] 240 **default**	For equalizing charge delay, 5min~900min setting range at 5min step is valid in case of a vented lead-acid battery and sealed lead-acid battery.
20	Equalizing charge derating time	[20]30 **default**	For equalizing charge derating time, 0~30days setting range at 1-day step is valid in case of a vented lead-acid battery and sealed lead-acid battery.
21	Equalizing charge enabling	[21] ENA	Start equalizing charge immediately.
		[21] DIS **default**	Stop equalizing charge immediatel.

22	Energysaving mode	[22] DIS **default**	No energy-saving mode
		[22] ENA	After the power saving mode is enabled, if the load is null or less than 50W, the inverter output is turned off after a delay for a certain period of time. When the load is more than 50W, the inverter automatic restart.
23	Automatic restart after overload	[23] DIS	When the automatic restart after overload is disabled, if the output is turned off upon overload, the machine shall not restore turnon.
		[23] ENA **default**	When the automatic restart after overload is enabled, if the output is turned off upon overload, output is restarted by the mains after 3min delay. The machine shall not restarted after 5 times of restarts.
24	Automatic restart after overtemperature	[24] DIS	When automatic restart after overtemperature is disabled, if the output machine is turned off upon overtemperature, no output is turned on.
		[24] ENA **default**	When automatic restart after overtemperature is enabled, if the output is turned off upon overtemperature, the output can be turned on after the machine cools down.
25	Buzzer alarm	[25] DIS	Disabling alarm.
		[25] ENA **default**	Enabling alarm.
26	Mode conversion reminding	[26] DIS	No alarm prompt in case of any change in main input source.
		[26] ENA **default**	Alarm prompt is enabled if state of main input source is changed.
27	Inverter overload to bypass	[27] DIS	No automatic switching to AC power in case of inverter overload.
		[27] ENA **default**	Automatic switching to AC power in case of inverter overload.
28	AC maximum charge current	[28] 40A **default**	AC Out 120Vac Setting range 0~40A.
30	RS485 address setting	[30] 1 **default**	RS485 communication address setting range 1 ~ 254, (refer to Number [32] is valid when set as SLA)
32	RS485 communication	[32] SLA **default**	RS485 port for PC and remote monitoring protocol.
		[32] BMS	RS485 port for BMS communication.
33	BMS communication protocols	When [32] setting item = BMS, you need to select the corresponding lithium battery manufacturer's brand for communication.	
		wow	SGP=SUNGOLDPOWER，PAC=PACE，RDA=Ritar，AOG=ALLGRANDBATTERY，OLT=OLITER，XWD=SUNWODA, DAQ=DAKING, WOW=SNPOWER, PYL=PYLONTECH，VOL=WEILAN，DYE=DEYE，LUX=LUXPOEWER
35	Battery lowvoltage recovery	[35] 52V **default**	Setting range 44V~58.4V.

37	Battery fully charged recovery point	[37] 52V **default**	After the battery is fully charged, it needs to be lower than this set voltage before it can be recharged
38	AC output voltage setting	[38] 120Vac **default**	U series settable： (100/105/110Vac/120Vac/127Vac)
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.
57	Stop charging current	[57] 2A **default**	Stop charging when the charging current is less than the set value.
58	0Discharge alarm SOC setting	[58] 15% **default**	SOC alarm when capacity is less than this setting. (Valid when BMS communication is normal)
59	Discharge cut-off SOC setting	[59] 5% **default**	Discharge stops when the capacity is less than this setting value. (Valid when BMS communication is normal)
60	Charge cut-off SOC setting	[60] 100% **default**	When the capacity is greater than this setting value, charging stops. (Valid when BMS communication is normal)

61	Switching to mains SOC setting	[61] 10% **default**	When the capacity is less than this setting value, switch to mains power. (Valid when BMS communication is normal)
62	Switch to inverter output SOC setting	[62] 100% **default**	When the capacity is greater than this setting, switch to inverter output mode. (Valid when BMS communication is normal)
63	Auto N-PE connection switch function	DIS (**default**)	Disable auto N-PE connection switch
		ENA	Enable auto N-PE connection switch

4.6 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 (USE)	Adjustable
Overvoltage disconnection voltage	60V	60V	60V	60V	
Battery fully charged recovery point(setup item [37])	52V	52V	52V	52V	√
Equalizing charge voltage	58.4V	-	59.2V	40 ~ 60V	√
Boost charge voltage	-	-	-	40 ~ 60V	√
Floating charge voltage	55.2V	55.2V	55.2V	40 ~ 60V	√
Undervoltage alarm voltage([01] fault)	44V	44V	44V	40 ~ 60V	√
Undervoltage alarm voltage recovery point([01] fault)	Undervoltage alarm voltage+0.8V				
Low voltage disconnection voltage([04] fault)	42V	42V	42V	40 ~ 60V	√
Low voltage disconnection voltage recovery point ([04] fault)(setup item [35])	52V	52V	52V	52V	√
Discharge limit voltage	-	-	-	40 ~ 60V	√
Over-discharge delay time	5s	5s	5s	1 ~ 30s	√
Equalizing charge duration	120 minutes	-	120 minutes	0 ~ 900 minutes	√

Equalizing charge interval	30 days	-	30 days	0～250 days	√
Boost charge duration	-	-	-	10～900 minutes	√

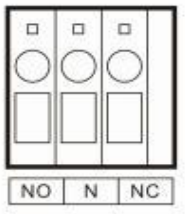
For Lithium Battery :

Battery type / Parameters	Ternary (N13)	Ternary (N14)	LFP (L16)	LFP (L15)	LFP (L14)	Adjustable
Overvoltage disconnection voltage	60V	60V	60V	60V	60V	
Battery fully charged recovery point(setup item [37])	50.4V	54.8V	53.6V	50.4V	47.6V	√
Equalizing charge voltage	-	-	-	-	-	√
Boost charge voltage	53.2V	57.6V	56.8V	53.2V	49.2V	√
Floating charge voltage	53.2V	57.6V	56.8V	53.2V	49.2V	√
Undervoltage alarm voltage([01] fault)	43.6V	46.8V	49.6V	46.4V	43.2V	√
Undervoltage alarm voltage recovery point([01] fault)	Undervoltage alarm voltage+0.8V					
Low voltage disconnection voltage([04] fault)	38.8V	42V	48.8V	45.6V	42V	√
Low voltage disconnection voltage recovery point ([04] fault)(setup item [35])	46V	49.6V	52.8V	49.6V	46V	√
Discharge limit voltage	36.4V	39.2V	46.4V	43.6V	40.8V	√
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 Function

5.1 Dry node function

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

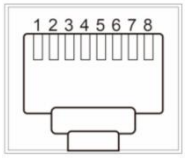


① Under normal conditions, in this terminal, NC-N point is closed and NO-N point is opened;

② When the battery voltage reaches the low-voltage disconnection voltage point, the coil of the relay is energized and NO-N point is closed and NC-N point opened. At this time, NO-N point can drive resistive loads 125VAC/1A, 230VAC/1A and 30VDC/1A.

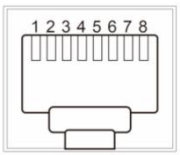
5.2 RS485 communication function

There are two communication ports WIFI and RS485 and also two functions:



RS485

① RS485 communication with lithium battery BMS can be conducted directly through this port RS485;

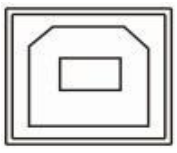


WI-FI

② WIFI is connected to the selected RS485 to WiFi /GPRS communication module independently developed by our company After the selected module is equipped, the reverse control all-in-one machine of our company can be connected through mobile APP, and the operating parameters and status of the reverse control all-in-one machine can be checked through the mobile APP.

Such 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.

5.3 USB communication function



This port is a USB communication port, which can be used for USB communication with the selected upper computer software of our company (Need to apply for). To use this port, the corresponding "USB to serial port chip CH340T driver" should be installed in the computer.

6. Protection

6.1 Protection function

No.	Protection Function	Note
1	Current limiting protection	When the charge current of the configured PV array exceeds the rated current of PV, it will be charged at the rated current.
2	Anti-reverse charge protection at night	At night, because the battery voltage is greater than that of the PV module, the battery shall be protected against discharge through the PV module.
3	AC input over- voltage protection	When the AC voltage exceeds 140V (120V model), the AC charge will be stopped and converted to inverter for output.
4	AC input under- voltage protection	When the AC voltage is lower than 90V (120V model), the AC charge will be stopped and converted to inverter for output.
5	Battery overvoltage protection	When the battery voltage reaches the overvoltage breaking voltage point, charge from PV and AC power to the battery shall be automatically stopped to prevent the battery from being damaged due to overcharge.
6	Battery low- voltage protection	When the battery voltage reaches the low-voltage breaking voltage point, the discharge to the battery will automatically stopped to prevent the battery from damage owing to overdischarge.
7	Load output short circuit protection	In case of short-circuit fault at the load output end, the output of AC voltage can be turned off immediately and then restored 1 minute later. After trying for 3 times, the output load end is still in short circuit state, it is required to eliminate the short circuit fault of the load at first, and then turn on the machine again to restore normal output.
8	Radiator overtemperature protection	In case of excessive internal temperature, the all-in-one machine shall stop charge and discharge; after the temperature returns to normal state, the all-in-one machine shall restore charge and discharge.
9	Overload protection	There is output within 3 minutes after overload protection. The output is turned off in case of 5 times of continuous overload until the machine is turned on again. Specific overload grade and duration are shown in the technical parameter able after the manual.
10	AC reverse flowing protection	Prevent AC power inverted from battery inverting against reverse flowing into bypass AC input.
11	Bypass overcurrent protection	Built-in AC input overcurrent protection breaker.

6.2 Meaning of fault code

Fault Code	Fault Name	Affecting output or not	Note
【01】	BatVoltLow	Yes	Battery undervoltage alarm
【02】	BatOverCurrSw	Yes	Average overcurrent software protectionforbattery discharge
【03】	BatOpen	Yes	No connection alarm of battery
【04】	BatLowEod	Yes	Stop discharge alarm for battery undervoltage
【05】	BatOverCurrHw	Yes	Battery overcurrent hardware protection
【06】	BatOverVolt	Yes	Charge overvoltage protection
【07】	BusOverVoltHw	Yes	Bus overvoltage hardware protection
【08】	BusOverVoltSw	Yes	Bus overvoltage software protection
【09】	PV VoltHigh	No	PV overvoltage protection
【10】	PV OCSw	No	PV overcurrent software protection
【11】	PV OCHw	No	PV overcurrent hardware protection
【12】	bLineLoss	No	AC power failure
【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	PV radiator overtemperature protection
【20】	OverTemperInv	Yes	Overtemperature protection of inverter radiator
【21】	FanFail	Yes	Fan fault
【22】	EEPROM	Yes	Memory fault
【23】	ModelNumErr	Yes	Inaccurate model setting
【26】	RlyShort	Yes	Inverted AC Output Backfills to Bypass AC Input
【29】	BusVoltLow	Yes	Bus undervoltage protection
【30】	BatCapacityLow1	No	Battery SOC below 10% alarm (Only enable BMS take effect)
【32】	BatCapacityLowStop	Yes	Battery dead (Only enable BMS take effect)
【58】	BMSComErr	No	BMS communication failure
【60】	BMSUnderTem	No	BMS under-temperature alarm (Only enable BMS take effect)

【61】	BMSOverTem	No	BMS over-temperature alarm (Only enable BMS take effect)
【62】	BMSOverCur	No	BMS over-current alarm (Only enable BMS take effect)
【63】	BMSUnderVolt	No	BMS under-voltage alarm (Only enable BMS take effect)

6.3 Some fault troubleshooting

Fault	Solving Measures
No display on screen	Check whether the battery air switch or PV air switch is closed; whether the switch is in "on" state; press any key on the screen to exit from the screen sleep mode.
Charge battery overvoltage protection	Measure whether the battery voltage exceeds 60V, and disconnect the photovoltaic array air switch and the AC air switch.
Battery undervoltage protection	After the battery charge restores to be above low-voltage disconnection recovery voltage.
Fan fault	Check if the fan doesn't work or if it's blocked by something else.
Radiator overtemperature protection	When the device cools below the overtemperature recovery temperature, it shall restore to normal charge and discharge control.
Bypass overload protection, inverting overload protection	① Decrease consumer; ② Restart all-in-one machine and the load output is restored.
Inverting short-circuit protection	① Carefully check load connection condition, clear short-circuit fault point; ② After power on again, the load output is restored.
PV overvoltage	Check whether PV input voltage exceeds maximum allowable input voltage with a multimeter.
No connection alarm of battery	Check whether the battery is not disconnected or whether the breaker at the battery side is not closed.

7. System Maintenance

- **In order to maintain the optimum and permanent operation performance, it is suggested to check the following items semiannually.**

1. Confirm that the air flow around the all-in-one machine will not be blocked. In addition, remove any dirt or debris from the radiator.
2. Check whether the insulation of all exposed wires is damaged due to sun exposure, friction with other objects around, dry rot, insect or rat damage, etc. If necessary, it is required to repair or replace the wires.
3. Verify that the indication and display are consistent with the operation of the device. Please pay attention to any fault or error display and take corrective measures if necessary.
4. Check all terminals for corrosion,insulation damage,high temperature or burning/discoloration sign, and tighten the terminal screws.
5. Check for dirt, nesting insects and corrosion phenomenon and clean as required.
6. If the arrester has failed, replace the failed arrester in time to protect the all-in-one machine and other user device against lightning damage.

Warning: Danger of electric shock! To perform above operations, make sure that all the power supplies of the all-in-one machine have been broken and all the capacitor electricity has been discharged. Afterwards, corresponding inspection or operation can be performed!

- **We are not responsible for any following damage:**

① Damage caused by improper use or use in inappropriate place.
② Open-circuit voltage of photovoltaic module exceeds maximum allowable voltage.
③ The damage caused by the operation ambient temperature beyond the limited operation temperature range.
④ Personally take apart and maintain the all-in-one machine.
⑤ Damage caused by force majeure: damage caused by transportation and handling of the all-in-one machine.

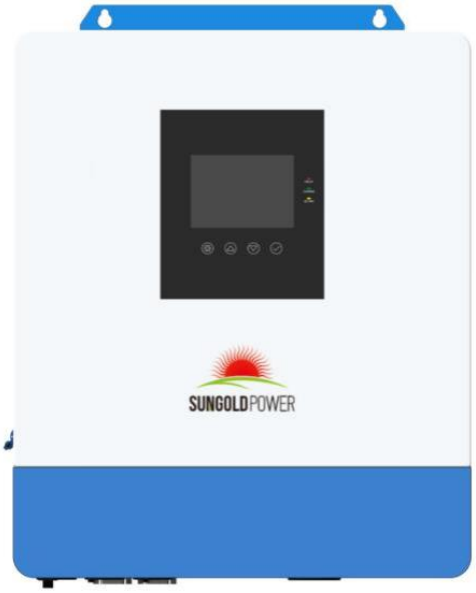
8. Technical Parameter

Model	SPH504880A
AC mode	
Rated input voltage	110/120Vac
Input voltage range	(90Vac-140Vac)
Frequency	50Hz/ 60Hz (auto-detect)
Frequency range	47±0.3Hz ~ 55±0.3Hz (50Hz); 57±0.3Hz ~ 65±0.3Hz (60Hz);
Overload/short- circuit protection	Breaker
Efficiency	>95%
Conversion time	10ms (Typical value)
Anti-reflux	yes
Max. bypass overload current	63A
Inverting mode	
Output voltage waveform	Pure sine wave
Rated output power	5000VA
Rated output power	5000W
Power factor	1
Rated output voltage	120Vac (100/105/110Vac Settable)
Output voltage error	±5%
Output frequency range	50Hz ± 0.3Hz/60Hz ± 0.3Hz
Efficiency	>90%
Overload protection	(102%<load<125%): Alarm and shutdown after 5 minutes. (125%<load<150%): Alarm and shutdown after 10 seconds. Load>150%: Alarm and shutdown after 5 seconds.
Peak power	10000VA
Loaded motor capacity	4HP
Output short-circuit protection	Breaker
Specification of bypass breaker	63A
Rated battery input voltage	48V (minimum start voltage 44V)
Battery voltage range	40.0Vdc~60Vdc ± 0.6Vdc (undervoltage alarm/turnoff voltage/overvoltage alarm/overvoltage restoration...settable LCD screen)

Power saving mode	Load ≤50W
AC charge	
Battery type	Lead acid or lithium battery
Max. charge current	40A
Charge current error	± 5Adc
Charge voltage range	40–60Vdc
Short-circuit protection	Breaker and blown fuse
Overcharge protection	Alarm, stop charging after 1 minute
Solar charge	
Max. PV open circuit voltage	500Vdc
MPPT operation voltage range	120-450Vdc
Battery voltage range	40-60Vdc
Max. PV input power	5500W
Charge current range of solar energy (settable)	0~80A
Charge short-circuit protection	Blown fuse
Wiring protection	Inverse wiring protection
Certified specifications	
Certification	CE(IEC62109-1)/FCC/SAA
EMC authentication grade	EN61000
Operation temperature range	-10°C ~ 55°C
Storage temperature range	-25°C ~ 60°C
Humidity range	5% to 95% (three-proof paint protection)
Noise	≤60dB
Thermal dissipation	Forced cooling with adjustable air speed
Communication interface	USB/RS485 (WiFi/GPRS)/dry node control
Dimension (L*W*D)	426mm*322mm*126mm
Weight	11.5kg

All-in-one solar charge inverter

User Manual



Product Model:

SPH5048P

Version: V2.7

Important safety instructions

Please keep this manual for future use.

This manual contains all safety, installation and operating instructions for the SPH Series all-in-one solar storage inverter.

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

- Non-safety voltage exists inside the all-in-one solar storage inverter. To avoid personal injury, users shall not disassemble the all-in-one solar storage inverter themselves. Contact our professional maintenance personnel if there is a need for repair.
- Do not place the all-in-one solar storage inverter within the reach of children.
- Do not install the all-in-one 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 all-in-one solar storage inverter is hot when it is working. Do not touch it.
- Do not open the terminal protective cover when the all-in-one solar storage inverter is working.
- It is recommended to attach proper fuse or circuit breaker to the outside of the all-in-one 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 all-in-one solar storage inverter.
- After installation, check that all wire connections are tight to avoid heat accumulation due to poor connection, which is dangerous.
- The all-in-one 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 all-in-one solar storage inverter, which integrates solar energy storage & means 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 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.

Features:

1. Anti-backflow grid connection function, support for inverter and mains power hybrid output, support for use without battery, can be set up for on-grid power generation.
2. Two output modes: mains bypass and inverter output; uninterrupted power supply.
3. Available in 2 charging modes: Only Solar, and Grid & 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. With time slot control, you can set the priority of using the mains and battery according to the time slot in conjunction with the local peak and valley tariffs.
7. Power saving mode available to reduce no-load loss.
8. Intelligent variable speed fan 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-around 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 all-in-one solar storage inverter, or directly invert into AC power to drive the load.

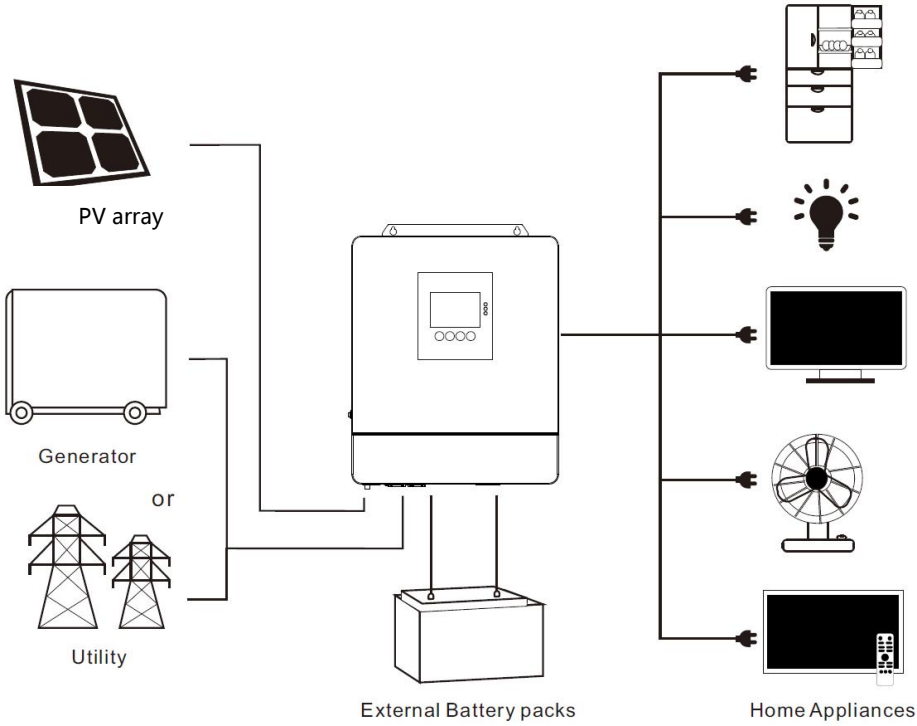
2. Mains or generator: Connected at the AC input, to power the load while charging the battery. If the mains or generator is not connected, the system can also operate normally, and the load is powered by the battery and PV module.

3. Battery: Provided to ensure normal power supply to the system loads when solar energy is insufficient and the Mains is not connected.

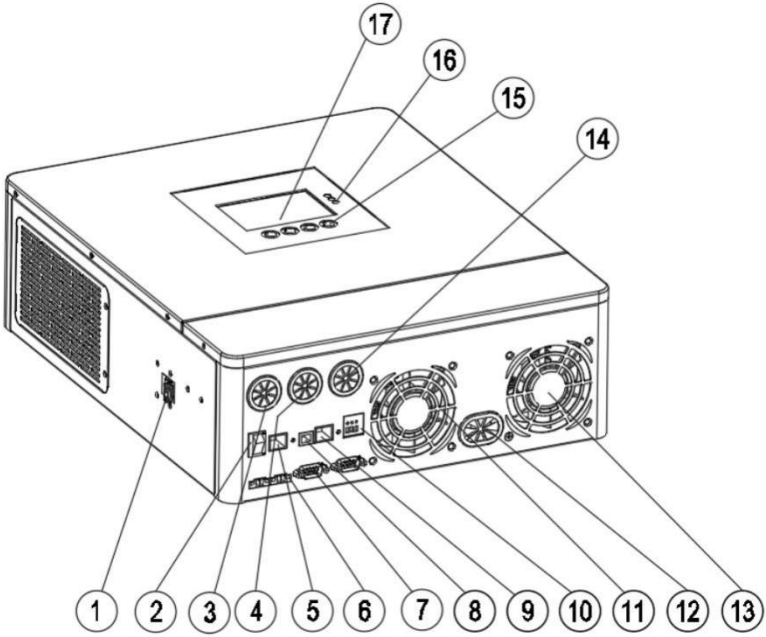
4. Household load: Allow connection of various household and office loads, including refrigerators, lamps, TVs, fans and air conditioners.

5. All-in-one solar storage inverter: The energy conversion unit of the whole system.

Specific system wiring method depends on the actual application scenario.

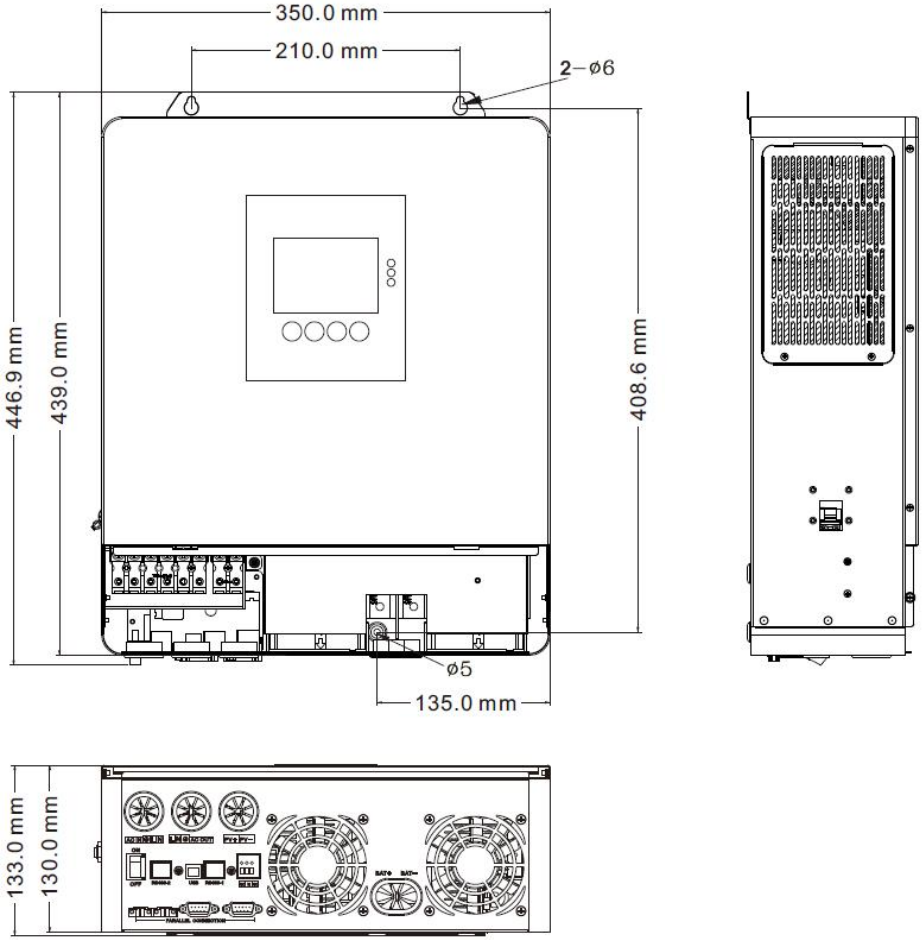


1.3 Appearance



①	Overload protector	⑩	Dry contact port
②	ON/OFF rocker switch	⑪	Cooling fan
③	AC input port	⑫	Battery port
④	AC output port	⑬	Cooling fan
⑤	RS485 communication port	⑭	PV port
⑥	Current sharing port (parallel module only)	⑮	Setup button
⑦	Parallel communication port (parallel module only)	⑯	Indicator light
⑧	USB communication port	⑰	LCD screen
⑨	WIFI communication port		

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 all-in-one solar storage inverter for heat dissipation. Do not install the all-in-one 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 all-in-one 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 all-in-one 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 all-in-one 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 storage 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 circuit breaker type
SPH5048P	4mm^2/12AWG	22A	2P—25A

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 circuit breaker type
SPH5048P	10mm^2/8AWG	63A	2P—63A

Note: There is already an appropriate circuit breaker at the Mains input wiring terminal, so it is not necessary to add one more.

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

Model	Recommended battery wiring diameter	Rated battery discharge current	Maximum charge current	Recommended circuit breaker type
SPH5048P	35mm^2/2AWG	125A	100A	2P—200A

- **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 circuit breaker type
SPH5048P	10mm^2/8AWG	42A	63A	2P—63A

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

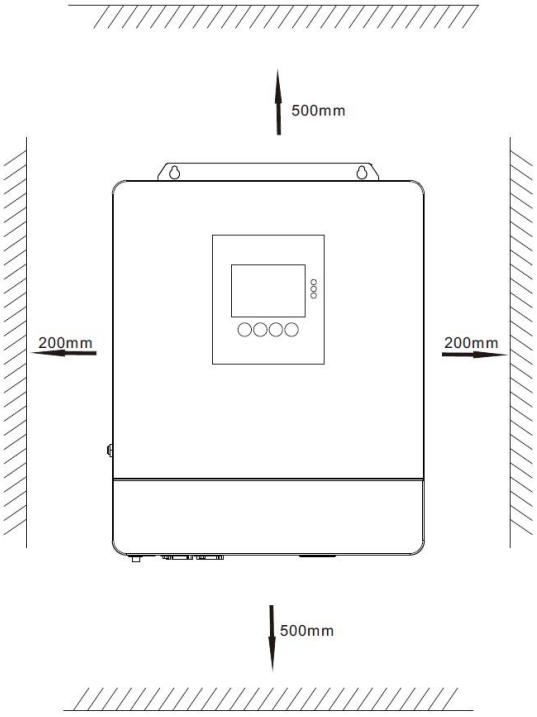
Note: The above are only recommended wiring diameter and circuit breaker. Please select the appropriate wiring diameter and circuit breaker according to actual situations.

2.3 Installation and wiring

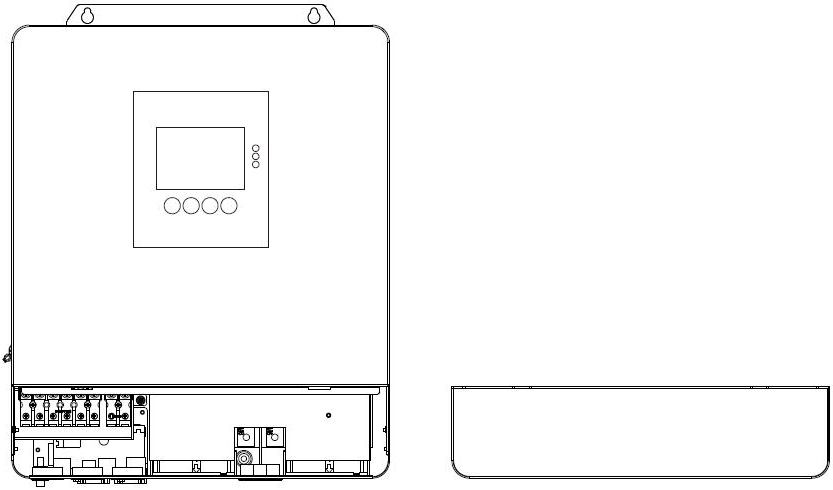
Installation steps:

Step 1: Determine the installation position and the space for heat dissipation. Determine the installation position of the all-in-one solar storage inverter, such as wall surface; when installing the all-in-one solar storage inverter, ensure that there is enough air flowing through the heat sink, and space of at least 200m m 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.

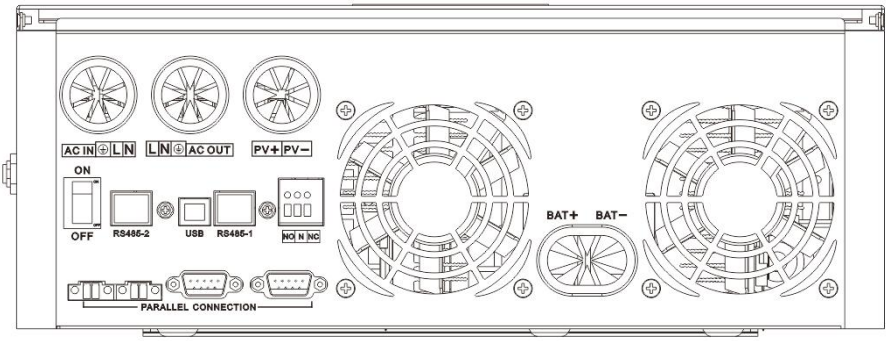
Warning: Danger of explosion! Never install the all-in-one solar storage inverter and lead-acid battery in the same confined space! Also do not install in a confined place where battery gas may collect.



Step 2: Remove the terminal cover.



Step3: Wiring.

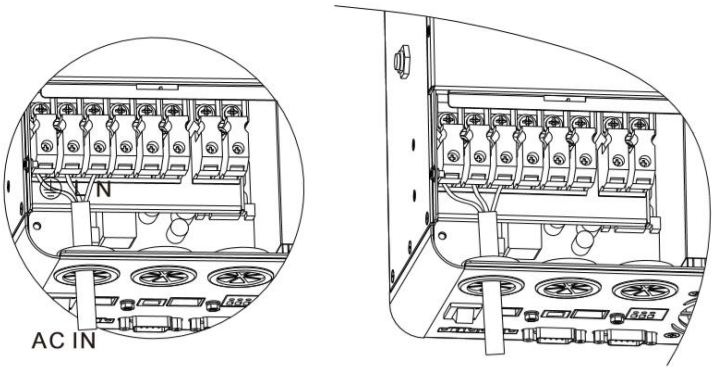


AC input / output wiring method:

1. Prior to AC input/output wiring, opening 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";

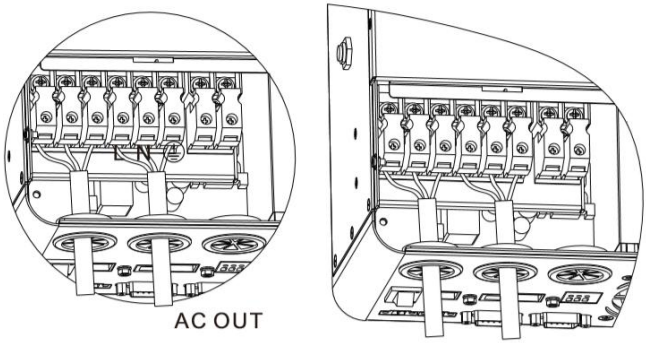
2. Properly connect the AC input wire according to the wire sequence and terminal position shown in the figure below. Please connect the ground wire first, and then the live wire and the neutral wire;

⏚ : Ground L : Live N : Neutral



2. 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



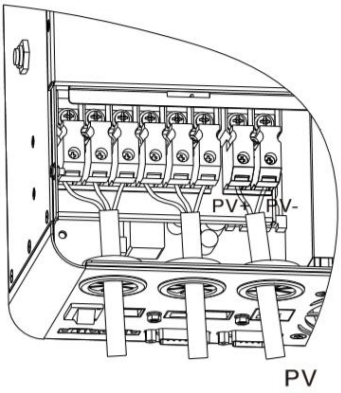
Note: The grounding wire shall be as thick as possible (cross-sectional area is not less than 4mm^2). The grounding point shall be as close as possible to the all-in-one solar storage inverter. The shorter the grounding wire, the better.

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: When used in parallel connection, different machines need to be connected to different PV arrays or PV sources.

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

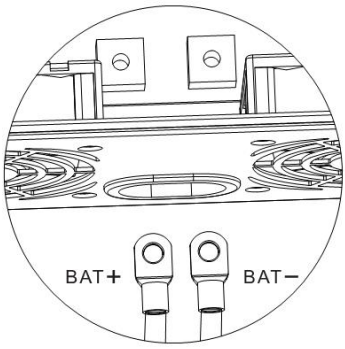


BAT wiring method:

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 6mm 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**



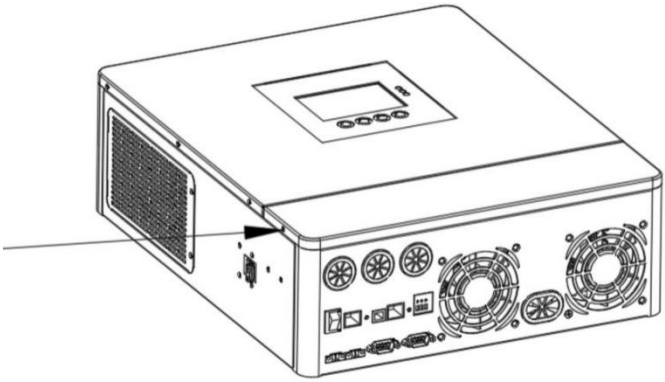
Warnings:

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

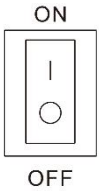
2. Be very careful during wiring; do not close the circuit breaker or fuse during wiring, and ensure that the "+" and "-" pole leads of each component are connected properly; a circuit breaker must be installed at the battery terminal. Refer to Section 2.2 "Wiring Specifications and Circuit Breaker Selection" 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 all-in-one 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 all-in-one 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 all-in-one solar storage inverter does not work properly or the LCD or indicator is abnormal, refer to Chapter 6 to handle the exceptions.

2.4 Parallel machine wire connection

2.4.1 Introduction

1. Up to six units connected in parallel.
2. When using the parallel operation function, the following connecting lines (package accessories) shall be firmly and reliably connected:

DB15 Parallel communication line*1: **Current sharing detection line*1:**

2.4.2 Precautions for connecting the parallel connecting lines

Warning:

1. **PV connection:**

   When used in parallel connection, different machines need to be connected to different PV arrays or PV sources.

2. **Battery wiring:**

   Parallel connection in single or split phase: Ensure that all all-in-one solar storage inverters are connected to the same battery, with BAT + connected to BAT + , BAT - connected to BAT -, and that the connection is correct with the same wiring length and line diameter before power on and start-up, so as to avoid the abnormal operation of parallel system output caused by wrong connection.

3. **AC OUT wiring:**

   Parallel connection in single phase: Ensure L-to-L, N-to-N and PE-to-PE connection for all all-in-one solar storage inverters, and that the connection is correct with the same wiring length and line diameter before power on and start-up, so as to avoid the abnormal operation of parallel system output caused by wrong connection. For specific wiring, please refer to 2.4.3 Wiring Diagram.

Parallel connection in split phase: Ensure N-to-N and PE-to-PE connection for all all-in-one solar storage inverters. The L lines of all inverters connected to the same phase need to be connected together. But L lines of different phases cannot be joined together. Other connection precautions are the same as parallel connection in single phase. For specific wiring, please refer to 2.4.4 Wiring Diagram.

4. **AC IN wiring:**

Parallel connection in single phase: Ensure L-to-L, N-to-N and PE-to-PE connection for all all-in-one solar storage inverters, and that the connection is correct with the same wiring length and line diameter before power on and start-up, so as to avoid the abnormal operation of parallel system output caused by wrong connection. Meanwhile, it is not allowed to have multiple different AC source inputs to avoid damage to the external equipment of the inverter. The consistency and uniqueness of AC source input shall be ensured. For specific wiring, please refer to 2.4.3 Wiring Diagram.

Parallel connection in split phase: Ensure N-to-N and PE-to-PE connection for all all-in-one solar storage inverters. The L lines of all inverters connected to the same phase need to be connected together. But L lines of different phases cannot be joined together. Other connection precautions are the same as parallel connection in single phase. For specific wiring, please refer to 2.4.4 Wiring Diagram.

5. **Wiring of parallel communication line**:

Parallel connection in single or split phase: Our company's parallel communication line is a DB15 standard computer cable with shielding function. Ensure the "one-in-one-out" rule when connecting each inverter, that is, connect the male connector (out) of this inverter with the female connector (in) of the inverter to be paralleled. Do not connect the male connector of the inverter to its female connector. In addition, make sure to tighten the parallel communication line of each inverter with self-contained end screws of DB15 to avoid the abnormal operation or damage of the system output caused by the falling off or poor contact of the parallel communication line.

6. **Wiring of current sharing detection line**:

Parallel connection in single phase: Our company's current sharing detection line is a twisted connection line. Ensure the "one-in-one-out" rule when connecting each inverter,

that is, connect the current sharing line of the inverter with the current sharing green port of the inverter to be paralleled (choose one port from the two, and there is no mandatory sequence requirement). The current sharing ports of the inverter cannot be connected to each other. In addition, make sure that the red and black current sharing connection lines of each inverter are not manually exchanged, and make sure to tighten the lines with self-contained screws to avoid the abnormal operation or damage of the system output caused by abnormal parallel current sharing detection. For specific wiring, please refer to 2.4.3 Wiring Diagram.

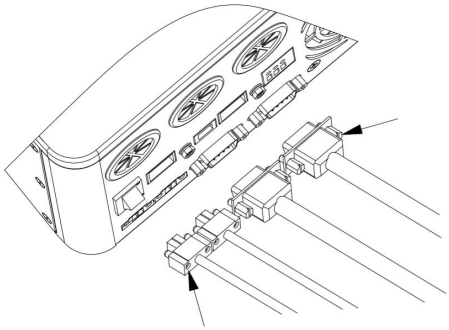
Parallel connection in split phase: The current sharing detection lines of all inverters connected to the same phase need to be connected together. But the current sharing detection lines of different phases cannot be joined together. Other connection precautions are the same as parallel connection in single phase. For specific wiring, please refer to 2.4.4 Wiring Diagram.

7. Before or after connecting the system, please carefully refer to the following system wiring diagram to ensure that all wiring is correct and reliable before power on.

8. After the system is wired, powered on and in normal operation, if a new inverter needs to be connected, make sure to disconnect the battery input, PV input, AC input and AC output, and that all all-in-one solar storage inverters are powered off before reconnecting into the system.

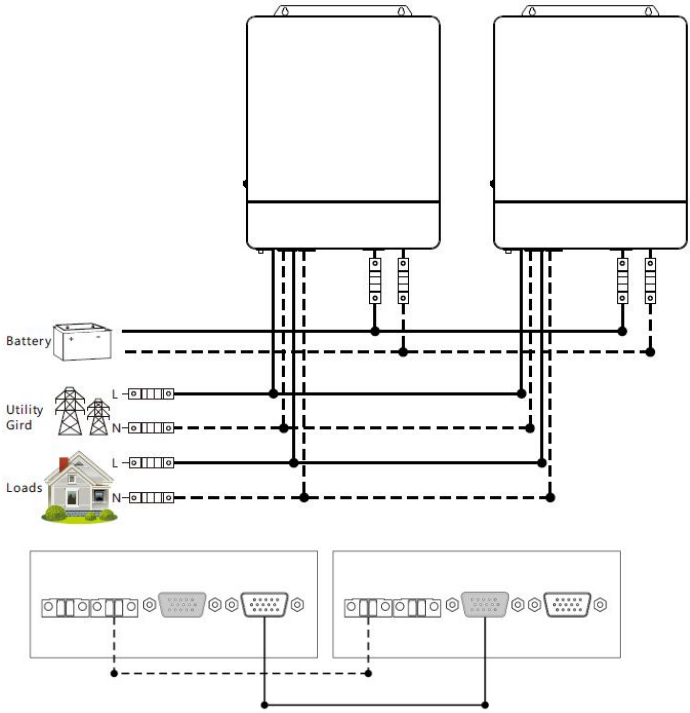
2.4.3 Schematic diagram of parallel connection in single phase

1. The parallel communication line and current sharing detection line of the all-in-one solar storage inverter need to be locked with screws after connecting. The schematic diagram is as follows:

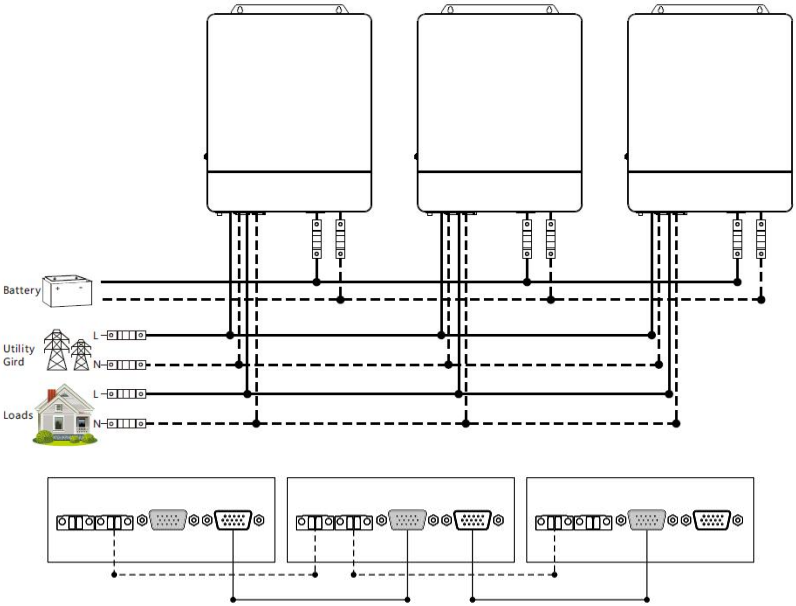


2. In case of parallel operation with multiple inverters, the schematic diagram of parallel connection is as follows:

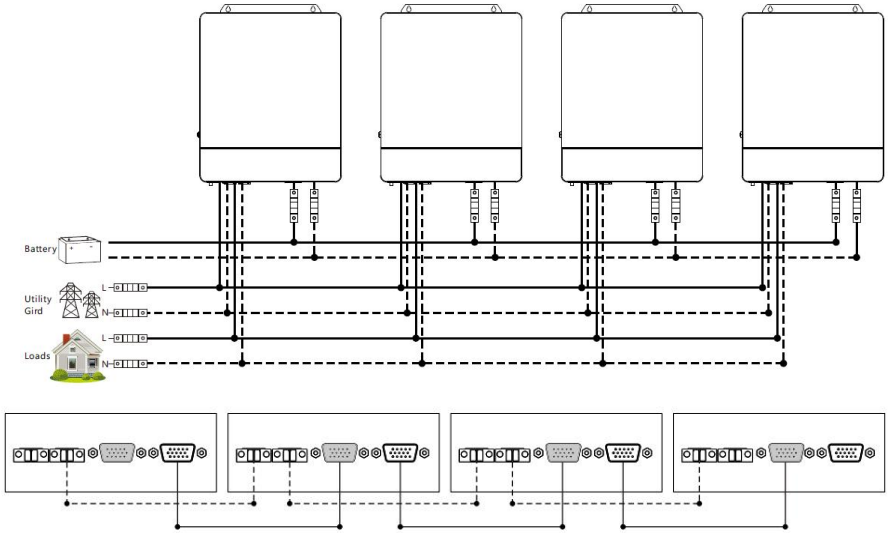
   a) Two all-in-one solar storage inverters of the system connected in parallel:



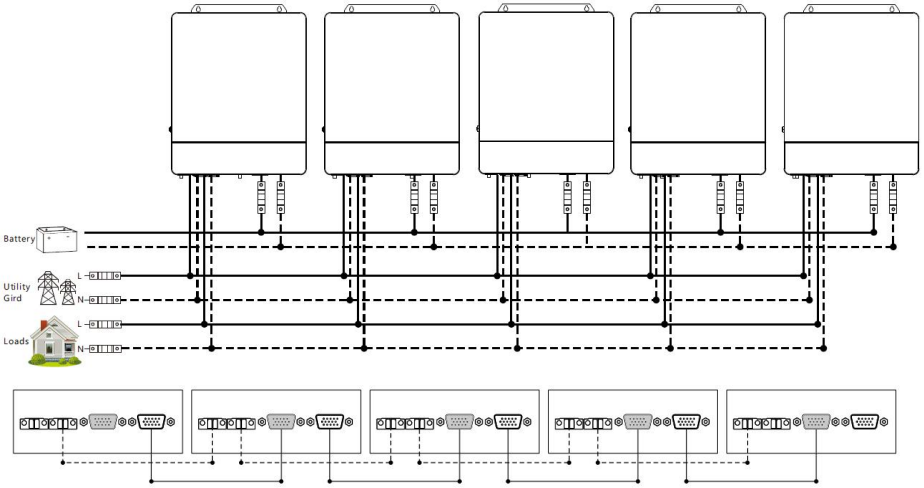
b) Three all-in-one solar storage inverters of the system connected in parallel:



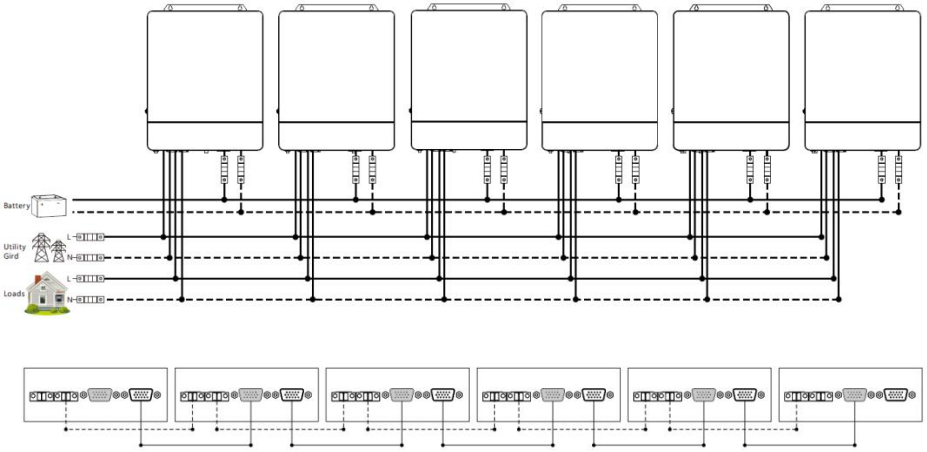
c) Four all-in-one solar storage inverters of the system connected in parallel:



d) Five all-in-one solar storage inverters of the system connected in parallel:

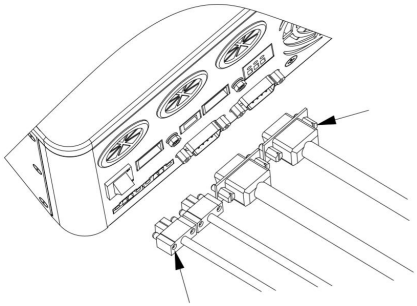


e) Six all-in-one solar storage inverters of the system connected in parallel:



2.4.4 Schematic diagram of parallel connection in split phase

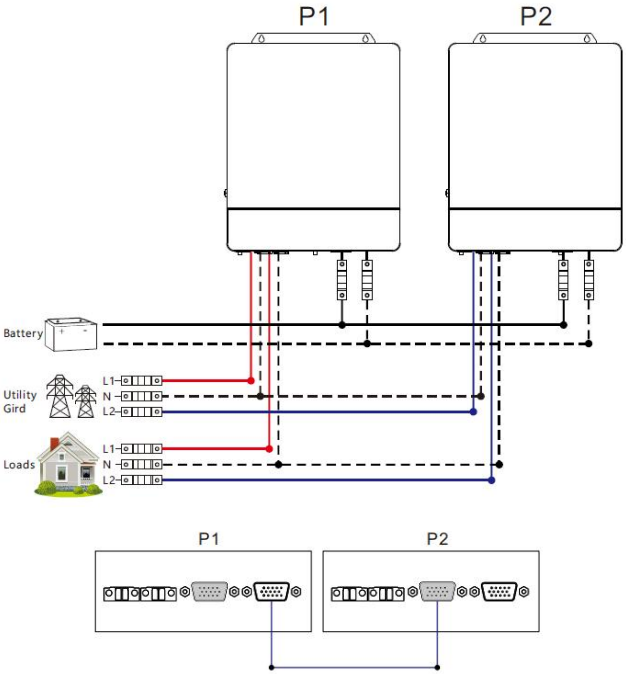
1. The parallel communication line and current sharing detection line of the all-in-one solar storage inverter need to be locked with screws after connecting. The schematic diagram is as follows:



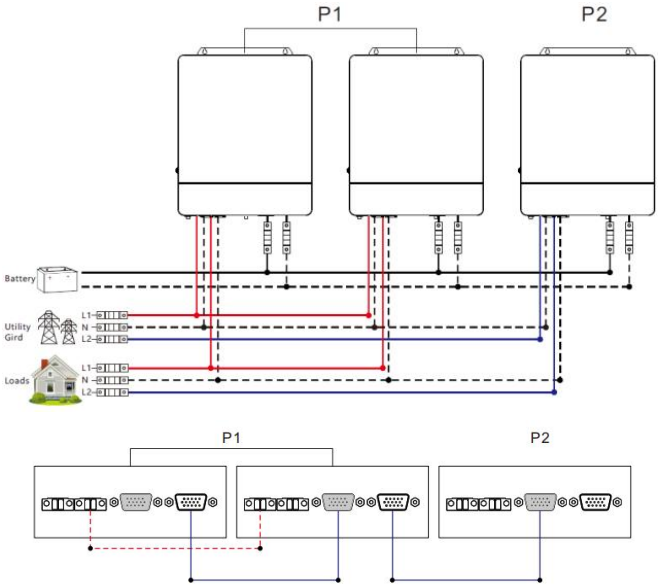
2. In case of parallel operation with multiple inverters, the schematic diagram of parallel connection is as follows:

Parallel Operation in two phase (only for U series model can be set):

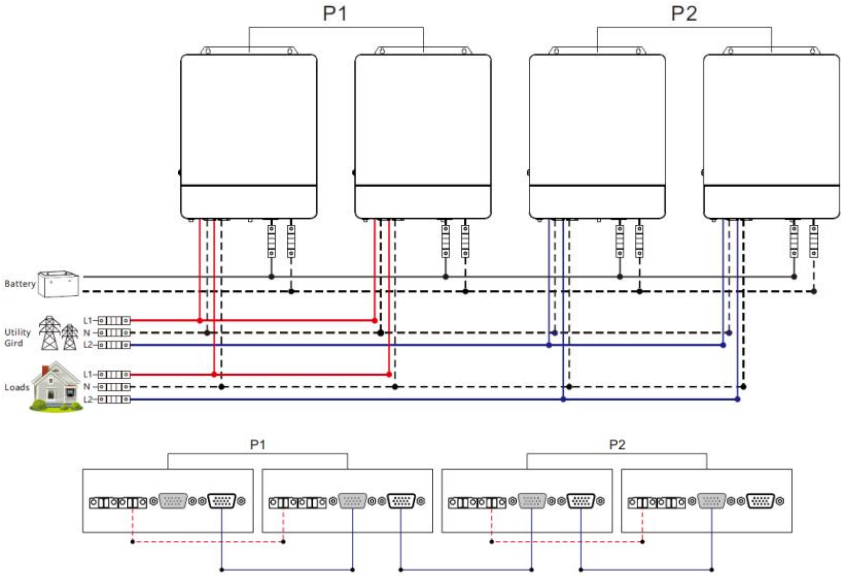
a) Two all-in-one solar storage inverters of the system connected in two phase: 1+1 system:



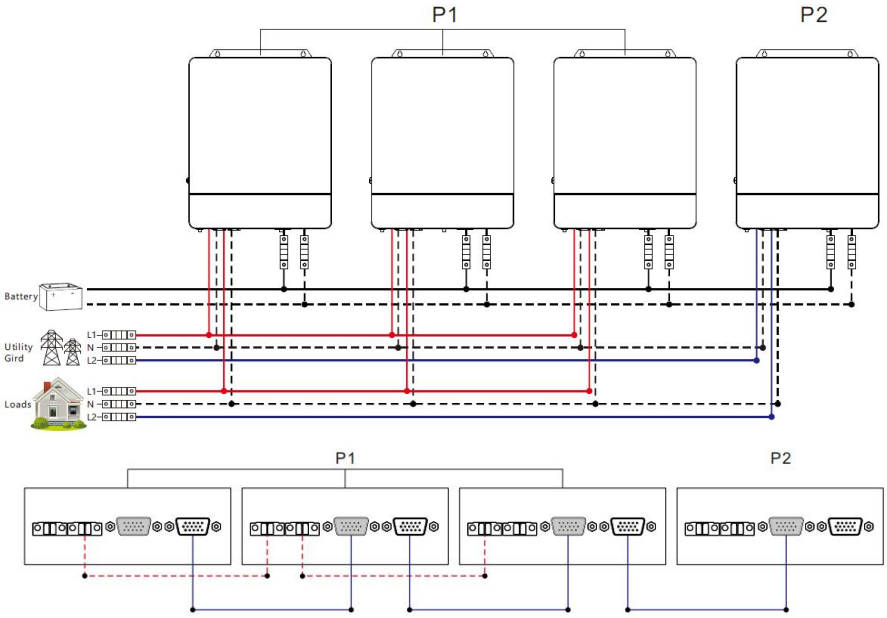
b) Three all-in-one solar storage inverters of the system connected in two phase: 2+1 system:



c) Four all-in-one solar storage inverters of the system connected in two phase: 2+2 system:

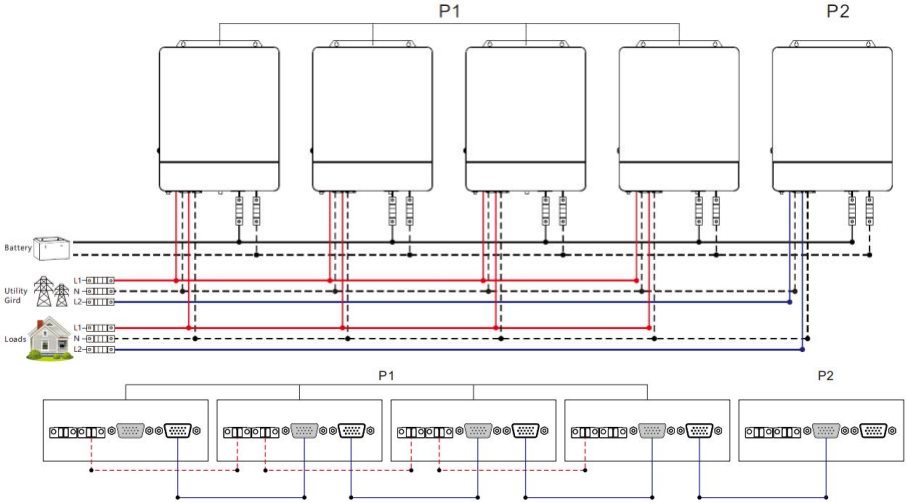


3+1 system:

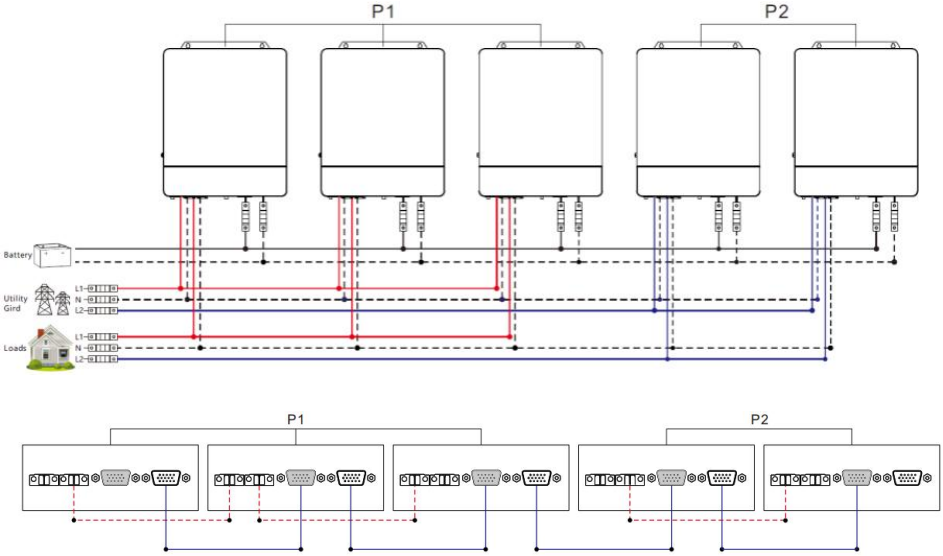


d) Five all-in-one solar storage inverters of the system connected in two phase:

4+1 system:

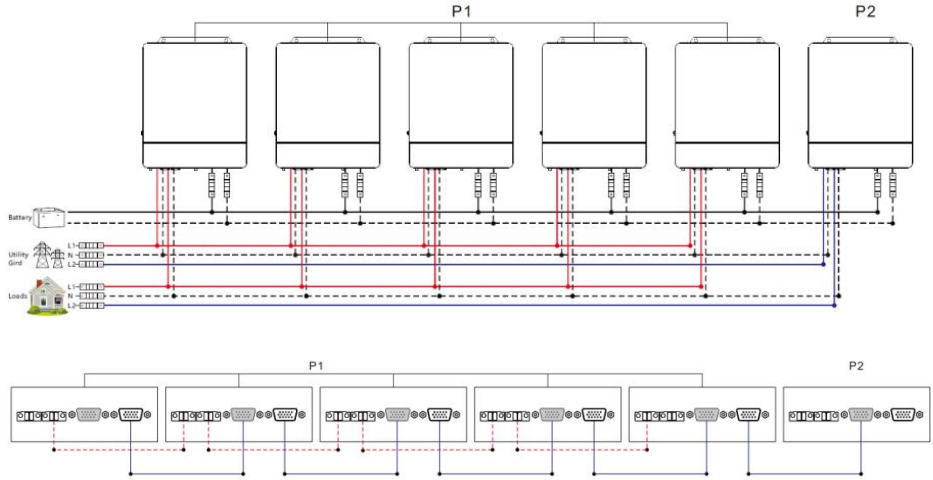


3+2 system:

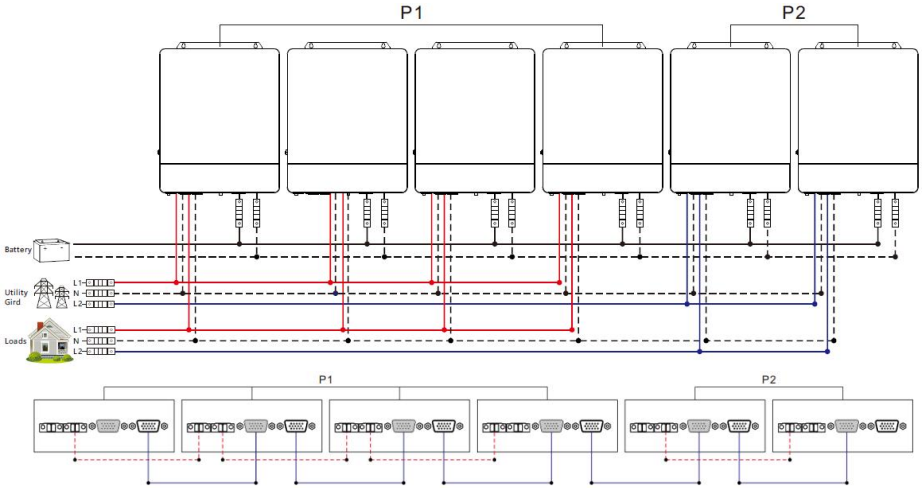


e) Six all-in-one solar storage inverters of the system connected in two phase:

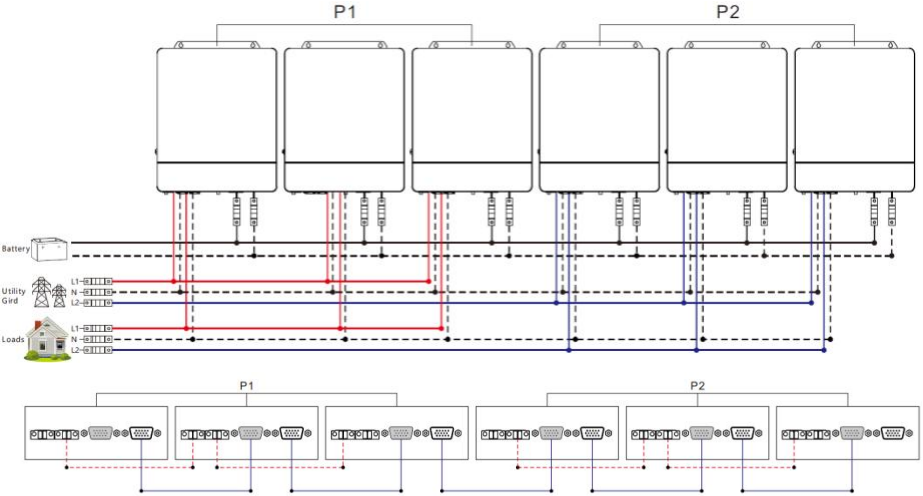
5+1 system:



4+2 system:

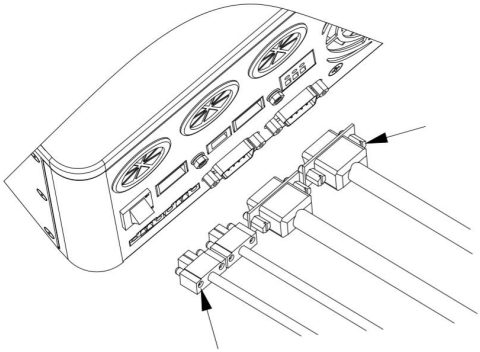


3+3 system:



2.4.5 Schematic diagram of parallel connection in three phase

1. The parallel communication line and current sharing detection line of the all-in-one solar storage inverter need to be locked with screws after connecting. The schematic diagram is as follows:

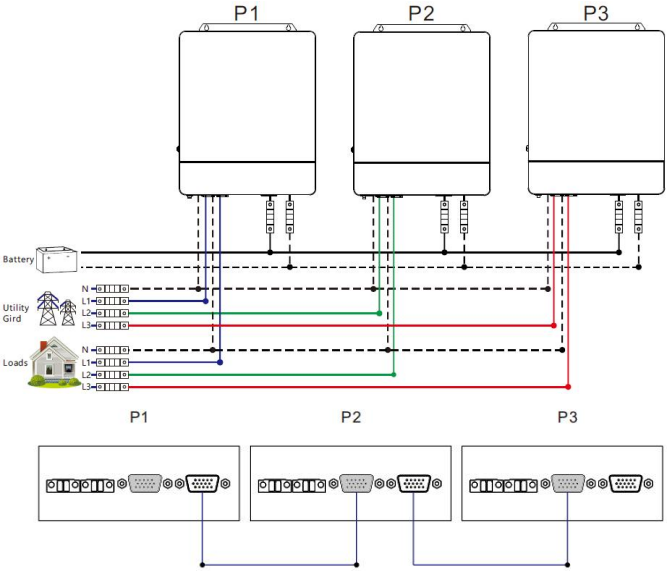


3. In case of parallel operation with multiple inverters, the schematic diagram of parallel connection is as follows:
4.

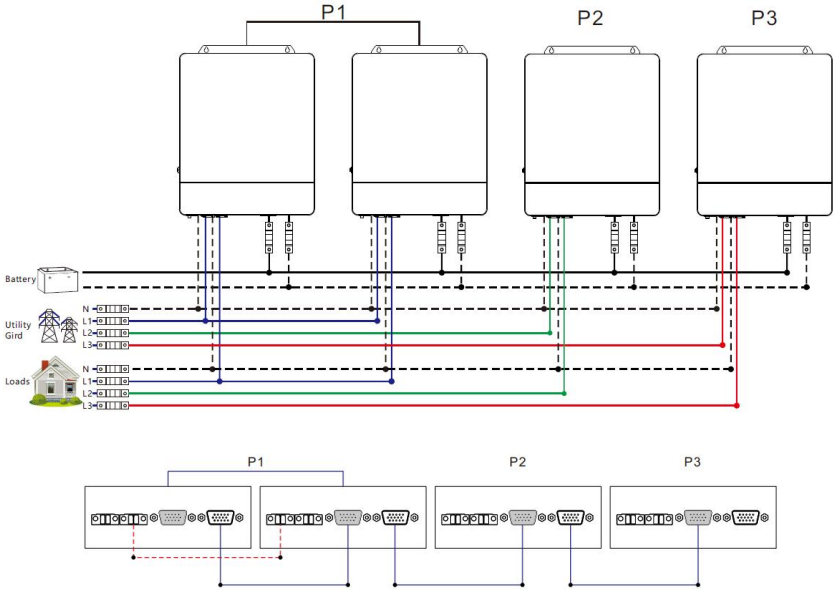
Parallel Operation in three phase :

a) Three all-in-one solar storage inverters of the system connected in three phase:

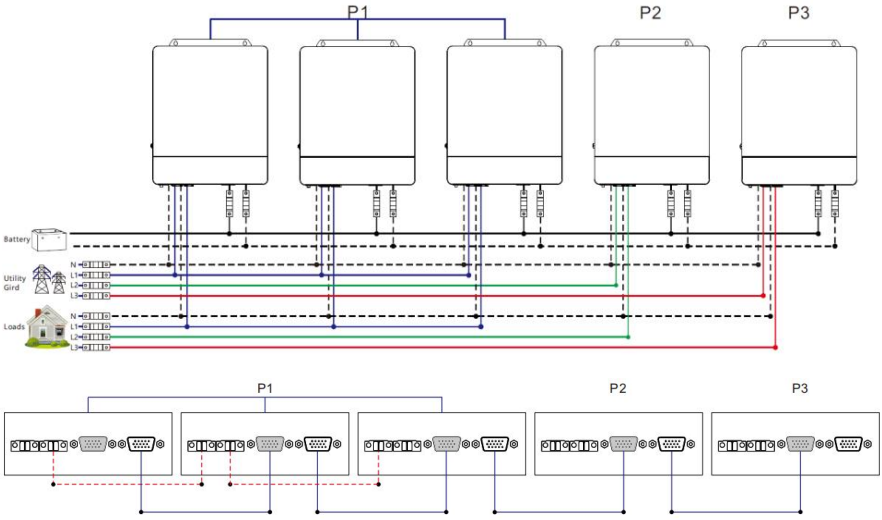
1+1+1 system:



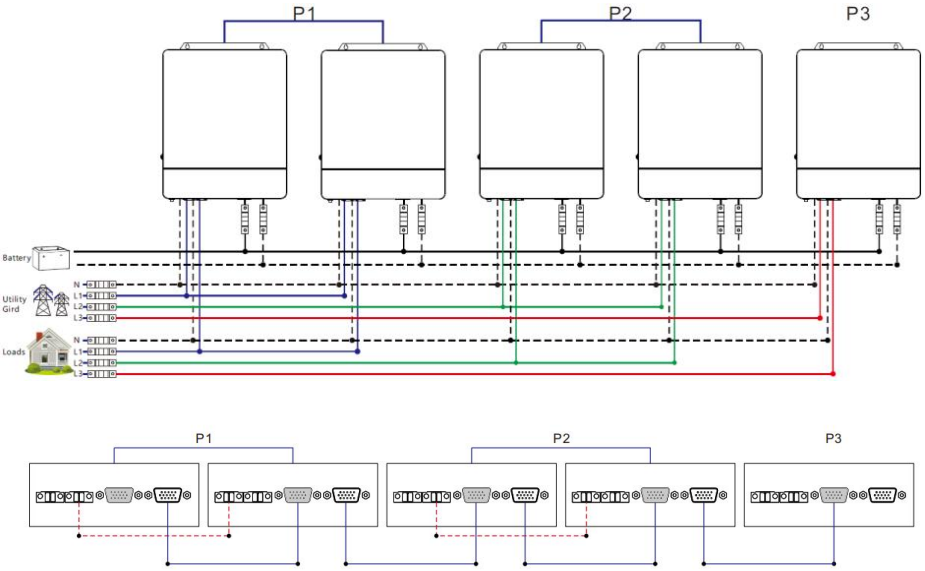
b) Four all-in-one solar storage inverters of the system connected in three phase: 2+1+1 system:



c) Five all-in-one solar storage inverters of the system connected in three phase: 3+1+1 system:

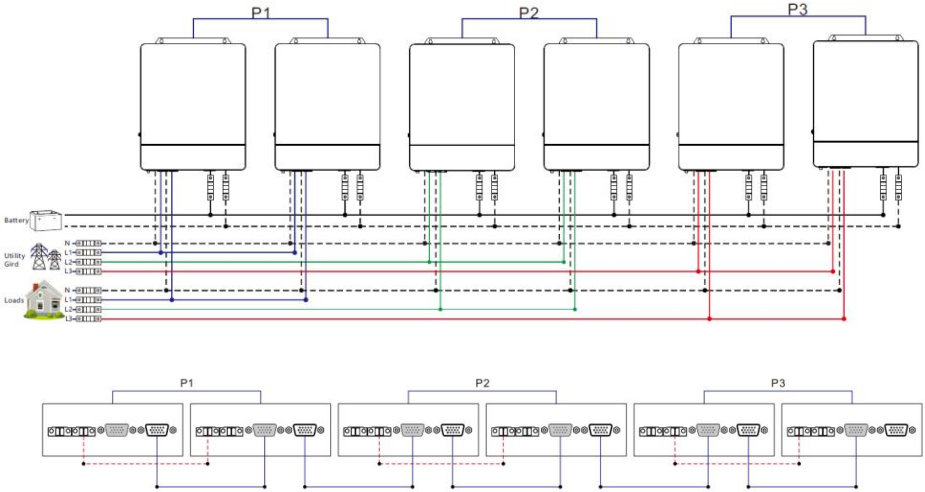


2+2+1 system:

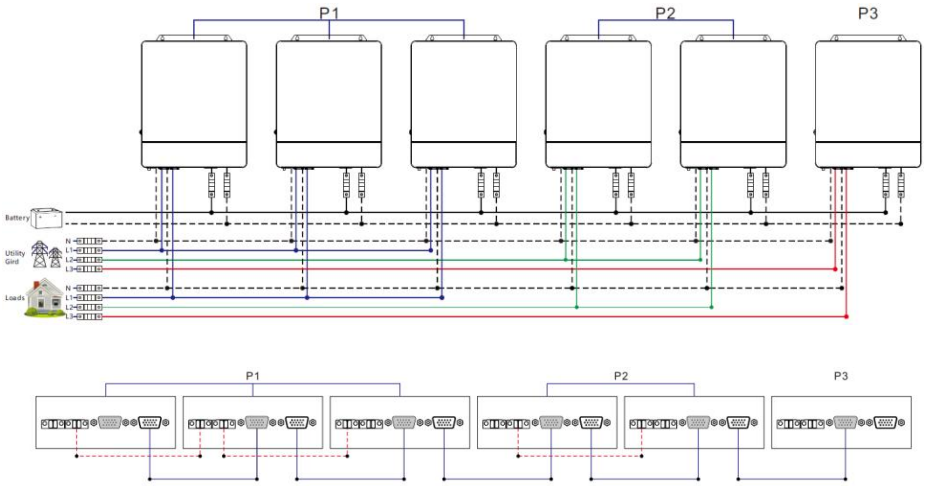


d) Six all-in-one solar storage inverters of the system connected in three phase:

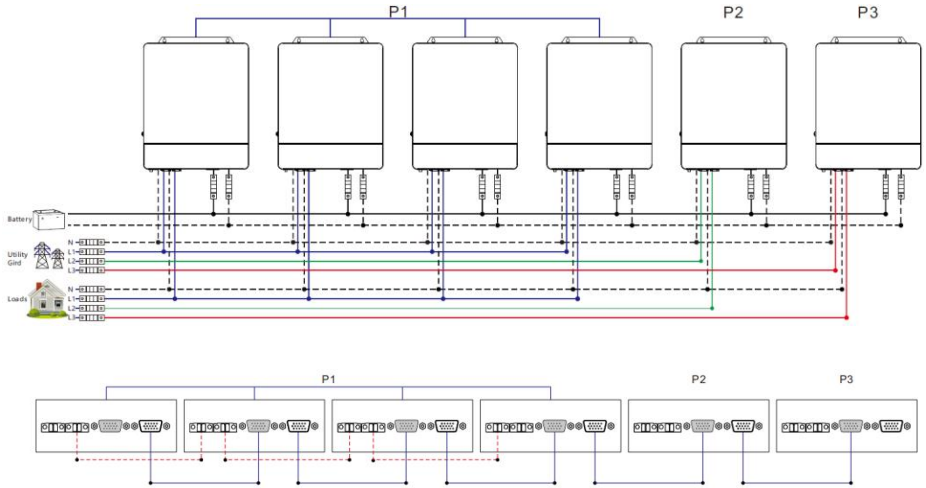
2+2+2 system:



3+2+1 system:



4+1+1 system:



Note:

1) Before starting up and running, please check whether the connection was correct to avoid any abnormalities in the system.

2) All wiring must be fixed and reliable to avoid wire drop during use.

3) When the AC output is wired to the load, it shall be properly wired according to the requirements of the electrical load equipment to avoid damage to the load equipment.

4) Settings [38] need to be set consistently or only for the host. When the machine is running, the voltage set by the host shall prevail, and the master will force the rewrite of the other slave machines to keep the same set. Only can be set in the standby mode.

5) Machine factory default for single machine mode, if you use parallel, split-phase or three-phase function, you need to set the [31] item parameters through the screen. The setting method is: power on one machine at a time, the rest of the machine off, and then set the [31] item parameters according to the site system operation mode. After this machine is set successfully, turn off the machine switch and wait for the machine to be powered down, then set the rest of the machines in turn until all machines are set, and then all machines are powered up again at the same time and enter the working state.

The [31] setting item：

When in single phase parallel connection : setting【31】should be set as 【PAL】

When in single phase parallel connection, setting【31】 should be set as follows：

When in three phase parallel connection ,all machines in phase 1 must be set as “3P1”, all machines in phase 2 must be set as “3P2” all machines in phase 3 must be set as “3P3”, at present, the voltage phase difference between P1-P2, P1-P3 and P2-P3 is 120 degrees.

- When the output voltage set in the setting 【38】 is 120 Vac, the line voltage between L1 in phase 1 and L2 in phase 2 is 120*1.732 = 208 Vac, similarly the line voltage between L1-L3, L2-L3 is 208 Vac; the single phase voltage between L1-N, L2-N, L3-N is 120 Vac.

In split phase parallel connection (U) , All connected P1-phase inverters are set to "2P0"：

1) If all connected P2-phase inverters are set to "2P1", AC output line voltage difference is 120 degrees (L1-L2), line voltage is 120*1.732= 208Vac; Phase voltage is 120Vac (L1-N; L2-N).

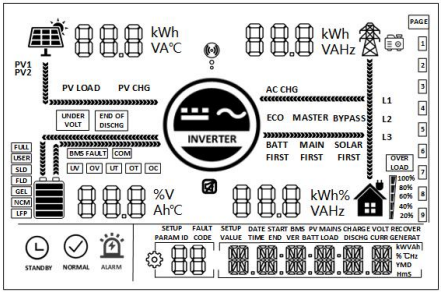
2) If all connected P2-phase inverters are set to "2P2", AC output line voltage difference is 180 degrees (L1-L2), line voltage is 120*2= 240Vac; Phase voltage is 120Vac (L1-N; L2-N).

6) After the system runs, the output voltage is measured correctly, and then the load setting is connected.

3. LCD screen operating instructions

3.1 Operation and display panel

The operation and display panel is shown below, including one LCD screen, 3 indicator lights and 4 operation buttons.



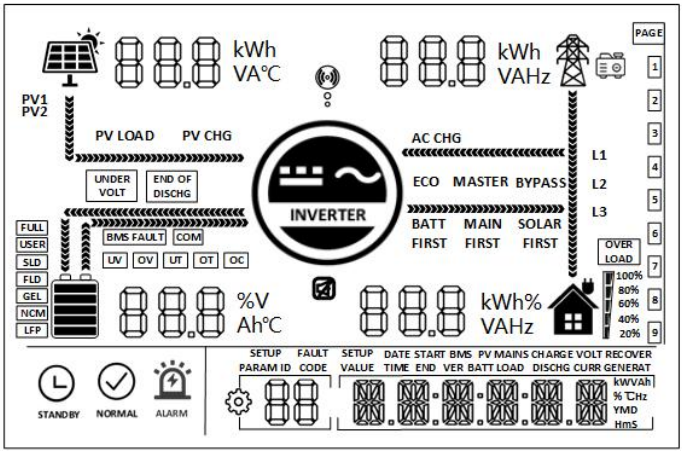
Operation buttons introduction

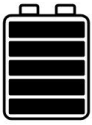
Function Key	Description
	Menu of Enter/Exit Settings
	Page Number/Option Increase
	Page Number/Option Decrease
	Under the menu of Settings, OK/Enter Options

Indicators introduction

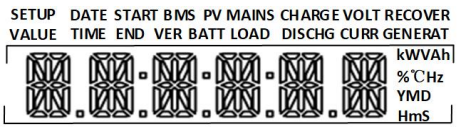
Indicator light	Color	Description
AC/INV	Yellow	Normally On: Mains Power output
		Flicker: Inverter output
CHARGE	Green	Flicker: The battery is being charged.
		Normally On: The charging is completed.
FAULT	Red	Normally On: Fault status

LCD screen introduction



Icon	function	Icon	function
	Indicates mains power		Indicates the inverter is working
	Indicates generator		Indicates home appliances
	Indicates solar power		Indicates AC output is overload
	 Battery remaining capacity is below 5%  Battery remaining capacity is 5%~19%  Battery remaining capacity is 20%~39%  Battery remaining capacity is 40%~59%  Battery remaining capacity is 60%~79%  Battery remaining capacity is 80%~100%		 Load percentage is below 5%  Load percentage is 5%~19%  Load percentage is 20%~39%  Load percentage is 40%~59%  Load percentage is 60%~79%  Load percentage is 80% ~ 100%
	Indicates that the machine is communicating with the Surveillance Equipment		Indicates that the buzzer is not enabled

FULL	Indicates that the battery is fully charged	USER	Indicates that the current battery type of the machine is user-defined
SLD	Indicates that the current battery type of the machine is sealed lead-acid battery	FLD	Indicates that the current battery type of the machine is flooded lead-acid battery
GEL	Indicates that the current battery type of the machine is gel battery	NCM	Indicates that the current battery type of the machine is NCM battery
LFP	Indicates that the current battery type of the machine is LFP battery	PAGE	Display the page number prompt of the main interface
1 2 3 4 5 6 7 8 9			Indicates the data page of the main display interface
STANDBY	Indicates that the machine is currently idle	NORMAL	Indicates that the machine is currently in normal operation
ALARM	Indicates that the machine is currently in an alarm or fault state		Indicates that the machine is currently in the parameter setting state
PV LOAD	Indicates that the PV is in a direct load state	PV CHG	Indicates that the PV is in a state of charge
AC CHG	Indicates that the AC is in a state of charge	BYPASS	Indicate that the Mains Power is in the bypass state
ECO	Indicates that the system is enabled in the ECO mode	BATT FIRST	Indicates that the output mode is Battery First
MAIN FIRST	Indicates that the output mode is Mains Power first	SOLAR FIRST	The indicated output mode is Solar First.
UNDER VOLT	Indicates battery under voltage	END OF DISCHG	Battery over-discharge
COM	Indicates internal communication failure	UV	Indicates system under voltage
OV	Indicates system over voltage	UT	Indicates system low temperature
OT	Indicates system over temperature	OC	Indicates system over current

BMS FAULT	Indicates BMS communication failure		Indicates the direction of energy flow
	When the system is in alarm or fault state, the main interface displays fault code; display setting options when setting		Display parameters of PV, battery, mains power and load
		Main Interface: display real-time time, date, total PV power generation, total load power consumption, RS485 address, version number Setting Interface: display setting contents	

Real-time data viewing method

On the LCD main screen, press  the button for page turning to view the real-time data of the machine.

Page	PV side parameters	Battery side parameters	Mains side parameters	Load side parameters	Comprehensive parameters
1	PV Voltage	Battery Voltage	AC Voltage	Load Voltage	Current Time
2	PV Current	Battery Current	AC Current	Load Current	Current Date
3	PV Power	BMS Batt SOC	AC Power	Load Power	PV Total kWh
4	PV Today kWh	BMS Batt Voltage	Reserved	Load Today kWh	Load Total kWh
5	PV Temperature	INV Temperature	AC Frequency	Load Frequency	RS485 Address
6	Maintenance Parm	Battery Rated Voltage	Today on grid power	Load kVA	Soft Version
7	PV Rated Voltage	Battery Rated Current	Reserved	Load Rated Power	Parallel Mode

3.2 Setup parameters description

Key Operation Instructions: Enter the setting menu and exit the setting menu, please press , After entering the setting menu, the parameter number [00] will flash. At this time, you can press the and key to select the parameter code to be set. Then press to enter the parameter editing state, at this time, the value of the parameter flashes, adjust the value of the parameter through the and , and finally press to complete the editing of the parameter and return to the parameter selection state.

The voltage setting logic: 【15】< 【12】< 【04/14】< 【35】< 【37】< 【05】< 【09/11】

Parameter Number	Parameter Name	Setting options	Description
00	Exit	[00]ESC	Menu of Exit Settings
01	Supply Priority Mode	[01] AC1ST	Photovoltaic energy priority with the load, photovoltaic is not enough, the grid power and photovoltaic mixed load, photovoltaic energy is enough with the load, the excess energy to charge the battery, the grid power only starts charging when the battery is too discharged (06 Settings as" OSO(only PV)) " , the grid power will not charge), the battery is only discharged when off the grid.
		[01] BT1ST	Inverter First Mode: switch to Grid Power only when the battery is under-voltage or lower than Parameter [04] Set Value.
		[01] PV1ST	Solar First Mode: switch to Mains Power when PV has failed or battery is lower than Parameter [04] Set Value.
		[01] Mix load **Default**	Solar energy priority charging, insufficient solar energy, grid energy and solar energy hybrid charging (if 06 Settings as" OSO(only PV) " ,the grid energy will not charge) and grid with load, when solar energy is enough to charge,excess energy not enough to load, excess solar energy and grid will hybrid load, the battery is able to discharge when off the grid.
02	Output Frequency (When the rocker switch is off can be set)	[02] 50.0	Bypass self-adaptation; when the mains is connected, it automatically adapts to the mains frequency; when the mains is disconnected, the output frequency can be set through this menu. The default output frequency of the 120V machine is 60Hz.
		[02] 60.0 **Default**	
03	AC Input Voltage	[03] UPS **Default**	Mains input voltage range of 120V machine: 90~140V.
		[03] APL	Mains input voltage range of 120V machine: 90~140V.

04	Battery to Mains	[04] 46V **Default**	When the Parameter [01] = BT1ST/PV1ST, the battery voltage is lower than the set value, and the output is switched from inverter to Mains Power, and the set range is 40V~52V.
05	Mains to Battery	[05] 56V **Default**	When the Parameter [01] = BT1ST/PV1ST, the battery voltage is higher than the set value or the battery is fully charged, and the output is switched from mains to inverter, and the set range is 48V~60V.
06	Charging mode	[06] Hybrid **Default**	Hybrid charging by PV and under utility grid give priority to PV, and use utility grid for supplementary if PV energy is insufficient. When the PV energy is sufficient, the utility grid will stop charging. **Note**: PV and utility grid are available for charging at the same time only when the bypass output is loaded, and only PV charging can be activated when the inverter is working.
		[06] ONLYPV	Only PV charging, no mains charging is enabled.
07	Maximum Charging Current	[07] 60A **Default**	Set Range of 0~100A.
08	Battery type	[08] USER	User-defined, all battery parameters can be set.
		[08] SLd	Sealed lead-acid battery with constant charge voltage of 57.6V and floating charge voltage of 55.2V
		[08] FLd	Flooded lead-acid battery with constant charge voltage of 58.4V and floating charge voltage of 55.2V
		[08] GEL **Default**	GEL lead-acid battery with constant charge voltage of 56.8V and floating charge voltage of 55.2V.
		[08]LFP14/LFP15/LFP16	LFP14/LFP15/LFP16 are corresponding to Battery Series of 14, 15 and 16, and their default constant charge voltages are 49.6V, 53.2V and 56.8V respectively, which can be adjusted.
		[08] NCM13/NCM14	NCM lithium battery, adjustable.
		[08] No battery	Disconnect battery.
09	Boost Voltage	[09] 57.6V **Default**	Setting of Boost Voltage: Set Range of 48V~58.4V, Step 0.4V, available when the battery type is user-defined and lithium battery.
10	Maximum Boost Duration	[10] 120 **Default**	Setting of Maximum Boost Duration, which is the maximum charging time when the voltage reaches the Parameter [09] when charging at constant voltage, with the Set Range of 5min~900min, and Step of 5min.

11	Float charge voltage	[11] 55.2V **Default**	Floating Charge Voltage, with the Set Range of 48V~58.4 V, Step of 0.4 V.
12	Over-discharge voltage	[12] 42V **Default**	Over-discharge Voltage: the battery voltage is lower than such criterion, and the Inverter output is turned off after the time delay parameter is set to [13], with the Set Range of 40V~48V and Step of 0.4V.
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 is turned off upon delay of time set by this Parameter, with the Set Range of 5S~50S, Step of 5S.
14	Battery under voltage alarm point	[14] 44V **Default**	Battery under-voltage alarm point: when the battery voltage is lower than such criterion, under-voltage alarm will be given, the output will not be shut down, with the Set Range of 40V~52V, Step of 0.4V.
15	Battery Discharge Limit Voltage	[15] 40V **Default**	Battery Discharge Limit Voltage: the battery voltage is lower than such criterion, output and shut down immediately. Set Range of 40V~52V, Step of 0.4V, available when the battery type is user-defined and lithium battery.
16	Equalization charge	[16] DIS	No equalization charging
		[16] ENA **Default**	Enable equalization charging, only Flooded lead-acid batteries, sealed lead-acid batteries and user-defined are effective.
17	Equalization Voltage	[17] 58V **Default**	Equalization Charging Voltage, with the Set Range of 48V~58V, Step of 0.4V, available for Flooded lead-acid battery, sealed lead-acid battery and user-defined.
18	Equalization Charging Time	[18] 120 **Default**	Equalization Charging Time, with the Set Range of 5min~900min, Step of 5min, available for Flooded lead-acid battery, sealed lead-acid battery and user-defined.
19	Equalized Charging Delay	[19] 120 **Default**	Equalization Charging Delay, with the Set Range of 5min~900min, Step of 5min, available for Flooded lead-acid battery, sealed lead-acid battery and user-defined.
20	Equalization Charge Interval Time	[20] 30 **Default**	Equalization Charge Interval Time, 0~30d, Step of 1d, available for Flooded lead-acid battery, sealed lead-acid battery and user-defined.
21	Equalization Charging Start-Stop	[21] ENA	Start equalization charging immediately.
		[21] DIS **Default**	Stop equalization charging immediately.

22	ECO mode	[22]DIS **Default**	Power saving mode disabled.
		[22] ENA	After the power saving mode is enabled, if the load is null or less than 50W, the inverter output is turned off after a delay for a certain period of time. When the load is more than 50W, the inverter automatic restart.
23	Overload Automatic Restart	[23] DIS	Overload automatic restart is disabled. If overload occurs, the output will be shut down, and the machine will not be restarted.
		[23] ENA **Default**	Enable overload auto restart. If overload occurs, shut down output, delay the machine for 3 min and then restart the output. After 5 times in total, no startup will be resumed.
24	Auto restart upon over-temperature	[24] DIS	Over-temperature automatic restart is disabled. If over-temperature occurs, the output will be shut down, and the machine will not be restarted for output.
		[24] ENA **Default**	Enable automatic restart upon over-temperature. If over-temperature occurs, shut down output, and restart output after the temperature has dropped.
25	Buzzer Alarm	[25] DIS	No Alarm
		[25] ENA **Default**	Enable alarm
26	Mode Change Reminder	[26] DIS	Alarm is disabled when the status of the main input source has change.
		[26] ENA **Default**	Alarm is disabled when the status of the main input source has change.
27	Inverter Overload to Bypass	[27] DIS	Automatic switch to Mains Power is disabled when the Inverter is overloaded.
		[27] ENA **Default**	Automatic switch to Mains Power when the inverter is overloaded.
28	Current of charging under grid electricity	[28] 40A **Default**	AC output 120Vac, with the Set Range of 0~40A
30	RS485 Address Setting	[30] 1 **Default**	RS485 communication address can be set within the range of 1~254 for stand-alone mode and 1 to 6 for parallel mode.

<table>
<tr><td rowspan="6">31</td><td rowspan="6">AC output mode （ When the rocker switch is off can be set ）</td><td>[31]SIG
Default</td><td>Single machine setting.</td></tr>
<tr><td>[31] PAL</td><td>Single-phase parallel connection setting.</td></tr>
<tr><td>[31]
2P0/2P1/2P2</td><td>Split-phase parallel connection setting.</td></tr>
<tr><td colspan="2">When the parameter [38] setting item=120.
All connected P1-phase inverters are set to "2P0" :
1) If all connected P2-phase inverters are set to "2P1", AC output line voltage difference is 120 degrees (L1-L2), line voltage is 120*1.732= 208Vac; Phase voltage is 120Vac (L1-N; L2-N).
2) If all connected P2-phase inverters are set to "2P2", AC output line voltage difference is 180 degrees (L1-L2), line voltage is 120*2= 240Vac; Phase voltage is 120Vac (L1-N; L2-N).</td></tr>
<tr><td>[31]
3P1/3P2/3P3</td><td>Three-phase parallel connection setting.</td></tr>
<tr><td colspan="2">All machines in phase 1 must be set as 【3P1】
All machines in phase 2 must be set as 【3P2】
All machines in phase 3 must be set as 【3P3】
When the output voltage set in the setting 【38】 is 120 Vac,
At present the line voltage between L1 in phase 1 and L2 in phase 2 is 120*1.732 = 208 Vac, similarly the line voltage between L1-L3, L2-L3 is 208 Vac; the single phase voltage between L1-N, L2-N, L3-N is 120 Vac.</td></tr>
<tr><td rowspan="2">32</td><td rowspan="2">Communication function</td><td>[32]SLA
Default</td><td>RS485-2 port for PC or telecommunication control.</td></tr>
<tr><td>[32] 485</td><td>RS485-2 port for 485-BMS communication.</td></tr>
<tr><td rowspan="2">33</td><td rowspan="2">BMS communication protocol</td><td colspan="2">When [32] enables BMS communication, the corresponding lithium battery manufacturer brand should be selected for communication.</td></tr>
<tr><td colspan="2">SGP=SUNGOLDPOWER，PAC=PACE，RDA=Ritar，AOG=ALLGRANDBATTERY，OLT=OLITER，XWD=SUNWODA, DAQ=DAKING, WOW=SNPOWER, PYL=PYLONTECH，VOL=WEILAN，DYE=DEYE，LUX=LUXPOWER</td></tr>
<tr><td>35</td><td>Battery Under-voltage Recovery Point</td><td>[35]52V
Default</td><td>When the battery is under-voltage, the battery voltage should be greater than this set value to restore the inverter AC output of the battery, and the set range is 44V~54.4V.</td></tr>
<tr><td>37</td><td>Battery Recharge Recovery Point</td><td>[37]52V
Default</td><td>After the battery is fully charged, the inverter will stop charging, and when the battery voltage is lower than this Value, the Inverter will resume charging again. And the set range is 44V~54V.</td></tr>
</table>

38	AC Output Rated Voltage （ When the rocker switch is off can be set ）	[38] 120Vac	You can set: 100/105/110/120/127Vac
39	Charge current limiting method （ when BMS is enabled ）	[39] LC SET	Max. battery charging current not greater than the value of setting 【07】.
		[39] LC BMS **Default**	Max. battery charging current not greater than the limit value of BMS.
		[39] LC INV	Max. battery charging current not greater than the logic judgements value of the inverter.
40	1-section start charging time	[40] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
41	1-section end charging time	[41] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
42	2-section start charging time	[42] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
43	2-section end charging time	[43] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
44	3-section start charging time	[44] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
45	3-section end charging time	[45] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
46	Sectional charging function	[46] DIS **Default**	Disable this Function
		[46] ENA	After the sectioned charging function is enabled, the power supply mode will change to BT1ST, and system will enable the mains power charging only in the set charging period or battery over discharge; If the sectioned discharge function is enabled at the same time, the power supply mode of the system will change to AC1ST, which only enable the mains charging in the set charging period, and switch to the battery inverter power supply mode in the set discharge period or when the mains power is off.
47	1-section start discharging time	[47] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
48	1-section end discharging time	[48] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
49	2-section start discharging time	[49] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00

50	2-section end discharging time	[50] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
51	3-section start discharging time	[51] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
52	3-section end discharging time	[52] 00:00:00 **Default**	Set Range: 00: 00-23: 59: 00
53	Sectional discharge function	[53] DIS **Default**	Disable this Function
		[53] ENA	After the sectioned discharge function is enabled, the power supply mode will change to AC1ST and the system will switch to battery inverter power supply only during the set discharge period or when the mains power is off.
54	Current date setting	[54] 00:00:00 **Default**	Set Range: 00:01: 01-99:12:31
55	Current time setting	[55] 00:00:00 **Default**	Set Range: 00:00: 00-23:59: 59
57	Stop charging current	[57] 2A **Default**	Charging stops when the default charging current is less than this setting.
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).
61	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-G automatically connect	[63] DIS **Default**	Disable automatic switching of N-G connection
		[63] ENA	Enable automatic switching of N-G connection
78	Battery hybrid discharge current	[78]100A **Default**	When the battery and grid hybrid load, set the battery discharging current.

3.3 Battery type parameters

For Lead-acid Battery :

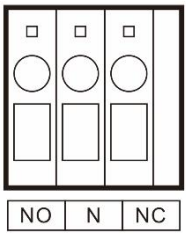
Battery type / Parameters	Sealed lead acid battery (SLD)	Gel lead acid battery (GEL)	Flooded lead acid battery (FLD)	User-defined (USE)	Adjustable
Overvoltage disconnection voltage	60V	60V	60V	60V	
Battery fully charged recovery point	52V	52V	52V	52V	√
Boost charge voltage	57.6V	56.8V	57.6V	40～60V	√
Undervoltage alarm voltage([01] fault)	44V	44V	44V	40～60V	√
Undervoltage alarm voltage recovery point([01] fault)	Undervoltage alarm voltage+0.8V				
Low voltage disconnection voltage([04] fault)	42V	42V	42V	40～60V	√
Low voltage disconnection voltage recovery point ([04] fault)(setup item [35])	52V	52V	52V	52V	√
Discharge limit voltage	-	-	-	40～60V	√
Over-discharge delay time	5s	5s	5s	1～30s	√
Boost charge duration	-	-	-	10～900 minutes	√

For Lithium Battery :

Battery type / Parameters	Ternary (N13)	Ternary (N14)	LFP (L16)	LFP (L15)	LFP (L14)	Adjustable
Overvoltage disconnection voltage	60V	60V	60V	60V	60V	
Battery fully charged recovery point(setup item [37])	50.4V	54.8V	53.6V	50.4V	47.6V	√
Boost charge voltage	53.2V	57.6V	56.8V	53.2V	49.2V	√
Floating charge voltage	53.2V	57.6V	56.8V	53.2V	49.2V	√
Undervoltage alarm voltage([01] fault)	43.6V	46.8V	49.6V	46.4V	43.2V	√
Undervoltage alarm voltage recovery point ([01] fault)	Undervoltage alarm voltage+0.8V					
Low voltage disconnection voltage([04] fault)	38.8V	42V	48.8V	45.6V	42V	√
Low voltage disconnection voltage recovery point ([04] fault)(setup item [35])	46V	49.6V	52.8V	49.6V	46V	√
Discharge limit voltage	36.4V	39.2V	46.4V	43.6V	40.8V	√
Over-discharge delay time	30s	30s	30s	30s	30s	√
Boost charge duration	120 minutes	120 minutes	120 minutes	120 minutes	120 minutes	√

4. Other functions

4.1 Dry contact



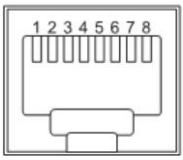
Working principle: This dry contact can control the ON/OFF of the diesel generator to charge the battery.

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.

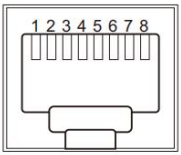
4.2 RS485 /WIFI communication port

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



RS485

1. RS485 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. WIFI allows direct connection with WiFi/GPRS communication module developed by our company through this port. After the module is selected, you can connect the all-in-one solar storage inverter through the mobile phone APP, on which you can view the operating parameters and status of the device.



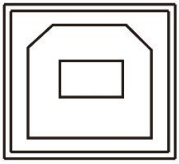
WIFI

As shown in the figure:

RS485: Pin 7 is RS485-A, and Pin 8 is RS485-B;

WIFI: Pin 1 is 5V power supply, Pin 2 is GND, Pin 7 is RS485-A, and Pin 8 is RS485-B;

4.3 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" in the computer.

4.4 Parallel communication function (parallel operation only)

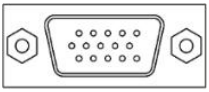
a) This port is used for parallel communication, through which the parallel modules can communicate with each other.

b) Each inverter has two DB15 ports, one for the male connector and the other for the female connector.

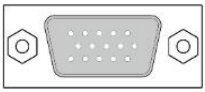
c) When connecting, make sure to connect the male connector of the inverter with the female connector of the inverter to be paralleled, or connect the female connector of the inverter to the male connector of the inverter to be paralleled.

d) Do not connect the male connector of the inverter to its female connector.

Female connector

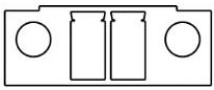


Male connector



4.5 Current sharing detection function (parallel operation only)

a) This port is used for current sharing detection, through which the current sharing of the parallel modules can be detected (parallel operation only).



b) Each inverter has two current sharing detection ports, which are connected in parallel. When it is connected to other Model to be paralleled, either port can be connected for convenience.
There is no special mandatory wiring requirements.

5. Protection

5.1 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 (120V model), 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.
8	Heat sink over temperature protection	When the internal temperature is too high, the all-in-one 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. (In off-grid mode)
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.
16	CAN communication loss protection	In parallel operation, an alarm will be given when CAN communication is lost.
17	Parallel connection error protection	In parallel operation, the equipment will be protected when the parallel line is lost.
18	Parallel battery voltage difference protection	In parallel operation, the equipment will be protected when the battery connection is inconsistent and the battery voltage is greatly different from that detected by the host.
19	Parallel AC voltage difference protection	In parallel operation, the equipment will be protected when the AC IN input connection is inconsistent.
20	Parallel current sharing fault protection	In parallel operation, the running equipment will be protected when the load difference of each inverter is large due to improper connection of current sharing line or device damage.
21	Synchronization signal fault protection	The equipment will be protected when there is a fault in the guidance signal between parallel buses, causing inconsistent behavior of each inverter.

5.2 Fault code

Fault code	Fault name	Affects output or not	Description
【01】	BatVoltLow	NO	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】	PvOCSw	NO	Boost overcurrent software protection
【11】	PvOCHw	NO	Boost overcurrent hardware protection
【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】	BusVoltLow	Yes	Internal battery boost circuit failure
【30】	BatCapacityLow1	NO	Alarm given when battery capacity rate is lower than 10% (setting BMS to enable validity)
【31】	BatCapacityLow2	NO	Alarm given when battery capacity rate is lower than 5% (setting BMS to enable validity)

【32】	BatCapacityLowStop	Yes	Inverter stops when battery capacity is low (setting BMS to enable validity)
【34】	CanCommFault	Yes	CAN communication fault in parallel operation
【35】	ParaAddrErr	Yes	Parallel ID （mailing address）setting error
【37】	ParaShareCurrErr	Yes	Parallel current sharing fault
【38】	ParaBattVoltDiff	Yes	Large battery voltage difference in parallel mode
【39】	ParaAcSrcDiff	Yes	Inconsistent AC input source in parallel mode
【40】	ParaHwSynErr	Yes	Hardware synchronization signal error in parallel mode
【41】	InvDcVoltErr	Yes	Inverter DC voltage error
【42】	SysFwVersionDiff	Yes	Inconsistent system firmware version in parallel mode
【43】	ParaLineContErr	Yes	Parallel line connection error in parallel mode
【44】	Serial number error	Yes	If the serial number is not set by omission in production, please contact the manufacturer to set it
【45】	Error setting of splitphase mode	Yes	[31]Settings item setting error
【58】	BMS communication error	NO	Check whether the communication line is connected correctly and whether [33] is set to the corresponding lithium battery communication protocol
【59】	BMS alarm	NO	Check the BMS fault type and troubleshoot battery problems
【60】	BMS battery low temperature alarm	NO	BMS alarm battery low temperature
【61】	BMS battery over temperature alarm	NO	BMS alarm battery over temperature
【62】	BMS battery over current alarm	NO	BMS alarm battery over current
【63】	BMS battery undervoltage alarm	NO	BMS alarm low battery
【64】	BMS battery over voltage alarm	NO	BMS alarm battery over voltage

5.3 Handling measures for part of faults

Fault code	Faults	Remedy
Display	No display on the screen	Check if the battery the PV circuit breaker has been turned off; 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 circuit breaker and Mains circuit breaker.
【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 disconnected alarm	Check if the battery is not connected or if the battery circuit breaker is not closed.
【40】 【43】	Parallel connection fault	Check whether the parallel line is not connected well, such as loose or wrong connection.
【35】	Parallel ID setting error	Check whether the setting of parallel ID number is repeated.
【37】	Parallel current sharing fault	Check whether the parallel current sharing line is not connected well, such as loose or wrong connection.
【39】	Inconsistent AC input source in parallel mode	Check whether the parallel AC inputs are from the same input interface.
【42】	Inconsistent system firmware version in parallel mode	Check whether the software version of each inverter is consistent.

6. Troubleshooting

- **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 all-in-one 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 all-in-one solar storage inverter without permission.
  5. Force majeure: Damage that occurs in transportation or handling of the all-in-one solar
  6. charge inverter.

7. Technical parameters

Model	SPH5048P
Parallel mode	
Permitted parallel number	1~6
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
Max. Efficiency	92%
Conversion time (bypass and inverter)	10ms (typical)
AC reverse protection	Available
Maximum bypass overload current	63A
Inverter mode	
Output voltage waveform	Pure sine wave
Rated output power (VA)	5000
Rated output power (W)	5000
Power factor	1
Rated output voltage (Vac)	120Vac (100/105/110Vac Settable)
Output voltage error	±5%
Output frequency range (Hz)	50Hz ± 0.3Hz 60Hz ± 0.3Hz
Maximum Efficiency	92%
Overload protection	(102% < load <110%) : alarm and turn off the output after 5 minutes; (110% < load < 125%) : alarm and turn off the output after 10 seconds; (Load >125%): alarm and turn off the output after 5 seconds;

Peak power (VA)	10000
Loaded motor capability	4HP
Rated battery input voltage	48V (Minimum starting voltage 44V)
Battery voltage range	Undervoltage alarm/shutdown voltage/overvoltage alarm /overvoltage recovery... settable on LCD screen)
Power saving mode self-consumption	Load≤50W
AC Output (Grid)	
Rated Output Power (W)	5000
Max. apparent power (VA)	5000
Max. output current (A)	41.7
THDI	< 3%
Rated voltage(V)	120Vac
Frequency	50Hz/60Hz
AC charging	
Battery type	Lead acid or lithium battery
Maximum charge current(can be set)	0-40A
Charge current error	± 3Adc
Charge voltage range	40-58Vdc
Short circuit protection	Circuit breaker and blown fuse
Circuit breaker specifications	63A
Overcharge protection	Alarm and turn off charging after 1 minute
PV charging	
Maximum PV open circuit voltage	500Vdc
PV operating voltage range	120-500Vdc
MPPT voltage range	120-450Vdc
Battery voltage range	40-60Vdc
Maximum PV input power	5500W
Maximum PV input current	22A
PV charging current range (can be set)	100A

Charging short circuit protection	Blown fuse
Wiring protection	Reverse polarity protection
Hybrid charging Max charger current specifications (AC charger+PV charger)	
Max charger current(can be set)	100A
Certified specifications	
Certification	CE(IEC62109-1)/FCC/UL1741
EMC certification level	EN61000
Operating temperature range	-10°C ~ 55°C (14°F ~131°F)
Storage temperature range	-25°C ~ 60°C (-13°F ~140°F)
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 control
Dimension (L*W*D)	446.9*350*133mm (1.47*1.15*0.44ft)
Weight	13kg (28.66lb)