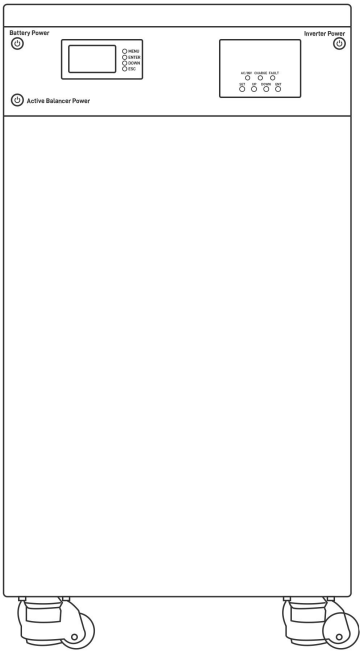
LiFePO4 Battery



User Manual

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1 Instruction

Thank you very much for choosing our household all-in-one solar battery storage system developed and produced by our company. Please read and understand all contents of the Manual carefully before installing and using the product. If you have any suggestions during the use, please do not hesitate to give us feedback.

NOTE： It is strictly forbidden to dismantle the case if Non-professionals, and no warranty service will be provided after.

1.1 Range of Application

The installation and user manual of AO series is applicable to the installation and use of the following products:

No.	Applicable to the countries with 220V mains voltage
1	AO-MB-51300-5KW-EU-PV500V/AO-MB48300-5KW-EU-PV500V
2	AO-MB-51280-5KW-EU-PV500V/AO-MB48280-5KW-EU-PV500V
3	AO-MB-51200-5KW-EU-PV500V /AO-MB48200-5KW-EU-PV500V
4	AO-MB-51150-5KW-EU-PV500V
5	AO-MB-51100-5KW-EU-PV500V

The product should be used in compliance with local standards, laws and regulations, because any non-compliance with the use may lead to personal injuries and property loss.

The drawings provided in this Manual are used to explain the concepts related to the product, including product information, installation guide, electrical connection, system debugging, safety information, common problems and maintenance, etc.

The internal parameters of this product have been adjusted before delivery. No internal parameters can be changed without permission. Any unauthorized changes to the settings will invalidate the warranty, and the Company will not be liable for any loss resulting therefrom.

This Manual and other related documents are an integral part of the product and should be kept properly for onsite installation personnel and related technical personnel to consult.

1.2 Meaning of Abbreviations

AC	Alternating Current
DC	Direct Current
PV	Photovoltaic
BMS	Battery Management System
PCS	Power Conversion System
RJ45	Registered Jack 45
SOC	State Of Charge
C	Charge C-rate
RS485	RS485 Communication Interface
CAN	Controller Area Network

Symbol Stipulations

Symbol	Description
	Indicate a hazard with a high level of risk which, if not avoided, will result in death or serious injuries.
	Indicate a hazard with a medium level of risk which, if not avoided, could result in death or serious injuries.
	Indicate a hazard with a low level of risk which, if not avoided, could result in minor or moderate injuries.
	Warning information about device or environment safety. If not avoided, equipment damage, data loss, performance degradation or other unanticipated results may be resulted in. The "NOTICE" does not involve any personal injuries.

2 Safety Precaution

2.1 Safety Symbols

This product contains the following symbols, please pay attention to identifying.

Symbols	Description
	Observe enclosed documentation
	Danger. Risk of electric
	Danger of high voltages. Danger to life due to high voltages in the All-in-one machine system.
	Hot surface
	CE certification
	Do not touch the product in 5mins after shutdown
	The All-in-one machine system should not be disposed together with the household waste.

2.2 General Safety

2.2.1 Important Notice

Before installing, operating and maintaining the device, please read this manual first and follow the symbols on the device and all the safety precautions in this manual.
The matters indicated with "DANGER", "CAUTION", "ATTENTION" and "NOTICE" in this manual do not represent all the safety matters to be observed, but are only the supplements to all the safety precautions. The company will not be liable for any violation of general safety operating requirements, or any violation of safety standards for the design, production and use of the device. The device must be used in an environment that meets the requirements of the design specifications. Otherwise, the device may fail, and the abnormal device function or component damage, personal safety accident, and property loss arising from this are not covered within the quality assurance scope of the device. When installing, operating, and maintaining the device, the local laws, regulations, and codes shall be followed. The safety precautions in this manual are only supplements to local laws, regulations, and codes. The company shall not be liable for any of the following circumstances.

- The device is not run under the conditions of operating described in this manual.
- The installation and operating environment is beyond the requirements of relevant international or national standards.
- The product is disassembled or changed, or the software code is modified without authorization.
- The operation instructions and safety warnings related with the product and in the documents are not followed.
- Damage of the device is caused by abnormal natural environment (force majeure, such as earthquake, fire, and storm).
- Transportation damage is caused during customer's own transportation.
- The storage condition does not meet the requirements of the product related documents and causes damage.

2.2.2 General Requirements

	Operating when the power is on is strictly prohibited during installation.
	It is strictly prohibited to install, use, and operate any outdoor equipment or cables (including but not limited to transporting equipment, operating equipment and cables, plugging and removing signal ports connected to the outdoor, working at altitude, and outdoor installation) in severe weather, such as thunder, rain, snow, and gale level 6.
	In case of any fire, evacuate the building or equipment area and press the fire alarm bell or dial the fire call. Under any circumstances, re-entry into a burning building is strictly prohibited.
	Under no circumstances should the structure and installation sequence of the device be changed without the manufacturer's permission.
	The battery terminal components shall not be affected during transportation. And, the battery terminal bolts shall not be lifted or transported.
	It is strictly prohibited to alter damage or block the marks and nameplates on the device.

	The composition and working principle of the entire photovoltaic power generation system, as well as the relevant standards of the country/region where the project is located shall be known fully.
	After the device is installed, the empty packing materials, such as cartons, foam, plastics, and cable ties, shall be removed from the device area.

2.2.3 Personnel Safety

- When operating the device, appropriate personal protective equipment shall be worn. If any fault that may lead to personal injury or damage of the device is found, immediately terminate the operation, report to the responsible person, and take effective protective measures.
- Before using any tools, learn the correct method of using the tool to avoid injuries and damage of the device.
- When the device is running, the temperature of the case is high, which may cause burns. Therefore, do not touch the case.
- In order to ensure personal safety and normal use, reliable grounding should be carried out before use.
- Do not open or damage the battery. The electrolyte released is harmful to skin and eyes, so avoid touch it.
- Do not place irrelevant items on the top of the device or insert them into any part of the device.
- Do not place flammable items around the device.
- Never place the battery in the fire to avoid explosion and prevent the personal safety from being endangered.
- Do not place the battery module in water or other liquids.
- Do not short-circuit the battery terminals, because short-circuiting of the battery may cause combustion.

The battery may pose a risk of causing electric shocks and large short-circuit currents. When using the battery, the following precautions should be paid attention to:

a) The metal objects, such as watch and rings, shall be removed.
b) Tools with insulated handles should be used.
c) Rubber gloves and shoes should be worn.
d) The charging power supply shall be disconnected before connecting or disconnecting terminals of the battery.
e) Check whether the battery is accidentally grounded. If the battery is accidentally grounded, remove the power supply from the ground.

- Do not clean the internal and external electrical components of the cabinet with water or detergent.
- Do not stand, lean or sit on the device.
- Do not damage any modules of the device.

2.3 Personnel Requirements

- The personnel in charge of installation and maintenance must be strictly trained to understand all safety precautions and master proper operation methods.
- Only qualified professionals or trained personnel are allowed to install, operate and maintain the device.
- The personnel who operate the device, including the operators, trained personnel and professionals, must have special operation qualifications required by the local country, such as high voltage operation, working high above the ground, and special equipment operation qualification.
- The replacement of device or components (including software) must be carried out by professionals or authorized personnel.

2.4 Electrical Safety

2.4.1 General Requirements

Before carrying out electrical connections, ensure that the device is not damaged, or an electric shock or fire may occur.

Never install or remove any power cables when the power is on. The electric arcs or sparks may be generated at the moment when the power cable contacts with the conductor, which may cause fire or personal injuries.

- All the electrical connections must meet the electrical standards of the country/region where the project is located.
- The cables prepared by users themselves shall comply with local laws and regulations.
- Special insulating tools should be used in high-voltage operations.
- Before connecting the power cord, ensure that the label identification on the power cord is correct.
- Operations on the device are allowed only five minutes after the device is completely powered off.
- The insulation layer of the cable may be aged or damaged when the cable is used in a high temperature environment. Therefore, the distance between the cable and the heat source must be at least 30mm.
- Cables of the same type should be bundled together. Whereas, the cables of different types should be routed at least 30mm apart, and shall not be wrapped together or crossed.

2.4.2 Grounding Requirements

- When installing the device to be grounded, the protective grounding wire must be installed first; when removing the device, the protective grounding wire must be removed at last.
- It is forbidden to destroy the grounding conductor.
- It is forbidden to operate the device without a grounding conductor installed.
- The device shall be permanently connected to the protective grounding wire. Before operating the device, electrical connection of the device shall be checked to ensure that the device is reliably grounded.

2.5 Installation Environment Requirements

- Do not install or use this product in an environment where the temperature is lower than -10 ℃ or higher than 50 ℃.
- It should be installed in a dry and well-ventilated environment to ensure good heat dissipation performance.
- The product can be installed at a maximum altitude of 2,000m.
- The installation position should be away from the fire source.
- The product should be installed and used away from children and animals.
- The installation position should be far away from water sources, such as faucets, sewer pipes, and sprinklers, to avoid entering of water.
- The device should be placed on a firm and flat supporting surface.
- Do not place any inflammable or explosive items around the device.
- When the device is running, do not block the ventilation vent or heat dissipation system to prevent fire caused by high temperature.

The operation and service life of the all-in-one machine is related to the operating temperature. The all-in-one machine should be installed at a temperature equal to or better than the ambient temperature.

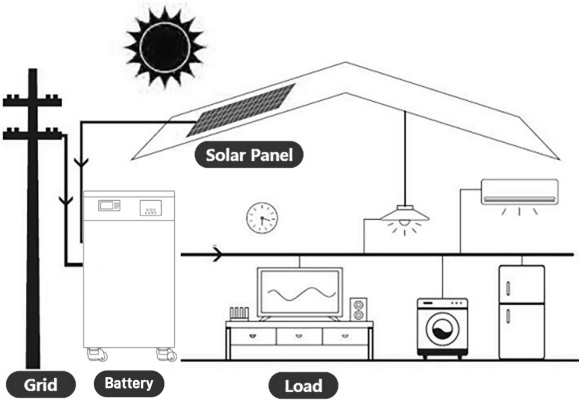
3 Product Introduction

3.1 Brief Introduction to Product

AO is a new generation of household all-in-one machine system with two output specifications of 230V, which can meet the diversified needs of global users.

The brand new topological circuit design is adopted in the power module, which can realize the energy exchange between photovoltaic, mains, battery and loads, and has the function of photovoltaic and mains charging. The photovoltaic charging module adopts the latest optimized MPPT tracking technology, which can quickly track the maximum power point of the photovoltaic array in any environment, and obtain the maximum energy of the solar panel in real time. In addition, MPPT has a wide voltage range. The advanced control algorithm is adopted in the mains charging module to realize the fully-digital double closed-loop control of voltage and current, so the control precision is high and the volume is small. The AC voltage input range is wide, and the input/output protection functions are complete, which can realize the stable and reliable charging and protection of batteries. The inverter module is based on the full-digital intelligent design, adopts the advanced SPWM technology, outputs pure sine wave, converts direct current into alternating current, and is applicable for household appliances, power tools and other AC loads.

The typical topological diagram for application of the system is as follows：



3.2 System Specification

Product mode	Battery Energy	Rated Output Power	Rated Output Voltage (Vac)	Frequency	Charge Current	Max. PV Power
AO-MB51300-5KW EU-PV500V	15.36kWh	5500W	230Vac	50Hz	0~100A	6000W
AO-MB48300-5KW EU-PV500V	14.40kWh	5500W	230Vac	50Hz	0~100A	6000W
AO-MB51280-5KW EU-PV500V	14.33kWh	5500W	230Vac	50Hz	0~100A	6000W
AO-MB48280-5KW EU-PV500V	13.44kWh	5500W	230Vac	50Hz	0~100A	6000W
AO-MB51200-5KW EU-PV500V	10.24kWh	5500W	230Vac	50Hz	0~100A	6000W
AO-MB48200-5KW EU-PV500V	9.60kWh	5500W	230Vac	50Hz	0~100A	6000W
AO-MB51150-5KW EU-PV500V	7.68kWh	5500W	230Vac	50Hz	0~100A	5500W
AO-MB51100-5KW-EU-PV500V	5.12kWh	5500W	230Vac	50Hz	0~100A	5500W

3.3 Model Coding

The model coding of the all-in-one machine battery is as follows：

AO-MB51100-5KW-EU-PV500V

① ② ③ ④ ⑤ ⑥ ⑦

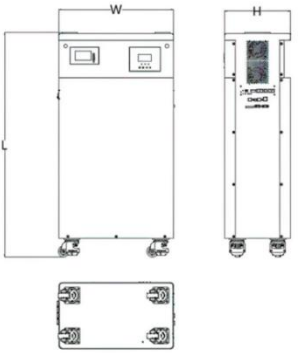
Identifier	Meaning	Value
①	Model	All-in-one
②	Product type	Roller type
③	Battery voltage	51.2V rated voltage
④	Battery capacity	100AH rated capacity
⑤	Inverter power	5KW rated power
⑥	Plug Specification	EU
⑦	Maximum PV Operating Voltage	500V

4 Description of All-in-one machine

4.1 Appearance Description

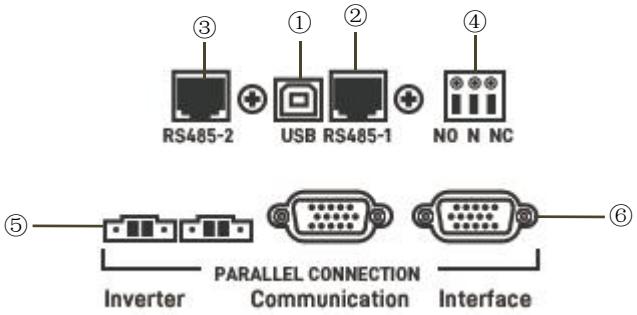
4.1.1 Dimensions

Model	Dimensions(L*W*H)
AO-MB-51300-5KW-EU-PV500V /AO-MB48300-5KW-EU-PV500V	1010*520*300
AO-MB-51280-5KW-EU-PV500V /AO-MB48280-5KW-EU-PV500V	1010*520*300
AO-MB-51200-5KW-EU-PV500V /AO-MB48200-5KW-EU-PV500V	1010*450*300
AO-MB-51150-5KW-EU-PV500V	880*520*300
AO-MB-51100-5KW-EU-PV500V	660*450*300



4.1.2 Appearance description of all-in-one machine

Inverter communication interface



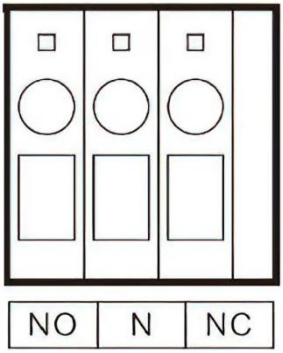
① USB	② RS485-2	③ RS485-1	④ Dry contact
⑤ Current sharing detection		⑥ Parallel communication	

Dry node：

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

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

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



RS485 communication port：

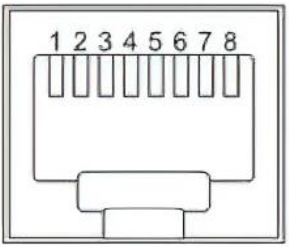
This port is an RS485 communication port

RS485-2 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.

As shown in the figure:

RS485-1: Pin 1 is 5V power supply, Pin 2 is GND, Pin 7 is RS485-A1, and Pin 8 is RS485-B1;

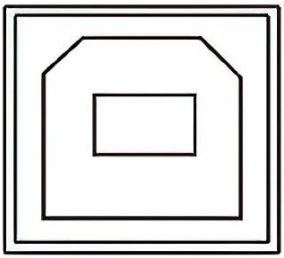
RS485-2: Pin 1 is 5V power supply, Pin 2 is GND, Pin 7 is RS485-A2, and Pin 8 is RS485-B2;



RS485

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.



Parallel communication function (parallel operation only)

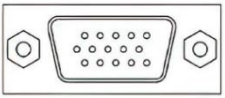
a) This port is used for parallel communication, through which the parallel modules can communicate with each other.

b) Each all-in-one machine 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

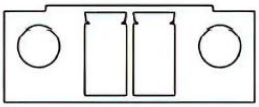


Male connector

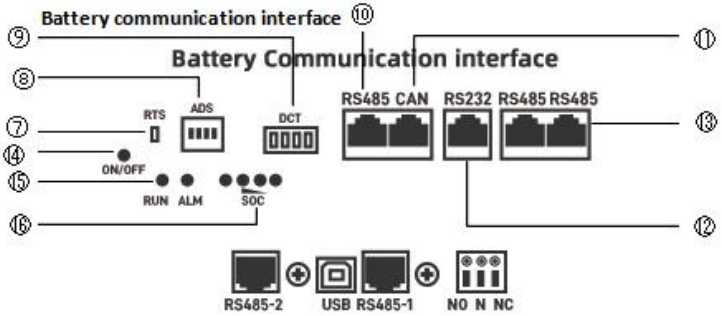
Current sharing detection function (parallel operation only)

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 all-in-one machine has two current sharing detection ports, which are connected in parallel. When it is connected to other models to be paralleled, either port can be connected for convenience. There is no special mandatory wiring requirements

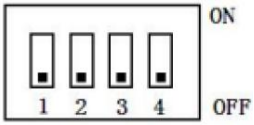


Battery communication interface

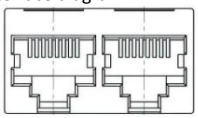


⑦Reset	⑧ DIP Switch	⑨Dry contact	⑩RS485 (Connect inverter)
⑪CAN (Connect inverter)	⑫RS232 (connect PC)	⑬RS485 (Parallel communication)	⑭LED (ON/OFF)
⑮LED (RUN/ALM)	⑯LED (SOC)		

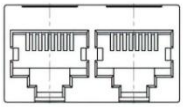
1. RST: Reset button.
2. ADS: dial switch

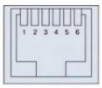


3. DCT: Dry contact interface
4. RS485: with dual RS485 interface, you can view the information of pack. The default baud rate is 9600bps.If it is necessary to communicate with the monitoring equipment through RS485, the monitoring equipment is used as the host, polling data according to the address, and the address setting range is 1 ~ 15.
5. CAN：CAN communication, baud rate 500K.
6. RS232: BMS can communicate with upper computer through RS232 interface, so as to monitor various information of battery, including battery voltage, current,temperature, status and battery production information, etc. the default baud rate is 9600bps.
7. Interface diagram


CAN and RS485 interface

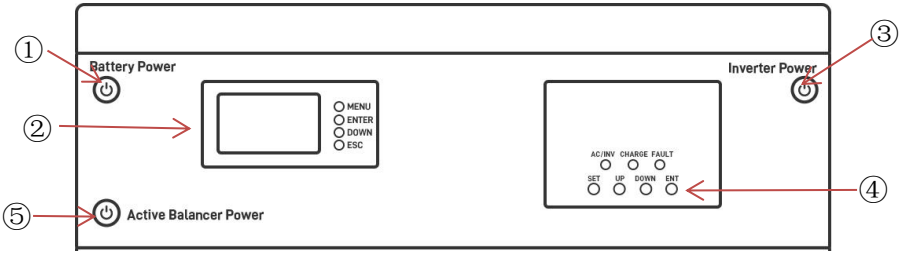
Dry contact


Parallel communication port

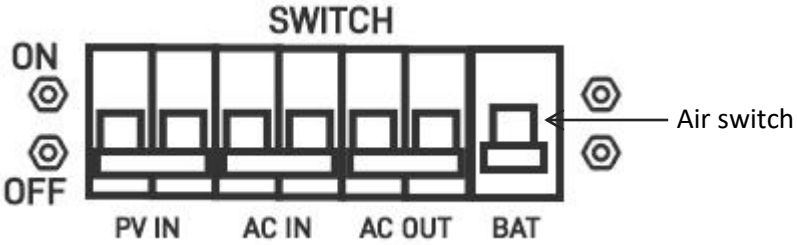

communication interface

8. Definition of electrical interface

Number	Communication	Function	Interface Type	Picture	instruction
⑫	RS232	Connect PC	RJ11-6P6C		2-NC 3-TX 4-RX 5-GND
⑩、⑬	RS485	Connect inverter/ paralleling	RJ45-8P8C		1、8-RS485-B 2、7-RS485-A 3、6-GND 4、5-NC
⑪	CAN	Connect inverter	RJ45-8P8C		9、10、11、14、16-NC 12-CANL 13-CANH 15-GND
②	RS485-2	Connect battery	RJ45-8P8C		1-5V 2-GND 7-RS485-A1 8-RS485-B1
③	RS485-1	Connect PC/WiFi	RJ45-8P8C		1-5V 2-GND 7-RS485-A2 8-RS485-B2



①Battery Power button	②Battery Display
③Inverter Power button	④Inverter Display
⑤Active Balance Power button （Optional）	

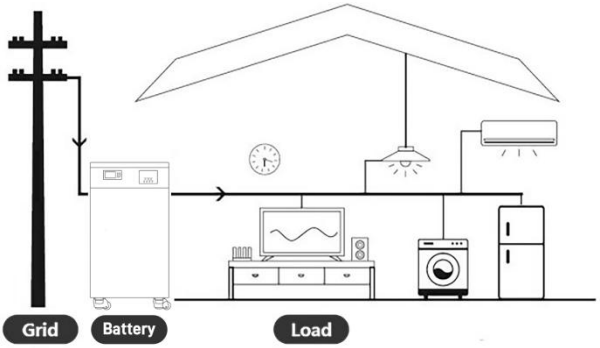


5 Application Scenarios

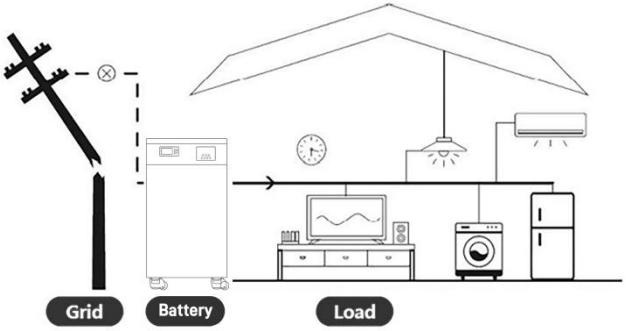
5.1 Application Scenarios

5.1.1 Application Scenarios with Only Mains Power but No Photovoltaic

When the mains are normal, it charges the battery and supplies power to the loads.

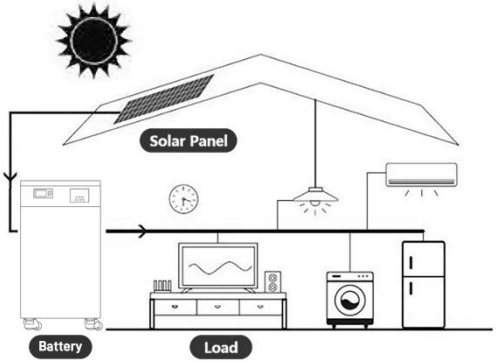


When the mains is disconnected or stops working, the battery supplies power to the load through the power module.

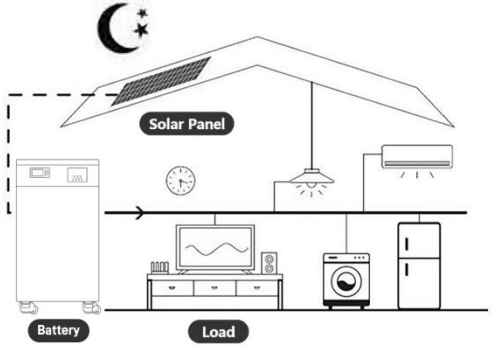


5.1.2 Application Scenarios with Only Photovoltaic but No Mains Power

During the day, the photovoltaic directly supplies power to the loads while charging

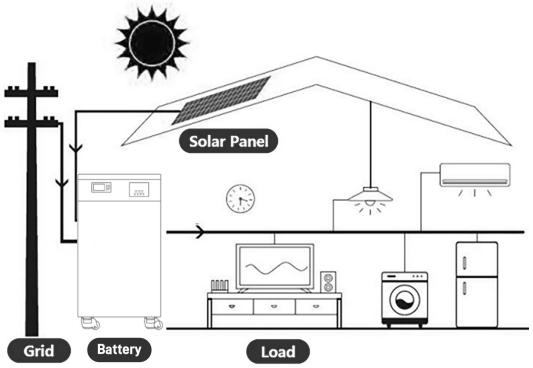


At night, the battery supplies power to the loads through the power module.

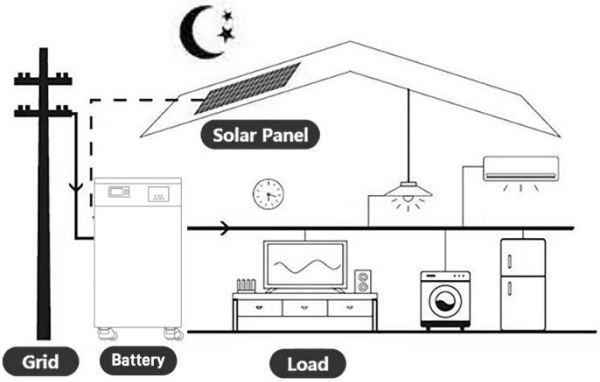


5.1.3 Complete Application Scenarios

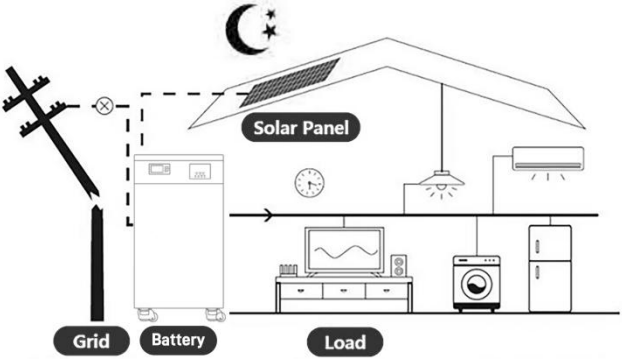
During the day, the mains and photovoltaic simultaneously charge the battery and supply power to the loads.



At night, the mains supplies power to the loads, and continue to charge the battery, if the battery is not fully charged.



If the mains are disconnected, the battery supplies power to the loads.



6 Installation instructions for all-in-one machine

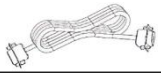
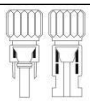
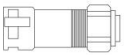
6.1 Inspections before Installation

6.1.1 Inspection of outer package

Before opening outer package of the all-in-one machine, check if there is any visible damage on the outer package, such as holes, cracks or other signs of possible internal damage, and check the type of all-in-one machine. If there is any abnormality on the package or model of the all-in-one machine is inconsistent, do not open it and contact us as soon as possible.

6.1.2 Inspection of deliverable

After opening outer package of the all-in-one machine, check if the deliverable is complete and whether there is any visible external damage. If any items are missing or damaged, please contact us.

NO.	Picture	Item	Quantity	Specification
1		All-in-one Machine	1	
2		Inverter parallel communication line	1	
3		Inverter parallel communication line	1	
4		Photovoltaic connectors	2	
5		Three hole AC plug	2	
6		Disassembly and assembly tools for solar panel connectors	1	
7		operating manual	1	

7 Electrical Connection

Before electrical connection, please ensure that the switches of the all-in-one machine are in the "OFF" state. Otherwise, the high voltage of the device may cause electric shock.

The operations related to electrical connections must be carried out by professional electrical technicians. When carrying out electrical connections, the operator must wear personal protective articles.

7.1 Internal Electrical Connection of All-in-one machine

7.1.1 Connecting Power Cord

Before connecting the all-in-one machine battery module, ensure that the all-in-one machine battery is not working and the indicator lights on the battery are OFF. Use proper power cord to

connect the positive and negative terminals of other batteries or power modules. It shall be noticed that the red cable should be connected to the red terminal (positive battery terminal) and the black cable to the black terminal (negative battery terminal).

7.2 External Electrical Connection of All-in-one machine

7.2.1 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

Models	Recommended PV wiring diameter	Maximum PV input current	Recommended air switch or circuit breaker type
HSI 5500P	6mm2 /10AWG	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:

Models	Recommended AC input wiring diameter	Maximum bypass output current	Recommended air switch or circuit breaker type
HSI 5500P	10mm2 /7AWG	40A	2P-40A

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

Models	Recommended battery wiring diameter	Rated battery discharge	Maximum charge current	Recommended air switch or circuit breaker type
HSI 5500P	30mm2 /2AWG	125A	100A	2P-160A

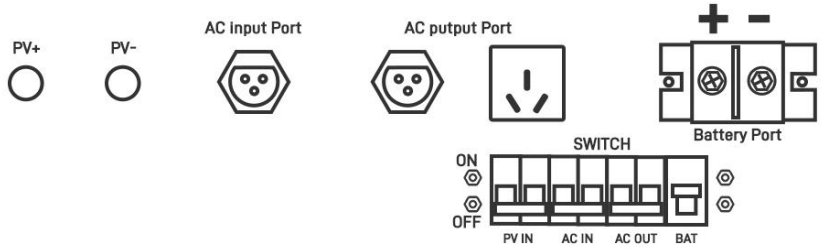
- Recommended AC output wiring specifications and circuit breaker selection

Models	Recommended AC output wiring diameter	Rated AC output discharge	Maximum bypass output current	Recommended air switch or circuit breaker type
HSI 5500P	10mm2/7AWG	24A	40A	2P—40A

Note: The wiring diameter is for reference only. If the distance between the PV array and the all-in-one solar charge inverter or the distance between the all-in-one solar charge 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.

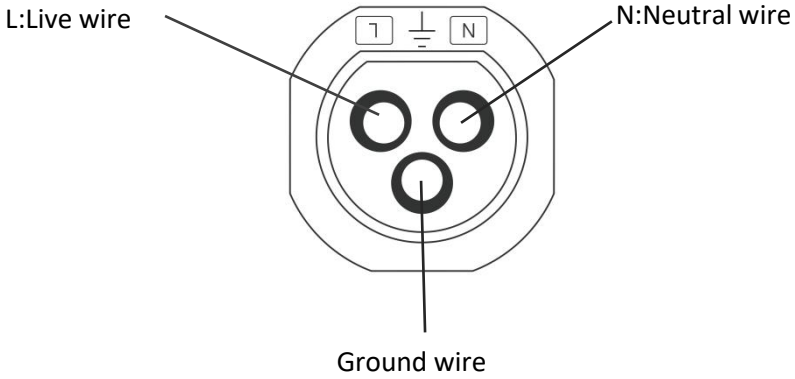
7.2.2 Installation and wiring



AC input / output wiring method:

① Prior to AC input/output wiring, disconnect the external circuit breaker and confirm that the wire used is thick enough. Please refer to Section 7.2.1 “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;



PV input wiring method：

7.3 Installation and wiring

7.3.1 Introduction

Maximum six all-in-one machines can be used for parallel operation.

When using the parallel operation function, the following connecting lines (package accessories) shall be firmly and reliably connected:

Parallel communication line*1:

Current sharing detection line*1:

7.3.2 Precautions for connecting the parallel connecting lines

1. Battery wiring:

Parallel connection in single or split phase: Ensure 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.

2. 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 machines, 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 7.3.3 Wiring Diagram.

Parallel connection in three phase: Ensure N-to-N and PE-to-PE connection for all all-in-one machines. 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 7.3.4Wiring Diagram.

3. 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 machines, 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 7.4.3 Wiring Diagram.

Parallel connection in three phase: Ensure N-to-N and PE-to-PE connection for all all-in-one solar charger 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 7.4.3 Wiring Diagram.

4. Wiring of parallel communication line:

Parallel connection in single or split phase: Single-phase or leaky phase parallel connection: The parallel communication line of our company is DB15 standard computer cable with shielding function. In addition, ensure that the parallel communication line of each all-in-one machine is tightened with the end screw of DB15 to avoid the abnormal operation or damage of the system output caused by the disconnection or poor contact of the parallel communication line.

5. Wiring of current sharing detection line:

Parallel connection in single phase: our current sharing detection line is twisted pair. When connecting each all-in-one machine, ensure the "one in and one out" rule, that is, connect the current-sharing line of the all-in-one machine with the current-sharing green port of the all-in-one machine to be connected in parallel (select one port from the two ports, there is no mandatory sequence requirement). The current-sharing ports of all-in-one machine cannot be connected with each other. In addition, ensure that the red and black current-sharing connecting lines of each all-in-one machine are not exchanged manually, and ensure that the lines are tightened with screws to avoid abnormal operation or system output damage caused by abnormal parallel current-sharing detection. See 7.3.3 wiring diagram for specific wiring.

Parallel connection in three phase: The current sharing detection lines of all all-in-one machine 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 7.3.4 Wiring Diagram.

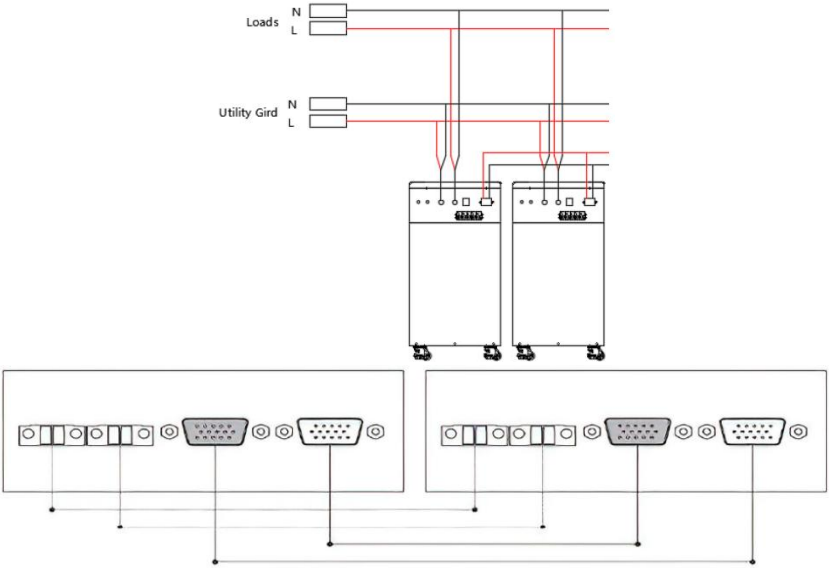
6. Before or after connecting the system, please carefully refer to the following system wiring diagram to ensure that all wiring is correct and reliable before power on.

7. 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 solar storage inverters are powered off before reconnecting into the system.

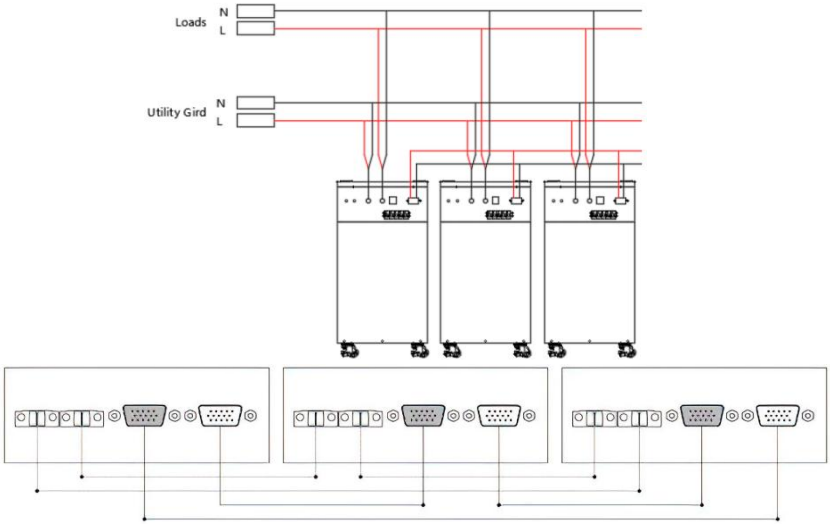
7.3.3 Schematic diagram of parallel connection in single phase

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

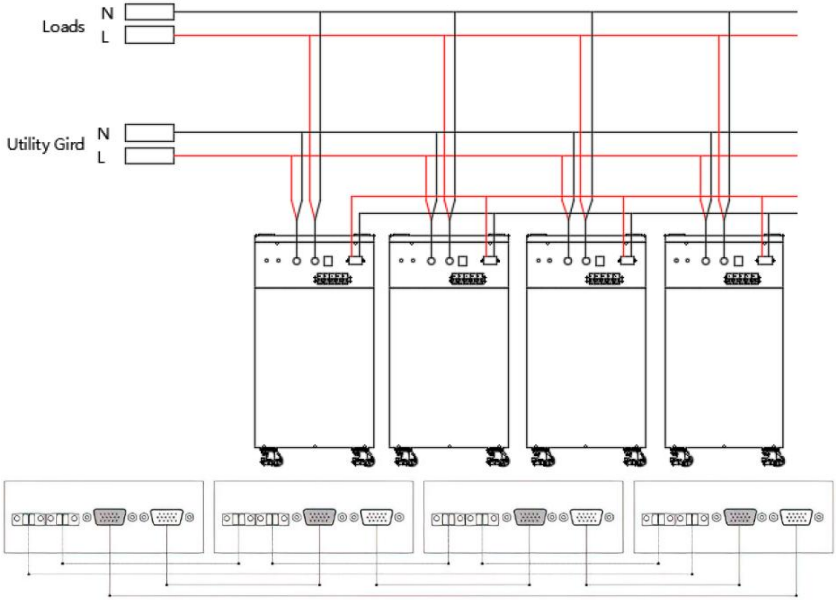
a) Two all-in-one machines of the system connected in parallel:



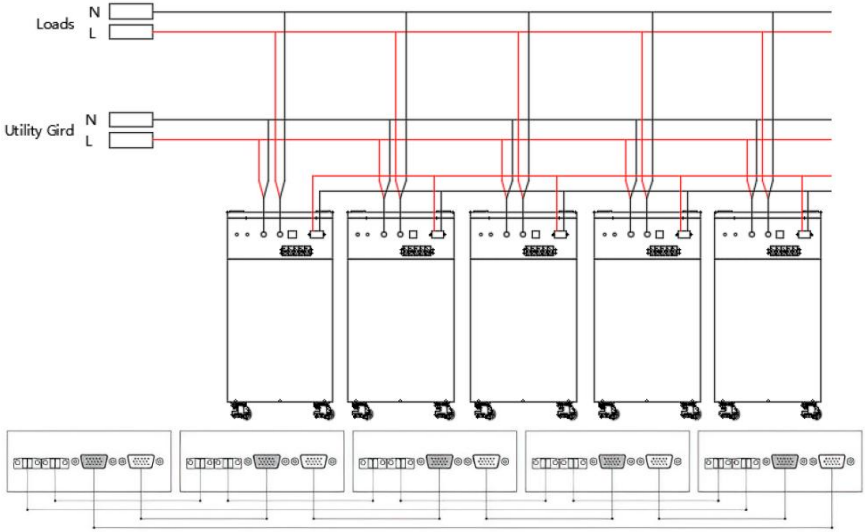
b) Three all-in-one machines of the system connected in parallel:



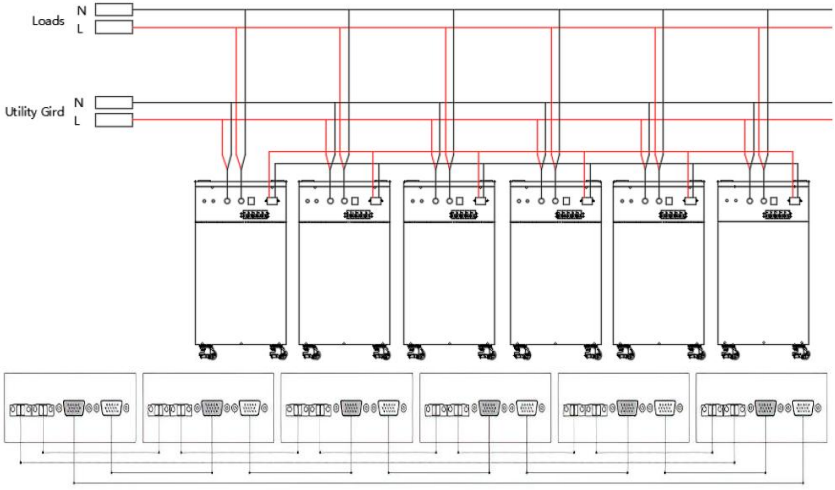
c) Four all-in-one machines of the system connected in parallel:



d) Five all-in-one machines of the system connected in parallel:



e) Six all-in-one machines of the system connected in parallel:



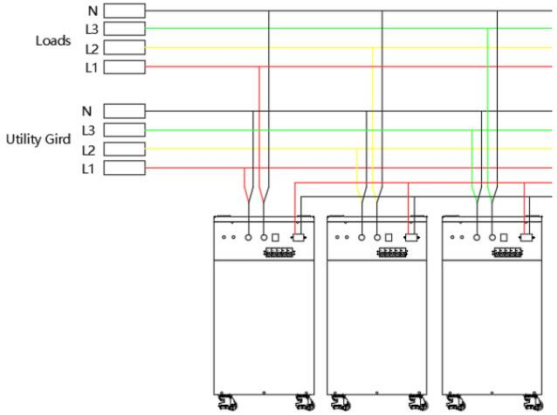
7.3.4 Schematic diagram of parallel connection in split phase

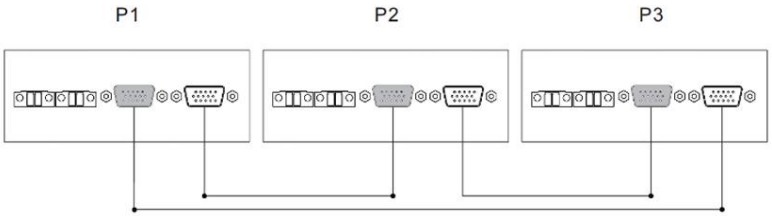
The parallel communication line and current sharing detection line of the all-in-one machines need to be locked with screws after connecting.

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

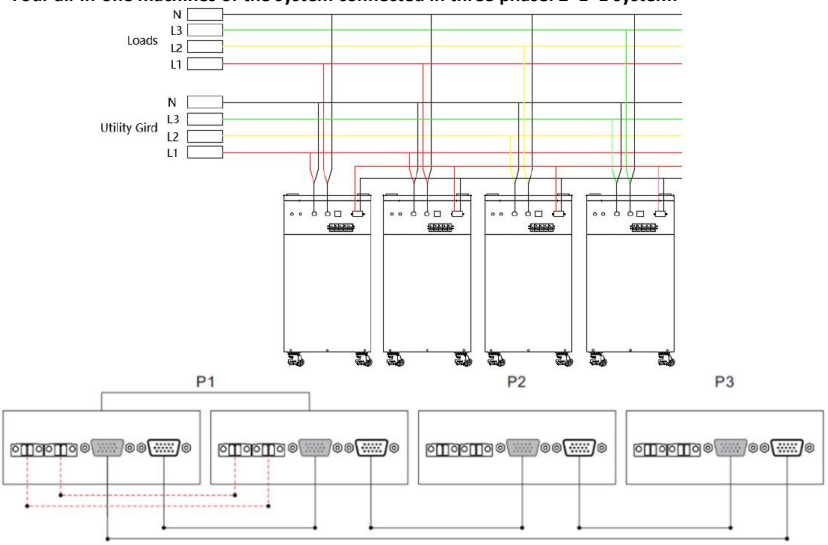
Parallel Operation in three phase：

a) Three all-in-one machines of the system connected in three phase: 1+1+1 system：

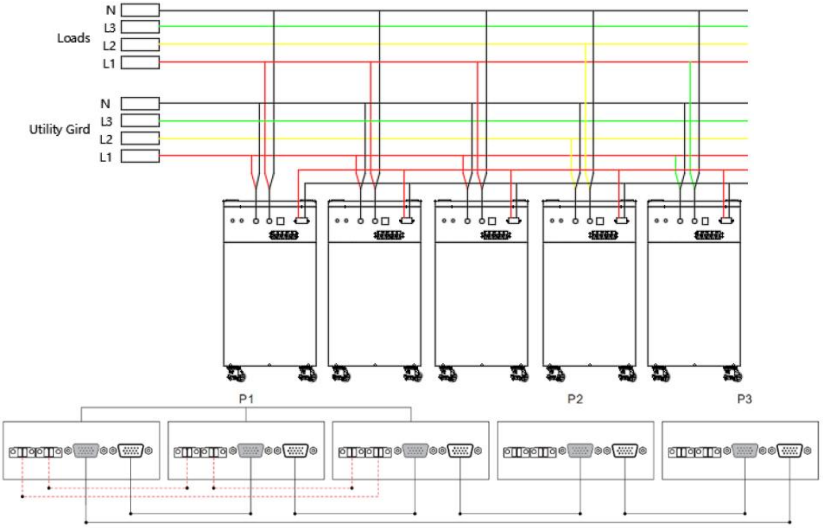




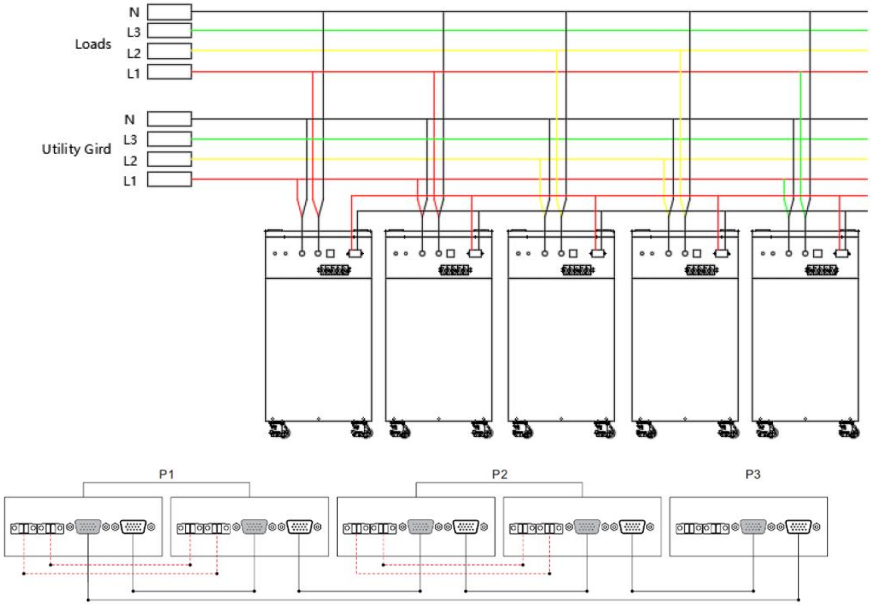
b) Four all-in-one machines of the system connected in three phase: 2+1+1 system:



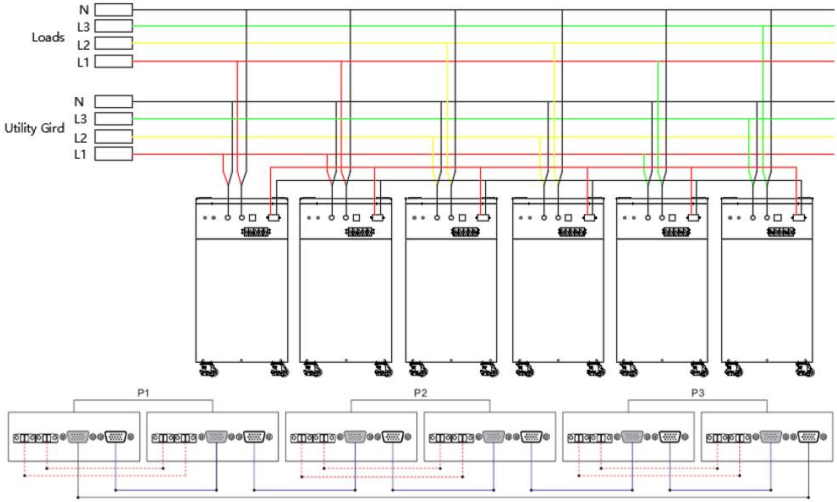
c) Five all-in-one machines of the system connected in three phase: 3+1+1 system:



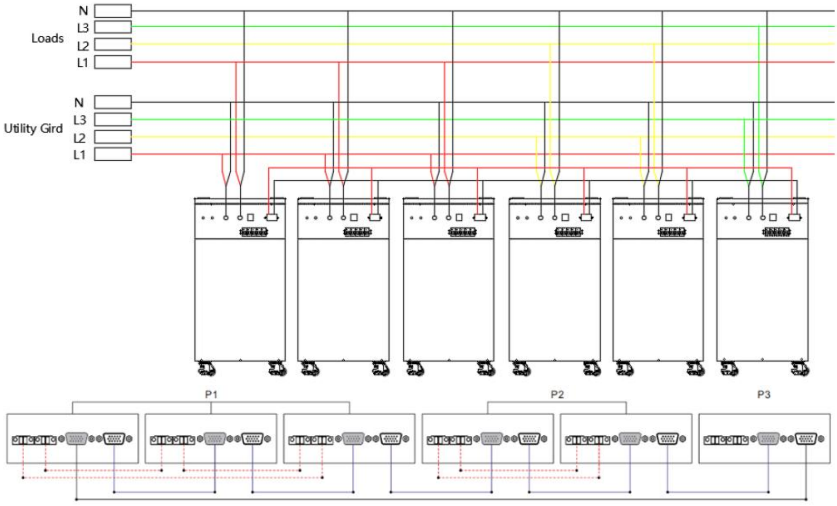
2+2+1 system:



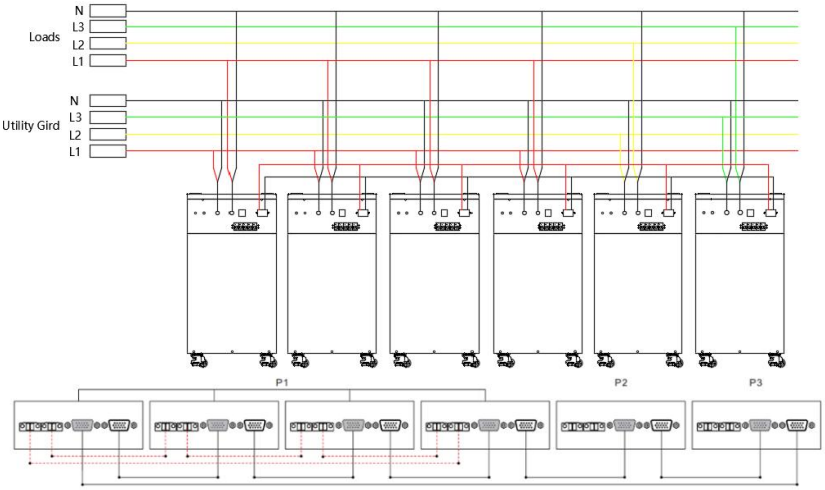
d) Six all-in-one machines of the system connected in three phase: 2+2+2 system:



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 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 three phase parallel connection, setting [31] should be set as follows: 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 230Vac (S model), the line voltage between the live wire L1 in phase 1 and the live wire L2 in phase 2 is 230*1.732 = 398Vac, and similarly the line voltage between L1-L3, L2-L3 is 398Vac; the single phase voltage between L1-N, L2-N, L3-N is 230Vac.

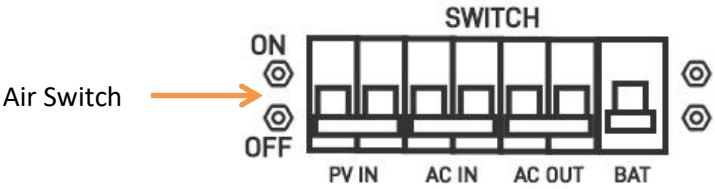
6) Finally, power off and start up again. After the system runs, the output voltage is measured correctly, and then the load setting is connected.

7.4 Inspections before Power-On

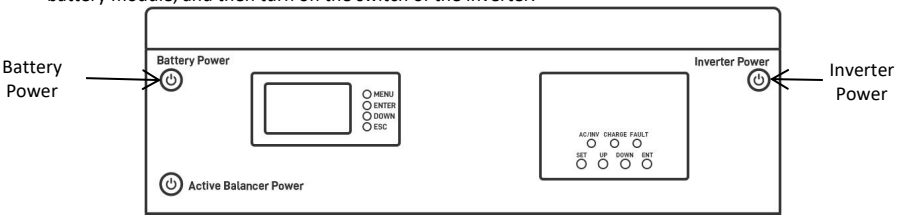
No.	Inspection items	Acceptance criteria	Validation
1	The all-in-one machine is installed in place	The installation is correct, secure and reliable.	☐Yes ☐No
2	The installation environment Meets requirements	The installation space is reasonable and the environment is clean and tidy without any construction	☐Yes ☐No
3	The power cord is correctly connected	The positive and negative terminals are connected correctly without any missing.	☐Yes ☐No
4	The signal line is correctly connected	The signal line is connected reliably, and there is no wrong position	☐Yes ☐No
5	The grounding is reliable	The grounding wire is correctly and reliably connected.	☐Yes ☐No
6	The switch of the energy storage battery module is off	All switches connected to the all-in-one machine are in the "OFF" state.	☐Yes ☐No

7.5 Power-On of All-in-one machine

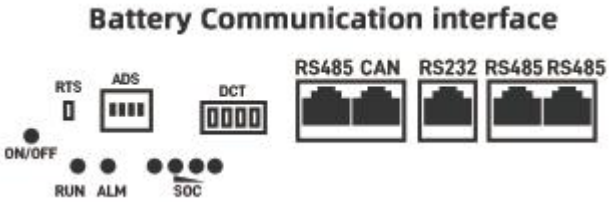
1. Turn on the air switch of the all-in-one machine.



2. After turning on the air switch and confirming, turn on the switch of the all-in-one machine battery module, and then turn on the switch of the inverter.



3. After the power switch is turned on, the LED indicator will light up or flash. The meaning of the LED indicator is as follows.



System Status	Events	RUN	ALM
POWER OFF	Power Off	OFF	OFF
Steady	Normal	Blinking1	OFF
	Alarm	Blinking1	Blinking3
Charging	Normal	ON	OFF
	Alarm	ON	Blinking3
	High temperature, Over Current	OFF	ON
Discharging	Normal	Blinking3	OFF
	Alarm	Blinking3	Blinking3
	Over Discharge Protection	OFF	OFF
	Over Current, Short Current	OFF	ON

Table 1 LED blinking description

Blinking	LED ON	LED OFF
Blinking1	0.25S	3.75S
Blinking2	0.5S	0.5S
Blinking3	0.5S	1.5S

7.5.1 Capacity Indicator

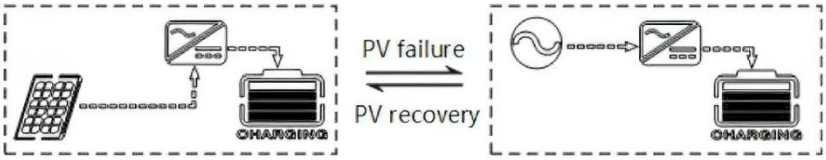
Capacity indicator LED	SOC
	0～25%
	25～50%
	50～75%

	75～100%
:LED ON :LED OFF	

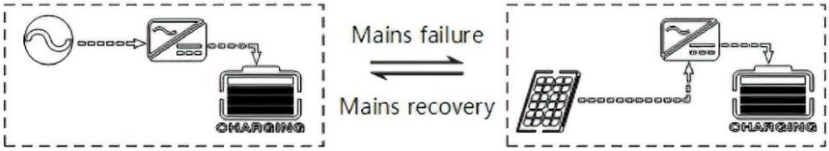
7.6 Operating modes

7.6.1 Charging mode

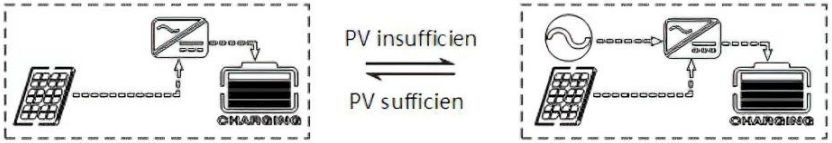
a) PV priority: PV module will charge the battery preferentially, and the battery is charged by the Mains only when the PV system fails. During the day, solar energy is fully used to charge, while at night, it converts to the Mains. This can maintain battery level, and is ideal for areas where the grid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



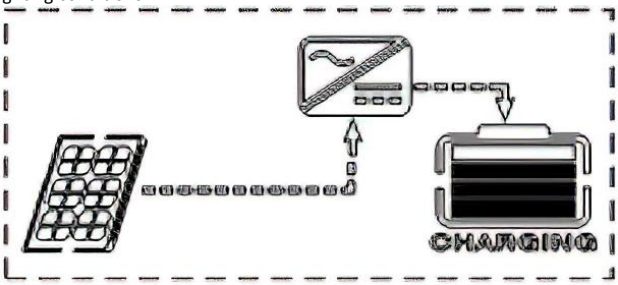
b) Mains priority: The Mains supply is preferentially used to charge the battery. Only when the Mains fails, the PV charging can be activated.



c) 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.



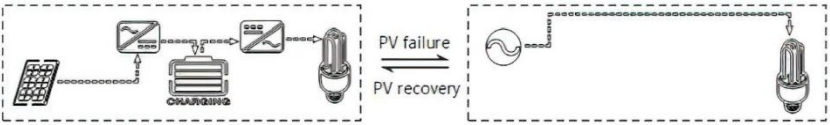
d) Only Solar (Only Solar): Only PV charging, without Mains charging. This is the most energy-efficient way in which battery is charged only by solar panels, and is usually used in areas with good lighting conditions.



7.6.2 Output mode

➢ PV priority mode:

Switch to mains supply when the PV charging fails. This mode maximizes the use of solar energy while maintaining battery power, suitable for use in the areas with relatively stable grid. Power supply priority：Solar—》Utility—》Battery.

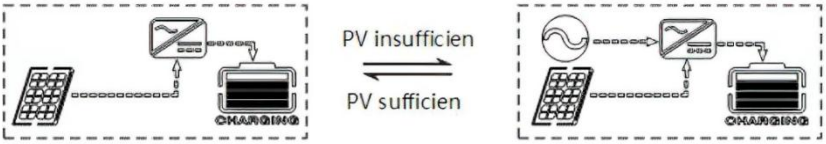


➢ Mains priority mode:

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

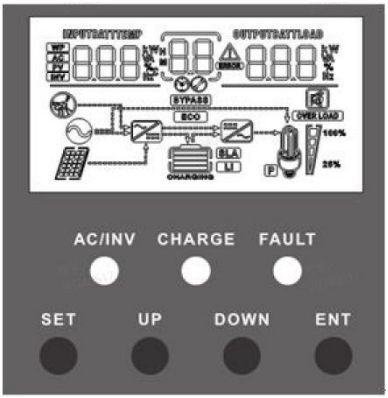
➢ Battery priority mode:

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



7.7 Inverter LCD Function Description

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



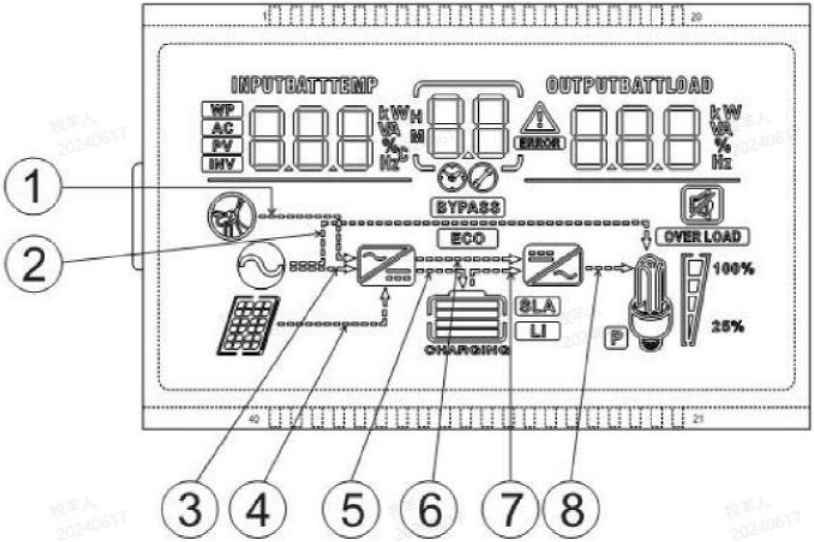
Operation buttons introduction

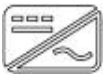
Function buttons	Description
SET	Enter/Exit Settings menu
UP	Previous choice
DOWN	Next choice
ENT	Confirm/Enter Options under the settings menu

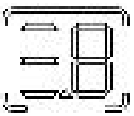
Indicators introduction

Indicators	Colors	Description
AC/INV	Yellow	Steady on: Mains output
		Flash: Inverter output
CHARGE	Green	Flash: Fast charging
		Steady on: Floating charge
FAULT	Red	Flash : Fault state

LCD screen introduction



Icons	Functions	Icons	Functions
	Indicates that the AC input terminal has been connected to the grid		Indicates that the inverter circuit is working

	Indicates that the AC input mode in APL mode (wide voltage range	BYPASS	Indicates that the machine is in the Mains Bypass mode
	Indicates that the PV input terminal has been connected to the solar panel	OVER LOAD	Indicates that the AC output is in an overload state
	Indicates that the machine has been connected to the battery: indicates that the remaining battery is 0%~24%; indicates that the remaining battery is 25%~49%; indicates that the remaining battery is 50%~74%; indicates that the remaining battery is 75%~100%.		Indicates the percentage of AC output loads: indicates that the load percentage is 0%~24%; indicates that the load percentage is 25%~49%, indicates that the load percentage is 50%~74%, indicates that the load percentage is ≥75%
Li	Indicates that the battery type of the machine is a lithium battery		Indicates that the buzzer is not enabled
SLA	Indicates that the current battery type of the machine is a lead-acid battery		Indicates that the machine has an alarm
CHARGING	Indicates that the battery is in charging state	ERROR	Indicates that the machine is in a fault condition
	Indicates that the AC/PV charging circuit is working		Indicates that the machine is in setup mode
	Indicates that the AC output terminal has an AC voltage output		The parameters displayed in the middle of the screen: In the non-setup mode, the alarm or fault code is displayed. In the setup mode, the currently set parameter item code is displayed.
P	In parallel operation, this icon indicates that this inverter is the host, which is only valid in parallel mode.		
Parameters display on the left side of the screen: input parameters			
AC	Indicates AC input		
PV	Indicates PV input		

INV	Indicates inverter circuit
WP	This icon is not displayed
	Display battery voltage, battery charge total current, mains charge power, AC input voltage, AC input frequency, PV input voltage, internal heat sink temperature, software version
Parameters display on the right side of the screen: Output parameters	
	Indicates output voltage, output current, output active power, output apparent power, battery discharge current, software version; in setup mode, displays the set parameters under the currently set parameter item code

Arrow display			
①	The arrow is not displayed	⑤	Indicates the charging circuit charging the battery terminal
②	Indicates the grid supplying power to the load	⑥	The arrow is not displayed
③	Indicates grid supplying power to the charging circuit	⑦	Indicates the battery terminal supplying power to the inverter circuit
④	Indicates PV module supplying power to the charging circuit	⑧	Indicates the inverter circuit supplying power to the load

7.7.1 Real-time data viewing method

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

Page	Parameters on the left side of the screen	Parameters in the middle of the screen	Parameters on the right side of the screen
1	INPUT BATT V (Battery input voltage)	Fault code	OUTPUT LOAD V (Output load voltage)
2	PV TEMP ℃ (PV charger heat sink temperature)		PV OUTPUT KW (PV output power)
3	PV INPUT V (PV input voltage)		PV OUTPUT A (PV output current)
4	INPUT BATT A (Input battery current)		OUTPUT BATT A (Battery output current)
5	INPUT BATT KW (Battery input power)		OUTPUT BATT KW (Battery output power)
6	AC INPUT Hz (AC input frequency)		AC OUTPUT LOAD Hz (AC output frequency)
7	AC INPUT V (AC input voltage)		AC OUTPUT LOAD A (AC output load current)

8	INPUT V (For maintain)		OUTPUT LOAD KVA (Load apparent power)
9	INV TEMP ℃ (AC charge or battery discharge heat sink temperature)		INV OUTPUT LOAD KW (Load active power)
10	APP software version		Boot loader software version
11	Model Battery Voltage Rating		Model Output Power Rating
12	Model PV Voltage Rating		Model PV Current Rating
13	RS485 Address Number		Phase Sequence Number

7.7.2 Setup parameters description

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

Note: in parallel mode, all machines will synchronize the setting parameters of the host (the machine with "P" is displayed on the display screen) before startup. After startup, the setting parameters of any machine will be synchronized to other machines in thesystem.

Parameter no.	Parameter name	Settings	Description
00	Exit setting menu	[00] ESC	Exit the setup menu
01	Work priority mode	[01] SOL	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	AC priority mode, it switches to inverter only when the AC power is invalid.
		[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].
02	Output frequency	[02] 50.0 default	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. For 230V machine, it is 50Hz by default.
		[02]60.0	

03	AC Input Voltage Range	[03] APL	230V machine wide range mains input voltage range 90~280V.
		[03] UPS default	230V machine narrow range mains input voltage range 170~280V.
04	Battery to mains	[04] 43.6V default	Parameter [01] = SBU, the battery voltage is lower than this setting value, the output is switched from inverter to mains, the setting range is 40V~52V, cannot be set more than [14] setting item.
05	Mains to battery	[05] 57.6V default	Parameter [01] = SBU, the battery voltage is higher than this setting value, the output is switched from mains to inverter, the setting range is 48V~60V. It cannot be set lower than [04] and [35] setting items.
06	Charging mode	[06] CSO	PV priority charging; only when the PV charging fails, the mains charging is started.
		[06] CUB	Mains priority charging; only when the mains charging fails, the PV charging is started.
		[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	Max charger current	[07]60A default	Max charger current (AC charger + PV charger). setting range 0~100A.
08	Battery Type	[08] USE	For user-defined, all battery parameters can be set.
		[08] SLd	Sealed lead-acid battery, constant-voltage charge voltage is 57.6V, float charge voltage is 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] LF14/LF15/LF16	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.
09	Boost charging voltage	[09] 56.8V default	The setting range of boost charging voltage is 48V~58.4V with 0.4V step. Valid when the battery type is user-define and lithium.
10	Boost charging 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.
11	Float voltage	[11] 55.2V default	48V~58.4V setting range of float voltage at 0.4V step.
12	Over-discharging voltage	[12] 42V default	When the battery voltage is lower than the judgement point, after delaying for the parameter [13] setting time, turn off the inverter output. 40V~52V voltage setting range at 0.4V step.
13	Over-discharging 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~50S setting range at 5S step.
14	Battery under-voltage alarm point	[14] 44V default	When the battery voltage is lower than the judgement point, the output is turned off immediately. 40V~52V setting range at 0.4V step. Valid when the battery type is user-define and lithium.
15	Battery discharge limit voltage	[15] 40V default	Battery discharge limit voltage; when the battery voltage is lower than the point, the output is turned off immediately; the setting range is 40V~52V, with a step of 0.4V. It is valid for user- defined battery and lithium battery.
16	Equalized charging	[16] DIS default	Disable equalized charging.
		[16] ENA	Enable equalized charging. Valid when battery type is flooded lead-acid batteries, sealed lead-acid batteries and user-defined.
17	Equalized charging voltage	[17] 56.8V default	48V~58.4V setting range at 0.4V step. Valid when the battery type is flooded lead-acid battery, sealed lead-acid battery and user-define.

18	Equalized charging time	[18] 120 default	5min~900min setting range at 5min step. Valid when the battery type is flooded lead-acid battery and sealed lead-acid battery.
19	Equalized charging delay	[19] 240 default	5min~900min setting range at 5min step. Valid when the battery type is flooded lead-acid battery, sealed lead-acid battery and user-define.
20	Equalized charging interval	[20] 30 default	0~30days setting range at 1-day step. Valid when the battery type is flooded lead-acid battery, sealed lead-acid battery and user-define.
21	Equalized charging enable	[21] DIS default	Stop equalizing charge immediately.
		[21] ENA	Start equalizing charge immediately.
22	Energy-saving mode	[22] DIS default	Disable 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.
		[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 over-temperature	[24] DIS	When automatic restart after over-temperature is disabled, if over-temperature occurs to switch off the output, the machine will no longer switch on the output.
		[24] ENA default	When automatic restart after over-temperature is enabled, If an over-temperature occurs to turn off the output, it will restart to turn on the output when the temperature drops.
25	Buzzer alarm	[25] DIS	Alarm is disabled
		[25] ENA default	Alarm is enabled
26	Mode change alert	[26] DIS	Disable alarm, when the state of the main input source changes.
		[26] ENA default	Enable alarm, when the state of the main input source changes.

27	Inverter overload to bypass	[27] DIS	Disable automatic switching to mains when inverter is overloaded.
		[27] ENA default	Enable automatic switching to mains when inverter is overloaded.
28	Max AC charger current	[28] 60A default	Maximum AC charging current setting. Setting range 0~60A, default 60A.
30	Communication address setting	[30] 1 default	Parallel mode needs to be set, the setting range is 1-6, and cannot be set in parallel operation. Note: Parallel mode can assign address automatically, usually no need to set manually.
31	AC output mode (can be set in the standby mode only)	[31] SIG default	Single machine setting.
		[31] PAL	Single-phase parallel connection setting.
		[31] 3P1/3P2/3P3	Three-phase parallel connection setting.
		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 230Vac (S model): At present, the voltage phase difference between (P1-P2, P1-P3,P2-P3) is 120 degrees, the line voltage between the live wire L1 in phase 1 and the live wire L2 in phase 2 is 230*1.732 = 398Vac, and similarly the line voltage between L1-L3, L2-L3 is 398Vac; the single phase voltage between L1-N, L2-N, L3-N is 230Vac.	
32	RS485-1 communication	[32]SLA default	RS485-2 port for PC or telecommunication control
		[32]BMS	RS485-2 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.	
		PAC=PACE, RDA=RITAR, AOG=ALLGRAND, OLT=OLITER,HWD=SUNWODA, DAQ=DYNESS, WOW=SRNE, PYL=PYLONTECH,UOL=VILION	
34	Hybrid power to load and on-grid setting	[34] DIS default	Disable this function.
		[34] Lod	Hybrid power to load mode, in which the PV is only charged first in utility mode and the remaining energy is supplied to the load and not fed into the grid.
		[34] Grd	On-grid function, in utility mode, the PV is charged first and the remaining energy is supplied to the load and fed into the grid.

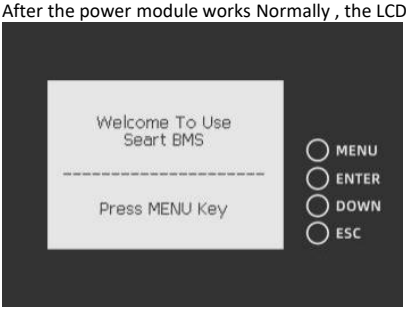
35	Low-voltage disconnect battery voltage recovery point (fault 04)	[35] 52V default	When the battery voltage is under voltage, the battery voltage needs to recover more than this set value before the inverter starts the output
36	Max PV charger current	[36] 80A default	Max PV charger current. Setting range: 0~100A
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 (only can be set in the standby mode)	[38] default	allow to set to 200 / 208 / 220 / 230 / 240Vac, default 230Vac. AC output power = (Rated Power)*(Setting voltage/230)
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 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	Discharge alarm SOC setting	[58] 15% default	SOC alarm when capacity is less than this setting. (Valid when BMS communication is normal)
59	Stop discharging SOC setting	[59] 5% default	Discharge stops when the capacity is less than this setting value. (Valid when BMS communication is normal)
60	Stop charging 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)

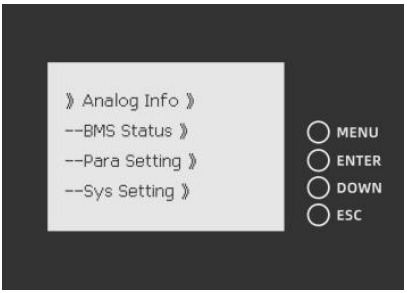
7.8 Battery LCD Function Description

Button Description:
MENU: enter the management system.
Enter: enter the submenu.
Down: moves the cursor down or to the next page.
ESC: returns to the previous one

After the power module works Normally , the LCD is described as follow:

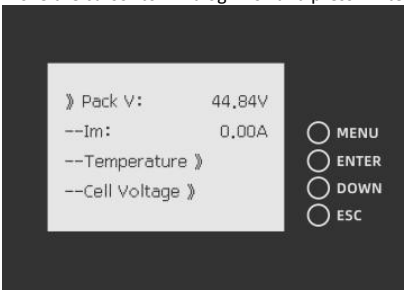


① Press “MENU” to enter the main menu.
Note:“》”indicates that there is a submenu. Press ”ENTER” to enter the submenu



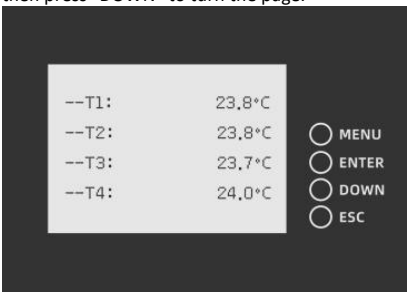
Analog Info	≥
BMS Status	≥
Para Setting	≥
Sys Setting	≥

Move the cursor to “Analog info” and press “Enter”



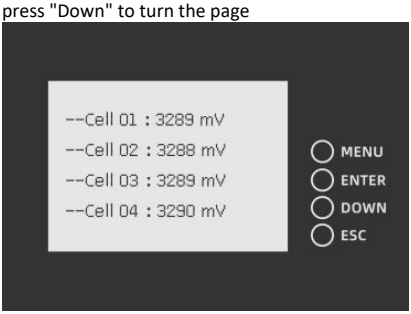
PackV：	xxV
Im	xxA
Temperature	≥
Cell Voltage	≥
CellCapacity	≥

Move the cursor to "Temperature" and press "Enter" to check the battery temperature information, then press "DOWN" to turn the page.



T1	**xx℃**
T2	**xx℃**
T3	**xx℃**
T4	**xx℃**
PCB-T	**xx℃**
ENV-T	**xx℃**

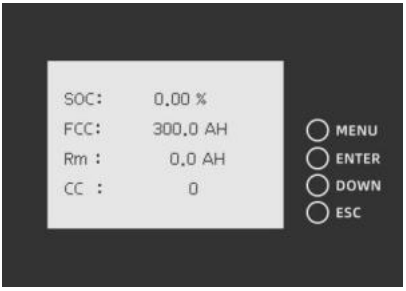
Move the cursor to "Cell Voltage" and press "Enter" to check the battery voltage information, then press "Down" to turn the page



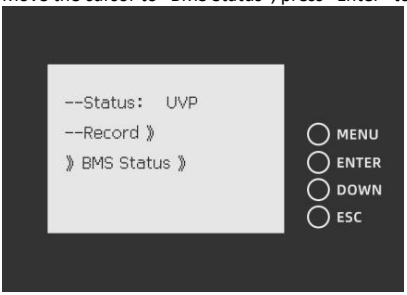
Cell01	**xxxx mV**
Cell02	**xxxx mV**
Cell03	**xxxx mV**
Cell04	**xxxx mV**
……	**……**
Cell14	**xxxx mV**
Cell15	**xxxx mV**
Cell16	**xxxx mV**

Move the cursor to “CellCapacity” and press “Enter” to check the battery capacity information.

SOC	**X %**
FCC	**X AH**
Rm	**X AH**
CC	**0**

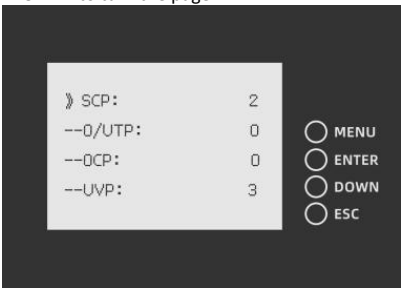


Move the cursor to “BMS Status”, press “Enter” to check the battery status.



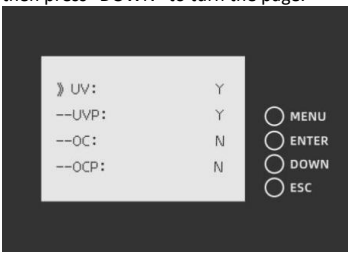
Status	**UVP**
Record	》
BMS Status	》

Move the cursor to "Record", then press "Enter" to check the battery alarm information, then press "DOWN" to turn the page.



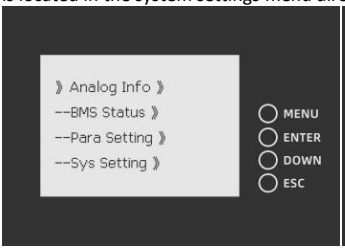
SCP	
O/UTP	
OCP	
UVP	
OVP	

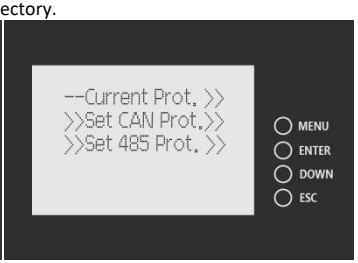
Move the cursor to "BMS Status", then press "Enter" to check the battery protection information, and then press "DOWN" to turn the page.

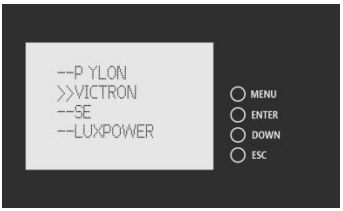


UV	**Y/N**
UVP	**Y/N**
OC	**Y/N**
OCP	**Y/N**
OT	**Y/N**
OTP	**Y/N**
OV	**Y/N**
OVP	**Y/N**
SCP	**Y/N**

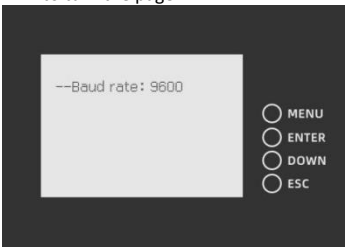
The user selects the correct communication protocol version by pressing the button and sends the selected protocol version number back to the BMS motherboard program, thereby changing the default communication protocol between BMS and the upper computer. The selection menu for this function is located in the system settings menu directory.







Move the cursor to "Sys Setting", then press Enter to check the version information, and then press "▼" to turn the page.



Hibernation and activation functions

After 1 minute of button-free operation in normal operation, the display will turn off (backlight only), and pressing any button while the screen is off will allow the screen to light up and function normally.

8 System Maintenance

8.1 System Power-Off

After the system is powered off, the case still has residual power and heat, which may cause electric shocks or burns. Therefore, protective gloves should be worn before operating the all-in-one machine 5 minutes after the system is powered off. Maintenance operations on all-in-one machine should be performed only after ensuring that all indicator lights of the all-in-one machine are off.

Power-off operation steps of the system:
Step 1 Turn off the breaker switch between the inverter and AC output (If installed).
Step 2 Turn off the breaker switch between the inverter unit and AC input (If installed).
Step 3 Turn off the breaker switch between the inverter unit and the PV string (If installed). Step 4 Turn off the battery breaker switch, all LED indicators are off.
Step 5 Turn off button on all all-in-one machine modules, the all-in-one machine is powered off successfully.

8.2 Routine Maintenance

To ensure the long-term and good operation of the all-in-one machine system, it is recommended to perform the routine maintenance as described in this section.

Item	Method	Maintenance interval
System cleanliness	Check if the radiator is covered or dirt on a regular basis.	Once every six months to one year.
Running status of system	● Observe whether the all-in-one machine appearance is ● Damaged or deformed. Listen to whether the all-in-one machine has any abnormal sound during running. ● When the all-in-one machine is running, check whether the indicator of the all-in-one machine battery is correct.	Once every six months.
Electrical connection	● Check if any cable connection is off or loose. ● Check if any cable is damaged, and especially if there are cuts on the sheath where the cable contacts with the metal surface. ● Check if the unused DC input terminals, all-in-one machine terminals, COM ports, and covers are locked.	Half a year after first debugging and testing, and once every six months to one year thereafter.
Grounding reliability	Check if the grounding cable is grounded reliably.	Half a year after first debugging and testing, and once every six months to one year thereafter.

8.3 Trouble shooting

8.3.1 Fault Code and Handling Methods

Fault code	Fault name	Whether it affects the 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】	PvBoostOCSw	No	Boost overcurrent software protection
【11】	PvBoostOCHw	No	Boost overcurrent hardware protection
【12】	bLineLoss	No	Mains power down
【13】	OverloadBypass	Yes	Bypass overload protection
【14】	OverloadInverter	Yes	Inverter overload protection
【15】	AcOverCurrHw	Yes	Inverter overcurrent hardware protection
【17】	InvShort	Yes	Inverter short circuit protection
【19】	OverTemperMppt	No	Buck heat sink over temperature protection
【20】	OverTemperInv	Yes	Inverter heat sink over temperature protection
【21】	FanFail	Yes	Fan failure
【22】	EEPROM	Yes	Memory failure
【23】	ModelNumErr	Yes	Model setting error
【26】	RlyShort	Yes	Inverted AC Output Backfills to Bypass AC Input
【29】	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】	BatCapacityLowSto p	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 setting error
【36】	-	-	-
【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 split phase 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 low battery alarm	NO	BMS alarm low battery
【64】	BMS battery over voltage alarm	NO	BMS alarm battery over voltage

8.3.2 Common Faults and Handling Methods

Fault code	Faults	Remedy
Display	No display on the screen	Check if the battery air switch or the PV air switch has been closed; if the switch is in the "ON" state; press any button on the screen to exit the screen sleep mode.
【06】	Battery over voltage protection	Measure if the battery voltage exceeds rated, and turn off the PV array air switch and Mains air switch.
【01】 【04】	Battery under voltage 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 lower than the recovery temperature, Normal charge and discharge control is resumed.
【13】	Bypass overload	①Reduce the use of power equipment;

【14】	protection, inverter overload protection	②Restart the unit to resume load output.
【17】	Inverter short circuit protection	①Check the load connection carefully and clear the short-circuit fault points; ②Re-power up to resume load output.
【09】	PV over voltage	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.

8.4 Battery Storage and Maintenance

8.4.1 Battery Storage Requirements

Do not put the battery into fire. The battery may explode. Do not open or damage the battery. The electrolyte flowing out from the battery is harmful to the skin and eyes. The electrolyte may also be toxic;

1. When being stored, the batteries shall be placed correctly in accordance with the marks on the packing case. Do not put them upside down or on the side.
2. When stacking up the battery packing cases, the stacking requirements on the outer package shall be met.
3. The batteries should be handled with care, and damage to batteries should be strictly prohibited.
4. Requirements for the storage environment：

——Ambient temperature: -10℃ to 55 ℃, recommended storage temperature: 20℃ to 30℃.
——Relative humidity: 5%RH-80%RH.
——Dry, well ventilated, and clean.
——The corrosive organic solvents, gases and other substances shall be kept away.
——Exposing to direct sunlight shall be avoided.
——The distance from the heat source should not be less than two meters.

5. When being stored, the battery shall be disconnected from the external connection. If there is an indicator light on the battery panel, the indicator light shall be off.
6. The warehouse keeper shall make monthly statistics on the battery storage, and regularly inform the planning link of the battery inventory. If any battery has been stored for nearly 15 months (-10 ℃ to 25 ℃), 9 months (25 ℃ to 35 ℃), or 6 months (35 ℃ to 55 ℃), recharging shall be arranged in time.
7. When the stored batteries are going to be delivered, the first-in first-out principle should be followed.

8. After the battery is produced and tested, it shall be recharged to at least 50% SOC before being stored. If the device will not be used for a long period of time, discharge the battery to 45% to 60% of the battery capacity and disconnect the battery output to avoid the battery runs out;
9. Do not touch the battery pack with wet hands.
10. Do not squeeze, drop, or pierce the battery.
11. The battery should always be disposed in accordance with local safety regulation.
12. The battery should be stored and recharged in accordance with this User's Manual.
13. Do not reverse polarity of the battery when storing or transporting the batteries, the batteries shall not be stacked up without protective packaging, and the number of stacked packed batteries should not exceed the number specified on the packaging.
14. All operators of the all-in-one machine system shall comply with the user manual, installation and service manual, and quality assurance requirements. Any damage to the device resulting from neglecting or misreading of the user's manual, installation and service manual, and the quality assurance requirements will invalidate the product warranty.

8.4.2 Requirements for Charging of Battery

The batteries to be stored for a long period of time (unused, for more than 3 months) must be kept in a dry and cool place. The storage voltage is 51V-53V. The batteries should be stored in a clean environment of 23 ± 2℃ and humidity of 45%-75%. If the battery will be shelved and not used for a long period of time, it should be recharged every 3 months to ensure that the battery voltage is within the above range.

As for batteries and long-term storage, routine maintenance is required. Please charge the battery to 40% SOC at a current of 0.2C according to the requirements in the table below.

Ambient temperature for storage	Relative humidity for storage environment	Storage Time	SOC
<-10℃	/	Prohibited	/
-10~25℃	5%~70%	≤12 months	30%≤SOC≤60%
25~35℃		≤6 months	
35~45℃		≤3 months	
>45℃	/	Prohibited	/

8.5 Device Cleaning

It is recommended to clean and maintain the product from time to time. When cleaning, the dust and stains on the product shall be removed with a piece of soft dry cloth or vacuum cleaner, especially when cleaning the heat dissipation and air vents on both sides of the product. The product shall not be cleaned with organic solvents, corrosive liquids and other cleaning products. If the fan fails, it can be replaced by a professional.

9 Technical Data

	AO-MB51110-5KW-EU-PV500V(16S)	AO-MB51150-5KW EU-PV500V (16S)	AO-MB51200-5KW-PV500V (16S) AO-MB48200-5KW-PV500V (15S)	AO-MB51280-5KW-PV500V (16S) AO-MB48280-5KW-PV500V (15S)	AO-MB51300-5KW-PV500V (16S) AO-MB48300-5KW-PV500V (15S)
BATTERY TECHNICAL SPECIFICATION					
Battery model	MB51100-100A-HWB(16S)	MB51100-100A-HWB(16S)	MB51200-100A-HWB(16S) MB48200-100A-HWB(15S)	MB51280-100A-HWB(16S) MB48280-100A-HWB(15S)	MB51300-100A-HWB(16S) MB48300-100A-HWB(15S)
Number of batteries	1				
Battery Energy	5120Wh	7.68kWh	10.24kWh(16S) 9.6kWh(15S)	14.33kWh(16S) 13.44kWh(15S)	15.36kWh(16S) 14.4kWh(15S)
Battery Capacity	100AH	150AH	200AH	280AH	300AH

Dimension L× D× H	660*450*300	880×520×300	1010×450×300	1010×520×300	1010×520×300
Battery Type	LiFePO4				
Battery Rated Voltage	51.2V/48.0V				
Battery Working Voltage Range	44.8 ～ 57.6V				
Maximum Charging Current	100A				
Maximum Discharging Current	100A				
DOD Designed Life-span	>10000 Cycles @ 0.2C/25℃ Charging/Discharging .				
INVERTER TECHNICAL SPECIFICATION					
INVERTER TECHNICAL	HSI 5500P				
PV CHARGE					
Solar Charge Type	MPPT				
Maximum Input Power	6000W				
PV Charging Current Range	0-100A				
Maximum PV input current	22A				
PV Operating Voltage Range	120-500Vdc				
MPPT Voltage Range	120-450Vdc				
AC CHARGE					
Maximum charge current(can be set)	60A				
Charge current error	± 3Adc				
Charge voltage range	40 –58Vdc				
Short circuit protection	Circuit breaker and blown fuse				
Circuit breaker specifications	40A				
Overcharge protection	Alarm and stop charging after 1 minute				
AC OUTPUT					
Rated Output Power	5500W				
Maximum Output Current	24A				
Frequency	50Hz ± 0.3Hz/60Hz ± 0.3Hz				
Rated voltage	230Vac				
BATTERY INVERTER OUTPUT					
Rated Output Power	5500VA				
Maximum Peak Power	11000VA				
Power Factor	1				
Rated Output Voltage (Vac)	230Vac				
Frequency	50Hz				
Auto Switch Period	＜15ms				
THD	＜3%				
GENERAL DATA					
Communication	RS485/CAN/WIFI				
Storage time/temperature	6 months @25℃;3 months @35℃;1 months @45℃;				
Charging temperature range	0～45℃				
Discharging temperature range	-10～45℃				
Operation Humidity	5% ～ 85%				
Nominal Operation Altitude	＜2000m				
Cooling Mode	Force-Air Cooling				
Noise	60dB(A)				
Ingress Protection Rating	IP20				

Recommended Operation Environment	Indoor
Installation Method	Vertical

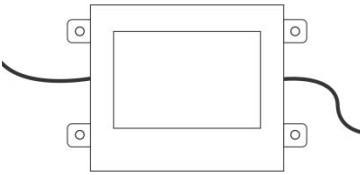
10 Optional function

10.1 Active equilibrium module

Qualification	Data specification
Balance Current	≤5A
Balance Mode	Active equilibrium
Balance on Condition	Reach the user-defined opening voltage and differential pressure Minimum voltage of single unit ≥ 3.2V (factory default) and equalizing opening differential pressure: ≥50mV (factory default)
Balance Closing Condition	Closing voltage and differential pressure reaching the user-defined setting Minimum voltage of single unit ＜ 3.2V (factory default) and equalizing differential pressure: ＜ 50mV (factory default)
Working Power Consumption	<1mA
Sleep Current	100uA
Working Temperature	-20℃～60℃

10.2 Fire extinguishing function

The battery is equipped with an aerosol fire extinguishing device. When the battery experiences a short circuit and catches fire, the fire extinguishing device can detect the temperature and automatically extinguish the fire.



Item	Parameter
Model specifications	QRR0.04G/S-MC-40-F-02-11
Working temperature range	－30℃～＋70℃
Relative humidity of working environment	≤95％RH
Start mode	Hot start
Spray time	≤3s
Starting temperature of thermal initiator	170±10℃

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