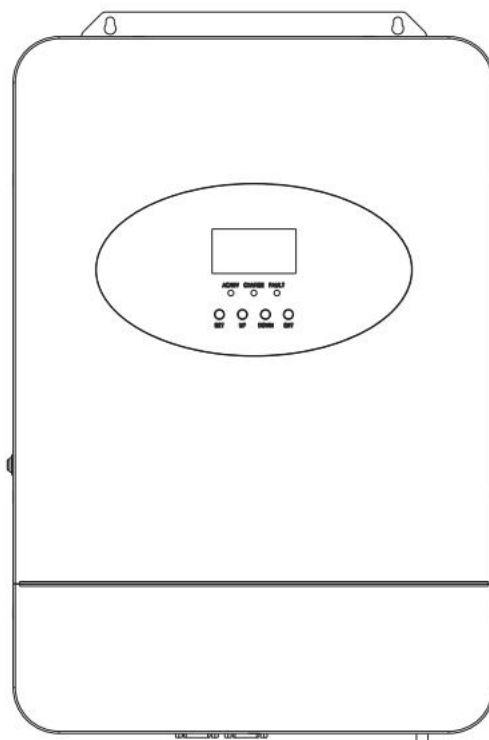


Description



Off-Grid Inverters

SD SPI-3K

SD MPI-3K

SD MPI-5K-PH

Preface

Applicable products

This description applies to the following product models:

- ▶ SD SPI-3K
- ▶ SD MPI-3K
- ▶ SD MPI-5K-PH

Overview

This manual describes the product architecture, installation guidance, operation guidance, and troubleshooting.

Please read the instructions carefully before installing and operating the product.

Target audience

This manual applies to qualified technicians or professional end users. Operators need the following skills:

- ▶ Understand how the inverter works
- ▶ Professional skills to deal with electrical equipment installation and use hazards and risk avoidance
- ▶ Have the expertise to install and debug electrical equipment
- ▶ Know how to apply safety standards
- ▶ Understand and follow the contents of this manual and comply with all safety requirements

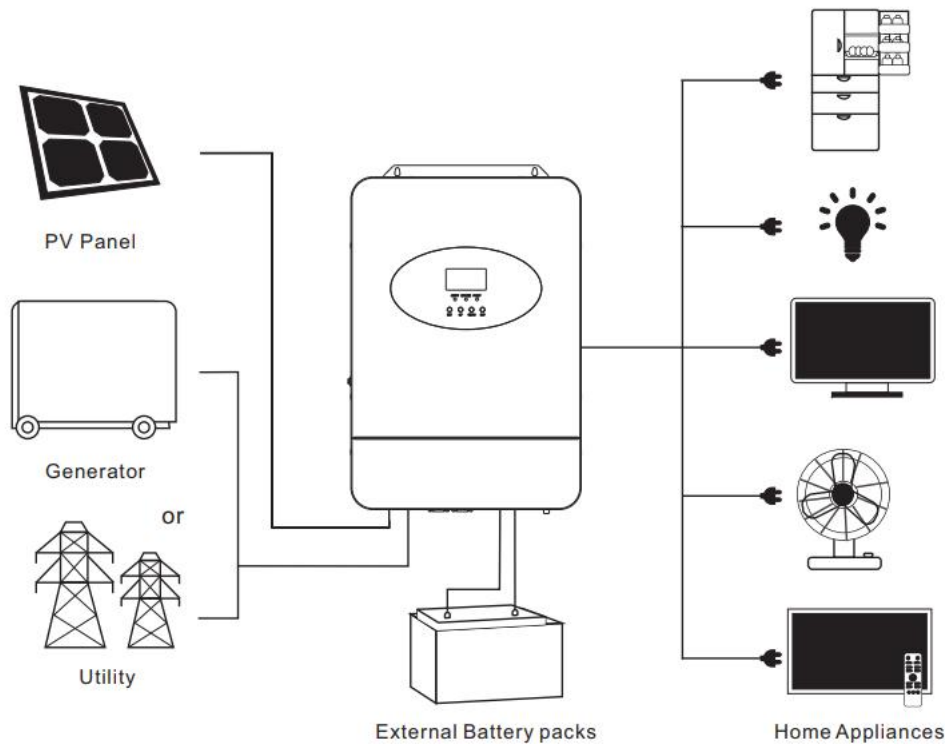
safety precautions

Warning : This section contains important security and operational instructions. Please read carefully and keep this manual for future reference.

1. Please specify which lithium or lead-acid battery is used, and the system will not work if the wrong battery mode is set.
2. Read the inverter, the warning marker on the battery, and all warning instructions in this Manual before using the device. The Company shall have the right not to provide quality assurance, and the Supplier shall have the right not to give a warranty if the equipment is damaged by not being installed as described in this Manual.
3. Please have a professional electrician or mechanical engineer perform all operations and connections.

4. All electrical installations must comply with local electrical safety standards.
5. When installing photovoltaic modules during daylight hours, the installer should cover the photovoltaic modules with opaque materials; otherwise, the component's end voltage in the sun is too high to be dangerous.
6. **NOTE** : Only rechargeable deep-cycle lead-acid and lithium batteries can be used to reduce injury risk. Other types of batteries may burst, causing personal injury and damage.
7. Do not remove this machine. Send it to a qualified service center if you need repairs or repairs. Incorrect reassembly can lead to the risk of electric shock or fire.
8. Disconnect all wires before attempting any maintenance or cleaning to reduce the risk of electrocution. Simply shutting down the device does not reduce the risk of electrocution.
9. Never charge a frozen battery.
10. For the inverter to work well, select the appropriate cable size for the required specifications. It is important to operate this inverter correctly.
11. Be very careful when using metal tools on or around batteries. Dropping tools can cause short circuits or sparks of storms or other electrical components and can cause explosions.
12. When disconnecting AC or DC terminals, follow the installation procedure strictly. See the installation section of this guide for more information.
13. **Ground description** : The inverter should be permanently grounded. Be sure to comply with local requirements and regulations to install this inverter.
14. Do not short-circuit AC output and DC input. Do not connect to ElectricAC power supply system supply power when DC enters a short circuit.
15. Ensure that the inverter is fully assembled before operating.

product presentation



Solar Off-Grid Energy Storage System

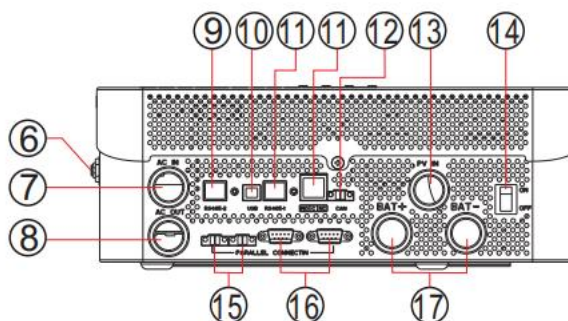
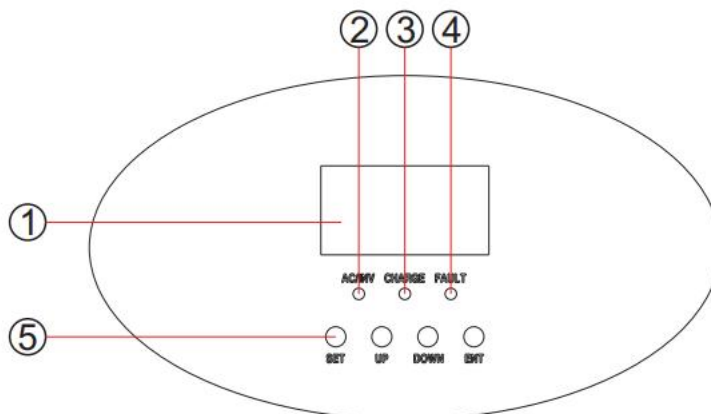
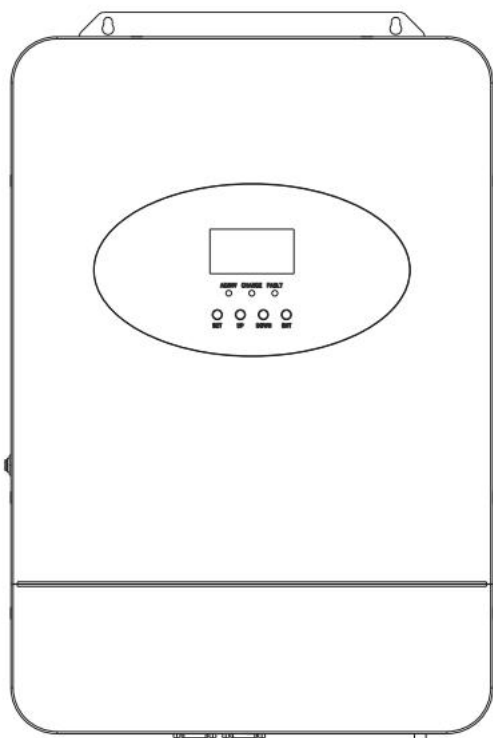
This multifunctional off-grid solar inverter integrates MPPT solar charging controller, high frequency pure sinusoidal inverter and a UPS function module. This inverter works with or without a battery.

The system requires additional equipment, such as photovoltaic modules, generators, or public power grids. Consult your system integrator at your request for other system components that may be used. The WiFi/GPRS module is a plug-and-play monitoring device installed on an inverter that allows the user to monitor the system's status anytime, anywhere, through a mobile phone or web page.

Main features

- ▶ Rated power 3.5KW or 5KW, power factor 1
- ▶ MPPT range 120V~450V, maximum PV open circuit voltage 500Vdc
- ▶ High frequency inverter, small in size and light in weight
- ▶ Solar energy and Electric AC power supply system supply power can be carried at the same time.
- ▶ With CAN/RS485 available to communicate with BMS
- ▶ Support for battery-free work
- ▶ Can be operated in parallel with up to 6 (battery must be connected when combined)
- ▶ WIFI/GPRS Remote Monitoring (Optional)

product overview



- | | |
|------------------------------------|---|
| 1. LCD display | 2. Status indicator |
| 3. Charge indicator | 4. Fault indicator |
| 5. Function key | 6. Circuit breaker |
| 7.AC Input Interface | 8. AC output interface |
| 9. RS485_2 communication interface | 10. USB communication interface |
| 11. RS485_1communication interface | 12. Dry contact |
| 13. CAN communication interface | 14. PV Input Interface |
| 15. ON/OFF on-off | 16. Parallel machine streamline interface |
| 17. parallel communication line | 18.Battery port |

Installation

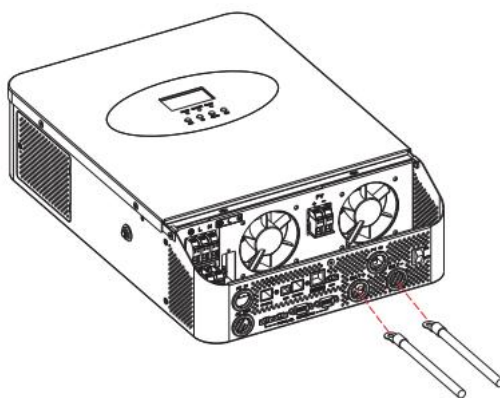
Out of the Box and Inspection

Check that the item is intact before installing it. Unpack the inverter to confirm that there is no damage in the package. Check to see if all of the following objects are included:

- ▶ Inverter x 1
- ▶ Manual x 1
- ▶ Parallel machine line x 1
- ▶ parallel communication line x 1

prepare before installation


Before wiring, remove the screws in the lower cover section of the upper panel of the machine and remove the lower cover.

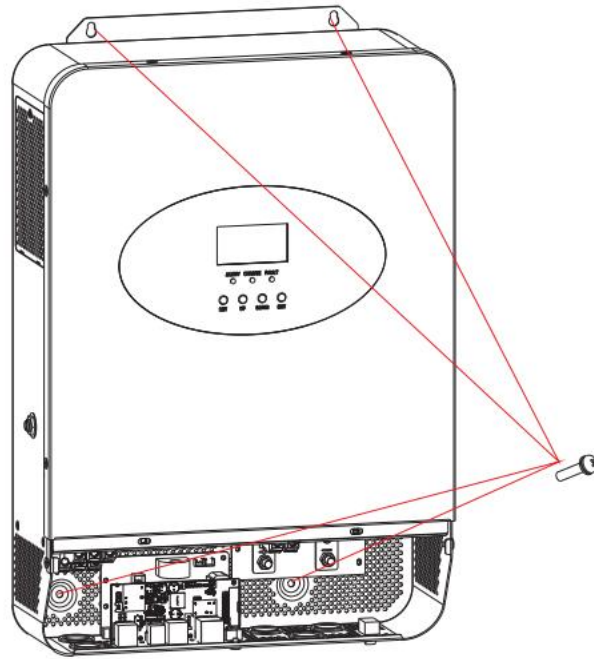


Install and Fix

Consider the following points before selecting the installation location:

- ▶ Do not install inverters on flammable building materials.
- ▶ Mounted on solid walls.
- ▶ The installation height Electric AC power supply system supply as high as possible for ease of operation as the eye view.
- ▶ Ensure optimal operating conditions; ambient temperatures should be between 0 ° C and 55 ° C.
- ▶ It is recommended to attach the machine vertically to the wall.
- ▶ Ensure that there is some free space around the inverter, as shown in the right, to ensure adequate heat dissipation and sufficient space to move the cable

 Suitable for mounting on concrete or other non-combustible building material surfaces.



As shown in the figure above, screws are screwed to secure the installation. M4 or M5 screws are recommended.

Battery Connection

Lead-acid battery Connection

Users can use the right capacity 48 V lead-acid battery pack, which is the factory default for GLE colloidal lead-acid batteries.

Note! To operate safely and comply with safety requirements, a DC overflow protection Disconnect is required between the battery and the inverter. A single machine circuit breaker recommends 140A for SD SPI-3K and 160A for SD MPI-5K-PH.

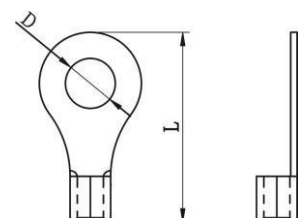
Caution! Professionals must perform all wiring.

Caution! Using the right cable to connect the battery is important for the system to operate safely and efficiently. To reduce risk, use the correct line and terminal specifications recommended below.

Recommended battery cable and terminal specifications:

model	Cable specifications	Torque value
SD SPI-3K	1 * 2AWG	2-3 Nm

Ring terminal:

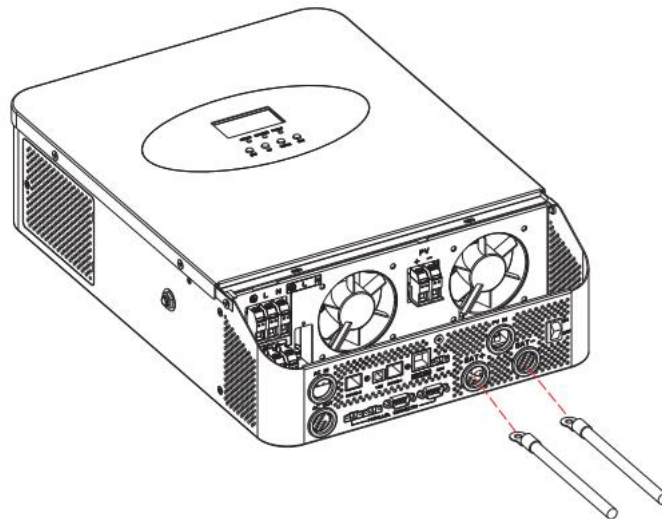


SD MPI-3K	1 * 3AWG	2-3 Nm
SD MPI-5K-PH	1 * 2 AWG	2-3 Nm

Note! The recommended charging current for lead-acid batteries is 0.2C (battery capacity referred to as C)

Follow these steps to connect the battery:

1. Assemble the battery according to recommended battery cable and ring terminal specifications.
2. SD SPI-3K/ SD MPI-3K /SD MPI-5K-PH recommend at least 200AH batteries as needed to connect all batteries.
3. Plug the annular terminal of the battery cable into the battery connection port of the inverter flat and ensure that the bolt is tightened at 2-3Nm torque. Ensure the polarity of the battery and inverter is properly connected, and pull the ring terminal to the battery terminal.



Caution! Electric shock hazard

Because the battery voltage in series is too high, care must be taken to install it.



Note! Do not place any items between the flat part of the inverter terminal and the ring terminal, otherwise it may cause a short circuit or overheat.

Note! Do not apply antioxidants to terminals until they are closely connected.

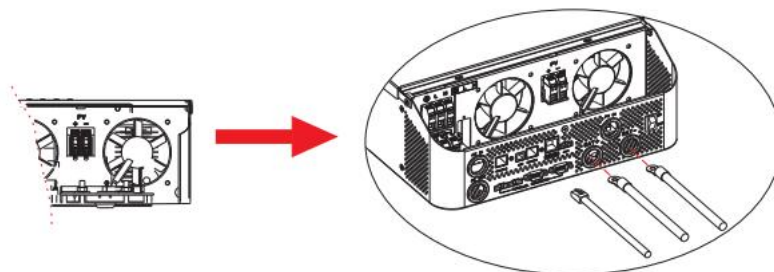
Note! Before making the final DC connection, ensure that the DC circuit breaker/isolation switch is disconnected, that the positive (+) must be connected to the positive (+) and the negative (-) must be connected to the negative (-).

Lithium battery Connection

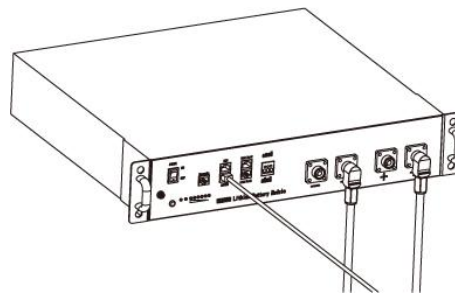
If you match a lithium battery for a SD SPI-3K/SD MPI-5K-PH inverter, only lithium batteries that already match the inverter protocol are allowed. There are two wiring ports on the lithium battery, the RJ45 interface for communication and the battery positive and negative power cord interface.

Follow these steps to operate the inverter to connect to the lithium battery:

1. Assemble battery ring terminals according to recommended battery cable and terminal specifications (as with lead-acid batteries, see lead-acid battery connect ion section for details)
2. Insert the annular terminal of the battery cable into the inverter's battery connect or flat and ensure the bolt is tightened at 2-3Nm torque. Ensure the polarity of the battery and inverter is properly connect ed, and the ring terminal is pulled to the battery terminal.
3. Connected end of the RJ45 line to the inverter BMS communication interface (RS 485/CAN).



4. Plug the other end of the RJ45 line into the battery communication interface (RS485 or CAN).

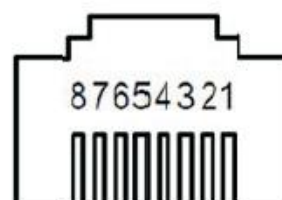


Note! If you choose a lithium battery and communicate with the inverter, ensure that the battery and inverter are connected using the RJ45 communication cable.

Use RJ45 wire to connect the battery end to the inverter end BMS communication interface.

Make sure that the lithium battery BMS interface corresponds to the pin of the inverter BMS communication interface. The inverter RS485 interface pin definition is shown below:

Pin	RS485接口
1	+5V
2	GND
3	--
4	--



5	--
6	--
7	RS485-A
8	RS485-B

LCD screen parameter settings

If communicating with the battery BMS, the inverter item 8 program sets the corresponding lithium battery type, and then the battery manufacturer is selected for the 33 items.

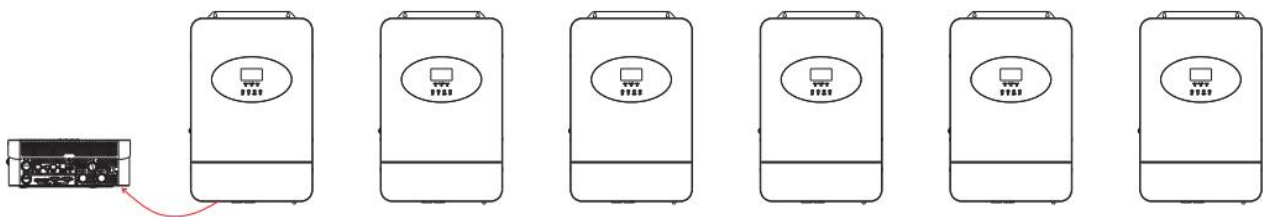
Note: The inverter, RS485, can only select one of the protocol traffic.

Note: When battery mode is set to lithium battery, the maximum charge current is specified, Item 07 can be set manually.

Note: If communication fails when battery mode is set to lithium battery, the Li text flashes. Contact your vendor for any problems communicating with the BMS.

The system communicates with the battery BMS

Only one other inverter communicates with the battery BMS when the inverter is multiple and the host is recommended to share with the battery.



AC Input/Output Connection

Note! Install a separate AC circuit breaker between the inverter and AC input power supply before connecting to the AC input power supplies. Ensures that the inverter is securely disconnected during maintenance and avoids AC input overload. Recommended specification 40A for inverter AC circuit breakers.

Note! There are two fiber terminals with "IN" and "OUT" markings. Avoid incorrect input and output wiring or causing machine damage.

Note! All wiring must be performed by professionals.

Note! AC input connections using suitable cables are important for the safe and efficient operation of the system. To reduce the risk of injury, use the cable specifications recommended below.

Open Specification Recommendations for AC Input:

model	wire gauge	Torque value
SD SPI-3K	1 * 7AWG	1.2-1.6 Nm
SD MPI-3K	1 * 8AWG	1.2-1.6 Nm
SD MPI-5K-PH	1 * 7 AWG	1.2-1.6 Nm

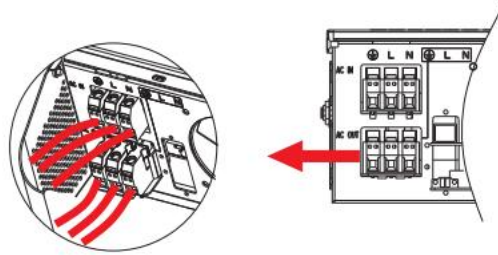
1. Follow these steps to perform an AC input/output connection:
2. Before making an AC input/output connection, make sure the DC protector or isolation switch is disconnected.
3. Peel off the insulated casing of 6 wires 10mm and cut the L and N wires 3 mm shorter.
4. Insert the AC input line as identified at the terminal and tighten the terminal screw. Be sure to connect the PE protector first.



→Ground Line (Yellow-Green)

L→Fire-line (brown, black)

N→Zero Line (Blue)



Note:

Before connecting it to the device, ensure that the AC input is empty and disconnected to avoid electric shock.

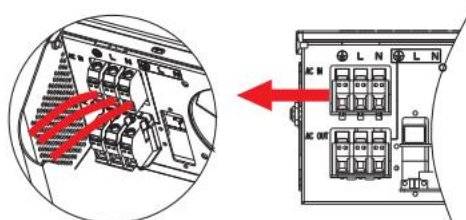
5. Then insert the AC output line and tighten the port screws according to the identity at the terminal. Be sure to connect the PE protector first.



→Ground Line (Yellow-Green)

L→Fire-line (brown, black)

N→Zero Line (Blue)



6. Make sure the wires are well connected.

Note: AC wiring follows the identification. If the L and N lines are misfired, multiple parallel runs may result in a short circuit to the grid.

Note: Appliances such as air conditioners may take 2 ~ 3 minutes to restart because sufficient time is required to balance the refrigerant gas inside the circuit. If there is a power shortage and recovery in a short period, it will cause damage to the devices you connect. To prevent such damage, verify with the air conditioner that there is a delay before

installation. Otherwise, the solar inverter triggers an overload failure and cuts the output to protect your device, but sometimes causes damage to the interior of the air conditioner.

PV connection

Note: Before connecting photovoltaic modules, install a DC circuit breaker between the inverter and the photovoltaic module.

Note! Professionals must perform all wiring.

Note! connecting photovoltaic modules with suitable cables is important for the safe and efficient operation of the system. To reduce system risk, use the correct cable specifications recommended below.

model	Wire gauge	Torque value
SD SPI-3K	1 * 10AWG	1.2-1.6 Nm
SD MPI-3K	1 * 10AWG	1.2-1.6 Nm
SD MPI-5K-PH	1 * 10AWG	1.2-1.6 Nm

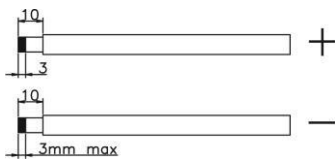
Photovoltaic Module Selection:

1. When selecting the appropriate photovoltaic modules, be sure to consider the following parameters:
2. PV open circuit voltage (Voc) does not exceed the maximum allowed open circuit voltage by the inverter.
3. PV open circuit voltage (Voc) configuration 360Vdc is optimal.

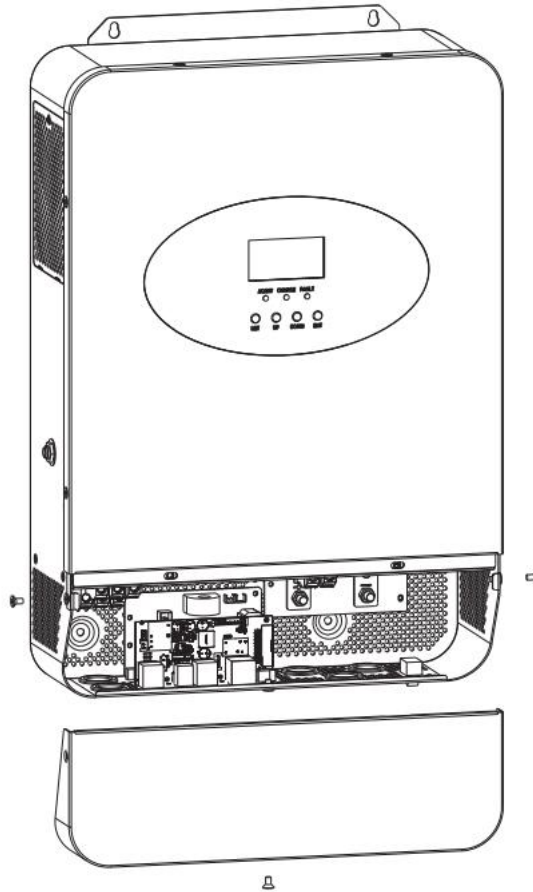
Model	SD SPI-3K	SD MPI-3K	SD MPI-5K-PH
Maximum open circuit voltage (Voc)	500Vdc		
Starting voltage	120Vdc		
MPPT voltage range	120Vdc~450Vdc		

Follow these steps to connect the PV mode array.

1. Stripped 10 mm positive and negative conductor-insulated casing



2. Check the correct polarity of the cable connection between the PV module and the PV input connector. Then connect the positive (+) of the cable to the positive (+) of the PV input connector. Connect the negative (-) of the line to the negative (-) of the PV input connector.



3. Make sure the wiring is firm.

Install Finishing Ends

When all the wires are connected, install the bottom cover back and screw.

Dry- contact point

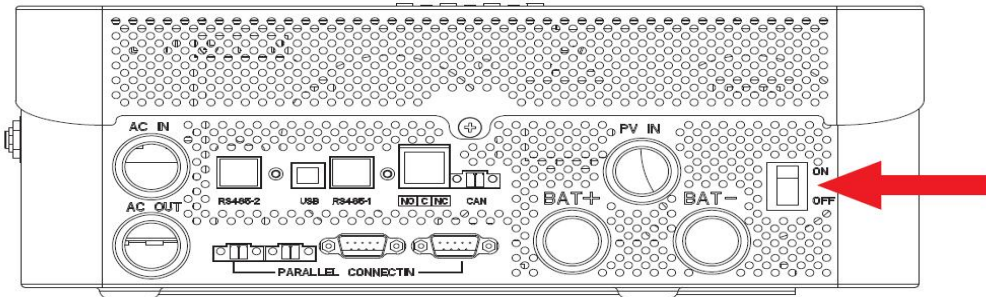
A dry node in the bottom port (1 A/250 VAC, 1A/125 VAC, 1A/30VDC) signals external devices when the battery voltage or capacity is low to a value. It is generally used to connect related external generators.

Equipment State	Condition		Dry contact port:	
			NC & C	NO & C
Power-off	The device is turned off		off	on
Power-on	Output by a Electric AC power supply system supply-electric bypass in the belt load		on	off
	Carry working mode	Item 1 is the UTI mode	Electric AC power supply system supply power preferential load mode, switch to battery mode when no Electric AC power	On

			supply system supply power input.		
		Setting Item 1 is in the "SUB" mode	Battery Limited Load Mode. Switch to Electric AC power supply system supply load when battery voltage < Item 04 is set, then switch to battery load mode when battery voltage charge reaches 05. Set item voltage point	off	on
		The first set item is "SOL" mode	Photovoltaic preferential band load, when no light volt input or battery voltage below 04 cell voltage point, switch to Electric AC power supply system supply band load	off	on

Product operation

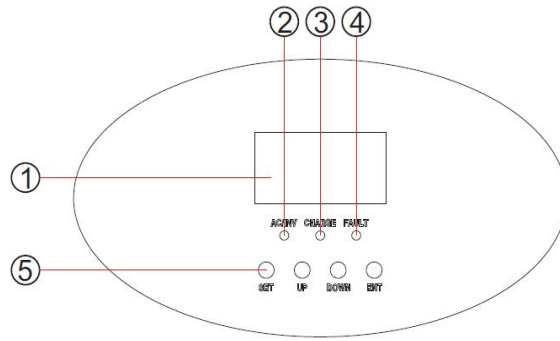
Power switch ON/OFF



After installing and connecting the battery correctly, press the On/Off switch (bottom right corner) to turn the machine on.

Operation & Display

The operation and display panels shown in the following figure are located on the front panel of the inverter. It includes three LED's, four function keys and an LCD to indicate operating status and input/output power information.



1. LCD display screen
2. Status indicator light
3. Charge lamp
4. Error indicator
5. function button

LED indicator light

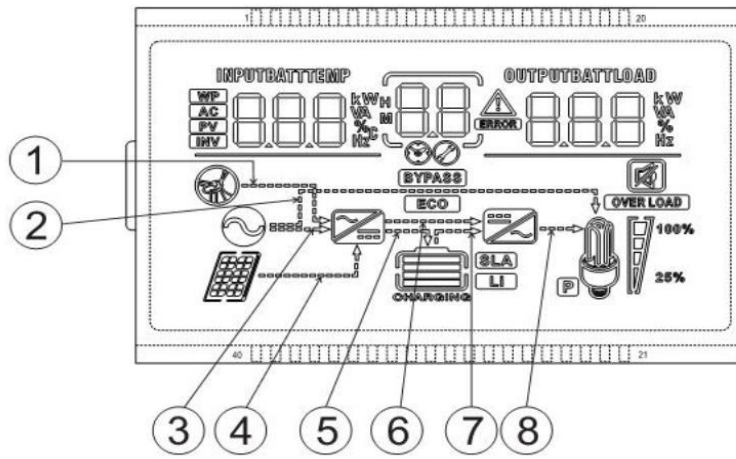
LED indicator light		message	
AC/INV	yellow	fix	In Electric AC power supply system supply mode, the output is powered by Electric AC power supply system supply power
		flash	In battery mode, the output is powered by a battery or PV
CHARGE	green	fix	Full Battery
		flash	battery is charging
FAULT	red	fix	Inverter malfunctions









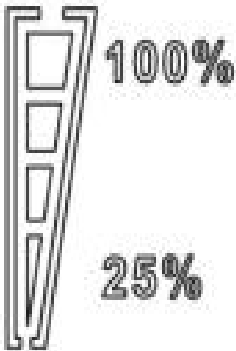









Function button



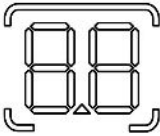

press	depict
ESC	Enter or exit the setting mode
UP	Ahead setting
DOWN	Next setting
ENT	Verify to select the set mode or enter the set mode

LCD Display Information





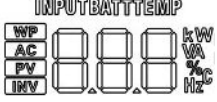
The LCD display information is switched by pressing the "UP" or "DOWN" keys. Display information includes voltage, frequency, current, power, firmware version



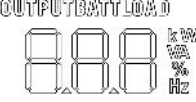
number	icon	Functional description
1)		AC input is connected to the power grid
2)		APL mode (oil mode)
3)		PV input is connected to the solar panel
4)		Machine is connected to the storage battery,
5)		The current battery type of the machine is a lithium battery
6)		The current type of the machine battery is a lead-acid battery
7)		Inverter circuit is working
8)		Machine is in Electric AC power supply system supply Bypass (Bypass) operating mode
9)		the percentage of the AC output load:  AC output load percentage of 0%~24%;  AC output load percentage of 25%~49%,  AC output load percentage of 50%~74%,  AC output load percentage of \geq 75%
10)		The buzzer was not enabled
11)		An alarm occurring on the machine
12)		Battery is in a charging state
13)		the AC / PV charging circuit is working
14)		AC voltage transmission at the AC

		output
15)		Machine is in a faulty state
16)		Machine is in the setup mode
17)		The middle parameter of the screen is displayed, indicating AC output has AC voltage output 1, non-set mode, display alarm or fault code; 2. In Set Mode, display the currently set parameter item code.
18)		When connected, this icon indicates that this machine is a host and only in parallel mode.

Input parameter

	AC input
	PV input
	Inverter circuit
	The icon is not shown
	Display battery voltage, total battery charge current, Electric AC power supply system supply charge power, AC input voltage, AC input frequency, PV input voltage, internal radiator temperature, and software version.

输出参数

	Indicates output voltage, output current, active output power, apparent output power, battery discharge current, and software version; In setup mode, displays the setting parameters under the currently set parameter item code.
---	--

LCD display parameter setting

Indicates output voltage, output current, active output power, apparent output power, battery discharge current, and software version; In setup mode, displays the setting parameters under the currently set parameter item code.

Set the item	describe	Set options
00	Withdraw from	Exit setup menu
01	Output priority, configure the power supply priority	<p>UTI: Electric AC power supply system supply band load priority mode, when there is no Electric AC power supply system supply, cut into the battery inverter belt load mode.SOL: Electric AC power supply system supply priority mode, switch to inverter only when city is invalid.</p> <p>SBU: Inverse priority mode, only switch to Electric AC power supply system supply if the battery is under voltage or below the parameter [04] set value;</p> <p>PV priority mode, switch to maidenhead PV is invalid or the battery is lower than the set value of parameter [04].</p>
02	output frequency	<p>The bypass adapts to the Electric AC power supply system supply power frequency automatically when there is Electric AC power supply system supply power; When there is no Electric AC power supply system supply power. The output frequency can be set from this menu. 230V the machine to silence 50 Hz, 120V the machine 60HZ by default.</p>
03	AC input voltage range.	<p>UPS default: 230V machine narrow range input city power voltage range 170 to 280 V Electricity input range of 120V machine: 90~140V</p> <p>APL: 230V Machine wide range input Electric AC power supply system supply voltage range 90 to 280 V Electricity input range of 120V machine: 90~140V</p>

04	Battery to Electric AC power supply system supply electricity	Default 43.6V: In the parameter [01] =SBU, when the battery voltage is lower than the setting value, the output switches from inverter to city power, and the setting range is 40 V to 52 V.
05	Used to battery	Default 57.6V: parameter [01] =SBU, the battery voltage is higher than the setting value, the output switch from main to inverter, the setting range is 48V~60V.
06	Charging mode	<p>SNU default: photovoltaic and Electric AC power supply system hybrid charging, priority photovoltaic charging, photovoltaic energy is insufficient, Electric AC power supply system charging supplement. When the photovoltaic power is sufficient, the Electric AC power supply system power stops charging. Note: Only the Electric AC power supply system bypass output with load-on time volt and Electric AC power supply system can be charged at the same time. When the inverter works, the photovoltaic charging can only be started.</p> <p>CSO: Photovoltaic charging is preferred, and only main supply is started when photovoltaic is invalid.</p> <p>CUB: main supply is a priority, and PV charging is started only when Electric AC power supply system is invalid.</p> <p>OSO: Only photovoltaic charging, not starting Electric AC power supply system charging.</p>
07	Maximum charging current	Default 60A, set range 0~100A.
08	Battery type	<p>USE : User custom, can set all battery parameters.</p> <p>SLd : Sealed lead-acid battery, constant voltage charging voltage 57.6V, floating charge voltage 55.2V.</p> <p>FLd: Open-mouth lead-acid battery, constant voltage charging voltage 58.4V, floating charge voltage 55.2V.</p> <p>GEL Default: colloidal lead-acid battery, constant</p>

		<p>voltage charging voltage 56.8V, floating charge voltage 55.2V.</p> <p>LF14 / LF15 / LF16: lithium iron phosphate battery LF16 / LF15 / LF14, corresponding to lithium iron phosphate battery 16,15 and 14,16 default constant voltage charging voltage 56.8V, 15 default constant voltage 53.2V, 14 default constant voltage 49.2V, can be adjusted.</p> <p>N13 / N14: ternary lithium battery, adjustable. N13 default constant voltage charging voltage 53.2V, N14 string default constant voltage charging voltage 57.6V.</p>
09	Increase charging voltage	Default 57.8V, go-up charging voltage setting, set range 48V~58.4V, step 0.4V, battery type is custom and lithium battery is valid
10	Increase the maximum charging time	Default 120min, improve the maximum charging time setting, refers to the constant voltage charging when the maximum set voltage charging time, the setting range of 5min~900min, step for 5 minutes.
11	floating charge voltage	Default 55.2V, floating charge voltage, set range 48V~58.4V, step 0.4V.
12	Over and over voltage	Default is 42V, the over discharge voltage, and the battery voltage is lower than the judgment point. After the delay parameter [13] is set for the time, the inverter output is closed, the set range is 40V~48V, and the step is 0.4V.
13	Over time delay time	Default 5S, over release delay time, when the battery voltage is lower than the parameter [12], close the inverter output after the delay time of this parameter is set, with the setting range of 5S~50S, and step 5S.
14	Battery under voltage alarm point	Default 44V, battery under voltage alarm point, the battery voltage is below the judgment point, the under voltage alarm, output does not off, set range 40V~52V, step 0.4V.
15	Battery discharge limit voltage	Default 40V, battery discharge limit voltage, battery voltage is below the judgment point, the

		output is immediately off. Set the range is 40V~52V, the step is 0.4V, and the battery type is custom and the lithium battery is valid.
16	equalizing charge	DIS, Equalized charging is prohibited. ENA default, it enables balanced charging, only open lead-acid batteries and sealed lead-acid batteries are effective, and the custom (User) is effective.
17	Balanced charging voltage	Default 58.4V, balanced charging voltage, set range 48V~58.4V, step 0.4V, open lead-acid battery and sealed lead-acid battery effective, and custom (User) valid.
18	Balanced charging time	Default 120, balanced charging time, set the range of 5min~900min, step for 5 minutes, open lead acid battery and sealed lead acid battery are effective.
19	Balanced charging delay	Default 240, balanced charging delay, set range of 5min~900min, step for 5 minutes, open lead acid battery and sealed lead acid battery valid, and custom (User) valid
20	Equalize the charging interval time	Default 30, balanced charging interval time, 0~30days, step for 1 day, open lead acid battery and sealed lead acid battery effective, and custom (User) effective
21	Balanced charging enables	Default DIS, stop balanced charging immediately. ENA, start the balanced charging immediately.
22	Energy saving mode	Default DIS, prohibit energy saving mode. ENA, after enabling the energy saving mode, if the load is empty or less than 50W, the inverter output delay after a period of time; when the load is greater than 50W, the inverter will automatically start.
23	Overload auto automatically	Default ENA enables overload and automatic restart. If overload shutdown output occurs, the machine will restart the output after 3 minutes delay. After accumulating 5 times, no longer resume the boot. DIS, prohibit overload

		automatic restart, if overload shutdown output occurs, the machine will not resume boot.
24	Over-temperature automatically re-star	<p>Default ENA enables automatic restart of over temperature. If over temperature closes the output, the open output will be restarted after the temperature drops.</p> <p>DIS, prohibit over temperature automatic restart, if over temperature turn off the output machine no longer open the output.</p>
25	buzzer warning	<p>Default ENA, enabling the alarm</p> <p>.DIS, No alarm.</p>
26	Mode conversion reminder	<p>Default ENA, which enables alarm prompts when the state of the main input source changes.</p> <p>DIS, The alarm warning is prohibited when the status of the main input source changes</p>
27	Inverse overload to bypass	<p>Default ENA, automatically switch to the city power when inverter overload.</p> <p>DIS, Automatic power cutting is prohibited during inverter overload.</p>
28	AC charging maximum current	Default 40A; EU series models, set range 0-60A, default 60 A. AC charging maximum charging current setting. UL series models, setting range 0~40A,
29	Output phase separation function	<p>Default DIS, and disables this feature.</p> <p>ENA, enabling the output with power frequency transformer.</p>
30	Model ID Settings	Default 1, parallel mode needs to be set, set the range 1-6
31	AC Output Mode (available in standby mode only)	<p>SIG: Stand-alone usage settings items</p> <p>PAL: Single-phase parallel use settings.</p> <p>2P0/2P1/2P2 : Use of two-phase parallel settings.</p> <p>All machine screens connect ed to the P1 need to be set to "2P0";</p>

		<p>1) Suppose that the output voltage set when the [38] setting item is 120Vac</p> <p>2) When all machine screens connect ed to P2 are set to "2P1", the voltage phase between P1 and P2 is 120 degrees, and the voltage between fire wire L1 of P1 and L2 of P2 is $120 \times 1.732 = 208\text{Vac}$; the voltage between L1-N and L2-N is 120 V a c.</p> <p>When all machine screens connect ed to P2 are set to "2P2", the voltage phase between P1 and P2 is 180 degrees, and the voltage between fire wire L1 of P1 and L2 of P2 phase is $120 \times 2 = 240\text{Vac}$; L1-N, and the voltage between L2-N is 120Vac.3P1/3P2/3P3:</p> <p>Use setting item for three-phase parallel.</p> <p>All machine screens connect ed to the P1 need to be set to "3P1"; All machine screens connect ed to the P2 are set to "3P2"; All machine screens connect ed to the P3 are set to "3P3" .</p> <p>1) Suppose the output voltage set is 120Vac: At this time, the voltage phase difference between (P1-P2, P1-P3-P3, P2-P 3), and the voltage between P1 phase L1 and L2 of P2 is $120 \times 1.732 = 208\text{Vac}$, L1-L3, L2-L3 is 208Vac, L1-N, L2-N, and L3-N is 120Vac.</p> <p>Suppose the output voltage set when the [38] setting item is 230Vac:</p> <p>At this time, the voltage phase difference between (P1-P2, P1-P3, P2-P3) is 120 degrees, and the voltage between P1 phase L1 and L2 of P2 is $230 \times 1.732 = 398\text{Vac}$, similarly L1-L3 and L2-L3 is 398Vac; the voltage between L1-N, L2-N and L3-N is 230Vac</p>
32	RS485communication function	<p>Default SLA, RS485-1 Remote monitoring protocol.</p> <p>[32] BMS , RS485-2 BMS Communication function.</p>

33	BMS communication	When [32] sets the item =BMS, the corresponding lithium battery manufacturer brand should be selected for communication. PAC= Peicheng, RDA= Ruida, AOG= Olympic, OLT= Eur, HWD= Xinwanda, DAQ= Daqin, PYL= energy, UOL= no blue.
35	Low voltage Disconnect battery voltage recovery point (04 fault)	52V default, when the battery low voltage disconnected inverter output, the battery voltage should be greater than this setting value to restore the battery inverter AC output.
36	PV Maximum charging current	80A By default, the maximum solar charging current is set: 0~80A
37	Battery Recharge recovery point	By 52V default, after the battery is charged, the inverter stops charging. When the battery voltage is lower than this voltage value, the charging is resumed.
38	AC output voltage gear setting	EU series models: 200 / 208 / 220 / 230 / 240Vac is available, and the default is 230Vac. AC output power = Rated power * (set voltage / 230) UL series models: 100 / 105 / 110 / 120Vac are available, with the default value of 120Vac. AC output power = Rated power * (set voltage / 120)
39	Stop charging current	By 2A default, when the charging current is less than the value, the charging stops
40	Discharge SOC alarm setting	By 15% default, When the capacity is low than 15%, SOC will alarm. (This parameter is valid when the BMS communication is normal),
41	Discharge cut-off SOC setting	By 5% default, When the capacity is lower than this value, the discharge stops. (This parameter is valid when the BMS communication is normal),
42	Charging cut-off SOC setting	By 100% default, When the capacity is smaller than the preset value, stop charging. (This parameter is valid when the BMS communication is normal),

43	SOC setting of switching to mains supply	By 10% default, when capacity is lower than the preset value, switch to mains supply.(This parameter is valid when the BMS communication is normal),
44	SOC setting of switching to inverter output	By 100% default, when capacity is smaller than the preset value, switch to inverter output. (This parameter is valid when the BMS communication is normal),

Charging mode

1) PV priority: PV charging is preferred, and Electric AC power supply system charging only starts when the PV fails. Make full use of solar power during the day, transfer to market electricity at night, can maintain the battery charge



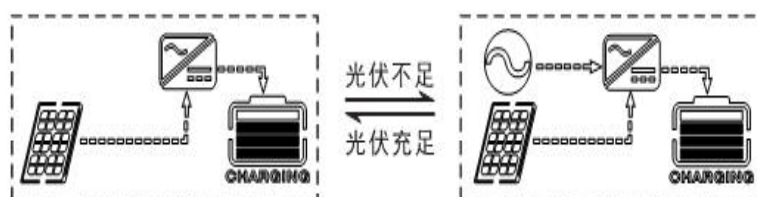
As shown in the figure, the PV connection is successful on the left and the failure is on the right

2) Main supply first: main supply gives priority to charging batteries, and only start photovoltaic charging when Electric AC power supply system is invalid.



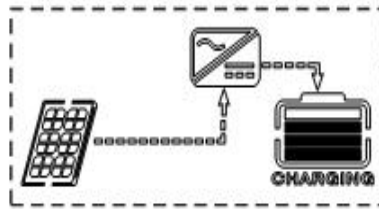
As shown in the figure, the main supply connection is successful on the left and the failure is on the right.

3) Hybrid charging: photovoltaic and Electric AC power supply system hybrid charging, priority photovoltaic MPPT charging, photovoltaic energy is insufficient, Electric AC power supply system supplement. When the photovoltaic power is sufficient, the Electric AC power supply system power stops charging.



As shown in the figure, the amount of photovoltaic charging is sufficient on the left, not on the right.

4) Photovoltaic charging only (Only Solar): photovoltaic charging only, not the main supply, is charging to start. This way is the most energy-saving way; the battery power is from solar energy, used in areas with good light conditions

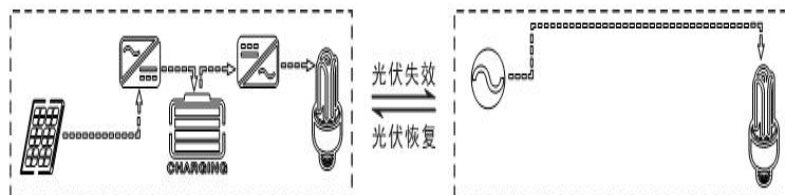


Power supply mode

PV priority mode:

When the photovoltaic is invalid, switch to the Electric AC power supply system power supply and charging. The mode maximizes the use of solar energy while maintaining battery power and is suitable for relatively stable grid areas.

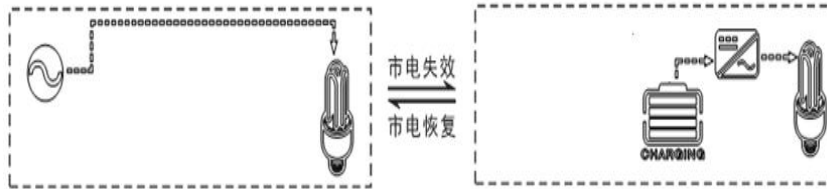
The priority of the power supply order realized is: Photovoltaic-electric AC power supply system-battery.



As shown in the figure, the PV connection is successful on the left and the failure is on the right.

Municipal Electricity priority mode:

Only switch to battery inverter power supply when there are no Electric AC power supply system, and switch to Electric AC power supply system charging and power supply when there are Electric AC power supply system. The equipment is equivalent to a backup UPS and is used in areas with power grid instability. Switching does not affect photovoltaic charging. **The priority of the power supply order realized is: Electric AC power supply system-photovoltaic-battery.**

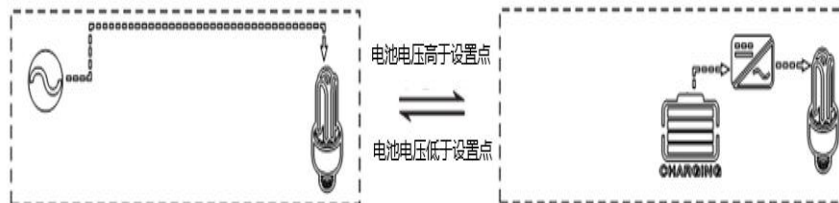


As shown in the figure, the main supply connection is successful on the left and the failure is on the right.

➤ **Inverse priority mode:**

Only when the battery voltage is lower than the setting point (04 setting point), switch to the city power supply, and when the city power charging battery voltage is higher than the (05 set point), switch to the battery discharge mode, and cycle the battery is charged and discharged. This model uses maximum DC power for grid stability areas. Switching does not affect photovoltaic charging. (Photovoltaic-battery-Electric AC power supply system priority power supply order).

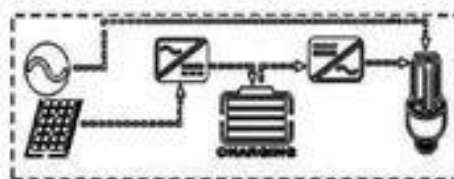
The priority of the power supply order realized is: photovoltaic-battery-Electric AC power supply system.



As shown, the graph on the right - is the battery voltage to the right of the set point; the graph on the left - is lower than the figure on the left of the set point.

➤ **Mixed load and grid connection settings:**

Mixed belt load mode, in Electric AC power supply system mode, photovoltaic only priority charging, surplus energy supply load, not feed into the grid; grid connection function, in Electric AC power supply system mode, photovoltaic priority charging, residual energy function load and feed into the grid.



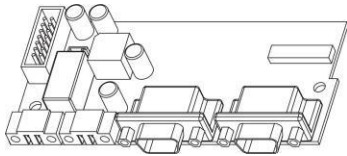
Parallel operating instructions

There are two parallel modes of the inverter

1. Single-phase parallel machine, up to 6 sets.
2. Three-phase parallel machine, up to 6 sets

NOTE: If the package has a parallel machine line and a parallel flow line, the inverter is the default with the parallel machine function. The parallel machine function will skip the following steps of installing the parallel machine board below. Machines without merge functions require additional merge kits and are installed by professionals in the next steps.

Packaging contents of parallel kit



Parallel machine board x 1



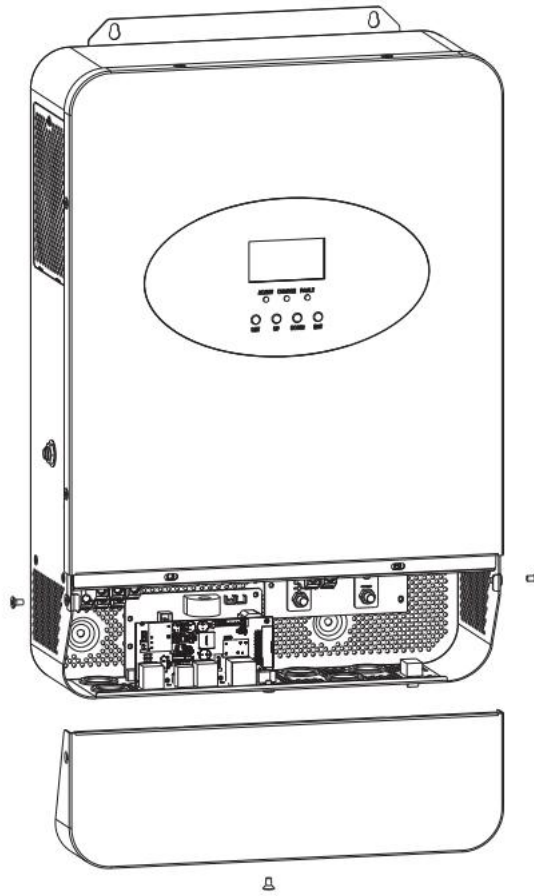
Combined machine communication line x 1



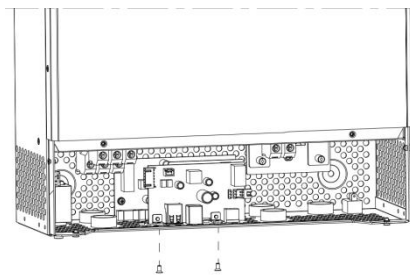
Parallel machine uniform streamline x 1

Parallel machine board installation

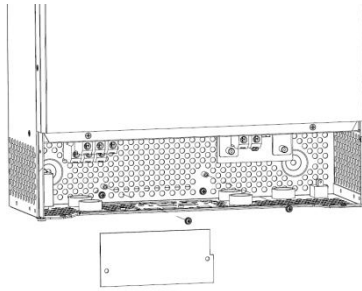
Step 1: screw the bottom cap and remove the cap.



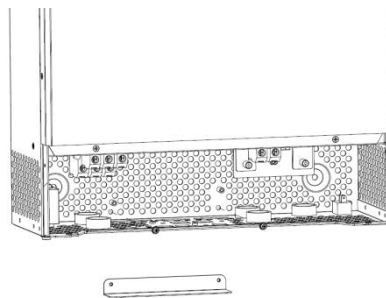
Step 2: Take the screw, remove the WiFi / GPRS communication board and CAN / RS485 communication board, and remove the 2-pin and 6-pin cables.



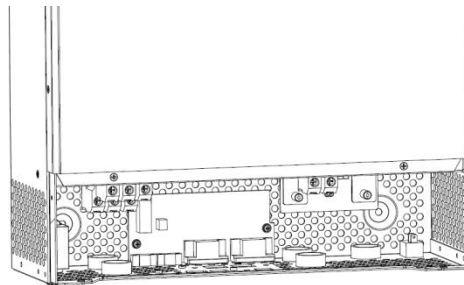
Step 3: Take the screw, remove the 2-pin and 14pin wiring, and remove the baffle.



Step 4: Take screw and remove the baffle at the communication interface

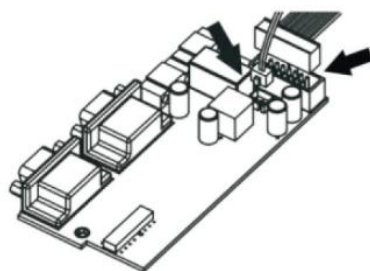


Step 5: Install the parallel board

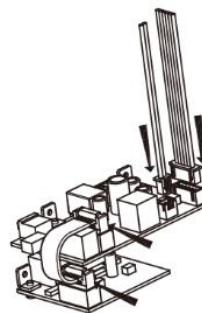


Step 6: Reconnect 2-pin and 14-pin to the parallel board, and reconnect 2-pin and 6-pin to the communication board

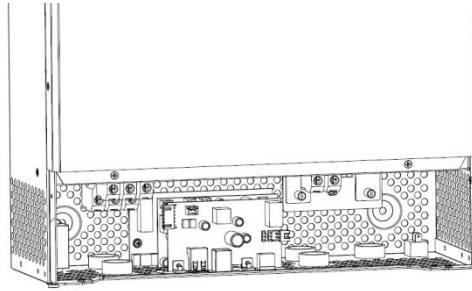
Parallel machine board



Communication board



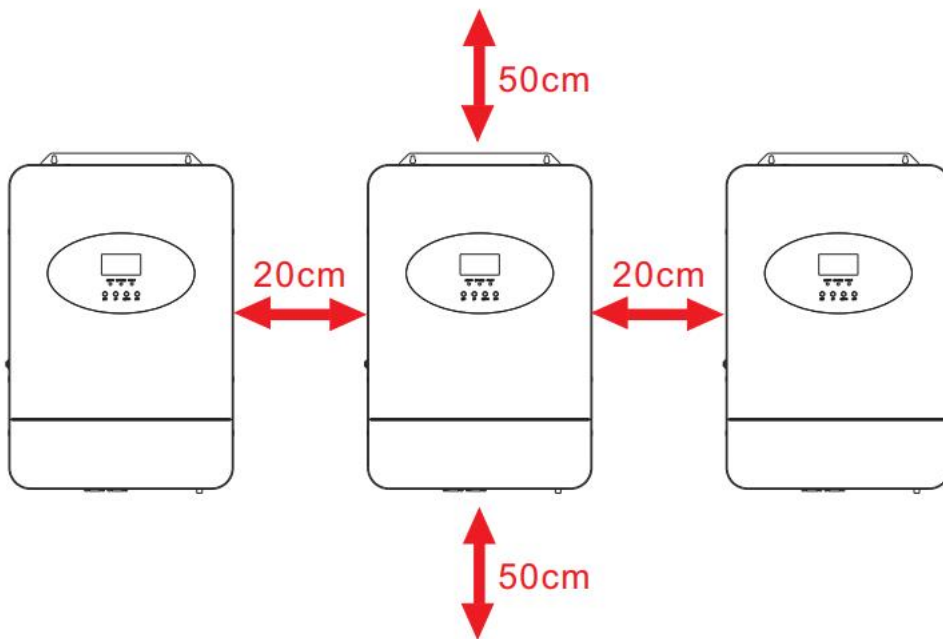
Step 7: Reinstall the communication board



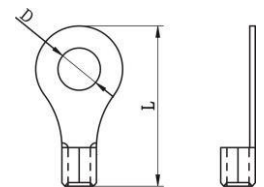
Step 8: Install the wiring cover back in

machine installation

When combining the machine for installation, in order to ensure normal heat dissipation, the machine should keep the following spacing (at least 20cm left and right, at least 50cm up and down) and install the machine on the same horizontal line.



Ring terminal:



The mode of connection

The recommended battery wire and terminal specifications for a single machine are as follows:

Model	Wire gauge	Torque
SD SPI-3K	1 * 3 AWG	2-3 Nm
SD MPI-3K	1 * 2 AWG	2-3 Nm

SD MPI-5K-PH	1 * 2 AWG	2-3 Nm
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NOTE : Make sure that all battery cables have the same length. Otherwise, there will be a voltage difference between the inverter and the battery, resulting in the parallel inverter does not work normally. The cable of each inverter needs to be connected together. In the case of the battery cable: you need to use the connector or junction row as a connector and then connect to the battery terminal. The bus wire specification of the battery terminal shall be X times that of the wire specification in the table above, and "X" indicates the number of parallel inverters. Follow the same principle for usage specifications for AC input and output wire.

The wire specifications of each AC input and output recommended for a single machine are as follows:

Model	Wire gauge	Torque
SD SPI-3K	1 * 7AWG	1.2-1.6Nm
SD MPI-3K	1 * 7AWG	1.2-1.6Nm
SD MPI-5K-PH	1 * 7AWG	1.2-1.6Nm

Pay attention to it! The battery and the inverter, as well as between the AC input and the inverter, should be connected to the empty open so that you can protect from the current and can also ensure the safe disconnection of the line during maintenance.

The recommended empty opening specifications for the battery access end of a single machine are as follows:

Model	1set*
SD SPI-3K	140A / 60VDC
SD MPI-3K	120A / 60VDC
SD MPI-5K-PH	160A / 60VDC

*If only one total available battery end is connected to the whole parallel system, the size of the space will be X times that of a single one, and X represents the number of parallel machines. AC input recommends recommended open specification (single-phase parallel):

Model	2sets	3sets	4stes	5stes	6stes
SD MPI-5K-PH	80A/230VAC	120A/230VAC	160A/230VAC	200A/230VAC	240A/230VAC

NOTE 1: SD SPI-3K, SD MPI-5K-PH single set can be used 40A empty open, each inverter AC input terminal has to open an empty open.

NOTE 2: The three-phase parallel machine system can use the four poles for the three-phase similar machine system. The empty opening specification is based on the maximum current of which phase (the largest degree of the machine), or we can also use the practice of each access open opening above.

The number of machine	2	3	4	5	6
battery capacity	400AH	600AH	800AH	1000AH	1200AH

WARN! In the parallel system, all inverters must share a single battery pack. Otherwise, the machine will not work.

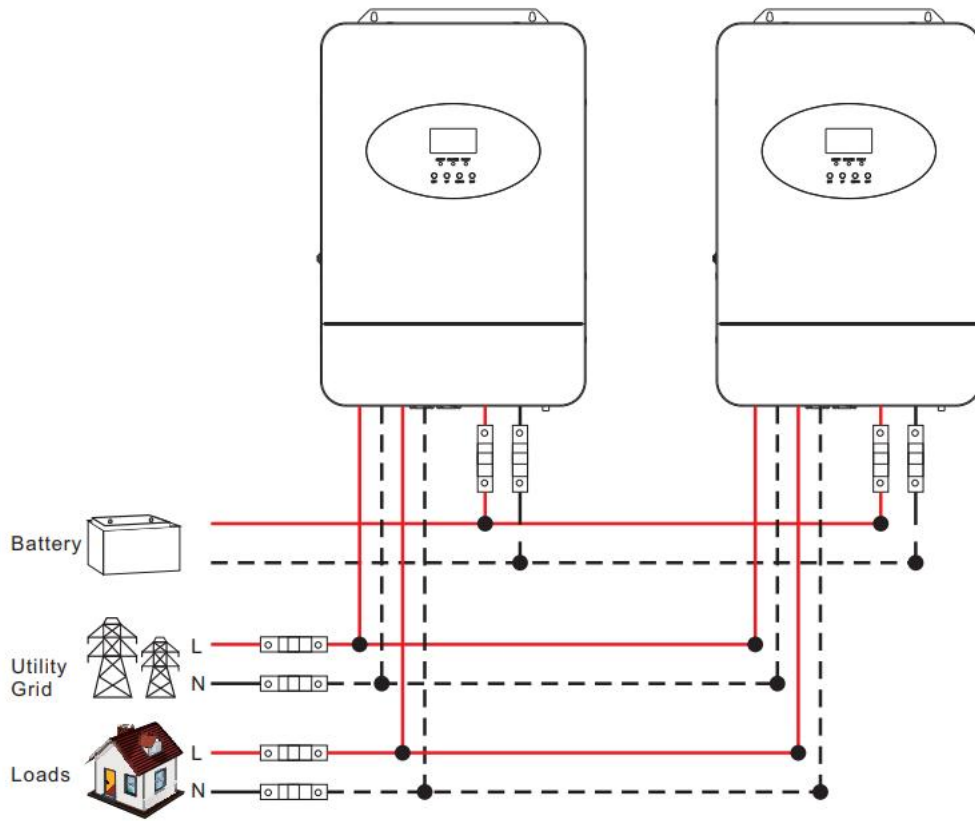
Each photovoltaic panel module, should be independent of each other, not different machines share a photovoltaic module.

Single phase and machine operation

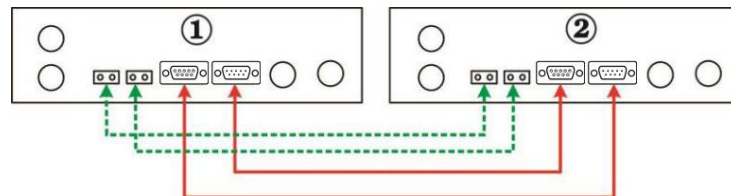
NOTE! All inverters shall be connected to the same battery pack, and the line length between each inverter and the battery is consistent.

Two inverters are operated in parallel:

system connection

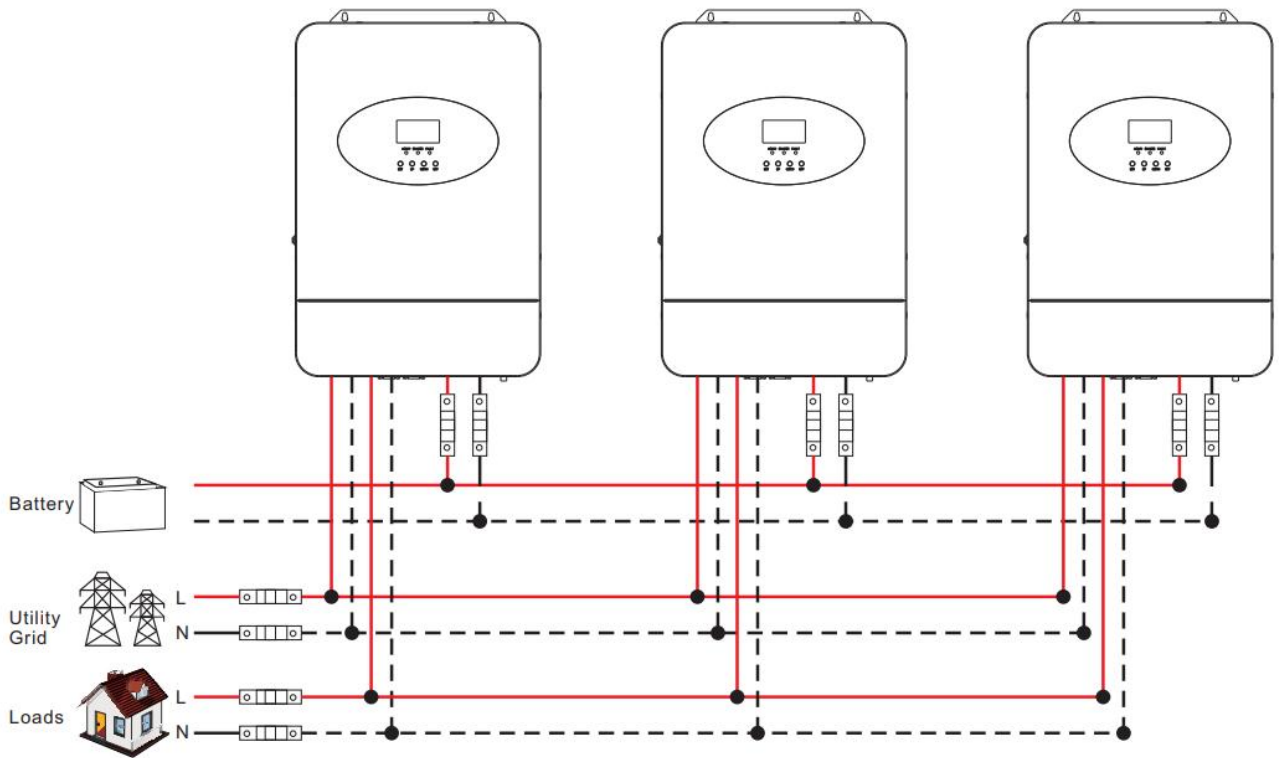


Connect communication

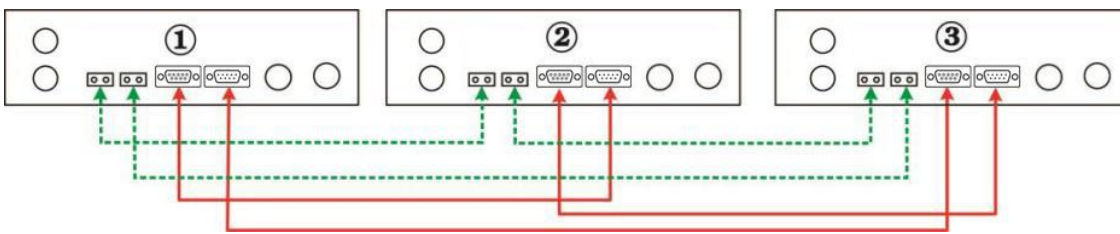


Three inverters are operated in parallel:

system Connection

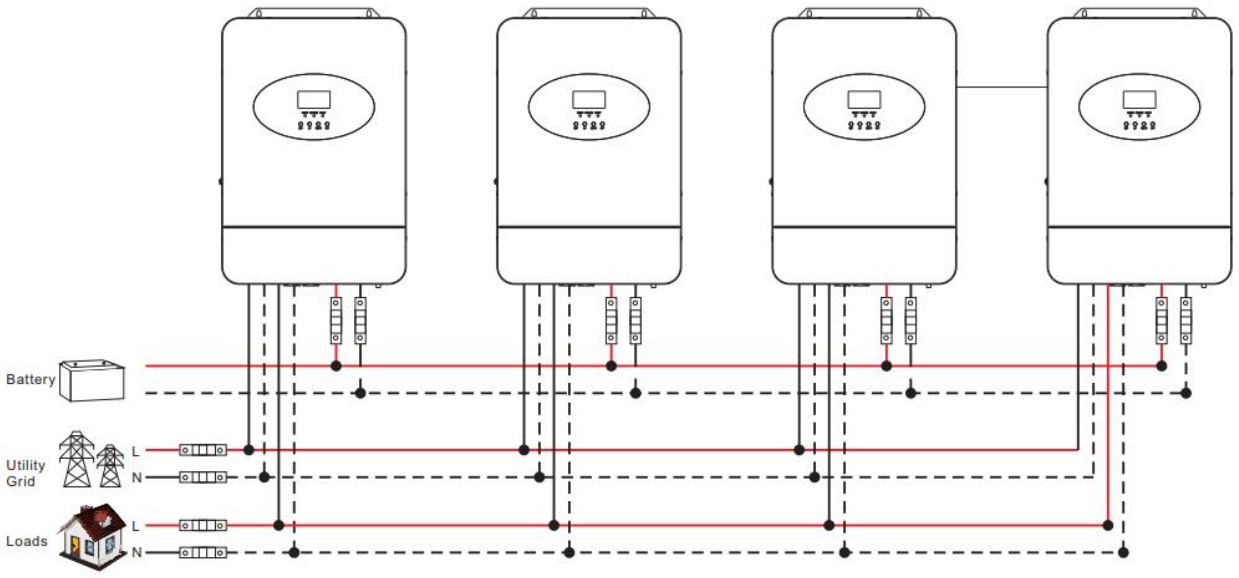


Connect communication

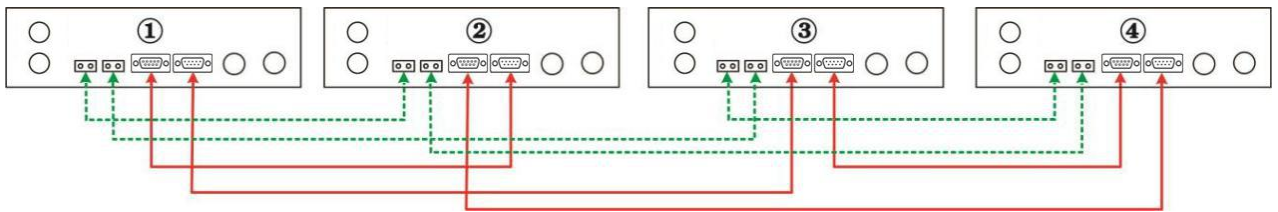


Four inverters are operated in parallel:

system Connection

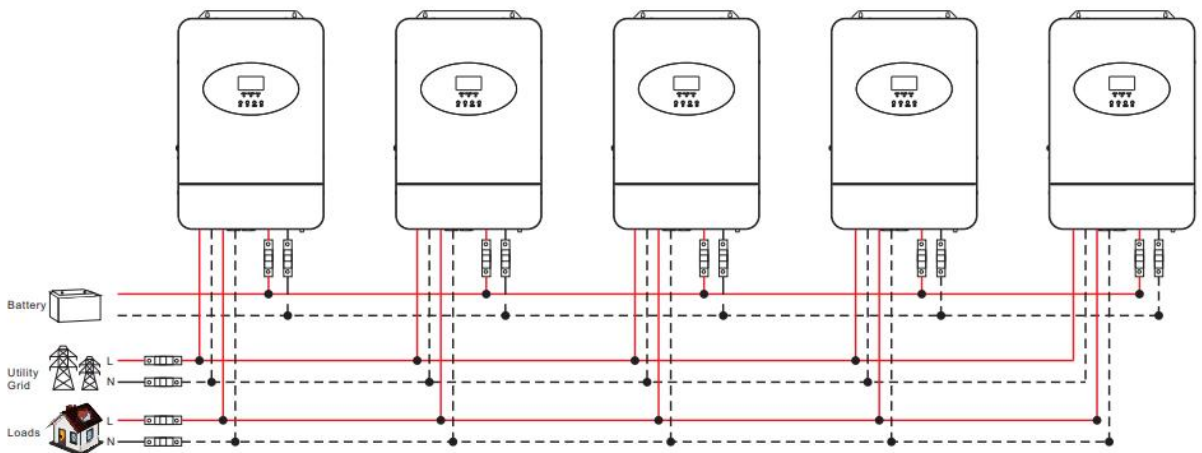


Connect communication

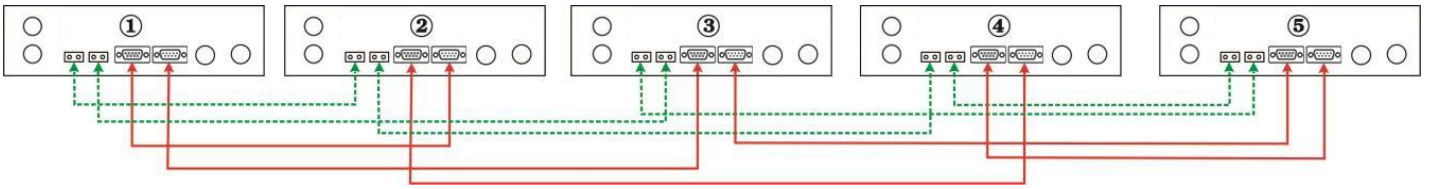


Five inverters are operated in parallel:

system Connection

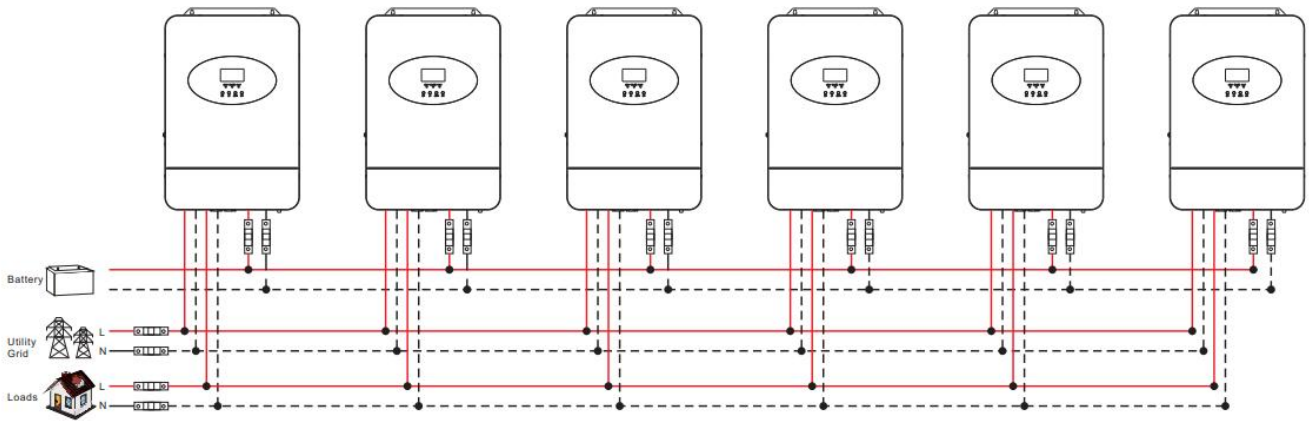


Connect communication

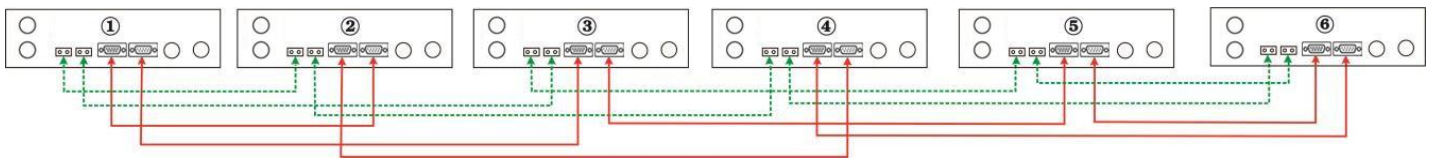


Six inverters are operated in parallel :

system Connection



Connect communication

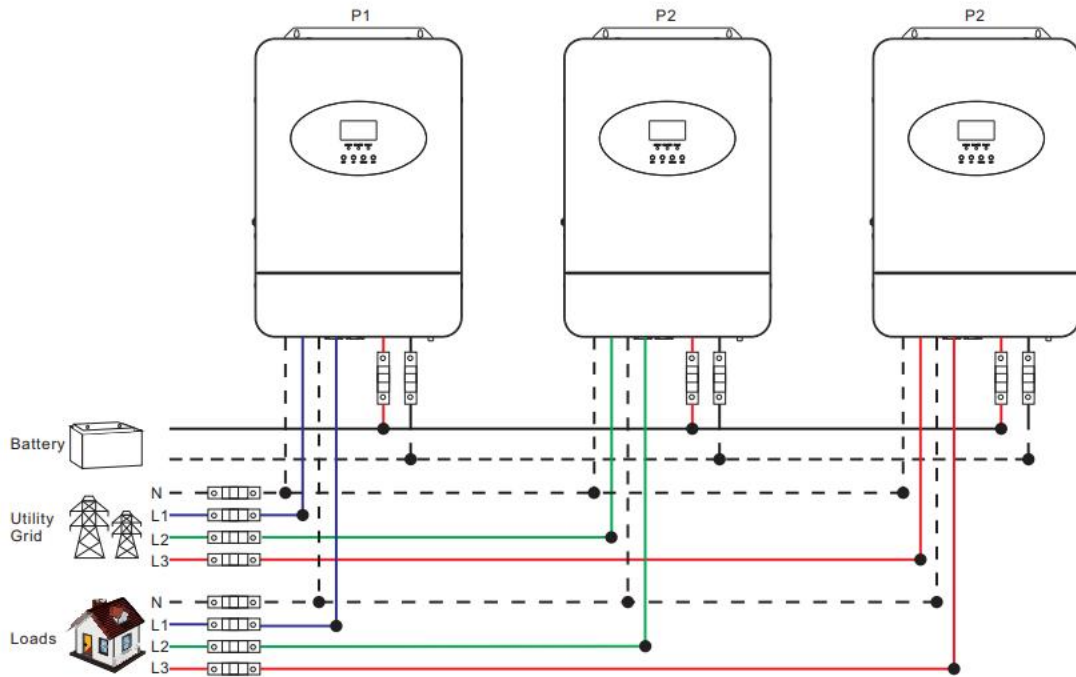


Three-phase parallel operation

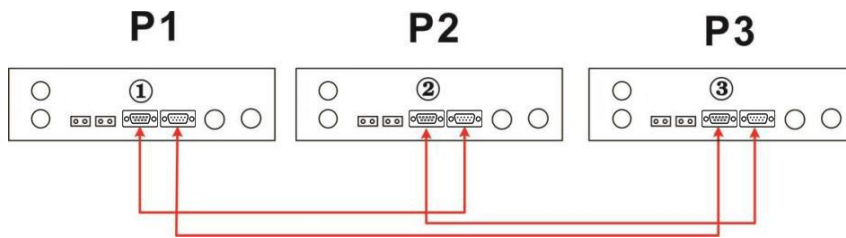
WARN! All inverters shall be connected to the same battery pack, and the line length between each inverter and the battery should be consistent.

One inverter per phase

system Connection

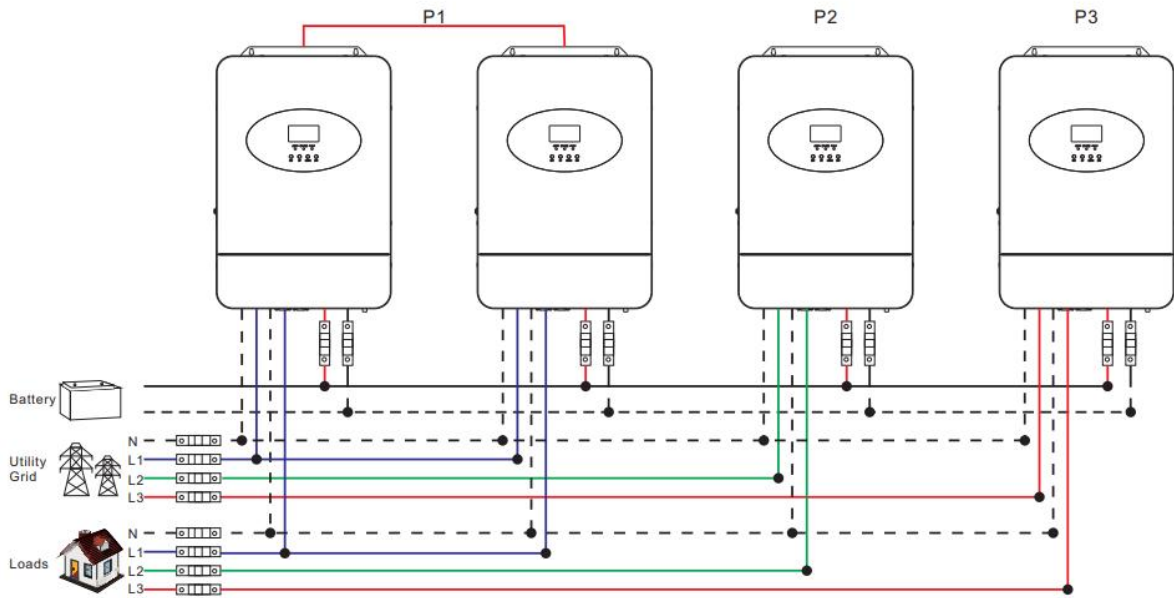


Connect communication

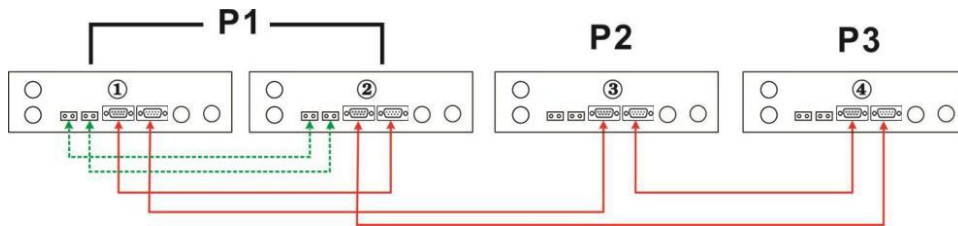


The first phase has two inverters, and only one inverter in the other phase

system Connection

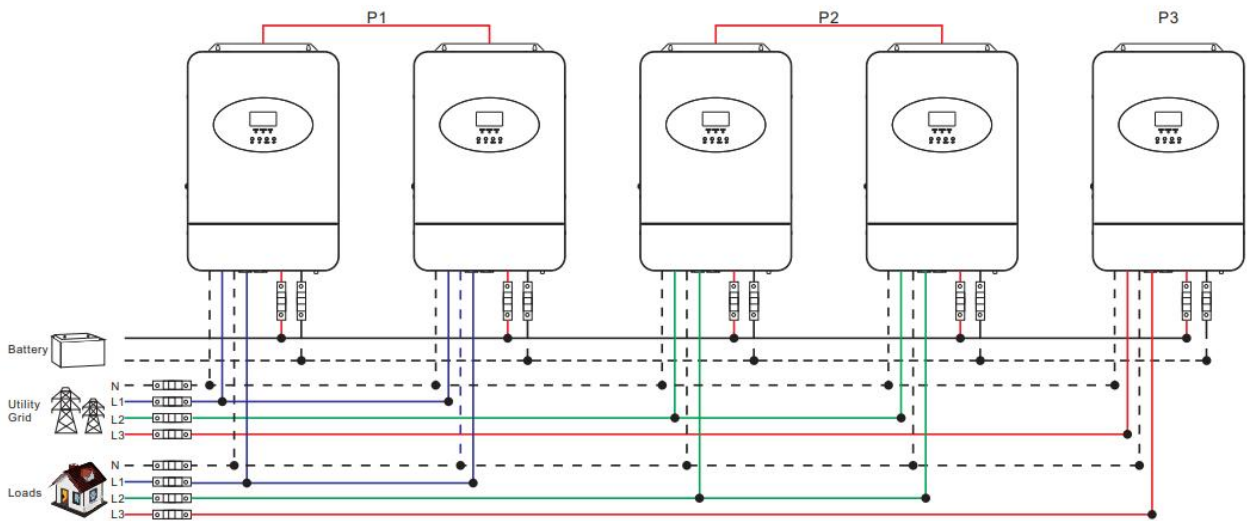


Connect communication

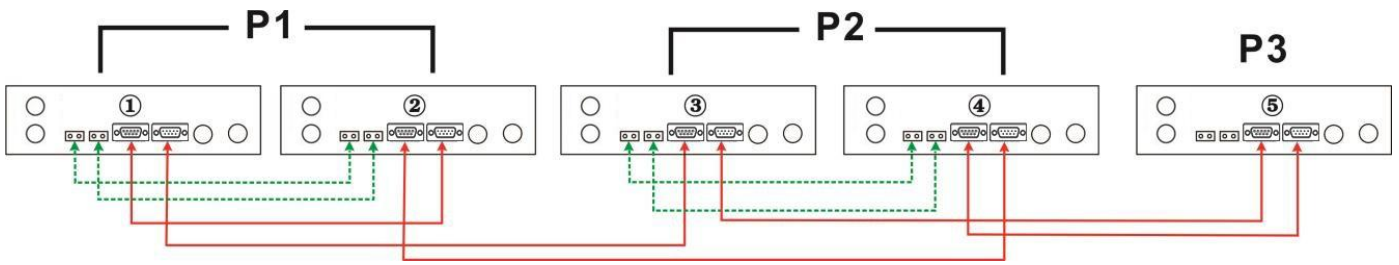


Two inverters in the first and second phase, and one inverter in the third phase

system Connection

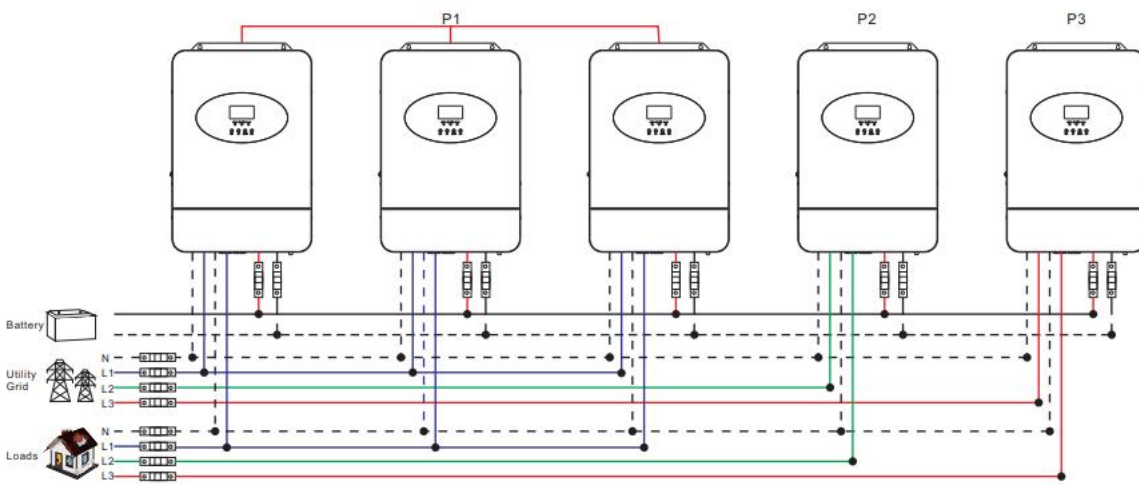


Connect communication

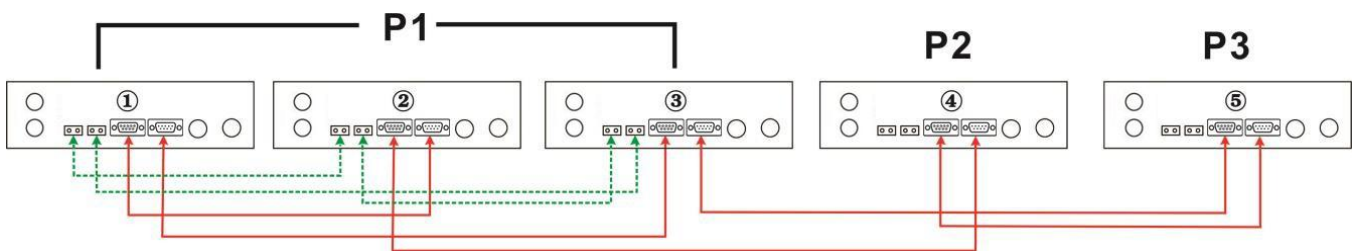


The first phase has three inverters, and one inverter for the other two phases

system Connection

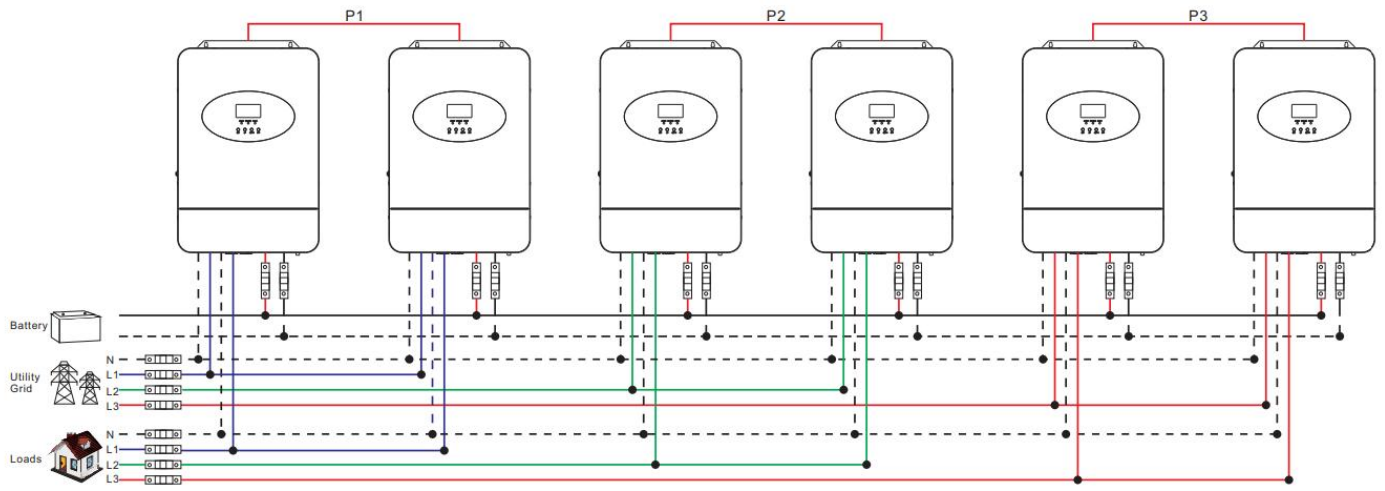


Connect communication

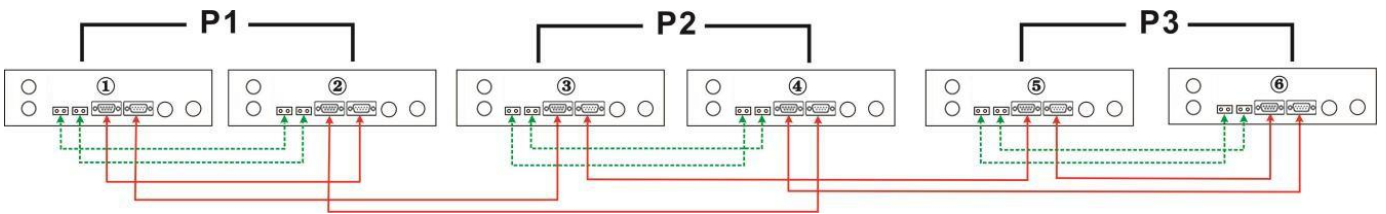


There are two inverters per phase

system Connection

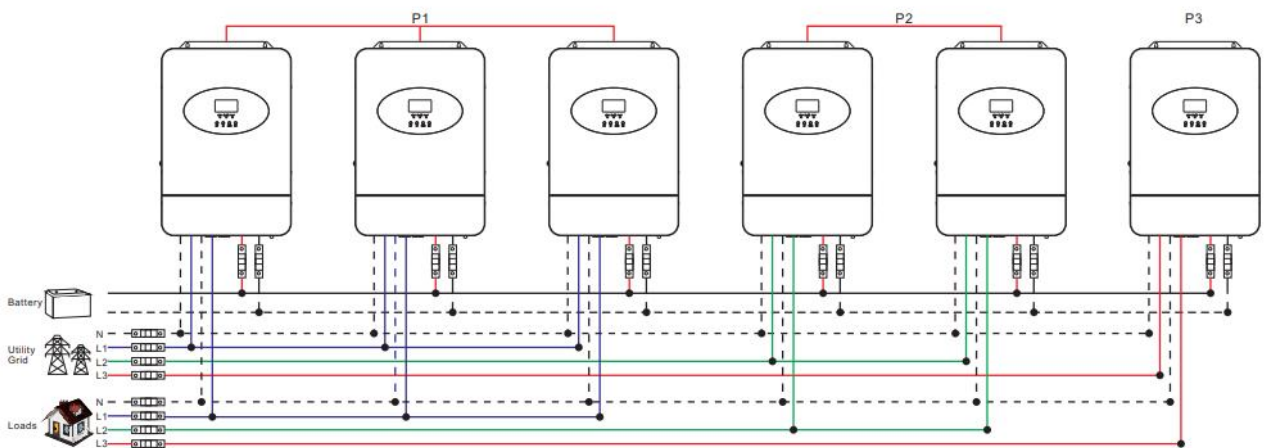


Connect communication

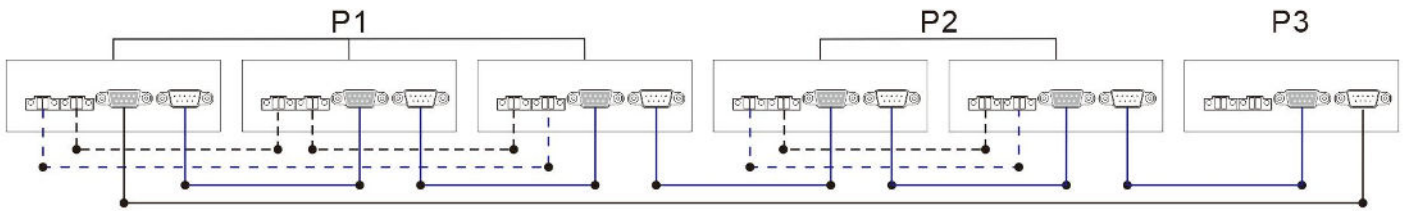


Three inverters in one phase, two inverters in the second phase, and one inverter in the third phase

system Connection

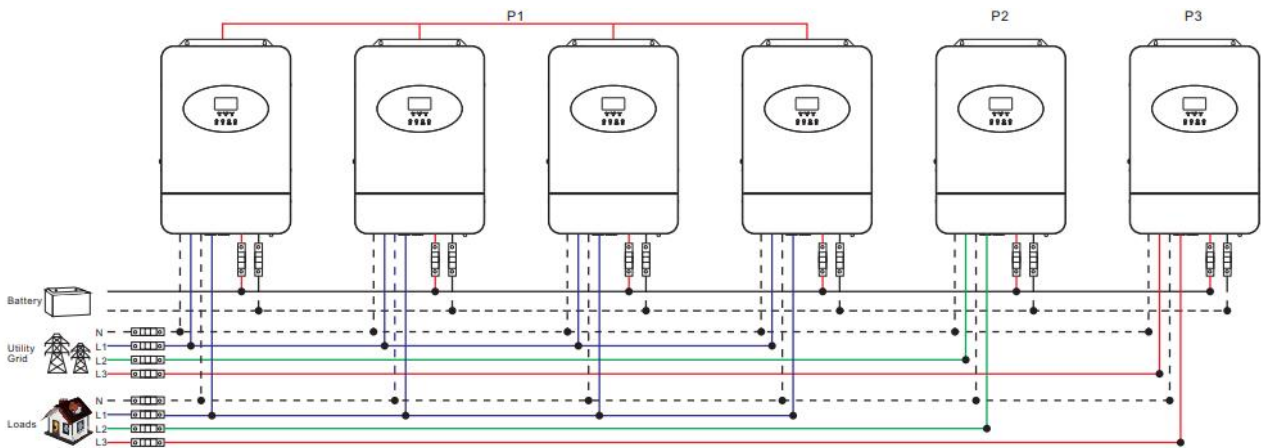


Connect communication

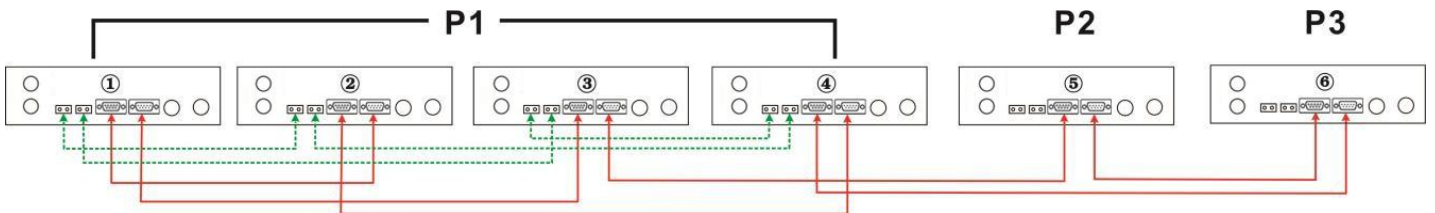


Four inverters for the first phases, and one inverter for the other two phases

system Connection



Connect communication



Fault code

Fault code	Fault name	State
01	Battery under pressure alarm	Y
02	Battery discharge and over current protection	Y
03	The battery was not alerted	Y
04	Battery under pressure alarm	Y
05	Battery over-current protection	Y
06	Charge over pressure protection	Y
07	Bus over pressure protection	Y

08	Bus over pressure protection	Y
09	PV over voltage crowbar	N
10	BOOST over current protection	N
11	BOOST over current protection	N
12	Electric AC power supply system power-fail	N
13	Bypass overload protection	Y
14	Inverse overload protection	Y
15	Inverse over-current protection	Y
17	Inverse short circuit protection	Y
19	PV heat-sink over-temperature protection	N
20	Inverter radiator over-temperature protection	Y
21	Fan fault	Y
22	Storage failure	Y
23	Machine setup error	Y
26	Inverse over current recharge to bypass AC output	Y
29	Bus under pressure protection	Y
30	Battery capacity is 10% low for alarm (BMS valid)	N
31	Battery capacity is 5% low for alarm BMS valid	N
32	Low battery capacity shutdown (BMS valid)	Y
34	CAN communication fault (parallel valid)	Y
35	Parallel machine ID set error	Y

37	Parallel machine flow fault	Y
38	In the parallel machine mode, the battery voltage difference is large	Y
39	In parallel mode, the mains input sources are inconsistent	Y
40	Combined machine mode, hardware synchronization signal failure	Y
41	Inverse voltage DC component is abnormal	Y
42	The parallel version is inconsistent	Y
43	Parallel machine wiring failure	Y
44	No serial number is set from the factory	Y
45	[31] Set Item set error	Y
58	Check whether the communication line is connect ed correctly and whether [33] is set to the corresponding lithium battery communication protocol	N
59	After checking the type of lithium battery BMS fault, remove the lithium battery fault	N
60	Lithium-battery BMS low-temperature alarm	N
61	Lithium battery BMS over-temperature alarm	N
62	Lithium battery BMS, battery over current alarm	N
63	Lithium battery BMS battery under voltage alarm	N
66	Lithium battery BMS battery over voltage alarm	N

Balanced battery charging

The machine contains a balanced charging function; generally, Y is for water batteries. It can reverse some cumulative negative chemical effects, such as the stratification effect, where the acid concentration at the bottom of the battery is higher than at the top. Equilibrium also helps remove sulfate crystals that may

accumulate on the plate; a condition called sulfation that reduces the overall battery capacity of the cell if not controlled. Therefore, it is recommended that the batteries be balanced regularly.

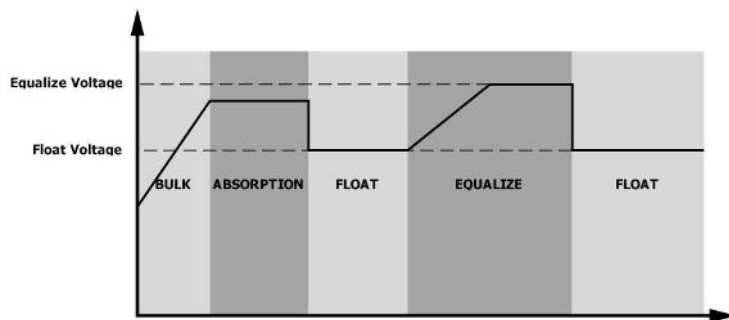
How to use the balanced charging function

First, select the balanced charging function in item 21. Then select the following method settings:

1. Item 20 sets the cycle balanced charging interval time
2. Item 21 setting starts balanced charging immediately

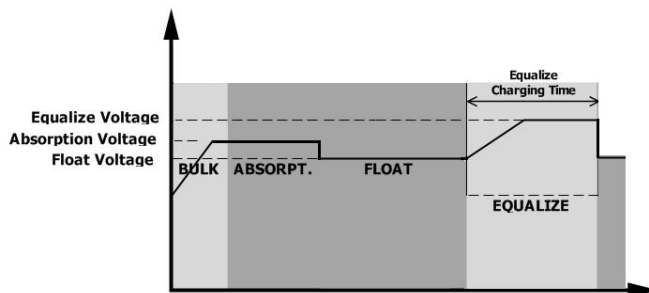
When do you start a balanced charging

In the floating charging stage, when the cycle equilibrium charging and the start time are set, or the equilibrium charging is fixed immediately, the charging will enter the equilibrium charging stage.

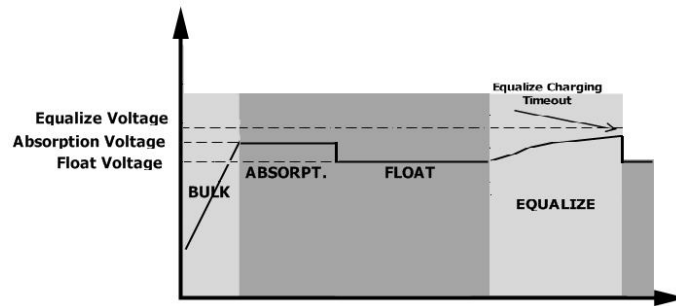


Balanced charging time and charging deadline time

During the balanced charging phase, the machine will charge the battery as much as possible until the battery voltage reaches the voltage point of the balanced charging. It then lasts for a period of stability at this voltage point until the set equilibrium charging time ends.



Suppose the equilibrium charging stage does not reach the equilibrium charging point until the end of the set equilibrium charging time. In that case, the machine will extend the equilibrium charging stage until the voltage point is reached. If Y's compensation charging voltage point does not come within the set extended time, the machine will stop the equilibrium charging and return to the floating charging stage.



parameter table

Table1 Electric AC power supply system supply mode parameter information

Model	SD SPI-3K	SD MPI-3K	SD MPI-5K-PH
Input voltage waveform	Pure sine wave / consistent with the mains or generator input voltage waveform		
Rated input voltage	120Vac	230Vac	
Low voltage cut voltage	90Vac±7V (Appliances)	170Vac±7V (UPS); (Appliances)	
Return the voltage after the low voltage is cut off	100Vac±7V(Appliances)	180Vac±7V (UPS); 100Vac±7V (Appliances)	
High voltage cut voltage	140Vac±5V	280Vac±7V	
Return voltage after the high voltage is cut off	130Vac±5V	270Vac±7V	
Maximum AC input voltage	150Vac	300Vac	
Rated input frequency	50Hz / 60Hz (adaptation)		
Low frequency cut-off point	40±1Hz		
Return point after a low-frequency cut-off	42±1Hz		
High frequency cut-off point	65±1Hz		
Return point after high frequency cut-off	63±1Hz		
Output short circuit protection	Circuit interrupter		
Efficiency (bypass mode)	>95% (Based on the R loaded, the battery is full loaded)		
Switching period	Normal 10ms, single mode 20ms, parallel mode 30ms		
Output drop When the AC input voltage drops to 170V, the output starts to decrease	<p>The graph illustrates the relationship between input voltage and output power. The x-axis represents Input Voltage (V) with key points at 90V, 170V, and 280V. The y-axis represents Output Power, with markers for Rated Power and 20% Power. The power remains constant at the Rated Power level from 170V up to 280V. At 170V, the power begins to decrease linearly, reaching 20% of the Rated Power at 90V. Below 90V, the power is zero.</p>		

Table 2 Inverter mode parameter information

Model	SD SPI-3K	SD MPI-3K	SD MPI-5K-PH
output rating	3KVA/3KW		5KVA/5KW
Output voltage waveform	pure sine wave		
output voltage	120Vac±5%	230Vac±5%	
output frequency	50Hz		
rated output current	25A	13A	22A
Peak efficiency	93%		
overload protection	5s@≥125% load ; 10s@110%~125% load	5s@≥150% load ; 10s@110%~150% load	
peak power	2 x power rating for 5 seconds		
Battery rated voltage	24Vdc		48Vdc
open circuit losses	<50W (Energy saving mode)		

Table 3 Parameter information of the charging mode

Model	SD SPI-3K	SD MPI-3K	SD MPI-5K-PH
Electric AC power supply system charging			
Charging logic	3 Sector charging		
Maximum AC charging current	40Amp(@VI/P=120Vac)	60Amp(@VI/P=230Vac)	
Generalized voltage	water battery	29.2V	
	Other lead acid batteries	24V	
floating charge voltage	27.6V		55.2Vdc
charging curve			
Photovoltaic charging mode			
Maximum photovoltaic power	4000W		6000W

processing capacity		
Maximum PV module input current	13A	22A
starting voltage	120Vdc±10Vdc	
MPPT voltage range	120Vdc~450Vdc	
Maximum PV open-circuit voltage	500Vdc	
The inverter reflux photovoltaic module current	0A	
Maximum PV charging current	80A	100A
Maximum charging current (main+PV)	80A	100A

Table 4: Basic Parameters

Model	SD SPI-3K	SD MPI-3K	SD MPI-5K-PH
certification standards	UL/CE		
operating temperature	0°C to 55°C		
storage temperature	-15°C~ 60°C		
humidity	5% to 95% relative humidity (no condensation)		
height	<2000m		
size(D*W*H), mm	460 x 285 x 113		485 x 335 x 124
net weight , kg	8		14

Failure recovery

Fault code	Fault	Treatment measure
display	The screen is not displayed	Check that the battery is open or the PV is available, YN is closed, the switch YN is in the "ON" state; press any button on the screen to exit the screen hibernation mode.
[06]	Charging battery over voltage protection	Check that the battery voltage YN exceeds the protection value. When exceeding, the battery needs to be

		discharged to the voltage below the over voltage recovery point.
【01】 【04】	Battery under pressure protection	When the battery charging returns to the low voltage disconnected recovery voltage is above.
【21】	Fan fault	Check that the fan YN does not turn or that the YN is blocked by something else.
【19】 【20】	Radiator over temperature protection	Resume normal charge and discharge control when the equipment temperature cools below the over temperature recovery temperature.
【13】 【14】	overload protection	① Reduce electricity and equipment; ② Restart the all-in-one machine and load restore the output
【17】	Inverse short circuit protection	① Carefully check the load connection situation, and clear the short-circuit fault point; ② Power up again, and load back to output.
【09】	PV over voltage	Check that the PV input voltage Y and Y does not exceed the maximum allowable input voltage.
【03】	The battery was not alerted	Check that the battery YN is not connected or that the battery side circuit breaker Y is not Y is not closed.
【40】 【43】	Parallel machine wiring fault	Check that the parallel wire YN is not well connected, such as loose or incorrect connection
【35】	Parallel machine ID set error	The setting YN of the parallel ID number is repeated
【37】	Parallel machine flow fault	Check that the parallel streamline YN is not well connected, such as: loose or incorrect connection
【39】	Parallel machine mode	Electric AC input source inconsistent check the parallel main input Y does not Y the same input interface
【42】	The parallel version is inconsistent	Check that the software version of YNY is consistent for each machine

NOTE: All power input sources must be disconnected when restarting the inverter. After the LCD screen lights go out, then only connect the battery to continue.