

User Manual



SunGoldPower Freedom 12K-B solar charge inverter

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1. Safety

1.1 About this Manual

- This Manual contains important information, guiding principles, operation, and maintenance of the product, and applies to the model: **Freedom 12K-B series**.
- Users must follow the instructions in this Manual during installation, use and maintenance.

1.2 Symbols and description

	<p>DANGER: Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</p>
	<p>WARNING: Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>
	<p>CAUTION: Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.</p>
	<p>NOTICE: Provides tips or cues regarding product operation.</p>

1.3 Safety matters

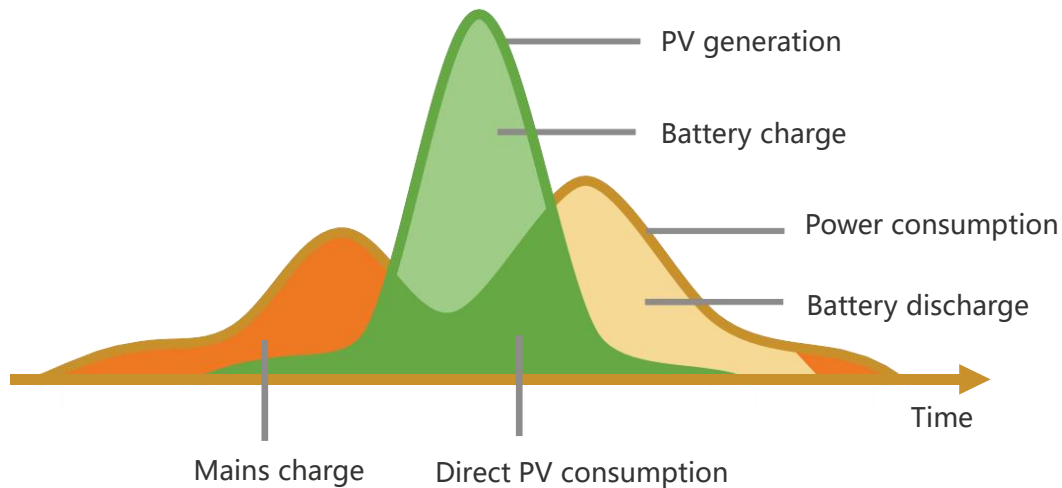
WARNING: This chapter contains important safety matters. Please read and keep this Manual for future reference.

- Please make sure to comply with local requirements and regulations when installing the inverter.
- Be careful of high voltage. Before and during installation, please turn off the switch of each power supply to avoid electric shock.
- In order to achieve optimal operation of the inverter, please select the appropriate cable size and necessary protective devices according to regulations.
- Do not connect or disconnect any connections when the inverter is working.
- Do not open the terminal cover when the inverter is working.
- Keep the inverter well-grounded.
- Avoid short circuits in AC output and DC input.
- Do not disassemble the inverter. Send the inverter to a professional service center for repair and maintenance.
- Do not charge frozen batteries.

2. About the Product

2.1 Description

FRFR12K-B series is a new type of solar storage inverter that integrates PV storage, mains charge, and energy storage and outputs sinusoidal AC. Equipped with DSP control and advanced control algorithm, it has high response speed and good reliability, and applies to industrial scenarios.



2.2 Features

- Support the connection of various types of energy storage batteries such as lead-acid battery and lithium-ion battery.
- The lithium-ion battery possesses a dual-activation function during its dormant period: it can be activated by connecting to mains power/photovoltaic (PV) power.
- Support split-phase/single-phase pure sine wave output.
- Support adjusting the voltage of each phase within the range of 100 VAC, 105 VAC, 110 VAC, 115VAC, 120 VAC and 127 VAC.
- Support two-channel PV input and have the function of simultaneous two-channel maximum power point tracking (MPPT) for charging/carrying capacity.
- Support two-channel MPPT, with an efficiency of up to 99.9% and a maximum single-channel current of 22 A, perfectly fitting high-power modules.
- Provide 2 charge modes: only PV and mains + PV.
- It features timed charging and discharging functions, allowing users to set the charging and discharging times according to the time-of-use electricity prices to save on electricity costs.
- Have the energy-saving mode, reducing no-load energy losses.
- Provide two output modes: mains bypass output and inverter output, achieving uninterrupted power supply.
- Support LCD display of dynamic flowchart, updating system data and operating status at any time.
- Provide 360° protection, including short circuit protection, overcurrent protection, overvoltage and undervoltage protection, and overload protection.
- Support CAN, USB, RS485 communication.

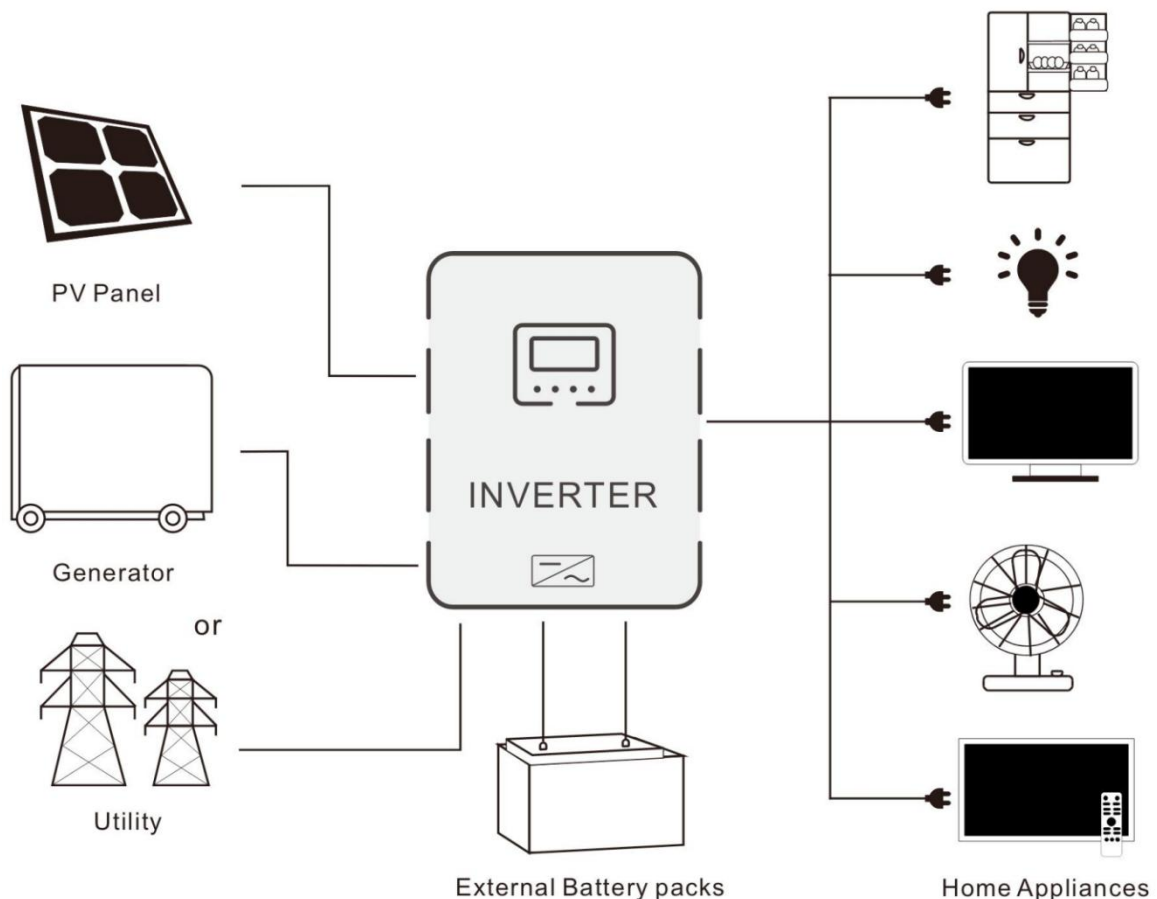
2.3 System connection diagram

The following figure shows the system application scenario of the product.

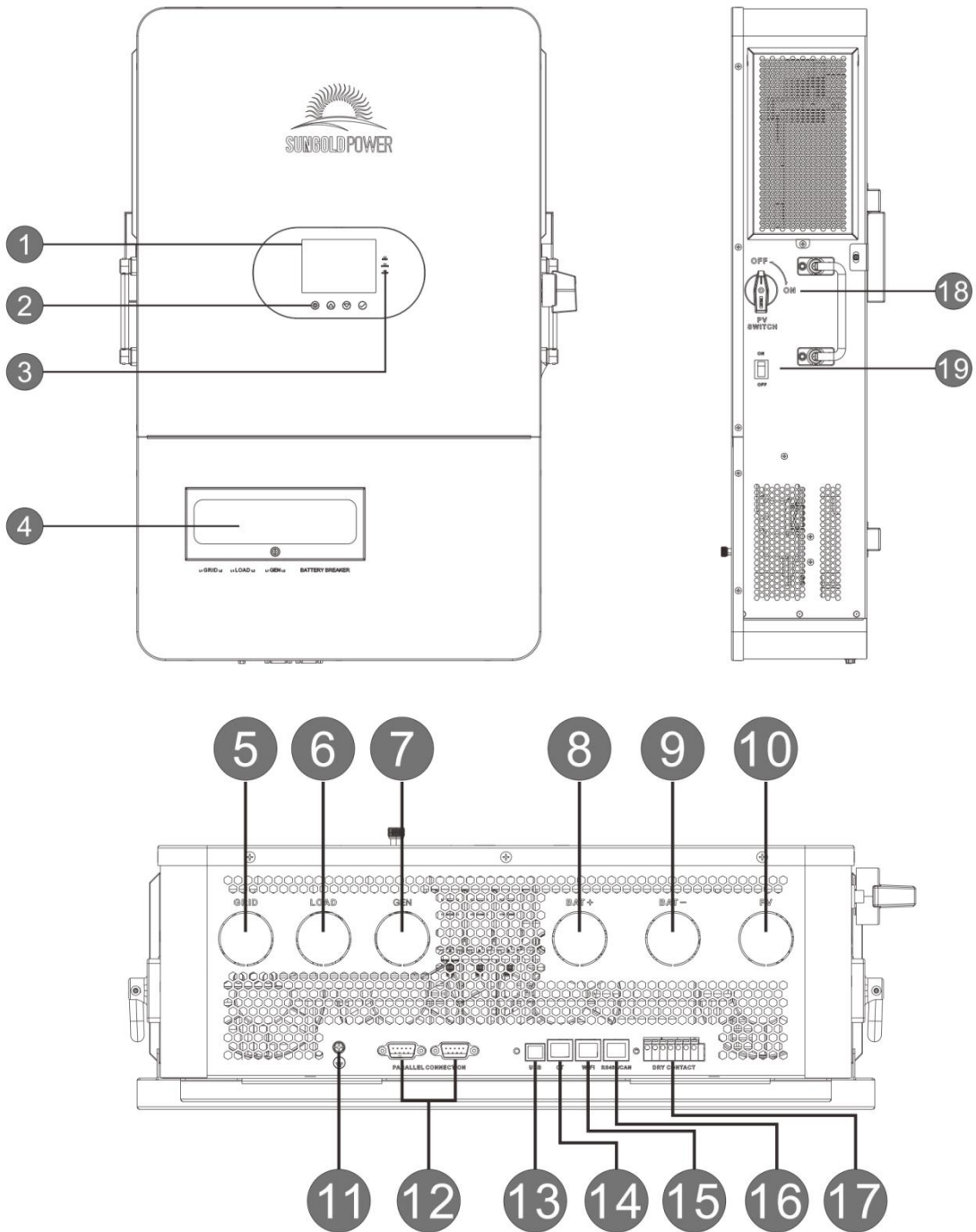
A complete system consists of the following parts:

1. **PV Panel:** It converts solar energy into DC to charge batteries or into AC to supply power to loads.
2. **Mains or generator:** Connected to AC input, it can charge batteries while supplying power to loads. When the battery and PV module supply power to the load, the system can generally operate without mains or generator.
3. **Battery:** The function of a battery is to ensure normal power supply for the system load when there is insufficient PV power and no mains.
4. **Household load:** It can connect various household and office loads, including refrigerators, lighting fixtures, TVs, fans, air conditioners, and other AC loads.
5. **Inverter:** It is the energy conversion device of the entire system.

The actual application scenario determines the specific system wiring mode.

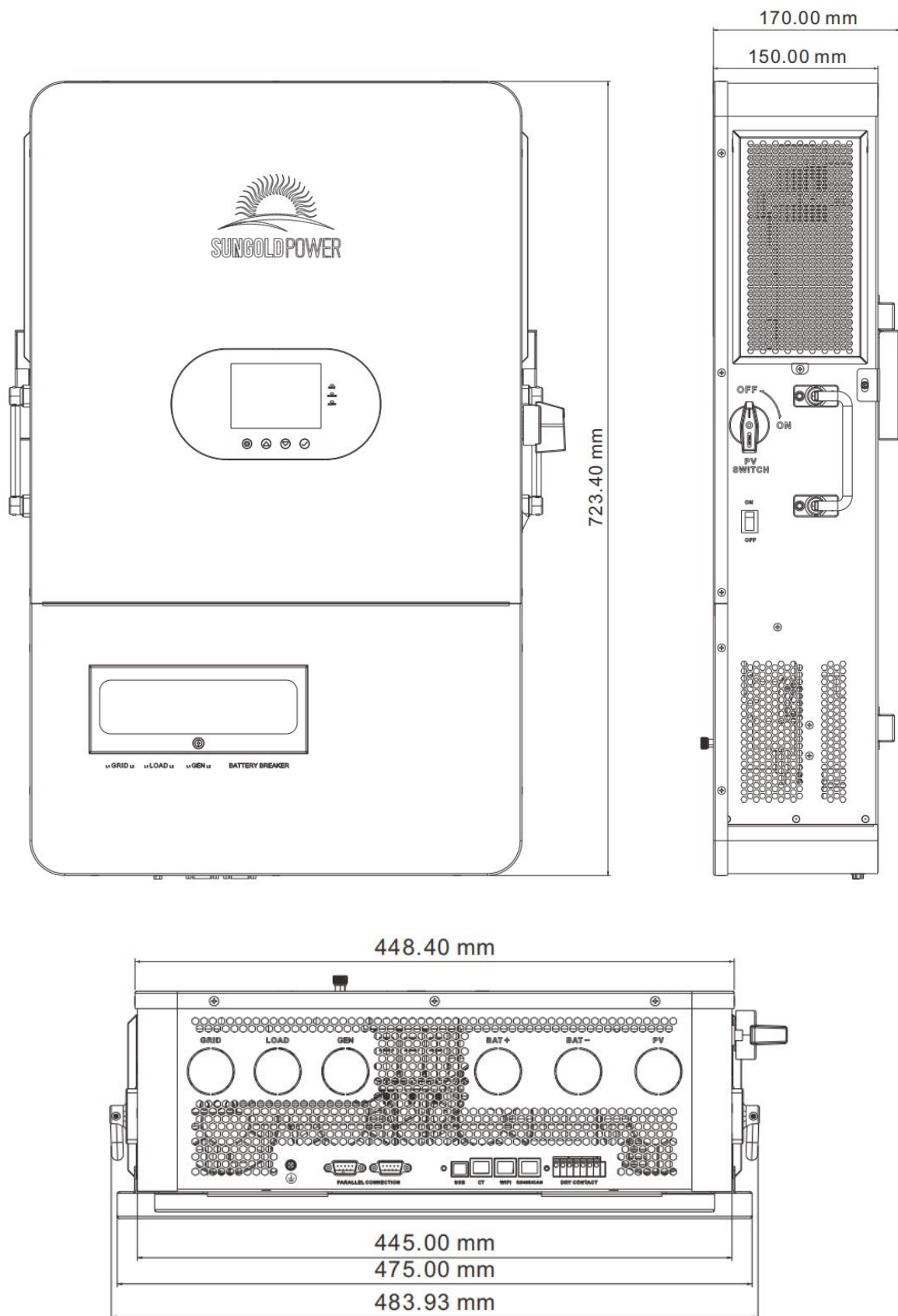


2.4 Product overview



1	LCD screen	2	Physical button	3	LED indicator
4	Circuit break cover	5	mains input (L1+L2+N)	6	Load output (L1+L2+N)
7	Generator port	8	Battery (positive electrode)	9	Battery (negative electrode)
10	PV port	11	Grounding screw	12	Parallel port
13	USB port	14	CT port	15	WiFi port
16	RS485/CAN port	17	Dry contact	18	PV Switch
19	ON/OFF rocker switch				

2.5 Dimension



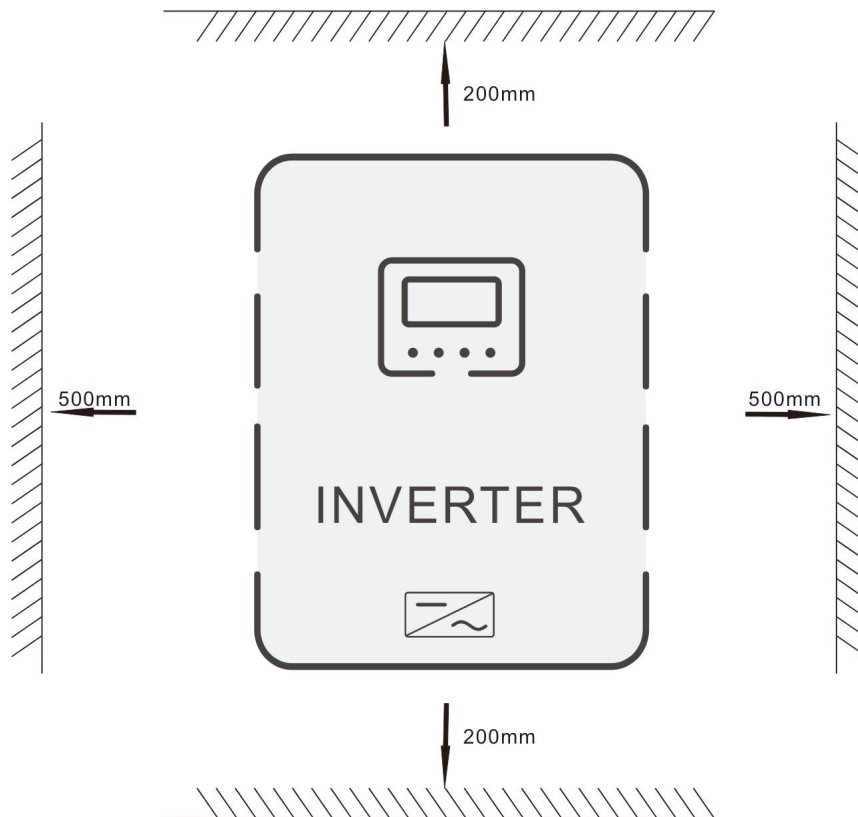
3. Installation

3.1 Installation location

FRFR12K-B series is only for indoor use (protection level: IP20).

Before selecting the installation location, users should consider the following factors:

- A solid wall.
- Installation height: flush with the line of sight.
- Sufficient heat dissipation space.
- Ambient temperature: -10°C – 55°C (14°F – 131°F), to ensure optimal operation.



⚠ DANGER

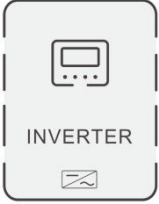
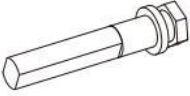

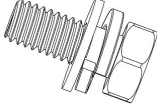






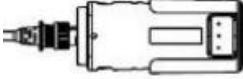


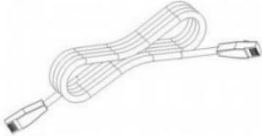


- Never install the inverter near flammable materials.
- Do not install the inverter in potential explosive areas.
- Do not install the inverter with lead-acid batteries in a confined space.

⚠ CAUTION

- Do not install the inverter in direct sunlight.
- Do not install or use the inverter in a humid environment.

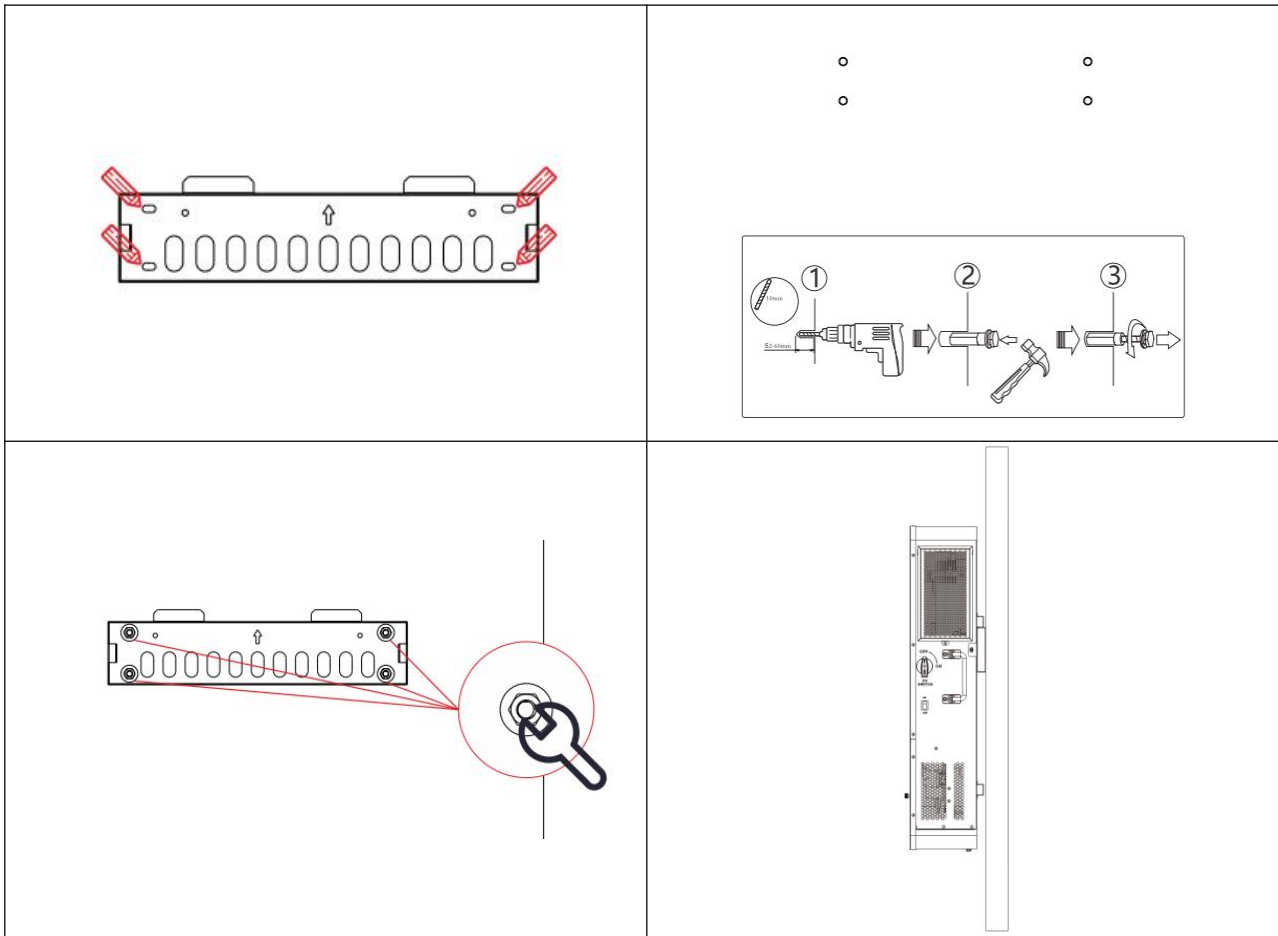
3.2 Packing list

Please check the equipment before installation. Make sure that there is no damage to the packaging. You should have received the following items in the package:

 <p>Inverter x 1pcs</p>	 <p>M6*60mm Expansion screw x 4pcs</p>	 <p>Phillips screw M5*10mm x 2pcs</p>	 <p>Phillips screw M8*12mm x 5pcs</p>
 <p>SC50-8 Copper lug x 4pcs</p>	 <p>SC95-8 Copper lug x 2pcs</p>	 <p>Black screw M4X8mm x 4pcs</p>	 <p>M8 Socket screwdriver x 1pcs</p>
 <p>Flat-head screwdriver x 1pcs</p>	 <p>Parallel communication cable x 1pcs</p>	 <p>WIFI logger x 1pcs</p>	 <p>The warranty card x 1pcs</p>
 <p>User Manual x 1pcs</p>	 <p>BMS Communication Cable x 1pcs</p>	 <p>Certificate of Conformity x 1pcs</p>	 <p>Shipment Inspection Report x 1pcs</p>

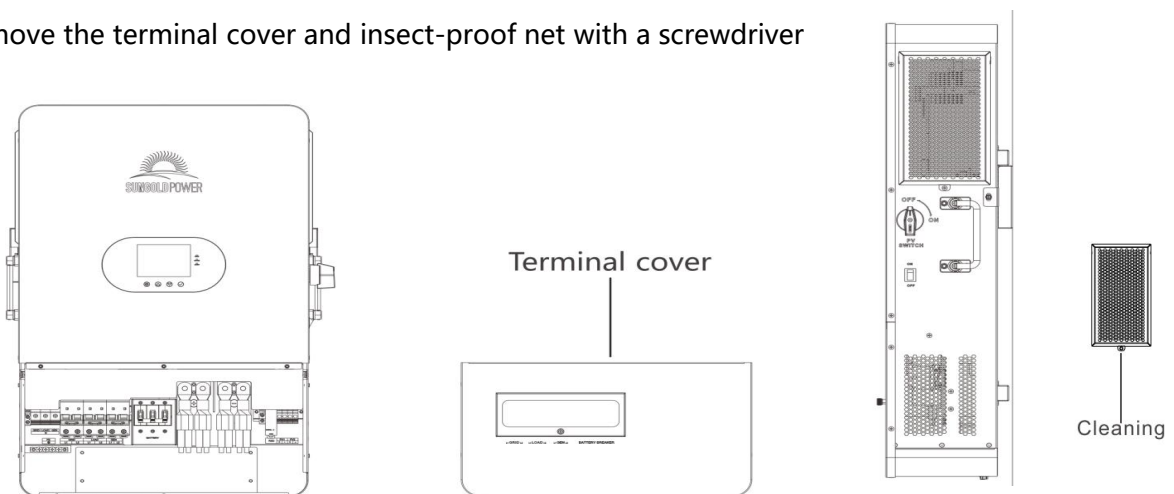
3.3 Inverter installation

Drill 4 installation holes of the specified sizes on the wall with an electric drill, insert 2 expansion screws above, and fix the inverter with two M5 screws below.



3.4 Removal of terminal cover and insect-proof net

Remove the terminal cover and insect-proof net with a screwdriver



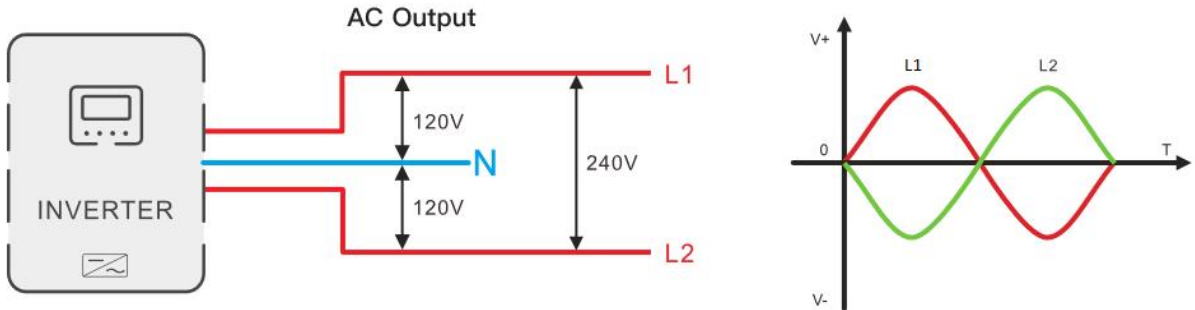
NOTICE

When using the inverter in areas with poor air quality, the dustproof net is easily blocked by air particles. Please regularly remove and clean it to avoid affecting the air flow rate inside the inverter; otherwise it may cause inverter overheating (19/20 fault), and affect power supply and the service life of the inverter.

4. Wiring

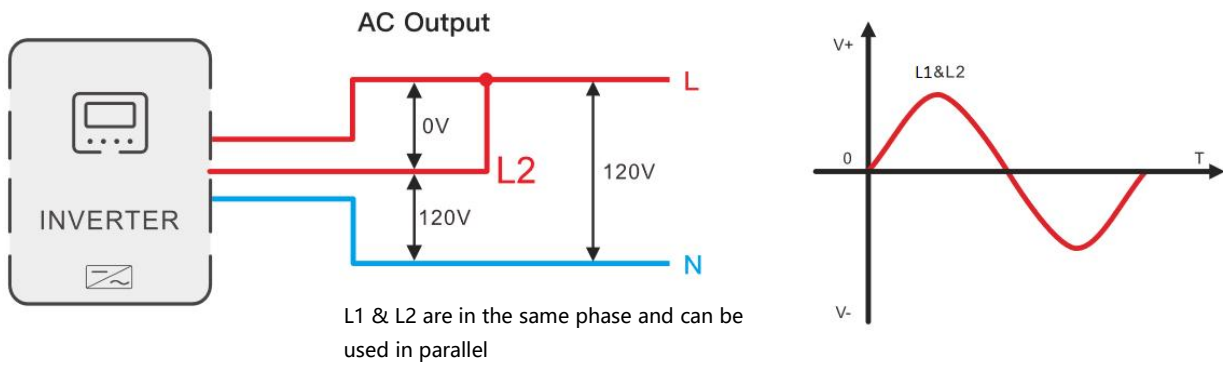
4.1 Wiring mode (depends on the output mode)

- Split-phase mode (default)



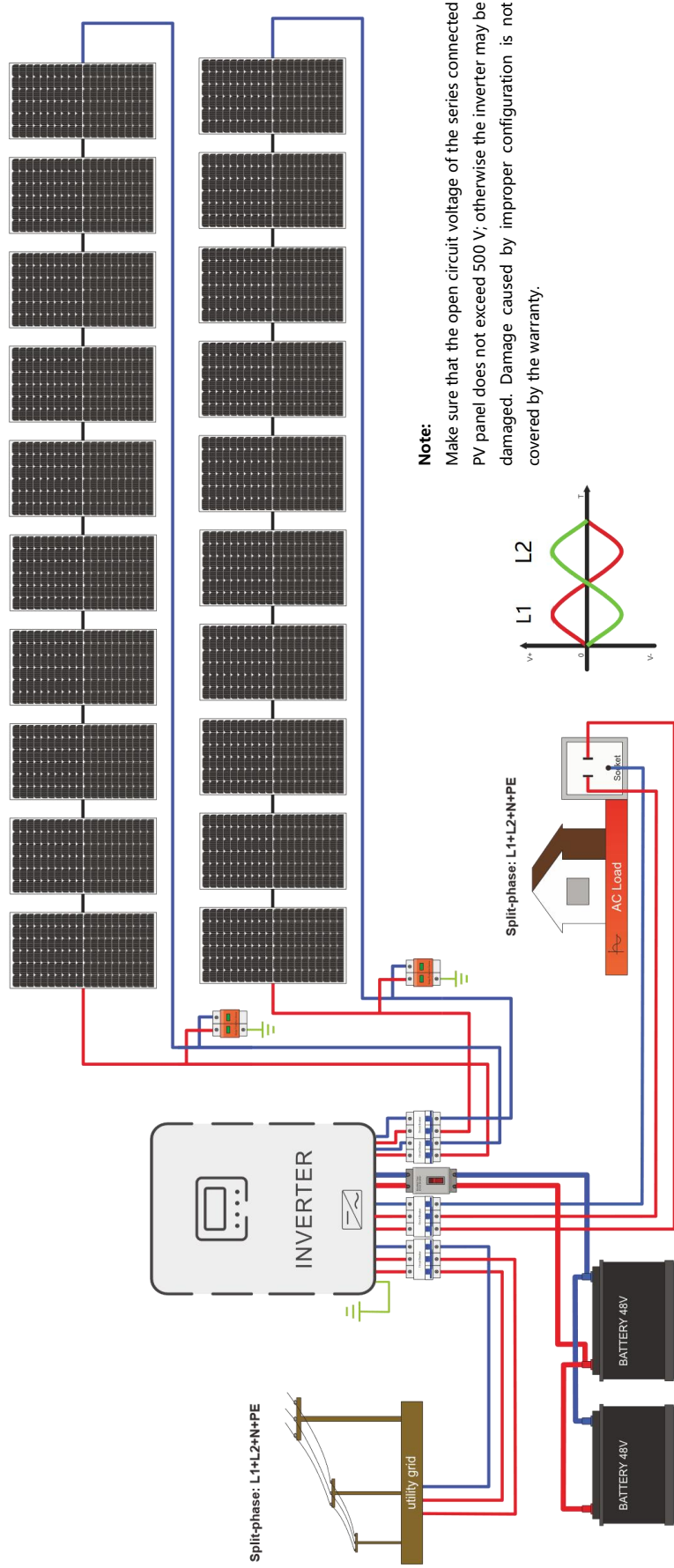
Item	Description
Applicable model	Freedom 12K-B series
AC output phase voltage (L-N)	100 VAC–120 VAC, 120 VAC (default)
AC output line voltage (L-L)	200 VAC–240 VAC, 240 VAC (default)

- Single-phase mode

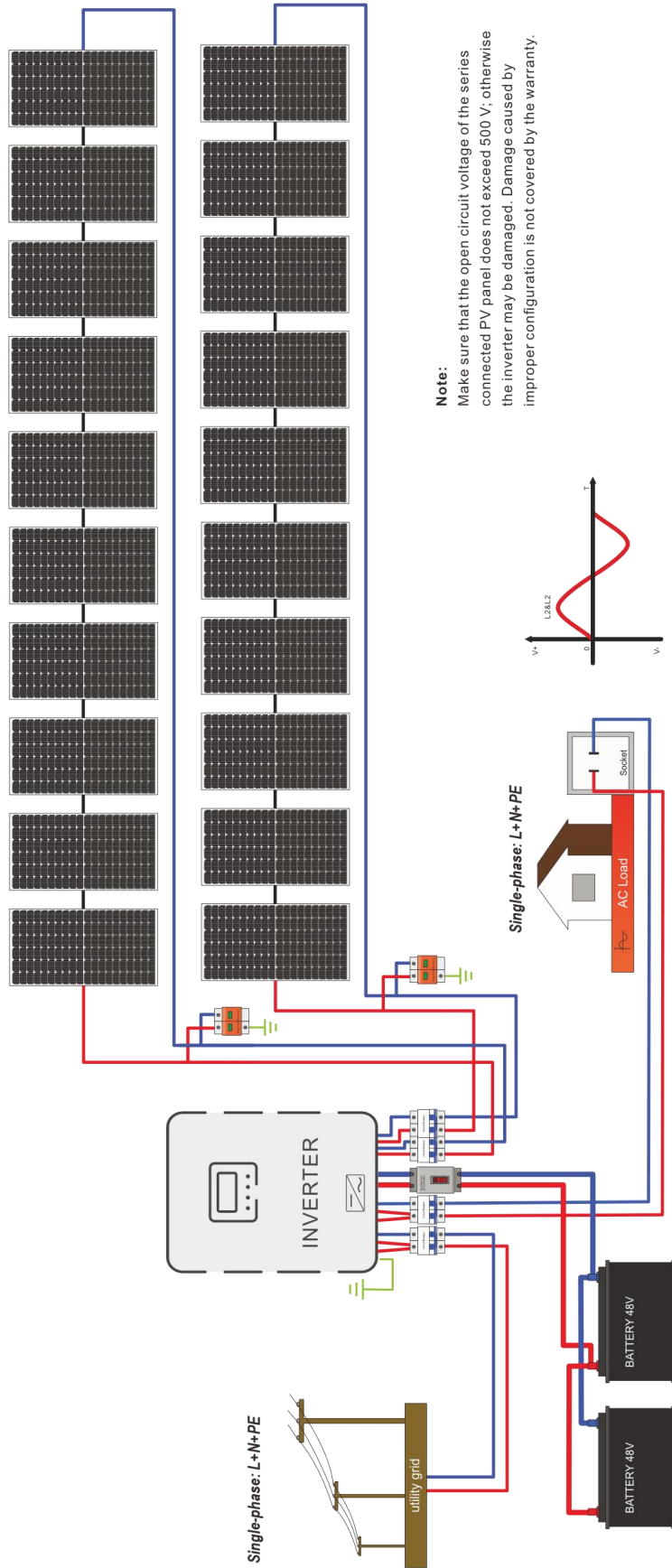


Item	Description
Applicable model	Freedom 12K-B series
AC output phase voltage (L-N)	100 VAC–120 VAC, 120 VAC (default)

Split-phase Mode



Single-phase Mode


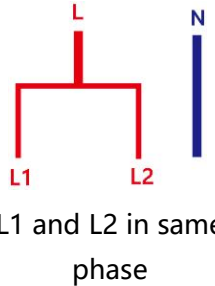


4.2 Cable and circuit breaker model

● PV INPUT

Inverter Model	Cable Size	Max. Input Current	Circuit Breaker Model
FR12K-B	4mm ² /12 AWG	22A	2P-25A

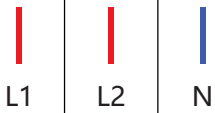
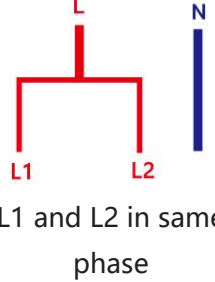
● AC INPUT

Inverter Model	Output Mode	Diagram	Max. Current	Cable Size	Circuit Breaker Model
FR12K-B	Split-phase		63A (L1/L2/N)	13mm ² /6 AWG (L1/L2/N)	3P-63A
	Single-phase		63A (L1/L2) 126 A (N)	13mm ² /6 AWG (L1/L2) 26mm ² /3 AWG (N)	2P-125A

● Battery

Inverter Model	Cable Size	Max. Current	Circuit Breaker Model
FR12K-B	85mm ² /000 AWG	260A	3P-300A

● AC output

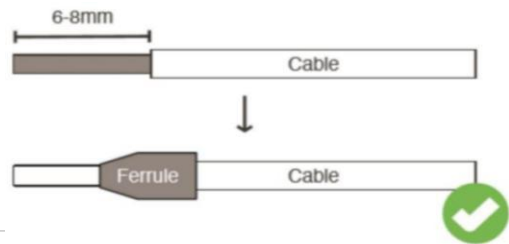
Inverter Model	Output Mode	Diagram	Max. Current	Cable Size	Circuit Breaker Model
FR12K-B	Split-phase mode		63A (L1/L2/N)	13mm ² /6 AWG (L1/L2/N)	3P-63A
	Single-phase mode		63A (L1/L2) 126 A (N)	13mm ² /6 AWG (L1/L2) 26mm ² /3 AWG (N)	2P-125A

NOTICE

● **PV input, AC input, and AC output:**

Use a wire stripper to remove 6-8mm of insulation from the cable.

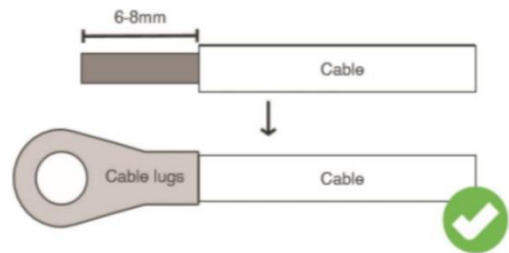
Fix a cable gland at the end of the cable (the cable gland should be prepared by the user).



● **Battery connections:**

Use a wire stripper to remove 6-8mm of insulation from the cable.

Fix the cable lug provided with the package at the cable end.

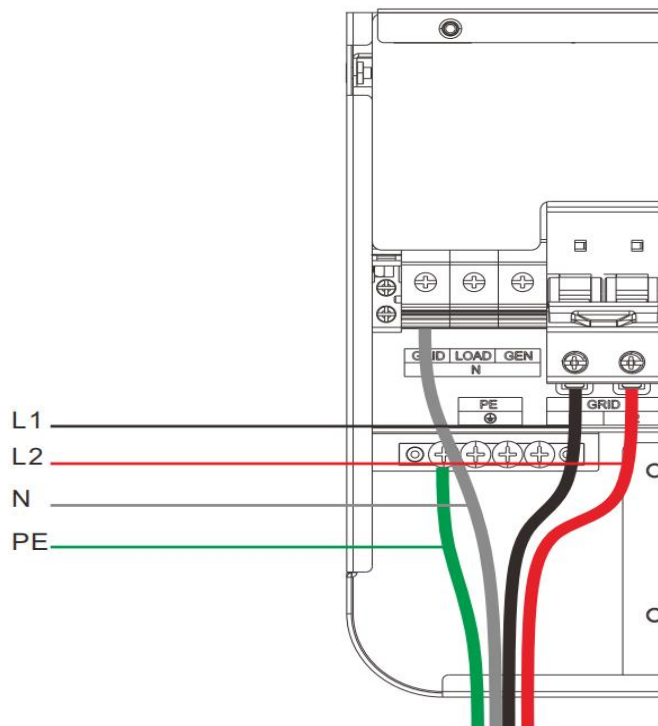


The wire diameter is for reference only. If the distance between the photovoltaic array and the inverter or between the inverter and the battery is long, using thicker wires can reduce voltage drop and improve system performance.

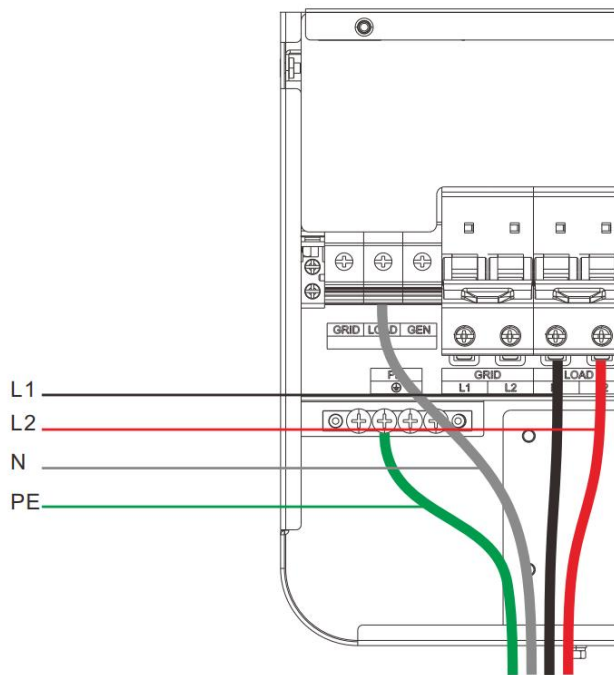
4.3 Mains and Load wiring

Connect the live wire, neutral wire, and ground wire according to the cable position and sequence shown in the following figure.

● **mains:**



● **LOAD:**

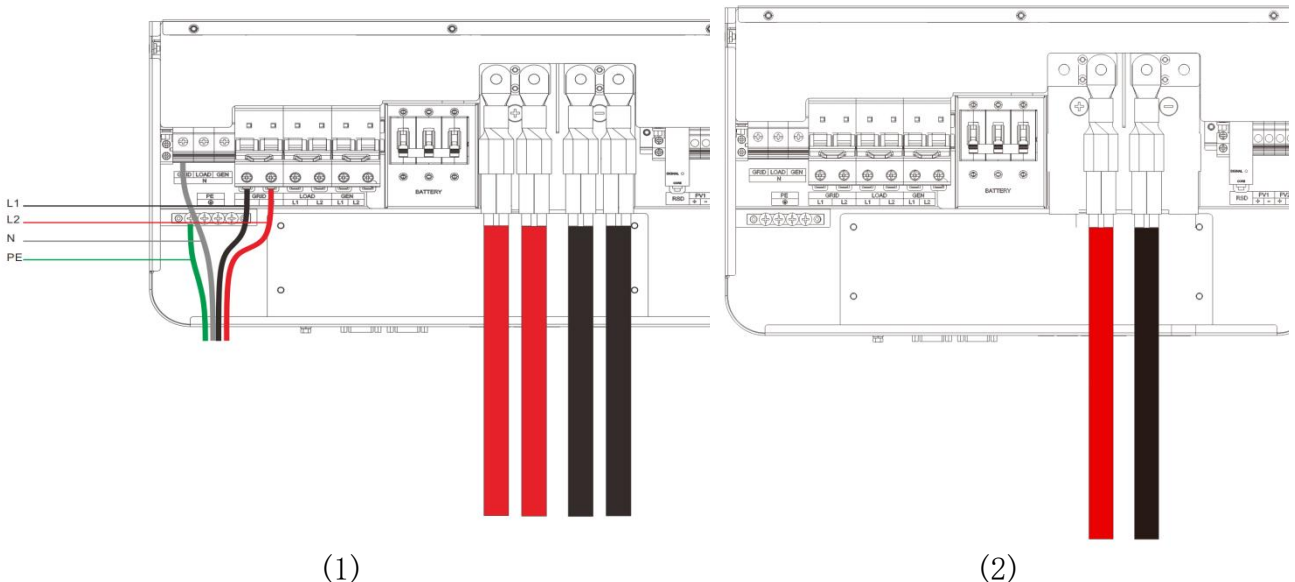


DANGER

- Before connecting AC input and output, be sure to disconnect the circuit breaker to avoid the risk of electric shock. Do not conduct live operation.
- Please check whether the cables used are sufficient to meet the requirements. Cables that are too thin or of poor quality may pose serious safety hazards.

4.4 Battery wiring

Connect the positive and negative cables of the battery according to the cable position and sequence shown in the following figure. Users can choice one way to connect.

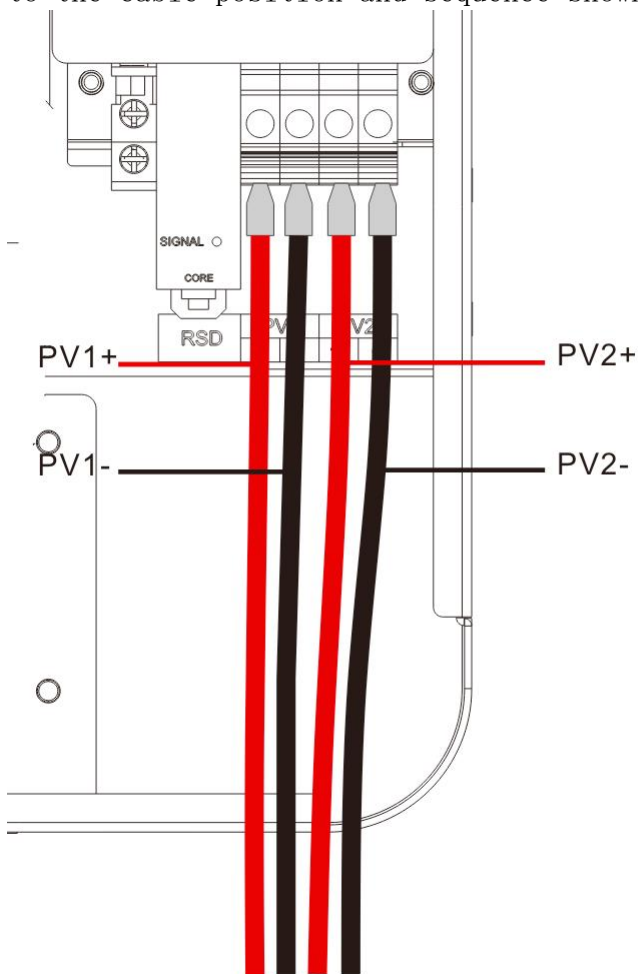


⚠ DANGER

- Before connecting the battery, be sure to disconnect the circuit breaker to avoid the risk of electric shock. Do not conduct live operation.
- Please check the positive and negative terminals of the battery for correct connection and no reverse connection; otherwise it may damage the inverter.
- Please check whether the cables used are sufficient to meet the requirements. Cables that are too thin or of poor quality may pose serious safety hazards.

4.5 PV wiring

Connect the positive and negative terminals of the two-channel PV modules according to the cable position and sequence shown in the following figure.

**⚠ DANGER**

- Before connecting PV modules, be sure to disconnect the circuit breaker to avoid the risk of electric shock. Do not conduct live operation.
- Please make sure that the open circuit voltage of the series connected PV modules does not exceed the maximum open circuit voltage of the inverter (in FRFR12K-B, this value is 500 V); otherwise the inverter may be damaged.

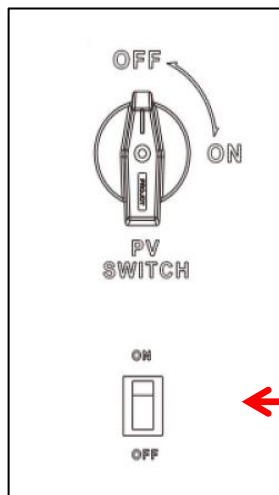
The Rapid Shutdown System

The inverter includes a rapid shutdown system that complies with 2017 and 2020 NEC 690.12 requirements. A rapid shutdown switch should be connected to the RSD terminals on the inverter and mounted on a readily accessible location outdoors (check with your AHJ for requirements).

The APsmart Rapid Shutdown System Transmitter-PLC is part of a rapid shutdown solution when paired with APsmart RSD, a PV module rapid shutdown unit. While powered on, the Transmitter-PLC sends a signal to the RSD units to keep their PV modules connected and supplying energy. RSD units automatically enter rapid shutdown mode when the Transmitter-PLC is switched off and resume energy production when power is restored to the Transmitter-PLC.

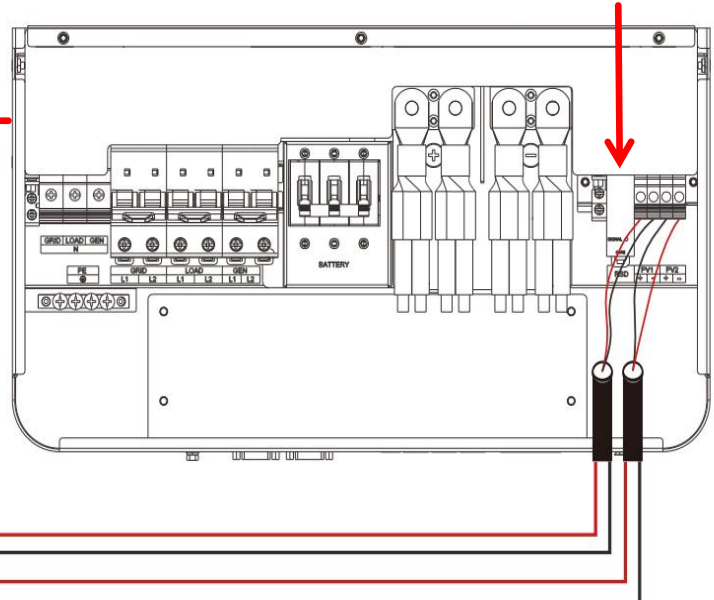


RSD System Wiring Diagram

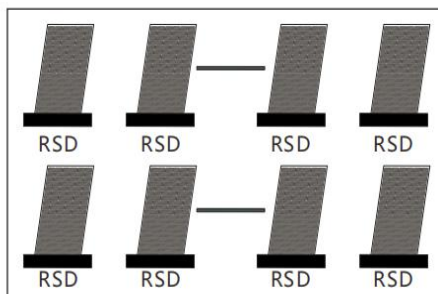


In case of emergency, press the ON/OFF rocker switch button to cut off the RSD power supply, in turn cutting the inverter's AC Output along with dropping the PV Conductors voltage to <math><30V</math> in 30 seconds.

RSD Transmitter

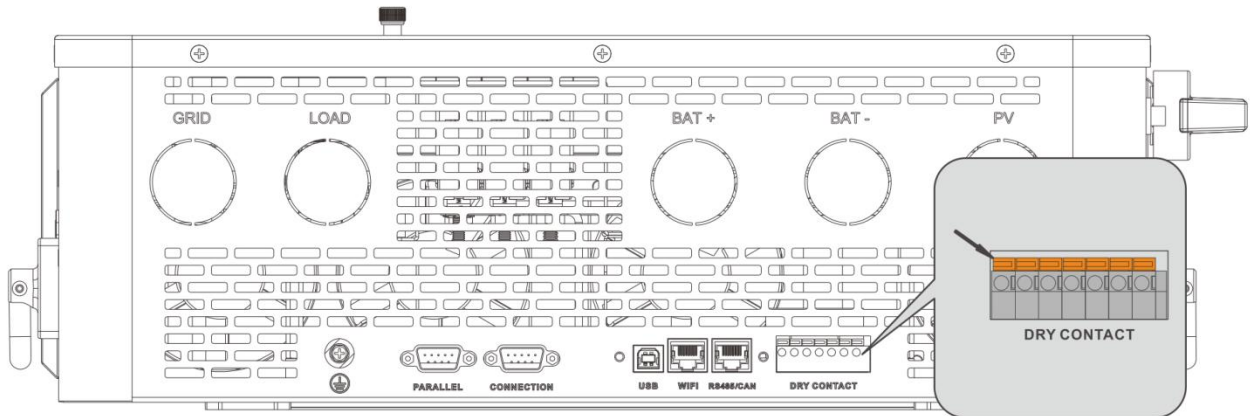


RSD Receiver



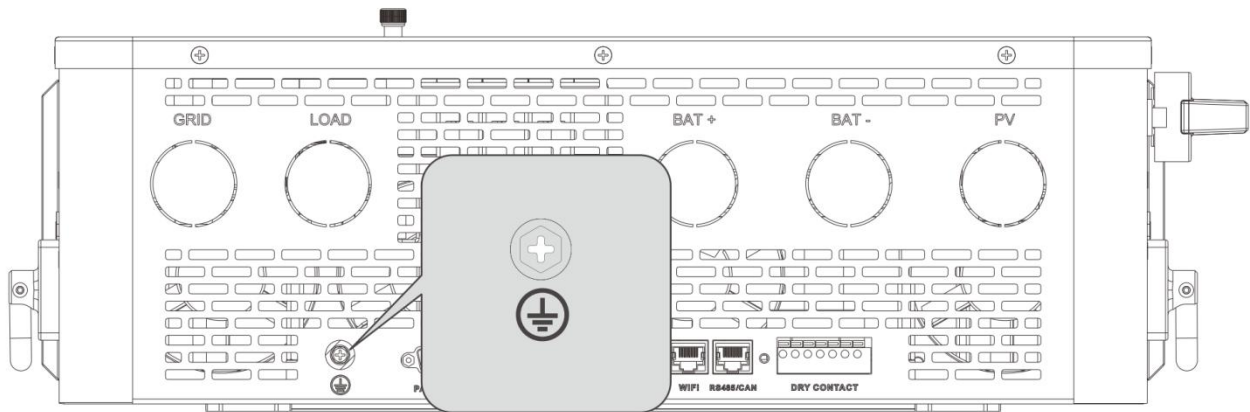
4.6 Dry contact wiring

Use a small-sized screwdriver to push back in the direction indicated by the arrow, and then insert the communication cable into the dry contact port. (Communication cable section: 0.2 mm²-1.5 mm²)



4.7 Grounding

Please ensure that the grounding terminal is reliably connected to the grounding busbar.



NOTICE

- The grounding cable size shall not be less than 4 mm² and shall be as close as possible to the grounding point.

4.8 Inverter start

After confirming reliable wiring and correct wiring sequence, restore the terminal cover to its original position

Step 1: Close the circuit breaker of the battery

Step 2: Press the rocker switch at the bottom of the inverter, and the screen and indicator will light up, indicating that the inverter is enabled

Step 3: Close the circuit breakers for PV input, AC input, and AC output in sequence

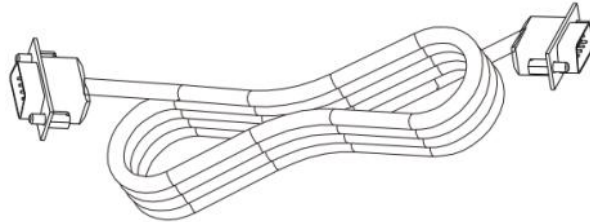
Step 4: Start loads one by one in order of power from small to large.

4.9 Parallel wiring

4.9.1 Parallel operation

1. The parallel operation supports up to six solar storage inverters.
2. When using the parallel function, it is necessary to connect the parallel communication cable in a correct and reliable manner. See the figure below for the communication cable (packaging accessory):

Parallel communication cable*1



4.9.2 Cautions for parallel connection

Warning:

1.PV wiring:

In parallel connection, the PV array of each inverter must be independent, and the PV array of PV1 and PV2 for one inverter must also be independent.

2.Battery wiring:

In single-phase or three-phase parallel connection, all solar storage inverters must be connected to the same battery, with BAT+ connected to BAT+ and BAT- to BAT-, and before power on and start-up, it is necessary to check and ensure correct connection, wiring length, and cable size, so as to avoid the abnormal operation of parallel system output caused by wrong connection.

3.AC OUT wiring:

In single-phase parallel connection, all solar storage inverters must be connected in the manner of L-to-L, N-to-N, and PE-to-PE, and before power on and start-up, it is necessary to check and ensure correct connection, wiring length, and cable size, so as to avoid the abnormal operation of parallel system output caused by wrong connection.

In three-phase parallel connection, all solar storage inverters must be connected in the manner of N-to-N and PE-to-PE. The L lines of all inverters in the same phase shall be connected together, but the AC output L lines of different phases shall not be connected together. Other cautions are the same as those for single-phase parallel connection.

4.AC IN wiring:

In single-phase parallel connection, all solar storage inverters must be connected in the manner of L-to-L, N-to-N, and PE-to-PE, and before power on and start-up, it is necessary to check and ensure correct connection, wiring length, and cable size, 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 AC source input shall

be consistent and unique.

In three-phase parallel connection, all solar storage inverters must be connected in the manner of N-to-N and PE-to-PE. The L lines of all inverters in the same phase shall be connected together, but the AC output L lines of different phases shall not be connected together. Other cautions are the same as those for single-phase parallel connection.

5. Communication wiring:

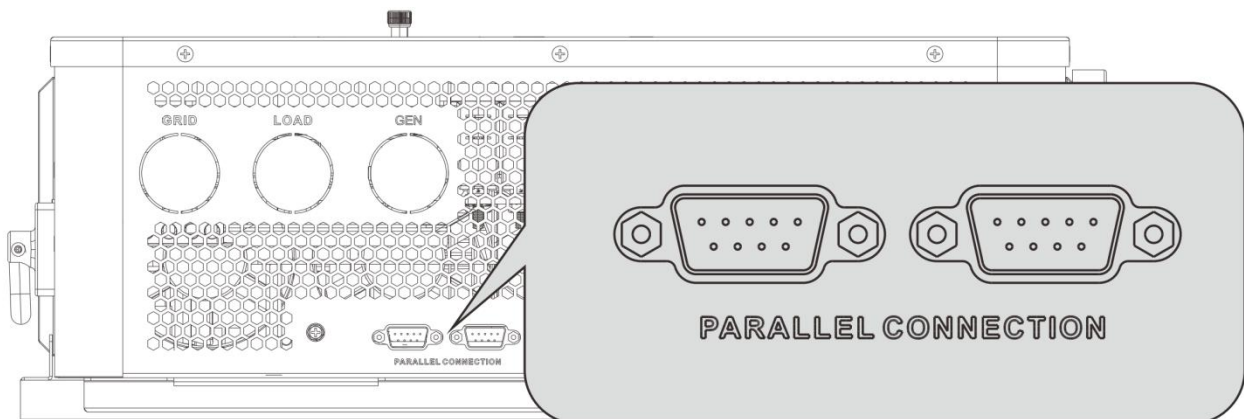
Our company's communication cable for parallel operation is a DB15 standard computer cable with shielding function, and it is used for single-phase or three-phase parallel connection. Each inverter shall be connected with one out and one in, that is, the male connector (out) of the inverter is to be connected to the female connector (in) of the parallel inverter, not the one of the inverter. In addition, DB15 terminal screws will be used to tighten the communication cable of each parallel inverter to avoid falling off or poor contact of the communication cable, followed by abnormal operation or damage of the system output.

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

7. After the system is correctly 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.

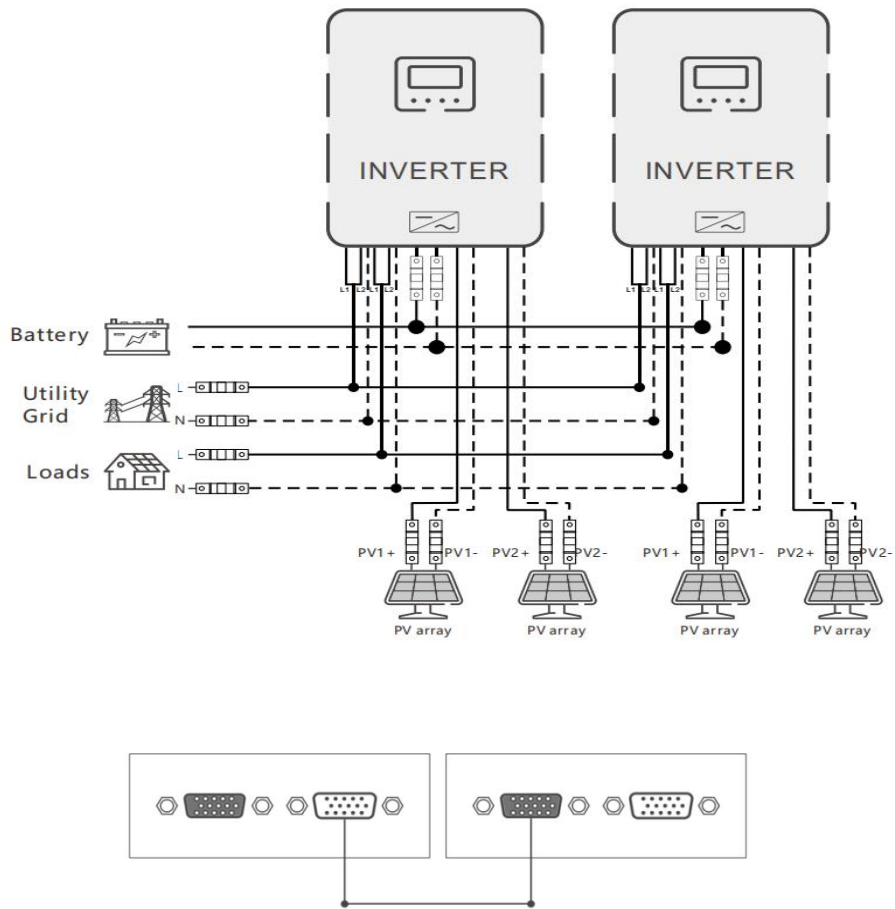
4.9.3 Wiring diagram for single-phase parallel connection (phase difference between L1 and L2: 0°)

- The communication cable of parallel solar storage inverter is to be locked with screws after connecting. See the diagram below:

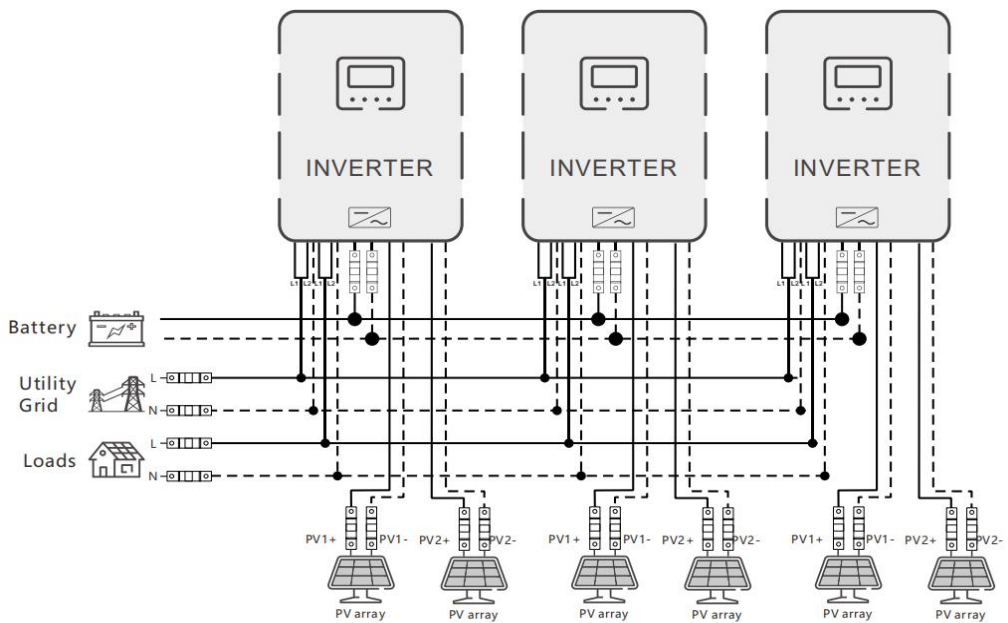


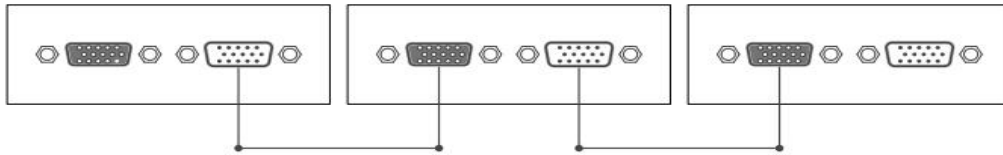
- See the diagram below for parallel connection. Set the item [31] to "PAL" and the item [68] to "0° ." When setting the item [38] to "120 V," the output L-N voltage is 120 V

1. Two parallel-connected solar storage inverters:

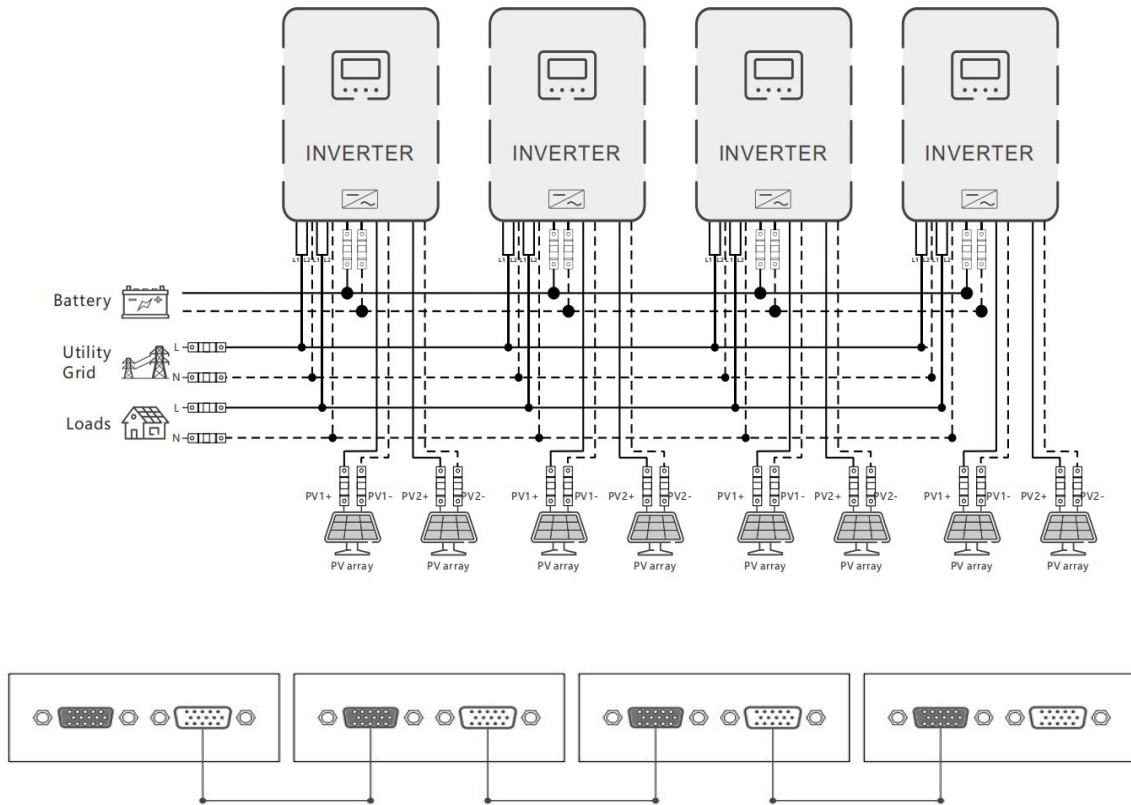


2. Three parallel-connected solar storage inverters

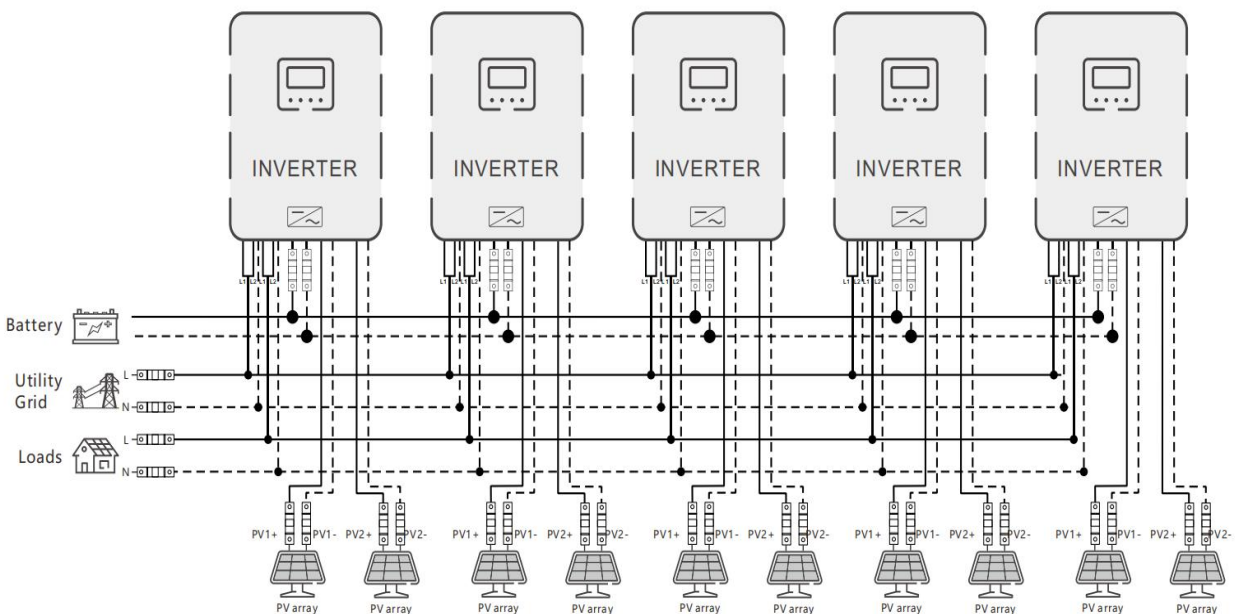


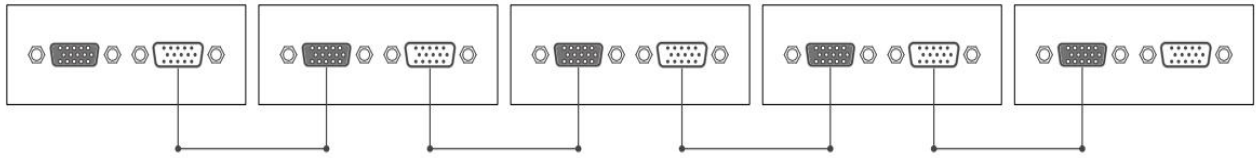


3. Four parallel-connected solar storage inverters:

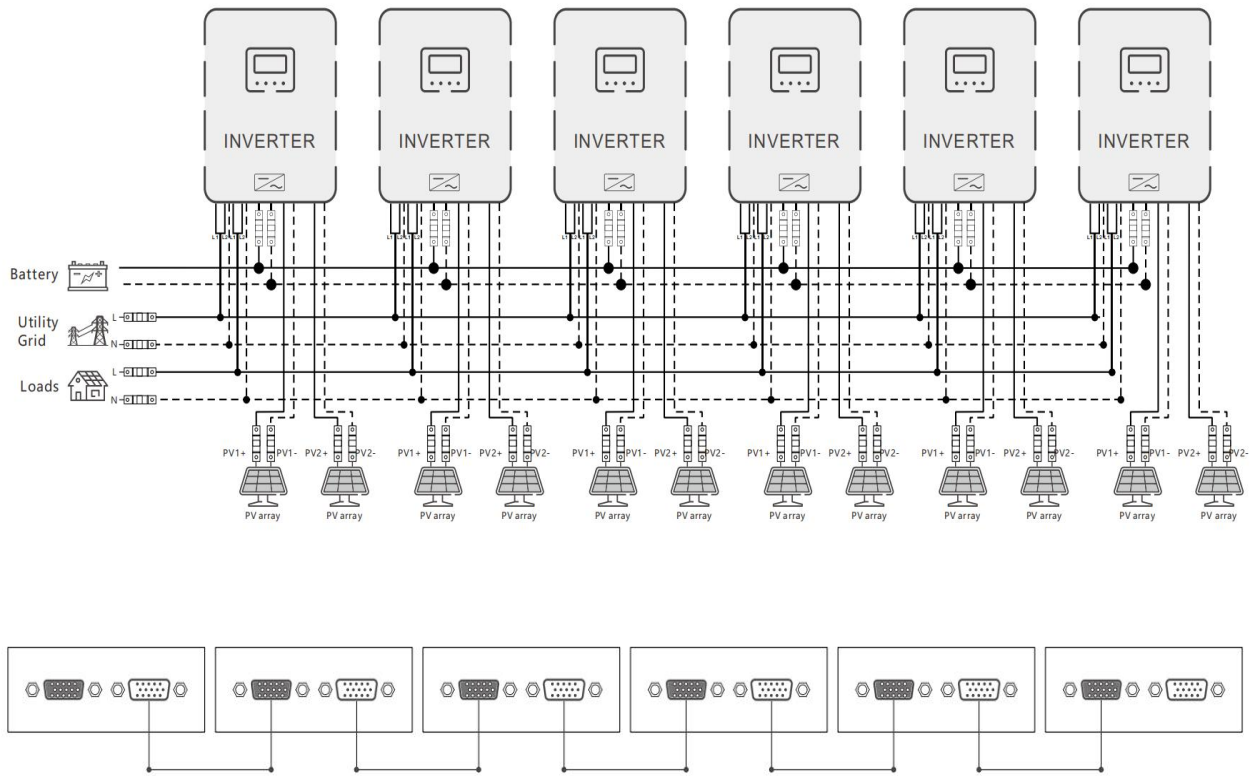


4. Five parallel-connected solar storage inverters:





5. Six parallel-connected solar storage inverters:



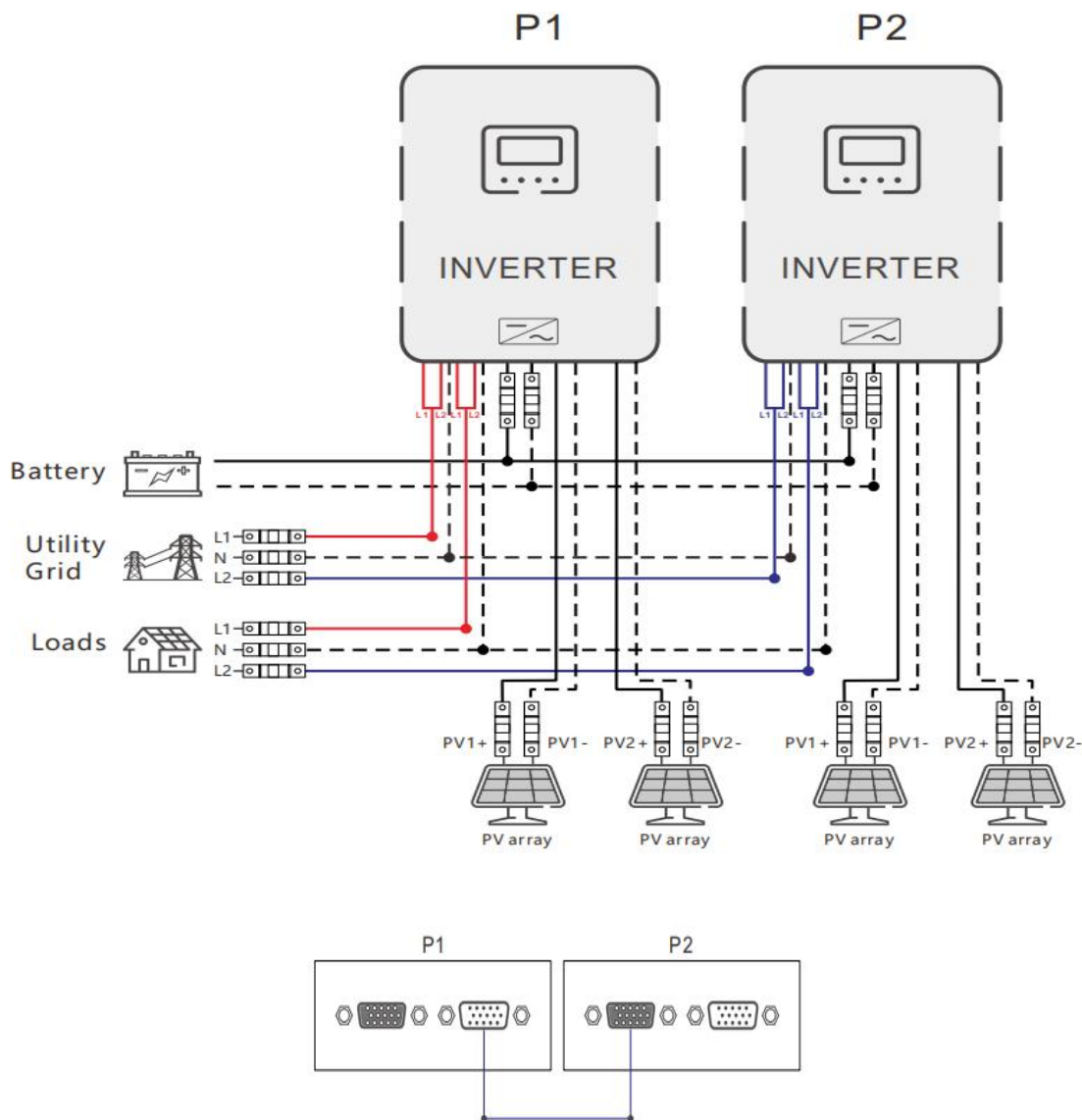
4.9.4 Wiring diagram for Split-phase parallel connection (phase difference between L1 and L2: 0°)

(1) P1: Set the item [31] to "2P0;" P2: Set the item [31] to "2P1," all of the P1/P2 inverter item [68] can not be set, it is default "0°" and the phase difference between P1 and P2 is 120°. When setting the item [38] to "120 V," the voltage between the live wire L1 of P1 phase and the live wire L2 of P2 phase is 208 V, and the L1-N voltage is 120 V

(2) P1: Set the item [31] to "2P0;" P2: Set the item [31] to "2P2," all of the P1/P2 inverter item [68] can not be set, it is default "0°" and the phase difference between P1 and P2 is 180°. When setting the item [38] to "120 V," the voltage between the live wire L1 of P1 phase and the live wire L2 of P2 phase is 240 V, and the L1-N voltage is 120 V, L2-N voltage is 120V

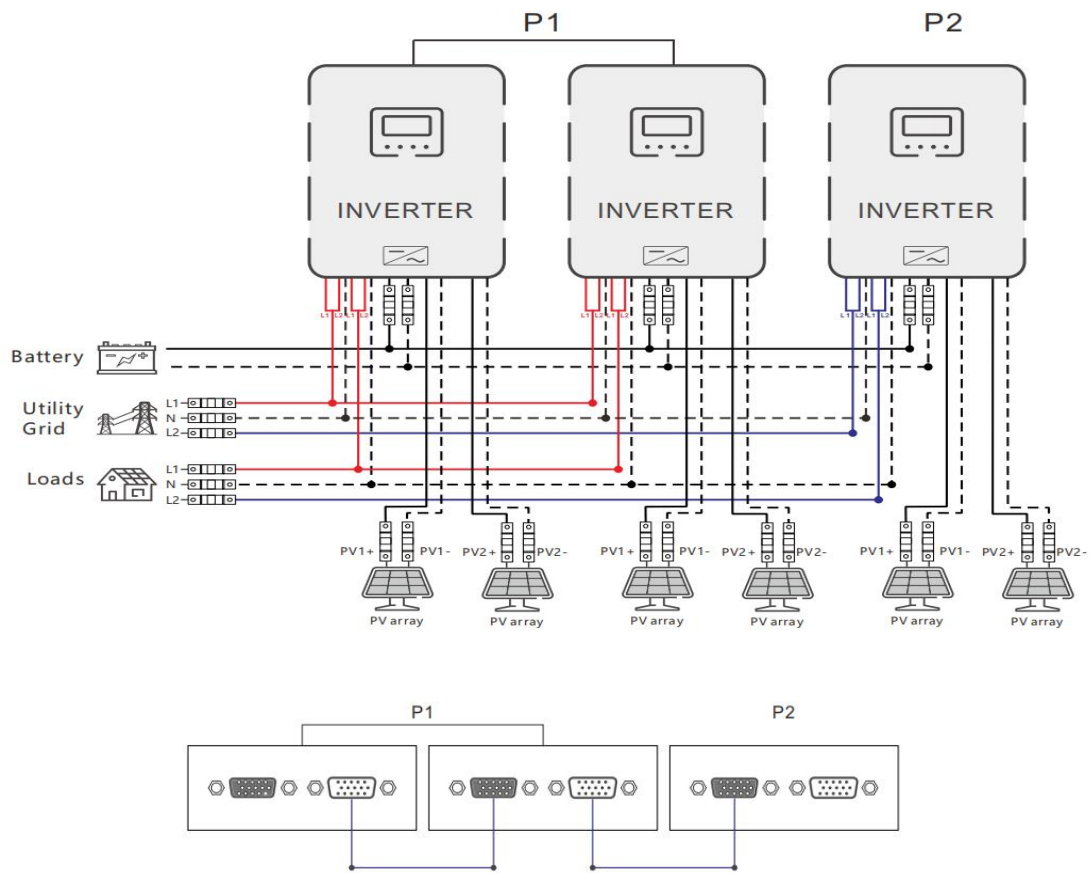
a. Split-phase system (two inverters)

1+1 system:



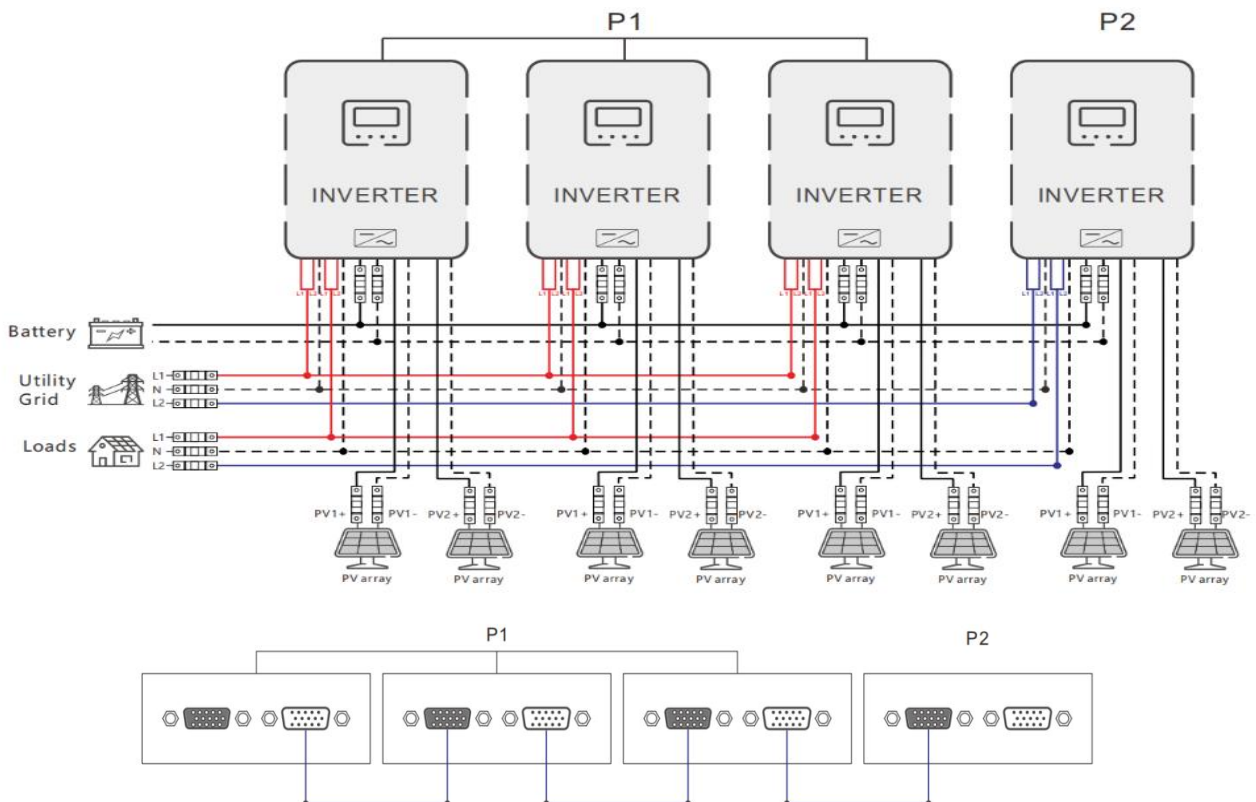
b. Split-phase system (three inverters)

2+1 system

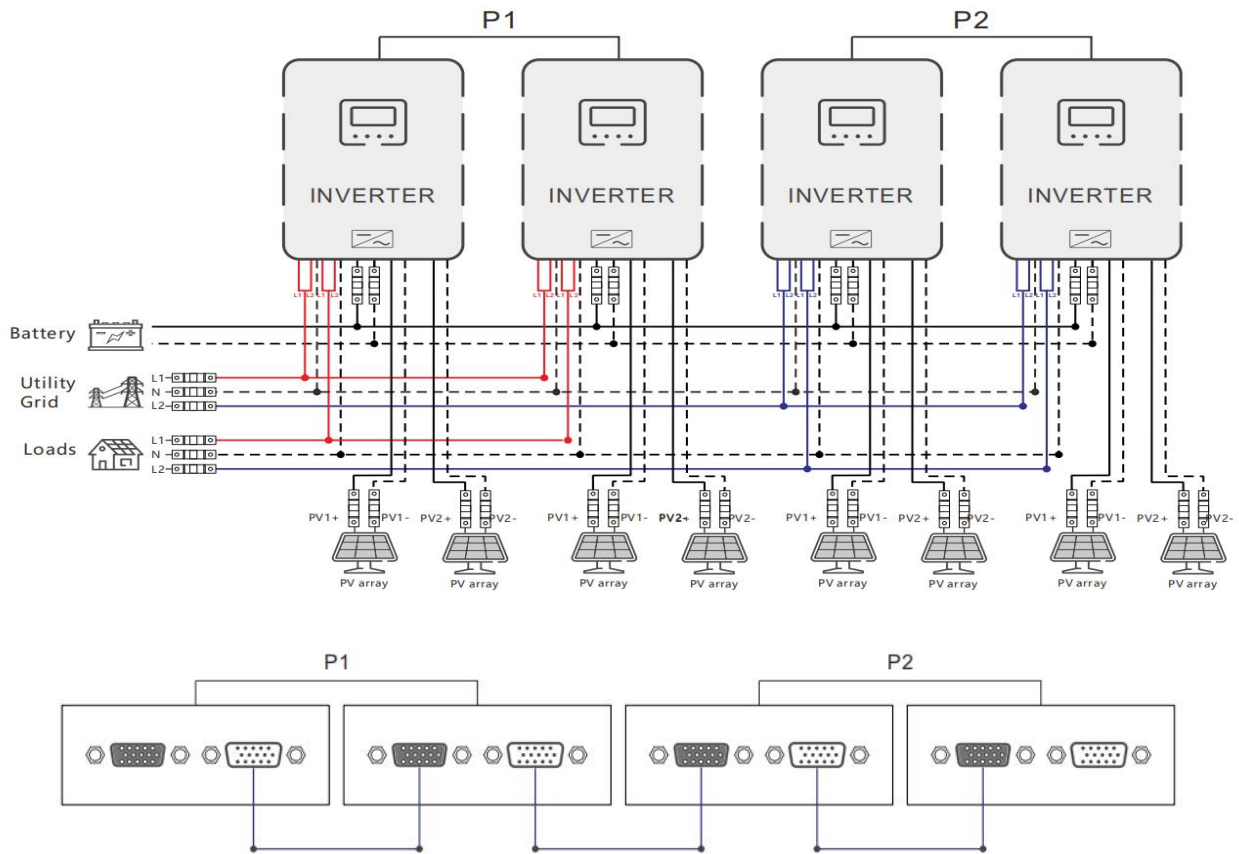


c. Split-phase system (four inverters)

3+1 system:

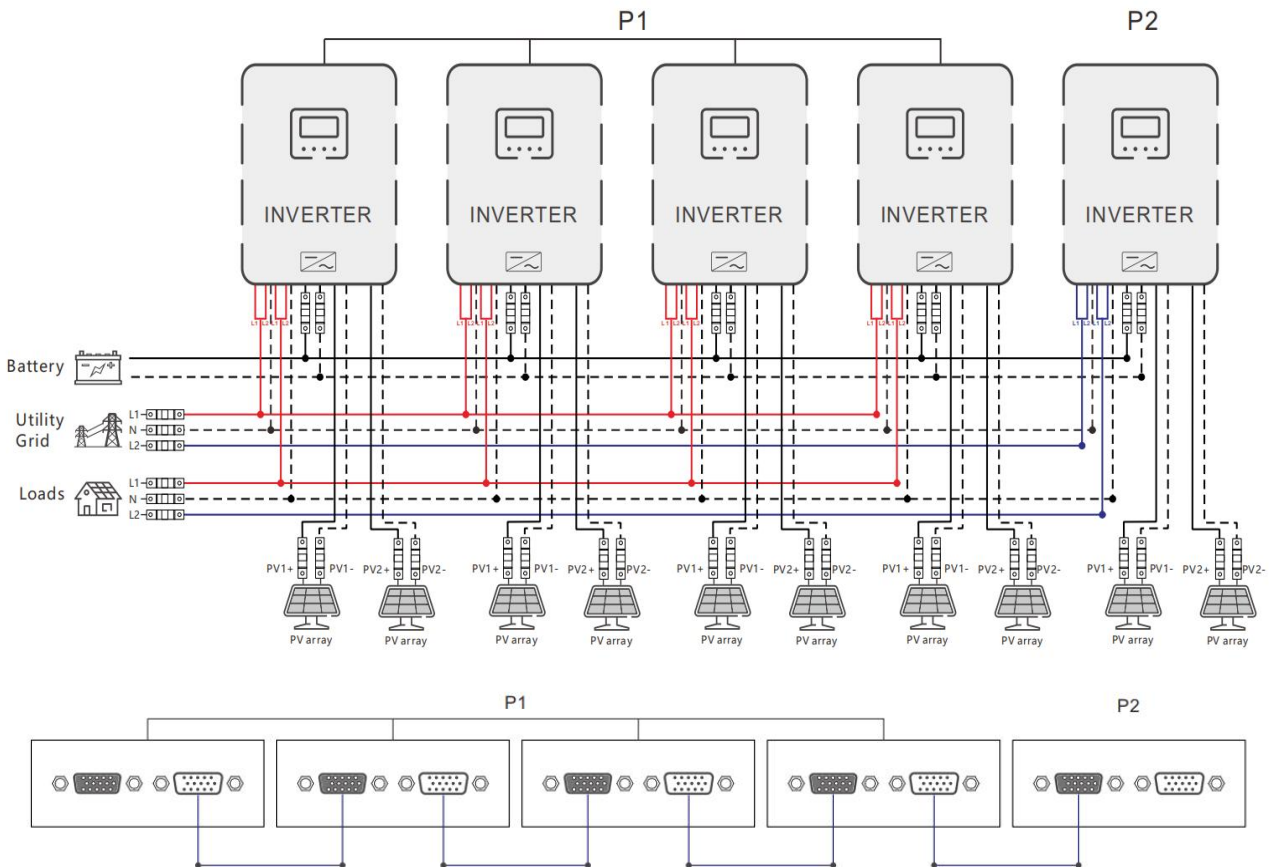


2+2 system:

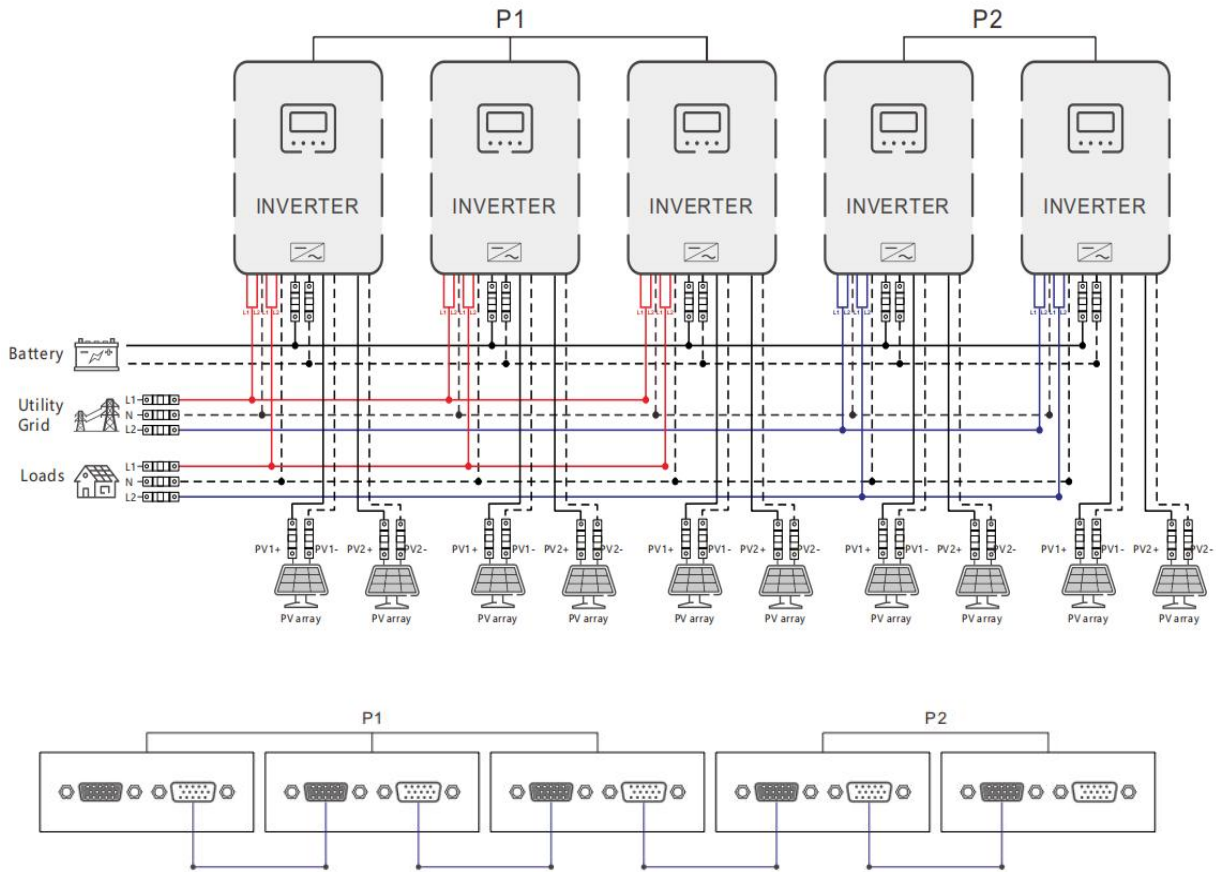


d. Split-phase system (five inverters)

4+1 system:

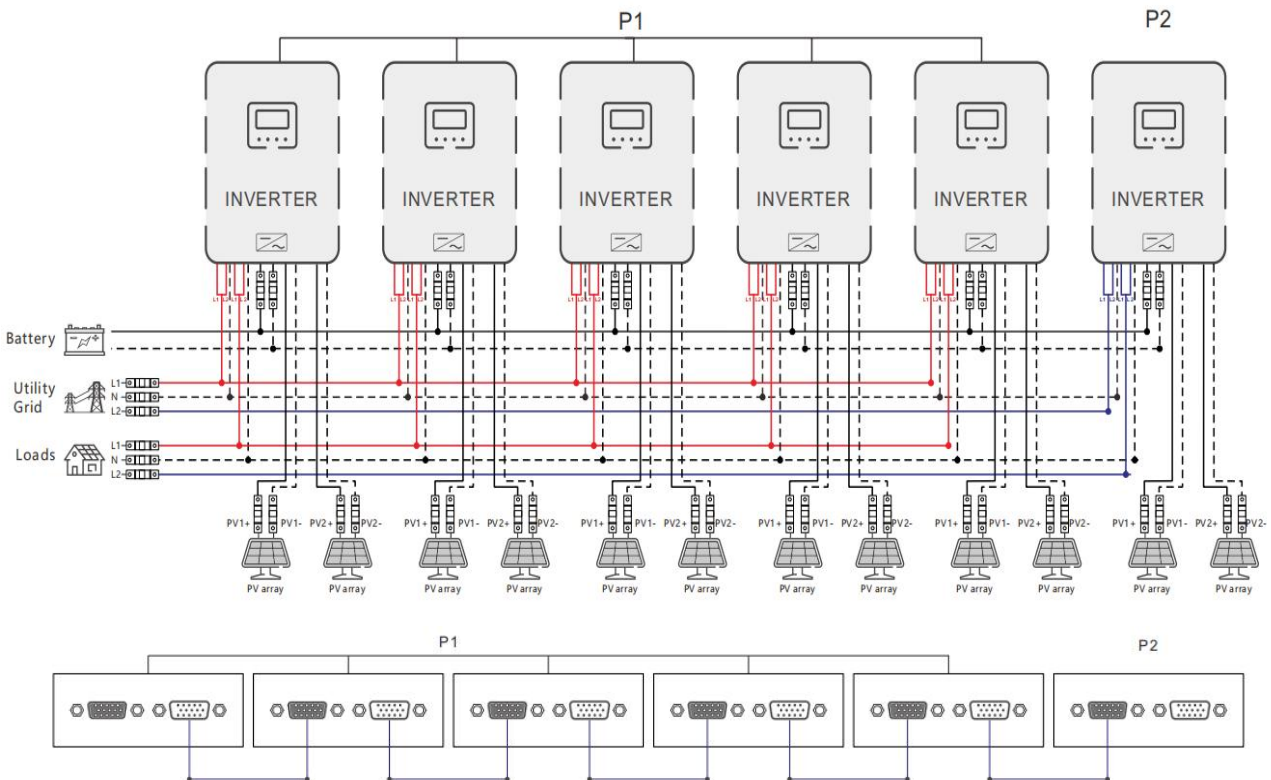


3+2 system:

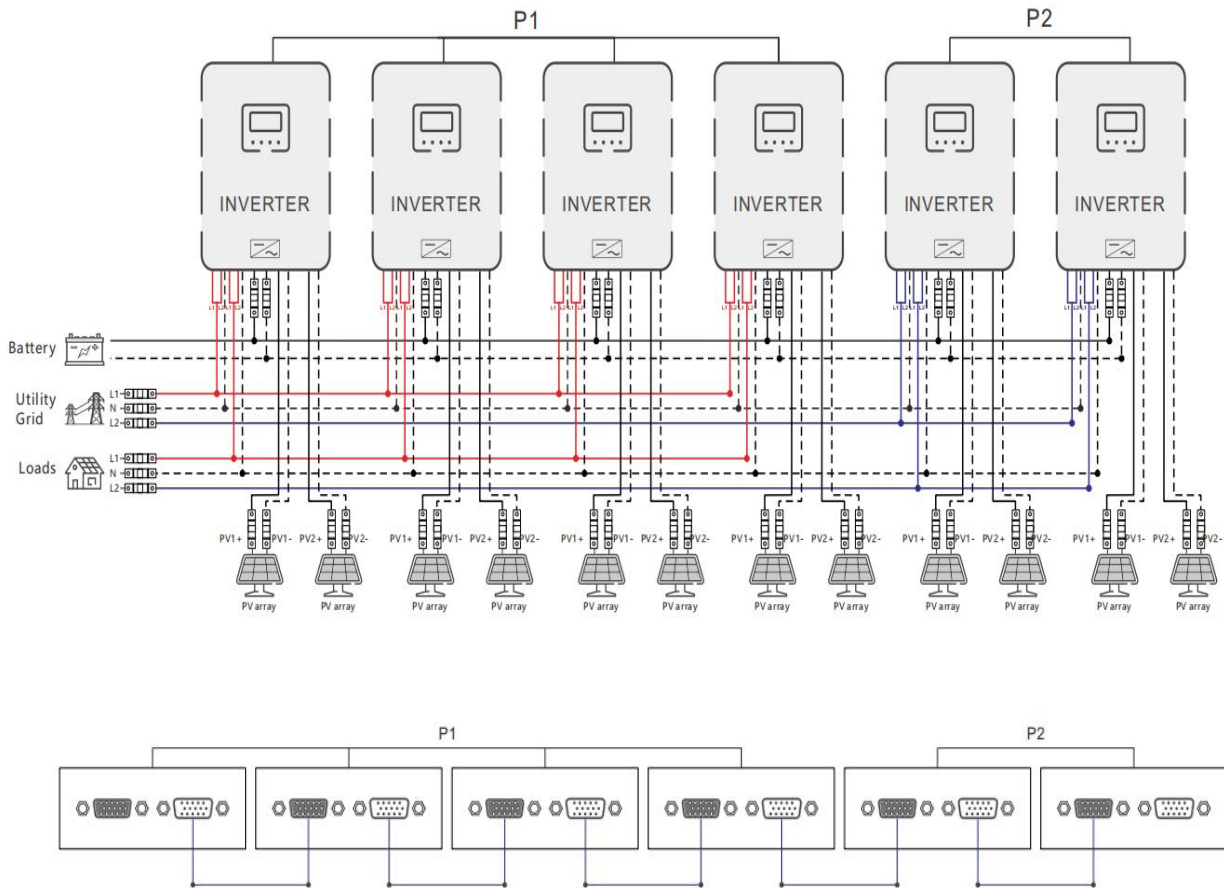


e. Split-phase system (six inverters)

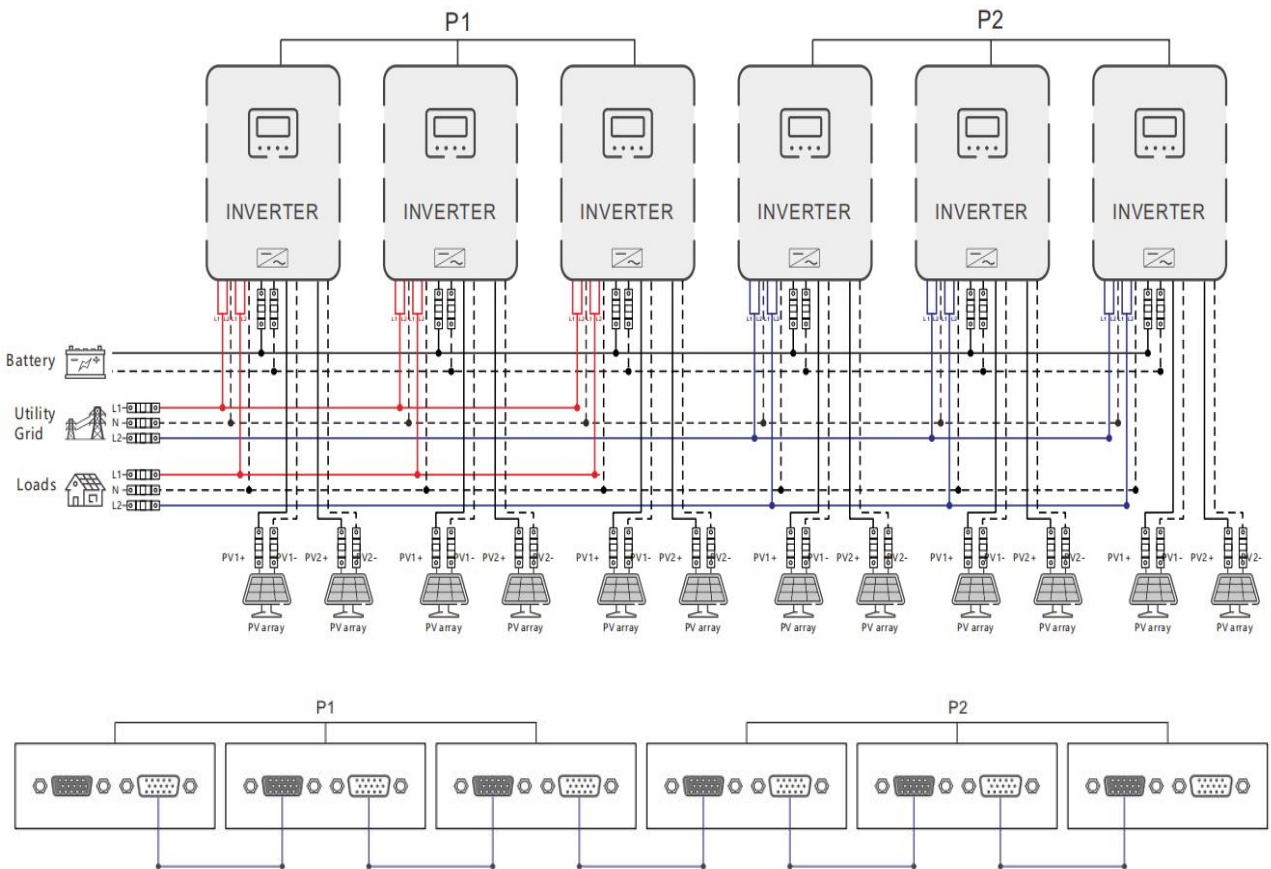
5+1 system:



4+2 system:



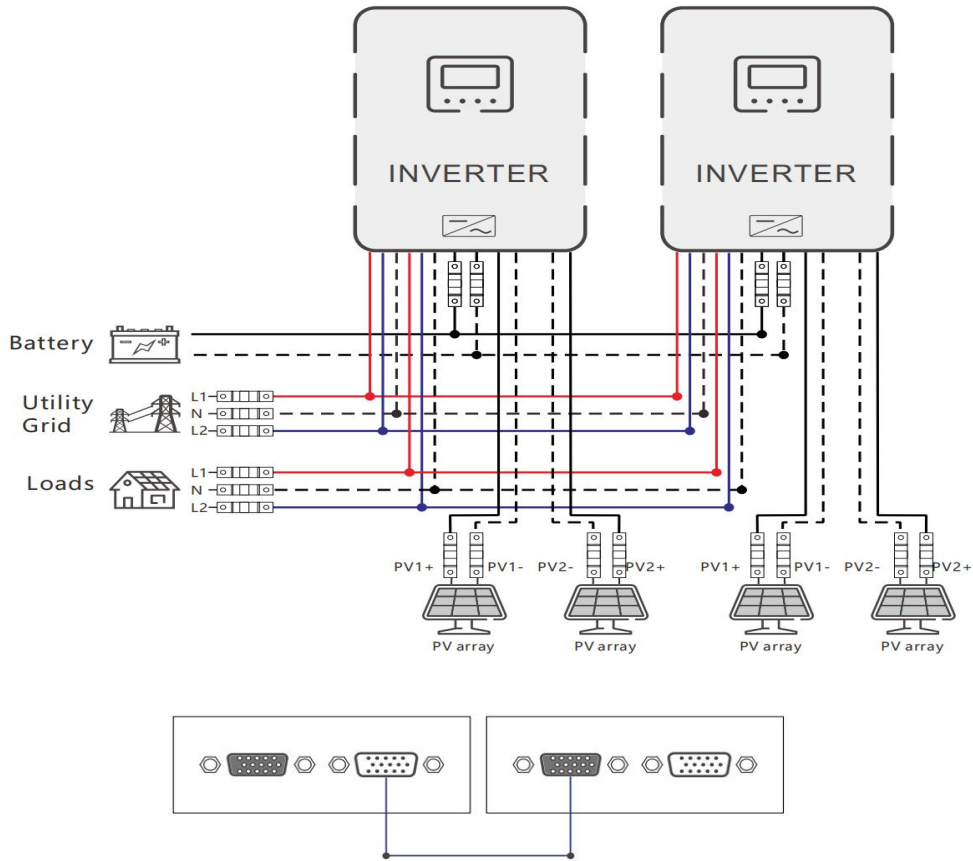
3+3 system:



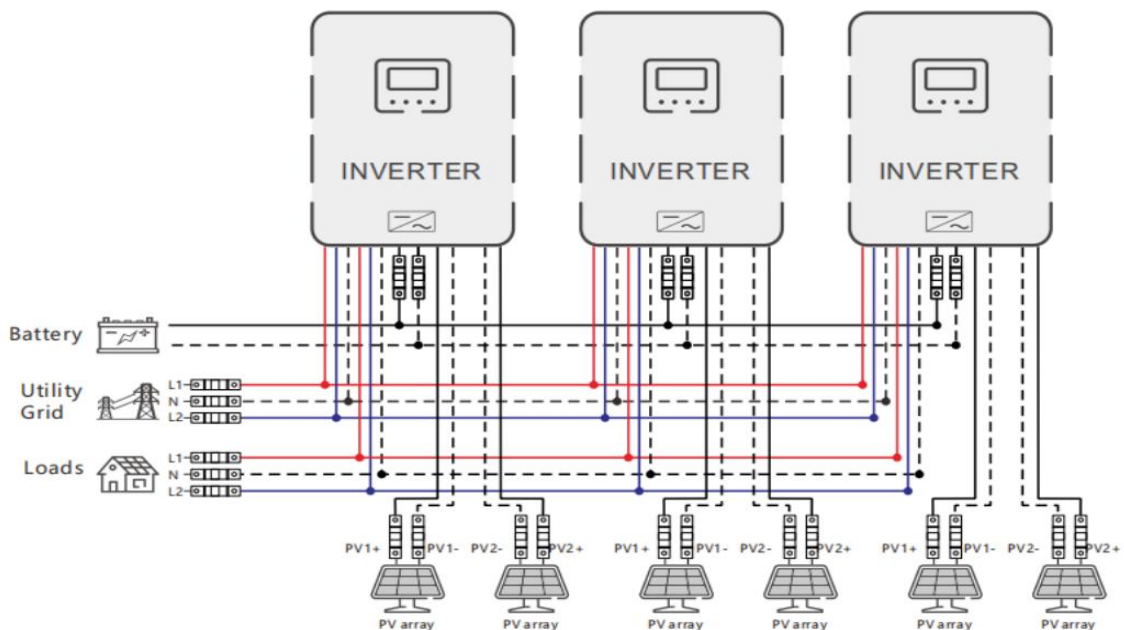
4.9.5 Wiring diagram for split-phase parallel connection (phase difference between L1 and L2: 180°)

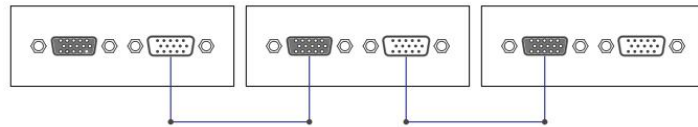
Set the item [31] to PAL, and set the item [68] to 180°. When setting the item [38] to "120 V," the L1-L2 voltage is 240 V, and the L1-N voltage is 120 V, L2-N voltage is 120V

a. Two parallel-connected solar storage inverters:

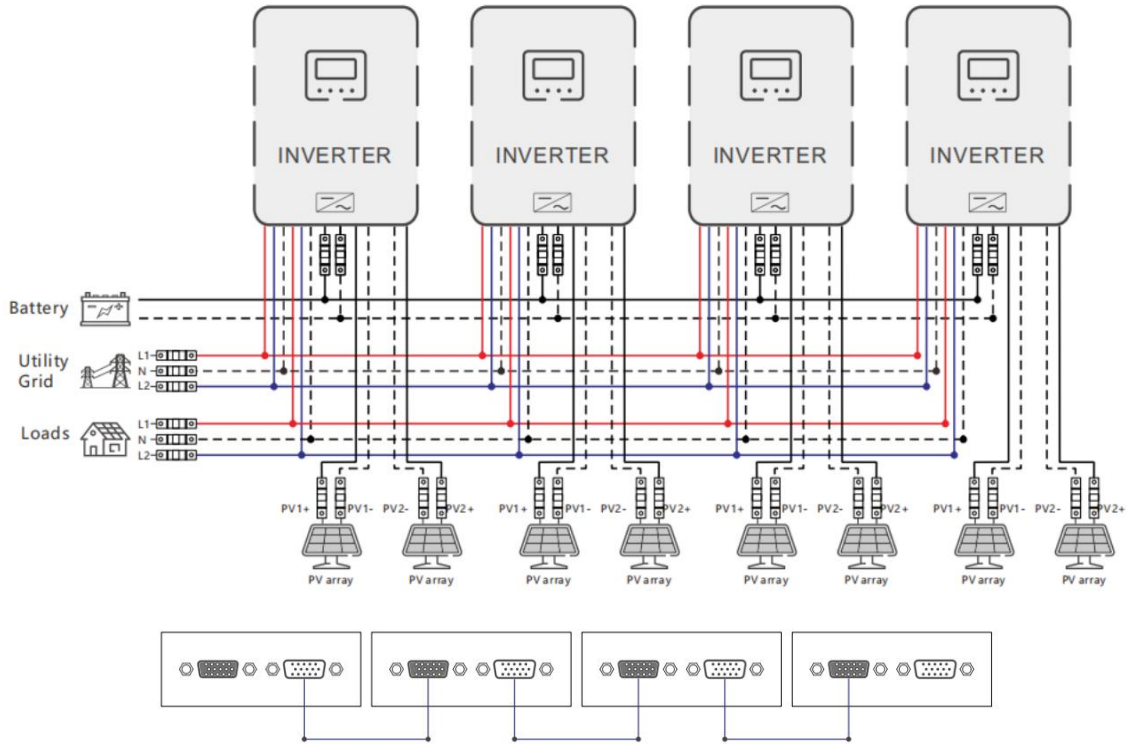


b. Three parallel-connected solar storage inverters:

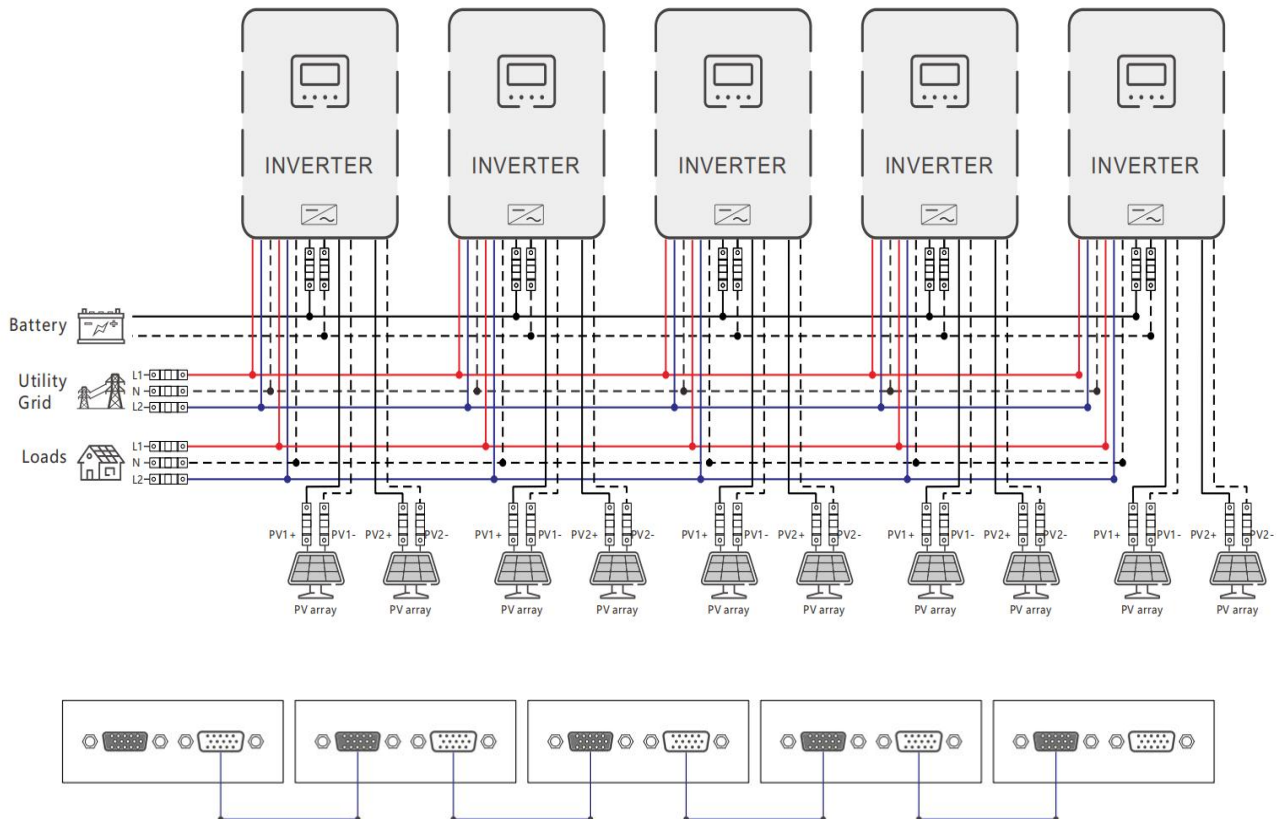




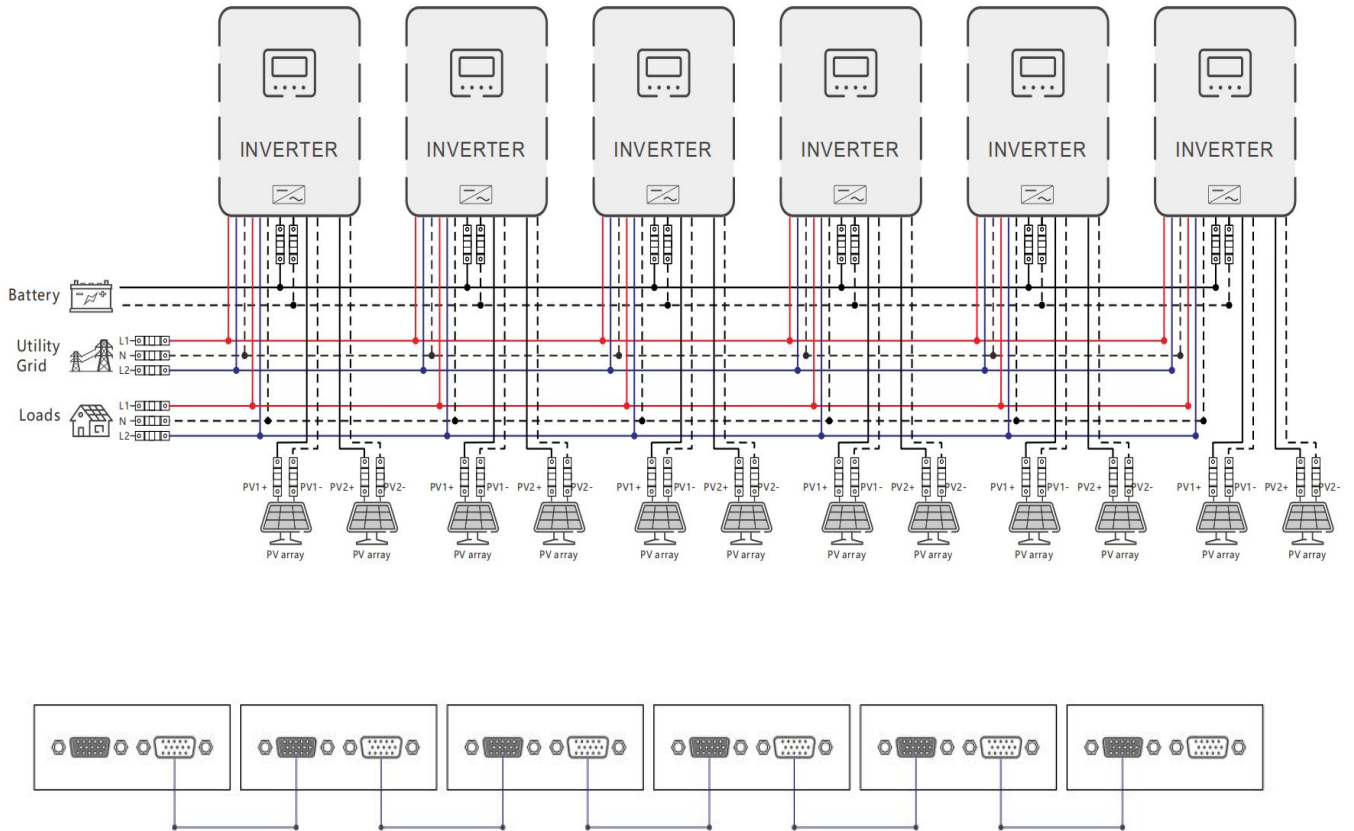
c. Four parallel-connected solar storage inverters:



d. Five parallel-connected solar storage inverters:



e. Six parallel-connected solar storage inverters:



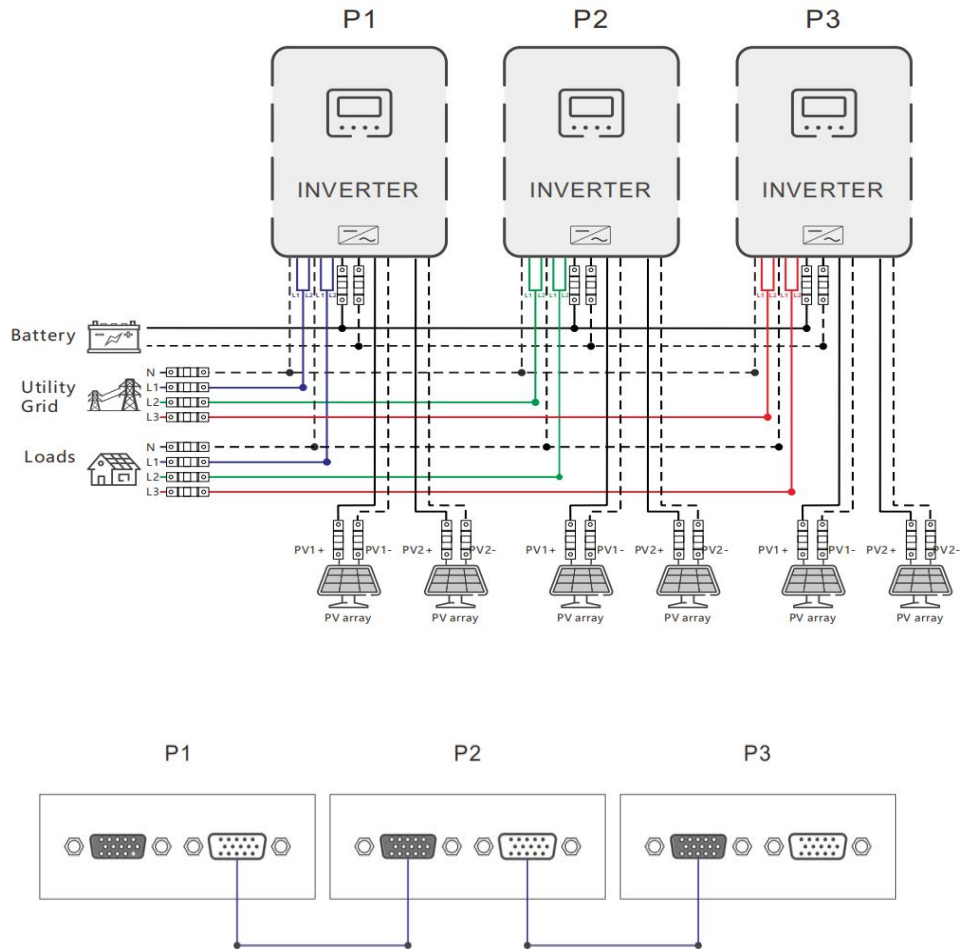
4.9.6 Wiring diagram for three-phase parallel connection

P1: Set the item [31] to "3P1;" P2: Set the item [31] to "3P2;" P3: Set the same to "3P3", all of P1/P2/P3 inverters item [68] can not be set, it is default "0"

At this point, the P1-P2, P1-P3, and P2-P3 phase difference is 120°. When setting the item [38] to "120 VAC," the voltage between the live wire L1 of P1 phase and the live wire L2 of P2 phase is $230 \times 1.732 = 208$ VAC. Similarly, the L1-L3 and L2-L3 voltage is 208 VAC:

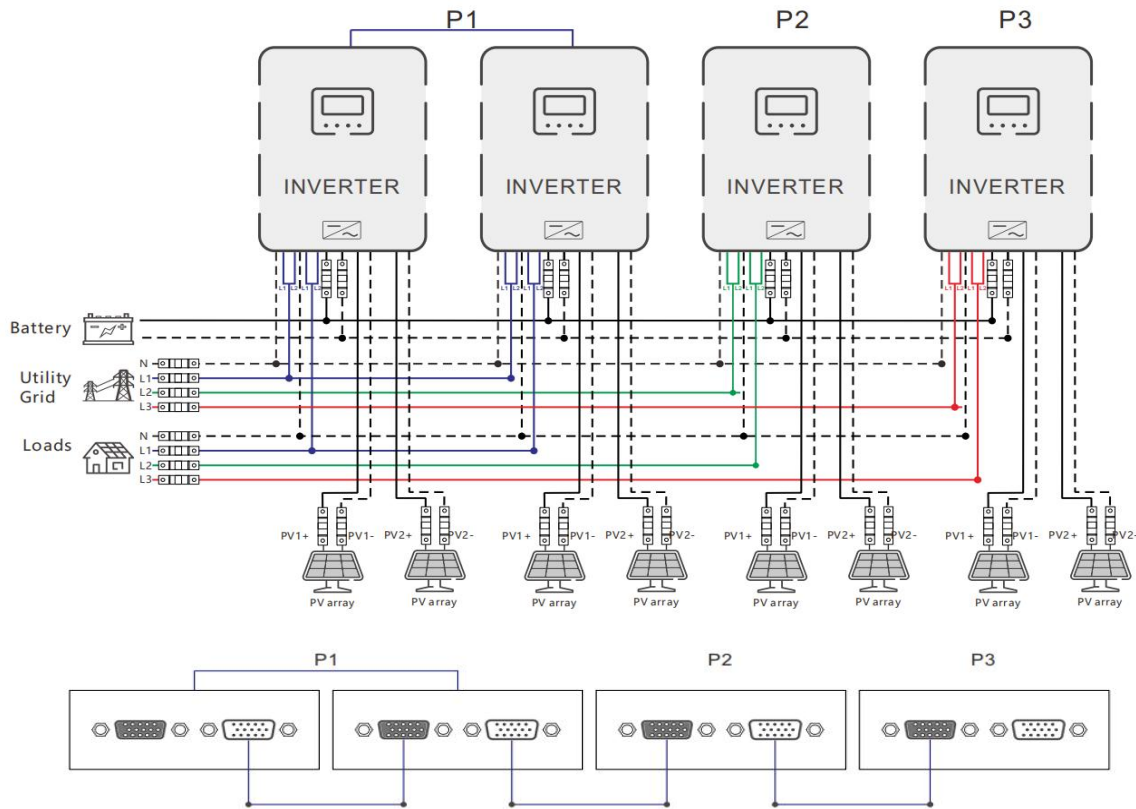
a. Three-phase system (three inverters)

1+1+1 system:



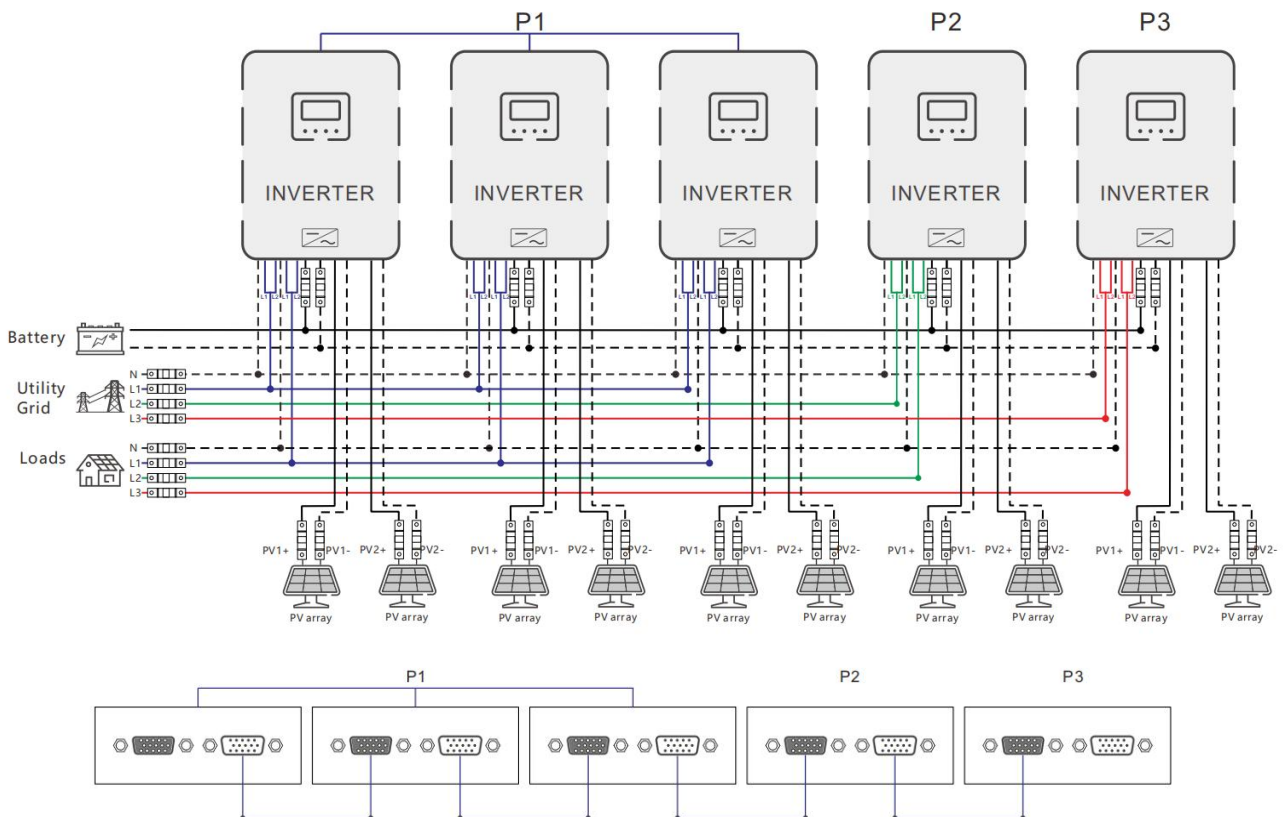
b. Three-phase system (four inverters)

2+1+1 system:

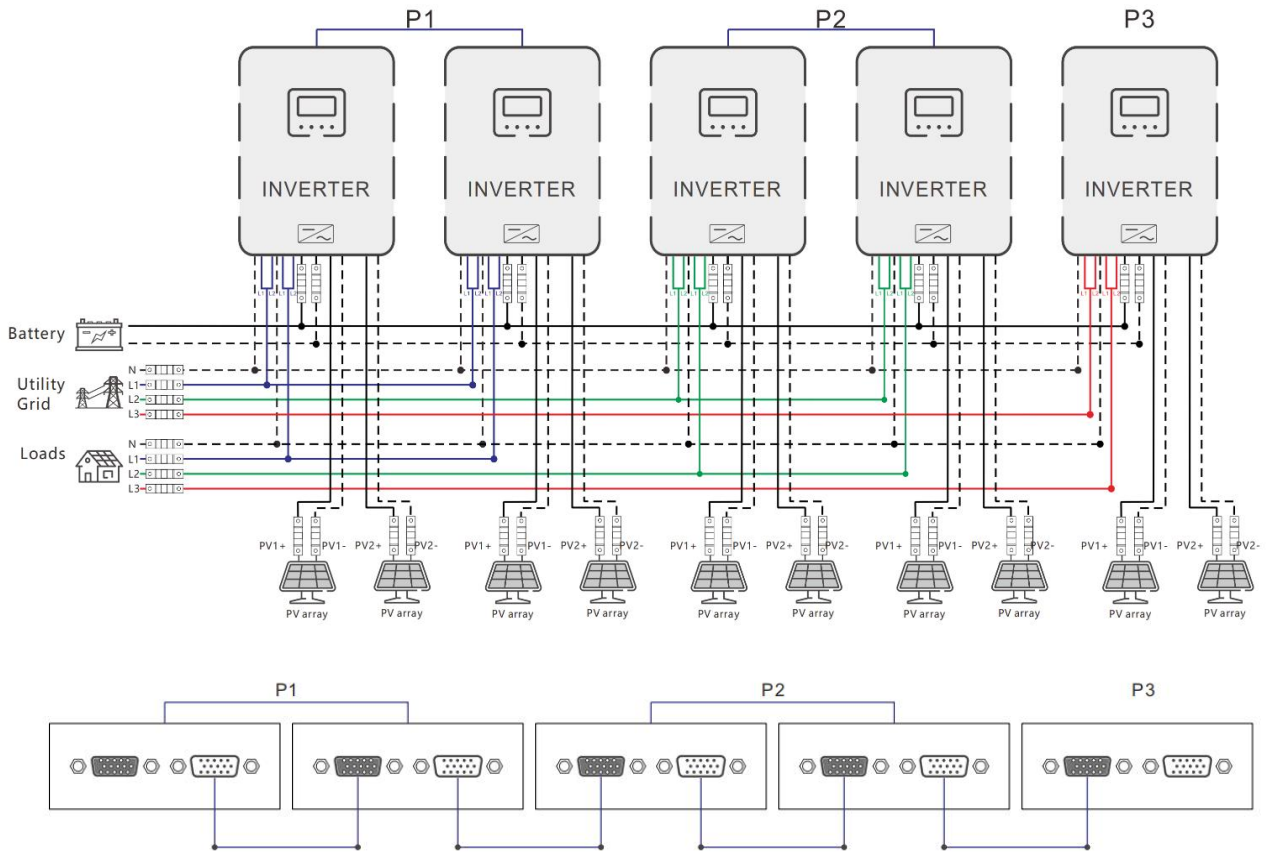


c. Three-phase system (five inverters)

3+1+1 system:

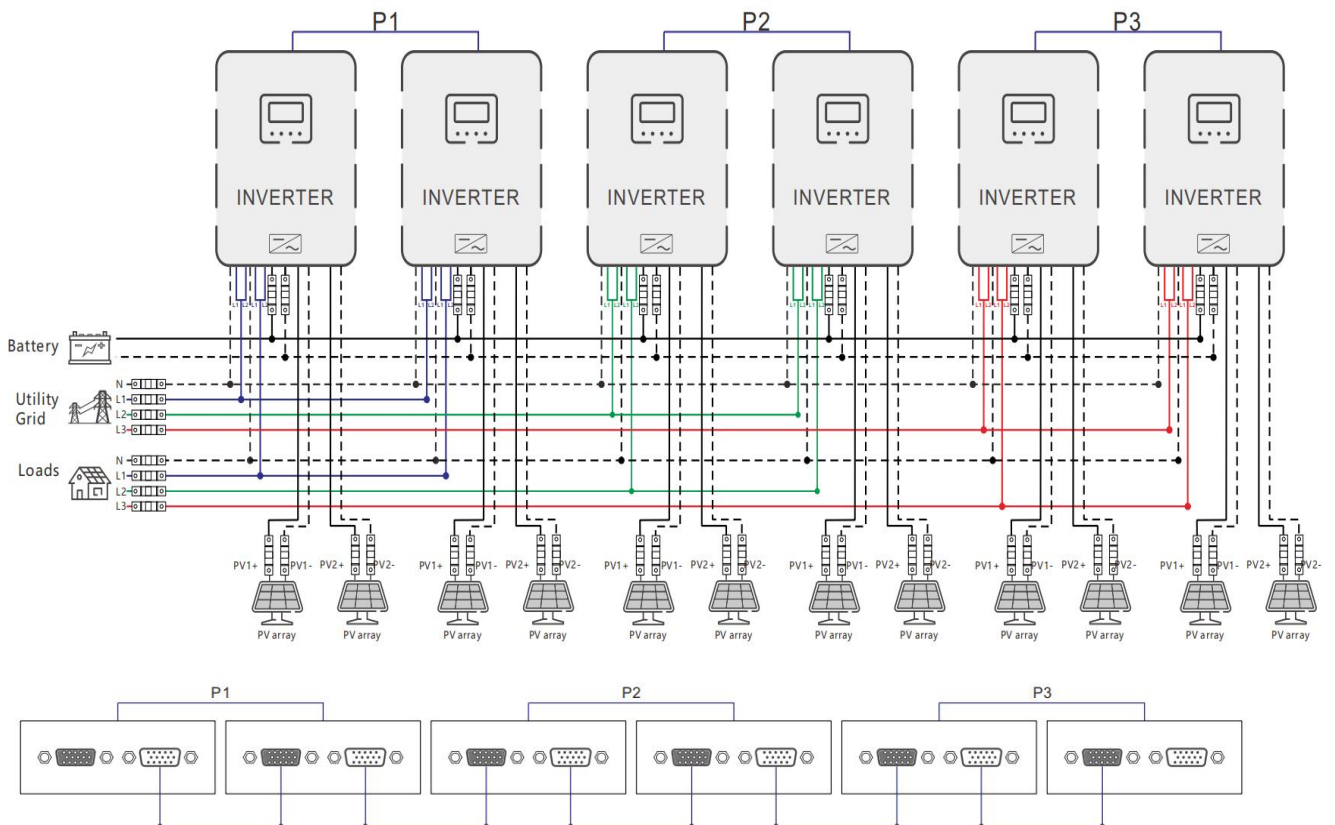


2+2+1 system:

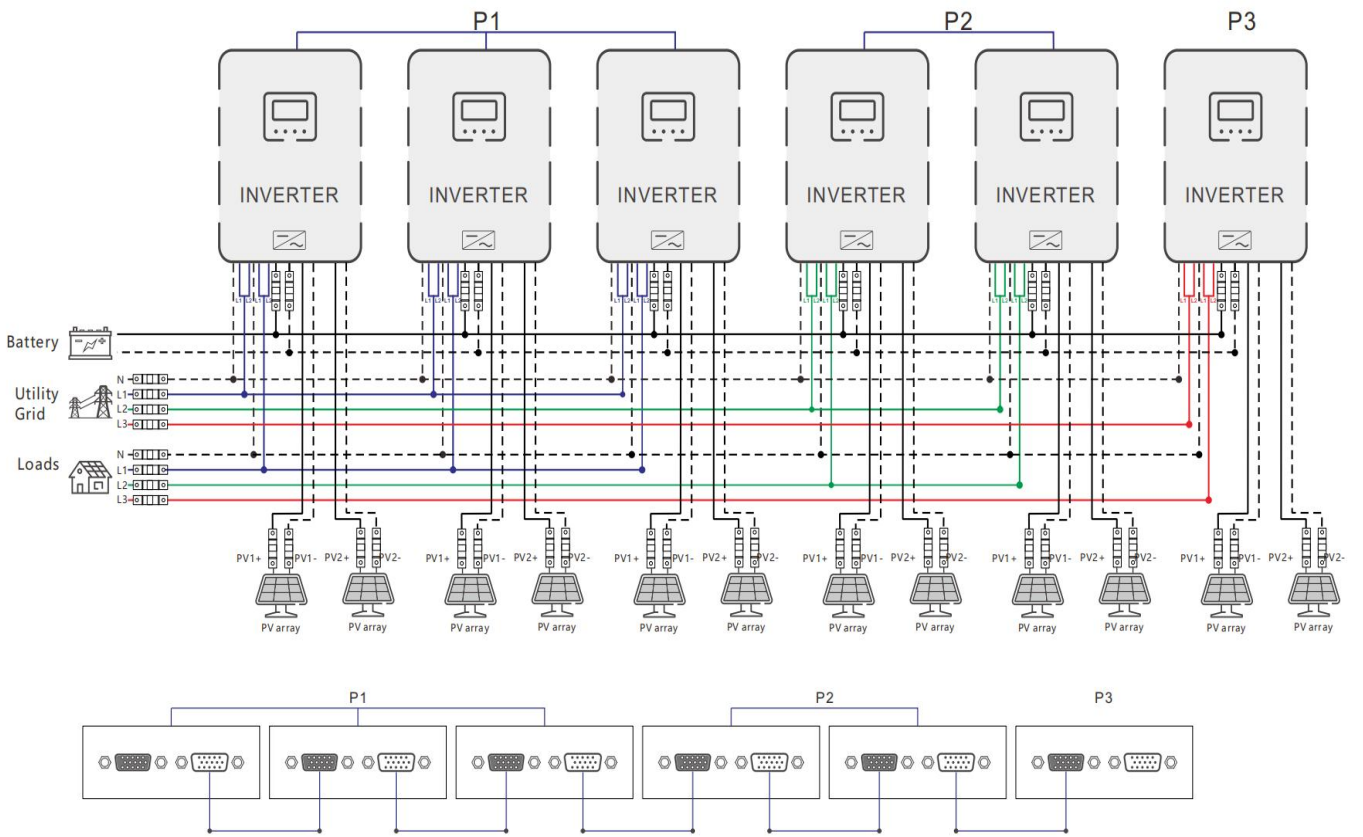


d. Three-phase system (six inverters)

2+2+2 system:



3+2+1 system:



Note:

- 1) Before powering on and lighting up the screen, check for correct wiring according to the above wiring diagrams to avoid system problems.
- 2) Check all connections for firm fixing to avoid detachment and abnormal system operation.
- 3) When connecting the AC output to the load, complete wiring according to the requirements of the electrical load to avoid damage to the load.
- 4) Set the item [38] to the same parameter, or only set it in the host inverter. During parallel operation, the voltage set in the host shall prevail, so the host inverter will forcibly set the item to the value for slave inverters. Only in standby mode can the item be set.
- 5) The inverter defaults to single mode at the factory. If using the parallel or three-phase function, set the item [31] on the screen as follows:
Power on one inverter each time, turn off the other inverters, and then set the item [31] according to the on-site system operation mode. After setting the inverter, turn off the inverter, and set the other inverters one by one. After all are set, power on all inverters at one time to enter the working state.

In single-phase parallel operation:

Set the item [31] to "PAL" and the item [68] to "0°." When setting the item [38] to "120 V," the output L-N voltage is 120 V

In two-phase parallel operation:

(1) P1: Set the item [31] to "2P0;" P2: Set the item [31] to "2P1," all of P1/P2 inverters item [68] can not be set, it is default "0°" and the phase difference between P1 and P2 is 120°. When setting the item [38] to "120 V," the voltage between the live wire L1 of P1 phase and the live wire L2 of P2 phase is 208 V, and the L1-N voltage is 120 V

(2) P1: Set the item [31] to "2P0;" P2: Set the item [31] to "2P2," all of P1/P2 inverters item [68] can not be set, it is default "0°" and the phase difference between P1 and P2 is 180°. When setting the item [38] to "120 V," the voltage between the live wire L1 of P1 phase and the live wire L2 of P2 phase is 240 V, and the L1-N voltage is 120 V

In split-phase parallel operation:

Set the item [31] to PAL, and set the item [68] to 180°. When setting the item [38] to "120 V," the L1-L2 voltage is 240 V, and the L1-N voltage is 120 V

In three-phase parallel operation:

P1: Set the item [31] to "3P1;" P2: Set the item [31] to "3P2;" P3: Set the same to

"3P3" all of P1/P2/P3 inverters item [68] can not be set, it is default "0°"

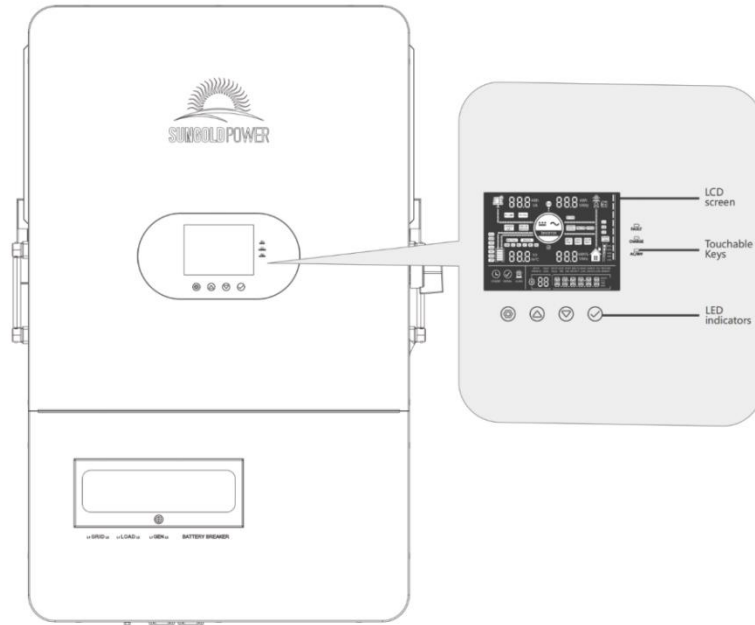
At this point, the P1-P2, P1-P3, and P2-P3 phase difference is 120°. When setting the item [38] to "120 VAC," the voltage between the live wire L1 of P1 phase and the live wire L2 of P2 phase is $230 \times 1.732 = 208$ VAC. Similarly, the L1-L3 and L2-L3 voltage is 208 VAC:

6) After the system runs, measure the correct output voltage before connecting to loads.

5. Operation

5.1 Operation and display panel

The operation and display panel of the inverter includes one LCD screen, three indicators, and four physical buttons



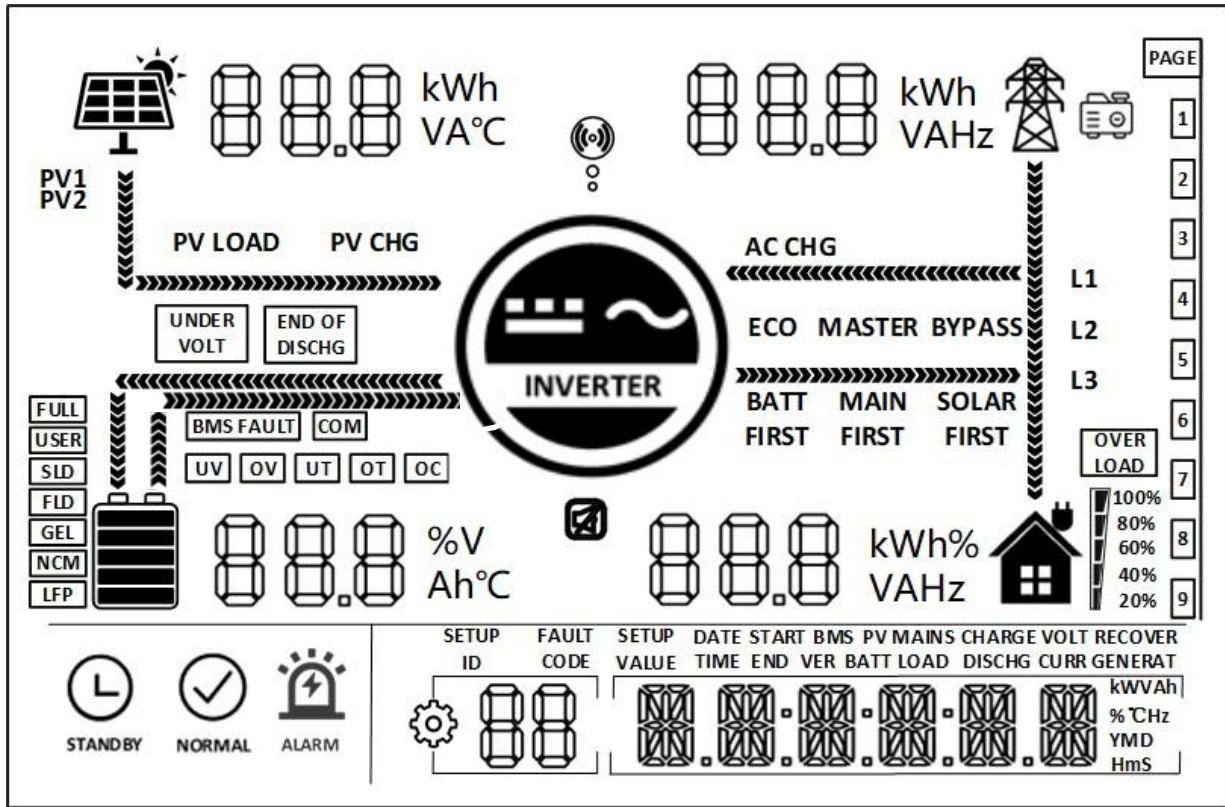
● Physical button

Physical button	Description
	Enter/Exit the setup menu
	Go to the next option
	Go to the previous option
	Confirm/Enter the option in setup menu

● LED indicator

Indicator	Color	Description
AC/INV	Yellow	Normally ON: mains bypass output
		Flash: inverter output
CHARGE	Green	Normally ON: charging completed
		Flash: charging
FAULT	Red	Normally ON: level-1 fault
		Flash: level-2 fault
		OFF: level-3 or level-4 fault

● Display screen

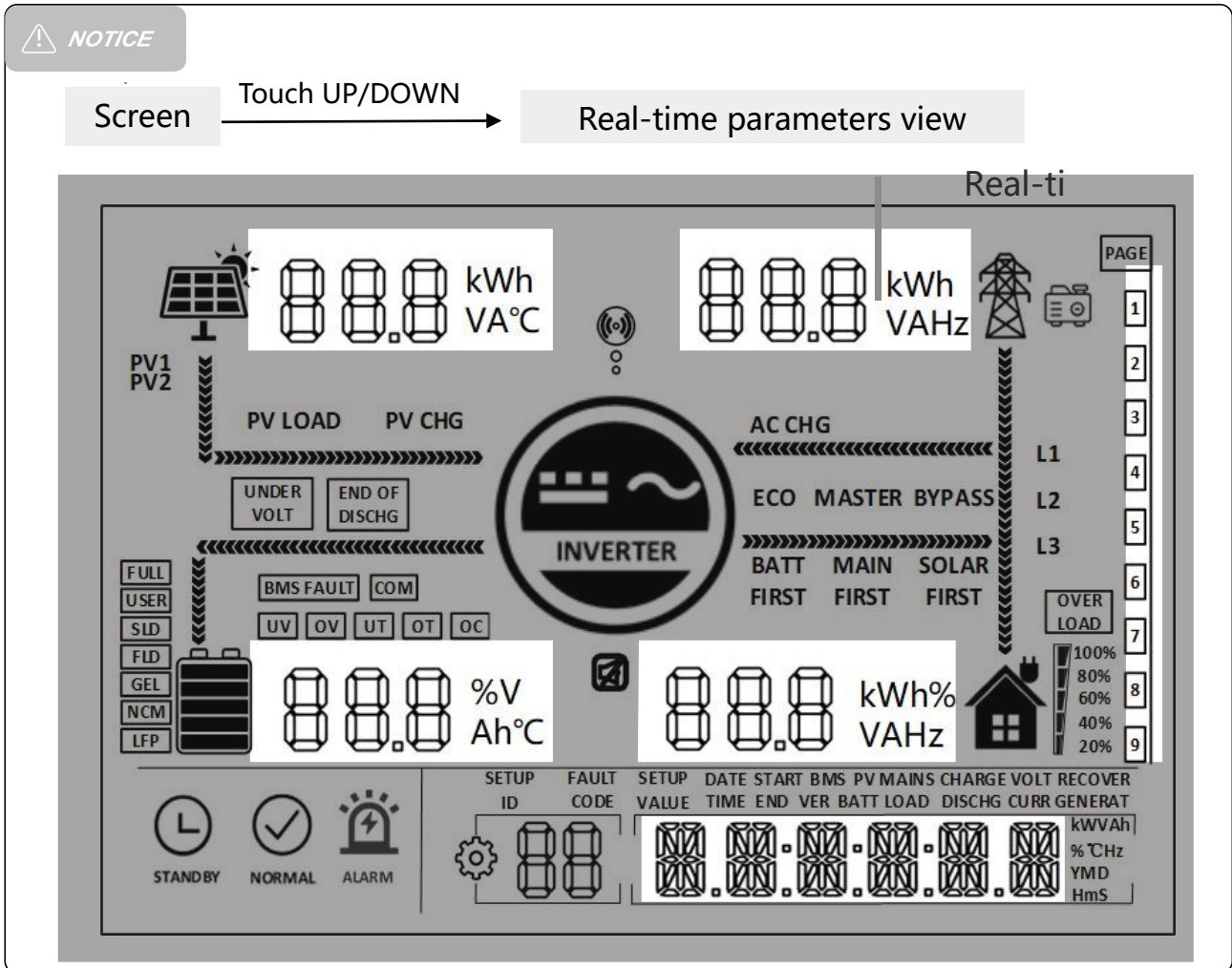


Icon	Description	Icon	Description
	PV panel		Mains
	Battery		Generator
	The inverter is working		Load
	The inverter is communicating with the data collector		The buzzer is in mute mode
	Power flow direction		
	The inverter is in standby mode		The inverter is working normally
	There is a fault		Settings
	Load power: 80%–100%		SOC: 80%–100%
	Load power: 60%–79%		SOC: 60%–79%
	Load power: 40%–59%		SOC: 40%–59%
	Load power: 20%–39%		SOC: 20%–39%
	Load power: 5%–19%		SOC: 5%–19%

Icon	Description	Icon	Description
UNDER VOLT	Battery under-voltage	END OF DISCHG	Battery over-discharge
OVER LOAD	Overload	BMS FAULT	BMS fault
COM	System communication error	UV	System under-voltage
OV	System overvoltage	UT	Too low system temperature
OT	Too high system temperature	OC	System overcurrent
FULL	Battery full power	USER	User-defined battery
SLD	Sealed lead-acid battery	FLD	Flooded lead-acid battery
GEL	Gel lead-acid battery	NCM	Ternary Li-ion battery
LFP	LFP Li-ion battery	ECO	Energy-saving mode
PVLOAD	PV power is loading	PVCHG	PV power is charging the battery
ACCHG	AC input power is charging the battery	MAINS FIRST	The output mode of the inverter is mains first
BYPASS	The output mode of the inverter is mains bypass	SOLAR FIRST	The output mode of the inverter is PV first
BATT FIRST	The output mode of the inverter is battery first		

● **Real-time parameters view**

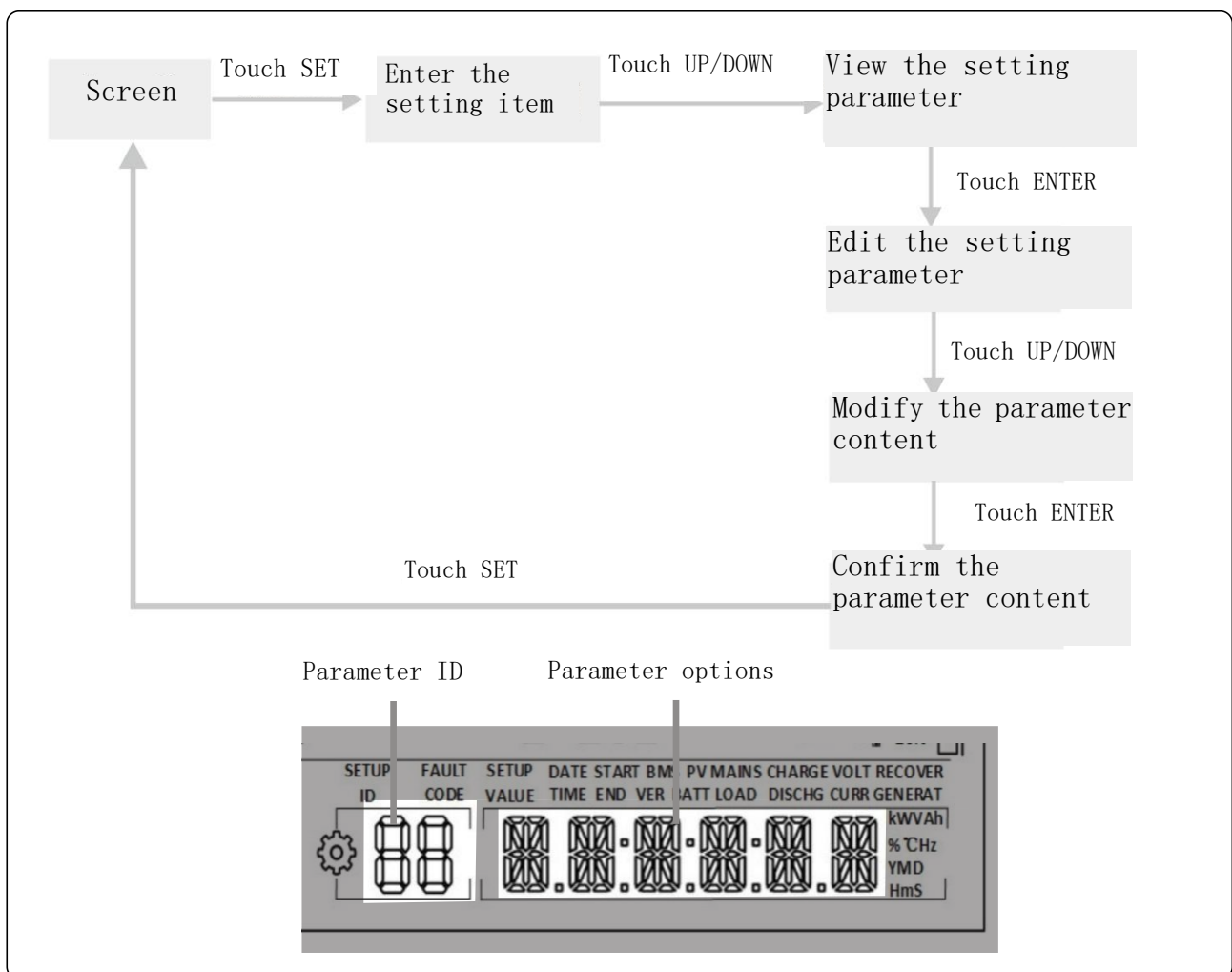
On the screen, press the UP/DOWN button to view real-time data of the inverter in operation.



Page	PV	Battery	AC input	Load	General
1	PV input voltage	Battery voltage	Mains input voltage	Single-phase voltage	Current time
2	PV input current	Battery current	Mains input current	Single-phase current	Current date
3	PV input power	Battery voltage	Mains total input power	Single-phase active power	PV gross generation
4	PV generation for the day	Battery SOC	Mains charging capacity for the day	Single-phase apparent power	Total load consumption
5	PV heat sink temperature	Heat sink temperature	Mains frequency	Inverter output frequency	RS485 address
6	Rated open circuit voltage	Rated battery voltage	Bus voltage	Rated output power	Software version
7	Maximum PV	Maximum	Maximum mains	Total output	/

	charge current	battery charge current	charge current	active power	
8			Maximum Generator charge current	Total output apparent frequency	/

5.2 Setting



ID	Parameter	Option	Description
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The voltage setting logic: 【15】 < 【12】 < 【04】 < 【14】 < 【35】 < 【37】 < 【05】 < 【09/11】 (When the battery communicate with inverter, the voltage setting is useless)			
00	Exit	ESC	Exit the setup menu
01	AC output mode	UTI	Photovoltaic energy priority with the load, photovoltaic is not enough, the mains power and photovoltaic mixed load, photovoltaic energy is enough with the load, the excess energy to charge the battery, the mains power only starts charging when the battery is too discharged (06 Settings as" OSO(only PV)) " , the mains power will not charge), the battery is only discharged when off the mains.
		SBU	Inverter first. The PV mode is to be applied first for loading, and only when the battery voltage is lower than the set value in the item 4, it will switch to the mains mode for loading. When the battery voltage is higher than the set value in the item 5, it will switch back to the PV mode from the mains mode.
		SOL	The PV mode is to be applied first and when the PV power is unavailable or the battery voltage is lower than the set value in the item 4, it will switch to the mains mode.
		SUB default	Solar energy priority charging, insufficient solar energy, mains energy and solar energy hybrid charging (if 06 Settings as" OSO(only PV) " ,the mains energy will not charge) and mains with load, when solar energy is enough to charge,excess energy not enough to load, excess solar energy and mains will hybrid load, the battery is discharged only when off the mains.
02	AC input frequency	50.0	In bypass mode, the AC output frequency will adapt to the mains frequency, and in other cases, the output will follow the preset value.
		60.0 default	
03	AC input voltage range	UPS default	When the output voltage is 120/110V, the input voltage range is 90V–140V.
		APL	When the output voltage is 100/105 V, the input voltage range is 85V–140V.
04	Battery to mains voltage threshold	43.6 default	When the parameter item 01 is SBU or SOL and the battery voltage is lower than the threshold, the output switches from inverter to mains. Setting range: 40V–52V.
05	Mains to battery voltage threshold	57.6 default	When the parameter item 01 is SBU or SOL and the battery voltage is higher than the threshold, the output switches from mains to inverter. Setting range: 48V–60V
06	Battery charge mode	SNU default	When both PV power and mains are used to charge the battery at one time, the PV charge first and when the PV power is insufficient, the mains tags in. Only in bypass mode can both PV power and mains be used to charge the battery at one time, and only the PV charge mode can be enabled during inverter operation.
		OSO	Do not enable the mains charge mode when in only PV

			charge mode.
07	Battery charge current	100	Setting range: 0A–200A
08	Battery type	USER	User-defined, and in this type, you can set all battery parameters.
		SLD	Sealed lead-acid battery.
		FLD	Flooded lead-acid battery.
		GEL default	Gel lead-acid battery.
		L14/L15/L16	LFP battery L14/L15/L16, corresponding to 14, 15, and 16 series of LFP batteries.
		N13/N14	Ternary Li-ion battery N13/N14, corresponding to 13 and 14 series of ternary Li-ion batteries.
		NO b	No battery.
09	Battery boost charge voltage	57.6	Setting range: 48V–58.4V, with a step of 0.4V, available for user-defined and lithium-ion battery types.
10	Boost charge duration	120	The continuous charging time when the voltage reaches the set voltage during constant voltage charging, with a setting range of 5 min–900 min and a step of 5 min
11	Battery floating charge voltage	55.2	Setting range: 48V–58.4V, with a step of 0.4V. This parameter cannot be set after successful BMS communication.
12	Battery over-discharge voltage (delayed shutdown)	42	When the battery voltage is lower than the voltage and triggers the set value in the item 13, it will turn off the inverter output. Setting range: 40V–48V, with a step of 0.4V
13	Battery over-discharge delay time	5	When the battery voltage is lower than the set value in the item 12 and triggers the delay time set in this parameter item, it will turn off the inverter output. Setting range: 5s–50s, with a step of 5s
14	Battery under-voltage alarm threshold	44	When the battery voltage is lower than the threshold, it will give an under-voltage alarm and the output will not shut down. Setting range: 40V–52V, with a step of 0.4V
15	Battery discharge limit voltage	40	When the battery voltage is lower than the value, the output immediately shuts down. Setting range: 40V–52V, with a step of 0.4V, available for user-defined and Li-ion batteries
16	Battery equalizing charge	DIS	Disable equalizing charge.
		ENA default	Enable equalizing charge, but only available for flooded lead-acid batteries, sealed lead-acid batteries, and user-defined ones.
17	Equalizing charge voltage	58	Setting range: 48 V–58 V, with a step of 0.4 V, but only available for flooded lead-acid batteries, sealed lead-acid batteries, and user-defined ones.
18	Equalizing charge duration	120	Setting range: 5 min–900 min, with a step of 5 min, but only available for flooded lead-acid batteries, sealed lead-acid batteries, and user-defined ones.

19	Equalizing charge delay time	120	Setting range: 5 min–900 min, with a step of 5 min, but only available for flooded lead-acid batteries, sealed lead-acid batteries, and user-defined ones.
20	Equalizing charge interval	30	Setting range: 0 day–30 days, with a step of 1 day, but only available for flooded lead-acid batteries, sealed lead-acid batteries, and user-defined ones.
21	Equalizing charge Enable/Disable	DIS default	Stop equalizing charge immediately.
		ENA	Start equalizing charge immediately.
22	Energy-saving mode	DIS default	Disable energy-saving mode.
		ENA	Enable energy-saving mode, and when the load power is below 25 W, it will turn off the inverter output after a 5-minute delay. When it exceeds 40 W, the inverter will automatically restart.
23	Overload auto restart	DIS	Disable overload auto restart and when overload occurs, it will turn off the output and the inverter will no longer resume startup.
		ENA default	Enable overload auto restart, and If overload occurs, the output will be turned off, and after a delay of 3 min, the output will restart. After 5 cumulative attempts, the inverter will no longer resume startup.
25	Buzzer alarm	DIS	Disable buzzer alarm.
		ENA default	Enable buzzer alarm.
26	Mode switch prompt	DIS	Disable prompt when the status of the main input source changes.
		ENA default	Enable prompt when the status of the main input source changes.
27	Inverter to bypass switch	DIS	Disable auto switch to mains for loading in case of inverter overload.
		ENA default	Enable auto switch to mains for loading in case of inverter overload.
28	mains charge current	60 default	Setting range: 0A–120A
30	RS485 communication address	ID: 1	Setting range: 1–253
31	Parallel mode (When the rocker switch is off can be set)	SIG default	Single inverter operation
		PAL	Parallel operation
		2P0/2P1/ 2P2	Two-phase parallel operation
		Set to "2P0" for the machine screens connected to P1 Assuming that the output voltage of the setting item [38] is set to 120 VAC 1) When all the inverters connected to P2 are set to "2P1" on the screen, the voltage phase difference between P1 and P2 is 120°, the	

		<p>voltage between the live wire L1 of phase-P1 and the live wire L2 of phase-P2 is $120 \times 1.732 = 208$ VAC, and the voltage of L1-N and L2-N is 120 VAC.</p> <p>2) When all the inverters connected to P2 are set to "2P2" on the screen, the voltage phase difference between P1 and P2 is 180°, the voltage between the live wire L1 of phase-P1 and the live wire L2 of phase-P2 is $120 \times 2 = 240$ VAC, and the voltage of L1-N and L2-N is 120 VAC.</p>	
		3P1/3P2/ 3P3	Three-phase parallel operation
		<p>Set to "3P1" on the screen for all the inverters connected to P1; set to "3P2" on the screen for all the inverters connected to P2; and set to "3P3" on the screen for those connected to P3. 1) Assuming that the output voltage of the setting item [38] is set to 120 VAC: then the voltage phase difference of P1-P2, P1-P3, and P2-P3 is 120°, the voltage between the live wire L1 of phase-P1 and the live wire L2 of phase-P2 is $120 \times 1.732 = 208$ VAC, and similarly the voltage of L1-L3 and L2-L3 is 208 VAC; the voltage of L1-N, L2-N, and L3-N is 208 VAC.</p>	
32	RS485 communication	DIS default	Disable BMS Faulty battery stops working.
		485	RS485 BMS communication function.
		CAN	CAN BMS communication function.
33	BMS communication	Select the corresponding communication protocol in item 33 when you set it to 485 or CAN in item 3.	
		SGP=SUNGOLDPOWER ,PAC=PACE ,RDA=Ritar ,AOG=ALLGRANDBATTERY OLT=OLITER ,XWD=SUNWODA, DAQ=DAKING, WOW=SNPOWER, PYL=PYLONTECH, DYE=DEYE,LUX=LUXPOWER	
35	Battery under-voltage recovery threshold	52	When the battery is under voltage, the battery voltage needs to be greater than the threshold to restore the AC output of the battery inverter. Setting range: 44 V–54.4 V
37	Recharge voltage threshold for fully charged battery	52	After the battery is fully charged, the inverter stops charging, and recovers charging when the battery voltage is lower than the threshold. Setting range: 44 V–54 V.
38	AC output voltage (When the rocker switch is off can be set)	120	Setting range: 100/105/110/115/120/127 VAC.
39	Charge current limit (when BMS works)	LCSET	The maximum battery charge current is not greater than the set value of [item 07].
		LCBMS default	The maximum battery charge current is not greater than the maximum value of BMS.
		LCINV	The maximum battery charge current is not greater than the logical judgment value of inverter.
40	Period-1 battery charge start time	00:00:00	Setting range: 00:00:00–23:59:00
41	Period-1 battery	00:00:00	Setting range: 00:00:00–23:59:00

	charge end time		
42	Period-2 battery charge start time	00:00:00	Setting range: 00:00:00–23:59:00
43	Period-2 battery charge end time	00:00:00	Setting range: 00:00:00–23:59:00
44	Period-3 battery charge start time	00:00:00	Setting range: 00:00:00–23:59:00
45	Period-3 battery charge end time	00:00:00	Setting range: 00:00:00–23:59:00
46	Timed battery charge function	DIS default	Disable the function
		ENA	The mains is available for power supply in the set period or after battery over-discharge. If the timed discharge function is enabled at the same time, the mains is only available for power supply in the set charge period, and the system only switches to the power supply of battery inverter during the set discharge period or mains failure.
47	Period-1 battery discharge start time	00:00:00	Setting range: 00:00:00–23:59:00
48	Period-1 battery discharge end time	00:00:00	Setting range: 00:00:00–23:59:00
49	Period-2 battery discharge start time	00:00:00	Setting range: 00:00:00–23:59:00
50	Period-2 battery discharge end time	00:00:00	Setting range: 00:00:00–23:59:00
51	Period-3 battery discharge start time	00:00:00	Setting range: 00:00:00–23:59:00
52	Period-3 battery discharge end time	00:00:00	Setting range: 00:00:00–23:59:00
53	Timed battery discharge function	DIS default	Disable the function.
		ENA	The system only switches to the power supply of battery inverter during the set discharge period or mains failure.
54	Current date	00:00:00	Year/Month/Day Setting range: 00:01:01–99:12:31
55	Current time	00:00:00	Setting range: 00:00:00–23:59:59
57	Charge stop current	3	The charge stops when the charge current is less than the set value (unit: A).
58	SOC setting for discharge alarming	15	When the capacity is less than the set value, the SOC alarms (unit: %, only available during normal BMS communication).
59	SOC setting for discharge cutoff	5	When the capacity is less than the set value, the discharge stops (unit: %, only available during normal BMS communication).
60	SOC setting for charge cutoff	100	When the capacity is greater than the set value, the charge stops (unit: %, only valid during normal BMS communication)

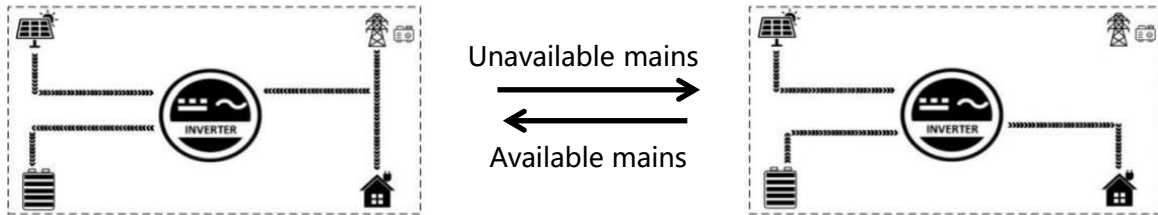
61	SOC setting for switching to mains	10	When the capacity is less than the set value, it switches to mains (unit: %, only available during normal BMS communication).
62	SOC setting for switching to inverter output	100	When the capacity is higher than the set value, it switches to the inverter output mode (unit: %, only available during normal BMS communication).
63	Auto N-PE connection switch function	DIS default	Disable auto N-PE connection switch.
		ENA	Enable auto N-PE connection switch.
68	AC output phase mode (When the rocker switch is off can be set	0	0 represents the single-phase mode. Assuming that the AC output voltage of item 38 is 120 V, the phase difference of L1-L2 is 0°, and L1/L2 can be connected in parallel, the phase voltage of L1-N/L2-N is 120 V
		180 default	180 represents the split-phase mode. Assuming that the AC output voltage of item 38 is 120 V, the phase difference of L1-L2 is 180°, the phase voltage of L1-N/L2-N is 120 V, and the voltage of L1-L2 is 240 V
		NO N	Without N-wire (When you set" No N" ,the phase difference is 180° default).
73	Generator charging current setting	60A default	setting range:0~120A.
74	Generator input power	12KW	setting range: 0-12kW.
77	Anti-reflux Error calibration power	100W	Setting range 0-500W.
78	Battery hybrid discharge current	200A default	When the battery and mains hybrid load, set the battery discharging current. Setting range 0-240A.
79	AFCI Enable	DIS default	Disable AFCI function.
		1-10	Enable AFCI function. Detection Threshold: 1-10.
80	AFCI fault manual clearing	NULL default	Do not clear.
		CLEAR	Manually clear the AFCI fault.
81	Generator interface selection	GEN IN default	Generator input.
		AC OUT	Secondary load output.

5.3 AC output mode

The AC output mode corresponds to parameter setting items of 01, allowing users' manual setting.

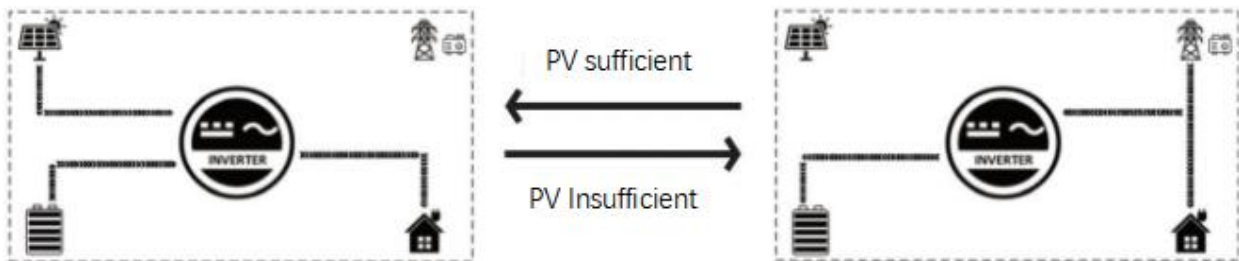
- **Mains first 01 UTI**

The mains first supplies power. When PV is available, mains and PV can supply power to the load at the same time. The battery only powers the load during unavailable mains (**priority: Mains > PV > Battery**)



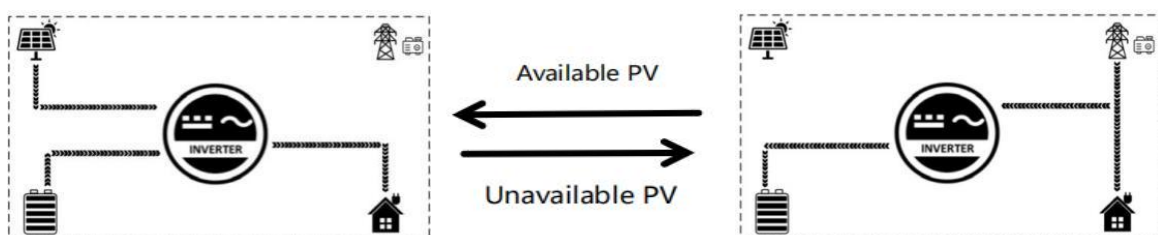
- **PV and Utility hybrid loading 01 SUB (default)**

PV energy first used for charging, the remaining energy supply load, when PV energy is insufficient, it is supplemented by the grid, the grid energy is first supplied to the load and second used for charging (if 06 Settings as "OSO(only PV)", the grid energy will not be used for charging). The battery only discharges when off the grid. (**Priority: PV > Mains > Battery**)



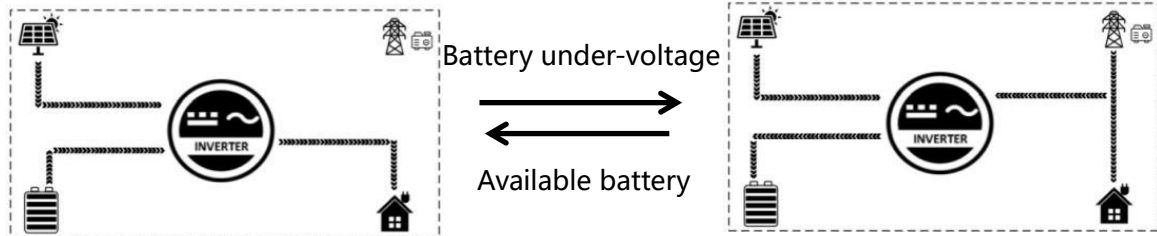
- **PV-first output 01 SOL**

PV first supplies power to the load. If PV power is insufficient, mains is used as a supplement to power the load. The mode uses PV power to the maximum extent while maintaining the battery power, suitable for areas with relatively stable power mains. (**Priority: PV > Mains > Battery**)



● **Inverter output mode 01 SBU**

Prioritises the use of PV to power the load and switches back to the grid to power the load only when the battery voltage is lower than the set value in parameter item [4] (when connected to the BMS, according to item [61]). When the battery voltage is higher than the value set in parameter [5] (when connected to the BMS, according to item [62]), it switches back to the PV from the grid to supply the load. **(Priority: PV > Battery > Mains)**

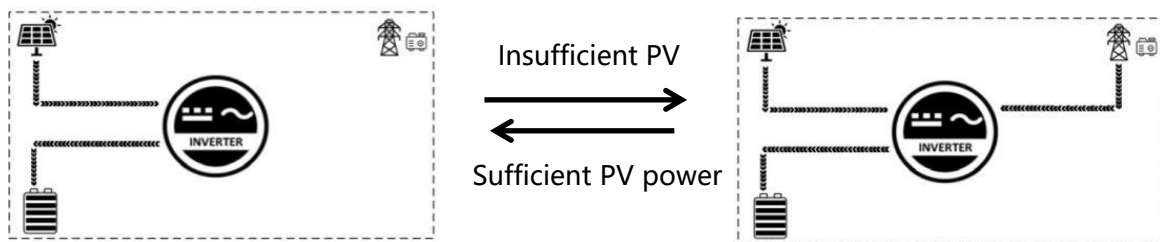


5.4 Battery charge mode

The charge mode corresponds to the parameter setting item 06, allowing users' manual setting.

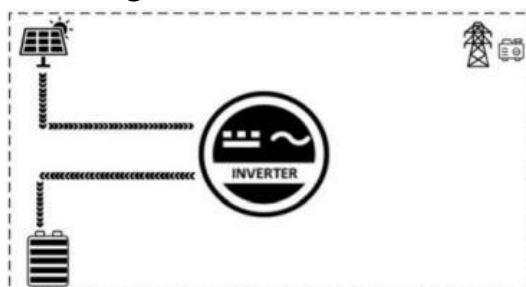
● **Mix charge SNU (default)**

Both PV and mains charge the battery, with PV used first, and mains as a supplement during insufficient PV power. This is the fastest charge method, suitable to provide users with sufficient backup power in areas where the power supply is insufficient. **(Priority: PV > Mains)**



● **Only-PV charge OSO**

Only PV power is used to charge the battery, with mains not used for charge. This is the most energy-saving method, by which the battery power comes from solar energy, usually used in areas with good radiation conditions.



5.5 Secondary load work mode

The "Generator Operating Mode" parameter is used to configure the function of the generator port, with the default setting being "Generator Input". It can also be set to "Secondary Load Output". When this function is set, ensure that a load is connected to the generator port, and refer to the wiring diagram for the connection method.

- (1) When selecting the generator port as the input port, the [81] setting item needs to be configured to the corresponding (GEN IN).
 - (2) When selecting the generator port as the output port for secondary load power supply, the [81] setting item needs to be configured to the corresponding (AC OUT).
- Enabling Conditions and Settings of Secondary load:"item 81 is set to AC OUT"

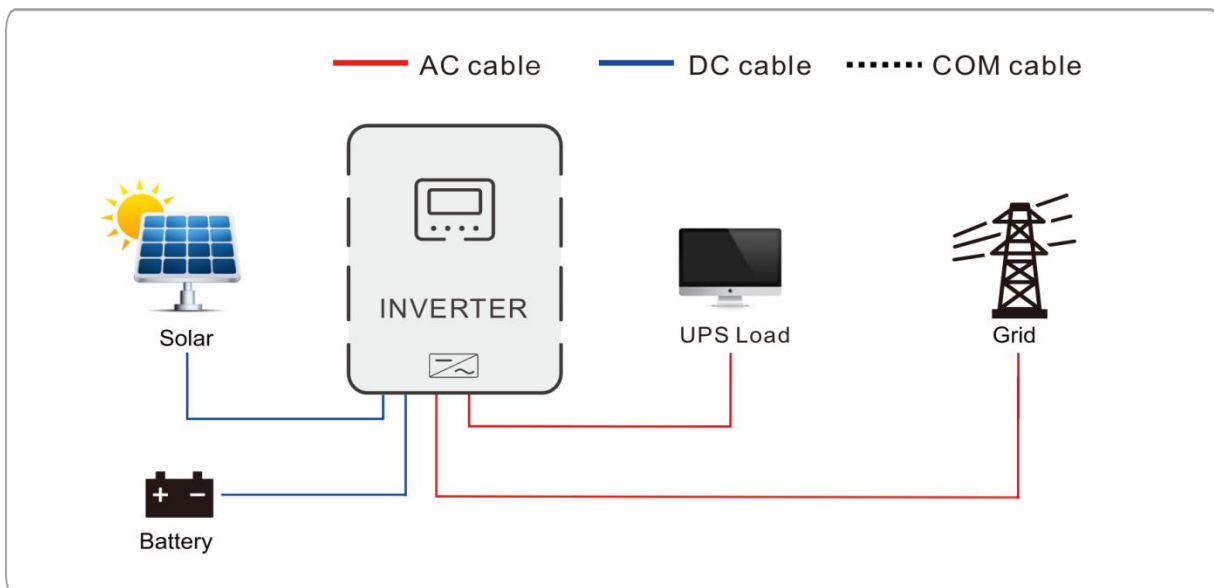
When parameter item 81 is set to AC OUT, the secondary load is enabled, and the inverter can carry both the primary load and the secondary load simultaneously.

How this Secondary load works:

- (1) In inverter mode, when the load is overloaded and the set delay time is reached, the secondary load will be disconnected while the primary load is retained. After the user reduces the load, the secondary load will be automatically restored after a 3-minute delay.
- (2) In mains mode, if the load is overloaded and the set delay time is reached, the secondary load will similarly be disconnected with the primary load retained. Once the user reduces the load, the secondary load will be automatically restored after a 3-minute delay.
- (3) In off-grid mode (Non-BMS), when the battery voltage drops below the set value of parameter 04, the secondary load will be disconnected while keeping the primary load. The secondary load will be restored when the battery is fully charged or the battery voltage reaches the set value of parameter 05.
- (4) In off-grid mode (BMS), if the battery SOC is lower than the set value of parameter 61, the secondary load will be disconnected with the primary load retained. The secondary load will be restored when the battery is fully charged, or when the battery SOC reaches the set value of parameter 60 or 62.

Operating Mode	Trigger Condition	Load Operation	Recovery Condition
Inverter Mode	The load is overloaded and the set delay time is reached	Disconnect the secondary load and retain the primary load	After the user reduces the load, the secondary load is automatically restored after a 3-minute delay.
Mains Mode	The load is overloaded and the set delay time is reached	Disconnect the secondary load and retain the primary load	After the user reduces the load, the secondary load is automatically restored after a 3-minute delay.
Off - Grid Mode (Non - BMS)	The battery voltage is lower than the set value of parameter 04	Disconnect the secondary load and retain the primary load	The battery is fully charged; or the battery voltage reaches the set value of parameter 05.
Off - Grid Mode (BMS)	The State of Charge (SOC) of the battery is lower than the set value of parameter 61	Disconnect the secondary load and retain the primary load	The battery is fully charged; or the battery SOC reaches the set value of parameter 60 or 62.

With generator or smart load

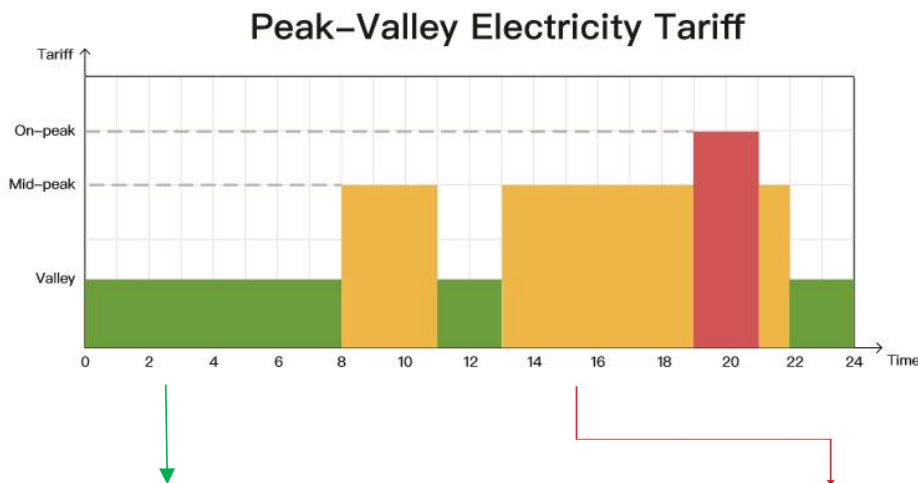


5.6 Timed charge/discharge function

With time-sharing charging and discharging functions. Users can set different charge and discharge periods according to the local time-of-use price, thus reasonably using mains and PV power. When mains is expensive, the battery inverter is used to supply power to the load; when mains is cheap, it can be used to supply power to and charge the load, thus helping users reduce electricity expenses to the full extent. Users can turn on/off the timed charge/discharge function in items 46 and 53 in the setup menu, and set charge and discharge periods in parameters 40–45 and 47–52.

The following is an example to help users understand the function.

Before using the function for the first time, please set the local time and date in parameters 54 and 55, and then you can set corresponding periods based on the local time-of-use price.



Timed charge and loading function



With 3 definable periods, users can freely set the mains charge/loading period in the range of 00:00–23:59. During the period set by the user, in case of PV energy output, it will be used first; in case of no PV energy output or lack of PV energy, mains will be used as a supplement.

Timed battery discharge function



With 3 definable periods, users can freely set the battery discharge period in the range of 00:00–23:59. During the period set by the user, the inverter will first use the battery inverter to load; if the battery power is insufficient, the inverter will automatically switch to mains to ensure stable operation of the load.

5.7 Battery parameters

● Lead-acid battery

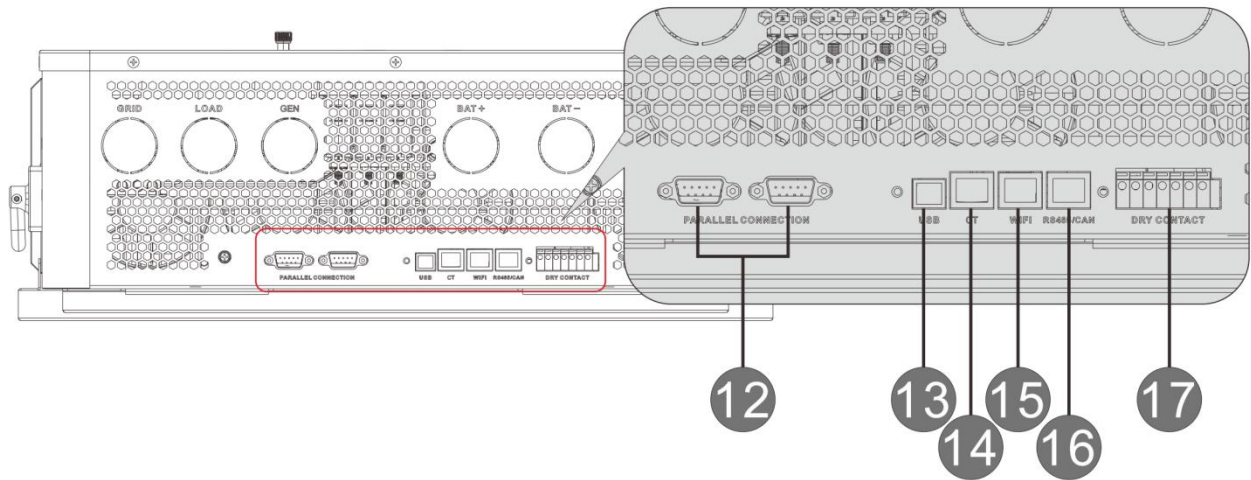
Parameter/Battery Type	Sealed Lead-acid Battery	Gel lead-acid battery	Flooded Lead-acid Battery	User-defined Battery
	SLD	GEL	FLD	USE
Overvoltage disconnect voltage	60 V	60 V	60 V	60 V
Equalizing charge voltage	58 V	56.8 V	58 V	40 V-60 V (settable)
Boost charge voltage	57.6 V	56.8 V	57.6 V	40 V-60 V (settable)
Floating charge voltage	55.2 V	55.2 V	55.2 V	40 V-60 V (settable)
Under-voltage alarm voltage	44 V	44 V	44 V	40 V-60 V (settable)
Under-voltage disconnect voltage	42 V	42 V	42 V	40 V-60 V (settable)
Discharge limit voltage	40 V	40 V	40 V	40 V-60 V (settable)
Over-discharge delay time	5s	5s	5s	1s-30s (settable)
Equalizing charge duration	120 min	-	120 min	0 min-900 min (settable)
Equalizing charge cycle	30 d	-	30 d	0 d-250 d (settable)
Boost charge cycle	120 min	120 min	120 min	10 min-900 min (settable)

● Li-ion battery

Parameter/Battery Type	Ternary Li-ion Battery		LFP Battery			User-defined Battery
	N13	N14	L16	L15	L14	USE
Overvoltage disconnect voltage	60 V	60 V	60 V	60 V	60 V	60 V
Equalizing charge voltage	-	-	-	-	-	40 V-60 V (settable)
Boost charge voltage	53.2 V	57.6 V	56.8 V	53.2 V	49.2 V	40 V-60 V (settable)
Floating charge voltage	53.2 V	57.6 V	56.8 V	53.2 V	49.2 V	40 V-60 V (settable)
Under-voltage alarm voltage	43.6 V	46.8 V	49.6 V	46.4 V	43.2 V	40 V-60 V (settable)
Under-voltage disconnect voltage	38.8 V	42 V	48.8 V	45.6 V	42 V	40 V-60 V (settable)
Discharge limit voltage	36.4 V	39.2 V	46.4 V	43.6 V	40.8 V	40 V-60 V (settable)
Over-discharge delay time	30s	30s	30s	30s	30s	1s-30s (settable)
Equalizing charge duration	-	-	-	-	-	0 min-900 min (settable)
Equalizing charge cycle	-	-	-	-	-	0 d-250 d (settable)
Boost charge cycle	120 min (settable)	120 min (settable)	120 min (settable)	120 min (settable)	120 min (settable)	10 min-900 min (settable)

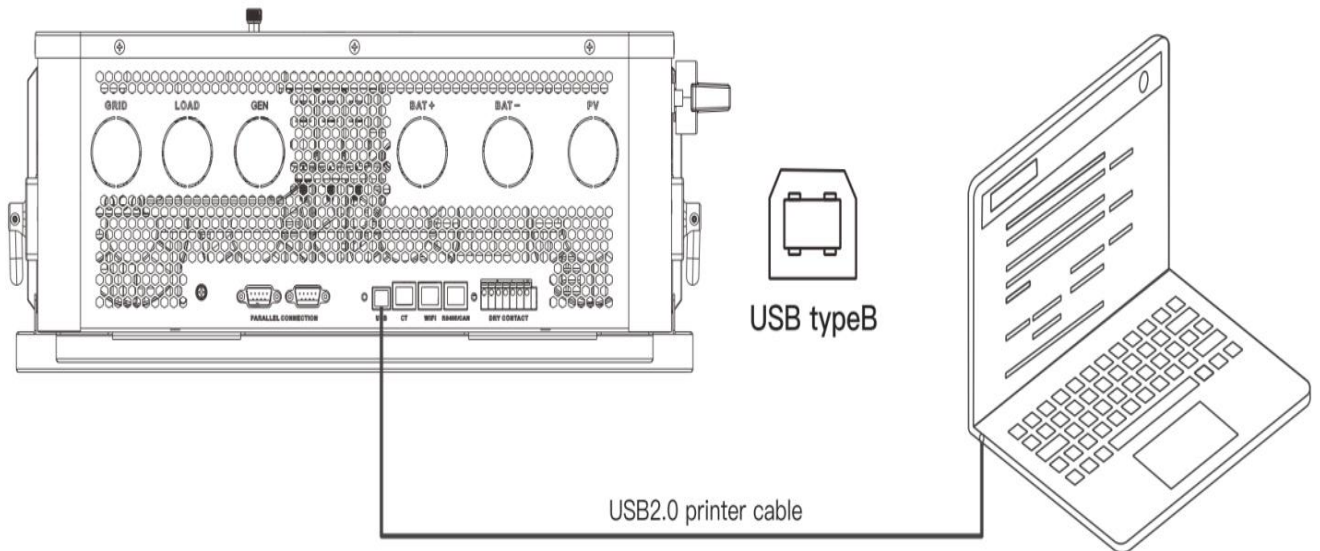
6. Communication

6.1 Overview



12	Parallel port	13	USB port	14	CT port (reserve)
15	WIFI port	16	RS485/CAN port	17	Dry contact

6.2 USB-B port

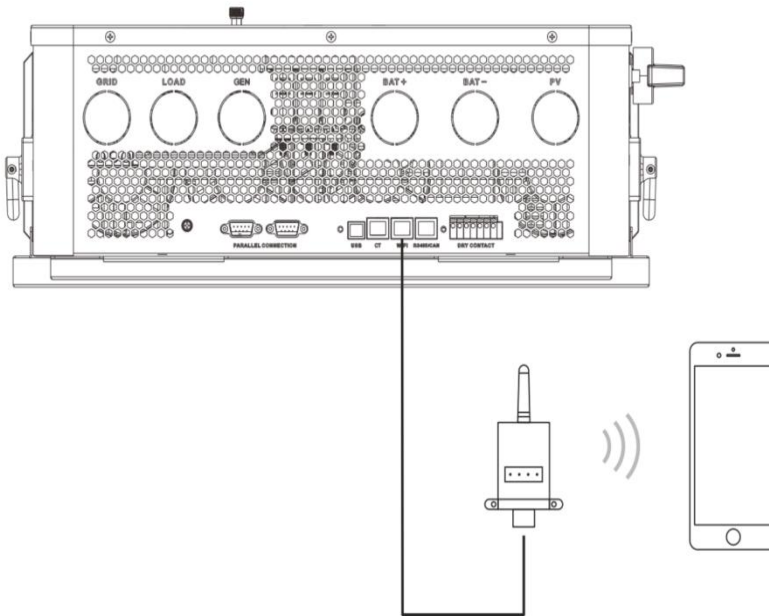


Users can use the upper computer software through the port to read and modify device parameters. If needing the installation package for the upper computer software, you can contact us to get it.

"NOTE: Use ONLY USB-B OR WIFI port (not both)."

6.3 WIFI port

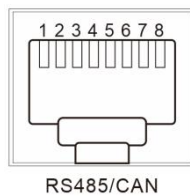
The WIFI port is used to connect to the Wi-Fi/GPRS data acquisition module, and then users can view the operation status and parameters of the inverter via the mobile APP.



RJ45	Definition
Pin 1	5 V
Pin 2	GND
Pin 3	/
Pin 4	/
Pin 5	/
Pin 6	/
Pin 7	RS485-A
Pin 8	RS485-B

6.4 RS485/CAN port

The RS485/CAN port is used to connect to the BMS of the Li-ion battery.



RJ45	Definition
Pin 1	RS485-B
Pin 2	RS485-A
Pin 3	/
Pin 4	CANH
Pin 5	CANL
Pin 6	/
Pin 7	RS485-A
Pin 8	RS485-B

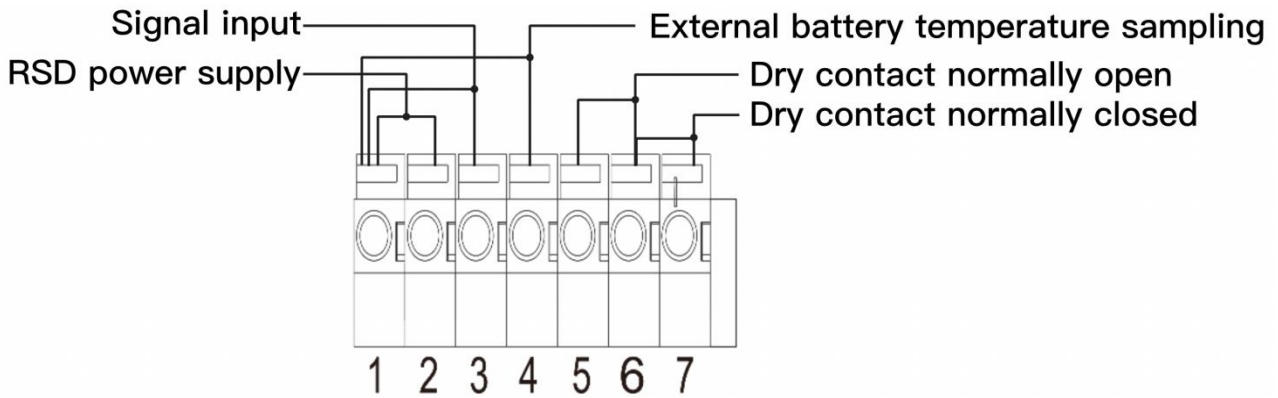
NOTICE

- If you need the communication between the inverter and the BMS of the Li-ion battery, please contact us to understand the communication protocol, or upgrade the inverter to the corresponding software program.

6.5 Dry contact port

The dry contact port has 5 functions:

1. RSD power supply
2. Signal input
3. External battery temperature sampling
4. Dry contacts normally open/closed

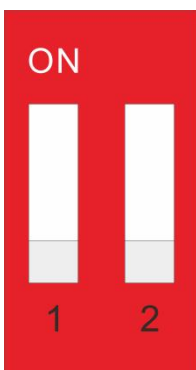


Function	Description
RSD power supply	Pin 1 is GND, Pin 2 is 12V. When the machine is operating normally, the voltage difference between the two pins is 0V. When rapid shutdown is required, 12V is output here.
Signal input	Digital signal input, maximum 12V.
External battery temperature sampling	Pin 1 and Pin 4 can be used for battery temperature sampling compensation.
Dry contact	Pin 5 is the common pin, Pin 5 and Pin 6 is normally open, Pin 5 and Pin 7 is normally closed, signal cannot be connected to Pin 6 and Pin 7

NOTICE

- If you need to use the remote start/stop function of the generator with dry contact, please ensure that the generator has an ATS and supports remote start/stop.

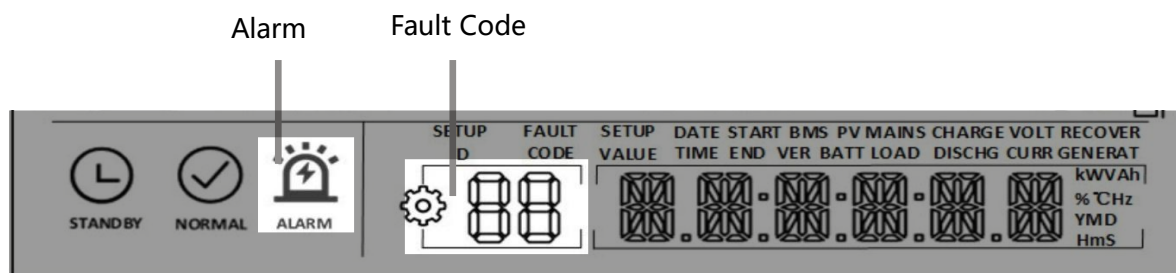
6.6 DIP switch



When connecting multiple inverters or using batteries with CAN communication, this switch needs to be adjusted appropriately. Setting it to the ON position enables the function.

7. Fault Codes and Response Measures

7.1 Fault codes



Fault Code	Meaning	Affect Output or Not	Description
01	BatVoltLow	Yes	Battery under-voltage alarm
02	BatOverCurrSw	Yes	Overcurrent software protection for average battery discharge current
03	BatOpen	Yes	Disconnected battery alarm
04	BatLowEod	Yes	Under-voltage battery discharge stop alarm
05	BatOverCurrHw	Yes	Battery overcurrent hardware protection
06	BatOverVolt	Yes	Charge overvoltage protection
07	BusOverVoltHw	Yes	Bus overvoltage hardware protection
08	BusOverVoltSw	Yes	Bus overvoltage software protection
09	PvVoltHigh	Yes	PV overvoltage protection
10	PvAFCIErr	No	PV arc fault.
11	PvBoostOCHw	No	Boost overcurrent hardware protection
12	SpiCommErr	Yes	SPI communication fault of master and slave chips
13	OverloadBypass	Yes	Bypass overload protection
14	OverloadInverter	Yes	Inverter overload protection
15	AcOverCurrHw	Yes	Inverter overcurrent hardware protection
16	AuxDspReqOffPWM	Yes	Slave chip OFF request fault
17	InvShort	Yes	Inverter short-circuit protection
18	Bussoftfailed	Yes	Bus soft-start failure
19	OverTemperMppt	No	PV heat sink over-temperature protection
20	OverTemperInv	Yes	Inverter heat sink over-temperature protection
21	FanFail	Yes	Fan fault
22	EEPROM	Yes	Memory fault
23	ModelNumErr	Yes	Model setting error
24	Busdiff	Yes	Positive and negative bus voltage imbalance
25	BusShort	Yes	Bus short-circuit

26	Rlyshort	Yes	Inverter AC output backward to bypass AC output
28	LinePhaseErr	Yes	Mains input phase error
29	BusVoltLow	Yes	Bus low-voltage protection
30	BatCapacityLow1	Yes	Alarm of battery capacity rate below 10% (taking effect after BMS communication is successful)
31	BatCapacityLow2	No	Alarm of battery capacity rate below 5% (taking effect after BMS communication is successful)
32	BatCapacityLowStop	Yes	Battery low-capacity OFF (taking effect after BMS communication is successful)
34	CanCommFault	Yes	Parallel can communication fault
35	ParaAddrErr	Yes	Parallel ID (communication address) setting error
36	Balance currentOC	Yes	Balance bridge arm overcurrent failure
37	ParaShareCurrErr	Yes	Parallel current sharing fault
38	ParaBattVoltDiff	Yes	Large battery voltage difference in parallel mode
39	ParaAcSrcDiff	Yes	Inconsistent mains 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 connection fault
44	Serialnumbererror	Yes	Failure to set the serial number before leaving factory
45	Errorsettingofsplit-phase mode	Yes	Setting error of setting items in parallel mode
48	AFCIComErr	Yes	AFCI communication error.
56	Lowinsulation resistancefault	No	Abnormally low earth impedance of PV1+, PV2+, and PV-
57	Leakagecurrent overloadfault	Yes	System current leakage out of the standard
58	BMSComErr	No	BMS communication fault
60	BMSUnderTem	No	BMS under-temperature alarm (taking effect after BMS communication is successful)
61	BMSOverTem	No	BMS over-temperature alarm (taking effect after BMS communication is successful)
62	BMSOverCur	No	BMS overcurrent alarm (taking effect after BMS communication is successful)
63	BMSUnderVolt	No	BMS under-voltage alarm (taking effect after BMS communication is successful)
64	BMSOverVolt	No	BMS overvoltage alarm (taking effect after BMS communication is successful)

7.2 Troubleshooting

Fault Code	Meaning	Cause	Solution
/	No screen display	There is no power input, or the device switch at its bottom is not turned on	Check if the battery air-switch or PV air-switch has been closed; check if the switch is in "ON"; press any button on the screen to exit the screen sleep mode.
01	Battery under-voltage	The battery voltage is lower than the value set in parameter [14]	Charge the battery until the battery voltage exceeds the value set in parameter [14].
03	Disconnected battery	The battery is not connected, or the BMS of the lithium-ion battery is in the discharge protection state	Check if the battery is reliably connected; check if the circuit breaker of the battery is off; ensure that the BMS of the lithium-ion battery can communicate normally.
04	Battery over-discharge	The battery voltage is lower than the value set in parameter 12	Manual reset: Turn off the power, and restart. Automatic reset: Charge the battery until the battery voltage is higher than the value set in parameter [35].
06	Rechargeable battery overvoltage protection	The battery is in the overvoltage state	Manually turn off the power, and restart. Check if the battery voltage exceeds the limit. If the limit is exceeded, discharge the battery until the voltage is below the overvoltage recovery threshold of the battery.
13	Bypass overload (software detection)	The output power or current of the bypass is overloaded within a certain period	Reduce the load power, and restart the device. For more details, please refer to item 11 in Protection Function.
14	Inverter overload (software detection)	The output power or current of the inverter is overloaded within a certain period	
19	Over-high temperature of the heat sink for PV input (software detection)	The temperature of the heat sink for PV input exceeds 90°C for 3s	Wait until the temperature of the heat sink is below the over-temperature recovery temperature, when charge and discharge return to normal.
20	Over-high temperature of the heat sink for inverter output (software detection)	The temperature of the heat sink for inverter output exceeds 90°C for 3s	

21	Fan fault	Software detection finds the fan has a fault	Shut down, manually flick the fan, and check if any foreign objects are blocking it.
26	AC input relay short-circuit	Stuck relay for AC output	Manually shut down, and restart. If the fault occurs again after restarting, contact the after-sales service personnel to repair the machine.
28	Mains input phase fault	The phase of AC input is inconsistent with that of AC output	Ensure that the phase of AC input is the same as that of AC output. For example, if the output is in the split-phase mode, the input shall also be in the split-phase mode.

 **NOTICE**

If you encounter product faults that cannot be solved by the methods listed in the above table, please contact our after-sales service department for technical support, and do not disassemble the device by yourself.

8. Protection Function and Maintenance

8.1 Protection function

No.	Protection Function	Description
1	PV current-limiting protection	When the charge current or power of the configured PV array exceeds the rated current and power of the inverter, it will charge at the rated current and power.
2	PV overvoltage protection	If the PV voltage exceeds the maximum allowable value of hardware, the machine will report the fault, and stop the step-up of PV to output sine AC waves.
3	Reverse charge protection at night	At night, as the battery voltage is greater than that of the PV module, it will prevent the battery from discharging to the PV module.
4	mains input overvoltage protection	When the mains voltage of each phase exceeds 140 VAC, it will stop mains from charging, and switch it to inverter output.
5	Mains input under-voltage protection	When the mains voltage of each phase is lower than 90 VAC, it will stop mains from charge, and switch it to inverter output.
6	Battery overvoltage protection	When the battery voltage reaches the overvoltage disconnect voltage threshold, it will automatically stop PV and mains from charging the battery, thus preventing damage to the battery due to overcharge.
7	Battery under-voltage protection	When the battery voltage reaches the low-voltage disconnect voltage threshold, it will automatically stop discharging the battery, thus preventing damage to the battery due to overdischarge.
8	Battery overcurrent protection	When the battery current exceeds the allowable range of hardware, the machine will turn off the output, and stop discharging the battery.
9	AC output short-circuit protection	When a short-circuit fault occurs at the load output terminal, it will immediately turn off the output of AC voltage. Only after manually powering on the device, normal output restores.
10	Heat sink over-temperature protection	When the internal temperature of the inverter is too high, the inverter will stop charging and discharging; when the temperature returns to normal, the inverter will charge and discharge again.
11	Overload protection	After overload protection is triggered, the inverter output will be restored after 3 min, and after 5 times of overload, the output will be off until the frequency changer is restarted. (102% < load < 110%): An error will be reported, and the output will be turned off after 5 min. (110% < load < 125%): An error will be reported, and the output will be turned off after 10s.

		Load > 125%: An error will be reported, and the output will be turned off after 5s.
12	AC backward protection	Prevent the mains of battery inverter backward to bypass AC input.
13	Bypass overcurrent protection	Built-in circuit breaker for AC input overcurrent protection.
14	Bypass wiring error protection	When the phase of the two bypass inputs is different from that of the inverter split-phase, the machine will prohibit connecting to the bypass, thus preventing the power failure or short circuit of load when connecting to the bypass.

8.2 Maintenance

To maintain optimal long-term performance, it is recommended to perform the following inspections twice a year for inverter systems:

1. Ensure that the airflow around the inverter is not blocked and remove any dirt or debris from the radiator.
2. Check that all exposed conductors are not damaged by sunlight, friction with other surrounding objects, dry rot, insect or rodent damage, etc. The conductors need to be repaired or replaced if necessary.
3. Verify that the indications and displays are consistent with the operation of the equipment, note any faults or incorrect displays and take corrective action if necessary.
4. Check all terminals for signs of corrosion, insulation damage, high temperatures or burning/discolouration and tighten terminal screws.
5. Check for dirt, nesting insects and corrosion, clean as required, clean insect screens regularly.
6. If the lightning arrester has failed, replace the failed arrester in time to prevent lightning damage to the inverter or other equipment of the user.

 **DANGER**

Make sure that the inverter is disconnected from all power sources and that the capacitors are fully discharged before carrying out any checks or operations to avoid the risk of electric shock.

The Company shall not be liable for damage caused by:

1. Damage caused by improper use or use in a wrong location.
2. PV modules with an open-circuit voltage exceeding the maximum permissible voltage.
3. Damage caused by the operating temperature exceeding the restricted operating temperature range.
4. Dismantling and repair of the inverter by unauthorised persons.
5. Damage caused by force majeure: damage during transport or handling of the inverter.

9. Parameter Table

Inverter Model	FR12K-B	Settable
Inverter output		
Rated output power	12000W	
Max. peak power	24000W	
Rated output voltage	120/240 VAC (single-phase/split-phase)	Y
Load motor capacity	6HP	
Rated frequency	50/60Hz	Y
Output wave	Pure sine wave	
Switching time	10 ms (typical value)	
Parallel number	6	
Overload protection	<p>After overload protection is enabled, the inverter output will be restored after 3 min, and after 5 times of overload, the output will be off until the inverter is restarted.</p> <p>(102% < load < 110%): An error will be reported, and the output will be turned off after 5 min.</p> <p>(110% < load < 125%): An error will be reported, and the output will be turned off after 10s.</p> <p>Load > 125%: An error will be reported, and the output will be turned off after 5s.</p>	
Battery		
Battery type	Lithium-ion battery/lead-acid battery/ user-defined	Y
Rated battery voltage	48Vdc	
Voltage range	40–60Vdc	Y
Max. PV charging current	200A	Y
Max. mains/generator charging current	120A	Y
Max. hybrid charging current	200A	Y
PV input		
MPPT channel number	2	
Max. input power	6600W+6600W	
Max. Input Current	22/22A	
Max. open circuit voltage	500Vdc	

MPPT operating voltage range	125–425Vdc	
mains/generator input		
Input voltage range	90–140Vac	
Input frequency range	50/60Hz	
Bypass overload phase current	63A	
Efficiency		
MPPT tracking efficiency	99.9%	
Max. efficiency of battery inverter	92%	
General		
Dimension	28.7 X 19.1 X 6.7 inches	
Weight	61.73lbs	
Protection level	IP20, for indoor use only	
Ambient temperature	-10°C–55°C, >45°C derating	
Noise	<60 dB	
Cooling mode	Intelligent fan	
Communication		
Built-in interface	RS485/CAN/USB/dry contact	Y
External module (optional)	Wi-Fi/GPRS	Y
Certification		
EMC	EN61000-6-1, EN61000-6-3, and FCC 15 class B	
RoHS	Yes	

