User Manual

All-In-One Off-Grid Inverter

SUNON 12

V1.1

Contents

1. Safety 1

1.1 About This Manual 1
1.2 Symbols and Descriptions 1
1.3 Safety Precautions 1

2. Product Overview 3

2.1 Description 3
2.2 Datasheet 3
2.3 Features 6
2.4 System Connection Diagram 7
2.5 Product Overview 8

3. Installation 10

3.1 Packing List 10
3.2 Installation Location 10
3.3 Installation Tools Preparation 12
3.4 Inverter Installation 13

4. Wiring 15

4.1 Cable Box Overview 15
4.2 Cable Box Knockouts 16
4.3 Wiring Diagrams 17
4.4 Wiring 20
4.4.1 Connecting Solar Panels 20
4.4.2 Connecting Batteries 23
4.4.3 Generator Connection 25
4.4.4 AC Connection 26
4.4.5 Multiple Inverters 27
4.4.6 Communication Connections 29

5. Operation 30

5.1. Startup 30
5.2 Shutdown 30
5.3 Operation and Display Panel 31
5.3 .1 LED Indicator Description 31
5.3 .2 LCD Display 31
5.3 .3 Page Overview 32
5.4. Parameter Settings 34
5.4.1. Overview 34
5.4.2.Battery Settings 34
5.4.3 AC settings 38
5.4.4 Advanced Parameter Settings 40
5.4.5 Other Settings 42
5.4.6 EMS settings 43

5.4.7 Quick settings 45
6. Fault codes and Troubleshooting 46
6.1. Fault codes 46
6.2. TroubleShootings 50
7. Protection and Maintenance 52
7.1. Protection Functions 52
7.2. Maintenance 54
8. Appendix 55
8.1. Disposal & Recycling 55
8.2. Warranty 55
8.3. Contact Support 55
8.4. Trademarks 55

1. Safety

1.1 About This Manual

This user manual provides information for the installation, operation, maintenance and troubleshooting of the RUiXU SUNON 12 inverter.

Read the user manual carefully before installing, operation and maintenance and follow the instructions during installation and operation. Keep this manual readily accessible for future reference.

Failure to follow these instructions and warnings may damage the unit, equipment malfunction, or cause electric shock, severe injury, or death. RUiXU assumes no liability for personal injury or property damage resulting from installation, operation, or use.

1.2 Symbols and Descriptions

Symbol	Description
⚠ DANGER	Indicates an imminently hazardous situation that will result in death or serious injury if not avoided.
⚠ WARNING	Indicates a hazardous situation that could result in death or serious injury if not avoided.
⚠ CAUTION	Indicates a hazardous situation that could result in minor or moderate injury if not avoided.
ⓘ NOTICE	Provides important information or operating tips.

1.3 Safety Precautions

⚠ DANGER

1. All work on this product, including system design, installation, operation, configuration, and maintenance, must be performed by qualified personnel.
2. To reduce the risk of electric shock, do not perform any servicing other than what is specified in the operating instructions unless you are qualified to do so..
3. **High voltage hazard.** Before installing or servicing the inverter, ensure that all power sources (PV, grid, and battery) are disconnect. Use a voltmeter to verify the absence of voltage before proceeding to avoid electric shock.
4. Do not connect or disconnect PV, grid, battery, or communication wiring while the inverter is operating.
5. Do not open the terminal cover while the inverter is in operation.

⚠ WARNING

6. Installers and service personnel must wear appropriate personal protective equipment (PPE) at all times during installation and servicing.
7. Ensure that all PV, battery, and utility grid connections are secure and properly installed to prevent equipment damage or personal injury.
8. Ensure that the inverter is properly grounded. All wiring must comply with the National Electrical Code (NEC, ANSI/NFPA 70), or the Canadian Electrical Code (CEC).
9. Ensure that the inverter AC output is the only power source connected to the load to prevent equipment damage.
10. Read all instructions before installation. For electrical work, follow all applicable local and electrical codes, regulations, and these installation instructions.
11. Connect the inverter to the utility grid only after approval has been obtained from the local utility company. Before installation, consult the local Authority Having Jurisdiction (AHJ) regarding all applicable codes and installation requirements.
12. Keep all warning labels and nameplates on the inverter clean, legible, and securely attached. Do not remove, cover, or damage them.
13. Keep children away from the inverter and related system components.

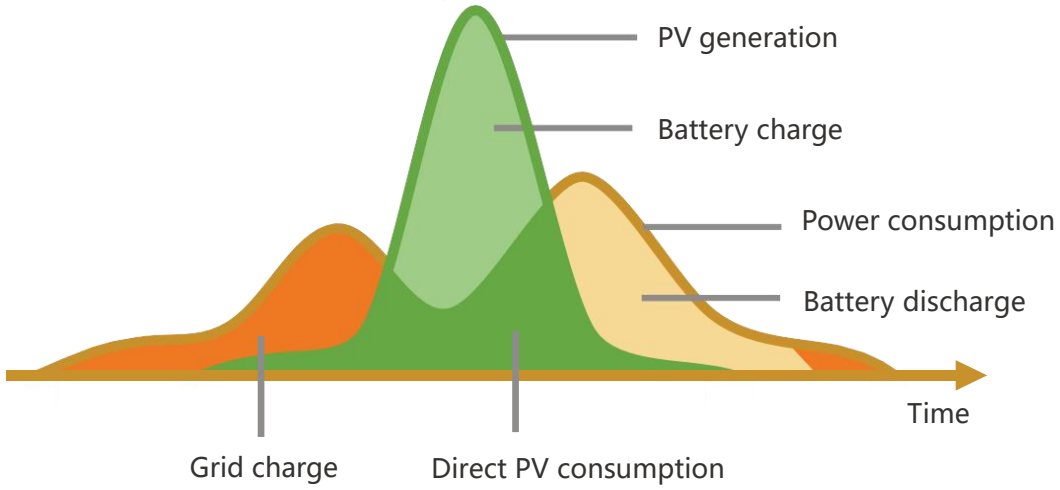
⚠ CAUTION

14. To ensure optimal inverter performance, use properly sized conductors and overcurrent protection devices in accordance with applicable electrical codes and regulations.
15. Some parts of the inverter may become hot during operation. Do not touch the enclosure, heat sink, or internal components while the inverter is operating. During normal operation, touch only the LCD display and control buttons.
16. Some components of the system are heavy. Use proper lifting techniques or team lifting to prevent personal injury during installation.

2. Product Overview

2.1 Description

The SUNON 12 is an off-grid inverter that integrates solar PV input, utility grid charging, battery energy storage, and pure sine wave AC output into a single system. Equipped with a high-performance DSP (Digital Signal Processor) and advanced control algorithms, it delivers fast response, stable operation, and high reliability.



2.2 Datasheet

Models	SUNON 12	Adjustable
Parallel mode		
Permitted parallel number	1~6	
Grid input		
Rated input voltage	120(L1/N, L2/N)/240Vac(L1/L2)	Y
Input phase voltage range	(85Vac~ 140Vac)±2%	
Frequency	50Hz/60Hz	Y
Frequency Range	47±0.3Hz~55±0.3Hz (50Hz);	Y
	57±0.3Hz~65±0.3Hz (60Hz);	Y
Grid Charging Efficiency	>95%	
Conversion time (bypass and inverter)	10ms (typical)	
AC reverse protection	Yes	
Maximum input current	200A/200A(L1/L2)	

GENERATOR INPUT		
Rated input voltage	120(L1/N, L2/N)/240Vac(L1/L2)	
Input phase Voltage Range	(85Vac~140Vac)±2%	
Input Frequency Range	50/60Hz	
Overload Current	60A	
Inverter output		
Output voltage waveform	Pure sine wave	
Rated output power (VA)	Split phase:12000	
	Single phase: 7200 (limited by the wiring terminals)	
Rated output power (W)	Split phase:12000	
	Single phase: 7200 (limited by the wiring terminals)	
Power factor	1	
Rated output voltage (Vac)	120Vac (L1/N, L2/N)/240Vac(L1/L2)	Y
Output voltage error	±1%	
Outputfrequency range (Hz)	50Hz±0.3Hz/60Hz±0.3Hz	Y
Maximum efficiency of inverter output	>93%	
Peak power	Split phase: 18000VA	
	Single phase: 10800VA	
Loaded motor capability	6HP	
Output short circuit protection	Continuous short circuit 200ms protect	
Bypass Overload Current	Load:125A,smart Load 60A	
Power saving mode self-consumption	Load per phase is null or less than 25W enter power-saving mode	
protection	Inverter Overload Protection Mechanism: ● Standard Recovery: After overload protection is triggered, the inverter output will automatically restore after 3 minutes. ● Lockout Protection: After 5 consecutive overload events, the output will remain off until the inverter is manually restarted. Protection Actions by Overload Range: ● 102% < Load < 110%: An error will be reported, and the output will be turned off after 5 minutes. ● 110% < Load < 125%: An error will be reported, and the output will be turned off after 10 seconds. ● Load > 125%: An error will be reported, and the output will be turned off after 5 seconds.	

Battery		
Battery type	Lead acid and lithium battery	Y
Rated battery input voltage	48V	
Battery voltage range	40.0Vdc~58.6Vdc±0.6Vdc	
Max charger current(AC+PV)	0-250A	Y
Max AC charge current	160A	Y
Short circuit protection	Circuit breaker 300A	
PV input		
Number of MPPT groups	2	
Maximum PV open circuit voltage	500Vdc	
PV operating voltage range	90Vdc~485Vdc	
MPPT voltage range	90Vdc~450Vdc	
Maximum PV input power	12,000W+12,000W	
Maximum PV input current	32/32A	
PV charge current(can be set)	0-250A	
MPPT Tracking Efficiency	99.9%	
Certified specifications		
Certification	UL 1741	
EMC certification level	FCC part15, CLASS B	
Operating temperature range	-10°C to 55°C(>45°C derating)	
Storage temperature range	-25°C ~ 60°C	
Humidity range	5% to 95% （ Conformal coating protection）	
Noise	≤60dB	
Heat dissipation	Forced air cooling, variable speed of fan	
Communication interface	USB/RS485/CAN/WiFi/ Dry node control	
Size (L*W*D)	30.91×19.09×6.33in(785×485×160.8mm)	
Weight (kg)	84.88lb(38.5kg)±3%	
Protection Degree	IP20 ,Indoor Only	
Integrated Circuit Breaker	INV Input/GEN/Load/Smart load/Battery/PV	

Built-in Automatic Transfer Switch (ATS) enables seamless transfer between utility grid and generator power during grid outages.

2.3 Features

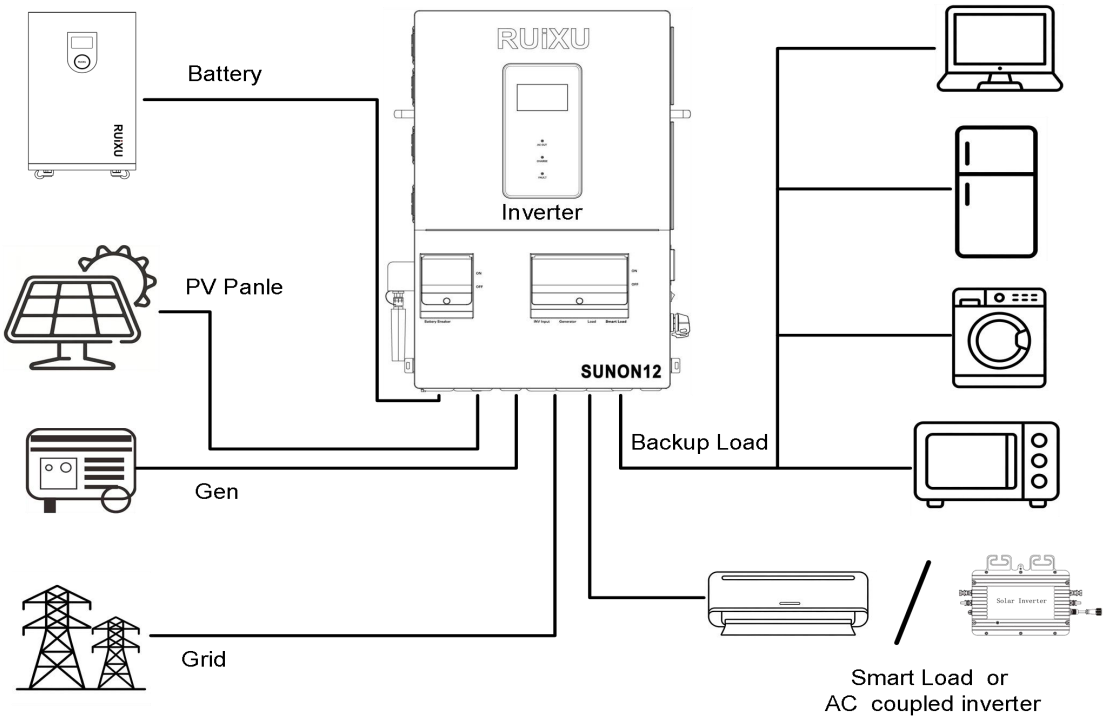
- Compatible with a wide range of energy storage batteries, including lead-acid and lithium-ion batteries.
- Supports lithium battery wake-up from sleep mode using PV or utility grid power.
- Provides pure sine wave output in both split-phase and single-phase configurations.
- Adjustable output voltage: 100 VAC, 105 VAC, 110 VAC, 115 VAC, 120 VAC, or 127 VAC.
- Supports parallel operation of up to six inverters for a maximum total output of 72 kW.
- Dual PV inputs with independent Maximum Power Point Tracking (MPPT).
- Supports up to 24 kW of total PV capacity with dual 12 kW PV inputs and a maximum input current of 32 A per MPPT.
- Supports Rapid Shutdown (RSD) for PV systems.
- Includes PV insulation resistance monitoring.
- Three selectable charging modes: PV Only, Grid + PV, and Generator + PV.
- Built-in Automatic Transfer Switch (ATS) enables seamless transfer between utility grid and generator power during grid outages.
- Supports scheduled charging and discharging to optimize energy consumption based on Time-of-Use (TOU) electricity rates.
- Energy Saving Mode reduces no-load power consumption.
- Dual AC output ports (Standard Load and Smart Load); the Smart Load port can also be configured as an AC-coupled input.
- Integrated battery, generator, backup load, and smart load circuit breakers provide circuit protection.
- LCD display with a dynamic power flow diagram for real-time system monitoring and operating status.
- Comprehensive protection functions, including short-circuit, overcurrent, overvoltage, undervoltage, and overload protection.
- Supports CAN, USB, and RS485 communication interfaces.

2.4 System Connection Diagram

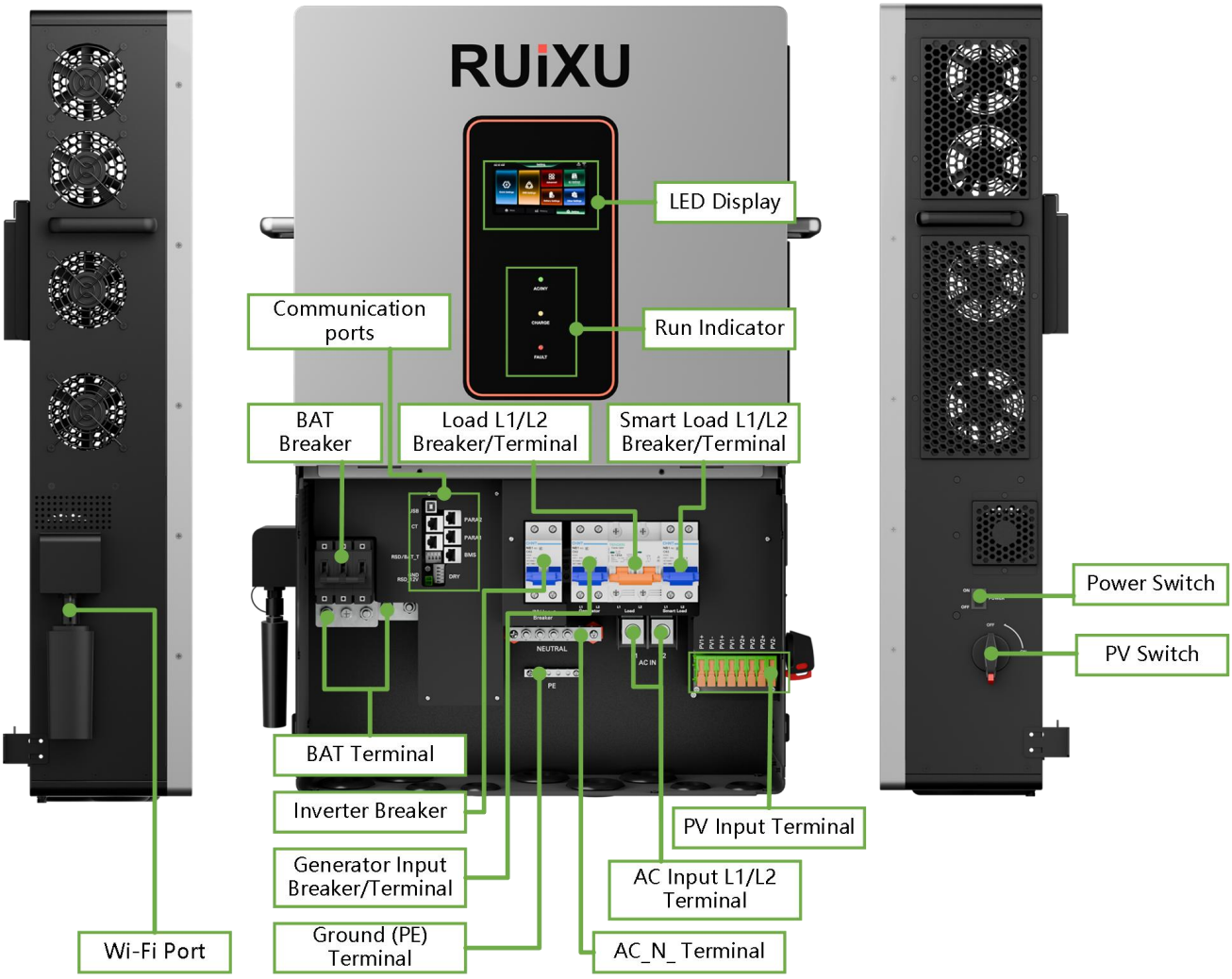
The following figure illustrates a typical system application for this product. A complete system consists of the following parts:

- PV modules: It converts solar energy into DC to charge batteries or into AC to supply power to connected loads.
- Grid: The grid can directly supply power to loads, and can also charge the battery during off-peak hours when electricity rates are low.
- Generator: Provides backup power source when grid power is unavailable or during grid outages.
- Battery: Stores energy when PV generation exceeds load demand or when grid electricity rates are low. It provides stable power to connected loads when PV generation is insufficient and grid power is unavailable.
- AC loads: Supports a variety of residential and light commercial AC loads, including refrigerators, lighting fixtures, televisions, fans, air conditioners, and other AC-powered equipment. Non-critical loads can be connected to the Smart Load output. A configurable battery discharge cutoff threshold helps prevent excessive battery discharge during backup operation.
- AC-Coupled Inverter: Integrates additional PV generation into the system through AC coupling, increasing the total PV capacity.
- Inverter: Serves as the central energy management and power conversion device for the entire system.

  Wiring configurations may vary depending on the application and local electrical code requirements.



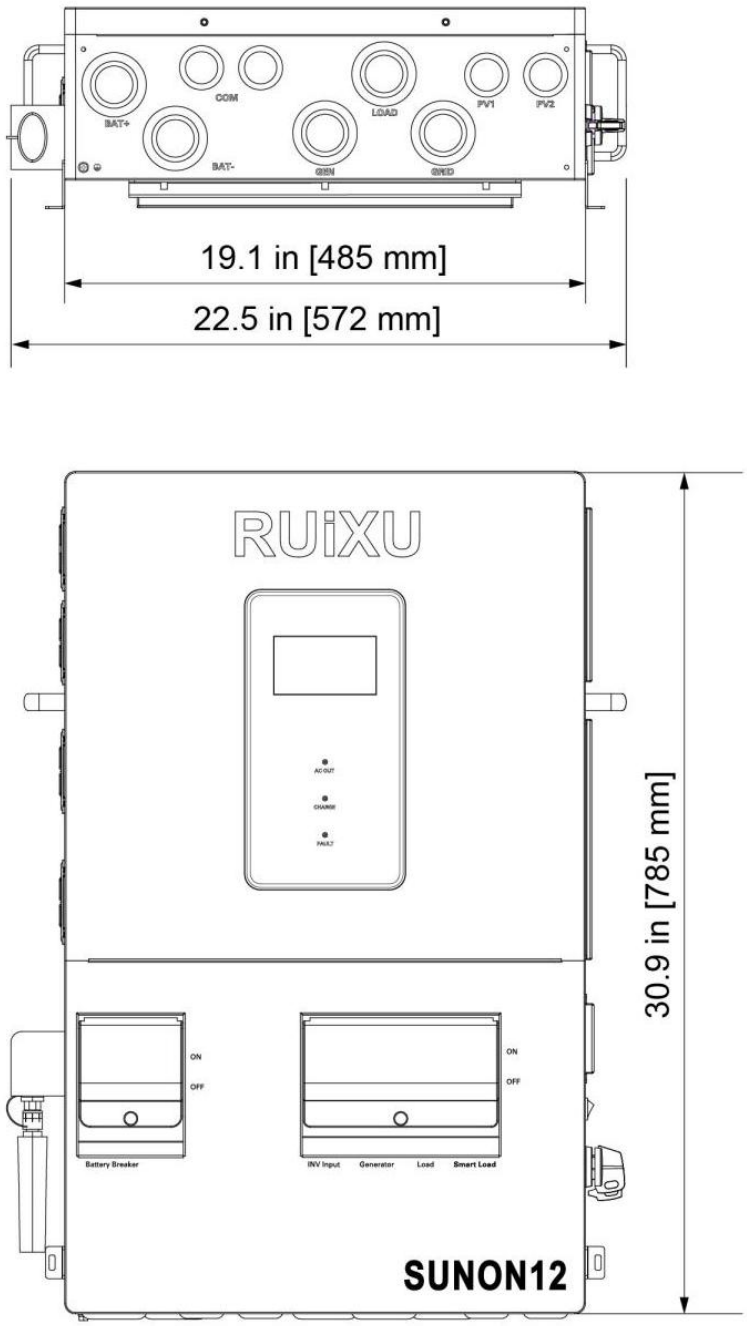
2.5 Product Overview



Weight :84.88lb(38.5kg)±3%

Dimension

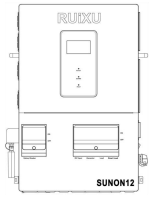
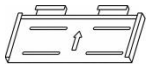
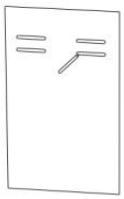
Unit: in/mm



3. Installation

3.1 Packing List

Before installing the inverter, inspect the package and the unit for any signs of damage. Verify that all items listed below are included and undamaged. If any item is missing or damaged, contact your dealer or RUiXU customer support before proceeding with the installation.The package should include the following items:

			
Inverter x1	Mounting Bracket x1	Lower Wall Brackets x2	Wi-Fi Monitoring Module x1
			
Expansion Bolt x4	6*50 Screw x 2 Expansion tube x2	Allen Wrench (2.5mm) x1 Allen Wrench (4.7mm) x1 Allen Wrench (8mm) x1	Hex Flange Nut(M8) x5
			
Copper lug SC70-8 x4	2m Network Cable x1	Mounting Hole Template x1	Anchor Bolt x4
			
The warranty card x1	Quality Certificate x1	Manual x1	Inspection report x1

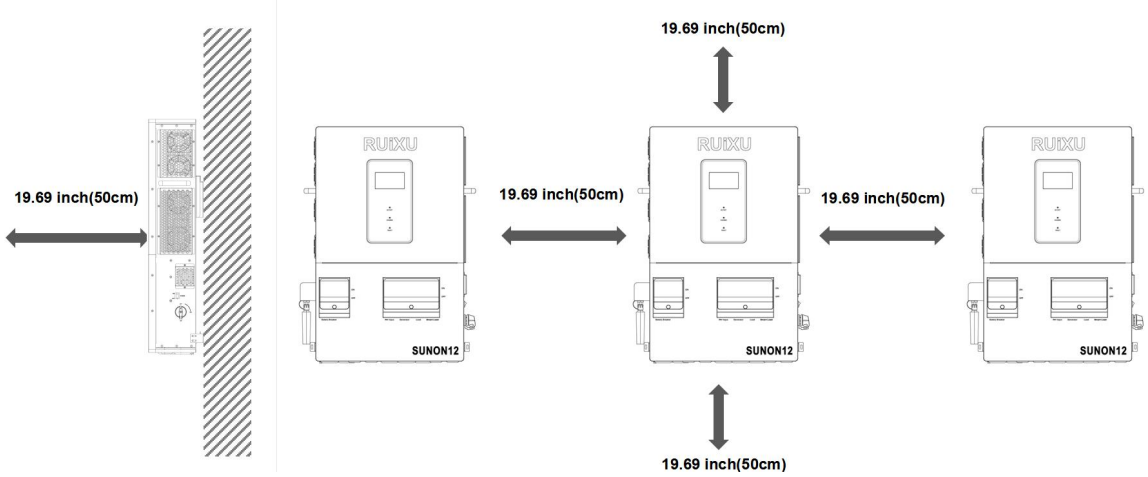
3.2 Installation Location

SUNON 12 is only for indoor use (protection level: IP20). Before selecting the installation location, users should consider the following factors:

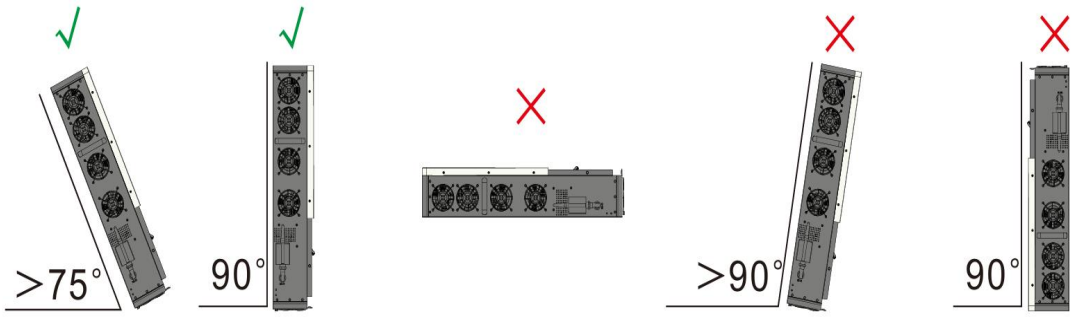
- Operating Temperature and Humidity: 14°F to 131°F (-10°C to 55°C), 5% to 95% RH (non-condensing)
- Maximum Installation Altitude: Up to 6,562 ft (2,000 m)
- Wall Strength: The mounting wall must be capable of supporting the full weight of the inverter.
- Mounting Surface: The mounting surface must be constructed of non-combustible

material.

- Mounting Height: Install the inverter at eye level for convenient viewing and operation.
- Clearance: Maintain sufficient clearance around the inverter to ensure adequate airflow and proper heat dissipation.



- Orientation: The inverter must be mounted vertically on a plumb wall. Refer to the figure below for the permitted installation angles.



⚠ DANGER

- Do not install the inverter near flammable materials.
- Do not install the inverter in potentially explosive environments.
- Do not install this unit or any lead-acid batteries in sealed or enclosed areas.

⚠ WARNING

- Due to the weight of the inverter, at least two qualified installers or appropriate lifting equipment may be required for safe installation.

⚠ CAUTION

- Do not install the inverter in direct sunlight.
- Do not install or operate the inverter in wet or humid locations.

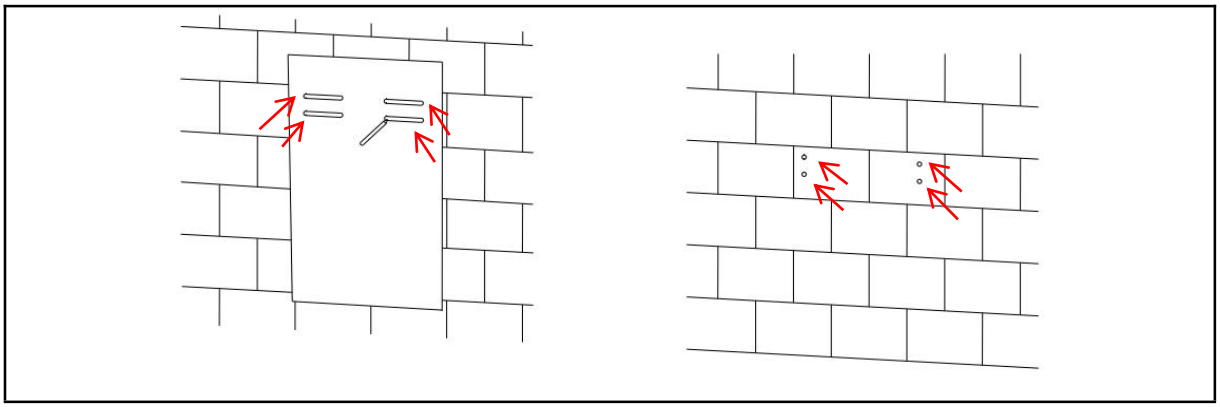
3.3 Installation Tools Preparation

The tool illustrations are provided for reference only. Installation tools include but are not limited to the following recommended ones. Use other auxiliary tools based on site requirements.

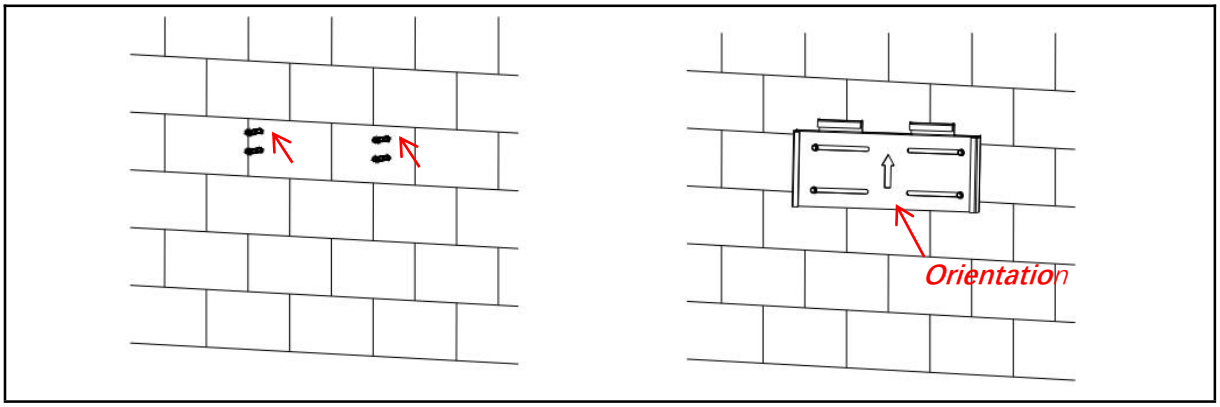
 Marker	 Measuring tape	 Utility knife	 Multimeter Measurement range: ≥ 1100 V DC	 Wrist strap
 Protective gloves	 Dust mask	 Earplugs	 Goggles	 Insulated shoes
 Vacuum cleaner	 Heat shrink tubing	 Heat gun	 Hammer drill Drill bit: Φ10	 Rubber mallet
 Electric screwdriver Tool bit: M4	 Phillips screwdriver Specification: M4	 Wire stripper	 Hydraulic plier	 Crimping tool Crimping range: 2.5-6
 Wrenchfor MC4 terminal	 Wire clipper	 RJ45 crimping tool	 Socket wrenches	

3.4 Inverter Installation

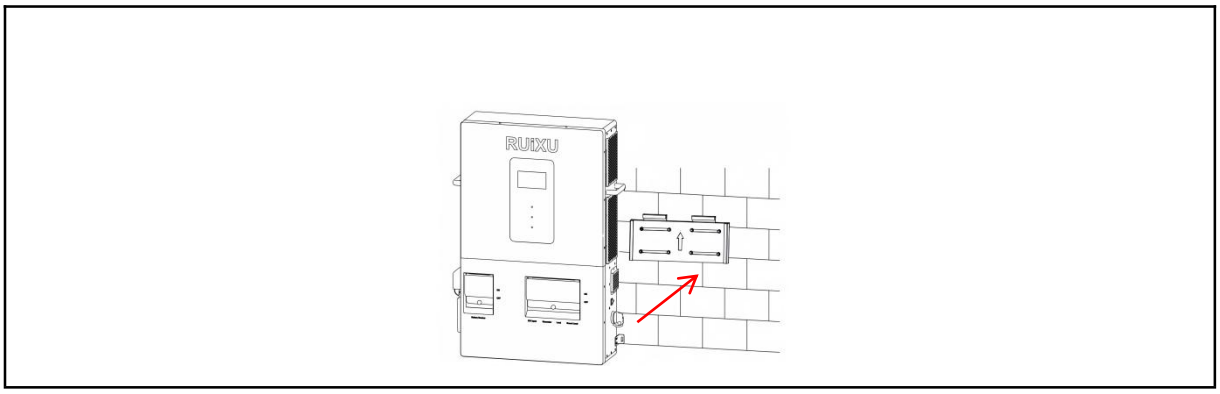
- Step 1：Position the Drill Template on the wall, mark the holes, and drill.



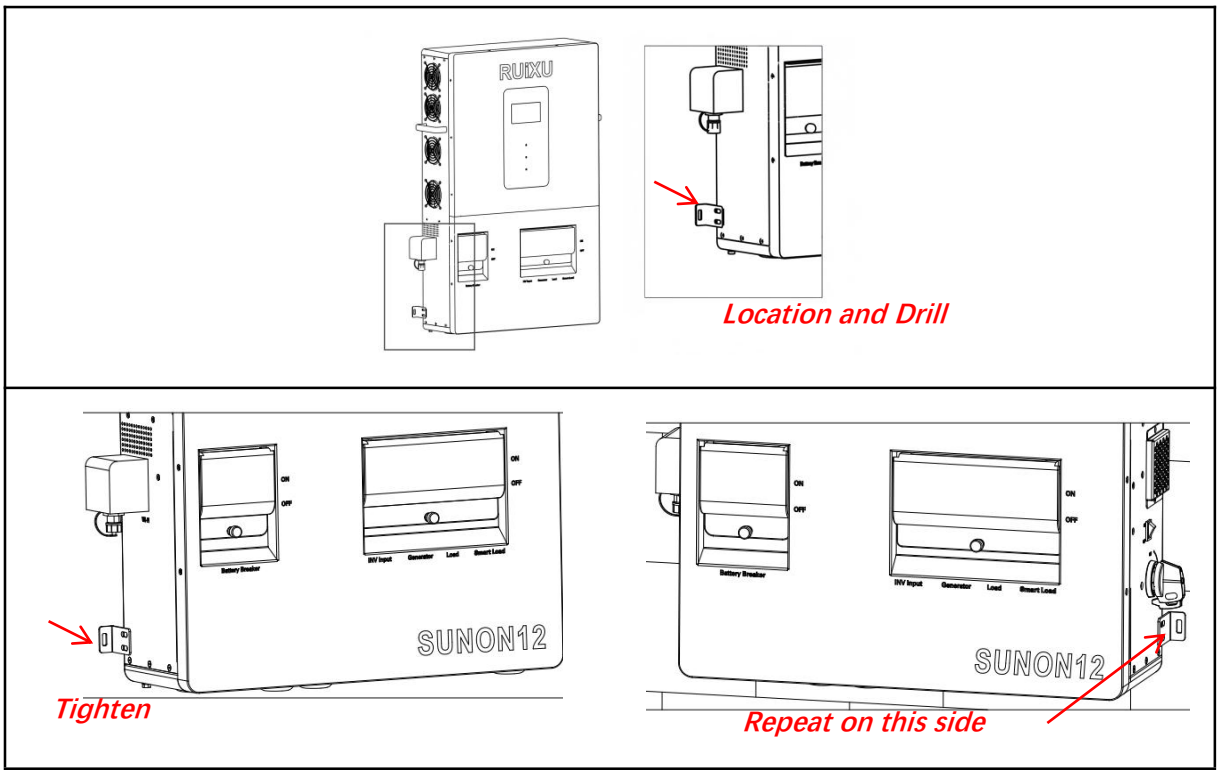
- Step 2：Install the expansion bolts and wall-mount bracket.



- Step 3：Lift the inverter and secure it onto the wall mount.



- Step 4：Fix the inverter with the right-angle brackets (supplied) on both bottom sides.



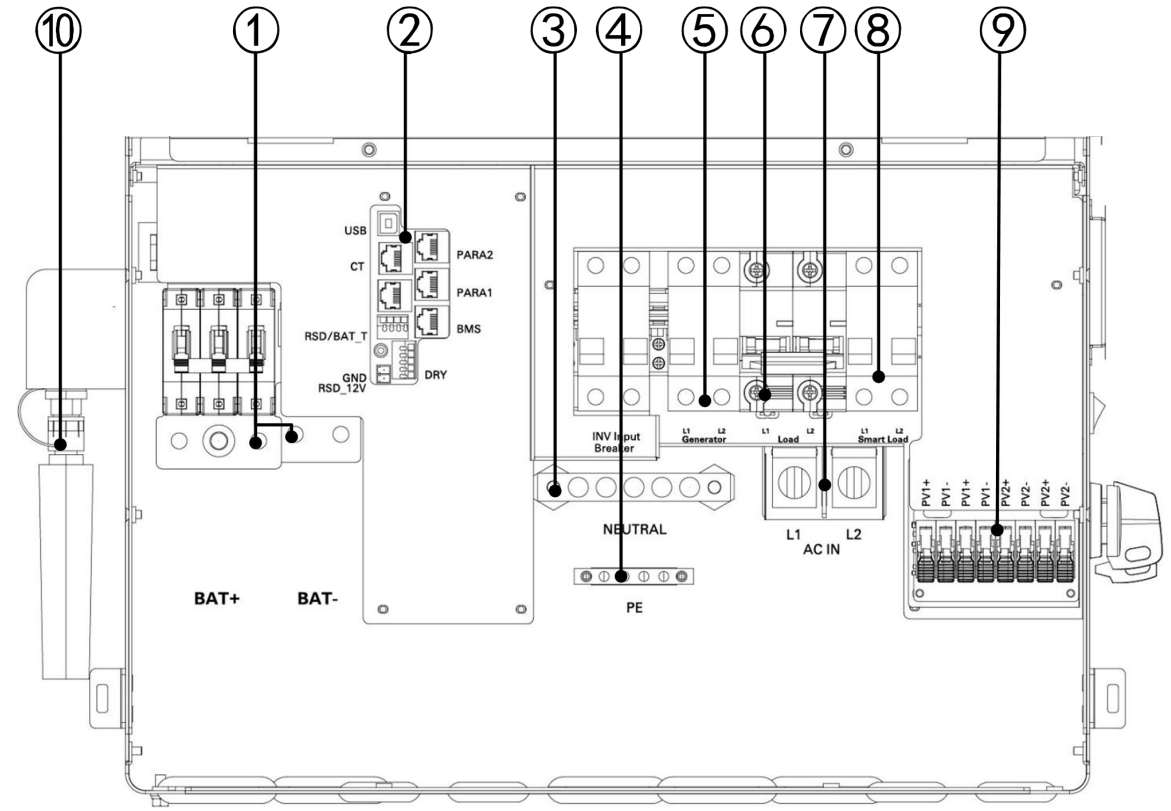
- Step 5：Installation Finished.

ⓘ NOTICE

When using the inverter in areas with poor air quality, the dust proof 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 (22/23 fault), and affect power supply and the service life of the inverter.

4. Wiring

4.1 Cable Box Overview



Terminal

Callout	Description	Callout	Description
1	Battery (BAT+ ,BAT-)	6	Load (L1 and L2)
2	Communication Board	7	Grid (L1 and L2)
3	Neutral	8	Smart Load
4	Ground （PE)	9	PV1–PV2
5	GEN （L1 and L2)	10	WiFi

Breaker or Disconnect

Integrated Bonded Load Breaker	L1/L2 :125A
Integrated Bonded Smart Load Breaker	L1/L2 :63A
Integrated Bonded Gen Breaker	L1/L2 :63A
Integrated Bonded INV input Breaker	L1/L2 :63A
Integrated Bonded Battery Breaker	Bat+.:300A
External PV DC Disconnect / Isolator	600V/40A

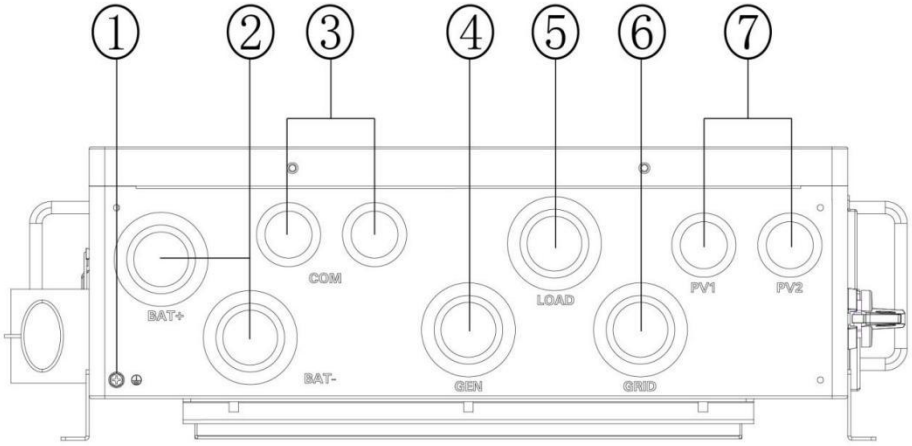
* When grid power is switched to inverter-only mode, the INV input breaker provides overcurrent protection; no additional wiring is required at the terminal below it.

Wire Gauge Guide (copper)

	Description	Recommended cable	Recommended torque	Note
1	GRID	L1,L2,N: 2/0AWG	L1,L2: 132.7 lb-in (15 Nm)	Distance Limits Will Vary Per User
2	GEN	L1,L2,N: 6AWG	L1,L2:17.7 LB·IN(2.0Nm)	
3	Load	L1,L2,N: 3AWG	L1,L2:31.0 LB·IN(3.5Nm)	
4	Smart Load	L1,L2,N: 6AWG	L1,L2:17.7 LB·IN(2.0Nm)	
5	Neutral	/	34.5 lb-in (3.9Nm)	
6	Ground(PE)	Grid/Load：4AWG Other ： 6AWG	22.1 lb-in (2.5Nm)	
7	PV	10~12AWG		
8	BAT+, BAT-	2/0 AWG(0~12ft.)	79.7 lb-in (9Nm)	With Copper lug
9		4/0 AWG(12~20ft.)		

4.2 Cable Box Knockouts

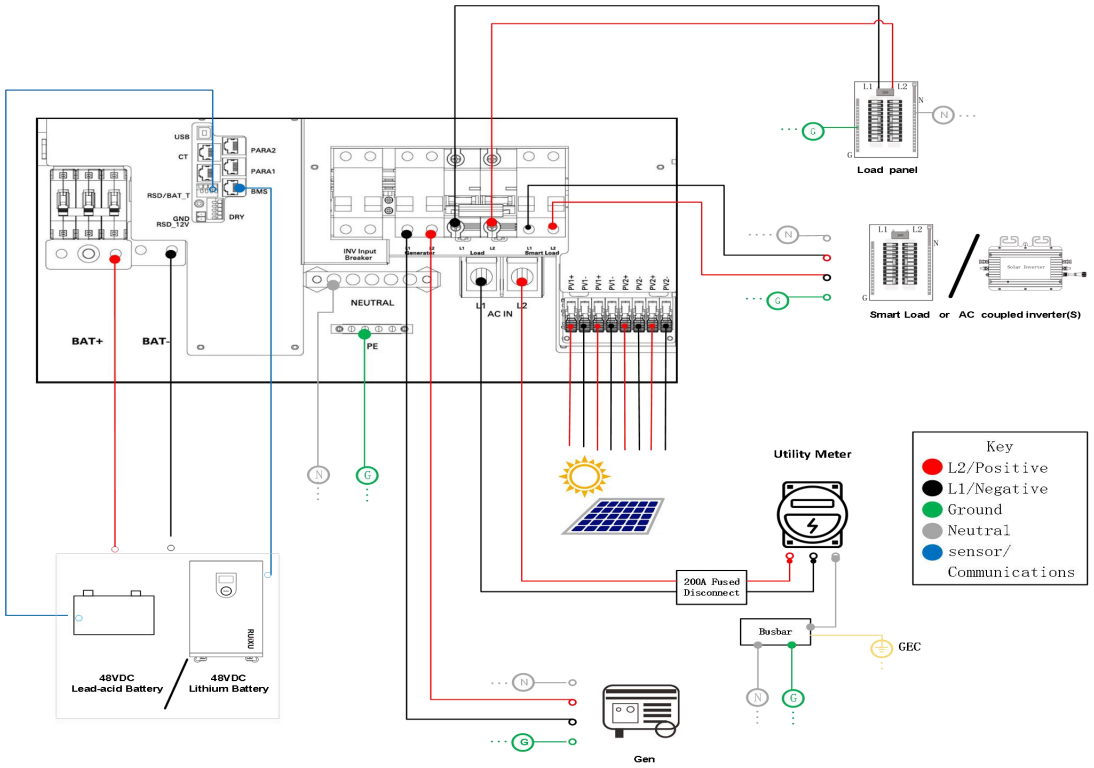
The image below represents the bottom view of the cable box area with knockout hole sizing shown in nominal trade sizes.



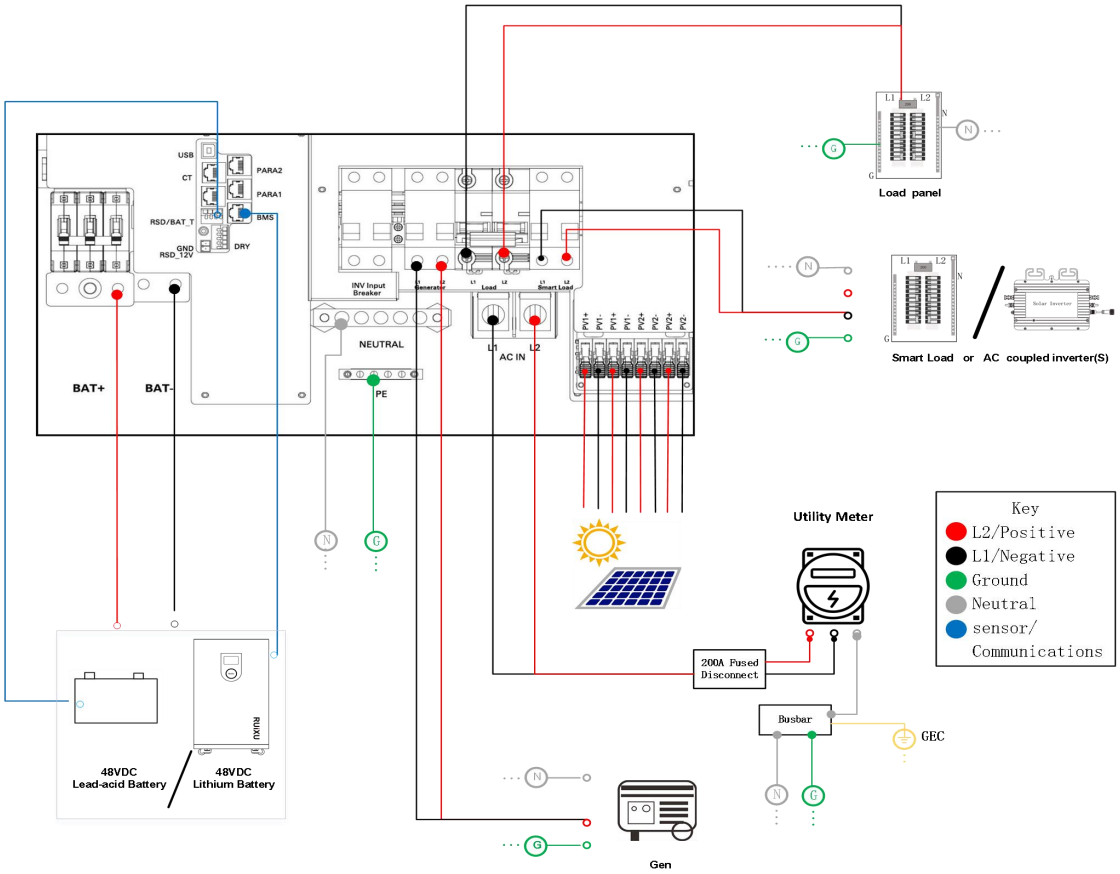
①	PE /Ground Terminal，
②	Battery Wiring Entry，Diameter: 1.98 in. (50.4 mm). Recommended conduit size: 1-1/2 in.
③	COM Wiring Entry，Diameter: 1.38 in. (34.9 mm). Recommended conduit size: 1 in.
④	GEN Wiring Entry，Diameter: 1.98 in. (50.4 mm). Recommended conduit size: 1-1/2 in.
⑤	Load Wiring Entry，Diameter: 1.98 in. (50.4 mm). Recommended conduit size: 1-1/2 in.
⑥	GRID Wiring Entry，Diameter: 1.98 in. (50.4 mm). Recommended conduit size: 1-1/2 in.
⑦	PV Wiring Entry，Diameter: 1.38 in. (34.9 mm). Recommended conduit size: 1 in.

4.3 Wiring Diagrams

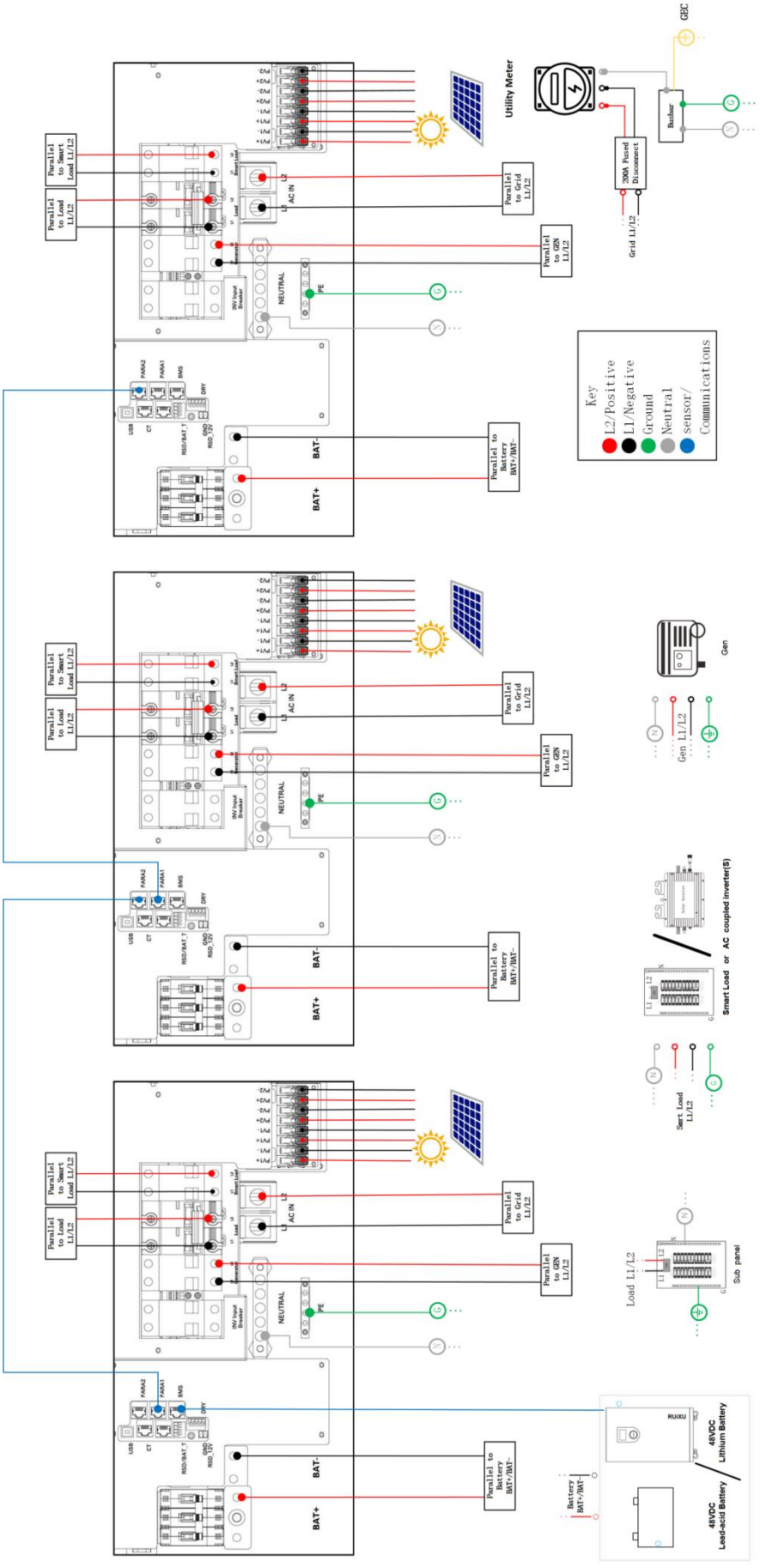
1. Single inverter:split-phase input and output



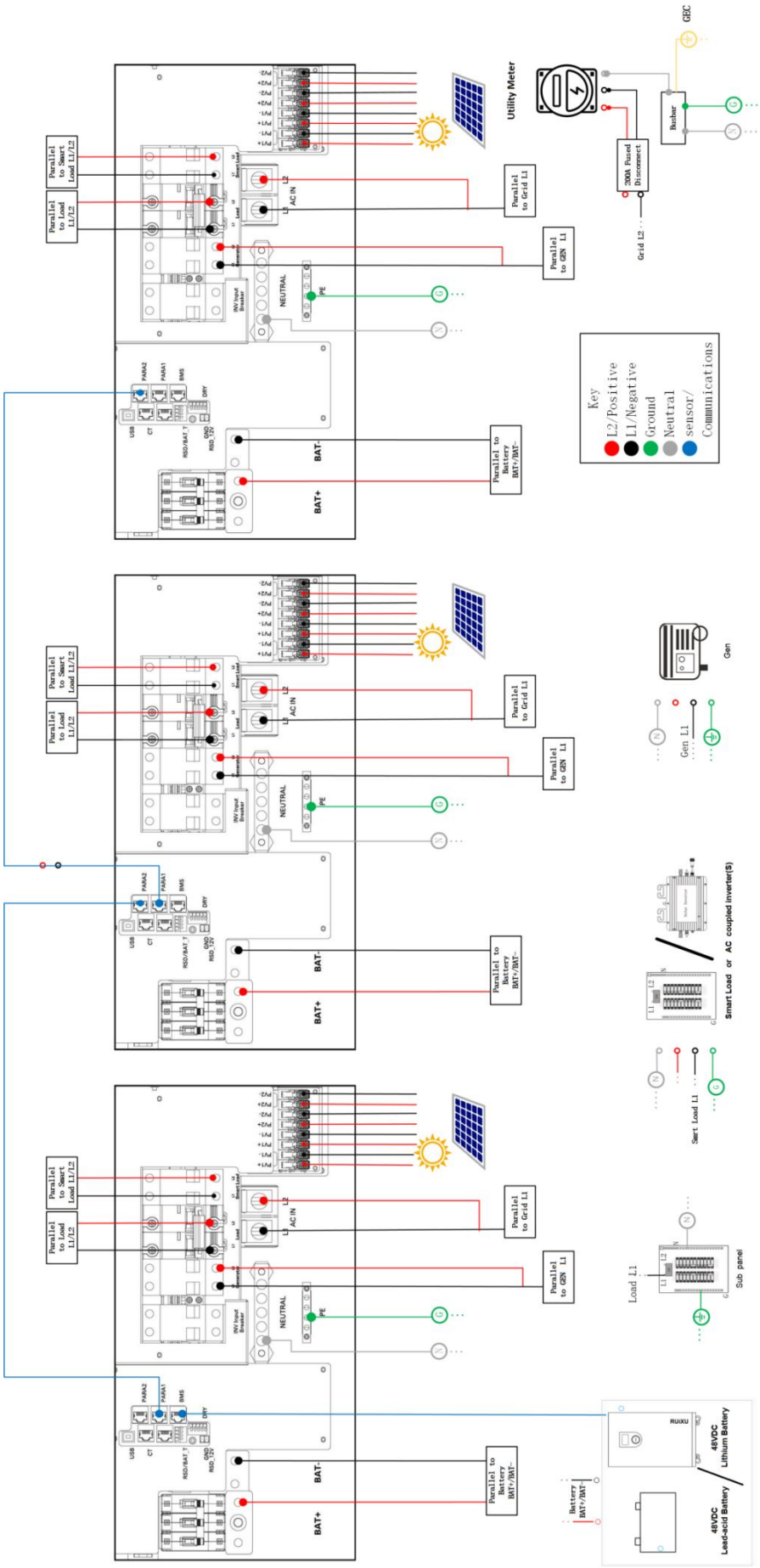
2.Single inverter:single-phase input and output.



3.Multiple inverters(max 6 unit in parallel)：split-phase input and output



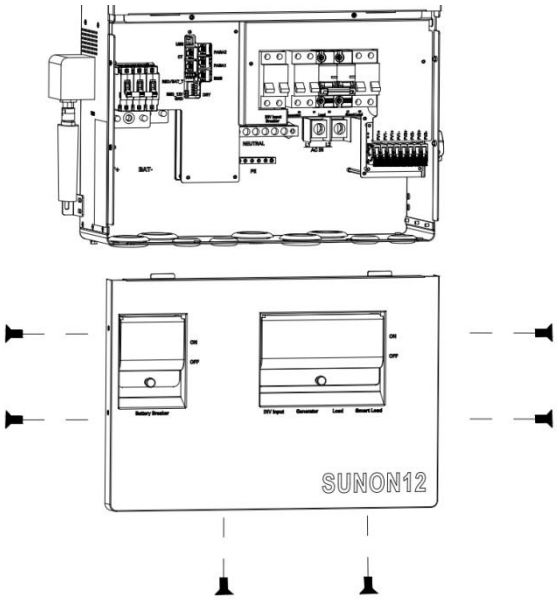
4.Multiple inverters(max 6 unit in parallel), single-phase input and output.



⚠ CAUTION

- These wiring diagrams are examples of common use-cases for RUiXU inverters (SUNON12). Diagrams must meet local electrical code and authorized jurisdiction requirements.

4.4 Wiring



To access the cable compartment, remove the screws as illustrated to open the cover. After taking off the cover, connect the cables as required. Before wiring any conductors to the inverter, verify with a multimeter that none of the wires carry live voltage. Once all cable connections are completed, refit the cover and secure it in place with the screws.

4.4.1 Connecting Solar Panels

The SUNON12 inverter is equipped with two independent MPPT channels. Each MPPT channel can accept up to two parallel PV strings. When two strings are connected in parallel to the same MPPT channel, both strings must:

- Use PV modules with identical specifications.
- Have the same number of modules connected in series.
- Receive the same solar irradiance conditions.

The maximum operating current for a single MPPT channel is 32 A. When two strings are connected in parallel, the maximum operating current of each string must not exceed 16 A.

If the PV input current exceeds the rated value, the MPPT cannot fully utilize the excess current. Long-term operation under such conditions may accelerate the aging of internal components and lead to equipment damage.

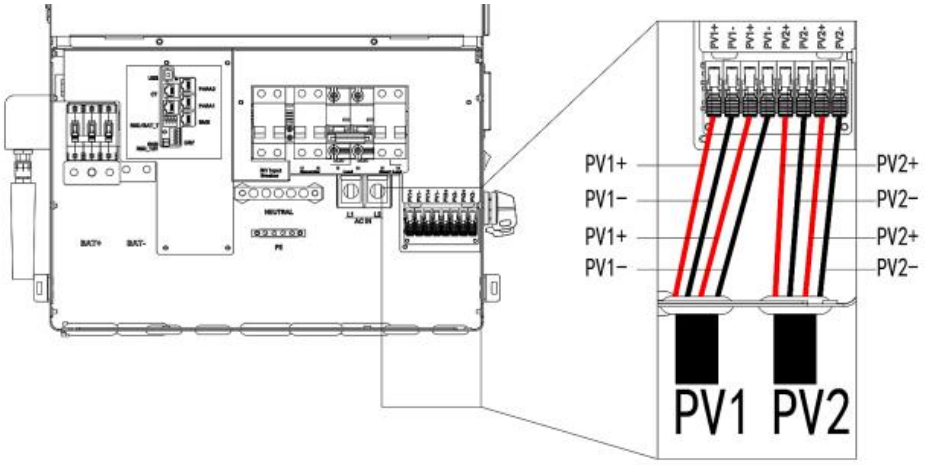
1. PV Input Voltage Requirements:

The inverter can start up only when the PV DC input voltage exceeds 90 VDC.

The inverter will supply power to the load terminals only when the PV voltage exceeds 120 VDC.

The MPPT (Maximum Power Point Tracking) operating voltage range is 90–450 VDC, which maximizes PV energy conversion efficiency.

The maximum PV string voltage must not exceed the inverter’ s 500 VDC maximum input voltage.



2. PV String Sizing and Configuration

When PV modules are connected in series to form a string，The total string voltage equals the voltage of a single module multiplied by the number of modules connected in series.

The string current remains the same as the rated current of a single module.

During system design, the following three parameters must be calculated and verified:

- String Operating Voltage (Vmp),Calculate the string voltage based on the module Vmp and the number of modules connected in series. The resulting maximum power voltage (Vmp) should fall within the MPPT operating voltage range of 90–450 VDC.
- String Open-Circuit Voltage (Voc),Calculate the string open-circuit voltage based on the module Voc and the number of modules connected in series. The calculated value must not exceed the MPPT maximum allowable input voltage of 500 VDC, otherwise equipment damage may occur.Environmental temperature and irradiance conditions affect module Voc. Lower temperatures and higher solar irradiance increase Voc. Particular attention should be paid to worst-case Voc conditions in high-altitude regions and areas with exceptionally strong sunlight. Refer to the PV module technical datasheet for detailed Voc calculations.
- Maximum String Operating Current,Verify that the maximum operating current of the PV string does not exceed the rated current-carrying capacity of the inverter MPPT circuit.

Example

Under Standard Test Conditions (STC) of 1000 W/m² irradiance and 77°F (25°C) cell temperature, a PV module has the following specifications:

Open-circuit voltage (Voc): 41.02 VDC

Maximum power voltage (Vmp): 33.72 VDC

Maximum power current (Imp): 13.05 A

When 10 modules are connected in series:

String open-circuit voltage = 410.2 VDC

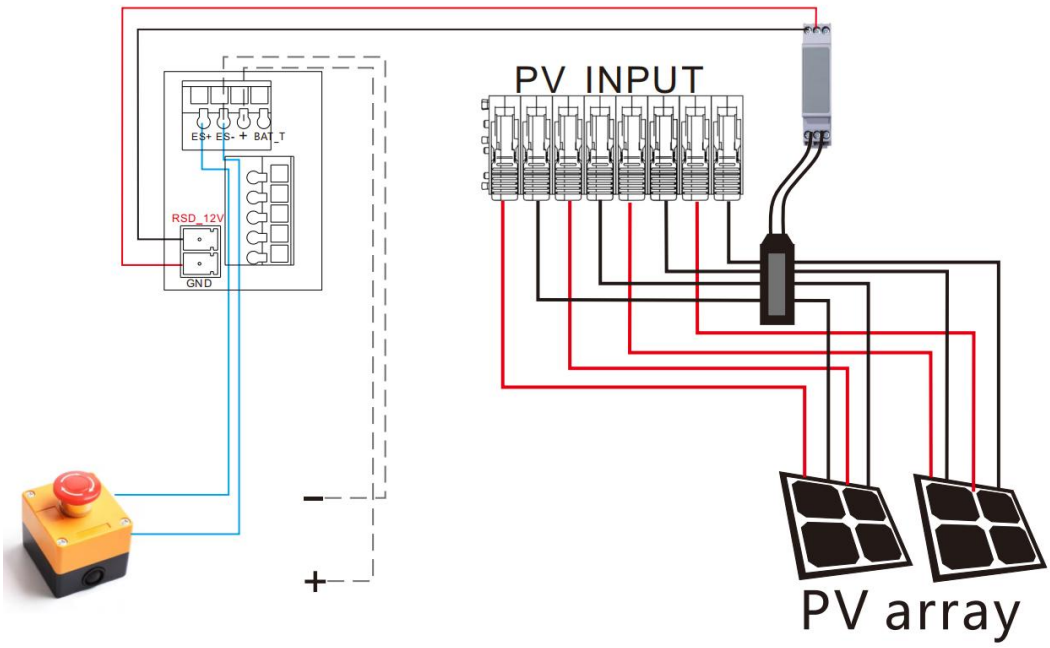
String maximum power voltage = 337.2 VDC

String operating current = 13.05 A

3. RSD System

The inverter's "RSD_12V" and "GND" terminals provide a 12 VDC / 1 ADC PLC signal. If required, this PLC signal can be connected to an external PV Rapid Shutdown Device (RSD) transmitter（not included）.

The wiring diagram is shown below:



Two emergency stop methods are available:

- Local Emergency Stop Switch: Connect a normally open (N.O.) emergency stop switch to the "ES+" and "ES−" terminals as shown in the wiring diagram.The emergency stop switch should be installed outdoors in a readily accessible location. Pressing the emergency stop switch will immediately initiate an emergency shutdown.
- Remote-Controlled Emergency Stop: Connect a controlled 12 VDC power source to the "ES−" and "+" terminals as shown in the wiring diagram.When 12 VDC is applied from the external power source, the inverter will initiate an emergency shutdown. This configuration allows implementation of a remotely controlled emergency stop function.

⚠ DANGER

- Before any wiring installation or removal, switch off all circuit breakers and disconnect switches, and verify with a multimeter that all circuits are fully de-energized.

⚠ CAUTION

- For multi-stranded flexible PV cables, pin-type ferrules shall be crimped onto both ends of each cable.
- The PV system shall be equipped with a complete lightning protection system, including equipment grounding, equipotential bonding, and Surge Protective Devices (SPDs), to protect the inverter and batteries from lightning-induced surge damage.

- The inverter is equipped with an auxiliary power interface for a Rapid Shutdown Device (RSD). End users must separately purchase and install dedicated RSD transmitter and receiver units. The inverter controls RSD operation by enabling or disconnecting the auxiliary power output.

4.4.2 Connecting Batteries

Cable Installation:

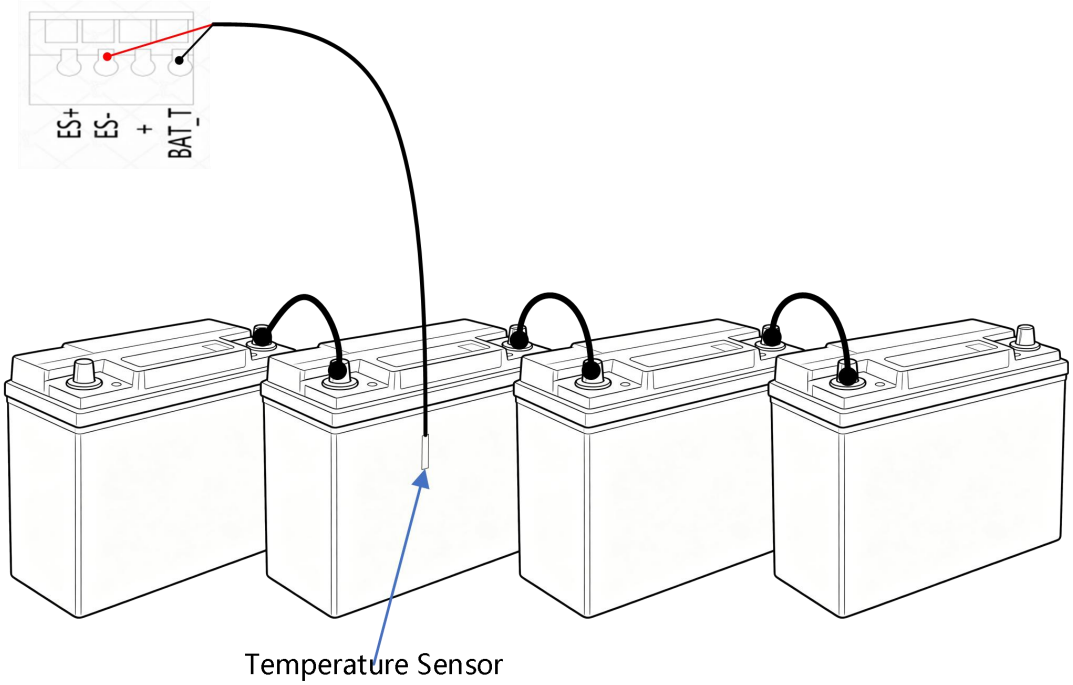
- The SUNON12 inverter is equipped with one pair of M8 positive (+) and negative (−) threaded battery terminals for battery cable connections.
- All battery cable terminations must use copper cable lugs. The inverter is supplied with SC70-8 copper lugs as standard. Equivalent copper lugs may also be used, provided they are compatible with the M8 threaded terminals and meet the required current-carrying capacity.
- Secure all cable lugs using the supplied flange bolts and tighten them to the specified torque. The battery cable installation is then complete.

After the battery cables have been connected, additional configuration requirements vary depending on the battery type.

Lead-Acid Batteries:

- Attach the temperature sensor (15KΩ F3950 NTC thermistor) securely to the surface of the battery.Connect the temperature sensor to the inverter:

Connect the battery temperature sensor cable to the ES- and BAT_T terminals. The inverter uses the measured surface temperature of the lead-acid battery to automatically compensate the charging voltage.

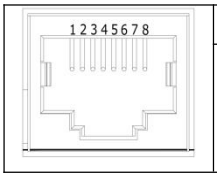


- Configure the appropriate battery voltage thresholds. Refer to Section 5.4.2.1, Battery Settings Without Communication Function.

Lithium-Ion Batteries：

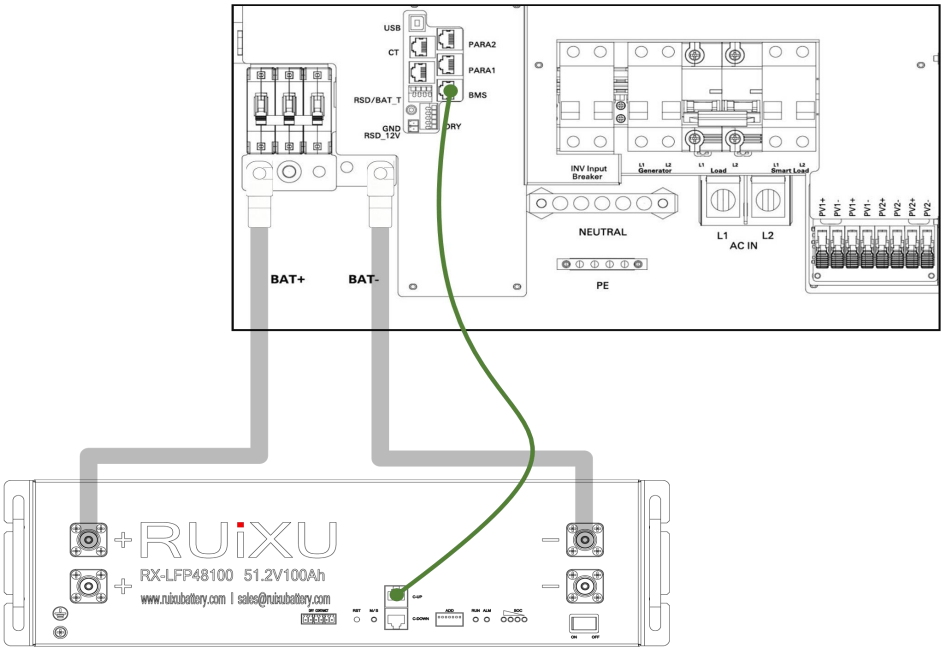
- Most lithium-ion batteries support communication with the inverter.When using a lithium-ion battery, it is recommended to connect the battery to the inverter using the supplied battery communication cable. This allows the inverter to communicate directly with the battery's Battery Management System (BMS), commonly referred to as closed-loop communication.

Inverter BMS port:



RJ45	PIN_1	PIN_2	PIN_3	PIN_4	PIN_5	PIN_6	PIN_7	PIN_8
Note	485-B	485-A		CAN_H	CAN_L		485-A	485-B

Provides two communication options, RS485 and CAN. The battery communication interface pinout for the selected communication mode must match the inverter ‘s BMS port. In addition, the corresponding communication protocol settings must be configured. For details, see Section 5.4.2.2.



- If no communication cable is connected between the battery and the inverter, the system operates in open-loop mode. In this mode, the inverter relies solely on the battery voltage for operation. The appropriate battery voltage thresholds must therefore be configured. Refer to Section 5.4.2.1, Battery Settings Without Communication Function.

⚠ DANGER

Before connecting or disconnecting any wiring, make sure all circuit breakers are set to the OFF position. Use a multimeter to check for DC voltage at the inverter breakers and battery cables (if connected to batteries or battery banks). Also verify that the PV disconnect switch is in the OFF position.

4.4.3 Generator Connection

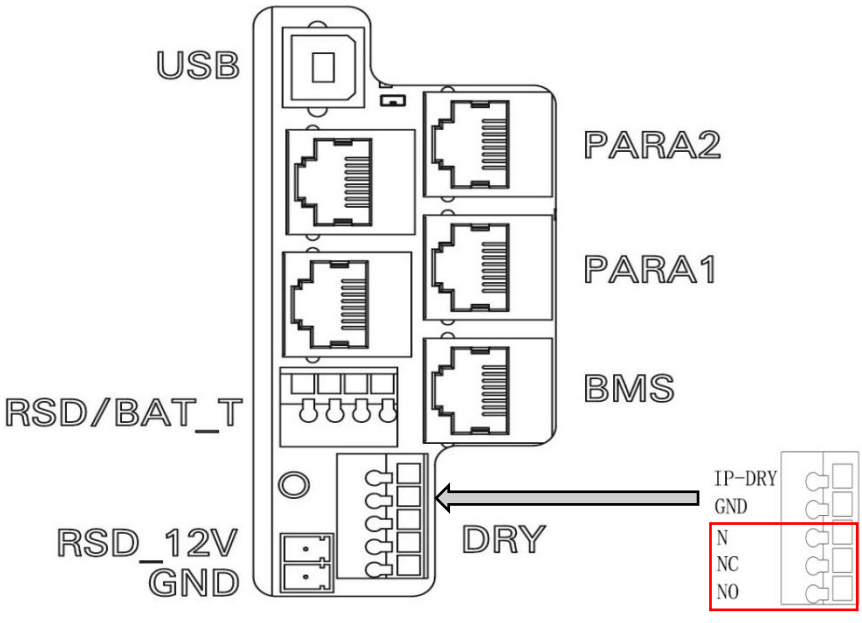
When connecting a generator directly to the inverter input, the generator's Total Harmonic Distortion (THD) must be less than 3%. To achieve optimal THD performance, the recommended configuration is for the generator's rated output power to be at least 1.5 times the inverter's rated output power. If only a lower-power generator is available, enable the Generator Boost function to allow the battery to supplement the generator output. In this case, generator oversizing is not required. For details, refer to **Section 5.4.3.2.**

The inverter can be connected to both the utility grid and a generator simultaneously. When utility power is available, the system automatically prioritizes Grid Mode. If a utility power outage occurs, the internal transfer relay automatically switches the system to Generator Mode.

Cable Installation:

- Identify the generator output conductors correctly. Typical wire color assignments are as follows : L1: Black;L2: Red;Neutral: White;Ground (PE): Green or bare conductor
- After verifying the conductors, connect the generator grounding conductor to the inverter's PE grounding busbar. Connect the L1 conductor to the L1 terminal of the generator input, and connect the L2 conductor to the L2 terminal. Then connect the generator neutral conductor to the Neutral busbar (marked NEUTRAL).

To enable remote generator start, connect the generator start signal to the GEN terminal on the Communication ports (N-NO-NC terminals). The inverter's EMS allows you to configure the generator start and stop conditions. For details, refer to Section 5.4.3.2.



Function	Working Principle	Operating Status	NOTE
N-NO-NC	Controls diesel generator ON/OFF	1. Normal: NC-N closed, NO-N open	NO-N resistive load rating: 125VAC/1A, 240VAC/1A, 30VDC/1A
		2. Battery voltage/SOC Below GEN-start threshold: Relay energized, NO-N closed, NC-N open.	

⚠ *DANGER*

Before performing any wiring, always turn off the inverter and the generator, and switch all circuit breakers to the OFF position.

4.4.4 AC Connection

The inverter supports 200A AC input at the grid port, which can simultaneously charge the battery and supply AC power to LOAD and smart load (bypass mode).

The LOAD port supports a maximum output of 125A, and the smart load port supports a maximum output of 60A. These two AC output ports can receive current directly from the AC input (grid or generator), or switch to accept AC from the PV/battery inverter output, with configurable switching conditions. A 63A breaker is placed between the inverter circuit and the AC output port to provide overcurrent protection when switching from AC input to inverter circuit, should the current exceed the inverter maximum capacity.

The Smart Load terminals support either the Smart Load function or the AC Coupling function. The desired function can be selected through the inverter settings. For details, refer to **Section 5.4.3.3.**

After Smart Load Enabled: The Smart Load terminals can be connected to a single non-critical load or an entire non-critical subpanel.

- Supports connection to a single non-critical appliance or an entire non-critical subpanel.
- Can be configured to automatically turn ON or OFF based on the battery voltage or State of Charge (SOC).

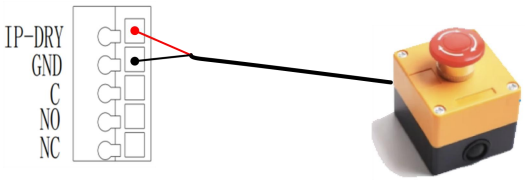
After AC Couple Enabled: The smart load terminals can connect to an existing grid-tied PV inverter (including micro-inverters) for AC coupling.

- Supports AC-coupled PV input with a maximum input current of 60 A.
- Energy from the AC-coupled PV inverter can be used to charge the battery and supply the LOAD output, but cannot be exported to the utility grid.
- The AC-coupled PV inverter synchronizes with the SUNON12, rather than the utility grid. As a result, AC coupling continues to operate normally during a utility grid outage.
- The inverter can simultaneously accept PV power from both MPPT inputs and the AC-coupled PV inverter. All PV sources are combined and managed as total PV input for energy monitoring and statistics.
- The AC Coupling function can be configured to automatically enable or disable based on the battery voltage or State of Charge (SOC).

Remote AC Output ON/OFF Control

The inverter provides a pair of dry-contact terminals for an external Emergency Stop (E-Stop) switch. Closing the E-Stop circuit immediately disables the inverter AC output.

1. IP-GND open: AC output ON
2. IP-GND closed: AC output OFF



Neutral-to-Ground Connection:

The neutral line is a solid bond between AC input and output (common neutral architecture), remaining permanently connected.

The system requires only one neutral-to-ground connection, typically provided by the main bonding jumper at the first utility disconnection point;

if absent, the inverter can internally establish .this connection via settings. (see Section 5.4.3.4 N Line Ground.)

⚠ DANGER

- Before making any connections, ensure that all circuit breakers are in the OFF position. Use a multimeter to verify that the AC input conductors (L1, L2, and Neutral) are not energized.

⚠ CAUTION

- Do not interchange the Grid input wiring with the load output wiring. Incorrect wiring may damage the inverter and connected equipment.
- Ensure that all AC conductors are connected to the correct terminals. For example, do not interchange the Line (L) and Neutral (N) conductors. Incorrect wiring may result in a short circuit and damage the equipment.

4.4.5 Multiple Inverters

SUNON12 supports parallel operation of up to six inverters. Before and after connecting the system, refer to the Multiple Inverters wiring diagram to ensure all connections are correctly and securely made.

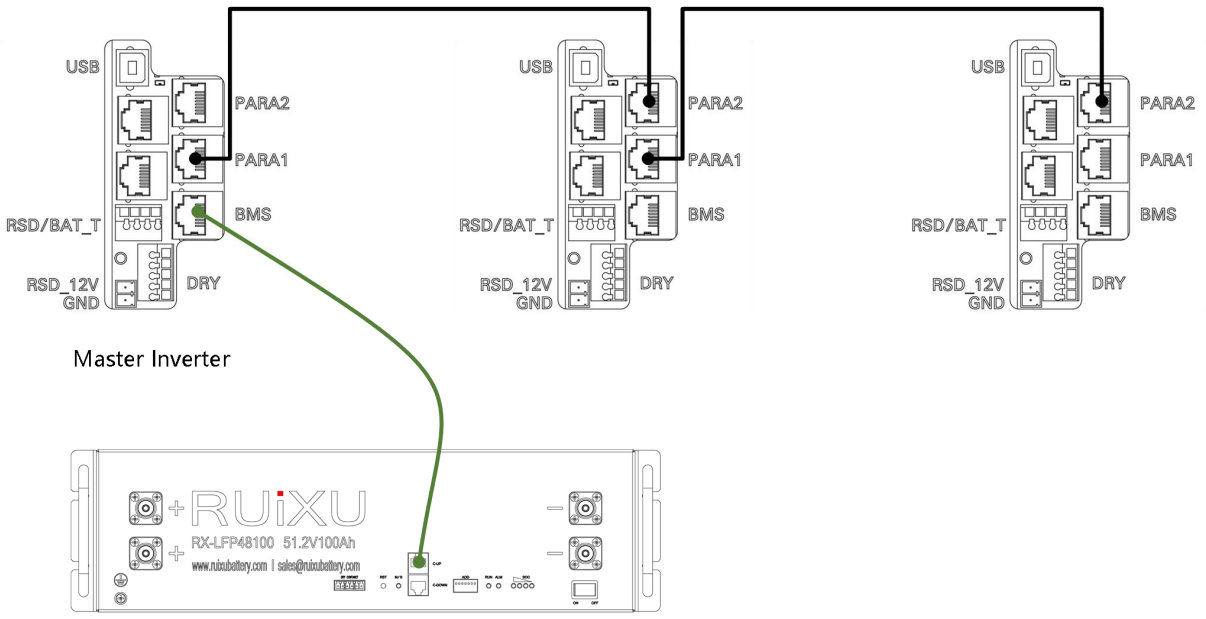
Cable Installation:

- PV wiring: For every inverter, each and every PV input must be matched to an independent and unique photovoltaic system. The RSD only needs to be connected to the master inverter.
- Multiple Inverters with Parallel Battery Banks: When multiple inverters are connected in parallel with multiple battery banks, the system should be designed to ensure that current is drawn evenly from each battery and distributed evenly among all inverters.It is recommended to connect all battery banks to a common busbar, and then connect each inverter to the busbar using equal-length positive and negative battery cables. This helps ensure balanced current sharing among the inverters.

- AC IN/OUT wiring: Refer to the wiring diagram for proper cable connections. All cables connecting the inverters to the service entrance, panel, busbar, etc., must be of equal length and the same wire gauge.

Inverter Parallel Communication Connection:

PARA_1 and PARA_2: Multi-inverter parallel communication ports. Use standard Ethernet cables（Cat 5e or higher） to connect the PARA_1 port of one inverter to the PARA_2 port of the next inverter, or PARA_2 to PARA_1 of the next inverter. However, PARA_1-to-PARA_1 or PARA_2-to-PARA_2 connections between two inverters are not permitted.



After completing the communication wiring between the inverters, assign a unique ID to each inverter in sequential order. For configuration instructions, refer to **Section 5.4.4.1.** The inverter assigned ID 1 operates as the master inverter.

When communicating with lithium-ion batteries, only the master battery and the master inverter need to be connected through the communication interface. No communication connection is required between the batteries and the slave inverters.

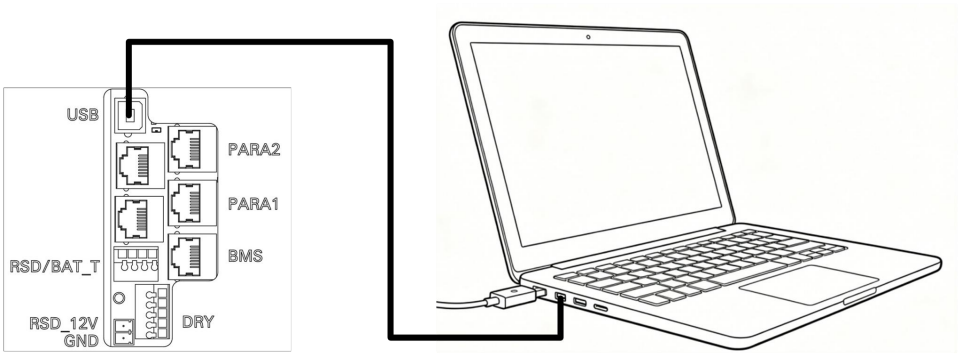
⚠ *DANGER*

- When adding or removing inverter units in a parallel system, all power switches must be turned off before performing any wiring operations. Before energizing the system, verify that all connections are correct to prevent abnormal operation of the parallel system due to wiring errors.

4.4.6 Communication Connections

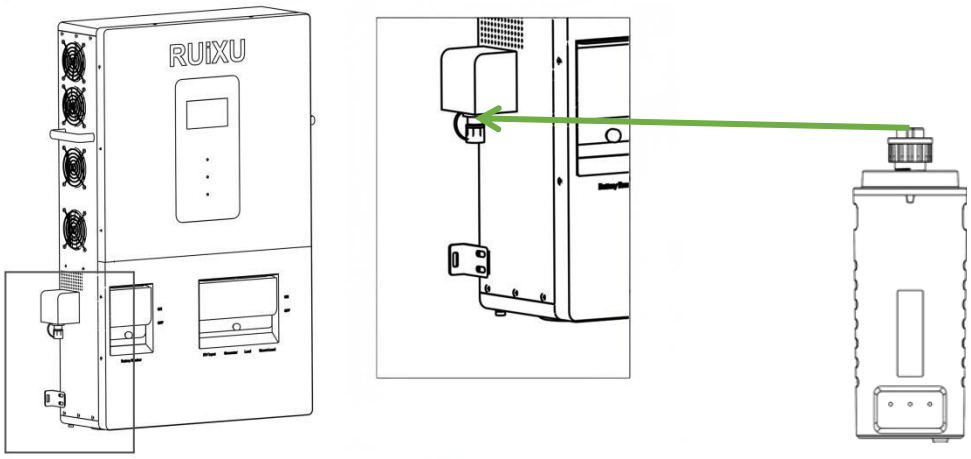
1. USB port

When necessary, users can use software to read and modify inverter parameters and upgrade the inverter's firmware via the port. When connecting to a computer, it is recommended to disconnect the connections between the inverter and the Wi-Fi Monitoring Module, as well as the communication connection between the inverter and the battery, to avoid interference with the communication. To use this port, you should install the corresponding "USB-to-serial chip CH340T driver" in the computer.



2. WIFI port

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



5. Operation

5.1. Startup

Step 1: Close the battery circuit breaker, and open all other circuit breakers.

Step 2: Close the grid-side circuit breaker.

Step 3: Turn on the DC switch on the left side of the inverter.

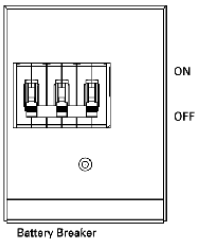
Step 4: Turn on the inverter power switch on the battery. For details, please refer to the battery user manual.

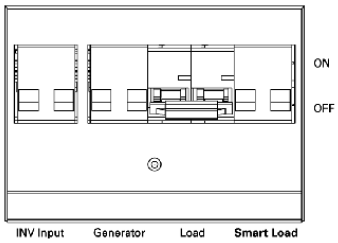
Step 5: Press the power button on the right side of the inverter.

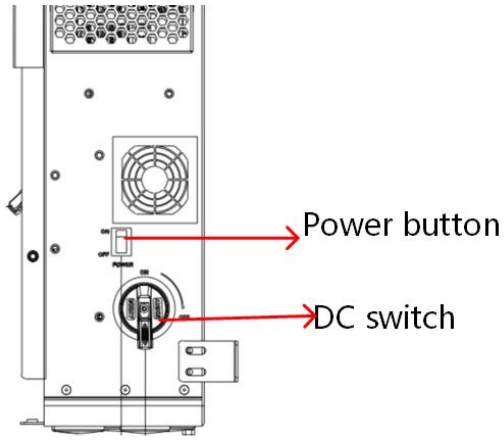
Step 6: Check the LED indicator status on the inverter panel to confirm normal operation. (Note: A fault alarm may also occur if the settings are incorrect.) If any issues arise, troubleshoot until the inverter operates normally.

Step 7: Close the remaining circuit breakers to start using the inverter.

For parallel inverter systems, start the master inverter first.







5.2 Shutdown

Step 1: Press the ON/OFF button on the right side of the inverter to turn it off.

Step 2: Turn off the DC switch.

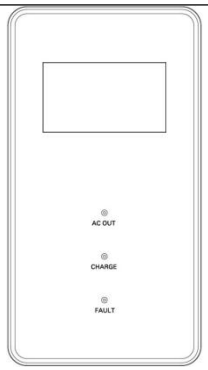
Step 3: Turn off the battery switch and the load switch.

Step 4: Open the grid-side circuit breaker.

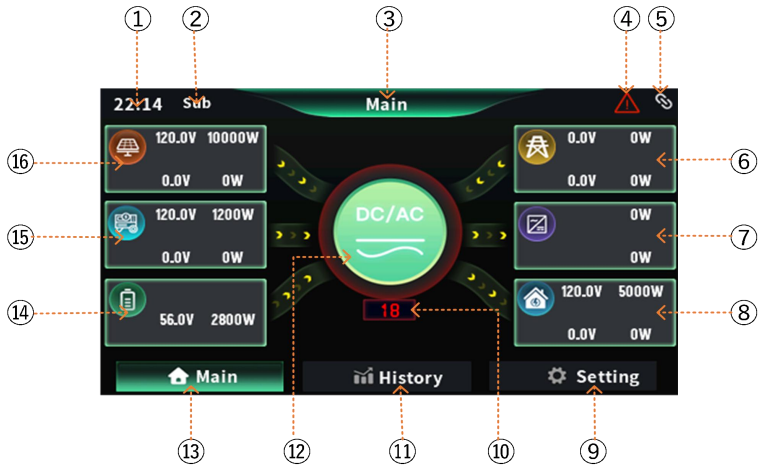
In a parallel inverter system, power off the slave inverters first.

5.3 Operation and Display Panel

5.3 .1 LED Indicator Description

	AC OUT	Output Indicator (Green): Flashes to indicate AC output is active
	CHARGE	Charging Indicator (Yellow): Flashes during charging.
	FAULT	Fault Indicator (Red): Lights up when a fault occurs. It will either remain steadily on or flash, indicating the severity level of the fault.

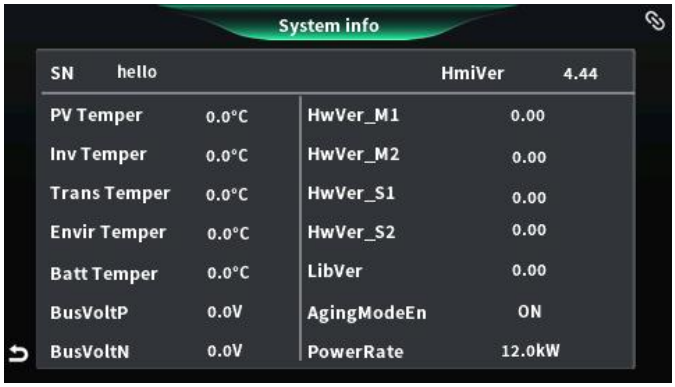
5.3 .2 LCD Display



①	Time	⑨	Setting
②	Parallel Mode Tag	⑩	Alarm Code
③	Page Selection Note	⑪	Historical data
④	Alert Indicator	⑫	System information
⑤	LCD Communication Indicator	⑬	Main
⑥	AC input parameters	⑭	Battery parameters
⑦	Normal Load	⑮	Generator parameters
⑧	Total Output Load	⑯	PV (PV) parameters

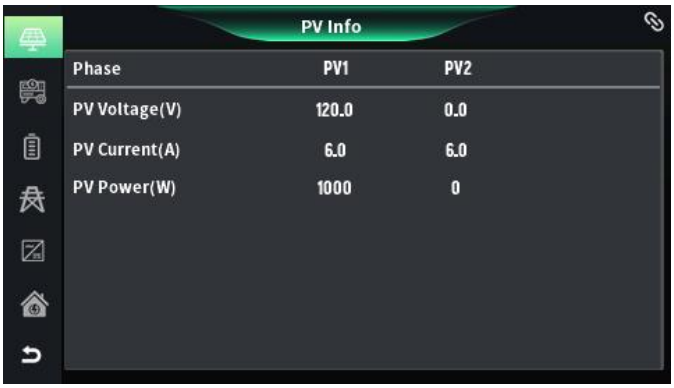
5.3 .3 Page Overview

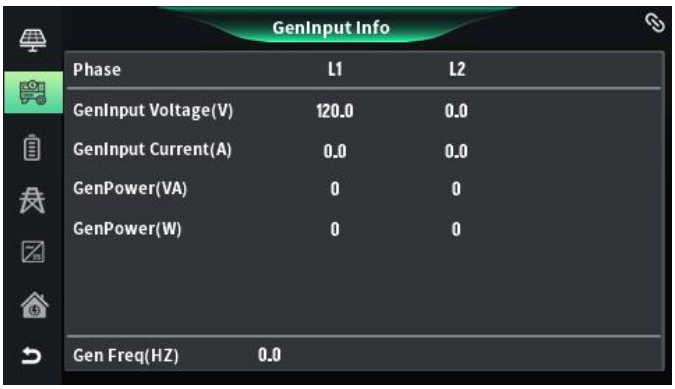
1. Main page:



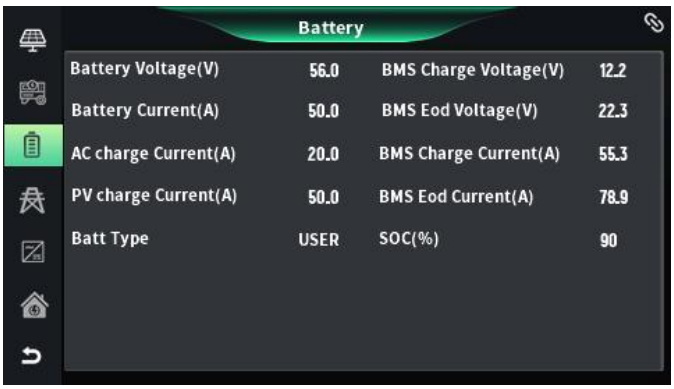
The main page displays energy-related data for each system module. Click the central DC/AC icon to view system information. Click the corresponding module icon to view detailed information for that module.

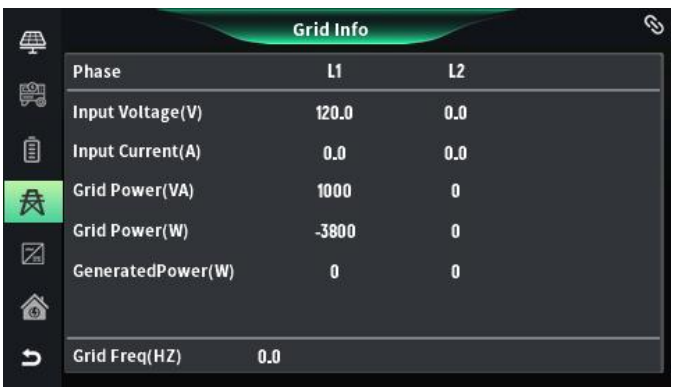
2. PV and GEN Information:



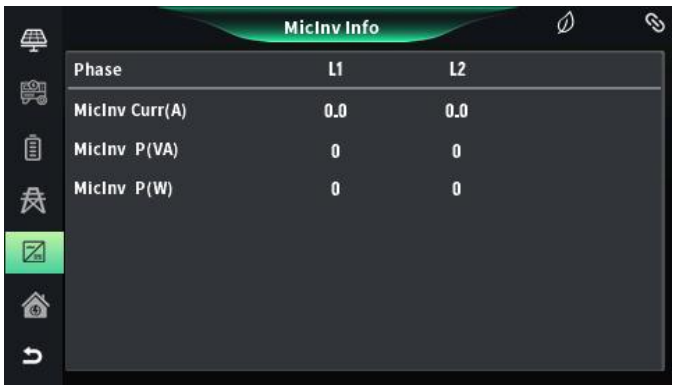


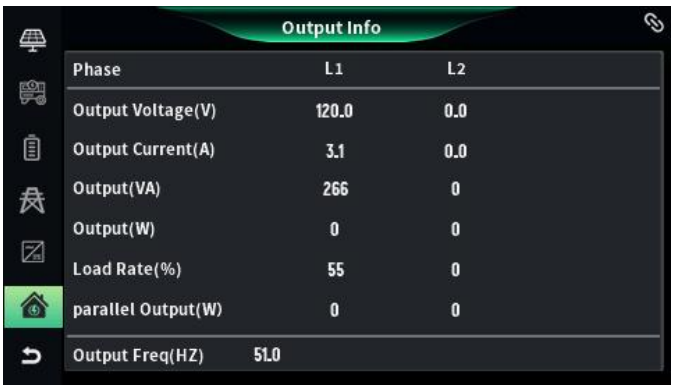
3. Battery and Grid Information:





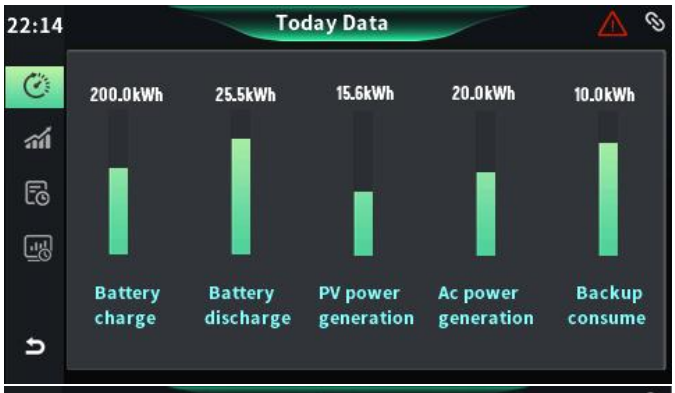
4. Smart Load or Micro-Inverter and Load Information:





5. History page:

Click History to enter the history data and records page. There are four tabs: Daily Data, Accumulation, Setting log, and Fault log.



6. Setting page

Click Setting to enter the settings interface. On the settings page, click the corresponding module to access its settings.

5.4. Parameter Settings

5.4.1. Overview

The settings page has six modules in total:

- Battery Settings Module: Configure battery-related parameters
- AC Settings: Configure AC input (grid, GEN, AC-coupled PV inverter) and AC output (backup load, smart load) related settings
- Advanced Settings: Configure parallel operation, AC phase settings, and related protection thresholds

The above three items are highly hardware-related. Once configured, they generally do not require significant changes later.

- Other Settings: System time, interface language, buzzer sound, display brightness. Power control, device reboot, factory reset.
- EMS Settings: The inverter Energy Management System. Here you can set the power source for load output (grid, battery, or a combination based on control logic), as well as the power source for battery charging (PV, grid, or a combination based on control logic).
- Quick Setup: The inverter comes with many default parameters pre-configured for the local market. Quick Setup includes essential EMS and battery settings, allowing customers to quickly get the system up and running.

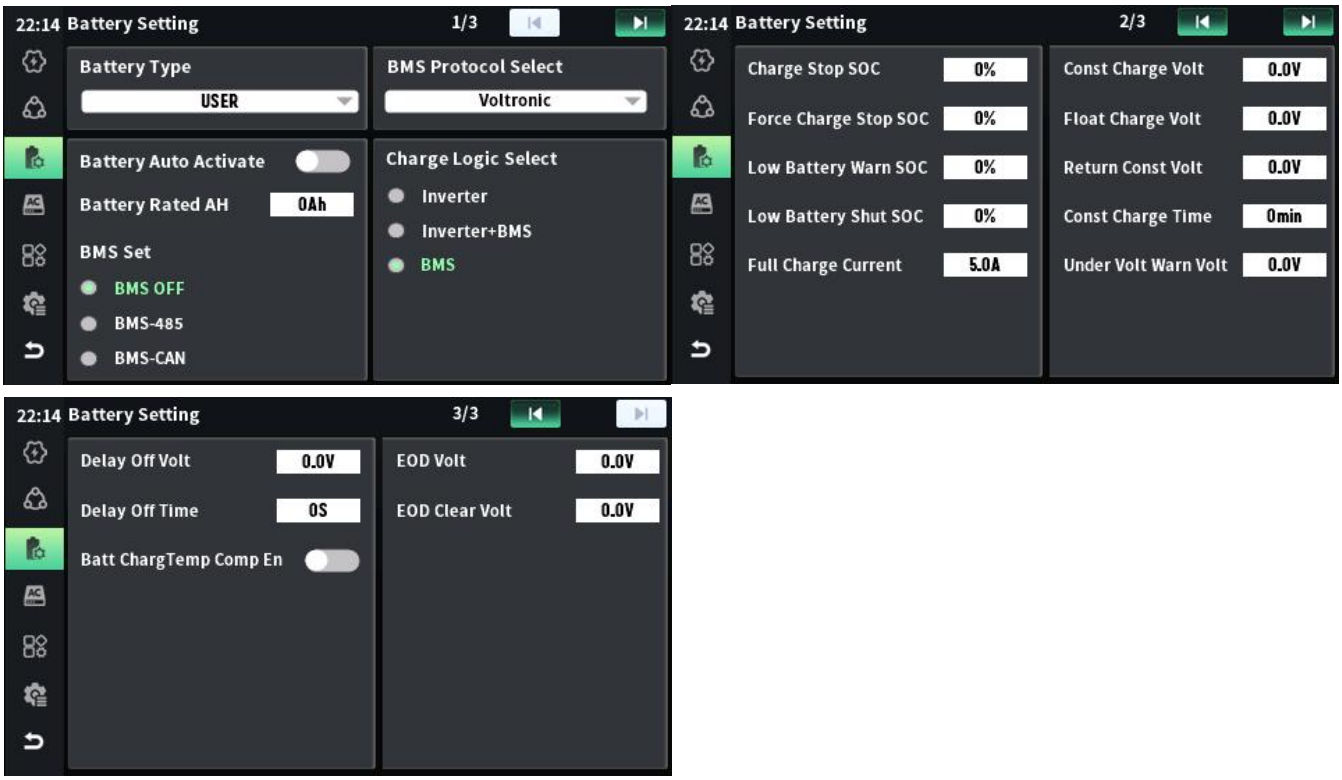
5.4.2.Battery Settings

For lithium-ion batteries, if the battery enters protection mode, a pulse current is required to deactivate the protection. We need to set the parameter "**Battery auto activate**" to Enabled; this allows the inverter to send pulse currents at regular intervals to ensure no lithium-ion batteries in protection mode are missed. For lead-acid batteries, this parameter can be set to Disabled.

Most lithium-ion batteries come with a communication function for inverters. The battery's BMS (Battery Management System) sends battery status information and charge-discharge

limits (voltage and current) to the inverter, which adjusts the charging or discharging voltage and current accordingly.

For lead-acid batteries and a small number of lithium-ion batteries without inverter communication capability, charge-discharge limits need to be set directly on the inverter.

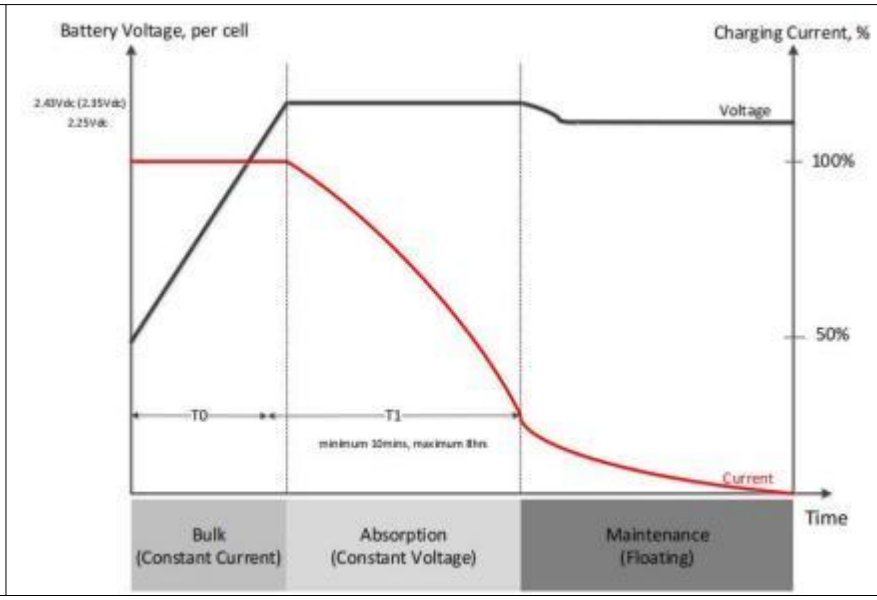


5.4.2.1 Battery Settings Without Communication Function

- Set "**BMS Select**" to "**OFF**" to disable communication between the inverter and the battery.
- In the "**Battery Type**" menu, select the battery type that matches the battery actually installed on site.
- Once a battery type is selected, the device will automatically synchronize and apply the corresponding limit parameters. Please refer to the table below for the parameter mapping. Some parameters can be fine-tuned as needed. However, for standard operating conditions, it is recommended to use the default values provided in the table without modification.
- If USER (Custom) mode is selected, all limit parameters can be manually configured.

Battery Type parameter	User-defined (User)	Sealed lead acid battery (SLD)	Colloidal lead acid battery (GEL)	Vented lead acid battery (FLD)	Lithium iron phosphate battery (LF16)	Lithium iron phosphate battery (LF15)
Const (Boost) Charge Volt	40 ~60V (Adjustable)	57.6V	56.8V	58.4V	57.6V (Adjustable)	53.2V (Adjustable)
Float Charge Volt	40 ~60V (Adjustable)	55.2V	55.2V	55.2V	57.6V (Adjustable)	53.2V (Adjustable)
Return const Volt	52V (Adjustable)	52V (Adjustable)	52V (Adjustable)	52V (Adjustable)	53.0V (Adjustable)	50.4V (Adjustable)
Const Charge Time	10 ~600min (Adjustable)	120 min	120 min	120 min	120 min	120 min
Under Volt warn Volt	40 ~60V (Adjustable)	44V	44V	44V	47.2V (Adjustable)	46.4V (Adjustable)
Delay off volt	40 ~60V (Adjustable)	42V (Adjustable)	42V (Adjustable)	42V (Adjustable)	46.4 (Adjustable)	45.6V (Adjustable)
Delay Off time	1 ~30s (Adjustable)	5s	5s	5s	30s (Adjustable)	30s (Adjustable)
EOD voltage (immediately off discharge)	40 ~60V (Adjustable)	40V	40V	40V	44.4V (Adjustable)	43.6V (Adjustable)
EOD voltage (Over discharge recovery)	52V (Adjustable)	52V (Adjustable)	52V (Adjustable)	52V (Adjustable)	51.2V (Adjustable)	49.6V (Adjustable)

In non-communication mode, the inverter charges the battery as shown in the figure below. When the current reaches the "Full charge current" (Fully charging judgment current), the inverter will deem the battery fully charged. The default value is 3A and can be adjusted as needed, but shall not be set lower than 2A.

Charging Curve	

5.4.2.2 Battery Settings for Communication-enabled Batteries

1. Communication Setup

Enable communication between the inverter and the battery by configuring these settings:

- **BMS Select**:Set to "**485-BMS**"or "**CAN-BMS**", matching your battery's communication method.
- **BMS Protocol**:In the "**BMS protocol setting**" menu, select the protocol specified by your battery manufacturer.

2. Charging Current Control

The charging current is managed by both the inverter setting and the BMS. Select the desired control mode in the "**Charge Logic Select**"menu.

- **BMS** : The maximum charging current of the battery is limited according to the current limit value provided by the BMS.
- **Inverter**:The maximum charging current of the battery is limited according to the value set on the inverter.
- **BMS+Inverter**:The maximum charging current will be the lowerof the two values provided by the BMS and the inverter.

3. Key SOC (State of Charge) Parameters

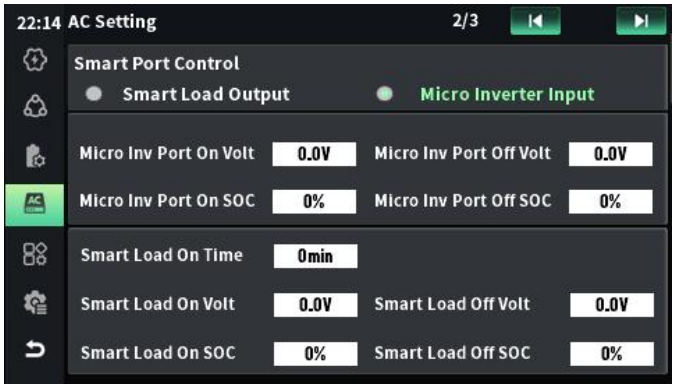
- Charge Cut-off SOC ("**Charge Stop SOC**"):
  Default:100%.
  Recommendation:Maintain the default 100% setting to allow the BMS to perform necessary SOC calibration.
- Discharge Cut-off SOC ("**Low Battery Shut SOC**"):
  Purpose:Defines the battery level that triggers BMS protection (discharge stop and forced charging)*.
  Adjustment:A higher value can prevent forced charging but may reduce protection.
- Exit Forced Charging SOC ("**Force Charge Stop SOC**"):
  Purpose:Sets the SOC level at which the inverter stops the forced charging.
  Use Case:For large-capacity systems, set a lower value to avoid charging to the BMS's preset high level.

> ***Note**: Forced charging is a BMS protection function to prevent battery damage from deep discharge. After the BMS sends a forced charging signal to the inverter, if the inverter is connected to the grid, it will use grid power to charge the battery until the battery's SOC recovers to the level where the BMS cancels the forced charging signal, or until the inverter's "SOC exit forced charging" value is reached.*

4. alarm

- Low Battery alarm:A warning is issued (via LED and a mutable buzzer).
- alarm Threshold:Adjusted via "**Low Battery Warn SOC**", typically set about 5% higher than the "SOC discharge off" value.

5.4.3 AC settings



5.4.3.1 Voltage and Frequency Settings

- **Output Volt Set**
  Selectable output voltages: 100Vac / 105Vac / 110Vac / 120Vac / 127Vac. After modifying the voltage, the rated output power will be derated according to the following formula: *Actual Rated Power = Nominal Rated Power × (Set Voltage ÷ 120)*. Ensure the set voltage matches the nominal voltage of the load to prevent abnormal operation.
- **Output Freq Set**
  Two fixed frequencies are available: 50Hz / 60Hz. When connected to the utility grid, the output frequency will automatically synchronize with the grid frequency without manual adjustment. During off-grid battery-powered operation, the output frequency will run at the manually set value. Under the 120Vac output setting, the default off-grid frequency is 60Hz.
- Grid Input Range Selection
  - UPS default：Auto-detection when Grid is connected: voltage range 90–140Vac (when system voltage is 100V/105V, minimum input voltage is limited to 85V); frequency range: 47–55Hz (for 50Hz); 57–65Hz (for 60Hz)."
  - 2.Generator：Auto-detection enable when diesel generator is connected: voltage range 90–140VAC; frequency range 40–70Hz."
  - APL：User-enabled APL: for both grid and generator, voltage range 85–140Vac; frequency range 40–70Hz."

5.4.3.2 Generator Control Parameters

- **Max Gen Input Current**:
  Sets the maximum allowable current from the diesel generator to limit generator charging power and protect internal circuits.
- **Gen Boost Enable**:
  Toggle switch for the generator low-voltage boost function. Turn ON when the generator output voltage/power is insufficient.
- **Gen Charge Start/Stop SOC**:
  In battery communication mode (BMS-485 / BMS-CAN), when the battery SOC drops below the start SOC threshold, the inverter uses the generator control relay to start the generator. Once the SOC rises to the stop SOC threshold, the inverter uses the same relay to shut down the generator
- **Gen Start/Stop Voltage**:
  Generator voltage trigger values in non-BMS communication mode (BMS OFF). When the generator voltage falls below the Start Voltage, the inverter activates the generator via the control relay. When the voltage exceeds the Stop Voltage, the inverter shuts down the generator via the control relay. *(Note: The original text stated "control generator to generate" for the stop condition; this has been corrected to "shuts down the generator" based on logical context).*

5.4.3.3 Smart Port Function Management

The smart AC port supports two mutually exclusive operating modes, each with independent voltage/SOC threshold parameters.

- **Mode Selection: Smart Load Output / Micro-Inverter Input**
  Only one mode can be active at a time. Select **"Micro-Inverter Input"** if connecting a solar micro-inverter to this port for PV feed-in. Select **"Smart Load Output"** if using this port as a controlled power supply for critical household loads.
- **Micro-Inverter Input Parameters**
  - **Micro Inv Port On/Off Volt**: In non-BMS communication mode (BMS OFF), the port opens to accept micro-inverter power when the battery voltage drops below the On Voltage, and disconnects the input when the voltage rises above the Off Voltage.
  - **Micro Inv Port On/Off SOC**: Battery SOC control points. The port allows micro-inverter input when the battery SOC is above the On SOC, and closes to stop PV input when the SOC drops below the Off SOC.

- **Smart Load Output Parameters**
  - **Smart Load On Time**: The delay (in minutes) before the load is powered on after the trigger conditions are met.
  - **Smart Load On/Off Volt**: In non-BMS communication mode (BMS OFF), controls the load power supply based on battery voltage. Output turns ON when the voltage reaches the On Voltage, and cuts OFF when it drops to the Off Voltage.
  - **Smart Load On/Off SOC**: In BMS communication mode (BMS-485/BMS-CAN), controls the load power supply based on battery SOC. Powers the smart load when SOC ≥ On SOC, and stops power supply when SOC ≤ Off SOC.

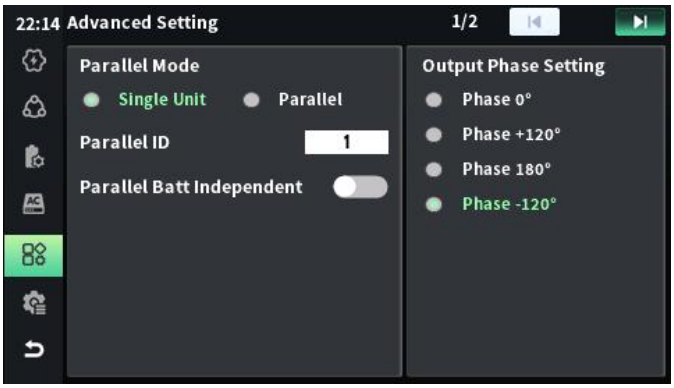
5.4.3.4 Other Function Settings

- **Grid 0 Power Comp**: Anti-backfeed power compensation function, defaulted to 0W. This feature prevents power from feeding back into the utility grid.
- **N Line Ground / N-PE Connection**: Toggle option for connecting the Neutral (N) line to the Protective Earth (PE).
  - **Disabled**: The inverter's internal Neutral (N) is never connected to PE (G) in any operating mode.
  - **Enabled**: In off-grid mode, the inverter internally connects N to PE (G) automatically. Once utility bypass input becomes available, the N-PE (G) connection is immediately disconnected.
- **Overload Auto Restart**: Overload auto-restart switch, enabled by default. If shutdown occurs due to an overload, the inverter will automatically restore output after a 3-minute delay. If 5 auto-restarts occur within 30 minutes, this function will be locked and require manual reset. When disabled, the inverter will not auto-recover after an overload shutdown; the user must remove the overloaded devices and restart manually.
- **Motor DriveOpt Enable**: Inductive motor load optimization switch. Enable this feature **only** when motor-type loads are connected to the output to suppress motor starting surge currents and improve adaptability to inductive loads. Keep this disabled for standard resistive loads.

5.4.4 Advanced Parameter Settings

NOTICE

IMPORTANT PREREQUISITE: All parameters on this section can **only** be modified when the inverter is in **Standby** mode(**Turn off the inverter power switch**).



5.4.4.1 Parallel Mode Settings

- **.Parallel Mode Selection**

  The factory default setting is **Single**. Select Single mode only when a single inverter is operating independently. For multi-unit single-phase parallel operation, select **PAL** mode. Please refer to Chapter 8.3 (Wiring Diagrams) in this manual for relevant wiring requirements.

- **Communication Address (Parallel ID)**

  The factory default value is

  Parallel Operation: Device addresses must be set between **1 and 6**, and IDs within the same parallel system must be unique. The system can automatically assign addresses during the initial power-up.

- **Independent Battery Access Setting**

  This function is disabled (**Disable**) by default. When disabled, all battery packs are connected in parallel to supply power to the inverter collectively.

  When enabled (**Enable**), battery packs are no longer paralleled; each individual battery pack corresponds to and connects exclusively to a single inverter (including communication lines).

5.4.4.2 Output Phase Setting

- **Phase 0°**: L1 and L2 are in phase. Select this option when the inverter input/output is configured as single-phase 120V. Please refer to Chapter 8.3 (Wiring Diagrams) for the corresponding wiring diagram.
- **Split 180°**: Default setting. L1 and L2 are out of phase (180° apart). Select this option when the inverter input/output is configured as split-phase 240V. Please refer to Chapter 8.3 (Wiring Diagrams) for the corresponding wiring diagram.
- **Split -120° & Split 120°**: Select this option when configuring three-phase output (Note: Three-phase configuration is currently not supported).

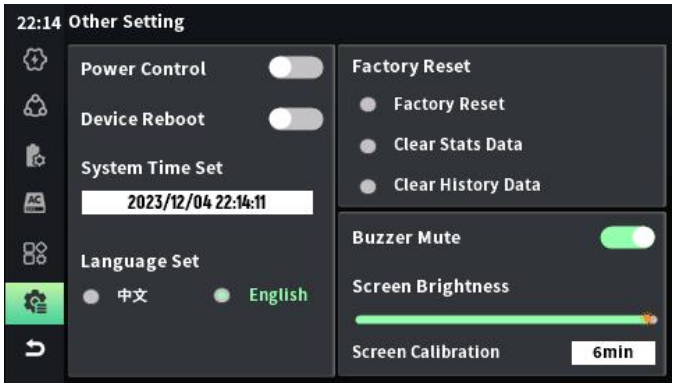
5.4.4.3 PV Safety Protection

- **Insulation Enable**
  Toggle switch for PV insulation monitoring.
- **Insul Low Level**
  Default value: **15 kΩ**. Setting range: **0–3 MΩ**.
  The MPPT will operate only if the inverter detects that the PV grounding impedance is above the set threshold. *(Note: Corrected from "below" to "above" based on standard electrical safety logic).*
- **AFCI Enable**
  Disabled by default.
  AFCI Level: Default is Level 0.
  Functionality: When enabled, if the inverter detects a PV arc fault, it will immediately cut off the RSD_12V power supply and shut down the MPPT system.

5.4.4.4 Battery Discharge Protection

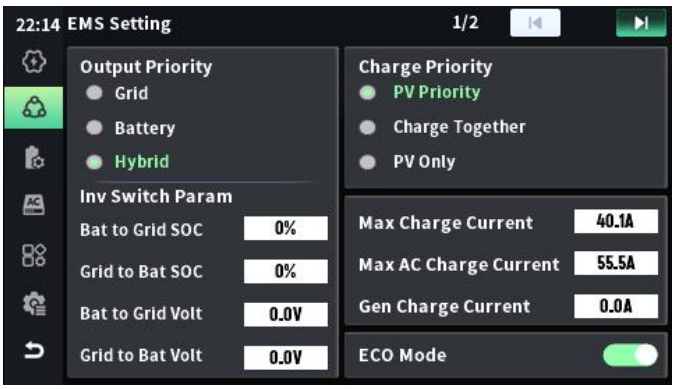
- **Hybrid Discharge A(AC charger+PV charger)**
  Default value: **272A**. Setting range: **0–272A**.
-

5.4.5 Other Settings



- **Power Control**: Controls the inverter to turn off the AC output.
- **Device Reboot**: Restarts the inverter.
- **System Time Set**: Sets the current system time.
- **Language Set**: Selects the display language (Chinese or English).
- **Factory Reset**: Restores the system to factory default settings, clears statistical data, and clears historical data.
- **Buzzer Mute**: Toggles the inverter's buzzer on or off.
- **Screen Brightness**: Adjusts the brightness of the display screen.
- **Screen Bright Times**: Sets the screen timeout duration. The screen will automatically turn off if no operations are performed within the specified interval.

5.4.6 EMS settings



5.4.6.1 Output Energy Source Priority

Whenever the inverter outputs AC current, it defaults to prioritizing PV power (the most economical option). If PV power is insufficient to meet the output demand, the system will draw power from either the grid or the battery. Customers can customize this behavior based on their specific circumstances (e.g., time-of-use electricity rates and desired backup capacity). The inverter provides three priority settings:

- **Grid Mode**: Prioritizes the grid as the supplementary power source. The battery is only used as a backup when the grid is disconnected.
- **Battery Mode**: Prioritizes the battery as the supplementary power source. The grid is only used as a backup when the battery reaches its protection threshold.
- **Hybrid Mode**: Alternates the priority between the grid and the battery based on switching conditions. When there is a communication connection between the battery and the inverter, SOC thresholds are applied. When connected via non-communication mode, voltage thresholds are applied.

5.4.6.2 Battery Charging Energy Source Priority

The battery can be charged using PV generation or Grid/GEN power. Customers should configure this setting based on actual conditions (e.g., grid electricity pricing).

Charging Modes:

- **PV Priority**: The system prioritizes battery charging with PV energy when sufficient, powering loads with surplus PV; when PV is insufficient, charging remains prioritized while loads switch to the grid supply.
- **Hybrid Charging**: Hybrid PV-Grid Charging Mode prioritizes PV charging. When PV generation is insufficient, the grid provides supplementary charging.
- **Only Solar**: PV-only charging mode that exclusively uses solar power without any grid supplementation.

Charging Current Settings:

- **Max Charge Current**: Default 60A; Setting range: 0–250A.
- **Max AC Charge Current**: Default 120A; Setting range: 0–160A.
- **Gen Charge Current**: Default 60A; Setting range: 0–160A.

5.4.6.3 ECO Mode

Disabled by default.

When ECO mode is enabled, if the load on each phase is < 25W, the inverter will output pulsed voltage after 5 minutes of low-load operation. If the load on any phase exceeds 50W, the inverter will automatically resume normal output.

5.4.6.4 Time-of-Use (TOU) Settings

Users can optimize costs based on varying grid electricity prices throughout the day. The system can be configured to charge the battery using grid power during off-peak (low-price) periods and prioritize discharging the battery during peak (high-price) periods.

- **Timed Grid Charging**

  Disabled by default (Disable / Enable).

  When enabled, the grid charges the battery and supplies the load during user-set charging periods or when the battery voltage is low.

  - ✧ **Slot 1–3 Start Charging Time**: Range: 00:00–23:59.
  - ✧ **Slot 1–3 End Charging Time**: Range: 00:00–23:59.

- **Timed Battery Discharging**

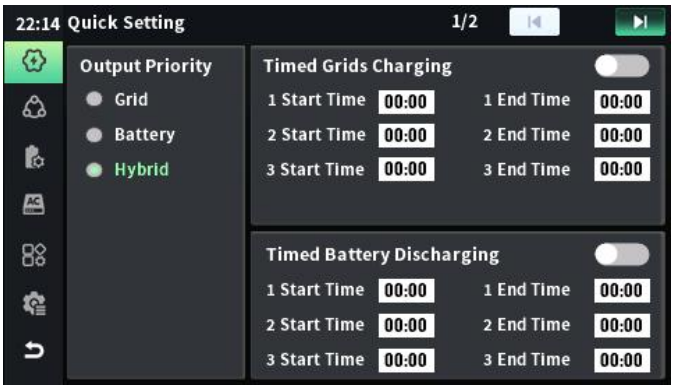
  Disabled by default (Disable / Enable).

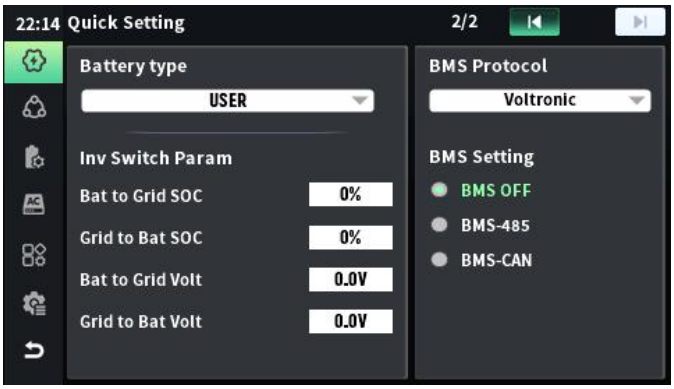
  When enabled, the battery discharges only during user-set discharge periods or when utility power is unavailable.

  - ✧ **Slot 1–3 Start Discharging Time**: Range: 00:00–23:59.
  - ✧ **Slot 1–3 End Discharging Time**: Range: 00:00–23:59

5.4.7 Quick settings

The inverter comes pre-configured with default parameters tailored to the local market. The Quick Setup includes essential EMS and battery settings, allowing customers to quickly get their system up and running.





- **Output Priority**: For details, please refer to the "EMS" settings.
- **Energy Select**: For details, please refer to the "Advanced" settings.
- **Timed Grid Charging & Timed Battery Discharging**: For details, please refer to the "EMS" settings.
- **Battery Type / Inv Switch Param / BMS Protocol / BMS Setting**: For details, please refer to the "Battery" settings.
- **PV Energy Priority**: For details, please refer to the "Advanced" settings.

6. Fault codes and Troubleshooting

6.1. Fault codes

Fault code	Fault name	Turn off the output	Description
【01】	Battery under voltage warning	No	If the battery voltage is lower than “battery under voltage alarm” setting, the battery was in the undervoltage state.
【02】	Battery under voltage protection	Yes	When the battery voltage was low, turn off the output to stop the battery discharge protection.
【03】	Average battery discharge current over current protection	Yes	If the average battery discharge current exceeds the maximum input battery current for 1 minute, turn off the output to stop the battery discharge protection.
【04】	Instantaneous battery discharge over current protection	Yes	If the instantaneous value of the battery discharge current is greater than the maximum instantaneous value of the device, turn off the output to stop the battery discharge protection.
【05】	Battery not connected	Yes	Battery not connected warning.
【06】	Battery over voltage	Yes	When the selected battery type or set battery voltage is exceeded, turn off the output to stop the battery charging protection.
【07】	BMS low battery talarm	No	BMS alarm low battery （Set BMS enablement to work）
【08】	BMS low battery protection	Yes	The BMS battery capacity rate is low. Disable the output to stop the battery discharge protection. (Set BMS enablement to work)
【09】	Bypass overload protection	Yes	If the grid is overloaded, turn off the AC output and stop the grid charging.
【10】	Battery output overload protection	Yes	If the battery discharge inverter is overloaded, turn off AC output and stop battery discharge protection.
【11】	Battery inverter output short circuit	Yes	If the AC output of the battery inverter discharge is short circuiting, turn off the AC output and stop the battery discharge protection.

【12】	The AC output of the battery inverter over circuit	Yes	If the AC output of the battery inverter discharge is over circuit, turn off the AC output and stop the battery discharge protection.
【13】	The DC component of the battery inverter voltage is abnormal	Yes	If the DC component of the battery inverter voltage is abnormal, turn off the AC output and stop the battery discharge protection.
【14】	Bus over voltage software sampling protection	Yes	Internal battery boost, boost bus voltage overvoltage software protection, turn off AC output and charge.
【15】	Bus over voltage hardware sampling protection	Yes	Internal battery boost, boost bus voltage overvoltage hardware protection, turn off AC output output and charge.
【16】	Bus under voltage protection	Yes	Internal battery boost, boost bus voltage undervoltage protection, turn off AC output output and charge.
【17】	Bus short circuit protection	Yes	Internal battery boost, boost bus voltage short-circuit protection, turn off AC output output and charge.
【18】	The PV input voltage is over voltage	Yes	The solar input voltage exceeds the maximum allowable input voltage protection.
【19】	PV Over Curr Sw	Yes	Solar charging overcurrent software protection, turn off solar charging.
【20】	PV over curr Hw	No	Solar charging overcurrent hardware protection, turn off solar charging.
【21】	PV ISO Low	Yes	The PV insulation impedance is low, and the inverter is shutdown.
【22】	The PV heat sink is overheated. Procedure	No	If the temperature of the solar charging radiator is too high, turn off the solar charging.
【23】	The AC heat sink is overheated. Procedure	Yes	If the temperature of the heat sink is too high, turn off the AC charging or battery inverter discharge.
【24】	The temperature of the main transformer is overheated	Yes	If the internal main transformer temperature is too high, turn off the AC charging or battery inverter discharge.
【25】	**Ac input** relay short	Yes	Ac input relay short-circuit protection prevents the

	circuit		inverter AC output from being pumped back into the bypass AC input,the inverter is turned off.
【26】	Output relay short	Yes	Output relay short circuit,
【27】	Fan failure	Yes	If the fan is blocked or fails, disable the inverter output and charging functions.
【28】	EEPROM	Yes	The program is not activated.
【29】	SPI Comm Err	Yes	Master chip and from the chip communication error.
【30】	Type detectionerror	Yes	The model is not set before delivery, and the model identification is wrong.
【31】	Bus Soft Start Fail	Yes	Inverter busbar soft start failed.
【32】	LeakageCurr Over	Yes	The leakage current sensor has a sampling exception.
【33】	Parallel control can communication is faulty	Yes	In parallel mode, CAN communication is lost, AC output and charging are turned off.
【34】	Parallel control can communication is faulty	Yes	In parallel mode, CAN communication is lost, AC output and charging are turned off.
【35】	Parallel mode is faulty	Yes	In parallel mode, the system has inconsistent machine parallel mode **[31]** Settings.
【36】	Parallel current sharing fault	Yes	In parallel mode, the AC output of the battery inverter differs greatly from the non-uniform current output of each machine. Turn off the AC output and charge.
【37】	Parallel ID setting error	Yes	In parallel mode, the RS485 addresses repeatedly conflict. The fault stops the AC output and charge. After the host automatically reallocates the address, the fault is cleared and the host enters the parallel.
【38】	Inconsistent Battery in parallel mode	Yes	In parallel mode, the battery voltage input of each machine varies greatly.
【39】	Inconsistent AC input source in parallel mode	Yes	Inconsistent AC input source in parallel mode
【40】	The parallel mode synchronization fails	Yes	Parallel mode, hardware synchronization signal reception failure, stop parallel and AC output.

【41】	Inconsistent system firmware version in parallel mode	Yes	If the program version is inconsistent in the parallel system, stop the parallel and AC output.
【42】	The parallel communication cable is faulty	Yes	The parallel communication line is faulty. Stop the parallel and AC output.
【43】	Serial number error	Yes	The serial number is not set before the factory, or the factory serial number is set repeatedly in the system.
【44】	Batt cap not enough	Yes	The battery voltage of the connected machine is low
【45】	Aux DSP abnormal	Yes	Contact the manufacturer
【46】	Bus unbalance	Yes	The split camera has an imbalance between the positive and negative busbars.
【48】	Grid phase err	No	Check the grid phase
【49】	BMS communication error	No	Check whether the communication line is connected correctly and whether **BMS** is set to the corresponding lithium battery communication protocol
【50】	BMS other alarm	No	Check the BMS fault type and troubleshoot lithium battery problems
【51】	BMS battery over temperature alarm	No	BMS alarm lithium battery over temperature
【52】	BMS battery over current alarm	No	BMS alarm lithium battery over current
【53】	BMS battery over voltage alarm	No	BMS alarm lithium battery over voltage
【54】	BMS battery low voltage alarm	No	BMS alarm lithium battery low voltage
【55】	BMS battery low temperature alarm	No	BMS alarm lithium battery low temperature
【73】	DC AFCI Abnormal	No	PV Arc Fault Detected. Check Installation & Wiring.
【77】	Grid Circuit Open	No	Check if the AC circuit breaker is closed. If open, close the breaker and restart the inverter to clear the fault.

6.2. TroubleShootings

Fault codes	Faults	Handling measures
/	No display on the screen	Check if the battery air switch or the PV air switch has been closed; if the switch is in the "ON" state; press any button on the screen to exit the screen sleep mode.
【06】	Rechargeable battery overvoltage protection	Measure if the battery voltage exceeds rated 。 If it exceeds, the battery needs to be discharged until the voltage is below the overvoltage recovery point of the battery.
【01】【02】	Battery under voltage protection	Charge the battery until it returns to the low voltage disconnection recovery voltage.
【27】	Fan failure	Check if the fan is not turning or blocked by foreign object.
【22】【23】	Heat sink over temperature protection	When the temperature of the device is cooled below the recovery temperature, normal charge and discharge control is resumed.
【09】【10】	Bypass overload protection, inverter overload protection	● 1.Reduce the use of power equipment; ● 2.Restart the unit to resume load output.
【11】	Inverter short circuit protection	1.Check the load connection carefully and clear the short-circuit fault points; 2.Re-power up to resume load output.
【18】	PV overvoltage	Use a multimeter to check if the PV input voltage exceeds the maximum allowable input voltage rated.
【05】	Battery missed alarm	Check if the battery is not connected or if the battery circuit breaker is not closed.
【40】【42】	Parallel connection fault	Check whether the parallel line is not connected well, such as loose or wrong connection.
【37】	Parallel ID setting error	Check whether the setting of parallel ID number is repeated.
【36】	Parallel current sharing fault	Check whether the parallel current sharing line is not connected well, such as loose or wrong connection.

【39】	Inconsistent AC input source in parallel mode	Check whether the parallel AC inputs are from the same input interface. If two of the three phases report that the grid input sources are inconsistent in the three-phase mode, you can try to swap the grid input wiring of any two machines to check whether the grid input phase sequence is inconsistent with the set phase sequence.
【41】	Inconsistent system firmware version in parallel mode	Check whether the software version of each inverter is consistent.

ⓘ NOTICE

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

7. Protection and Maintenance

7.1. Protection Functions

No.	Protections	Description
1	PV current/ power limiting protection	When charging current or power of the PV configured exceeds the PV rated, it will charge at the rated.
2	Nighttime Reverse Current Protection	At night, the battery is prevented from discharging through the PV module because the battery voltage is greater than the voltage of PV module.
3	grid input over voltage protection	When the grid voltage exceeds 140V, the grid charging will be stopped and switched to the inverter mode.
4	grid input under voltage protection	When the grid voltage is lower than or 85V , the grid charging will be stopped and switched to the inverter mode.
5	Battery over voltage protection	When the battery voltage reaches the overvoltage disconnection point, the PV and the grid will be automatically stopped to charge the battery to prevent the battery from being overcharged and damaged.
6	Battery low voltage protection	When the battery voltage reaches the low voltage disconnection point, the battery discharging will be automatically stopped to prevent the battery from being over-discharged and damaged.
7	Load output short circuit protection	When a short circuit fault occurs at the load output terminal for more than 200 milliseconds, the AC output is immediately turned off.
8	Heat sink over temperature protection	When the internal temperature is too high, the all-in-one machine will stop charging and discharging; when the temperature returns to normal, charging and discharging will resume.
9	Overload protection	Output again 3 minutes after an overload protection, and turn the output off after 5 consecutive times of overload protection until the machine is re-powered. For the specific overload level and duration, refer to the technical parameters table in the manual.
10	PV reverse polarity protection	When the PV polarity is reversed, the machine will not be damaged.
11	AC reverse protection	Prevent battery inverter AC current from being reversely input to Bypass.

12	Bypass over current protection	Built-in AC input overcurrent protection circuit breaker.
13	Battery input over current protection	When the discharge output current of the battery is greater than the maximum value and lasts for 1 minute, the AC input would switched to load.
14	Battery input protection	When the battery is reversely connected or the inverter is short-circuited, the battery input fuse in the inverter will blow out to prevent the battery from being damaged or causing a fire.
15	Charge short protection	When the external battery port is short-circuited in the PV or AC charging state, the inverter will protect and stop the output current.
16	CAN communication loss protection	In parallel operation, an alarm will be given when CAN communication is lost.
17	Parallel connection error protection	In parallel operation, the equipment will be protected when the parallel line is lost.
18	Parallel battery voltage difference protection	In parallel operation, the equipment will be protected when the battery connection is inconsistent and the battery voltage is greatly different from that detected by the host.
19	Parallel AC voltage difference protection	In parallel operation, the equipment will be protected when the AC IN input connection is inconsistent.
20	Parallel current sharing fault protection	In parallel operation, the running equipment will be protected when the load difference of each inverter is large due to improper connection of current sharing line or device damage.
21	Synchronization signal fault protection	The equipment will be protected when there is a fault in the guidance signal between parallel buses, causing inconsistent behavior of each inverter.

7.2. Maintenance

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

This manufacturer shall not be liable for damage resulting from:

1. **Improper use or use in improper site.**
2. **Open-circuit voltage of the PV module exceeds the maximum allowable rated voltage.**
3. **Temperature in the operating environment exceeds the limited operating temperature range.**
4. **Disassemble and repair the all-in-one solar charge inverter without permission.**

Force majeure: Damage that occurs in transportation or handling of the all-in-one

⚠ DANGER

Danger of electric shock! When doing the above operations, Disconnect all power sources and discharge all capacitors before servicing., and all capacitors have been discharged, and then check or operate accordingly!

8. Appendix

8.1. Disposal & Recycling

This device should not be disposed as a residential waste. An inverter that has reached the end of its operation life is not required to be returned to your dealer;instead, it must be disposed by an approved collection and recycling facility in your area.

8.2. Warranty

Check the product warranty conditions and terms on the RUiXU website:
http://www.ruixubattery.com

8.3. Contact Support

ZHUHAI RUiXU ELECTRONIC TECHNOLOGY CO., LTD
Address: Factory Blog. 1, No.6 Chuangye N. Rd, Hongqi Town,Jinwan District, Zhuhai, Guangdong, China, P.C. 519000
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8.4. Trademarks

RUiXU is the trademark of ZHUHAI RUiXU ELECTRONIC TECHNOLOGY CO., LTD