



Growatt New Energy

Download
Manual

Shenzhen Growatt New Energy Co., Ltd.

4-13/F, Building A, Sino-German (Europe) Industrial Park,
Hangcheng Blvd, Bao'an District, Shenzhen, China

T +86 755 2747 1942

E service@ginverter.com

W www.ginverter.com

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**PV Hybrid Inverter
(SPE 12000 ES, SPE 10000 ES, SPE 8000 ES)
User Manual**

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1. Information on this Manual

1.1 Validity

This manual is valid for the following devices:

- ▶ SPE 12000 ES
- ▶ SPE 10000 ES
- ▶ SPE 8000 ES

1.2 Scope

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations.

1.3 Target Group

This document is intended for qualified persons and end users. Tasks that do not require any particular qualification can also be performed by end users. Qualified persons must have the following skills:

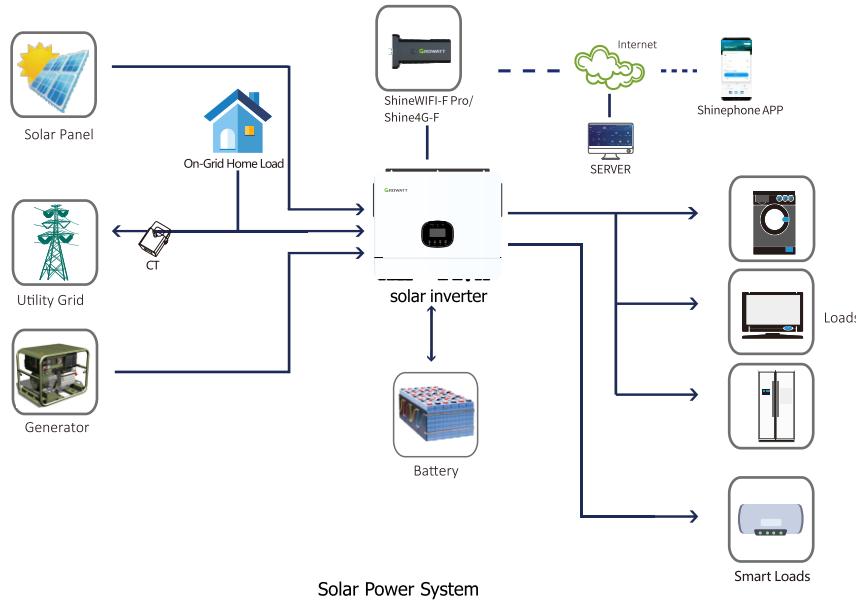
- ▶ Knowledge of how an inverter works and is operated.
- ▶ Training in how to deal with the dangers and risks associated with installing and using electrical devices and installations.
- ▶ Training in the installation and commissioning of electrical devices and installations.
- ▶ Knowledge of the applicable standards and directives.
- ▶ Knowledge of and compliance with this document and all safety information.

1.4 Safety Instructions

 **WARNING:** This chapter contains important safety and operating instructions.
Read and keep this manual for future reference.

1. Before using the unit, read all instructions and cautionary marking on the unit, the batteries and all appropriate sections of this manual. The company has the right not to quality assurance, if not according to the instructions of this manual for installation and cause equipment damage.
2. All the operation and connection please professional electrical or mechanical engineer.
3. All the electrical installation must comply with the local electrical safety standards.
4. When install PV modules in the daytime, installer should cover the PV modules by opaque materials, otherwise it will be dangerous as high terminal voltage of modules in the sunshine.
5. **CAUTION**-To reduce risk of injury, charge only deep-cycle lead-acid type rechargeable batteries and lithium batteries. Other types of batteries may burst, causing personal injury and damage.
6. Please be clear which kind of battery system you want, lithium battery system or lead-acid battery system, if you choose the wrong system, energy storage system can't work normally.
7. **NEVER** charge a frozen battery.
8. Be very cautious when working with metal tools on or around batteries. A potential risk exists to drop a tool to spark or short circuit batteries or other electrical parts and could cause an explosion.
9. For optimum operation of this inverter, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter.
10. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
11. GROUNDING INSTRUCTIONS -This inverter should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
12. **NEVER** cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
13. Make sure the inverter is completely assembled, before the operation.
14. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
15. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
16. This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

2. Product Overview



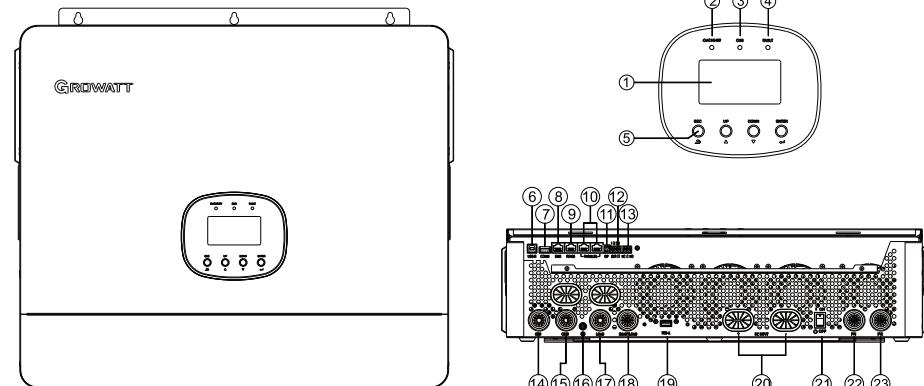
This is a multifunctional PV Hybrid inverter, integrated with a MPPT solar charge controller, a high frequency pure sine wave inverter and a UPS function module in one machine, which is perfect for off grid backup power and self-consumption applications. This inverter can work with or without batteries.

The whole system also need other devices to achieve complete running such as PV modules, generator, or utility grid. Please consult with your system integrator for other possible system architectures depending on your requirements. The WIFI / 4G module is a plug-and-play monitoring device to be installed on the inverter. With this device, users can monitor the status of the PV system from the mobile phone or from the website anytime anywhere.

2.1 Product Features

- ▶ Rated power 8KW to 12KW, power factor 1.
- ▶ 2 strings of MPPT, Max. PV array power 10000watt to 15000watt.
- ▶ MPPT Voltage range 60Vdc-480Vdc, 550Voc.
- ▶ Pure sine wave inverter and MPPT solar charge controller integrated inside.
- ▶ Built-in ATS for automatic grid and generator switching.
- ▶ Able to work with or without battery.
- ▶ With CAN/RS485 for BMS communication.
- ▶ WIFI/4G wireless monitoring(optional).
- ▶ Parallel operation up to 9 unit(only with battery connected).
- ▶ With grid tied function.
- ▶ With dual outputs.
- ▶ With grid peak shaving.
- ▶ With external CT for zero exporting into grid.

2.2 Panel and Port Definitions



Panel operation

| | |
|-----------------------|---------------------|
| 1. LCD display | 2. Status indicator |
| 3. Charging indicator | 4. Fault indicator |
| 5. Function buttons | |

Communication port

| | |
|--|---|
| 6. USB communication port | 19. WiFi / 4G communication port |
| 8. BMS communication port (support CAN/RS485) | 9. RS485 communication port (for expansion) |
| 10. Parallel communication ports | 11.DIP |

Connection port

| | |
|---------------------------|---------------------|
| 14. Generator input | 15. Grid input |
| 16.PE | 17. AC output(main) |
| 18. AC output(smart load) | 20. Battery input |
| 22. PV1 input | 23. PV2 input |

Other

| | |
|-------------------------|-----------------|
| 12. EXT CT | 13. Dry contact |
| 21. Power on/off switch | |

3. Installation Instructions

3.1 Accessory list

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items in the package:

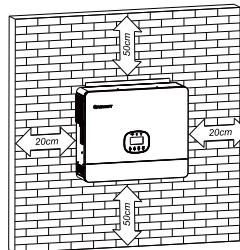
| Part List | | |
|-----------|------------------------------|-----|
| Item | Item Name | Qty |
| A | The unit | 1 |
| B | Communication cable | 1 |
| C | Parallel communication cable | 1 |
| D | R-type terminal | 1 |
| E | O-type terminal | 4 |
| F | User manual | 1 |

A
B
C
D
E
F

3.2 Points for attention

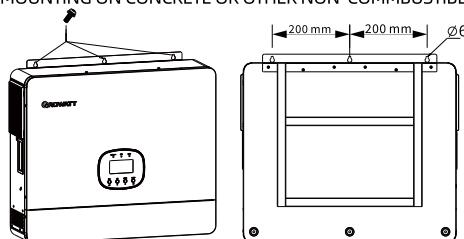
Consider the following points before selecting where to install:

- Install this inverter at eye level in order to allow the LCD display to be read at all times.
- The ambient temperature should be between -10°C and 50°C to ensure optimal operation.
- The recommended installation position is to be adhered to the wall vertically.
- Do not install in too narrow confined space and pay attention to ventilation.
- Be sure to keep other objects and surfaces as shown in the right diagram to guarantee sufficient heat dissipation and to have enough space for removing wires.



⚠️ If the energy storage is installed in areas with salt damage, it will be corroded and may cause fire. Therefore, do not install it outdoors in areas with salt damage. The areas with salt damage are defined as the areas which are not 500m away from shore or will be affected by sea breezes. The areas affected by the sea breezes vary depending on meteorological conditions (e.g. typhoons, monsoons) or topographical conditions (dams, hills).

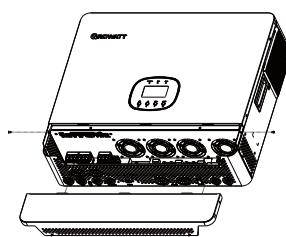
⚠️ SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMMUBSTIBLE SURFACE ONLY.



Install the unit by screwing three screws. It's recommended to use M4 or M5 screws.

Preparation for wiring.

Before connecting all wiring, please take off bottom cover by removing four screws as shown below.



3.3 Battery Connection



WARNING!

- All wiring must be performed by a qualified person.
- Shock Hazard:** Installation must be performed with care due to high battery voltage in series.
- Always disconnect all circuit breakers before making connections to the battery power cable.
- Make sure the battery power cable positive (+) must be connected to battery positive (+), negative (-) must be connected to battery negative (-).
- Do not place anything between the flat part of the inverter terminal and the ring terminal. Otherwise, a short circuit may occur, resulting in overheating and fire.
- Do not apply anti-oxidant substance on the terminals before terminals are connected tightly.

3.3.1 Wiring preparation

- For safety operation and regulation compliance, it's requested to install a separate DC breaker (over-current protector) or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications, however, it's still requested to have DC breaker installed. Please refer to typical amperage in below table as required breaker size.

Recommended DC breaker specification of battery for a single inverter:

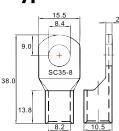
| Model | 1 unit* |
|--------------|--------------|
| SPE 12000 ES | 400A / 60VDC |
| SPE 10000 ES | 350A / 60VDC |
| SPE 8000 ES | 300A / 60VDC |

- It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable and terminal size as below.

Recommended battery cable and terminal size:

| Model | Wire Size | Torque value |
|--------------|-----------|--------------------------|
| SPE 12000 ES | 2 * 2 AWG | 2 * 33.62mm ² |
| SPE 10000 ES | 2 * 2 AWG | 2 * 33.62mm ² |
| SPE 8000 ES | 2 * 3 AWG | 2 * 26.67mm ² |

O-type terminal:



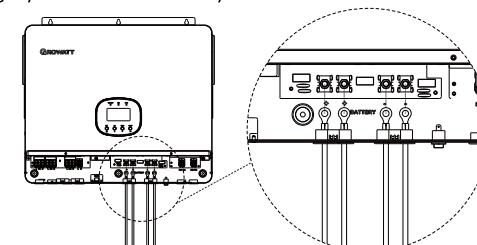
- Battery Module Selection: Choose the appropriate battery according to the actual situation.

| Battery Type | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
|-------------------|------------------------|------------------------|------------------------|
| Lead-acid Battery | 400Ah capacity battery | 300Ah capacity battery | 300Ah capacity battery |
| Lithium Battery | 400Ah capacity battery | 300Ah capacity battery | 300Ah capacity battery |

3.3.2 Battery power cable connection

Please follow below steps to implement battery connection:

- Assemble battery ring terminal based on recommended battery cable and terminal size.
- Connect all battery packs as units requires.
- Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2Nm. Make sure polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.

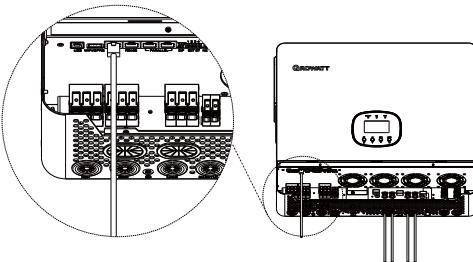


3.3.3 Lithium battery communication cable connection

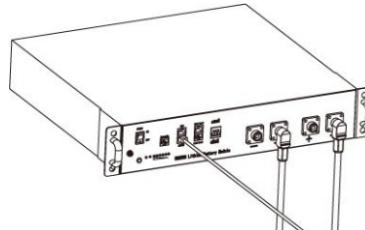
If used with lithium batteries, make sure to connect the BMS communication cable between the battery and the inverter. It is recommended to use lithium batteries that have been tested with our configuration.

Please follow below steps to implement BMS communication cable connection:

1. Connect one end of the battery's communication cable to the inverter's BMS communication port (below left), which supports RS485 or CAN protocols.

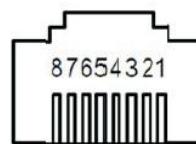


2. The other end of the battery communication cable plugs into the battery communication port (RS485 or CAN).



3. The inverter BMS port pin and RS485 port pin assignment shown as below:

| Pin number | BMS port | RS485 port (for expansion) |
|------------|----------|----------------------------|
| 1 | RS485B | RS485B |
| 2 | RS485A | RS485A |
| 3 | -- | -- |
| 4 | CANH | -- |
| 5 | CANL | -- |
| 6 | -- | -- |
| 7 | -- | -- |
| 8 | -- | -- |



Note: The RS485 port (for expansion) is used for communication expansion and connection to external devices.

Note: In order to ensure the normal communication of lithium battery BMS, please set the battery type as "Li" in program 5, and then LCD will automatically switch to program 36 to select the communication protocol. You can Choose RS485 communication protocol which is from L01 to L50, and you can also choose CAN Communication protocol which is from L51 to L99. (About the specific protocol address of the inverter, please consult the dealer or manufacturer to choose which communication protocol to match the BMS).

3.4 AC Connection



WARNING!

- All wiring must be performed by a qualified personnel.
- Shock Hazard: Be sure that AC power source is disconnected before attempting to wire it to the unit.
- Always disconnect all circuit breakers before making Grid/ GEN/ AC output connection.
- Be sure to connect AC wires with correct polarity. If L and N wires are connected reversely, it may cause utility short-circuited when these inverters are worked in parallel operation.
- There are four terminal blocks with "Grid", "GEN" and "Load" and "Smart Load" markings. Please do not mistakenly connect the input and output connectors.
- Appliances such as air conditioner are required at least 2~3 minutes to restart because it's required to have enough time to balance refrigerant gas inside of circuits. If a power shortage occurs and recovers in a short time, it will cause damage to your connected appliances. To prevent this kind of damage, please check with manufacturer of air conditioner that if it's equipped with time-delay function before installation. Otherwise, this off grid solar inverter will trig overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

3.4.1 Connection preparation

1. Before connecting to AC input power source, please install a separate AC breaker between inverter and Grid power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of Grid. Please refer to typical amperage in below table as required breaker size.

Recommended breaker specification of Grid for a single inverter:

| Model | 1 unit* |
|--------------|--------------|
| SPE 12000 ES | 70A / 230VAC |
| SPE 10000 ES | 70A / 230VAC |
| SPE 8000 ES | 70A / 230VAC |

2. It is very important for system safety and efficient operation to use appropriate cable for Grid connection , GEN connection, Load connection and Smart Load connection. To reduce risk of injury, please use the proper recommended cable size as below.

Recommended AC wires size:

| Model | AC Input Wire Size | AC Output Wire Size | Torque value |
|--------------|--------------------|---------------------|--------------|
| SPE 12000 ES | 1 * 6 AWG | 13.3mm ² | 1 * 6 AWG |
| SPE 10000 ES | 1 * 6 AWG | 13.3mm ² | 1 * 7 AWG |
| SPE 8000 ES | 1 * 6 AWG | 13.3mm ² | 1 * 8 AWG |

3.4.2 Grid/GEN/ Load/ Smart Load wires Connection :

Please follow the steps below to make Load/ Smart Load /Grid/GEN connections:

1. Remove the insulation covers of the seven wires.
2. Connect the PE protection line first, and then lock in the Load, Smart Load line, Grid line, and GEN line in order.
3. Corresponding polarity positions marked on the terminals.

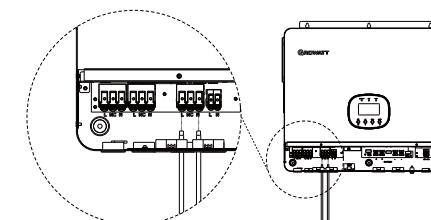
Please refer to the following:

→ Ground (yellow- green) L → LINE (brown or black) N → Neutral (blue)

1. Insert first Load wires according to polarities indicated on terminal block and ensure that the buckle presses the wire tightly.

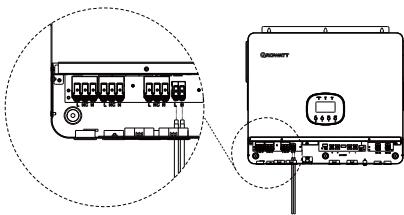
L → LINE (brown or black)

N → Neutral (blue)



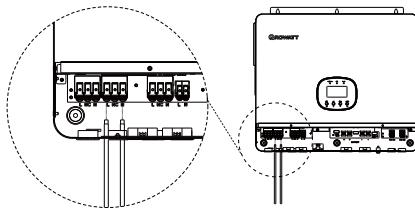
2. Insert Smart Load wires according to polarities indicated on terminal block and ensure that the buckle presses the wire tightly.

L→ LINE (brown or black)
N→ Neutral (blue)



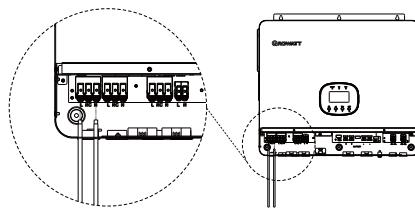
3. Insert Grid wires according to polarities indicated on terminal block and ensure that the buckle presses the wire tightly.

L→ LINE (brown or black)
N→ Neutral (blue)



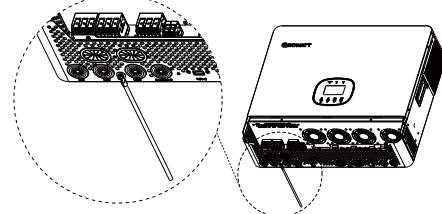
4. Insert GEN wires according to polarities indicated on terminal block and ensure that the buckle presses the wire tightly.

L→ LINE (brown or black)
N→ Neutral (blue)

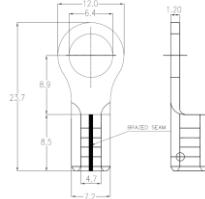


5. Make sure the inverter metal housing is grounded (Ground in the grid system).

Ground (yellow-green)



R-type terminal:



Precautions:

- 1) Before performing the above operations, please ensure that your operating environment is: Non-energized environment.
- 2) After inserting the wire according to the polarity marked on the terminal, don't forget to check that the screw is tightened or the buckle presses the wire tightly.
- 3) After you complete all wiring, please check again to confirm whether the corresponding wires are connected in the correct position to avoid misoperation that may cause the inverter to fail to work properly or damage your equipment.

These details that cannot be ignored ensure a good user experience to a certain extent.

3.5 PV Connection



WARNING!

- All wiring must be performed by a qualified personnel.
- Shock Hazard: Operation with power on is strictly prohibited.
- Before connecting the PV input, be sure to turn off all circuit breakers and confirm that the machine is powered off.
- Be sure to connect PV cable with correct polarity.

3.5.1 Connection preparation

1. Before connecting to PV modules, please install separately a DC circuit breaker between inverter and PV modules.

Recommended breaker specification of PV input for a single inverter:

| Model | 1 unit* |
|--------------|--------------|
| SPE 12000 ES | 27A / 550Vdc |
| SPE 10000 ES | 27A / 550Vdc |
| SPE 8000 ES | 27A / 550Vdc |

2. It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below

| Model | Wire Size | Torque value |
|--------------|-----------|--------------------|
| SPE 12000 ES | 1 * 9 AWG | 8.4mm ² |
| SPE 10000 ES | 1 * 9 AWG | 8.4mm ² |
| SPE 8000 ES | 1 * 9 AWG | 8.4mm ² |

3. PV Module Selection:

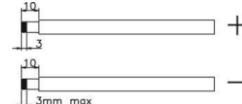
When selecting proper PV modules, please be sure to consider below parameters:

- a) Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter. Exceeding the limit will cause damage to the inverter.
- b) Open circuit Voltage (Voc) of PV modules should be higher than start-up voltage. Lower than will lead to insufficient photovoltaic.

| INVERTER MODEL | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
|------------------------------------|------------------------------------|--------------|-------------|
| Max. PV Array Open Circuit Voltage | 550Vdc | | |
| Start-up Voltage | 120Vdc | | |
| PV Array MPPT Voltage Range | 60Vdc~480Vdc (Recommend 380 Vdc) | | |
| Quantity Of PV Panels | Recommend 2~11 photovoltaic panels | | |

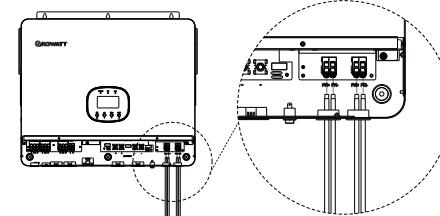
3.5.2 PV cable Connection:

Please follow below steps to implement PV module connection:



1. Remove insulation sleeve 10 mm for positive and negative conductors.

2. then connect positive pole (+) of connection cable to positive pole (+) of PV input connector, connect negative pole (-) of connection cable to negative pole (-) of PV input connector.



3.6 Communication Connection

Please use supplied communication cable to connect to inverter and PC. Follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software. The monitoring software is downloadable from our website www.ginverter.com.

3.7 Dry Contact Signal

There is one dry contact(3A/250VAC) available on the rear panel. Dry contacts are used to connect generators. As shown in the table below. When the inverter meets the conditions on the left, it will perform the function on the right. It could be used to deliver signal to external device When the following conditions are met.

| Unit Status | Condition | Dry contact port: | |
|--|--|--|--------|
| | | NC & C | NO & C |
| If program 24 is set to automatic | | | |
| Power Off | Unit is off and no output is powered | Close | Open |
| Power On | Output is powered from Utility | Close | Open |
| | Program 01 set as Utility first | Open | Close |
| | Battery voltage (SOC) < Low DC warning voltage(SOC) | Close | Open |
| | Program 01 is set as SBU or Solar first | Open | Close |
| | Battery voltage (SOC) > Setting value in Program 13 or battery charging reaches floating stage | Close | Open |
| | Battery voltage (SOC) < Setting value in Program 12 | Open | Close |
| If program 24 is set to enable | | | |
| Power On | Output is powered from Battery or Solar | The dry contact always sends a power-on signal. | Open |
| If program 24 is set to disable | | | |
| Power On | Output is powered from Battery or Solar | The dry contact always sends a power-off signal. | Close |

3.8 CT Connection

CT is an optional accessory and can be purchased separately according to needs. The currently available CT specifications are as follows:

| Part number | CT specification | Recommender system |
|---------------|-----------------------------|--|
| 013.SK0000500 | 100A-50mA / 2000:1 / 4m | Single system or 3 Pcs three-phase parallel system |
| 013.SK0002500 | 100A-50mA / 2000:1 / 10m | Single system or 3 Pcs three-phase parallel system |
| 013.SK0002800 | 250A-62.5mA / 4000:1 / 10m | 2-3 Pcs Single phase parallel or 6 Pcs three-phase parallel system |
| 013.SK0002900 | 500A-66.7mA / 7500:1 / 10m | 4-6 Pcs Single phase parallel |
| 013.SK0004400 | 750A-62.5mA / 12000:1 / 10m | 7-9 Pcs Single phase parallel |

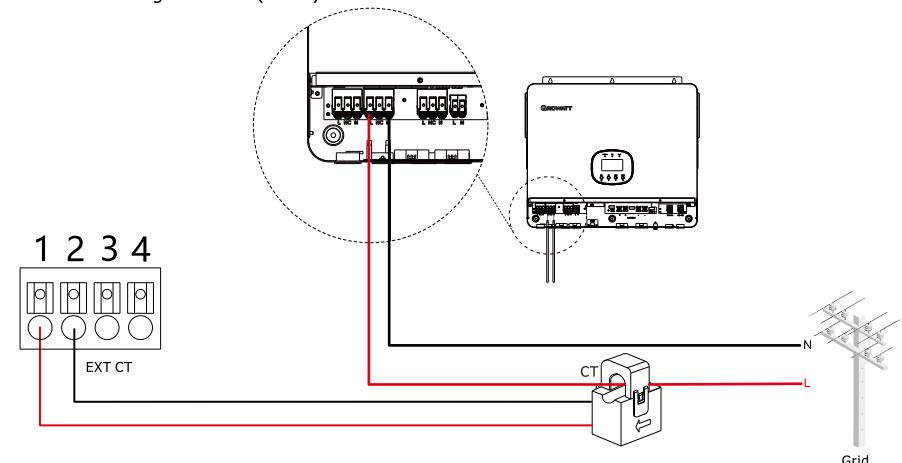
The specific installation method is as follows.

Note: The L line passes through the CT, and the arrow on the CT indicates the current direction points to the inverter.

Connect the two signal wires coming out of the CT to the terminal marked EXT CT:

White (or red) cable → No. 1 Signal Terminal (CT-L-I+)

Black cable → No. 2 Signal Terminal (CT-L-I-)

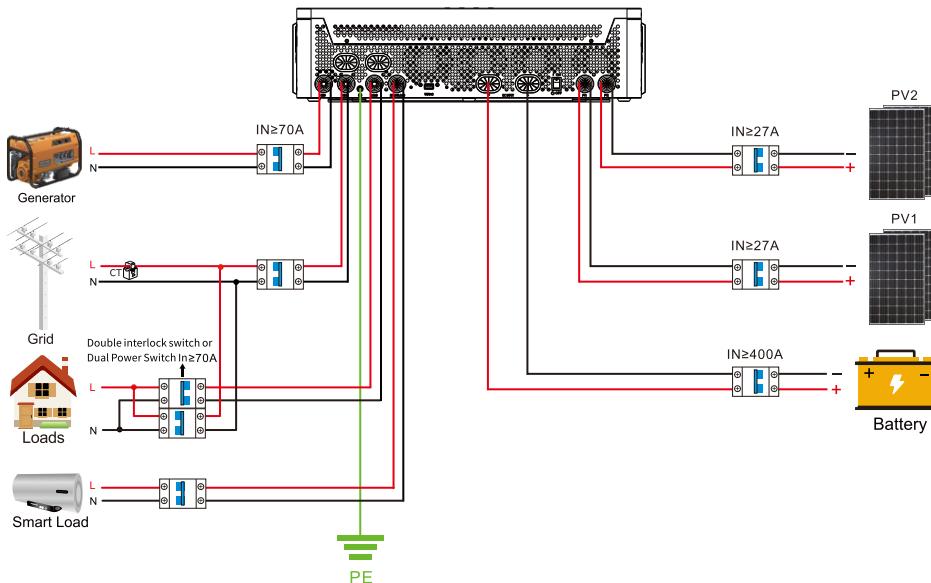


Final Assembly

Double check that all wiring is correct. Please put bottom cover back by screwing four screws as shown below.

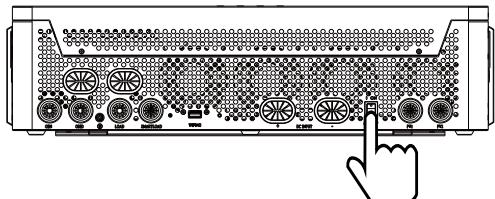


3.9 Wiring system for inverter



4. Operation

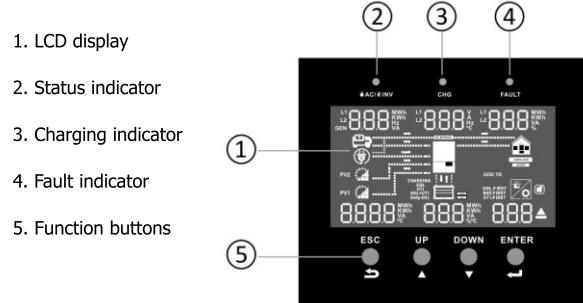
4.1 Power ON/OFF



After correct installation, switch on the battery switch, switch on the inverter switch, wait about 40 seconds, inverter output.

4.2 Display Panel Introduction

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three indicators, four function keys and a LCD display, indicating the operating status and input/output power information.



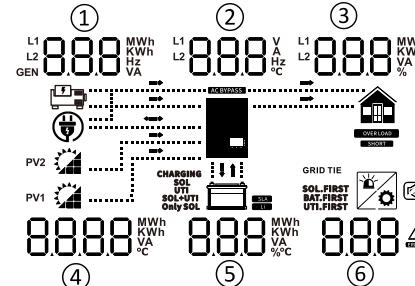
LED Indicator

| LED Indicator | | Messages | |
|---------------|-------|----------|---|
| | Green | Solid On | Output is powered by utility in Line mode. |
| | | Flashing | Output is powered by battery or PV in battery mode. |
| | Green | Solid On | Battery is fully charged. |
| | | Flashing | Battery is charging. |
| | Red | Solid On | Fault occurs in the inverter. |
| | | Flashing | Warning condition occurs in the inverter. |

Function Buttons

| Button | Description |
|--------|--|
| ESC | To exit setting mode |
| UP | To go to previous selection |
| DOWN | To go to next selection |
| ENTER | To confirm the selection in setting mode or enter setting mode |

4.2.1 LCD Display Icons



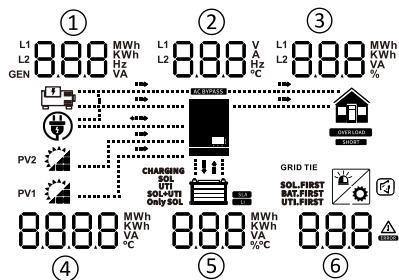
| Icon | Description |
|-----------------------------|---|
| AC Input Information | |
| | Grid icon |
| | Generator icon |
| | Indicate AC input power, AC input voltage, AC input frequency, AC input current |
| | Indicate AC power loads in bypass |
| PV Input Information | |
| | Left: PV1 input icon |
| | Right: PV2 input icon |
| | Indicate PV power, PV voltage, PV current, etc |
| Output Information | |
| | Inverter icon |
| | Indicate output voltage, output current, output frequency, inverter temperature |
| Load Information | |
| | Load icon |
| | Indicate power of load, power percentage of load |
| | Indicate overload happened |
| | Indicate short circuit happened |
| Battery Information | |
| | Indicate battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode. |
| | Indicate battery voltage, battery percentage, battery current |
| | Indicate SLA battery |
| | Indicate lithium battery |
| | Indicate charging source priority: solar first, solar and utility, or only solar |
| Other Information | |
| | Indicate output source priority: solar first, utility first, SBU mode or SUB mode |
| | Indicate warning code or fault code |
| | Indicate a warning or a fault is happening |
| | Indicate it's during setting values |
| | Indicate the alarm is disabled |

| In battery charge mode, battery icon will present Battery Charging Status | | |
|---|-----------------|--|
| Status | Battery voltage | LCD Display |
| Constant Current mode / Constant Voltage mode | <48V | 4 bars will flash in turns. |
| | 48 ~ 50V | Bottom bar will be on and the other three bars will flash in turns. |
| | 50 ~ 52V | Bottom two bars will be on and the other two bars will flash in turns. |
| | > 52V | Bottom three bars will be on and the top bar will flash. |
| Floating mode. Batteries are fully charged. | | 4 bars will be on. |

| In battery discharge mode, battery icon will present Battery Capacity | | |
|---|-----------------|-------------|
| Load Percentage | Battery Voltage | LCD Display |
| Load >50% | < 41.2V | |
| | 41.2~43.2V | |
| | 43.2~45.2V | |
| | > 45.2V | |
| 50%> Load > 20% | < 43.6V | |
| | 43.6~46V | |
| | 46~47.6V | |
| | > 47.6V | |
| Load < 20% | < 44.8V | |
| | 44.8~46.8V | |
| | 46.8~48.8V | |
| | > 48.8 | |

4.2.2 Display Information

The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: voltage, frequency, current, power, temperature, energy, firmware version.



| Setting Information | LCD display | LCD display |
|---|---|---|
| ① AC Input voltage (grid input) ② Output voltage ③ Load percentage ④ Left: PV1 input voltage Right: PV2 input voltage ⑤ Battery voltage ⑥ Warning or Fault code *Default Display Screen | 228v 227v 80% PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 299.1v 549v 0 1△ | 228v 229v 81% PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 2966v 549v 0 1△ |
| ① AC Input voltage (generator input) (If the AC input is only generator input, it means that what is displayed at this time is the input voltage of the generator. The current, power and frequency displayed after turning the page are also the input parameters of the generator, which will not be explained below.) ② Output voltage ③ Load percentage ④ Left: PV1 input voltage Right: PV2 input voltage ⑤ Battery voltage ⑥ Warning or Fault code | 228v 229v 86% GEN PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 2969v 550v 0 1△ | 229v 228v 87% GEN PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 2955v 550v 0 1△ |
| ① AC Input frequency ② Output frequency ③ Load power ④ PV energy sum ⑤ Battery percentage ⑥ Warning or Fault code | 500 Hz 500 Hz 0.96 kVA PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 445 kWh 790% 0.1△ | / |
| ① AC Input current ② Output current ③ Load percentage ④ Left: PV1 input current Right: PV2 input current ⑤ Battery charging current ⑥ Warning or Fault code | 98 A 42 A 80% PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 23 A 462 A 0 1△ | 98 A 43 A 81% PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 23 A 462 A 0 1△ |
| ① Feed to Grid current ② Output current ③ Load percentage ④ Left: PV1 input current Right: PV2 input current ⑤ Battery charging current ⑥ Warning or Fault code | 43 A 30 A 53% PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 74 A 493 A 0 1△ | 43 A 31 A 54% PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 74 A 493 A 0 1△ |
| ① AC input power ② Output voltage ③ Load power ④ Left: PV1 input power Right: PV2 input power ⑤ Battery charging power ⑥ Warning or Fault code | 2.18 kW 229 v 0.96 kW PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 0680 kW 259 kW 0 1△ | 2.14 kW 228 v 0.94 kW PV1 PV2 CHARGING SOLAR UTILITY GRID TIE 0673 kW 258 kW 0 1△ |

| | | |
|--|--|---|
| ① Feed to Grid power ② Output voltage ③ Load power ④ Left: PV1 input power Right: PV2 input power ⑤ Battery charging power ⑥ Warning or Fault code | | |
| ① CT power ② CT active Power screen ③ Loads and home load power ④ Left: PV1 input power Right: PV2 input power ⑤ Battery charging power ⑥ Warning or Fault code | | |
| ① CT power ② CT active Power screen ③ Load power ④ Left: PV1 temperature Right: PV2 temperature ⑤ Left: Ic temperature Right: Battery temperature ⑥ Warning or Fault code | | |
| ① AC input power ② Inverter temperature ③ Load power ④ Left: PV1 temperature Right: PV2 temperature ⑤ Left: Ic temperature Right: Battery temperature ⑥ Warning or Fault code | | |
| ① Left: Today's energy feed to grid Right: Total energy feed to grid ② Output frequency ③ Left: Today's load energy Right: Total load energy ④ Left: Today's PV energy Right: Total PV energy ⑤ Left: Today's battery discharge energy Right: Total battery discharge energy ⑥ Indicate today's energy or total energy. | | |
| Firmware version (CPU1: 141-00-527; CPU2:142-00-529; CPU3:143-00-528) | | |
| Time (13:54:29, May 29, 2024) | | / |

4.2.3 Operating Mode Description

| Operation mode | Description | LCD display |
|--|---|---|
| Standby mode /Power saving mode Note: *Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output. *Power saving mode: If enabled, the output of inverter will be off when connected load is pretty low or not detected. | No output is supplied by the unit but it still can charge batteries. | Charging by PV energy No charging |
| Fault mode Note: *Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on. | PV energy can charge batteries. | Charging by PV energy No charging |
| Line Mode | The unit will provide output power from the mains. It can also charge the battery at line mode. | Charging by PV energy Charging by utility No battery connected |
| Feeds grid Mode | Solar feeds to the grid or battery feeds to the grid PV energy charges battery, PV energy provides power to the load and feeds remaining energy to the grid. | Solar feeds to the grid or battery feeds to the grid Battery energy provides power to the load and feeds remaining energy to the grid. |
| Battery Mode | The unit will provide output power from battery and PV power. | Power from battery and PV energy Power from battery only |

4.3 LCD parameter setting

4.3.1 General settings

After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. Then press "ENTER" button to confirm the selection or ESC button to exit.

| Program | Description | Setting Option |
|---------|--|---|
| 99 | Quick Settings * After setting TY1, TY2, or TY3, the initial default values of some settings will be changed. Users can set them based on actual usage, which can help users quickly set the inverter settings. | TY0: Self-consumption (default) SELF E40 099 Program 01 03 14 55 67 69 Value SBU APL CSO LBU DIS 12KW Program 71 76 78 79 80 Value DIS DIS 0KW DIS 24KW |
| | | When the PV power is sufficient, the PV energy first prioritizes supplying power to the off grid load. Any excess energy is used to charge the battery, and the PV energy is not fed into the grid. Meanwhile, the on-grid load is powered by the utility power. Conversely, When the PV power is insufficient, both the PV system and the battery energy are used to supply power to the off-grid load, and the on-grid load is powered by the grid power. In the event of grid power outage, the PV energy and battery discharge together to supply power to the off-grid loads. |
| | | TY1: Load First Mode Load.F E41 099 Program 01 03 14 55 67 69 Value SBU UPS SNU LBU ENA 12KW Program 71 76 78 79 80 Value ENA ENA 12KW DIS 24KW |
| | | When PV power is sufficient, the PV energy first prioritizes supplying power to the on/off grid load, the excess PV energy is used to charge the battery, after that any surplus PV energy will feed into the grid. Conversely, When PV power is insufficient, both the PV energy and battery energy are used to supply power to the on/off-grid load, but the battery energy will not feed into the grid. External CT sensor required for this mode, the installation method of the external CT sensor please refer to chapter 3.8 CT Connection. |
| | | TY2: Battery First Mode BAT.F E42 099 Program 01 03 14 55 67 69 Value SBU UPS SNU BLU ENA 12KW Program 71 76 78 79 80 Value ENA ENA 12KW DIS 24KW |
| | | When the PV power is sufficient, the PV energy gives priority to charging the battery. After that the excess PV energy is used to supply power to the on/off-grid load, and any excess surplus PV energy is fed into the grid. Conversely, when the PV power is insufficient, both the PV energy and the grid energy to supply power to the on/off-grid load. In the absence of grid power, the PV energy and the battery discharge together to power the off grid load, but the battery energy will not feed into the grid. External CT sensor required for this mode, the installation method of the external CT sensor please refer to chapter 3.8 CT Connection. |

| | | |
|----|--|--|
| 01 | Output source priority: To configure load power source priority. (After program 67 are enabled, this program is fixed SBU and cannot be set.) | TY3: Export Limit Mode 2001 E43 099 Change the default values of the following settings as follows: |
| | | Program 01 03 14 55 67 69 Value SBU UPS SNU LBU ENA 12KW |
| | | Program 71 76 78 79 80 Value ENA ENA 0KW DIS 24KW |
| | | When PV power is sufficient, the PV energy first prioritizes supplying power to the on/off grid load. Any surplus energy is used to charge the battery, and the excess PV energy is not fed into the grid. Conversely, when PV power is insufficient, both the PV energy and the battery discharge together to power the on/off grid load. However, the battery energy is not fed into the grid. External CT sensor required for this mode, the installation method of the external CT sensor please refer to chapter 3.8 CT Connection. |
| | | Solar first OPPF SOL 001 Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power to the loads at the same time. Utility provides power to the loads only when any one condition happens: -Solar energy is not available -Battery voltage drops to either low-level warning voltage or the setting point in program 12. |
| | | Utility first OPPF UEL 001 Utility will provide power to the loads as first priority. Solar and battery energy will provide power to the loads only when utility power is not available. |
| | | SBU priority (default) OPPF SBU 001 Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery will supply power to the loads at the same time. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12. |
| | | SUB priority OPPF Sub 001 Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, solar and utility will power loads at the same time. Battery provides power to the loads only when solar energy is not sufficient and there is no utility. |

| | | |
|----|---|---|
| 02 | Maximum charging current: set total charging current for solar and utility chargers. | CHG. I 120 ⁰⁰² SPE 12000 ES: Default 120A, 0A~250A Settable. SPE 10000 ES: Default 120A, 0A~220A Settable. SPE 8000 ES: Default 120A, 0A~190A Settable. (Max. charging current = utility charging current + solar charging current) (If LI is selected in Program 5, this program can't be set up) |
| 03 | AC input voltage range (After program 67 are enabled, this program is fixed UPS and cannot be set). | Appliance (default) ACU APL 003 If selected, acceptable AC input voltage range will be within: 90~280VAC UPS ACU UPS 003 If selected, acceptable AC input voltage range will be within: 170~280VAC |
| 04 | Power saving mode enable/disable | Saving mode disable (default) SAVE DIS 004 If disabled, no matter connected load is low or high, the on/off status of inverter output will not be effected. Saving mode enable SAVE ENA 004 If enabled, the output of inverter will be off when connected load is pretty low or not detected. |
| 05 | Battery type | AGM (default)—Suitable for lead-acid battery BATI AGM 005 Items that cannot be set: 19 20 21 default: 56.4V 54V 42V Items that can be set: default Set range Set requirements 02 120A 0A~250A 11 60A 0A~250A 12 46V 44~51.2V <13 setting value 13 54V 48~58.0V |
| | | Flooded—Suitable for lead-acid battery or flood battery BATI FLd 005 Items that cannot be set: 19 20 21 default: 58.4V 56V 42V Items that can be set: default Set range Set requirements 02 120A 0A~250A 11 60A 0A~250A 12 48V 44~51.2V <13 setting value 13 56V 48~58.0V |

| | | |
|--|---|---|
| | | Lithium (only suitable when communicated with BMS communication) BATI LI 005 Items that cannot be set: 02 19 20 |
| | | Items that can be set: default Set range Set requirements 11 20A 0A~250A 12 50% 10%~95% <13 setting value 13 95% 15%~100% 21 20% 5%~50% <12 setting value |
| User-Defined—Suitable for lead-acid battery, battery parameters can be set manually | | |
| | | BATI USE 005 Items that can be set: default Set range Set requirements 02 120A 0A~250A 11 60A 0A~250A 12 46V 44~51.2V <13 setting value 13 54V 48~58.0V 19 56.4V 48~58.4V 20 54V 48~58.4V 21 42V 40~48V <12 setting value |
| User-Defined 2 (suitable when lithium battery without BMS communication or communication protocol not matched with the inverter, battery parameters can be set manually) | | |
| | | BATI US2 005 Items that can be set: default Set range Set requirements 02 20A 0A~250A 11 20A 0A~250A 12 48V 44~51.2V <13 setting value 13 52V 48~58.0V 19 54V 48~58.4V 20 54V 48~58.4V Suggestion=19 setting value 21 46V 40~48V <12 setting value |
| 06 | Auto restart when overload occurs | Restart disable (default) LdFS DIS 006 LdFS ENA 006 |
| 07 | Auto restart when over temperature occurs | Restart disable (default) ErTS DIS 007 ErTS ENA 007 |
| 08 | Output voltage | 230V (default) OUTU 230 008 OUTU 220 008 240V OUTU 240 008 OUTU 208 008 |
| 09 | Output frequency | 50Hz (default) OUTF 50 009 OUTF 60 009 |

| | | |
|----|--|---|
| 11 | Maximum utility &Generator charging current | ACI 60° GENI 40° 0 11° SPE 12000 ES: Default 60A/utility)/40A(generator), 0A~250A Settable. SPE 10000 ES: Default 60A/utility)/40A(generator), 0A~220A Settable. SPE 8000 ES: Default 60A/utility)/40A(generator), 0A~190A Settable. Note: If setting value in Program 02 is smaller than that in Program 11, the inverter will apply charging current from Program 02 for utility charger |
| 12 | Setting voltage point back to utility source when selecting "SBU priority" or "Solar first" in program 01 | b2AC 460° 0 12° The default value and adjustable range vary in different Battery type, please refer to program 5 for details |
| 13 | Setting voltage point back to battery mode when selecting "SBU priority" or "Solar first" in program 01 | AC26 540° 0 13° The default value and adjustable range vary in different Battery type, please refer to program 5 for details |
| 14 | Charger source priority: To configure charger source priority. (After program 67 are enabled, this program is fixed SUN and cannot be set.) | If this off grid solar inverter is working in Line, Standby or Fault mode, charger source can be programmed as below: Solar first (default) CGPF 50° 0 14° Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available. Solar and Utility CGPF 5AU 0 14° Solar energy and utility will both charge battery. Only Solar CGPF 050 0 14° Solar energy will be the only charger source no matter utility is available or not. If this PV Hybrid Inverter is working in Battery mode or Power saving mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient. |
| 15 | Alarm control | Alarm on (default) 6022 0N 0 15° Alarm off 6022 OFF 0 15° |
| 16 | Backlight control | Backlight on LCdb 0N 0 16° Backlight off (default) LEDb OFF 0 16° |
| 17 | Beeps while primary source is interrupted | Alarm on (default) ALAR 0N 0 17° Alarm off ALAR OFF 0 17° |
| 18 | Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode. | Bypass disable (default) bYP diS 0 18° Bypass enable bYP ENA 0 18° |
| 19 | C.V. charging voltage. | CU 56.4° 0 19° Default 56.4V, 48.0V~58.4V Settable |
| 20 | Floating charging voltage. | FILE 54.0° 0 20° Default 54.0V, 48.0V~58.4V Settable |

| | | |
|----|---|---|
| 21 | Low DC cut-off voltage. | CUE 420° 0 21° The default value and adjustable range vary in different Battery type, please refer to program 5 for details Note: The low voltage alarm point is (program 21) +2V. When this value is reached, the machine reports 04. When reach Low DC cut-off voltage: 1) If battery power is only power source available, inverter will shut down. 2) If PV energy and battery power are available, inverter will charge battery without AC output. 3) If PV energy, battery power and utility are all available, inverter will transfer to line mode and provide output power to loads, and charge the battery at the same time. |
| 23 | AC output mode *This setting is only available when the inverter is in standby mode (Switch off). Note: Parallel operation can only work when battery connected | Parallel: PPLL PAL 023° L1 Phase: PPLL 3P1 023° L2 Phase: PPLL 3P2 023° L3 Phase: PPLL 3P3 023° When the units are used in parallel with single phase or alone, please select "PAL" in program 23. It requires 3 inverters to support three-phase equipment, 1 inverter in each phase. Please select "3P1" in program 23 for the inverters connected to L1 phase, "3P2" in program 23 for the inverters connected to L2 phase and "3P3" in program 23 for the inverters connected to L3 phase. |
| 24 | Dry Contact Signal * For details, please refer to Chapter 3.7 | Automatic (default) dRY AEO 024° The dry contact can intelligently generate a power-on or power-off signal to the generator based on the battery voltage. Enable dRY ENA 024° The dry contact always sends a power-on signal. Disable dRY diS 024° The dry contacts always send a power-off signals. |
| 28 | Address setting (for expansion) | Addr 1 028° Default 1, 1~255 Settable |
| 36 | RS485 Communication protocol CAN Communication protocol | PtCL L01 036° Protocol 1~50 PtCL L51 036° Protocol 51~99 |
| 37 | Real time setting--Year | 2018 037° Default 2018, range 2018~2099 |
| 38 | Real time setting--Month | 10N 12 038° Default 01, range 01~12 |
| 39 | Real time setting--Date | dRY 13 039° Default 01, range 01~31 |
| 40 | Real time setting--Hour | HOUR 13 040° Default 00, range 00~23 |
| 41 | Real time setting--Minute | 11N 50 041° Default 00, range 00~59 |

| | | | |
|----|---|--|--|
| 42 | Real time setting---Second | SEC 50 042 | Default 00, range 00~59 |
| 43 | Battery equalization | Battery equalization enable EQ ENA 043 | Battery equalization disable(default) EQ dI5 043 |
| | | If "Flooded" or "User-Defined" is selected in program 05, this program can be set up. | |
| 44 | Battery equalization voltage | EQ 584 044 | Default 58.4V, 48.0V~58.4V Settable |
| 45 | Battery equalized time | EQ 60 045 | Default 60min, 5min~900min Settable |
| 46 | Battery equalized timeout | EQ 120 046 | Default 120min, 5min~900min Settable |
| 47 | Equalization interval | EQ 30 047 | Default 30days, 1 days~90 days Settable |
| 48 | Equalization activated immediately | Equalization activated immediately on EQ ON 048 | Equalization activated immediately off(default) EQ OFF 048 |
| | | If equalization function is enabled in program 43, this program can be setup. If "On" is selected in this program, it's to activate battery equalization immediately and LCD main page will shows "EQ". If "Off" is selected, it will cancel equalization function until next activated equalization time arrives based on program 47setting. At this time, "EQ" will not be shown in LCD main page. | |
| 49 | Utility charging time (This program can only be set when program 67 are not enabled) | CHG E17 0000 049 | The time allows utility to charge the battery. Use 4 digits to represent the time period, the upper two digits represent the time when utility start to charge the battery, setting range from 00 to 23, and the lower two digits represent the time when utility end to charge the battery, setting range from 00 to 23. (eg: 2320 represents the time allows utility to charge the battery is from 23:00 to the next day 20:59, and the utility charging is prohibited outside of this period) |

| | | | |
|----|--|--|---|
| 50 | Utility output time (This program can only be set when program 67 are not enabled) | 0000(default) Allow utility r to power the load all day run. OP2 E17 0000 050 | The time allows utility to power the load. Use 4 digits to represent the time period, the upper two digits represent the time when utility start to power the load, setting range from 00 to 23, and the lower two digits represent the time when utility end to power the load, setting range from 00 to 23. (eg: 2320 represents the time allows utility to power the load is from 23:00 to the next day 20:59, and the utility power is prohibited outside of this period) |
| 54 | Lithium battery strong charging execution cycle time. (If program 05 is set to Li and set to ON, it means that the lithium battery is periodically forced to charge to SOC of 100%. OFF indicates that the function is not enabled) | OFF: Turn off periodic strong charging LIJ OFF 054 | ON: Turn on periodic strong charging. Default 30days, 1 days~90 days Settable LIJ ON 054 LIJ 030 054 |
| 55 | Setting solar energy supply priority when selecting "SUB priority" in program 01 | Charge first SGFd bLU 055 | Solar energy provides power to charge battery as first priority. Solar energy provides power to the loads as second priority. Solar energy provides power to feed to grid as third priority. |
| | | Load first (default) SGFd lBU 055 | Solar energy provides power to the loads as first priority. Solar energy provides power to the charge battery as second priority. Solar energy provides power to feed to grid as third priority. |
| | | Load first SGFd lUb 055 | Solar energy provides power to the loads as first priority. Solar energy provides power to feed to grid as second priority. Solar energy provides power to the charge battery as third priority. (This program can only be set when program 67 are enabled) |
| 56 | NG relay enable setting | NG relay enable(default) NGY ENA 056 | Grounding in inverter operation mode, ungrounded in grid operation mode |
| | | NG relay disable NGY dI5 056 | No grounding in any mode |
| 57 | The power grid mode allows the smart load output to remain on. | Disable(default) OP2 dI5 057 | Enable OP2 ENA 057 |
| 58 | Setting of the smart load output time period. * Note: When time period 1 is set to "Sta0000-End0000", it means that the smart load can output all time periods. | First time period 0000 001 058 | Smart load output start time 0000 58A 058 |
| | | Second time period 0000 002 058 | Smart load output shutdown time 0000 End 058 |
| | | | Smart load output start time 0000 58A 058 |
| | | | Smart load output shutdown time 0000 End 058 |

| | | | |
|--|--|--|---|
| | | Third time period 0000 003 058 | Smart load output start time 0000 Sta 058 Smart load output shutdown time 0000 End 058 |
| The time setting consists of 4 digits, with the first two digits representing hours and the last two digits representing minutes. For example, Sta2300-End2059 represents the smart load output time range from 23:00 to 20:59 the next day. | | | |
| 59 | The cut-off battery voltage point/SOC setting for the smart load output. | LOSS 480 ⁺ 059 | Default 48.0V, 44.0V~54.0V Settable Lithium battery mode: Default 60%, 20%~95% Settable |
| 60 | Recovery battery voltage point/SOC setting for the smart load output. | BACK 530 ⁺ 060 | Default 53.0V, 48.0V~58.0V Settable Lithium battery mode: Default 90%, 20%~100% Settable |
| 61 | Setting of PV power value for the smart load output to be turned on | PUL 00 ^{kw} 061 | SPE 12000 ES: Default 0KW, 0KW~12KW Settable SPE 10000 ES: Default 0KW, 0KW~10KW Settable SPE 8000 ES: Default 0KW, 0KW~8KW Settable |
| 62 | Menu Return Settings | Disable(default) RENU di 5 062 | Display screen page remains stuck |
| | | Enable RENU ENR 062 | Automatically return to the main page after no human-machine interface operation within five minutes |
| 65 | Generator run time | GEN RUN E17 HOUR 00 065 | Default 00, range 01~24 The time allows Generator to work. Use 2 digits to represent the time period, setting range from 00 to 24. (eg: 02 represents the time allows Generator to run for two hours.) Note: 00 represents that the generator can run continuously. |
| 66 | BMS Communication Loss | Enable (default) b75E ENR 066 | If BMS Communication Loss, The inverter 04 and 20 warning Icon flasing, but enable to work for original status. |
| | | Disable b75E di 5 066 | If BMS Communication Loss, The inverter 04 and 20 warning Icon flasing and disable to work. (cut off the output and can't charge) |
| 67 | Feed to grid configuration | Feed to grid disable(default) FEED di 5 067 | Solar energy feed to grid disable. |
| | | Feed to grid enable FEED ENR 067 | Solar energy feed to grid enable. |
| 68 | | South Africa FFNG SAF 068 | Grid-connected voltage range: 195.5~253VAC Grid-connected frequency range: 47~51.5Hz. |

| | | | |
|----|---|--|---|
| 68 | Regulations standard *This program is only effective when program 67 is enabled | Standard FFNG Std 068 | Grid-connected voltage range: 195.5~253VAC. Grid-connected frequency range: 49~51Hz. |
| | | Pakistan FFNG PAI 068 | Grid-connected voltage range: 185~275VAC. Grid-connected frequency range: 47~52Hz. |
| | | Europe FFNG EUR 068 | Grid-connected voltage range: 184~264.5VAC. Grid-connected frequency range: 47.5~51.5Hz. |
| | | Spain FFNG SPA 068 | Grid-connected voltage range: 195.5~253VAC. Grid-connected frequency range: 48~51Hz. |
| 69 | Feed grid power settings | FEED 120 ^{kw} 069 | The maximum feed grid power can be set SPE 12000 ES: Default 12KW, 0KW~12KW Settable SPE 10000 ES: Default 10KW, 0KW~10KW Settable SPE 8000 ES: Default 8KW, 0KW~8KW Settable |
| | | L99 ⁺ 280 ⁺ 070 | SPE 12000 ES: Default 280A, 0A~280A Settable SPE 10000 ES: Default 240A, 0A~240A Settable SPE 8000 ES: Default 200A, 0A~200A Settable *If Program 05 is set to Li mode. The value LXXX in the lower left corner of the LCD is the maximum allowable discharge current of the lithium battery. The middle value is to set the maximum allowable discharge current value of the battery. The smaller of the two is the current limit value of the battery feed grid. |
| 70 | Battery discharge current *This program is only effective when program 71 is enabled | Feed to grid disable(default) FEED di 5 071 | battery energy feed to grid disable. |
| | | Feed to grid enable FEED ENR 071 | battery energy feed to grid enable. |
| 71 | Battery feed loss point | LOSS 460 ⁺ 072 | Lithium battery mode: Default 40%, 15%~90% Settable The other battery mode: Default 46.0V, 46.0V~52.0V Settable |
| 72 | Battery feedback point | BACK 540 ⁺ 073 | Lithium battery mode: Default 80%, 25%~100% Settable The other battery mode: Default 54.0V, 48.0V~54.0V Settable |
| 74 | Battery feed time * Note: When time period 1 is set to "Sta0000-End0000", it means that the battery can feed the grid for the entire time period | First time period 0800 001 074 | Battery feed start time 0800 Sta 074 Battery feed shutdown time 1159 End 074 |
| | | Second time period 1200 002 074 | Battery feed start time 1200 Sta 074 Battery feed shutdown time 1759 End 074 |

| | | | |
|--|---|------------------------------------|---|
| | | Third time period 1800 003 074 | Battery feed start time 1800 58A 074 Battery feed shutdown time 1959 END 074 |
| * There are three time periods for battery feeding that can be set, which can be achieved by setting the start feeding time and the ending feeding time. * The time setting consists of 4 digits, with the first two digits representing hours and the last two digits representing minutes. For example, Sta2300-End2059 represents battery feeding time range from 23:00 to 20:59 the next day. | | | |
| | | First time period 2000 001 075 | Grid charging start time 2000 58A 075 Grid charging shutdown time 2359 END 075 |
| | | Second time period 0000 002 075 | Grid charging start time 0000 58A 075 Grid charging shutdown time 0559 END 075 |
| | | Third time period 0600 003 075 | Grid charging start time 0600 58A 075 Grid charging shutdown time 0759 END 075 |
| * There are three time periods for grid charging that can be set, which can be achieved by setting the start feeding time and the ending feeding time. * The time setting consists of 4 digits, with the first two digits representing hours and the last two digits representing minutes. For example, Sta2300-End2059 represents grid charging time range from 23:00 to 20:59 the next day. | | | |
| 75 | Grid charging time * The setting is only valid when program 67 is enabled. * Note: When time period 1 is set to "Sta0000-End0000", it means that charging can be done during the entire time period; charging takes priority over power feeding. | | |
| 76 | Anti-backflow enable | disable(default) ECE d15 076 | Disable external CT anti-backflow function |
| | | enable ECE ENA 076 | Enable external CT anti-backflow function |
| 77 | External CT sampling ratio | 2000 CEF 077 | Default 2000, 1000~15000 Settable. For example, 2000 means the sampling ratio is 1:2000 For example, C000 means the sampling ratio is 1:12000 |
| 78 | Anti-backflow power *The setting is only valid when program 76 is enable | POS EHP 120 ^{kW} 078 | POS: stands for backflow power, Power that can be fed into the grid. |
| | | NEG EHP 0.1 ^{kW} 078 | NEG: Predict the backflow value in advance to prevent backflow.(0-0.5kW Settable) |

| | | |
|----|---|--|
| | | SPE 12000 ES: Default 0kW, 0~12.0kW Settable SPE 10000 ES: Default 0kW, 0~10.0kW Settable SPE 8000 ES: Default 0kW, 0~8.0kW Settable For example, the anti-backflow power is set to 2kW Single: the anti-backflow power is 2kW. Single-phase parallel: If the number of parallel machines is (n) PCS, the total anti-backflow power of the parallel system is (2 * n) kW. Three-phase parallel: If the number of three-phase parallel machines is (x/y/z) PCS, the anti-backflow power of each phase line is (2 * x / 2 * y / 2 * z) kW. |
| 79 | Grid peak shaving enable | disable(default) GFI d d15 079 enable GFI d ENA 079 |
| 80 | Grid peak shaving power *The setting is only valid when program 79 is enabled | GFI d 240 ^{**} 080 SPE 12000 ES: Default 24kW, 0~24.0kW Settable SPE 10000 ES: Default 20kW, 0~20.0kW Settable SPE 8000 ES: Default 16kW, 0~16.0kW Settable *For example, the grid peak shaving power is set to 2kW Single: Grid peak shaving power is 2kW. Single-phase parallel: If the number of parallel machines is (n) PCS, the total grid peak shaving power of the parallel system is (2 * n) kW. Three-phase parallel: If the number of three-phase parallel machines is (x/y/z) PCS, the grid peak shaving power of each phase line is (2 * x / 2 * y / 2 * z) kW. |

4.3.2 Hide settings

- 1) After pressing and holding UP and DOWN buttons at the same time for 3 seconds, the unit will enter PASS mode. Change the middle three numbers 000 to 111.

| Program | Description | Setting Option | |
|---------|--|---------------------------------------|--|
| 27 | Inverter model query (View the inverter model size of the current model). | HCPAP 120 027 | SPE 12000 ES: The model of the current model is 12.0kW. |
| | | HCPAP 100 027 | SPE 10000 ES: The model of the current model is 10.0kW. |
| | | HCPAP 80 027 | SPE 8000 ES: The model of the current model is 8.0kW. |
| 29 | Grid input voltage calibration | 224 _v | Users can calibrate the grid voltage within a range of ± 9V based on the current grid voltage parameters displayed in the upper left corner of the LCD screen. Calibrate the grid voltage by inputting the actual grid voltage. *Note: The grid voltage must be greater than 90V for voltage calibration |
| | | GFD _v 224 _v 029 | |
| 30 | Battery voltage calibration | 499 _v 499 _v | Users can calibrate the battery voltage within a range of ± 9V based on the current battery voltage parameters displayed in the upper left corner of the LCD screen. Calibrate the battery voltage by inputting the actual battery voltage. * Note: The battery voltage must be greater than 40V for voltage calibration. |
| | | 688 _v 499 _v 030 | |

| | | | |
|----|--|--|--|
| 31 | Inverter voltage calibration | 115° 115° 031° | Users can calibrate the inverter voltage within a range of $\pm 9V$ based on the current inverter voltage parameters displayed on the LCD screen. Input half of the true inverter voltage to complete the calibration. *Note: The inverter voltage must be greater than 90V for voltage calibration |
| 32 | AC output voltage calibration | 230° 00E° 230° 032° | Users can calibrate the output voltage within a range of $\pm 9V$ based on the current AC output voltage parameters displayed on the LCD screen. Calibrate the AC output voltage by inputting the actual AC output voltage. Note: AC output voltage must be greater than 90V to perform voltage calibration |
| 33 | PV1 voltage calibration | 299° PU1 299° 033° | Users can perform PV1 voltage calibration within a range of $\pm 9V$ based on the current PV1 voltage parameters displayed in the upper left corner of the LCD screen. Enter the real PV1 voltage to calibrate the voltage of PV1. Note: PV1 voltage must be greater than 150V for voltage calibration |
| 34 | PV2 voltage calibration | 299° PU2 299° 034° | Users can perform PV2 voltage calibration within a range of $\pm 9V$ based on the current PV2 voltage parameters displayed in the upper left corner of the LCD screen. Enter the real PV2 voltage to calibrate the voltage of PV2. Note: PV2 voltage must be greater than 150V for voltage calibration |
| 51 | Fault restart | disable(default) FF5E d15 051° enable FF5E ENR 051° | The inverter cannot automatically restart after reporting a fault. The inverter can automatically restart after reporting a fault. |
| 52 | PV ISO detection | disable(default) PU15 d15 052° enable PU15 ENR 052° | Disable PV ISO detection function. Enable PV ISO detection function. |
| 53 | Redundant relay detection | disable(default) EE1 d15 053° enable EE1 ENR 053° | Disable redundant relay detection function. Enable redundant relay detection function. |
| 63 | Inverter current DC component protection | disable(default) dCI d15 063° enable dCI ENR 063° | Disable inverter current DC component protection function. Enable inverter current DC component protection function. |
| 64 | Generator input voltage calibration | 223° GENU 223° 064° | Users can calibrate the generator voltage within a range of $\pm 9V$ based on the current generator voltage parameters displayed in the upper left corner of the LCD screen. Enter the real generator voltage to calibrate the voltage of generator *Note: The generator voltage must be greater than 90V for voltage calibration |

| | | | |
|----|---|---|---|
| 81 | GFCI protection | disable(default) GFCI d15 081° | Disable GFCI protection function. |
| | | enable GFCI ENR 081° | Enable GFCI protection function. |
| 82 | Feed grid voltage loss protection point | FEd VLL 253° 195° 082° | High voltage loss protection point can be set range: 240-280Vac, default 253Vac. Low voltage loss protection point can be set range: 170-200Vac, default 195Vac. |
| 83 | Feed grid frequency loss protection point | 50Hz system FEd 50Hz FF9 515 470 083° | High frequency loss protection point can be set range: 51.0-55.0Hz, default 55Hz. Low frequency loss protection point can be set range: 45.0-49.0Hz, default 45Hz. |
| | | 60Hz system FEd 60Hz FF9 615 570 083° | High frequency loss protection point can be set range: 61.0-65.0Hz, default 65Hz. Low frequency loss protection point can be set range: 55.0-59.0Hz, default 55Hz |
| 85 | Ground detection function | disable Gnd d15 085° | Disable Ground detection function. |
| | | enable(default) Gnd ENR 085° | Enable Ground detection function. |

2) After pressing and holding UP and DOWN buttons at the same time for 3 seconds, the unit will enter PASS mode. Change the middle three numbers 000 to 305.

| Program | Description | Setting Option |
|---------|---------------------------|---|
| 35 | Reset to factory settings | Reset: EE F5E 035° Press the "ENTER" button twice to confirm the selection, then press "ESC" to return and complete the settings. |

5. Parallel Installation Guide

Introduction

This inverter can be used in parallel with two different operation modes.

1. Parallel operation in single phase with up to 9 units.
2. Maximum 9 units work together to support 3-phase equipment. 7 units support one phase maximum.

5.1 Parallel accessories



► Parallel communication cable

5.2 Points of Attention for Parallel

- Ensure that all breakers in the line on the load side are disconnected.
- Be sure the length of all battery cables is the same. Otherwise, there will be voltage difference between inverter and battery to cause parallel inverters not working.
- Be sure that all inverters will share the same battery bank. Otherwise, the inverters will transfer to fault mode.
- Each inverter in the parallel system can only be connected to a separate PV string, and it is prohibited for multiple PV ports to share the same string, and there is a risk of blowing up the inverter.
- Recommended battery capacity.

| Inverter parallel numbers | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------------------------------|-------|--------|--------|--------|--------|--------|--------|--------|
| SPE 12000 ES-Battery Capacity | 800AH | 1200AH | 1600AH | 2000AH | 2400AH | 2800AH | 3200AH | 3600AH |
| SPE 10000 ES-Battery Capacity | 600AH | 900AH | 1200AH | 1500AH | 1800AH | 2100AH | 2400AH | 2700AH |
| SPE 8000 ES-Battery Capacity | 600AH | 900AH | 1200AH | 1500AH | 1800AH | 2100AH | 2400AH | 2700AH |

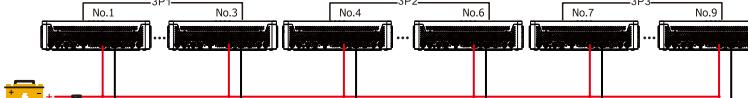
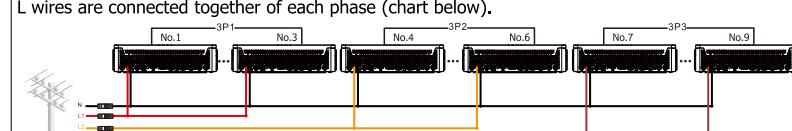
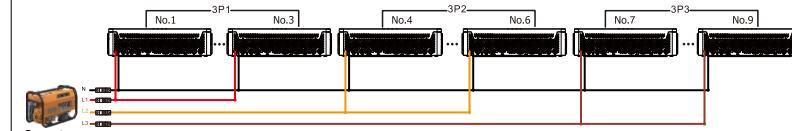
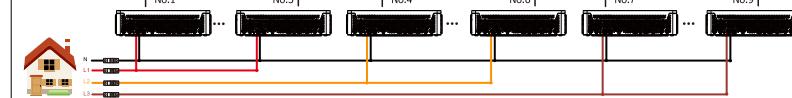
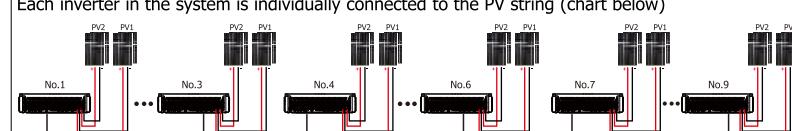
5.3 Wire Connections

5.3.1 Single-phase parallel wire connection

| Parallel mode | Port | Charts and descriptions |
|--|------|--|
| DC Input left-positive, right-negative | | <p>When the inverters are connected in parallel, the + wires are connected together and the - wires are connected together at the DC input. (chart below)</p> <p>In the inverter parallel system, each inverter battery needs to be connected to a DC circuit breaker, single access circuit breaker specifications recommended 400 A. If you choose to access the total circuit breaker at the system end, the recommended access circuit breaker specifications $400\text{ A} * \text{the number of parallel}$ (eg: four inverter system access to the total circuit breaker, the recommended access circuit breaker specifications 1600A).</p> |

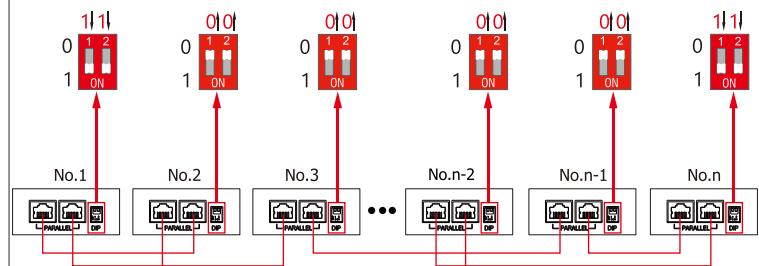
| | |
|--------------------------------|--|
| Grid | <p>When the inverters are connected in parallel, the N wires are connected together and the L wires are connected together at the Grid. (chart below)</p> <p>In an inverter-parallel system, an AC circuit breaker is required to be connected to the utility for each inverter, and a single access circuit breaker size of 70A is recommended.</p> |
| Generator | <p>When the inverters are connected in parallel, the N wires are connected together and the L wires are connected together at the generator input. (chart below)</p> |
| AC Output | <p>When the inverters are connected in parallel, the N wires are connected together and the L wires are connected together at the AC output. (chart below)</p> <p>In an inverter-parallel system, an AC circuit breaker is required to be connected to the load for each inverter, and a single access circuit breaker size of 70A is recommended.</p> |
| PV Input | <p>Each inverter in the system is individually connected to the PV string. (chart below)</p> |
| Parallel communication port | <p>Please put the CAN communication DIP to on status for the first and the end inverter.</p> |
| Lithium BMS Communication port | <p>Make sure to connect the BMS communication cable between the battery and one inverter of the parallel system. It's recommended to connect to the master inverter of the parallel system.</p> |

5.3.2 Three-phase parallel wire connection

| | | |
|-----------|-------------------------------|--|
| Port | parallel mode | Charts and descriptions |
| DC Input | left-positive, right-negative | When the inverters are connected in parallel, the + wires are connected together and the - wires are connected together of the DC input. (chart below)  |
| Grid | | In the inverter parallel system, each inverter battery needs to be connected to a DC circuit breaker, single access circuit breaker specifications recommended 400 A. If you choose to access the total circuit breaker at the system end, the recommended access circuit breaker specifications 400 A * the number of parallel (eg: four inverter system access to the total circuit breaker, the recommended access circuit breaker specifications 1600 A)  |
| Generator | | After the inverter is connected in parallel, at the Grid, the N wires are connected together and the L wires are connected together of each phase (chart below).  |
| AC Output | | After the inverter is connected in parallel, at the AC output, the N wires are connected together and the L wires are connected together of each phase (chart below).  |
| PV Input | | Each inverter in the system is individually connected to the PV string (chart below)  |

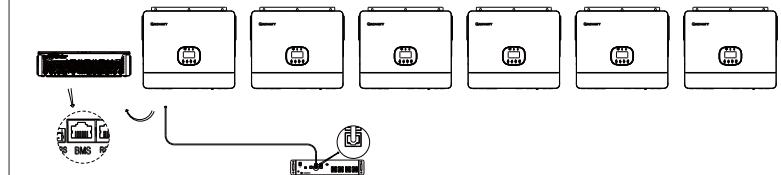
Please put the CAN communication DIP to on status for the first and the end inverter.

Parallel communication port



Lithium BMS communication port
Make sure to connect the BMS communication cable between the battery and one inverter of the parallel system. It's recommended to connect to the master inverter of the parallel system.

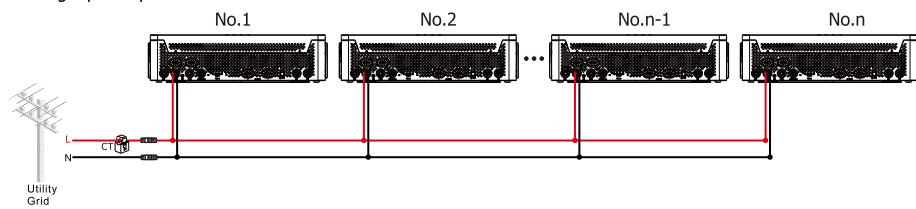
Lithium BMS communication port



5.3.3 CT wire connection

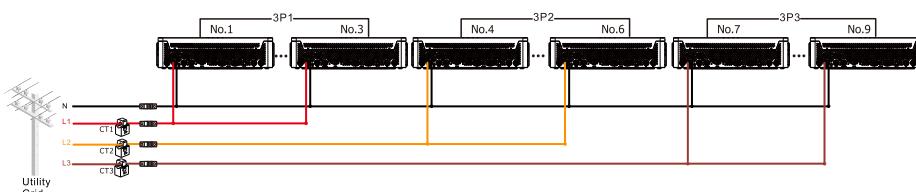
The following introduces the CT wire connection method of single-phase parallel system and three-phase parallel system.

Single-phase parallel wire connection



Only one CT needs to be connected to the inverter NO.1 and placed near the meter. Other inverters no longer need an external CT, and the entire single-phase parallel system only needs one external CT.

three-phase parallel wire connection



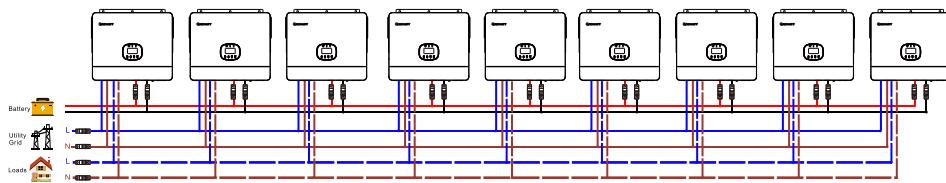
Select one inverter in each of the three phases to connect to the CT. The entire three-phase parallel system requires three external CTs, which are placed near the meter.

5.4 Parallel Example

Parallel Operation in Single Phase

Single-phase parallel master and slave do not need to be set, the system automatically assigns the master and slave according to the order of start-up, the first one to start is the master, and the rest are the slaves. Be sure to confirm that the wiring is correct, the wiring is shown in the following figure. Nine inverters in parallel:

Power Connection



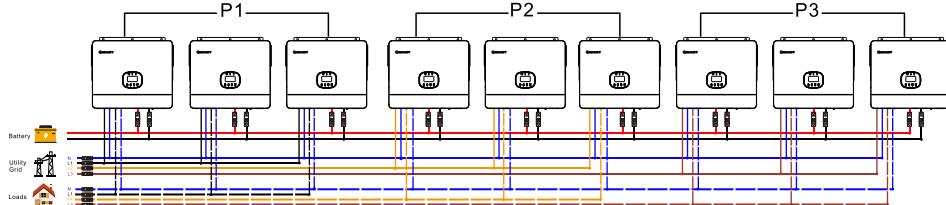
Parallel Operation in Three Phase

Try to connect to the utility at the same time after three-phase parallel connection.

When setting up three-phase parallel, you need to define the master and the slave, see the 5.5 for the specific setting method. Be sure to confirm that the wiring is correct, the wiring method is shown in the table below. The following chart is an example of (3+3+3) (4+3+2)

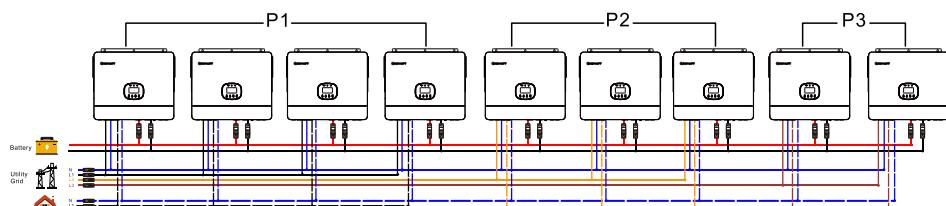
(3+3+3) Three inverters in one phase, three inverters in second phase and three inverters for the third phase:

Power Connection



(4+3+2) Four inverters in one phase, three inverters in second phase and two inverters for the third phase:

Power Connection



5.5 Parallel setup and display

Refer to Program 23 on Page 23

Parallel in Single Phase

Step 1: Check the following requirements before commissioning:

- Correct wire connection
- Ensure all breakers in Line wires of load side are open and each Neutral wires of each unit are connected together.

Step 2: Turn on each unit and set "PAL" in LCD setting program 23 of each unit. And then shut down all units.

Note: It's necessary to turn off switch when setting LCD program. Otherwise, the setting cannot be programmed.

Step 3: Turn on each unit.

| LCD display in Master unit | LCD display in Slave unit |
|----------------------------|---------------------------|
| | |

Note: Master and slave units are randomly defined.

Step 4: Switch on all AC breakers of Line wires in AC input. It's better to have all inverters connect to utility at the same time. If not, it will display warning 15.

| LCD display in Master unit | LCD display in Slave unit |
|----------------------------|---------------------------|
| | |

Step 5: If there is no more fault alarm, the parallel system is completely installed.

Step 6: Please switch on all breakers of Line wires in load side. This system will start to provide power to the load.

Parallel in Three Phase

Step 1: Check the following requirements before commissioning:

- Correct wire connection
- Ensure all breakers in Line wires of load side are open and each Neutral wires of each unit are connected together.

Step 2: Turn on all units and configure LCD program 23 as P1, P2 and P3 sequentially. Then shut down all units.

Note: It's necessary to turn off switch when setting LCD program. Otherwise, the setting cannot be programmed.

Step 3: Turn on all units sequentially. Please turn on HOST inverter first, then turn on the rest one by one.

| LCD display in L1-phase unit | LCD display in L2-phase unit | LCD display in L3-phase unit |
|------------------------------|------------------------------|------------------------------|
| 0v 230v 0.1% 00v 564v HST | 0v 230v 0.1% 00v 564v 3P2 | 0v 230v 0.1% 00v 564v 3P3 |

Step 4: Switch on all AC breakers of Line wires in AC input. If AC connection is detected and three phases are matched with unit setting, they will work normally. Otherwise, they will display warning 15/16 and will not work in the line mode.

| LCD display in L1-phase unit | LCD display in L2-phase unit | LCD display in L3-phase unit |
|--------------------------------|--------------------------------|--------------------------------|
| 230v 230v 0.1% 00v 564v HST | 230v 230v 0.1% 00v 564v 3P2 | 230v 230v 0.1% 00v 564v 3P3 |

Step 5: If there is no more fault alarm, the system to support 3-phase equipment is completely installed.

Step 6: Please switch on all breakers of Line wires in load side. This system will start to provide power to the load.

Note 1: If there's only one inverter in L1-phase, the LCD will show as "HST". If there is more than one inverter in L1-phase, the LCD of the HOST inverter will show as "HST", the rest of L1-phase inverters will show as "3P1".

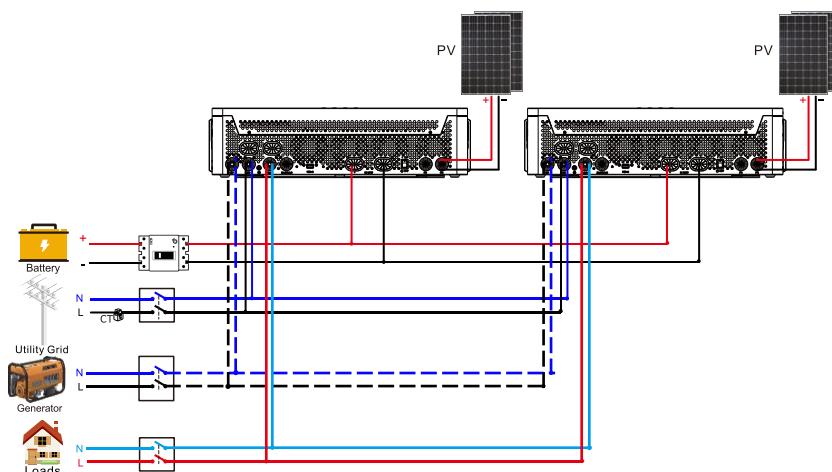
Note 2: To avoid overload occurring, before turning on breakers in load side, it's better to have whole system in operation first.

Note 3: Transfer time for this operation exists. Power interruption may happen to critical devices, which cannot bear transfer time.

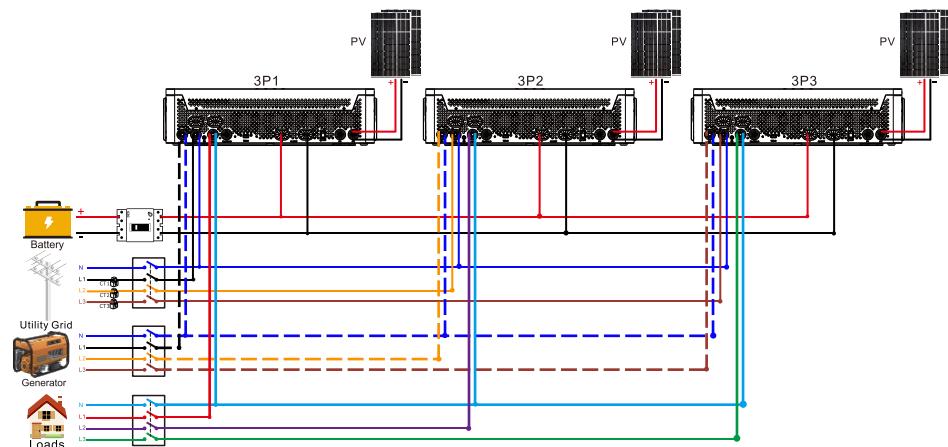
Note4: In a single-phase parallel system, when some inverters are connected to solar energy, energy can be obtained from the AC output end due to the parallel connection of the AC output end, resulting in energy transmission between inverters. Therefore, the AC input and AC output power displayed on the LCD display screen of a single inverter cannot accurately represent the energy flow of the inverter. It needs to be judged based on the total AC input and AC output power of the entire parallel system. (This phenomenon also exists between inverters in the same phase in a three-phase parallel system.)

5.6 Example of a parallel system diagram

Single-phase parallel wire connection:



Three-phase parallel wire connection:



6. Fault Reference Code

6.1 Fault Reference Code

| Fault Code | Fault Event | Icon on |
|------------|------------------------------|---------|
| 02 | Over temperature | 02- |
| 03 | Battery voltage is too high | 03- |
| 05 | Output short circuited | 05- |
| 06 | Output voltage is too high. | 06- |
| 07 | Overload time out | 07- |
| 08 | Bus voltage is too high | 08- |
| 09 | Bus soft start failed | 09- |
| 11 | The main relay failed | 11- |
| 12 | The INV relay failed | 12- |
| 51 | Over current or surge | 51- |
| 52 | Bus voltage is too low | 52- |
| 53 | Inverter soft start failed | 53- |
| 58 | Output voltage is too low | 58- |
| 60 | Negative power fault | 60- |
| 61 | PV voltage is too high | 61- |
| 62 | Internal communication error | 62- |
| 65 | BUS voltage imbalance | 65- |
| 66 | GFCI is too high | 66- |
| 67 | DCI failed | 67- |
| 70 | Battery input overcurrent | 70- |
| 80 | CAN fault | 80- |

6.2 Warning Indicator

| Warning | Warning Event | Audible Alarm | Icon flashing |
|---------|--|----------------------------|---------------|
| 01 | Fan is locked when inverter is on | Beep 3 times every second | 01△ |
| 02 | Over temperature | Beep once every second | 02△ |
| 03 | Battery is over-charged | Beep once every second | 03△ |
| 04 | Low battery | Beep once every second | 04△ |
| 07 | Overload | Beep once every 0.5 second | 07△ |
| 10 | Output power derating voltage | Beep twice every 3 seconds | 10△ |
| 13 | Solar charger stops due to high PV voltage | Beep once every second | 13△ |
| 14 | Solar charger stops due to overload | Beep once every second | 14△ |
| 15 | Parallel input utility grid different | Beep once every second | 15△ |
| 16 | Parallel input phase error | Beep once every second | 16△ |
| 17 | Parallel output phase loss | Beep once every second | 17△ |
| 18 | BUS over current | Beep once every second | 18△ |
| 19 | Battery disconnect | No beep | 19△ |
| 20 | BMS communication error | Beep once every second | 20△ |
| 21 | PV power insufficient | Beep once every second | 21△ |
| 22 | Parallel forbidden without battery | Beep once every second | 22△ |
| 23 | The parallel version is different | Beep once every second | 23△ |
| 25 | Parallel inverters' capacity different | Beep once every second | 25△ |
| 26 | ISO detection failed | Beep once every second | 26△ |
| 27 | Abnormal grounding warning | Beep once every second | 27△ |
| 28 | GFCI error | Beep once every second | 28△ |
| 29 | LLC overcurrent | Beep once every second | 29△ |
| 30 | BUS low voltage | Beep once every second | 30△ |
| 31 | In consistent switches | Beep once every second | 31△ |
| 36 | Total over voltage | Beep once every second | 36△ |
| 37 | Total under voltage | Beep once every second | 37△ |
| 38 | Charge over voltage | Beep once every second | 38△ |
| 39 | Discharge over temperature | Beep once every second | 39△ |
| 40 | Discharge over temperature | Beep once every second | 40△ |
| 41 | Charge over temperature | Beep once every second | 41△ |
| 81 | Host loss | Beep once every second | 81△ |

7. Specifications

7.1 PV Specification

| | | | |
|---|-----------------|-----------------|-----------------|
| It's applicable to Grid Tie & Hybrid & Off Grid | | | |
| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
| Max. power | 15000W | 12500W | 10000W |
| Max. PV Array Open Circuit Voltage | | 550Vdc | |
| Nominal PV Voltage | 380Vdc | 380Vdc | 380Vdc |
| Full load MPPT voltage rated | 280Vdc ~ 480Vdc | 240Vdc ~ 480Vdc | 190Vdc ~ 480Vdc |
| PV Start-up Voltage | | 120Vdc±10V | |
| PV Array Voltage High Loss | | 550Vdc | |
| PV Array Voltage High Comeback | | 520Vdc | |
| PV Array Voltage Low Loss | | 60Vdc | |
| PV Array Voltage Low Back | | 120Vdc | |
| PV MPPT Voltage Range | | 60Vdc ~ 480Vdc | |
| PV MPPT Voltage Low Loss | | 60Vdc | |
| PV MPPT Voltage Low Back | | 75Vdc | |
| Number of MPP Trackers | | 2 | |
| Max. DC Input current per string | 27Amp | 27Amp | 27Amp |
| Max. short-circuit current per MPPT tracker | 34Amp | 34Amp | 34Amp |
| PV Voltage Accuracy | +/-5V | | |

7.2 AC Input Specification

| | | | |
|--------------------------------------|--|--------------|-------------|
| It's applicable to Hybrid & Off-Grid | | | |
| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
| Nominal Input Voltage | | 230Vac | |
| Low Loss Voltage | 170Vac±7V(UPS); 90Vac±7V(Appliances) | | |
| Low Loss Return Voltage | 180Vac±7V(UPS); 100Vac±7V (Appliances) | | |
| High Loss Voltage | 280Vac±7V | | |
| High Loss Return Voltage | 270Vac±7V | | |
| Max AC Input Voltage | 300Vac | | |
| Nominal Input Frequency | 50Hz / 60Hz (Auto detection) | | |
| AC input frequency range | 40.0 ~ 65.0Hz | | |
| AC input frequency comeback value | 42.0/63.0Hz | | |
| Max. AC Input current | 70Amp (Include Loads and Charging) | | |
| Rating of Transfer Relay | 70Amp (Include Loads and Charging) | | |

7.3 Grid Feeding Specification

| | | | |
|--------------------------------------|--|--------------|-------------|
| It's applicable to Grid-tie & Hybrid | | | |
| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
| Nominal output voltage | | 230Vac | |
| Nominal output frequency | | 50Hz | |
| Max. feeding power | 12000W | 10000W | 8000W |
| Output voltage range | 195.5~253.0VAC (±3%) @Standard regulation 195.5~253.0VAC (±3%) @South Africa regulation 185.0~275.0VAC (±3%) @Pakistan regulation 184.0~264.5VAC (±3%) @Europe regulation 195.5~253.0VAC (±3%) @Spain regulation | | |

| | |
|---------------------------------------|--|
| Output voltage comeback value | 205.0~243.0VAC (±3%) @Standard regulation 195.5~253.0VAC (±3%) @South Africa regulation 195.0~265.0VAC (±3%) @Pakistan regulation 194.0~254.5VAC (±3%) @Europe regulation 205.5~243.0VAC (±3%) @Spain regulation |
| Operational frequency range | 49.0~51.0Hz (±0.1Hz) @Standard regulation 47.0~52.0Hz (±0.1Hz) @South Africa regulation 47.0~52.0Hz (±0.1Hz) @Pakistan regulation 47.5~51.5Hz (±0.1Hz) @Europe regulation 48.0~51.0Hz (±0.1Hz) @Spain regulation |
| Output frequency comeback value | 49.5~50.5Hz (±0.1Hz) @Standard regulation 47.5~51.5Hz (±0.1Hz) @South Africa regulation 47.5~51.5Hz (±0.1Hz) @Pakistan regulation 48.0~51.0Hz (±0.1Hz) @Europe regulation 48.5~50.5Hz (±0.1Hz) @Spain regulation |
| Output current | 52.2A |
| Max. output current | 65.2A |
| O/P current distortion | <5% |
| O/P current DC component | <300mA |
| Power Factor | 0.8 leading to 0.8 lagging |
| Max. Conversion Efficiency(PV/AC) | 96.5% |
| European Efficiency@V nominal (PV/AC) | 95.5% |

7.4 Battery Mode Specification

| | | | |
|---------------------------|--|--------------|-------------|
| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
| Nominal Output Power | 12000W | 10000W | 8000W |
| Max Discharge Current | 280A | 240A | 200A |
| Waveform | Pure Sine Wave | | |
| Nominal Output Voltage | 230Vac | | |
| Nominal Output Frequency | 50/60Hz auto sensing | | |
| Output Voltage Distortion | <3% for linear load, <5% for non-linear load @ V nominal | | |
| Output DC offset | <150mV | | |
| Peak Efficiency | 95% | | |
| No Load Power Consumption | <75W@Rate Voltage | | |
| Transfer Time | <20ms@Single <30ms @ Parallel | | |
| Output Parallel-able | Yes | | |

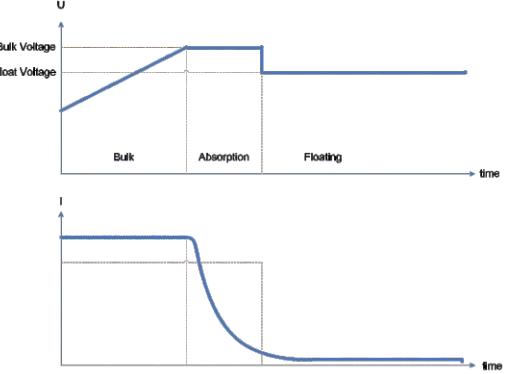
7.5 Smart Load Output Power Specification

| | | | |
|------------------------|--------------|--------------|-------------|
| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
| Full Load Output Power | 12000W | 10000W | 8000W |
| Maximum Main Load | 12000W | 10000W | 8000W |
| Maximum smart load | 8000W | 8000W | 8000W |

7.6 Overload Capability Specification

| | |
|--------------|------------------------------|
| Line Mode | @>70A AC input current, 1min |
| Battery Mode | 5sec, @>120% Load |
| | 10sec, @103%~120% |
| | 4-cycle, short-circuits |

7.7 Battery & Charger Specification

| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
|--|---|--|-------------|
| Nominal DC Voltage | | 48Vdc | |
| Cold Start Voltage(Lead-Acid Mode) | | 46.0Vdc | |
| Cold Start SOC(Li Mode) | | Default 30%, Low DC Cut-off SOC +10% | |
| Low DC Warning Voltage (Lead-Acid Mode) | | 44.0Vdc @ load < 20% 42.8Vdc @ 20% ≤ load < 50% 40.4Vdc @ load ≥ 50% | |
| Low DC Warning Recovery Voltage (Lead-Acid Mode) | | 46.0Vdc @ load < 20% 44.8Vdc @ 20% ≤ load < 50% 42.4Vdc @ load ≥ 50% | |
| Low DC Cut-off Voltage (Lead-Acid Mode) | | 42.0Vdc @ load < 20% 40.8Vdc @ 20% ≤ load < 50% 38.4Vdc @ load ≥ 50% | |
| Low DC Warning SOC (Li Mode) | | Low DC Cut-off SOC +5% | |
| Low DC Warning Return SOC (Li Mode) | | Low DC Cut-off SOC +10% | |
| Low DC Cut-off SOC(Li Mode) | | Default 20%, 5%~50% settable | |
| High DC Recovery Voltage | | 56.4Vdc(C.V. charging voltage) | |
| High DC Cut-off Voltage | | 60Vdc | |
| Max. AC Charging Current | 250Amp | 220Amp | 190Amp |
| Max. Solar Charging Current | 250Amp | 220Amp | 190Amp |
| Max. Charging Current | 250Amp | 220Amp | 190Amp |
| Absorption Charging Voltage | | 56.4Vdc | |
| Floating Charging Voltage | | 54.0Vdc | |
| Overcharge Protection | | 60Vdc | |
| Charging Algorithm | | 3-step | |
| Charging process based on default setting. 3 stages: First – max. charging voltage increases to 56V; Second- charging voltage will maintain at 56V until charging current is down to 5 Amp, or after 12 hours of continuous charging; Third- go to floating charging at 54V. |  | | |

7.8 Environmental

| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
|-----------------------------|--------------|-------------------------|-------------|
| Operation Temperature Range | | -10°C ~ 50°C | |
| Storage Temperature Range | | -15°C ~ 60°C | |
| Altitude | | <2000m | |
| Relative humidity | | 5% ~ 95% non-condensing | |
| Audible Noise | | <75dB | |
| Cooling | | DC FAN | |
| Safety Certification | | CE | |

7.9 Mechanical Specification

| Model | SPE 12000 ES | SPE 10000 ES | SPE 8000 ES |
|-------------------------------|--------------|----------------|-------------|
| Housing Dimension (L*W*H), mm | | 550*465*150 mm | |
| Packing Dimension (L*W*H), mm | | 705*625*260 mm | |
| Housing Color | | White | |
| Net Weight, kg | | 21.5 | |
| Gross Weight, kg | | 25.5 | |

8. Appendix

Appendix I. Fault information and processing

The energy storage inverter is designed according to the off-grid connected operation standard and meets the safety requirements and electromagnetic compatibility requirements. Before leaving the factory, the inverter undergoes several rigorous tests to ensure that the inverter can operate reliably.

 If any of the fault messages listed in Table 6-1 appear on your inverter and the fault has not been removed after restarting, please contact your local dealer or service center. You need to have the following information ready.

1. Inverter serial number;
2. The problem description (including the fault code and indicator status displayed on the LCD, or specific fault video and picture) is as detailed as possible.
3. Basic system component information (such as batteries, photovoltaic panels, load usage and specifications)
4. Your contact information.

In order to give you a clearer understanding of the inverter's fault information, we will list all possible fault codes and their descriptions when the inverter is not working properly

| error code | Description | Solutions |
|-------------|---|--|
| F01 | Fan is locked | 1.Check whether all fans are working properly. 2.Replace the fan. |
| F02 | Internal temperature of component is over 100°C. | Check whether the air flow of the unit is blocked or whether the ambient temperature is too high. |
| F03 | Battery is over-charged. The battery voltage is too high | Restart the unit 1.Measure battery voltage in DC input. (Check battery SOC in LCD when use Li battery) 2.Adjust the charging current to less than 0.2C 3.Check if spec and quantity of batteries are meet requirements. |
| W04 | Battery voltage is too low | 1.Measure battery voltage in DC input. (Check battery SOC in LCD when use Li battery) 2.Recharge the battery. |
| F05 | Output short circuited | 1.Disconnect load and restart the unit 2.Check if wiring is connected well and remove abnormal load. |
| F07 | Overload time out | Reduce the connected load by switching off some equipment. |
| F08 | Bus voltage is too high | 1. If you connect to a lithium battery without communication, check whether the voltage points of the program 19 and 21 are too high for the lithium battery. 2. Restart the unit |
| F11/F12 | Relay detection failed | Restart the unit |
| F09/F53/F57 | Bus soft start failed | Restart the unit |
| W15 | The input status is different in parallel system. | Check if AC input wires of all inverters are connected well. |
| W16 | Input phase is not correct. | Change the input phase S and T wiring. |
| W17 | The output phase not correct in parallel. | 1.Make sure the parallel setting is the same System (single or parallel; 3P1,3P2,3P3). 2.Make sure all phases inverters are power on. |
| W19 | Lead acid battery disconnect Lithium battery disconnect | Check if spec and quantity of batteries are meet requirements. 1. Check BMS communication cable connection 2. Check setup parameters |

| | | |
|---------|------------------------------|---|
| W20 | BMS communication error | 1. Check whether communication line is correct connection between inverter and battery. 2. Check whether BMS protocol type is correct setting. |
| W27 | Abnormal grounding warning | Check whether the ground connection is normal. |
| W31 | Inconsistent switches | Check if all inverter switches are closed |
| F29/F51 | Over current or surge | Restart the unit |
| F52 | Bus voltage is too low | Restart the unit |
| F55 | Output voltage is unbalanced | Restart the unit |
| F61 | PV voltage is too high | 1. Measure whether the PV voltage in the DC input is consistent with the value displayed on the LCD screen. 2. If consistent, standardize the parallel connection method of PV panels. |
| F62 | Internal communication error | Restart the unit |
| F65 | BUS voltage imbalance | Restart the unit |
| F66 | GFCI is too high | 1.Check if the load equipment has a leakage phenomenon 2. Restart the unit |
| F67 | DCI failed | Restart the unit |
| F70 | Battery input overcurrent | Reduce the connected load by switching off some equipment. |
| F80 | CAN fault | 1. Check whether the parallel communication cables are connected well. 2. Check whether Program 23 settings are right for the parallel system. |
| F81 | Host loss | |

| Other Problem | LCD/LED/Buzzer | Explanation | What to do |
|---|--|---|---|
| Unit shuts down automatically during startup process. | LCD/LEDs and buzzer will be active for 3 seconds and then complete off. | The battery voltage is too low. (<1.91V/Cell) | 1. Re-charge battery. 2. Replace battery. |
| No response after power on. | No indication. | 1.The battery voltage is far too low. (<1.4V/Cell) 2.Battery polarity is connected reversed. | 1.Check if batteries and the wiring are connected well. 2.Re-charge battery. 3.Replace battery. |
| Mains exist but the unit works in battery mode. | Input voltage is 0 on the LCD and green LED is flashing. Green LED is flashing. | Input protector is tripped. Insufficient quality of AC power (Shore or Generator) | Check if AC breaker is tripped and AC wiring is connected well. 1.Check if AC wires are too thin and/or too long. 2.Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS → Appliance) |
| When it's turned on, internal relay is switching on and off repeatedly. | Green LED is flashing. | Set "Battery First" or "Solar First" as the priority of output source. | Change output source priority to Utility first. |
| | LCD display and LEDs are flashing | Battery is disconnected. | Check if battery wires are connected well. |

Note: To restart the inverter, all power sources need to be disconnected. After the LCD screen light is off, only use the battery to boot.

Appendix II Restore factory settings

After pressing and holding UP and DOWN buttons at the same time for 3 seconds, the unit will enter PASS mode. Change the middle three numbers 000 to 305. Press the "ENTER" button twice to confirm the selection, then press "ESC" to return and complete the settings.

| Program | Setting Option |
|---------|----------------|
| PASS | PASS 305 000 |

Appendix III Battery Equalization

| | | | | |
|----|------------------------------------|---|--|--|
| 43 | Battery equalization | Battery equalization enable EQ ENA 043 | Battery equalization disable(default) EQ d15 043 | |
| | | If "Flooded" or "User-Defined" is selected in program 05, this program can be set up. | | |
| 44 | Battery equalization voltage | EQV 584° 044 | Default 58.4V, 48.0V~58.4V Settable | |
| 45 | Battery equalized time | EQT 60 045 | Default 60min, 5min~900min Settable | |
| 46 | Battery equalized timeout | EQTO 120 046 | Default 120min, 5min~900min Settable | |
| 47 | Equalization interval | EQI 30 047 | Default 30days, 1 days~90 days Settable | |
| 48 | Equalization activated immediately | EQ ON 048 | Equalization activated immediately on EQ OFF 048 Equalization activated immediately off(default) | |
| | | If equalization function is enabled in program 43, this program can be setup. If "On" is selected in this program, it's to activate battery equalization immediately and LCD main page will shows "EQ". If "Off" is selected, it will cancel equalization function until next activated equalization time arrives based on program 47 setting. At this time, "EQ" will not be shown in LCD main page. | | |

Equalization function is added into charge controller. It reverses the buildup of negative chemical effects like stratification, a condition where acid concentration is greater at the bottom of the battery than at the top. Equalization also helps to remove sulfate crystals that might have built up on the plates. If left unchecked, this condition, called sulfation, will reduce the overall capacity of the battery. Therefore, it's recommended to equalize battery periodically.

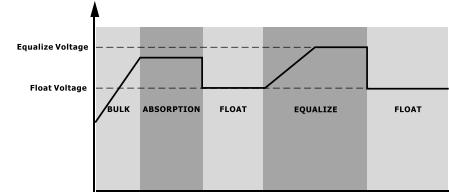
● How to Apply Equalization Function

You must enable battery equalization function in monitoring LCD setting program 43 first. Then, you may apply this function in device by either one of following methods:

1. Setting equalization interval in program 47.
2. Active equalization immediately in program 48.

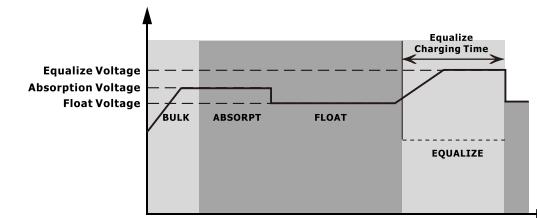
● When to Equalize

In float stage, when the setting equalization interval (battery equalization cycle) is arrived, or equalization is active immediately, the controller will start to enter Equalize stage.

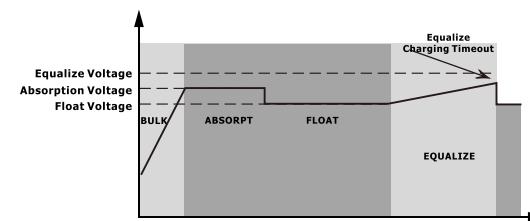


● Equalize charging time and timeout

In Equalize stage, the controller will supply power to charge battery as much as possible until battery voltage raises to battery equalization voltage. Then, constant-voltage regulation is applied to maintain battery voltage at the battery equalization voltage. The battery will remain in the Equalize stage until setting battery equalized time is arrived.



However, in Equalize stage, when battery equalized time is expired and battery voltage doesn't rise to battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves battery equalization voltage. If battery voltage is still lower than battery equalization voltage when battery equalized timeout setting is over, the charge controller will stop equalization and return to float stage.



Appendix IV Routine maintenance

To ensure the long-term and good operation of the energy storage system, it is recommended to perform the routine maintenance as described in this section (Cleaning and maintenance of the inverter must be carried out with the power supply disconnected to ensure personal safety.)

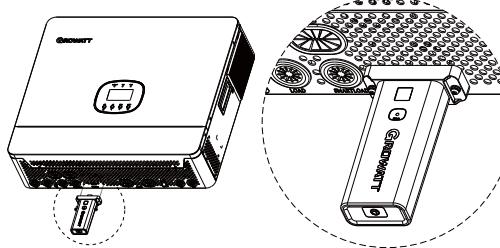
| Items | Methods | Maintenance interval |
|---------------------------------|--|--|
| System cleanliness for inverter | <ul style="list-style-type: none"> Regularly check the surface of the inverter for dust or other debris and clean it with a dust sponge. Regularly check that radiators and vents are not covered with dust and clean them with a soft brush or compressed air. Remove the dustproof cotton at the air inlet and clean it. | <p>Once every six months to one year</p> <p>Once every 3 months.</p> |
| Electrical connection | <ul style="list-style-type: none"> Check if any cable connection is off or loose. Check if any cable is damaged, and especially if there are cuts on the sheath where the cable contacts with the metal surface. Check the internal circuit boards and components of the inverter for abnormalities, such as damage, discoloration, etc., and repair and replace them in a timely manner. | Half a year after first debugging and testing, and once every six months to one year thereafter. |
| Grounding reliability | Check if the grounding cable is grounded reliably. | |
| Normal operation | <p>Periodically check the input voltage, output voltage and current of the inverter to ensure that it is operating within its rated range.</p> <p>Regularly check the operating status and performance parameters of the inverter via the inverter's monitoring system or display.</p> | |
| Other Maintenance | Ensure that the inverter is installed in a dry, well-ventilated environment, protected from humidity, heat or excessive dust. | |

Appendix V WIFI Monitoring

Plug cube WIFI into the WIFI/4G port. Scan the QR code below to download ShinePhone, also you can search ShinePhone in iOS or Google Play Store, download and install it.

Note: 1. Make sure you download the latest version.

2. For further information please visit server. growatt.com



【Android & iOS】