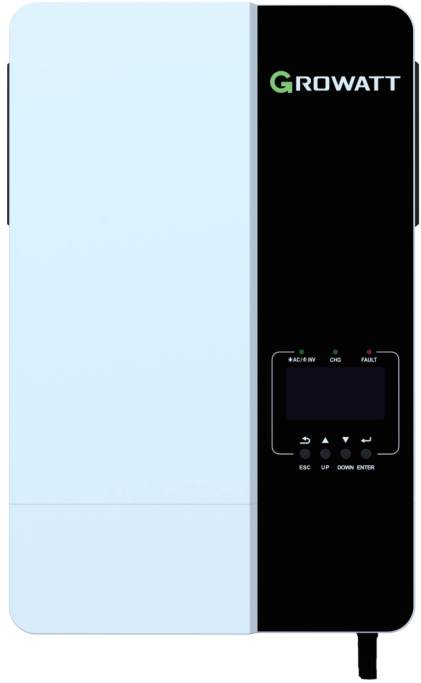


Off Grid Solar Inverter

SPF 3500 ES Lite

SPF 5000 ES Lite

User Manual

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1.Information on this Manual

1.1 Validity

This manual is valid for the following devices:

- SPF 3500 ES Lite
- SPF 5000 ES Lite

1.2 Scope

This manual describes the assembly, installation, operation and trouble shooting 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:

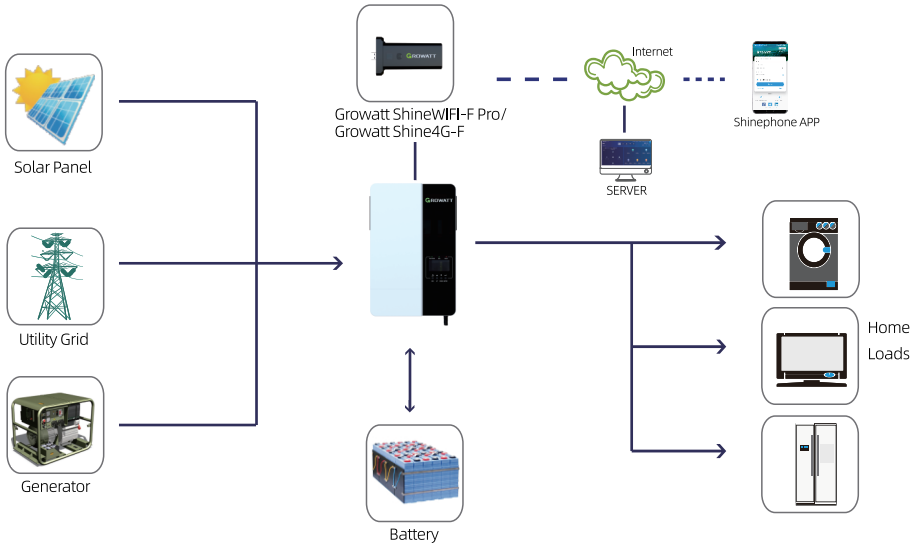
- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of the applicable standards 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. **NEVER** charge a frozen battery.
6. 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.
7. For optimum operation of this inverter, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter.
8. 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.
9. 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.
10. **NEVER** cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
11. 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.
12. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
13. 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



Hybrid Power System

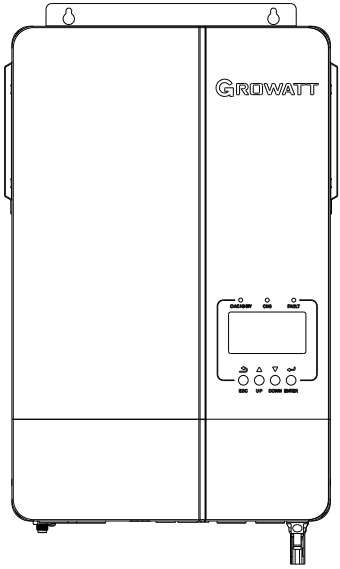
This is a multifunctional off grid solar inverter, integrated with a MPPT solar charge controller, a high frequency pure sine wave inverter and a UPS function module in one machine, which is perfect for off grid backup power and self-consumption applications. This inverter can work with or without batteries.

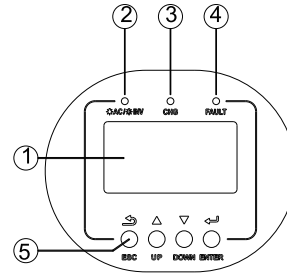
The whole system also need other devices to achieve complete running such as PV modules, generator, or utility grid. Please consult with your system integrator for other possible system architectures depending on your requirements. The WiFi / 4G module is a plug-and-play monitoring device to be installed 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.

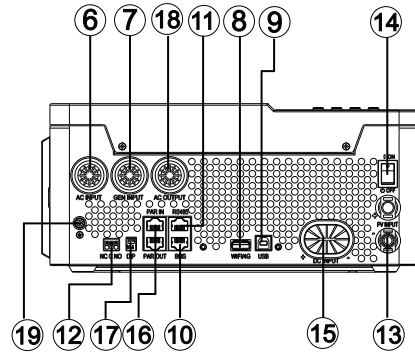
2.1 Product Features

- Rated power 3.5KW to 5KW, power factor 1.
- 1 strings of MPPT, Max. PV array power 4500watt to 5500watt.
- MPPT Voltage range 120Vdc-450Vdc, 500Vdc.
- Built-in ATS for automatic grid and generator switching.
- Built-in anti-dust kit for harsh environment.
- MC4 PV input connector.
- Parallel operation up to 9 unit (only with battery connected).
- WIFI/4 G remote monitoring (optional) .
- Able to work with or without battery.
- With CAN/RS485 for BMS communication.

2.2 Panel and Port Definitions







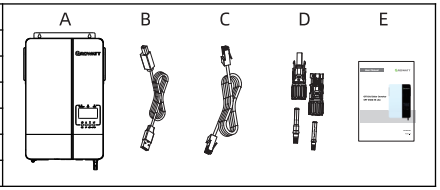
Panel operation	
1. LCD display	2. Status indicator
3. Charging indicator	4. Fault indicator
5. Function buttons	
Connection port	
6. AC input	7. Generator input
13. PV input	15. Battery input
18. AC output	19.PE
Communication port	
8. WiFi/4G communication port	9. USB communication port
10. BMS communication port (support	11.RS485 communication port (for expansion)
16. Parallel	17. DIP(for parallel operation)
Other	
12.Dry contact	14. Power on/off switch

3. Installation Instructions

3.1 Accessory list

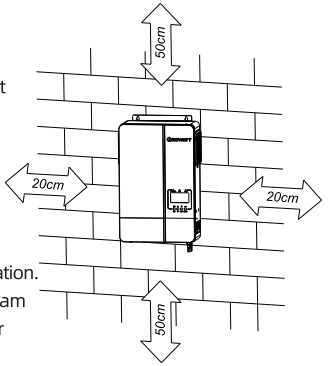
Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items in the package:

Part List		
Item	Item Name	Qty
A	The unit	1
B	Communication cable	1
C	Parallel communication cable	1
D	MC4 connector	2
E	User manual	1



3.2 Points for attention

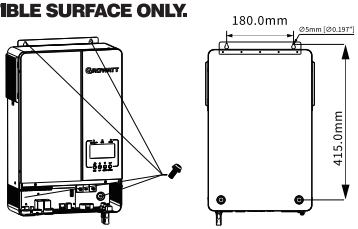
Consider the following points before selecting where to install:
Install this inverter at eye level in order to allow the LCD display to be read at all times.



- The ambient temperature should be between 0°C and 55°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).**

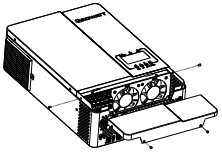
⚠ **SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.**



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

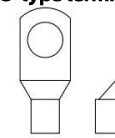
1、For safety operation and regulation compliance, it's requested to install a separate DC breaker （over-current protector) or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications, however, it's still requested to have DC breaker installed. 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*
SPF 3500 ES Lite	100A / 60VDC
SPF 5000 ES Lite	150A / 60VDC

2、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
SPF 3500 ES Lite	1 * 4 AWG	2-3 Nm
SPF 5000 ES Lite	1 * 2AWG	2-3 Nm

O-type terminal:

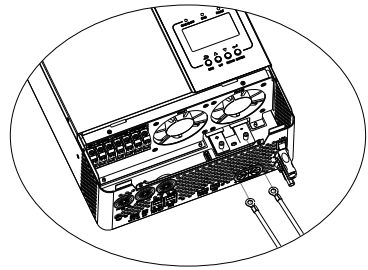


3、Battery Module Selection： Choose the appropriate battery according to the actual situation.

Battery Recommended specifications	SPF 3500 ES Lite	SPF 5000 ES Lite
Lead-acid Battery	100Ah capacity battery	200Ah capacity battery
Lithium Battery	100Ah capacity battery	200Ah capacity battery

3.3.2 Battery power cable connection

Please follow below steps to implement battery connection:
1、Assemble battery ring terminal based on recommended battery cable and terminal size.
2、Connect all battery packs as units requires.
3、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.

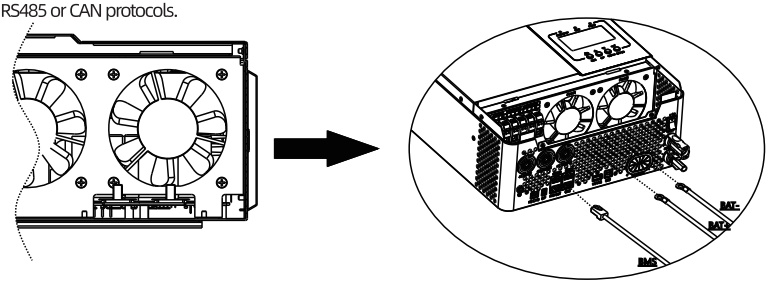


3.3.3 Lithium battery communication cable connection

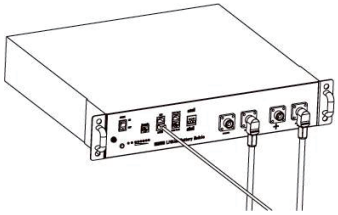
If used with lithium batteries, make sure to connect the BMS communication cable between the battery and the inverter. It is recommended to use lithium batteries that have been tested with our configuration.

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.

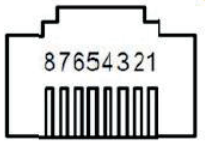


2、The other end of the battery communication cable plugs into the battery communication port (RS485 or CAN).



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	CANL	-
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 programe 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 AC input/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 three terminal blocks with "AC INPUT", "GEN" and "AC OUTPUT" markings. Please do NOT mis-connect 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 AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. Please refer to typical amperage in below table as required breaker size.

Recommended breaker specification of AC input for a single inverter:

Model		1 unit*
SPF 3500 ES Lite	SPF 5000 ES Lite	40A / 230VAC

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

Recommended AC wires size:

Model	Wire Size		Torque value
SPF 3500 ES Lite	1 * 10 AWG	6mm²	1.2-1.6 Nm
SPF 5000 ES Lite	1 * 8AWG	8 mm²	1.2-1.6 Nm

3、When the generator is used as the AC input source of the inverter, the generator power needs to be matched according to the load power. In order to prevent the generator's output voltage, frequency and waveform from being affected due to too large a load, and thus not being able to meet the AC input conditions of the inverter resulting in an AC input cut-out, the following recommendations are made for the generator power.

	Power Recommendation	
load	Inductive load<=2KW	
generator	Single Phase	>=10KVA
	Three-phase parallel system	>=20KVA

3.4.2 AC Input/GEN/Output wires Connection：

Please follow the steps below to make AC output/AC input/GEN connections:

1. Remove the insulation covers of the seven wires.

2. Connect the PE protection line first, and then lock in the AC output line, AC input line, and GEN line in order. Corresponding polarity positions marked on the terminals.

Please refer to the following:

⏚→Ground (yellow-green)

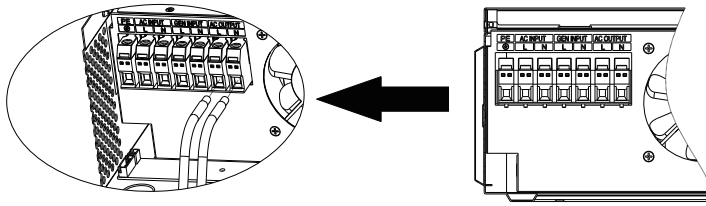
L→LINE (brown)

N→Neutral (blue)

1.First, insert AC output wires according to polarities indicated on terminal block and tighten terminal screws.

L→LINE (brown)

N→Neutral (blue)

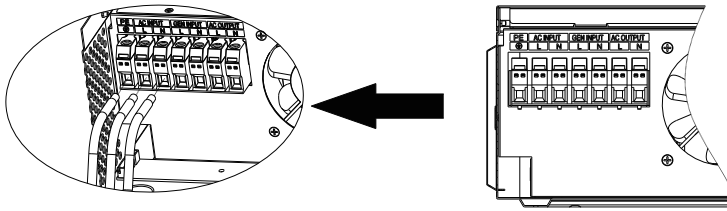


2.Second, insert AC input wires according to polarities indicated on terminal block and tighten terminal screws.

⏚→Ground (yellow-green)

L→LINE (brown)

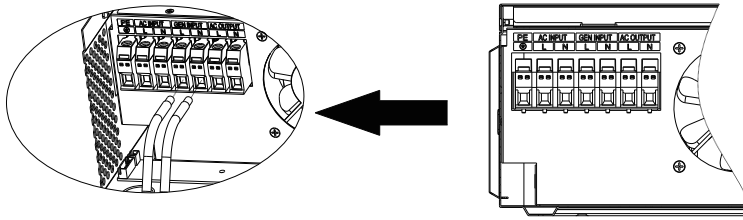
N→Neutral (blue)



3.Last,insert GEN wires according to polarities indicated on terminal block and tighten the terminal screws.

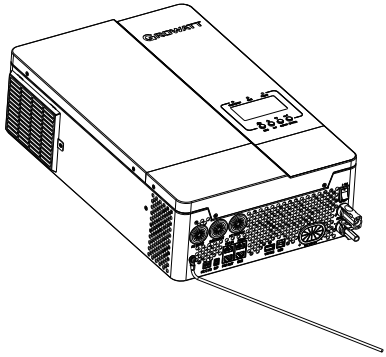
L→LINE (brown)

N→Neutral (blue)

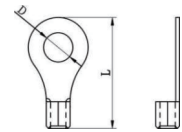


4.Make sure the inverter metal housing is grounded(Ground in the grid system).

⏚→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.

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
SPF 3500 ES Lite	SPF 5000 ES Lite	25A / 500Vdc

2、It' 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
SPF 3500 ES Lite	SPF 5000 ES Lite	1 * 12 AWG	4mm²	1.2-1.6 Nm

3、PV Module Selection:

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

1.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.

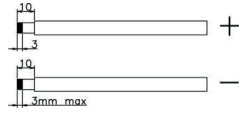
2.Open circuit Voltage (Voc) of PV modules should be higher than start-up voltage. Lower than will lead to insufficient photovoltaic.

INVERTER MODEL	SPF 3500 ES Lite	SPF 5000 ES Lite
Max. PV Array Open Circuit	500Vdc	
Start-up Voltage	150Vdc±10Vdc	
PV Array MPPT Voltage Range	120Vdc~450Vdc（Recommend 370 Vdc）	
Quantity Of PV Panels	Recommend 3~9 photovoltaic panels	

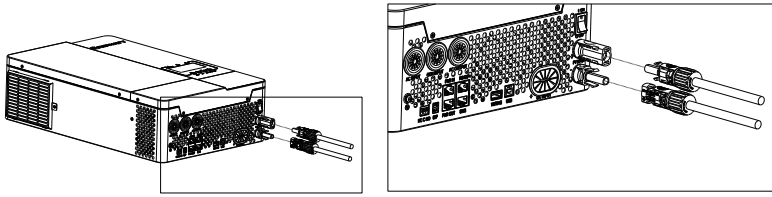
3.5.2 PV cable Connection:

Please follow below steps to implement PV module connection:

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



2.Connect PV cables to MC4 terminalswith correct polarity (+) to (+) 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.

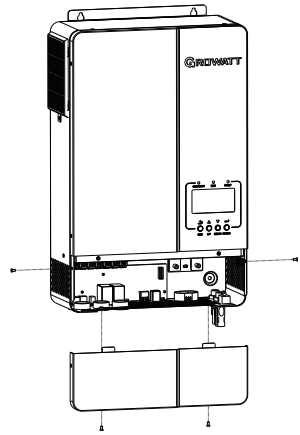
3.7 Dry Contact Signal

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 battery voltage reaches warning level.

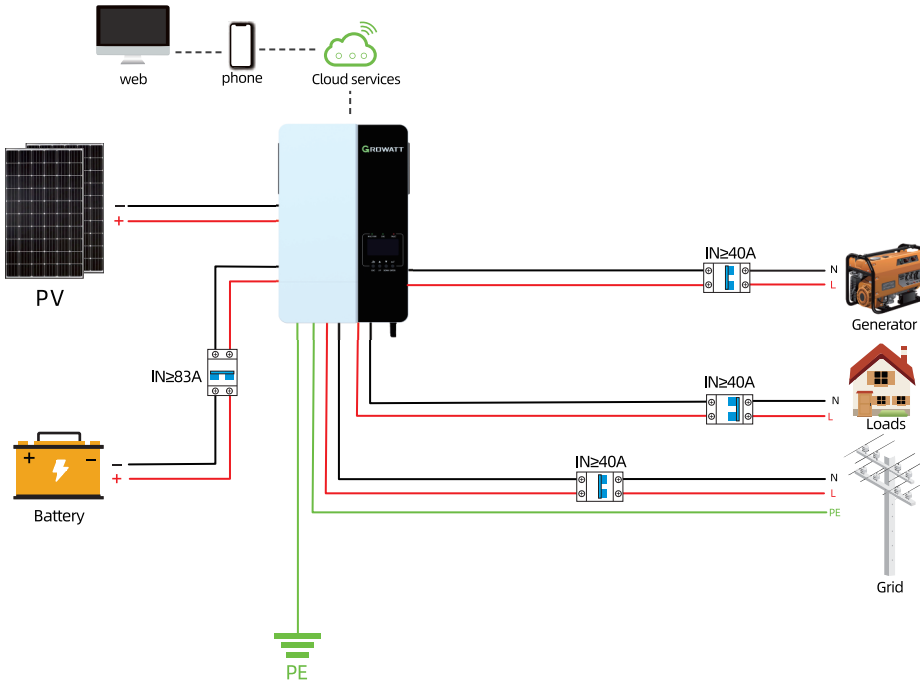
Unit Status	Condition			Dry contact port:  NC C NO	
				NC & C	NO & C
Power Off	Unit is off and no output is powered			Close	Open
Power On	Output is powered from Utility			Close	Open
	Output is powered from Battery or Solar	Program 01 set as Utility first	Battery voltage (SOC)< Low DC warning voltage(SOC)	Open	Close
			Battery voltage(SOC) > Setting value in Program 13 or battery charging reaches floating stage	Close	Open
		Program 01 is set as SBU or Solar first	Battery voltage (SOC)< Setting value in Program 12	Open	Close
			Battery voltage (SOC)> Setting value in Program 13 or battery charging reaches floating stage	Close	Open

Final Assembly

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

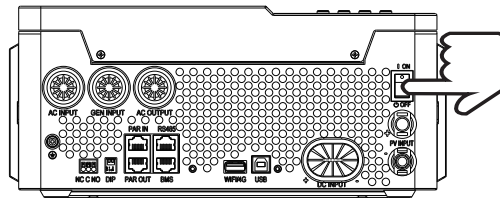


3.8 Wiring system for inverter



4. Operation

4.1 Power ON/OFF

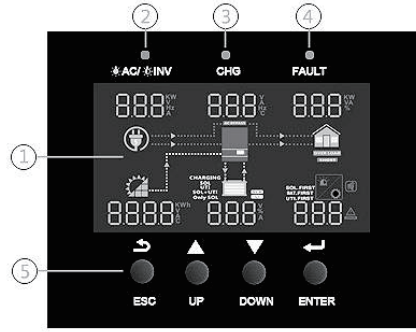


After correct installation, switch on the battery switch, switch on the inverter switch, wait about 30 seconds, inverter output.

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.

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



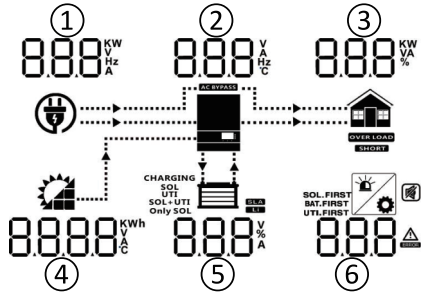
LED Indicator

LED Indicator			Messages
AC/INV	Green	Solid On	Output is powered by utility in Line mode.
		Flashing	Output is powered by battery or PV in battery mode.
CHG	Green	Solid On	Battery is fully charged.
		Flashing	Battery is charging.
FAULT	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



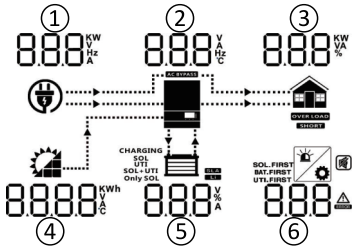
Icon	Description
AC Input Information	
	AC input icon
①	Indicate AC input power, AC input voltage, AC input frequency, AC input current
AC BYPASS	Indicate AC power loads in bypass
PV Input Information	
	PV input icon
④	Indicate PV power, PV voltage, PV current, etc
Output Information	
	Inverter icon
②	Indicate output voltage, output current, output frequency, inverter temperature
Load Information	
	Load icon
③	Indicate power of load, power percentage of load
OVER LOAD	Indicate overload happened
SHORT	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.
⑤	Indicate battery voltage, battery percentage, battery current
SLA	Indicate SLA battery
Li	Indicate lithium battery
CHARGING SOL SOL+UTI Only SOL	Indicate charging source priority: solar first, solar and utility, or only solar
Other Information	
SOL. FIRST BAT. FIRST UTI. FIRST	Indicate output source priority: solar first, utility first, SBU mode or SUB mode
⑥	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

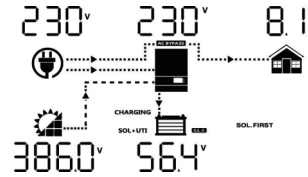
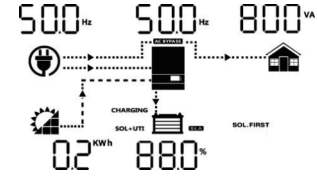
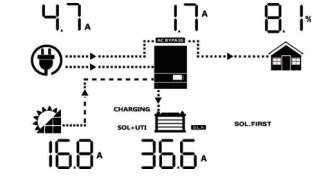
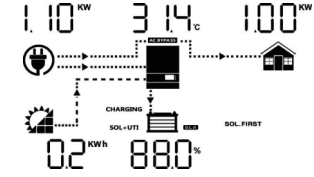
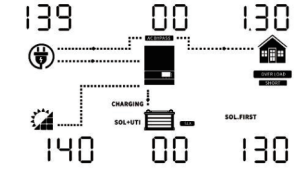
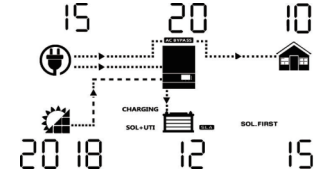
In battery charge mode, battery icon will present Battery Charging Status		
Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<48V	4 bars will flash in turns.
	48 ~ 50V	Bottom bar will be on and the other three bars will flash in turns.
	50 ~ 52V	Bottom two bars will be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

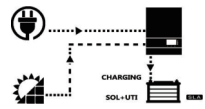
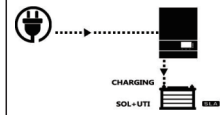
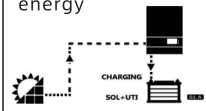
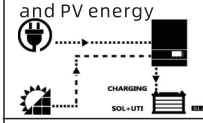
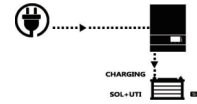
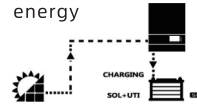
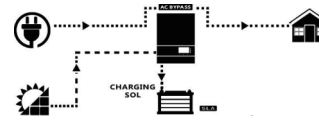
4.2.2 Display Information

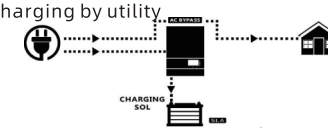
The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: voltage, frequency, current, power, firmware version.

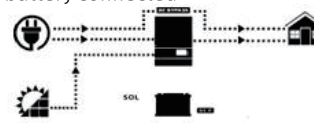
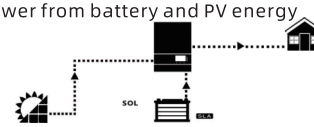


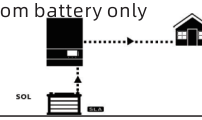
Setting Information	LCD display
①AC Input voltage （If it flashes, it indicates that the input voltage of the generator is displayed at this time, and the current, power and frequency displayed after turning the page are also the input parameters of the generator.） ②Output voltage ③ Load percentage ④ PV input voltage ⑤ Battery voltage ⑥ Warning or Fault code (Default Display Screen)	
① AC Input frequency ② Output frequency ③ Load power in VA ④ PV energy sum in KWH ⑤ Battery percentage ⑥ Warning or Fault code	
① AC Input current ② Output current ③ Load percentage ④ PV input current ⑤ Battery charging current ⑥ Warning or Fault code	
① AC input power in Watts ② Inverter temperature ③ Load power in Watts ④ PV energy sum in KWH ⑤ Battery percentage ⑥ Warning or Fault code	
Firmware version （CPU1: 139-00-130; CPU2:140-00-130）	
Time (15:20:10, December 15, 2018)	

4.2.3 Operating Mode Description

<table>
<tr><th>Operation mode</th><th>Description</th><th colspan="2">LCD display</th></tr>
<tr><td rowspan="2">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.</td><td rowspan="2">No output is supplied by the unit but it still can charge batteries</td><td>Charging by utility and PV energy.

</td><td>Charging by utility

</td></tr>
<tr><td>Charging by PV energy

</td><td>No charging
</td></tr>
<tr><td rowspan="2">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.</td><td rowspan="2">PV energy and utility can charge batteries.</td><td>Charging by utility and PV energy

</td><td>Charging by utility

</td></tr>
<tr><td>Charging by PV energy

</td><td>No charging
</td></tr>
<tr><td>Line Mode</td><td>The unit will provide output power from the mains. It can also charge the battery at line mode.</td><td colspan="2">Charging by PV energy


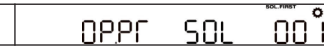
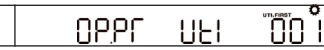
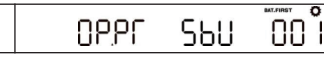
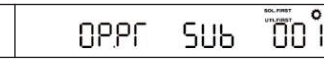
Charging by utility


No battery connected

</td></tr>
<tr><td>Battery Mode</td><td>The unit will provide output power from battery and PV power.</td><td colspan="2">Power from battery and PV energy


Power from battery only

</td></tr>
</table>

4.3 LCD parameter setting

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	
01	Output source priority: To configure load power source priority	Solar first	
		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 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 (default)	
		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	
		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	
		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.	 (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	Appliance (default)  If selected, acceptable AC input voltage range will be within: 90~280VAC	
		UPS  If selected, acceptable AC input voltage range will be within: 170~280VAC	

<table>
<tr><td>04</td><td>Power saving mode enable/disable</td><td>Saving mode disable (default)

If disabled, no matter connected load is low or high, the on/off status of inverter output will not be effected.

Saving mode enable

If enabled, the output of inverter will be off when connected load is pretty low or not detected.</td></tr>
<tr><td>05</td><td>Battery type</td><td>AGM (default)–Suitable for lead-acid battery

<table>
<tr><td>Items that cannot be set</td><td>19</td><td>20</td><td>21</td></tr>
<tr><td>default</td><td>56.4V</td><td>54V</td><td>42V</td></tr>
</table>
<table>
<tr><th>Items that can be set:</th><th>default</th><th>Set range</th><th>Set requirements</th></tr>
<tr><td>02</td><td>60A</td><td>0A~80A(100A)</td><td></td></tr>
<tr><td>11</td><td>30A</td><td>0A~60A(80A)</td><td></td></tr>
<tr><td>12</td><td>46V</td><td>44~51.2V</td><td><13 setting value</td></tr>
<tr><td>13</td><td>54v</td><td>48~58.0V</td><td></td></tr>
</table>
Flooded–Suitable for lead-acid battery or flood battery

<table>
<tr><td>Items that cannot be set:</td><td>19</td><td>20</td><td>21</td></tr>
<tr><td>default</td><td>58.4V</td><td>56V</td><td>43.6V</td></tr>
</table>
<table>
<tr><th>Items that can</th><th>default</th><th>Set range</th><th>Set requirements</th></tr>
<tr><td>02</td><td>60A</td><td>0A~80A(100A)</td><td></td></tr>
<tr><td>11</td><td>30A</td><td>0A~60A(80A)</td><td></td></tr>
<tr><td>12</td><td>48V</td><td>44~51.2V</td><td><13 setting value</td></tr>
<tr><td>13</td><td>56v</td><td>48~58.0V</td><td></td></tr>
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Lithium (only suitable when communicated with BMS commu\nication)

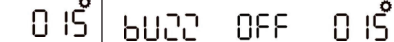
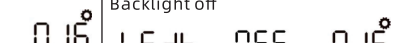
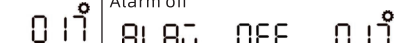
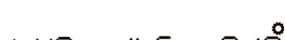
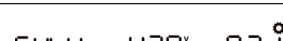
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<tr><td>Items that cannot be set:</td><td>02</td><td>19</td><td>20</td></tr>
</table>
<table>
<tr><th>Items that can be set:</th><th>default</th><th>Set range</th><th>Set requirements</th></tr>
<tr><td>11</td><td>30A</td><td>0A~60A(80A)</td><td></td></tr>
<tr><td>12</td><td>50%</td><td>10%~95%</td><td><13 setting value</td></tr>
<tr><td>13</td><td>95%</td><td>15%~100%</td><td></td></tr>
<tr><td>21</td><td>20%</td><td>5%~50%</td><td><12 setting value</td></tr>
</table>
User-Defined–Suitable for lead-acid battery, battery parameters can be set manually

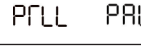
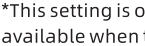
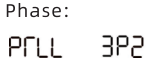
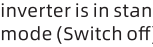
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<tr><td>13</td><td>54V</td><td>48~58.0V</td><td></td></tr>
<tr><td>19</td><td>56.4V</td><td>48~58.4V</td><td></td></tr>
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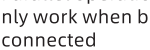
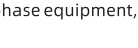
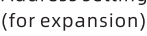
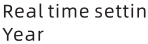
<table>
<tr><td></td><td></td><td>User-Defined 2 (suitable when lithium battery without BMS communication or communication protocol not matched with the inverter, battery parameters can be set manually)

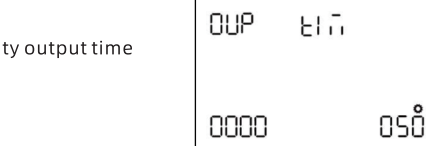
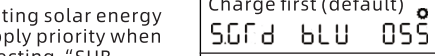
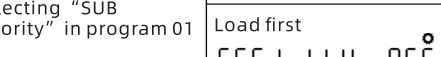
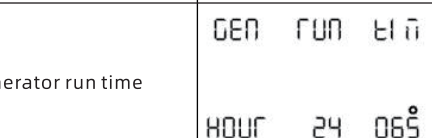
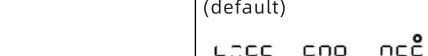
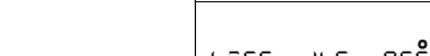
<table><tr><th>Items that can be set:</th><th>default</th><th>Set range</th><th>Set requirements</th></tr><tr><td>02</td><td>60A</td><td>0A~80A(100A)</td><td></td></tr><tr><td>11</td><td>30A</td><td>0A~60A(80A)</td><td></td></tr><tr><td>12</td><td>48V</td><td>44~51.2V</td><td><13 setting value</td></tr><tr><td>13</td><td>54V</td><td>48~58.0V</td><td></td></tr><tr><td>19</td><td>54V</td><td>48~58.4V</td><td></td></tr><tr><td>20</td><td>54V</td><td>48~58.4V</td><td>Suggestion=19 setting value</td></tr><tr><td>21</td><td>46V</td><td>40~48V</td><td><12 setting value</td></tr></table></td></tr>
<tr><td>06</td><td>Auto restart when overload occurs</td><td>Restart disable (default)
</td><td>Restart enable
</td></tr>
<tr><td>07</td><td>Auto restart when over temperature occurs</td><td>Restart disable (default)
</td><td>Restart enable
</td></tr>
<tr><td rowspan="2">08</td><td rowspan="2">Output voltage</td><td>230V (default)
</td><td>220V
</td></tr>
<tr><td>240V
</td><td>208V
</td></tr>
<tr><td>09</td><td>Output frequency</td><td>50Hz (default)
</td><td>60Hz
</td></tr>
<tr><td>10</td><td>Number of series batteries connected</td><td colspan="2">
(e.g. Showing batteries are connected in 4 series)</td></tr>
<tr><td>11</td><td>Maximum utility & Generator charging current</td><td colspan="2">

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</td></tr>
<tr><td>12</td><td>Setting voltage point back to utility source when selecting “SBU priority” or “Solar first” in program 01</td><td colspan="2"></td></tr>
</table>

13	Setting voltage point back to battery mode when selecting "SBU priority" or "Solar first" in program 01		
14	Charger source priority: To configure charger source priority	Solar first 	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Solar and Utility 	Solar energy and utility will both charge battery.
		Only Solar 	Solar energy will be the only charger source no matter utility is available or not.
15	Alarm control	Alarm on (default) 	Alarm off 
16	Backlight control	Backlight on (default) 	Backlight off 
17	Beeps while primary source is interrupted	Alarm on (default) 	Alarm off 
18	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable (default) 	Bypass enable 
19	C.V. charging voltage.		
20	Floating charging voltage.		
21	Low DC cut-off voltage.	 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.	

<table>
<tr><td rowspan="4">23</td><td rowspan="4">AC output mode
*This setting is only available when the inverter is in standby mode (Switch off).
Note:
Parallel operation can o nly work when battery connected</td><td>Single:
</td><td>Parallel:
</td></tr>
<tr><td>L1 Phase:
</td><td>L2 Phase:
</td></tr>
<tr><td colspan="2">L3 Phase:
</td></tr>
<tr><td colspan="2">When the units are used in parallel with single phase, 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.</td></tr>
<tr><td>28</td><td>Address setting
(for expansion)</td><td colspan="2">
Default 1, 1~255 Settable</td></tr>
<tr><td rowspan="2">36</td><td>Rs485
Communication protocol</td><td>Protocol 1~50</td><td></td></tr>
<tr><td>CAN
Communication protocol</td><td>Protocol 51~99</td><td></td></tr>
<tr><td>37</td><td>Real time setting---
Year</td><td></td><td>Default 2018, range 2018~2099</td></tr>
<tr><td>38</td><td>Real time setting---
Month</td><td></td><td>Default 01, range 01~12</td></tr>
<tr><td>39</td><td>Real time setting---
Date</td><td></td><td>Default 01, range 01~31</td></tr>
<tr><td>40</td><td>Real time setting---
Hour</td><td></td><td>Default 00, range 00~23</td></tr>
<tr><td>41</td><td>Real time setting---
Minute</td><td></td><td>Default 00, range 00~59</td></tr>
<tr><td>42</td><td>Real time setting---
Second</td><td></td><td>Default 00, range 00~59</td></tr>
<tr><td>49</td><td>Utility charging time</td><td>0000(default)
Allow utility to charge the battery all day run.

</td><td>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)</td></tr>
</table>

50	Utility output time	0000(default) Allow utility r to power the load all day run. 	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)
55	Setting solar energy supply priority when selecting "SUB priority" in program 01	Charge first (default) 	Solar energy provides power to charge battery as first priority.
		Load first 	Solar energy provides power to the loads as first priority.
65	Generator run time		Default 24, range 01~24 The time allows Generator to work. Use 2 digits to represent the time pe riod, setting range from 01 to 24. (eg: 02 represents the time allows Generator to run for two hours.
66	BMS Communication Loss	(default) 	If BMS Communication Loss, The inverter 04 and 20 warning Icon flashing , but enable to work for original status.
			If BMS Communication Loss, The inverter 04 and 20 warning Icon flashing and disable to work. (cut off the output and can't charge)

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. Seven units support one phase maximum.

5.1 Parallel accessories



Parallel communication cable

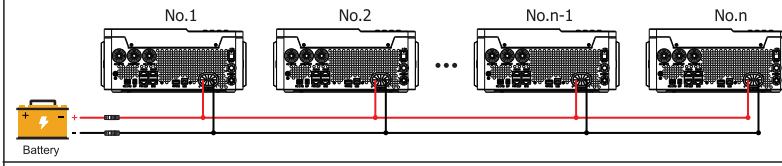
5.2 Points of Attention for Parallel

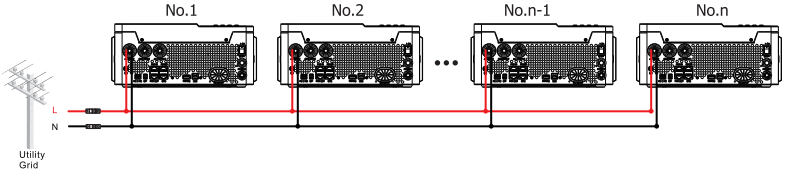
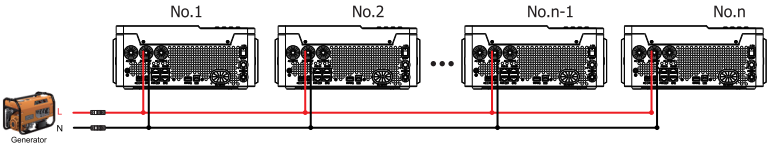
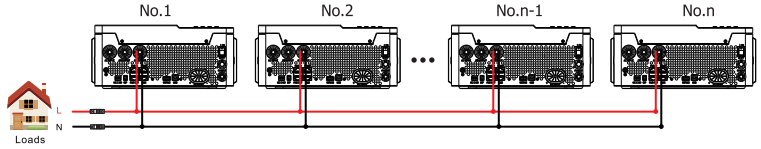
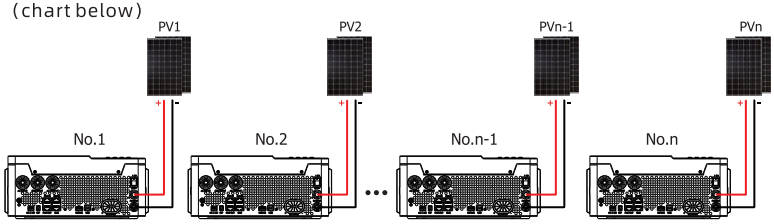
- Ensure that all breakers in the line on the load side are disconnected.
- Be sure the length of all battery cables is the same. Otherwise, there will be voltage difference between inverter and battery to cause parallel inverters not working.
- Be sure that all inverters will share the same battery 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

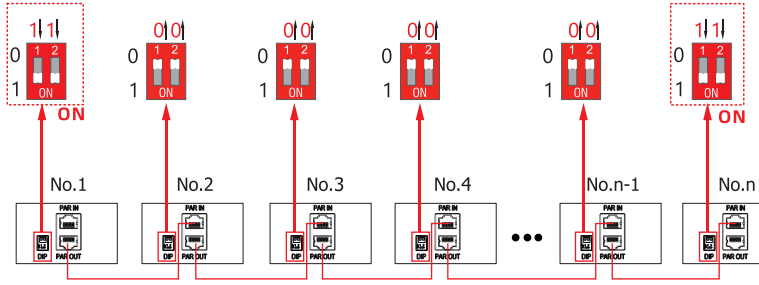
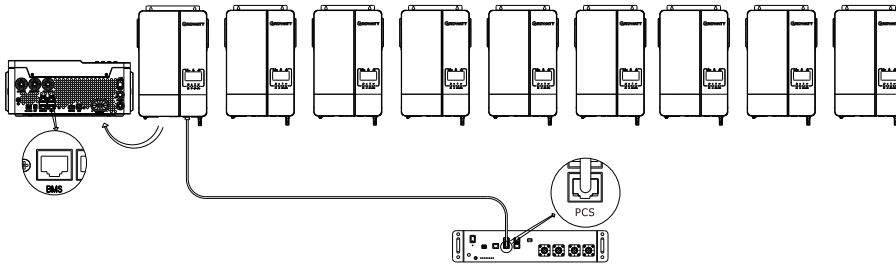
Inverter parallel	2	3	4	5	6	7	8	9
SPF 3500 ES Lite	200AH	300AH	400AH	500AH	600AH	700AH	800AH	900AH
SPF 5000 ES Lite	400AH	600AH	800AH	1000AH	1200AH	1400AH	1600AH	1800AH

5.3 Wire Connections

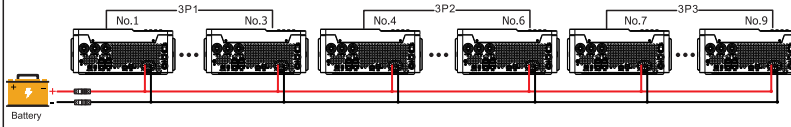
5.3.1 Single-phase parallel wire connection

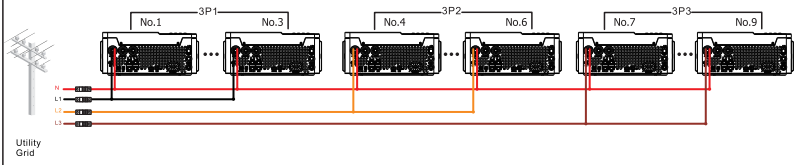
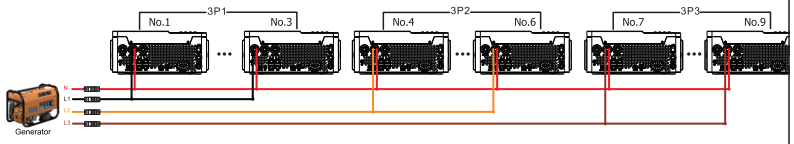
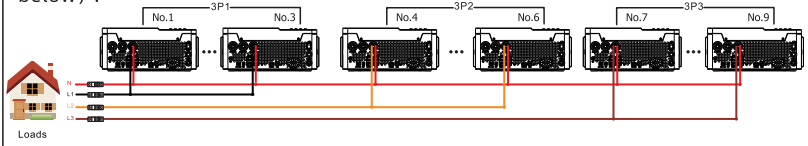
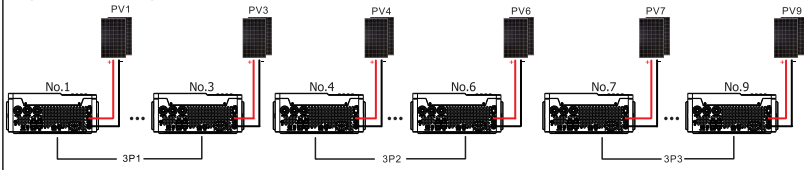
<table>
<tr><th>parallel
port mode</th><th>Charts and descriptions</th></tr>
<tr><td rowspan="2">DC Input
left-positive,
right-
negative</td><td>When the inverters are connected in parallel, the + wires are connected together and the - wires are connected together at the DC input . (chart below)

</td></tr>
<tr><td>In the inverter parallel system, each inverter battery needs to be connected to a DC circuit breaker, single access circuit breaker specifications recommended 100A (150A). If you choose to access the total circuit breaker at the system end, the recommended access circuit breaker specifications 100A (150A) * the number of parallel (eg: four inverter system access to the total circuit breaker, the recommended access circuit breaker specifications 400A (600A))</td></tr>
</table>

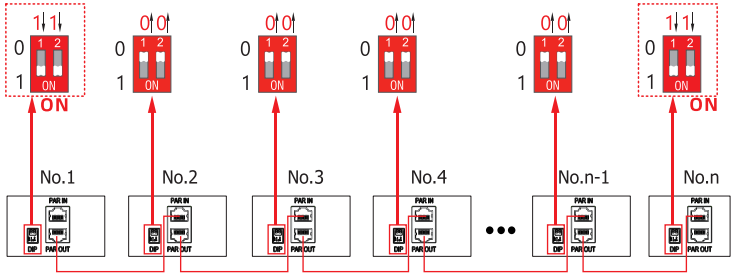
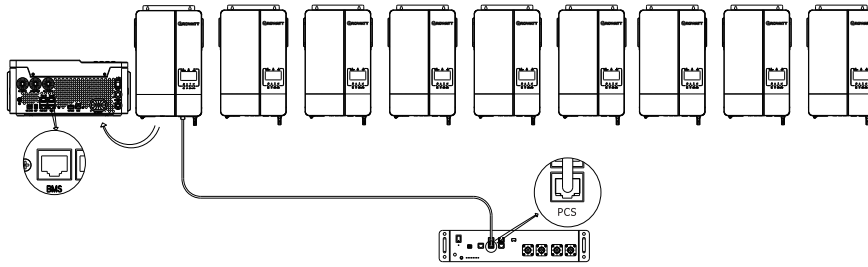
<table>
<tr><td>AC Input</td><td>When the inverters are connected in parallel, the N wires are connected together and the L wires are connected together at the AC input. (chart below)

</td></tr>
<tr><td></td><td>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 40A is recommended.</td></tr>
<tr><td>Generator</td><td>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)

</td></tr>
<tr><td>AC Output</td><td>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)

</td></tr>
<tr><td></td><td>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 40A is recommended.</td></tr>
<tr><td>PV Input</td><td>Each inverter in the system is individually connected to the PV string (chart below)

</td></tr>
</table>

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

5.3.2 Three-phase parallel wire connection

parallel / port 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) 
	In the inverter parallel system, each inverter battery needs to be connected to a DC circuit breaker, single access circuit breaker specifications recommended 100A(150A). If you choose to access the total circuit breaker at the system end, the recommended access circuit breaker specifications 100A (150A) * the number of parallel (eg: four inverter system access to the total circuit breaker, the recommended access circuit breaker specifications 400A (600A))

AC Input	After the inverter is connected in parallel, at the AC input, the N wires are connected together and the L wires are connected together of each phase（chart below）.  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 40A is recommended
Generator	After the inverter is connected in parallel, at the generator input, 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）.  In an inverter-parallel system, an AC circuit breaker is required to be connected to the utility for each load, and a single access circuit breaker size of 40A is recommended.
PV Input	Each inverter in the system is individually connected to the PV string（chart below） 

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

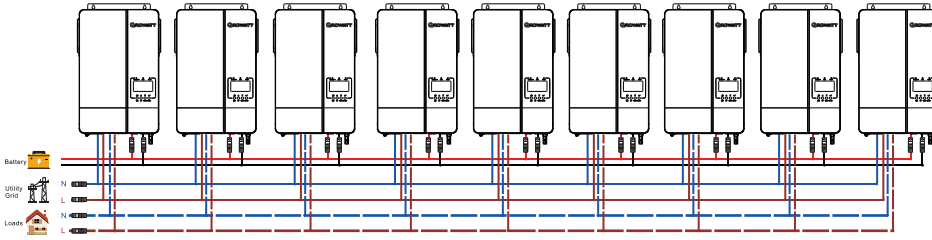
5.4 Parallel Example

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, parallel less than nine wires in order to reduce.

Nine inverters in parallel:

Power Connection



Parallel Operation in Three Phase

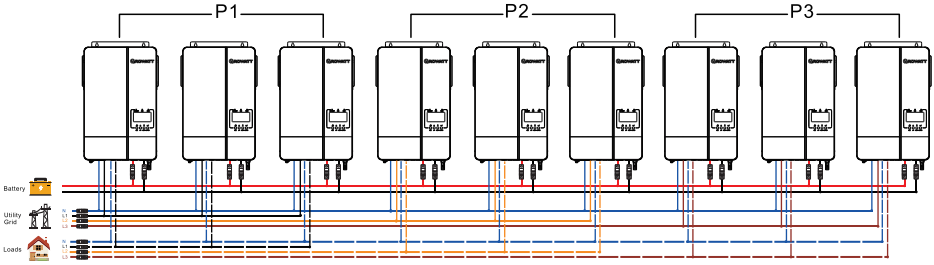
Try to connect to the utility at the same time after three-phase parallel connection.

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)

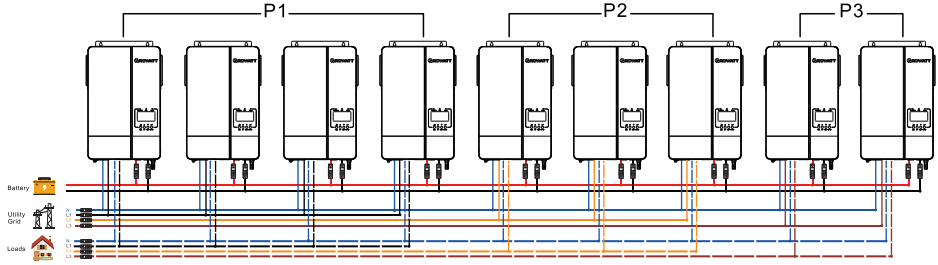
(3+3+3)Three inverters in one phase, three inverters in second phase and three inverters for the third phase:

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 21

Parallel Operation in Single Phase

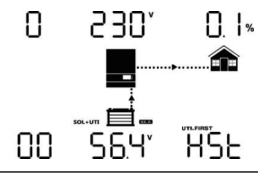
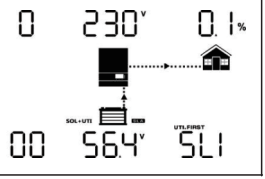
Step 1: Check the following requirements before commissioning:

- 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.

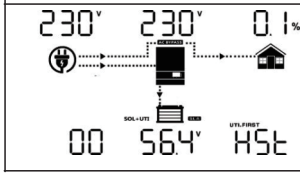
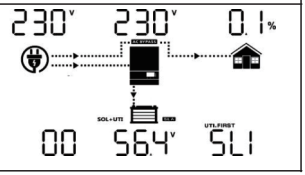
Note: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not be programmed.

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
	

Parallel in Three Phase

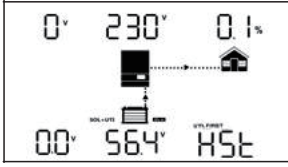
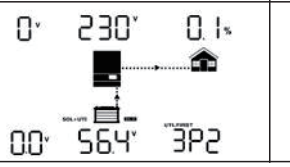
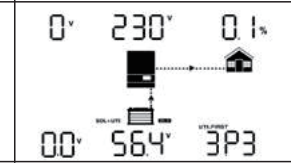
Step 1: Check the following requirements before commissioning:

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

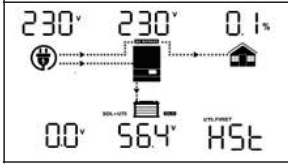
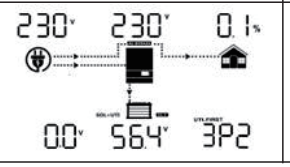
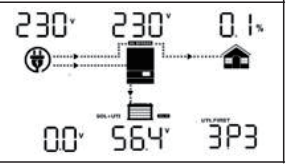
Step 2: Turn on all units and configure LCD program 23 as P1, P2 and P3 sequentially. Then shut down all units.

Note: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not 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
		

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
		

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.

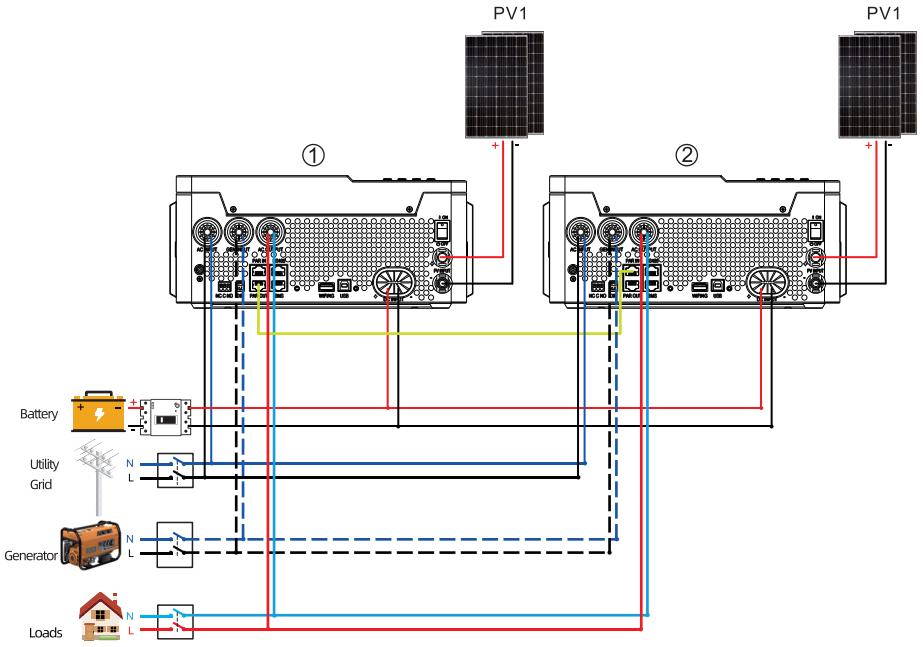
Note 1: If there's only one inverter in L1-phase, the LCD will show as "HST". If there is more than one inverter in L1-phase, the LCD of the HOST inverter will show as "HST", the rest of L1-phase inverters will show as "3P1".

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

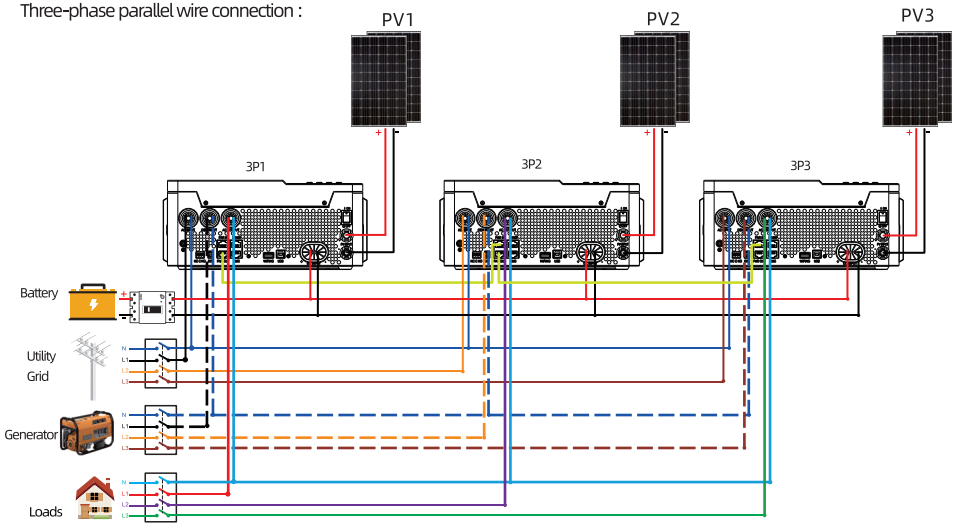
Note 3: Transfer time for this operation exists. Power interruption may happen to critical devices, which cannot bear transfer time.

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

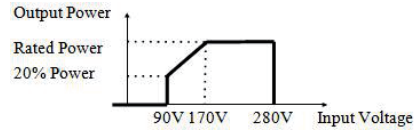
Fault Code	Fault Event	Icon on
01	Fan is locked	
02	Over temperature	
03	Battery voltage is too high	
04	Battery voltage is too low	
05	Output short circuited	
06	Output voltage is too high.	
07	Overload time out	
08	Bus voltage is too high	
09	Bus soft start failed	
11	The main relay failed	
51	Over current or surge	
52	Bus voltage is too low	
53	Inverter soft start failed	
55	Over DC voltage in AC output	
56	Battery connection is open	
57	Current sensor failed	
58	Output voltage is too low	
60	Negative power fault	
61	PV voltage is too high	
62	Internal communication error	
80	CAN fault	
81	Host loss	

6.2 Warning Indicator

Warning Code	Warning Event	Audible Alarm	Icon flashing
01	Fan is locked when inverter is on	Beep 3 times every second	
02	Over temperature	Beep once every second	
03	Battery is over-charged	Beep once every second	
04	Low battery	Beep once every second	
07	Overload	Beep once every 0.5 second	
10	Output power derating	Beep twice every 3 seconds	
12	Solar charger stops due to low battery	Beep once every second	
13	Solar charger stops due to high PV voltage	Beep once every second	
14	Solar charger stops due to overload	Beep once every second	
15	Parallel input utility grid different	Beep once every second	
16	Parallel input phase error	Beep once every second	
17	Parallel output phase loss	Beep once every second	
18	Buck over current	Beep once every second	
19	Battery disconnect	No beep	
20	BMS communication error	Beep once every second	
21	PV power insufficient	Beep once every second	
22	Parallel forbidden without battery	Beep once every second	
25	Parallel inverters' capacity different	Beep once every second	
26	PV insulation test failed	Beep once every second	
33	BMS communication loss	Beep once every second	
34	Cell over voltage	Beep once every second	
35	Cell under voltage	Beep once every second	
36	Total over voltage	Beep once every second	
37	Total under voltage	Beep once every second	
38	Discharge over voltage	Beep once every second	
39	Charge over voltage	Beep once every second	
40	Discharge over temperature	Beep once every second	
41	Charge over temperature	Beep once every second	
42	Mosfet over temperature	Beep once every second	
43	Battery over temperature	Beep once every second	
44	Battery under temperature	Beep once every second	
45	System shut down	Beep once every second	
63	Battery voltage consistent failed	Beep once every second	

7. Specifications

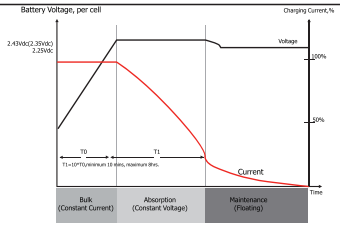
7.1 Line Mode Specifications

INVERTER MODEL	SPF 3500 ES Lite	SPF 5000 ES Lite
Input Voltage Waveform	Sinusoidal (utility or generator)	
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)	
Low Loss Frequency	40±1Hz	
Low Loss Return Frequency	42±1Hz	
High Loss Frequency	65±1Hz	
High Loss Return Frequency	63±1Hz	
Output Short Circuit Protection	Circuit Breaker	
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)	
Transfer Time	10ms typical, 20ms Max@ Single <30ms @ Parallel	
Output power derating: When AC input voltage drops to 170V, the output power will be derated.		

7.2 Inverter Mode Specifications

INVERTER MODEL	SPF 3500 ES Lite	SPF 5000 ES Lite
Rated Output Power	3.5KVA/3.5KW	5KVA/5KW
Output Voltage Waveform	Pure Sine Wave	
Output Voltage Regulation	230Vac±5%	
Output Frequency	50Hz / 60Hz (Auto detection)	
Nominal Output Current	15.2A	22A
Max. Output Fault Current/ Duration	80A/ 300μs	
Max. Output Over current Protection	58A	
Peak Efficiency	93%	
Overload Protection	5s@≥150% load; 10s@110%~150% load	
Surge Capacity	2* rated power for 5 seconds	
Nominal DC Input 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 Return 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 Cut-off Voltage (Li Mode)	42.0Vdc	
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	60.8Vdc	
No Load Power Consumption	<60W	

7.3 Charge Mode Specifications

Utility Charging Mode			
INVERTER MODEL		**SPF 3500 ES Lite**	**SPF 5000 ES Lite**
Charging Algorithm		3-Step	
Max. AC Charging Current		60Amp(@VI/P=230Vac)	80Amp(@VI/P=230Vac)
Bulk Charging Voltage	**Flooded Battery**	58.4Vdc	
	AGM / Gel Battery	56.4Vdc	
Floating Charging Voltage		54Vdc	
Charging Curve			
MPPT Solar Charging Mode			
Max. PV Array Power		4500W	5500W
		Power derating above 45℃ or PV input voltage below	
Max. PV Input Current		22A	
Start-up Voltage		150Vdc±10Vdc	
PV Array MPPT Voltage Range		120Vdc~450Vdc	
Max. PV Array Open Circuit Voltage		500Vdc	
Max. Inverter Back Feed Current To The Array		0A	
Max. PV Charging Current		80A	
Max. Charging Current (AC Charger Plus Solar Charger)		80A	100A

7.4 General Specifications

INVERTER MODEL	**SPF 3500 ES Lite**
Safety Certification	CE
Operating Temperature Range	-10℃ to 55℃
Storage temperature	-15℃~ 60℃
Humidity	5% to 95% Relative Humidity (Non-condensing)
Altitude	<2000m
Dimension(D*W*H), mm	435 x 280 x 125
Net Weight, kg	9.2

8. Appendix

Appendix I. Error 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 following Table appear on your inverter and the fault has notbeen removed after restarting, please contact your local dealer or service center. You need to havethe 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)

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℃.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
F03	Battery is over-charged.	Restart the unit
	The battery voltage is too high	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 lithum battery without communication, check whether the voltage points of the program 19 and 21 are too high for the lithum battery. 2. Restart the unit
F09/53/57	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 are the same system(sigle or paralle; 3P1,3P2,3P3). 2.Make sure all phases inverters are power on.

W19	lead acid battery disconnect	Check if spec and quantity of batteries are meet requirements.
	Lithium battery disconnect	1.Check BMS communication cable connection Check setup parameters
W20	BMS communication error	1. Check whether communication line is correct connection between inverter and battery. Check whether BMS protocol type is correct setting.
F51	Over current or surge	Restart the unit
F52	Bus voltage is too low	
F55	Output voltage is unbalanced	
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
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.	Input protector is tripped.	Check if AC breaker is tripped and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power (Shore or Generator)	1.Check if AC wires are too thin and/or too long. 2.Check if generator (if applied) is working wellor if input voltage range setting is correct. (UPS→Appliance)
	Green LED is flashing.	Set "Battery First" or "Solar First" as the priority of output source.	Change output source priority to Utility first.
When it's turned on, internal relay is switching on and off repeatedly.	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. Then press "ENTER" button to confirm the selection and Wait about 7 seconds. Press "ESC" to return and the setting is completed.

Program	Setting Option
PASS	PASS 305 000

Appendix III Battery Equalization

43	Battery equalization	Battery equalization enable E9 ENA 043	Battery equalization disable(default) E9 dIS 043
		If "Flooded" or "User-Defined" is selected in program 05, this program can be set up.	
44	Battery equalization voltage	E9U 58.4V 044 Default 58.4V, 48.0V~58.4V Settable	
45	Battery equalized time	MIN E9t 60 045	Default 60min, 5min~900min Settable
46	Battery equalized timeout	MIN E9t0 120 046	Default 120min, 5min~900min Settable
47	Equalization interval	dAY E9i 30 047	Default 30days, 1 days~90 days Settable
48	Equalization activated immediately	Equalization activated immediately on E9 ON 048	Equalization activated immediately off(default) E9 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 "". If "Off" is selected, it will cancel equalization function until next activated equalization time arrives based on program 47setting. At this time, "" 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.

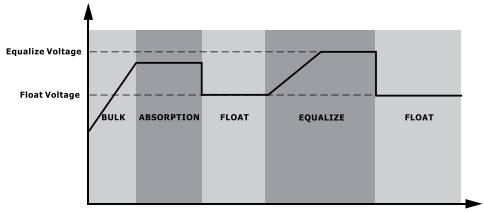
- **How to Apply Equalization Function**

  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.

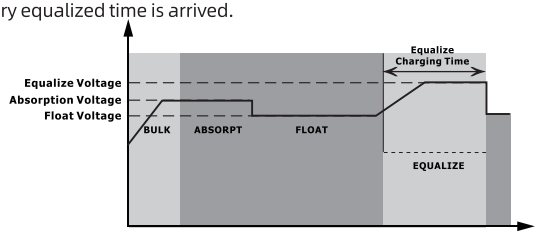
- **When to Equalize**

  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.

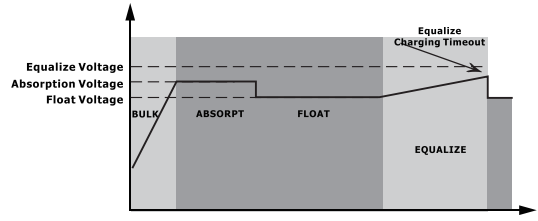


- **Equalize charging time and timeout**

  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.



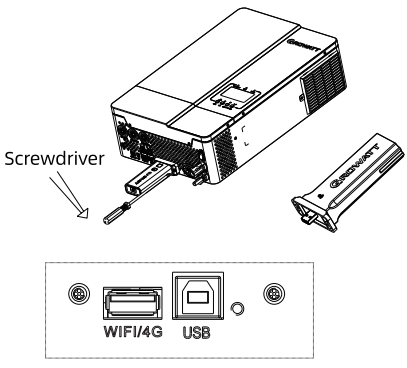
Appendix IV Routine maintenance

To ensure the long-term and good operation of the energy storage system, it is recommended to performthe 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	Regularly check the surface of the inverter for dust or other debris and clean it with a dust sponge.	Once every six months to one year
	Regularly check that radiators and vents are not covered with dust and clean them with a soft brush or compressed air.	Once every 3 months.
Electrical connection	Check if any cable connection is off or loose.	Half a year after first debugging and testing, and once every six months to one year thereafter.
	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.	
Grounding reliability	Check if the grounding cable is grounded reliably.	
normal operation	Periodically check the input voltage、output voltage and current of the inverter to ensure that it is operating within its rated range.	
	Regularly check the operating status and performance parameters of the inverter via the inverter's monitoring system or display.	
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 lates version.
2.For further information please visit server.
growatt.com

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