User Manual

GROWATT

Off Grid Solar Inverter
SPF 3000T HVM-G2
SPF 6000T HVM-G2

Version: 1.3
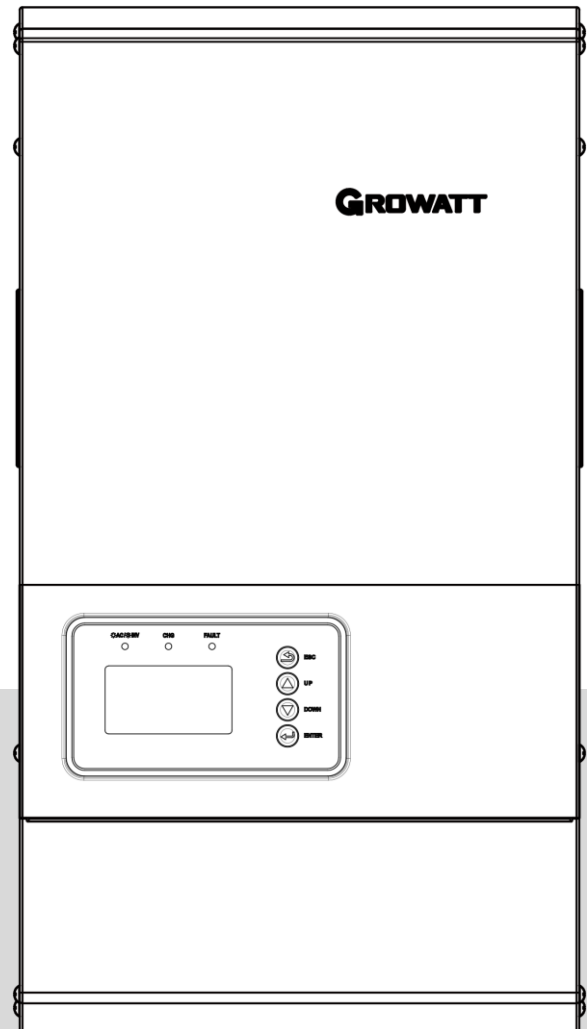
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Information on this Manual

Validity

This manual is valid for the following devices:
- ▶ SPF 3000T HVM-G2
- ▶ SPF 6000T HVM-G2

Scope

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

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

Safety Instructions

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

1. 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.
2. 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.
3. All the operation and connection please professional electrical or mechanical engineer.
4. All the electrical installation must comply with the local electrical safety standards.
5. 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.
6. 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.
7. 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.
8. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
9. NEVER charge a frozen battery.
10. For optimum operation of this inverter, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter.
11. 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.
12. 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.
13. 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.
14. NEVER cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
15. Make sure the inverter is completely assembled, before the operation.

Introduction
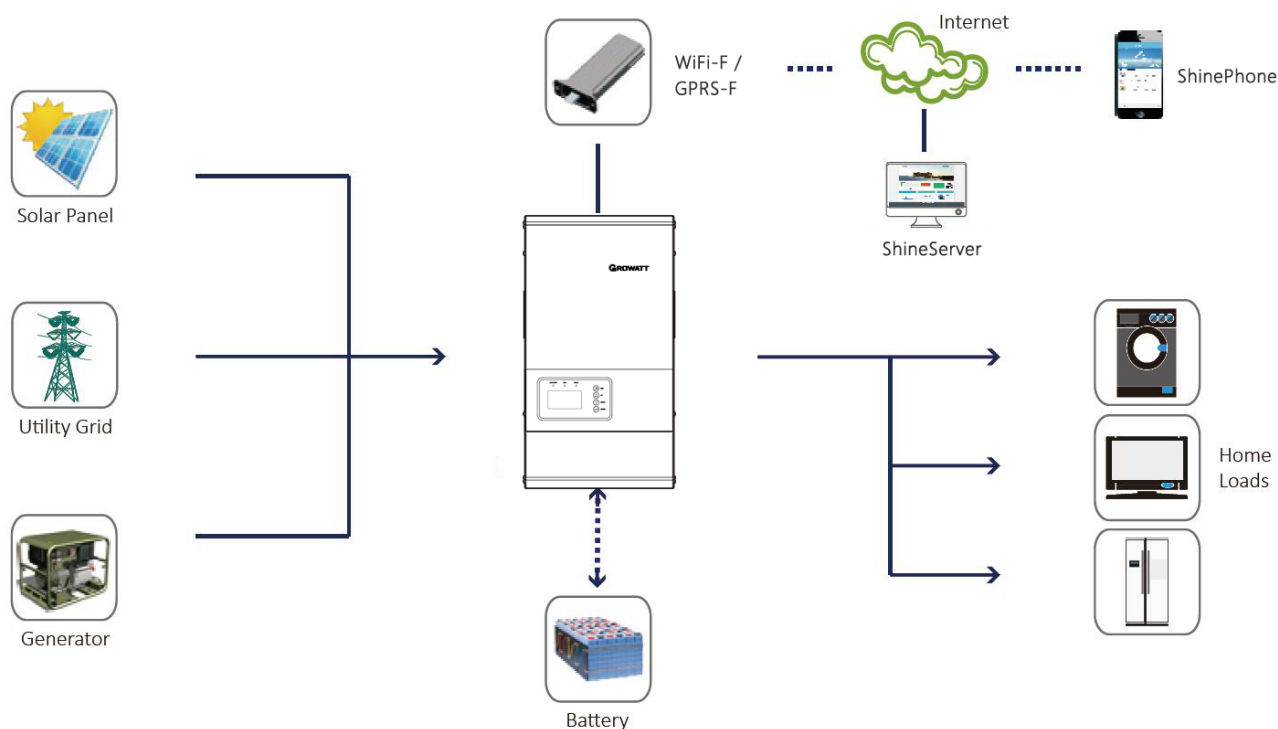
Hybrid Power System

This is a multifunctional off grid solar inverter, integrated with a MPPT solar charge controller, a low 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 / GPRS 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.

Features

▶ Rated power 3000W to 6000W, power factor 1

▶ PV input voltage ranges 60~250Vdc

▶ Low frequency inverter with large transformer

▶ Pure sine wave AC output

▶ Solar and utility grid can power loads at the same time

▶ With CAN/RS485 for BMS communication

▶ System will go to bypass and cut off charging if an error happens under utility grid mode

▶ With the ability to work without battery (only under utility grid mode)

▶ WiFi/ GPRS remote monitoring (optional)

Product Overview
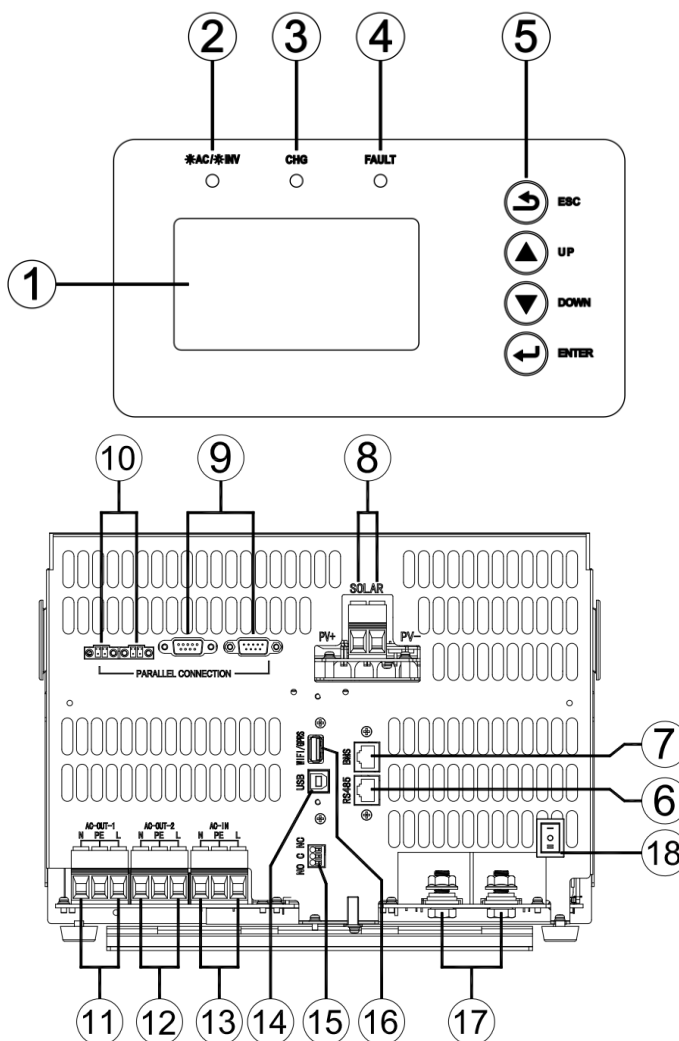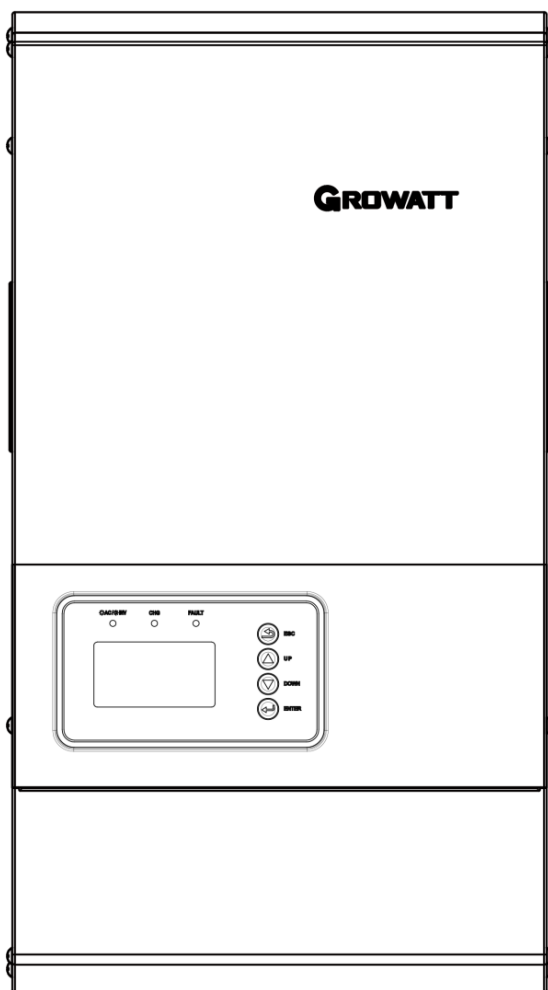
1. LCD display
2. Status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons
6. RS485 communication Port (for expansion)
7. BMS communication Port(support CAN/RS485 protocol)
8. PV input
9. Parallel communication ports
10. Current sharing ports
11. AC output 1
12. AC output 2
13.AC input
14. USB communication port
15. Dry contact
16. WiFi/GPRS communication port
17. Battery input
18. Power on/off switch

Installation

Unpacking and Inspection

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:

▶ The unit x 1
▶ User manual x 1
▶ Communication cable x 1
▶ Parallel communication cable x 1
▶ Screws x 3
▶ Mounting board x 1

Note: The Software CD is no longer provided, if necessary, please download it from the official website www.ginverter.com

Preparation

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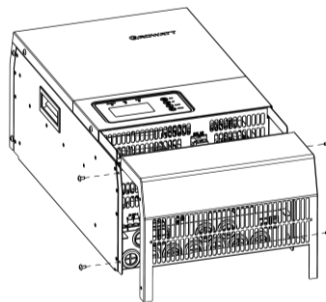
Mounting the Unit

Consider the following points before selecting where to install:

▶ Do not mount the inverter on flammable construction materials.
▶ Mount on a solid surface
▶ 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 50°C to ensure optimal operation.
▶ The recommended installation position is to be adhered to the wall vertically.
▶ 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.
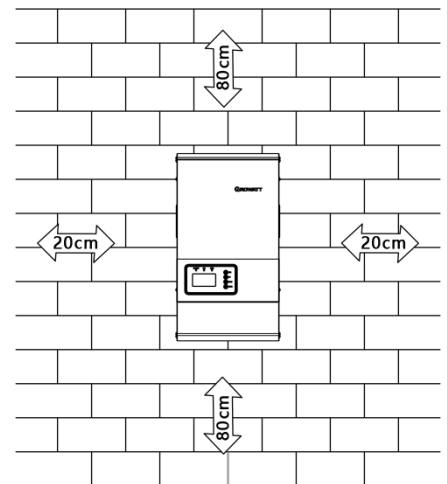
⚠ **SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.**
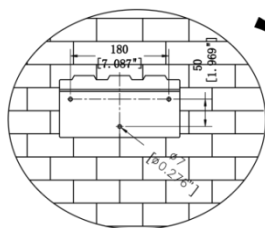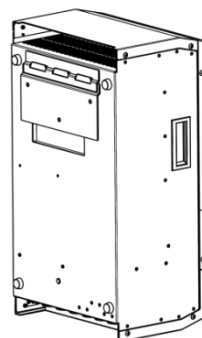
Left   Back   Front

Screw three screws to install the unit. It is recommended to use attachment screw ST6.3X40 outside hexagon self-tapping stainless steel screws and Plastic expansion tube

Battery Connection

Lead-acid Battery Connection

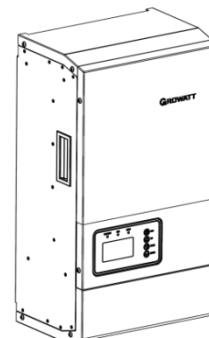User can choose proper capacity lead acid battery with a nominal voltage at 48V. Also, you need to choose battery type as "AGM(default) or FLD"

CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC 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 over-current protection installed. Please refer to typical amperage in below table as required fuse or breaker size.

Ring terminal:

WARNING! All wiring must be performed by a qualified person.

WARNING! 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.
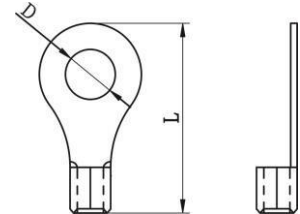
Recommended battery cable and terminal size:

Model	Wire Size	Torque value
SPF 3000T HVM-G2	1 * 4 AWG	2-3 Nm
SPF 6000T HVM-G2	1 * 2 AWG	2-3 Nm

Note: For lead acid battery, the recommended charge current is 0.2C(C→battery capacity)

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. It's suggested to connect at least 200Ah capacity battery for SPF 3000T HVM-G2 and at least 250Ah capacity battery for SPF 6000T HVM-G2 .
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.
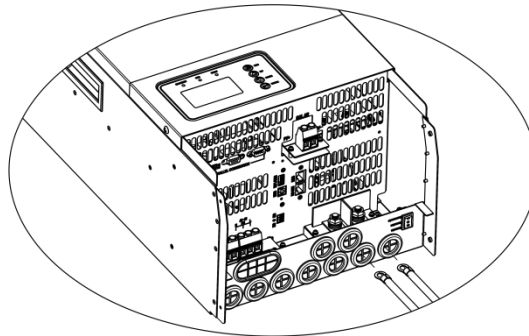
⚠	**WARNING: Shock Hazard** Installation must be performed with care due to high battery voltage in series.

| ⚠	**CAUTION!!** Do not place anything between the flat part of the inverter terminal and the ring terminal. Otherwise, overheating may occur. **CAUTION!!** Do not apply anti-oxidant substance on the terminals before terminals are connected tightly. **CAUTION!!** Before making the final DC connection or closing DC breaker/disconnector, be sure positive (+) must be connected to positive (+) and negative (-) must be connected to negative (-).

Lithium Battery Connection

If choosing lithium battery for the inverter, you are allowed to use the lithium battery only which we have configured. There are two connectors on the lithium battery, RJ45 port of BMS and power cable.

Please follow below steps to implement lithium battery connection:
1. Assemble battery ring terminal based on recommended battery cable and terminal size (same as Lead acid, see section Lead-acid Battery connection for details) .

2. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2-3Nm. 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. Connect the end of RJ45 of battery to BMS communication port(RS485 or CAN) of inverter.
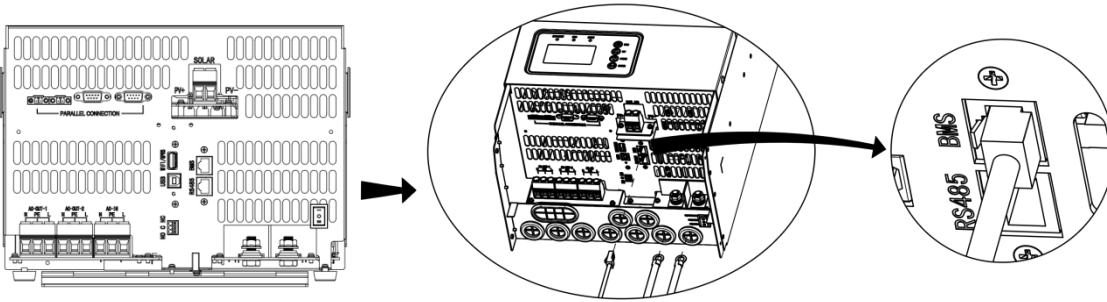
4. The other end of RJ45 insert to battery communication port(RS485 or CAN).
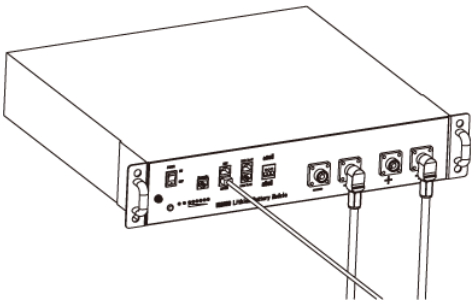
Note: If choosing lithium battery, make sure to connect the BMS communication cable between the battery and the inverter. You need to choose battery type as "lithium battery".

Lithium battery communication and setting

In order to communicate with battery BMS, you should set the battery type to "LI" in Program 5. Then the LCD will switch to Program 51, which is to set the protocol type. There are several protocols in the inverter. Please get instruction from Growatt to choose which protocol to match the BMS.

1. Connect the end of RJ45 of battery to BMS communication port of inverter

Make sure the lithium battery BMS port connects to the inverter is Pin to Pin, the inverter BMS port pin assignment shown as below:

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

87654321
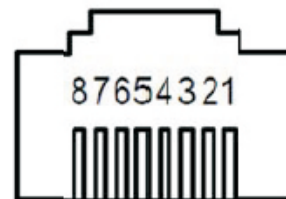
LCD setting

To connect battery BMS, need to set the battery type as "LI" in Program 05.

After set "LI" in Program 05, it will switch to Program 51 to choose 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.

Note: You can only use one communication type RS485 or CAN in a time.

05	Battery type	AGM (default) bAtt AGM 005
		Flooded bAtt FLd 005
		Lithium (only suitable when communicated with BMS) bAtt LI 005
		User-Defined bAtt USE 005 If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 19, 20 and 21.
		User-Defined 2 (suitable when lithium battery without BMS communication) bAtt US2 005 If "User-Defined 2" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 19, 20 and 21. It is recommended to set to the same voltage in program 19 and 20(full charging voltage point of lithium battery). The inverter will stop charging when the battery voltage reaches this setting.

| 51 | RS485
Communication protocol | Protocol L01 | L01 91 |
		Protocol L02	L02 91
		. . .	. . .
		Protocol L50	L50 91
	CAN Communication protocol	Protocol L51	L51 91
		Protocol L52	L52 91
		. . .	. . .
		Protocol L99	L99 91

Note: When the battery type set to Li, the setting option 12, 13, 21 will change to display percent.
Note: When the battery type set as "LI", the Maximum charge current can't be modified by the user. When the communication fail, the inverter will cut off output.

12	Setting SOC point back to utility source when selecting "SBU priority" or "Solar first" in program 01	b2AC 40% 012⚙ Default 40%, 6%~50% Settable, value set higher than Program 21 setting
13	Setting SOC point back to battery mode when selecting "SBU priority" or "Solar first" in program 01	AC2b 80% 013⚙ Default 80%, 51%~100% Settable

21	Low DC cut-off SOC If "LI" is selected in program 5, this program can be set up	Cut4 20% 021⚙ Default 20%, 5%~49% Settable，value set lower than Program 12 setting

Note: Any questions about communicating with BMS, please consult with Growatt.

Communicating with battery BMS in parallel system

If need to use communicate with BMS in a parallel system, you should 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.
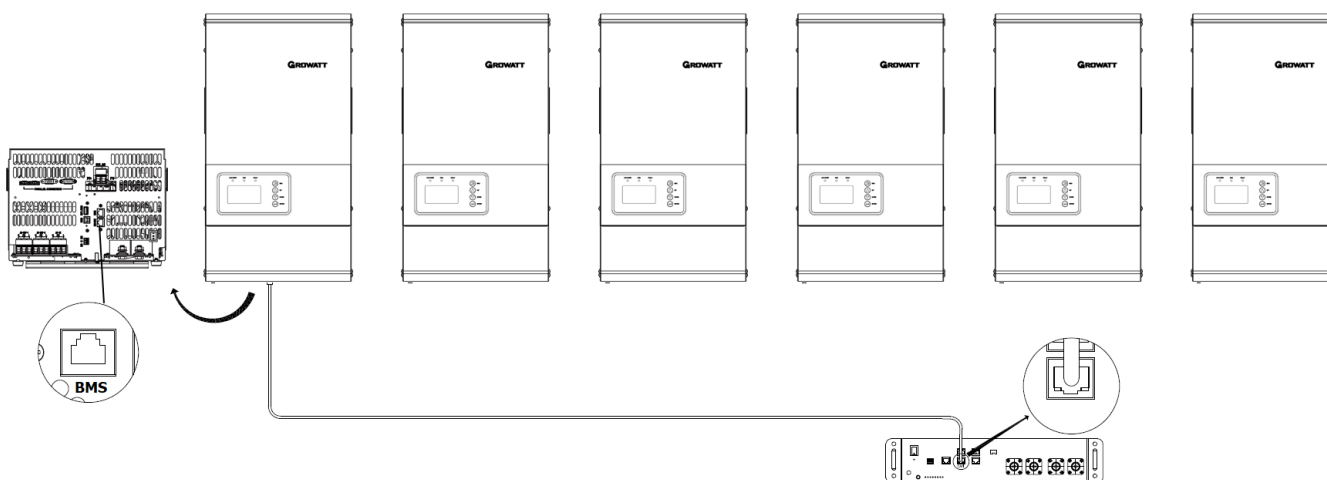
AC Input/Output Connection

CAUTION!! 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. The recommended spec of AC breaker is 32A for SPF 3000T HVM-G2, and 60A for SPF 6000T HVM-G2.

CAUTION!! There are two terminal blocks with "IN" and "OUT" markings. Please do NOT mis-connect input and output connectors.

WARNING! All wiring must be performed by a qualified personnel.

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

| Model	Gauge	Torque Value
SPF 3000T HVM-G2	1 * 10 AWG	1.2-1.6 Nm
SPF 6000T HVM-G2	1 * 8 AWG	1.2-1.6 Nm

Please follow below steps to implement AC input/output connection:

1. Before making AC input/output connection, be sure to open DC protector or disconnector first.
2. Cut the insulation sleeves of the six conductors by 10mm..
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor ⏚ first.

   ⏚ →**Ground (yellow-green)**

   L→LINE (brown or black)
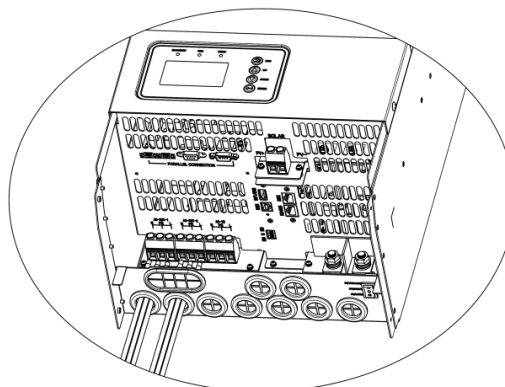
   N→Neutral (blue)
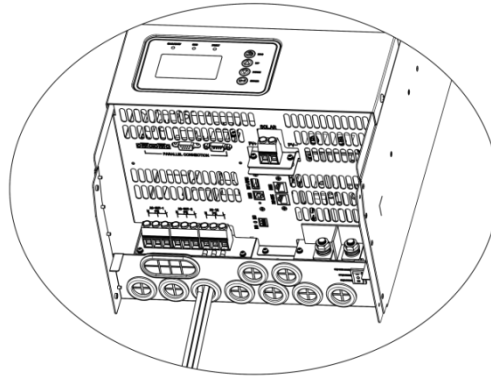
⚠	**WARNING:** Be sure that AC power source is disconnected before attempting to hardwire it to the unit.

4. Then, insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor ⏚ first.

   ⏚ →**Ground (yellow-green)**

   L→LINE (brown or black)

   N→Neutral (blue)

5. Make sure the wires are securely connected.

CAUTION: Important

Be sure to connect AC wires with correct polarity. If L and N wires are connected reversely, it may cause utilility short-circuited when these inverters are worked in parallel operation.

CAUTION: 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.

Note: SPF 3000T HVM-G2: Max. AC input current is 30A. If AC input current is over 30A, AC charge current will drop down to zero. Then the system will cut off output in 10 seconds if the AC input is continued to be over 30A.

SPF 6000T HVM-G2: Max. AC input current is 50A. If AC input current is over 50A, AC charge current will drop down to zero. Then the system will cut off output in 10 seconds if the AC input is continued to be over 50A.

Note:

'AC-OUT-1' will be as the main output line.

'AC-OUT-2' is intended for non-critical loads.

Under utility grid mode: AC-OUT-2 will always be available.

Under battery model: If overload happens, AC-OUT-2 will get cut off, only restart or system goes bypass would make AC-OUT-2 available again. If battery under voltage happens, AC-OUT-2 will get cut off and it would be available again when battery is back to normal.

PV Connection

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

WARNING! All wiring must be performed by a qualified personnel.
WARNING! 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 3000-6000T HVM-G2	1 * 8AWG	1.2-1.6 Nm

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.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

INVERTER MODEL	SPF 3000-6000T HVM-G2
Max. PV Array Open Circuit Voltage	250Vdc

Please follow below steps to implement PV module connection:
1. Remove insulation sleeve 10 mm for positive and negative conductors.

   Check correct polarity of connection cable from PV modules and PV input connectors. 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.
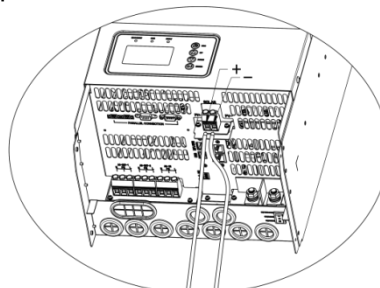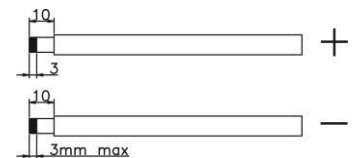
2. Make sure the wires are securely connected.

Final Assembly

After connecting all wiring, please put bottom cover back by screwing four screws as shown below.
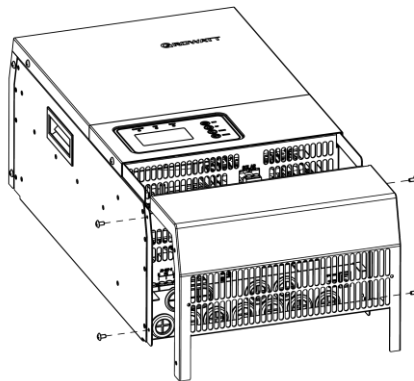
Communication Connection

Please use supplied communication cable to connect to inverter and PC. Insert bundled CD into a computer and follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software inside of CD.

Dry Contact Signal

There is one dry contact(3A/250VAC) available on the rear panel. 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 & C
Power Off	Unit is off and no output is powered.		Close	Open
Power On	Output is off and no output is powered		Close	Open
	Battery not in "LI" mode	Battery voltage < Low DC Cut-off Voltage +2Vdc	Open	Close
		Battery Voltage reaches setting in 13	Close	Open
	Battery in "LI" mode	Battery SOC < Low DC Cut-off Soc +5%	Open	Close
		Battery Voltage reaches setting in 13	Close	Open

Battery Charger

The inverter is equipped with an active PFC (power factor correction) multistage battery charger.

When AC voltage is in the range of 191~265VAC, the charging current is 100%. The inverter is with a strong charging current, and the charge current can be adjusted from 0A~40A @3000W (0A~60A @6000W). When AC voltage is in the range of 155~190VAC, the maximum charging current is 30A.

 There are mainly 3 stages:

Bulk Charging: This is the initial stage of charging. While Bulk Charging, the charger supplies the battery with controlled constant current. The charger will remain in Bulk charge until the absorption charge voltage is achieved.

Absorb Charging: This is the second charging stage and begins after the absorb voltage has been reached. Absorb charging provides the batteries with a constant voltage and reduces the DC charging current in order to maintain the absorb voltage setting.

In this period，the inverter will start a T1 time; the charger will keep the boost voltage in Boost CV mode until the T1 time has run out. When charging current is <0.01C or the time is over 12 hours, then drop the voltage Down to the float voltage.

Float Charging: The third charging stage occurs at the end of the absorb charging time. During float charging, the charge voltage is reduced to the float charge voltage. In this stage, the battery are kept fully charged and ready if needed by the inverter.
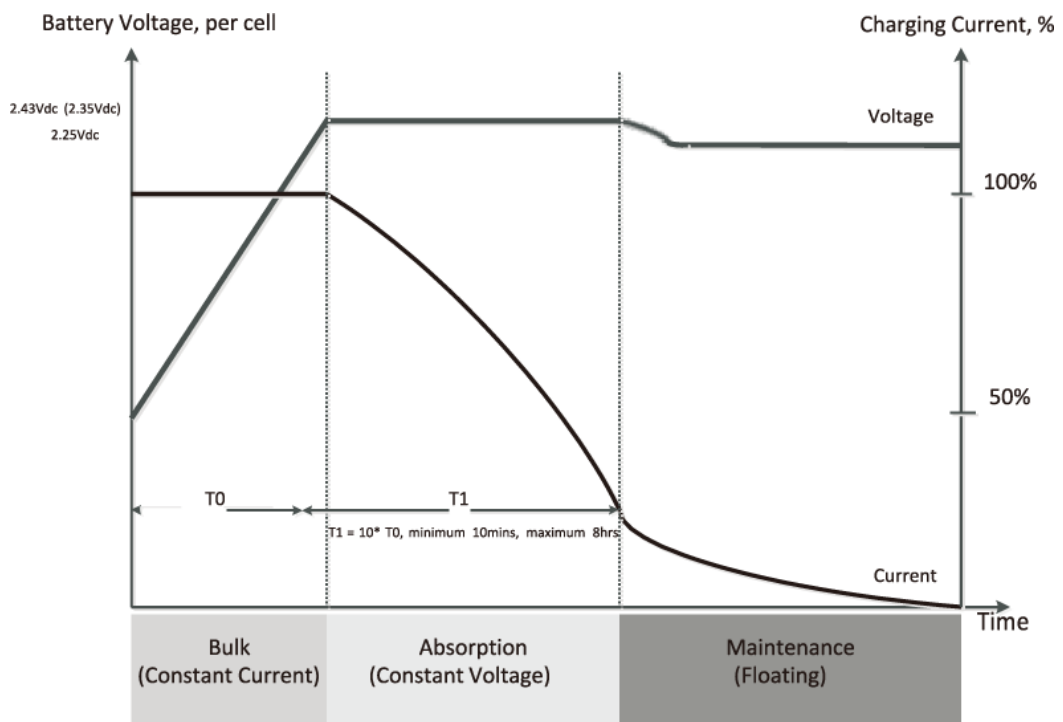
Battery Equalization

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 27 first. Then, you may apply this function in device by either one of following methods:

1. Setting equalization interval in program 31.

2. Active equalization immediately in program 32.

- **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.
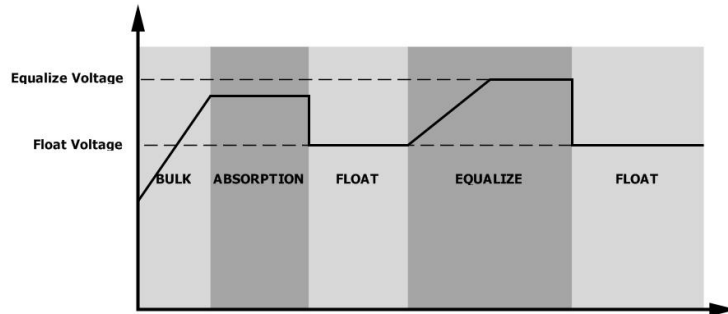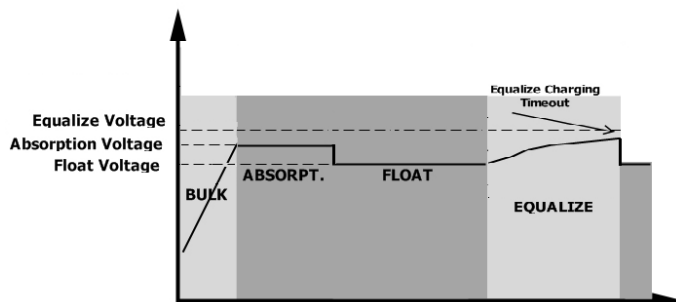

- **Equalize charging time and timeout**

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.
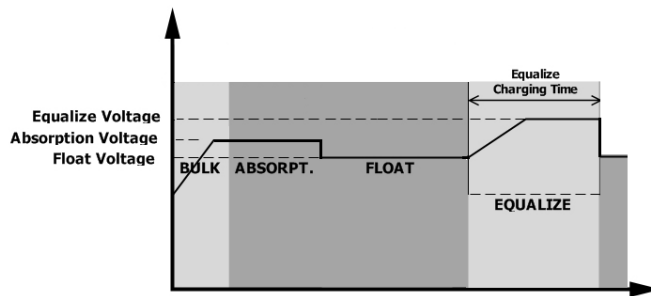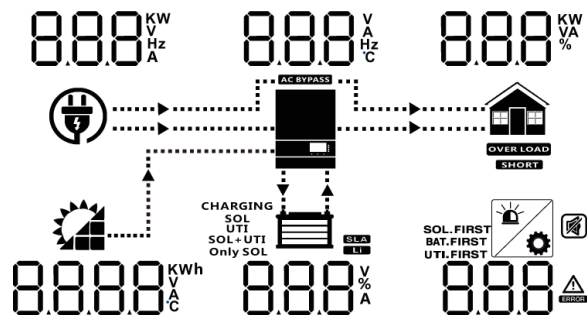

However, in Equalize stage, when battery equalized time is expired and battery voltage doesn't rise to battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves battery equalization voltage. If battery voltage is still lower than battery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

Operation

Power ON/OFF

Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch (located on the button of the case) to turn on the unit. The switch is located on the underside to the bottom right of the product.

The switch has three positions. The middle position means OFF. The II position means ON, turning on inverting and inverter is fully functional. The I position is Power Save Mode, inverter will only go inverting when loads are higher than 50W if under this power save mode.

Operation and Display Panel

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

LCD Display Icons

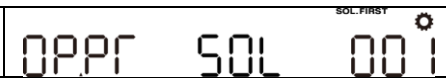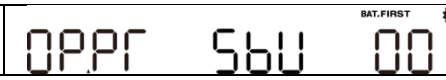| Icon	Description
AC Input Information	
	AC input icon
	Indicate AC input power, AC input voltage, AC input frequency, AC input current
AC BYPASS	Indicate AC power loads in bypass
PV Input Information	
	PV input icon
	Indicate PV power, PV voltage, PV current
Output Information	
	Inverter icon
	Indicate output voltage, output current, output frequency, inverter temperature
Load Information	
	Load icon
	Indicate power of load, power percentage of load
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.
	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
	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 AC mode, battery icon will present Battery Charging Status		
Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	4 bars will flash in turns.
	2 ~ 2.083V/cell	Bottom bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	Bottom two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	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 mode, battery icon will present Battery Capacity		
Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.717V/cell	(battery icon – empty)
	1.717V/cell ~ 1.8V/cell	(battery icon – 1 bar)
	1.8 ~ 1.883V/cell	(battery icon – 2 bars)
	> 1.883 V/cell	(battery icon – 3 bars)
50%> Load > 20%	< 1.817V/cell	(battery icon – empty)
	1.817V/cell ~ 1.9V/cell	(battery icon – 1 bar)
	1.9 ~ 1.983V/cell	(battery icon – 2 bars)
	> 1.983	(battery icon – 3 bars)
Load < 20%	< 1.867V/cell	(battery icon – empty)
	1.867V/cell ~ 1.95V/cell	(battery icon – 1 bar)
	1.95 ~ 2.033V/cell	(battery icon – 2 bars)
	> 2.033	(battery icon – 3 bars)

LCD 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.
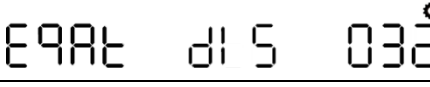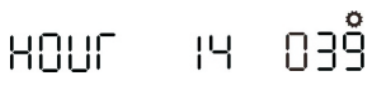
Note：When under parallel operation, only can set parameters at the HOST inverter, except for Program 23 which all inverters can be accessed to set value.
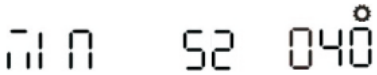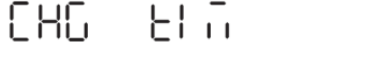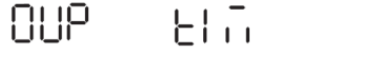
Program	Description	Setting Option		
01	Output source priority: To configure load power source priority	Solar first	OP.Pr SOL 001	
		Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power the loads at 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)	OP.Pr Uti 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	OP.Pr SbU 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 battery voltage drops to either low-level warning voltage or the setting point in program 12.		
		BPL priority	OP.Pr bPL 01	Choose BPL, then press ENTER to switch to Program 90, which is set voltage point to charge battery
				SUbУ 52.0v 90 Default 52V, 46V~58V Settable (Program 21 < Program 90 < Program 20)
		Utility energy provides power to the loads as first priority. If utility energy is not sufficient to power all connected loads, battery Energy and solar energy will supply power the loads at the same time.		
02	Maximum charging current: set total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	CHGi 80A 002 3000W model: Default 80A, 10A~120A Settable 6000W model: Default 80A, 10A~140A Settable (If LI is selected in Program 5, this program can't be set up)		

03	AC input voltage range	Appliance (default) ᴀᴄᵁ ᴀᴘʟ 003 If selected, acceptable AC input voltage range will be within 154~272VAC
		UPS ᴀᴄᵁ ᴜᴘꜱ 003 If selected, acceptable AC input voltage range will be within 184~272VAC

05	Battery type	AGM (default) bAtt AGM 005
		Flooded bAtt FLd 005
		Lithium (only suitable when communicated with BMS) bAtt LI 005
		User-Defined bAtt USE 005 If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 19, 20 and 21.
		User-Defined 2 (suitable when lithium battery without BMS communication) bAtt US2 005 If "User-Defined 2" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 19, 20 and 21. It is recommended to set to the same voltage in program 19 and 20(full charging voltage point of lithium battery). The inverter will stop charging when the battery voltage reaches this setting.

06	Auto restart when overload occurs	Restart disable (default) LdrS diS 006
		Restart enable LdrS EnA 006
		Restart bypass LdrS byP 006 When overload under battery mode，system will switch to bypass automatically

08	Output voltage	230V (default) Outᵁ 230 008	220V Outᵁ 220 008
		240V Outᵁ 240 008	208V Outᵁ 208 008

09	Output frequency	50Hz (default) OutF 50 009	60Hz OutF 60 009

11	Maximum utility charging current 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	**RC1 30ᴬ 011** 3000W model: Default 30A, 0A~40A Settable 6000W model: Default 30A, 0A~60A Settable (If LI is selected in Program 5, this program can't be set up)	
12	Setting voltage point back to utility source when selecting "SBU priority" or "Solar first" in program 01	**b2RC 46.0ᵛ 012** Default 46.0V, 44.0V~51.2V Settable	
		b2RC 40% 012 Default 40%, 6%~50% Settable, value set higher than Program 21 setting	
13	Setting voltage point back to battery mode when selecting "SBU priority" or "Solar first" in program 01	**RC2b 54.0ᵛ 013** Default 54.0V, 48.0V~58.0V Settable	
		RC2b 80% 013 Lithium battery mode: default 80%, 51%~100% settable	
14	Charger source priority: To configure charger source priority	If this off grid solar inverter is working in Line, Standby or Fault mode, charger source can be programmed as below:	
		Utility first **CG.Pr ᵁᵀᴵ CUt 014**	Utility will charge battery as first priority. Solar energy will charge battery only when utility power is not available.
		Solar first **CG.Pr ˢᴼᴸ CSO 014**	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Solar and Utility **CG.Pr ˢᴼᴸ⁺ᵁᵀᴵ SNU 014**	Solar energy and utility will both charge battery.
		Only Solar **CG.Pr ᴼⁿˡʸ ˢᴼᴸ OSO 014**	Solar energy will be the only charger source no matter utility is available or not.
		If this off grid solar 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) **bU22 ON 015**	Alarm off **bU22 OFF 015**
16	Backlight control	Backlight on (default) **LCdb ON 016**	Backlight off **LCdb OFF 016**

17	Beeps while primary source is interrupted	Alarm on (default)	Alarm off
		ALArm ON 017	ALArm OFF 017
19	C.V. charging voltage. If self-defined is selected In program 5, this program can be set up	CV 56.4ᵛ 019 Default 56.4V, 48.0V~58.4V Settable	
20	Floating charging voltage. If self-defined is selected in program 5, this program can be set up	FLtV 54.0ᵛ 020 Default 54.0V, 48.0V~58.4V Settable	
21	Low DC cut-off voltage. If self-defined is selected in program 5, this program can be set up.	CUtV 42.0ᵛ 021 Default 42.0V, 36.0V~52.0V Settable CUtV 20% 021 Default 20%, 5%~49% Settable，value set lower than Program 12 setting When reach Low DC cut-off voltage: If battery power is only power source available, inverter will shut down. If PV energy and battery power are available, inverter will charge battery without AC output. 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.	
22	RS485 communication address	Addr 001 022 Default 001,001-255 Settable	
23	Parallel operation setting, parameters can be set only under battery mode (inverting mode). The system needs reboot after setting all parameters. **Note:** Parallel operation can only work when battery connected	Single: PrLL SIG 023	Parallel: PrLL PAL 023
		L1 Phase: PrLL 3P1 023	L2 Phase: PrLL 3P2 023
		L3 Phase: PrLL 3P3 023	
		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.	
27	Battery equalization	EQUA ENA 027 Battery equalization enable	EQUA dIS 027 Battery equalization disable(default)
		If "Flooded" or "User-Defined" is selected in program 05, this program can be set up.	

28	Battery equalization voltage	E9U4　58.4ᵛ　028⚙
		Default 58.4V, 48.0V~58.4V Settable (the value should be higher than Program 19 value)

29	Battery equalized time	E9t　060　029⚙
		Default 60min, 5min~900min Settable

30	Battery equalized timeout	E9tO　I20　030⚙
		Default 120min, 5min~900min Settable

31	Equalization interval	E9it　00I　031⚙
		Default 1days, 1 days~90 days Settable

32	Equalization activated immediately	Equalization activated immediately enable	Equalization activated immediately disable (default)
		E9At　EnA　032⚙	E9At　diS　032⚙
		If equalization function is enabled in program 27, 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 "E9". If "Off" is selected, it will cancel equalization function until next activated equalization time arrives based on program 31setting. At this time, "E9" will not be shown in LCD main page.	

36	Real time setting---Year	2021　　036⚙	Default 2000, range 2000~2099
37	Real time setting---Month	ñOn　II　037⚙	Default 01, range 01~12
38	Real time setting---Date	dAY　I0　038⚙	Default 01, range 01~31
39	Real time setting---Hour	HOUr　I4　039⚙	Default 00, range 00~23

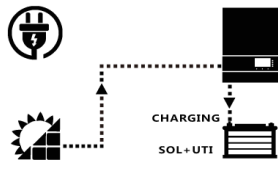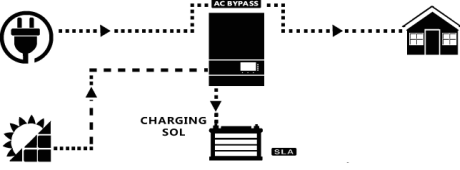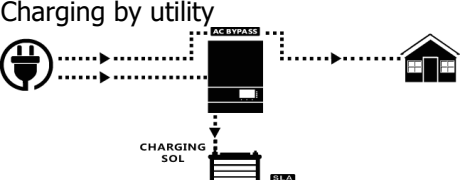| 40	Real time setting---Minute	⁻ıⁿ 52 04ᵒ	Default 00, range 00~59
42	Max AC input current	bPı 30. 42ᵒ 3000W model:Default 15A, adjustable 5-15A 6000W model:Default 30A, adjustable 5-30A	
49	Utility charging time	0000(default) Allow utility to charge the battery all day run. CHG tıⁿ 0000 04ᵒ9	The time 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 19:59, and the utility charging is prohibited outside of this period)
50	AC output time	0000(default) Allow inverter to power the load all day run. OUP tıⁿ 0000 05ᵒ	The time allows inverter to power the load. Use 4 digits to represent the time period, the upper two digits represent the time when inverter start to power the load, setting range from 00 to 23, and the lower two digits represent the time when inverter end to power the load, setting range from 00 to 23. (eg: 2320 represents the time allows inverter to power the load is from 23:00 to the next day 19:59, and the inverter AC output power is prohibited outside of this period)
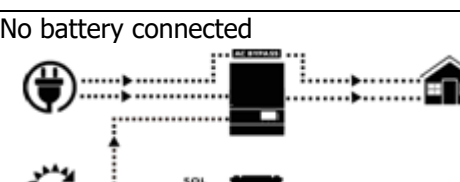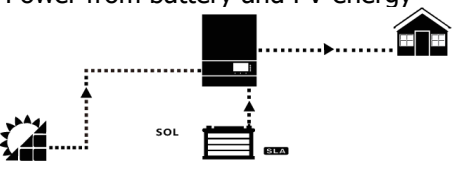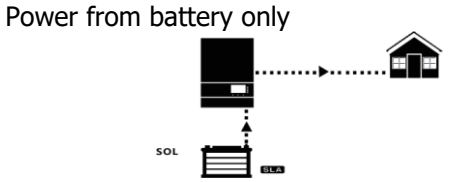
Display Information

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.
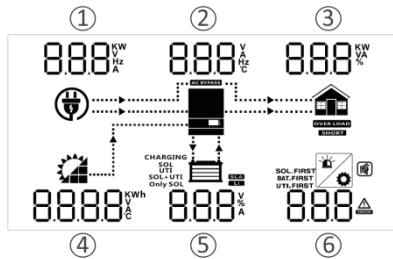
Setting Information	LCD display
① AC Input voltage ② Output voltage ③ Load percentage ④ PV input voltage ⑤ Battery voltage ⑥ Warning or Fault code (Default Display Screen)	
① AC Input frequency ② Output frequency ③ Load power in VA ④ PV energy sum in KWH ⑤ Battery percentage ⑥ Warning or Fault code	
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: 040-00-b21; CPU2:041-00-b21)	
Time (15:20:10, December 15, 2018)	

Operating Mode Description

Operation mode	Description	LCD display
Standby mode **Note:** *Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output.	No output is supplied by the unit but PV it still can charge batteries.	When utility grid connected, no charging; PV can charge
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
Battery Mode	The unit will provide output power from battery and PV power.	Power from battery and PV energy Power from battery only

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 6units.
2. Maximum 6 units work together to support 3-phase equipment. Four units support one phase maximum.

Note: If the package includes share current cable and parallel cable, the inverter is default supported parallel operation. You may skip section 3. If not, please purchase parallel kit and install this unit by following instruction from professional technical personnel in local dealer.

Package Contents

In parallel kit, you will find the following items in the package:

Parallel communication cable

Mounting the Unit
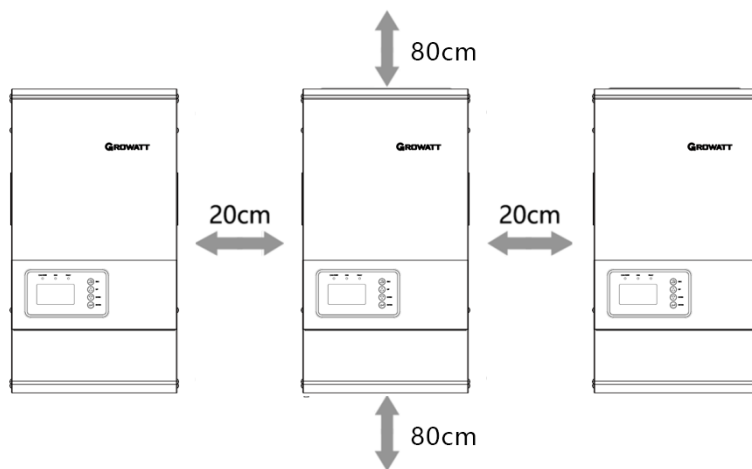
Note: For proper air circulation to dissipate heat, allow a clearance of approx. 20cm to the side and approx. 80 cm above and below the unit. Be sure to install each unit in the same level.

Wiring Connection

The cable size of each inverter is shown as below
Recommended battery cable and terminal size for each inverter:

Ring terminal:

Model	Wire Size	Torque value
SPF 3000T HVM-G2	1 * 4 AWG	2-3 Nm
SPF 6000T HVM-G2	1 * 2 AWG	2-3 Nm
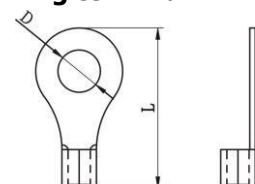
WARNING: Be sure the length of all battery cables is the same. Otherwise, there will be voltage difference between inverter and battery to cause parallel inverters not working.

You need to connect the cables of each inverter together. Take the battery cables for example: You need to use a connector or bus-bar as a joint to connect the battery cables together, and then connect to the battery terminal. The cable size used from joint to battery should be X times cable size in the tables above. "X" indicates the number of inverters connected in parallel.

Regarding AC input and output, please also follow the same principle.
Recommended AC input and output cable size for each inverter:

Model	Gauge	Torque Value
SPF 3000T HVM-G2	1 * 10 AWG	1.2-1.6 Nm
SPF 6000T HVM-G2	1 * 8 AWG	1.2-1.6 Nm

CAUTION!! Please install the breaker at the battery and AC input side. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of battery or AC input.

Recommended breaker specification of battery for each inverter:

Model	1 unit*
SPF 3000T HVM-G2	100A / 60VDC
SPF 6000T HVM-G2	200A / 60VDC

*If you want to use only one breaker at the battery side for the whole system, the rating of the breaker should be X times current of 1 unit. "X" indicates the number of inverters connected in parallel.

Recommended breaker specification of AC input with single phase:

Model	2 units	3 units	4 units	5 units	6 units
SPF 3000T HVM-G2	60A/230VAC	90A/230VAC	120A/230VAC	150A/230VAC	180A/230VAC
SPF 6000T HVM-G2	120A/230VAC	180A/230VAC	240A/230VAC	300A/230VAC	360A/230VAC

Note1: You can use 30A breaker for SPF 3000T HVM-G2 for only 1 unit, and each inverter has a breaker at its AC input. And use 60A breaker for SPF 6000T HVM-G2 for only 1 unit, and each inverter has a breaker at its AC input.
Note2: Regarding three phase system, you can use 4 poles breaker, the rating is up to the current of the phase which has the maximum units. Or you can follow the suggestion of note 1.

Recommended battery capacity

Inverter parallel numbers	2	3	4	5	6
Battery Capacity@3000W	400AH	600AH	800AH	1000AH	1200AH
Battery Capacity@6000W	500AH	750AH	1000AH	1250AH	1500AH

WARNING! Be sure that all inverters will share the same battery bank. Otherwise, the inverters will transfer to fault mode.

Parallel Operation in Single Phase

WARNING! All inverters must be connected to the same batteries and ensure each group of cables from the inverters to the batteries in the same length.

Two inverters in parallel:
Power Connection
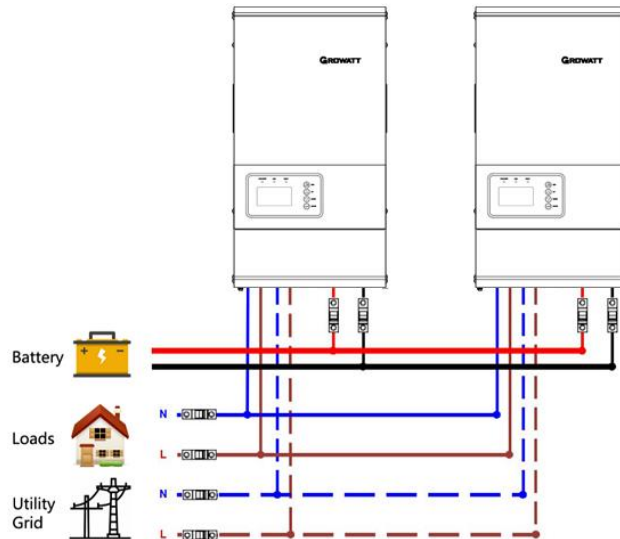
Communication Connection

Three inverters in parallel:
Power Connection

Communication Connection

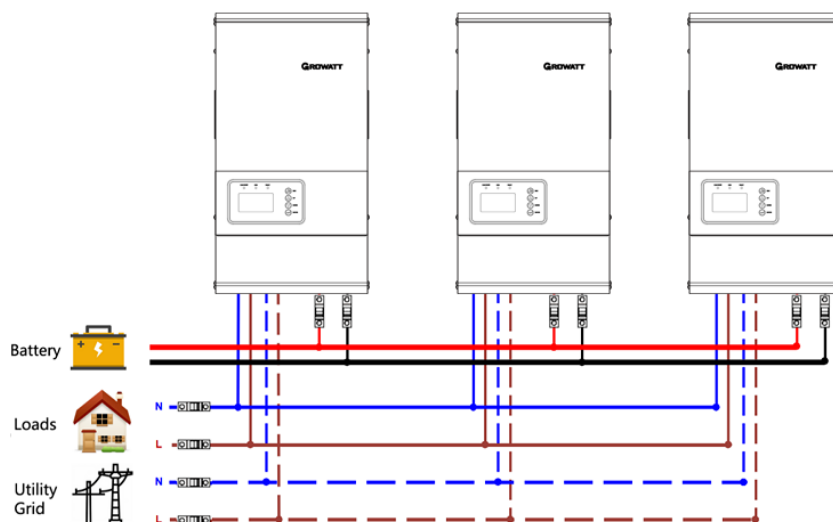Four inverters in parallel:

Power Connection

Communication Connection
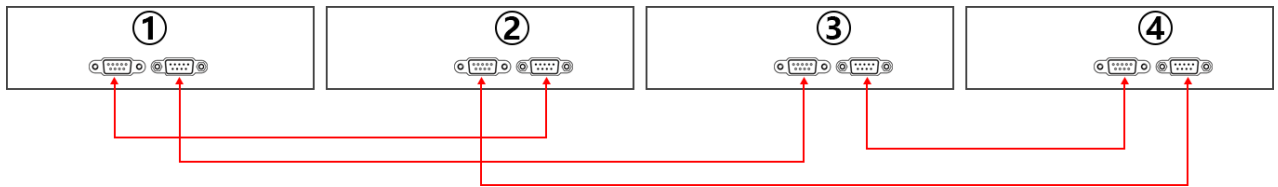
Five inverters in parallel:

Power Connection

Communication Connection
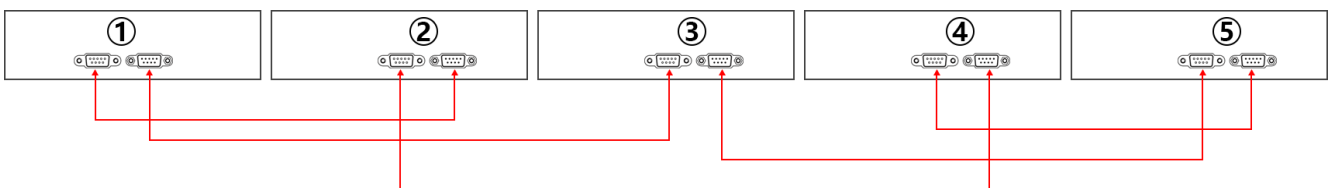
Six inverters in parallel:

Power Connection
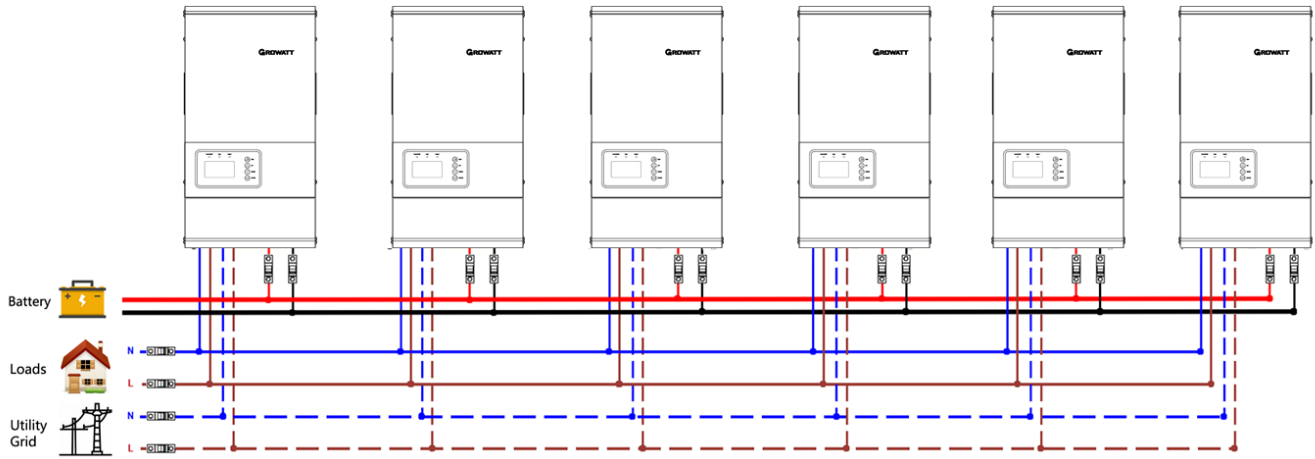
Communication Connection
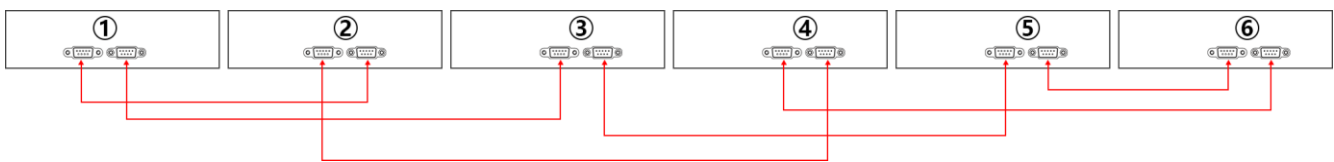
Parallel Operation in Three Phase

WARNING! All inverters must be connected to the same batteries and ensure each group of cables from the inverters to the batteries in the same length.

One inverter in each phase:
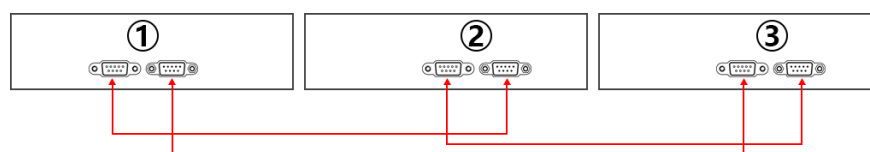
Power Connection
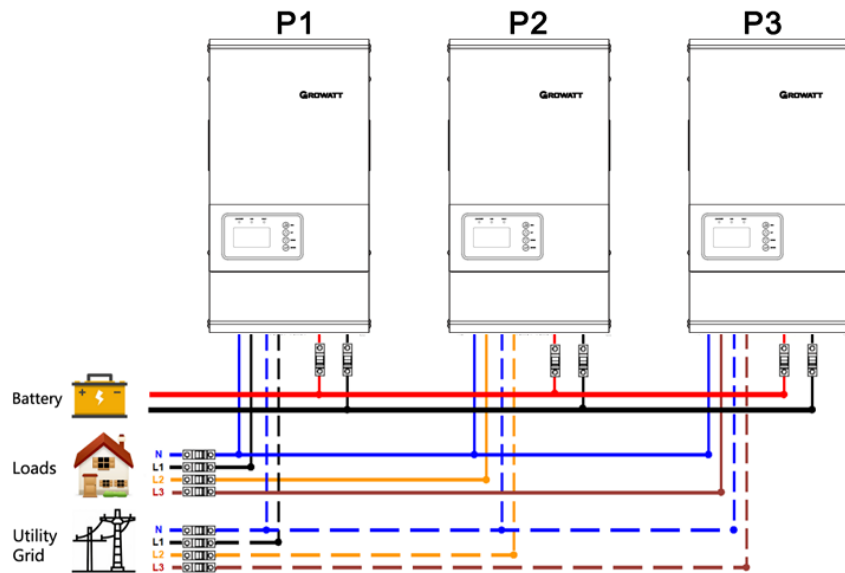
Communication Connection
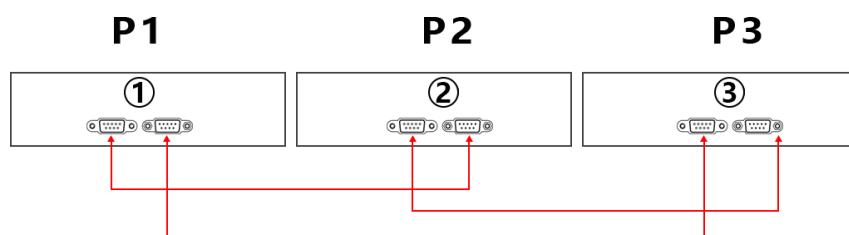
Two inverters in one phase and only one inverter for the remaining phases:

Power Connection
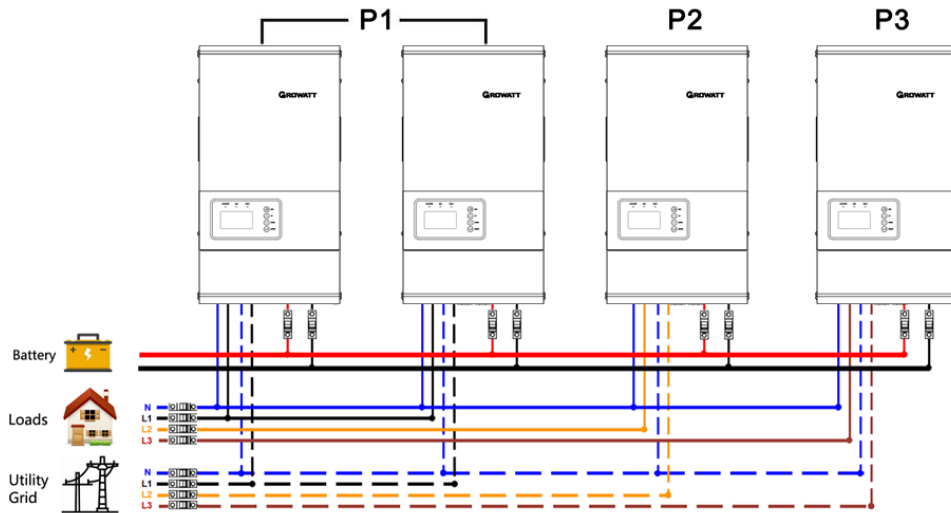
Communication Connection
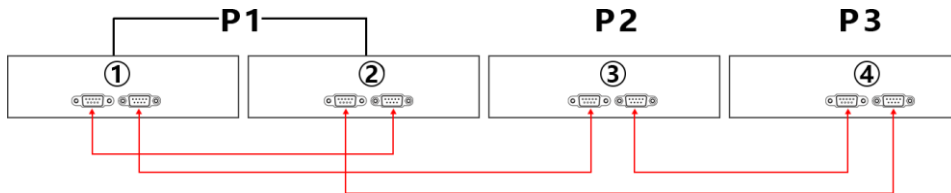
Two inverters in two phases and only one inverter for the remaining phase:

Power Connection
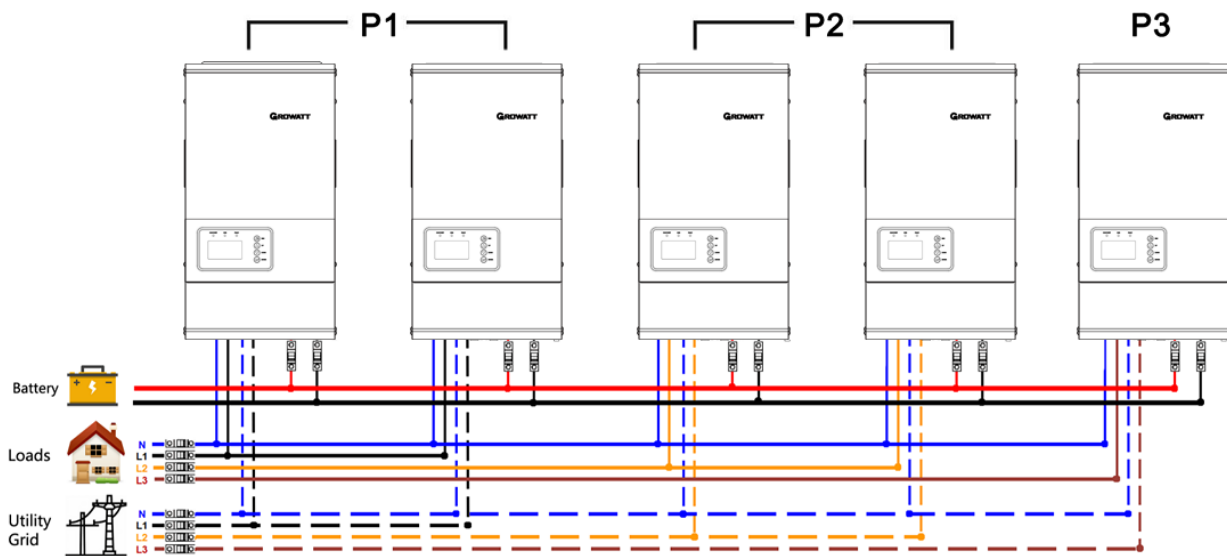
Communication Connection
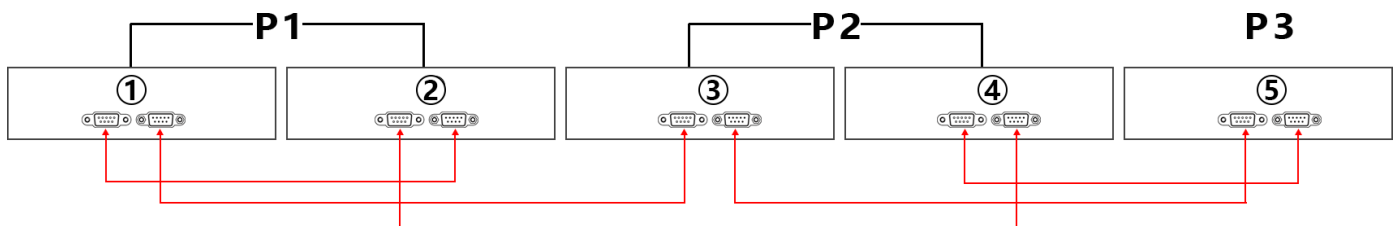
Three inverters in one phase and only one inverter for the remaining two phases:
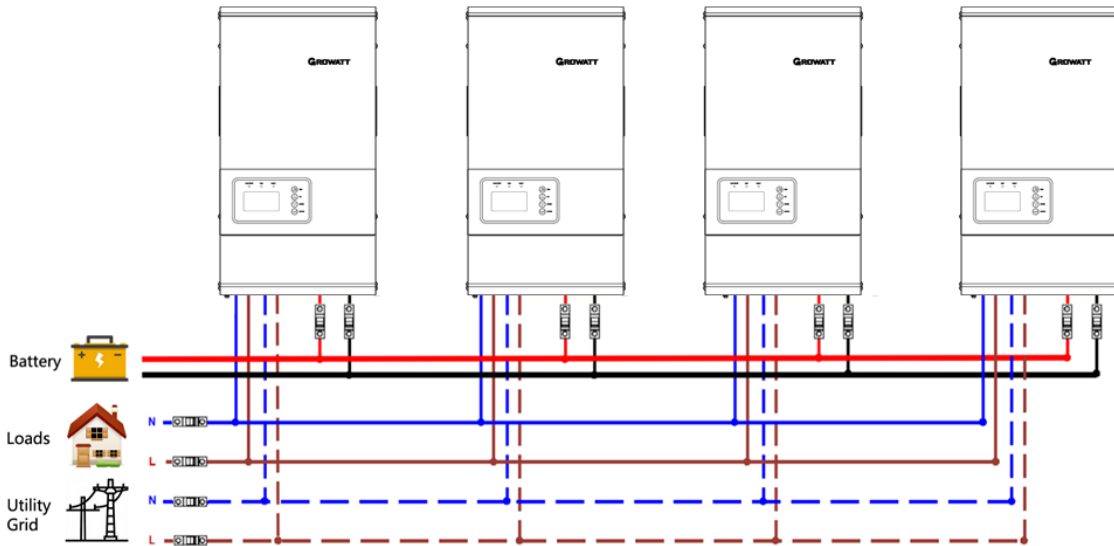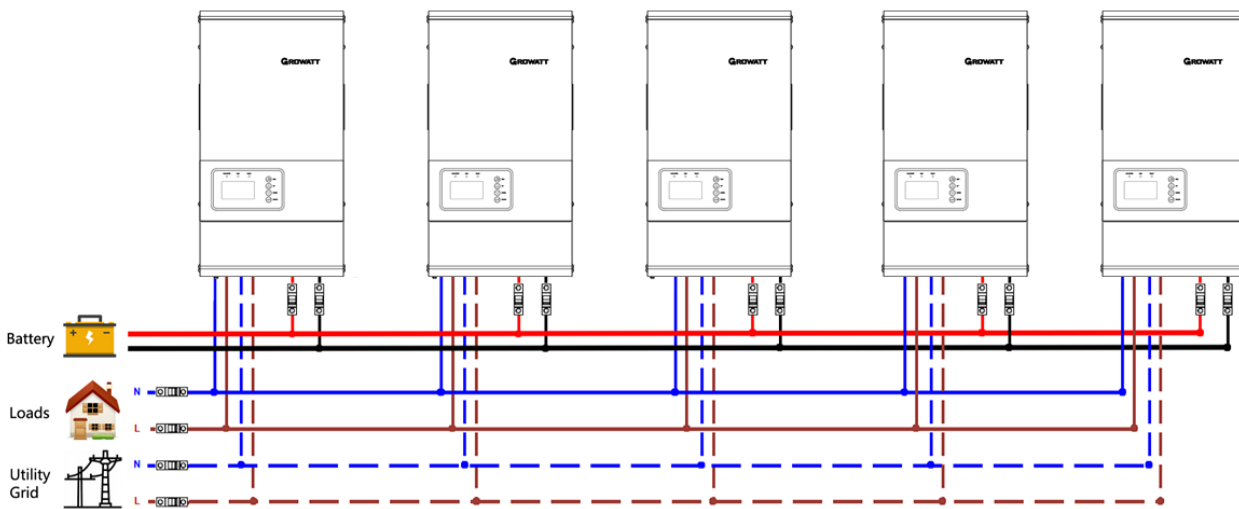
Power Connection
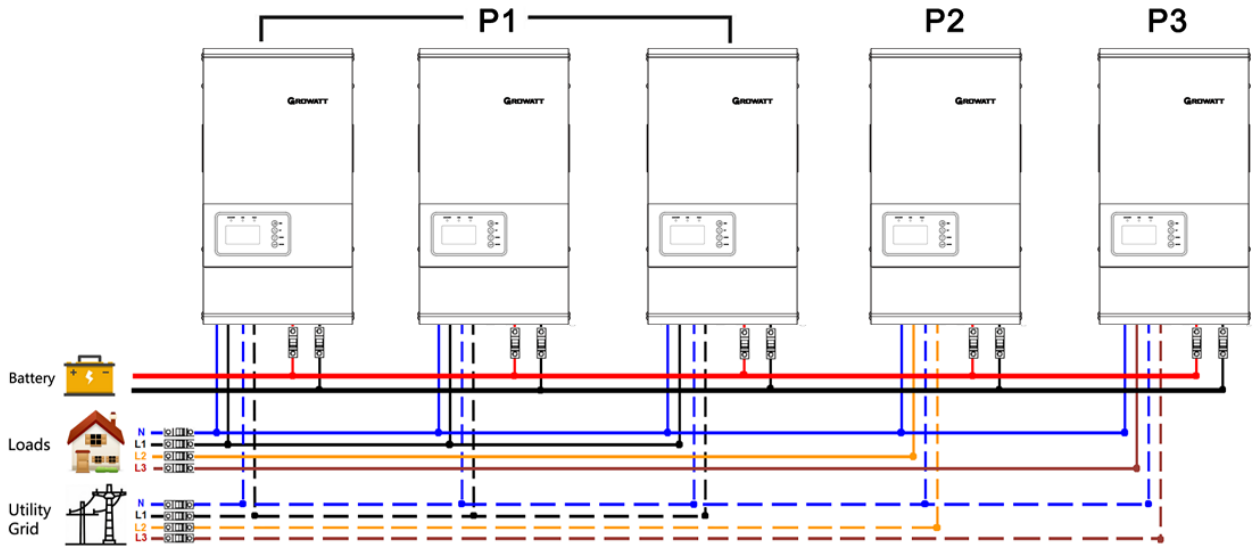
Communication Connection
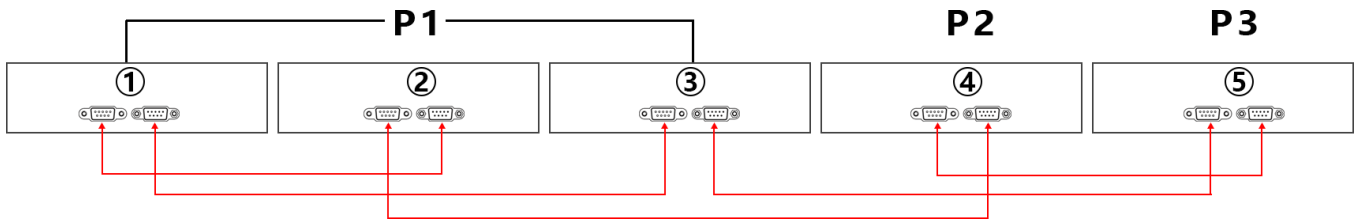
Two inverters in each phase:

Power Connection
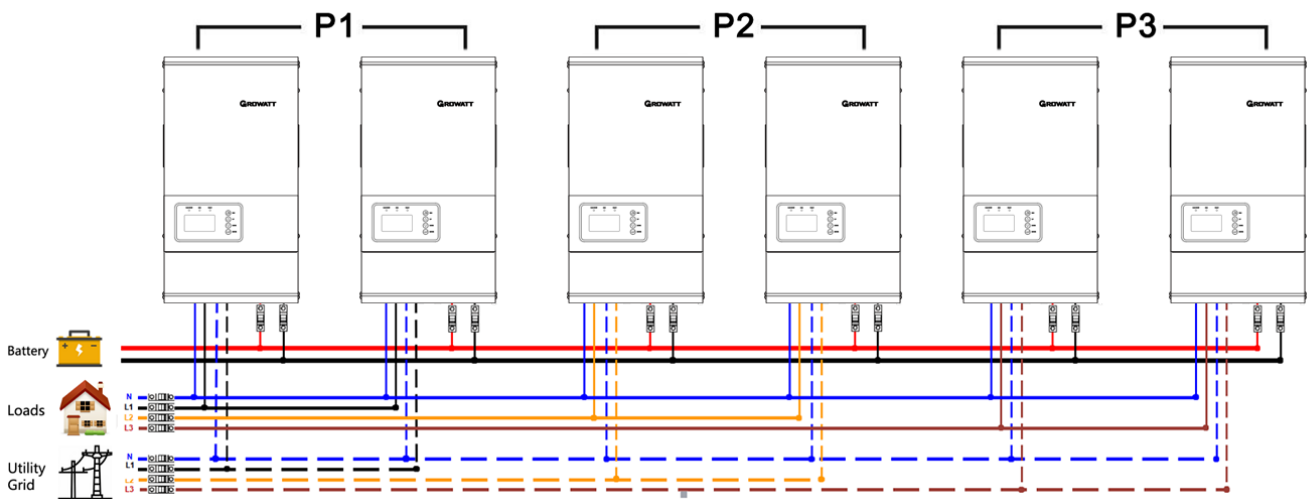
Communication Connection
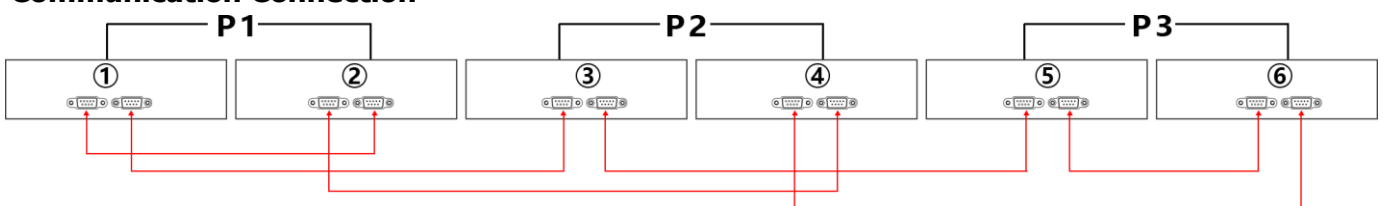
Three inverters in one phase, two inverters in second phase and one inverter for the third phase:

Power Connection
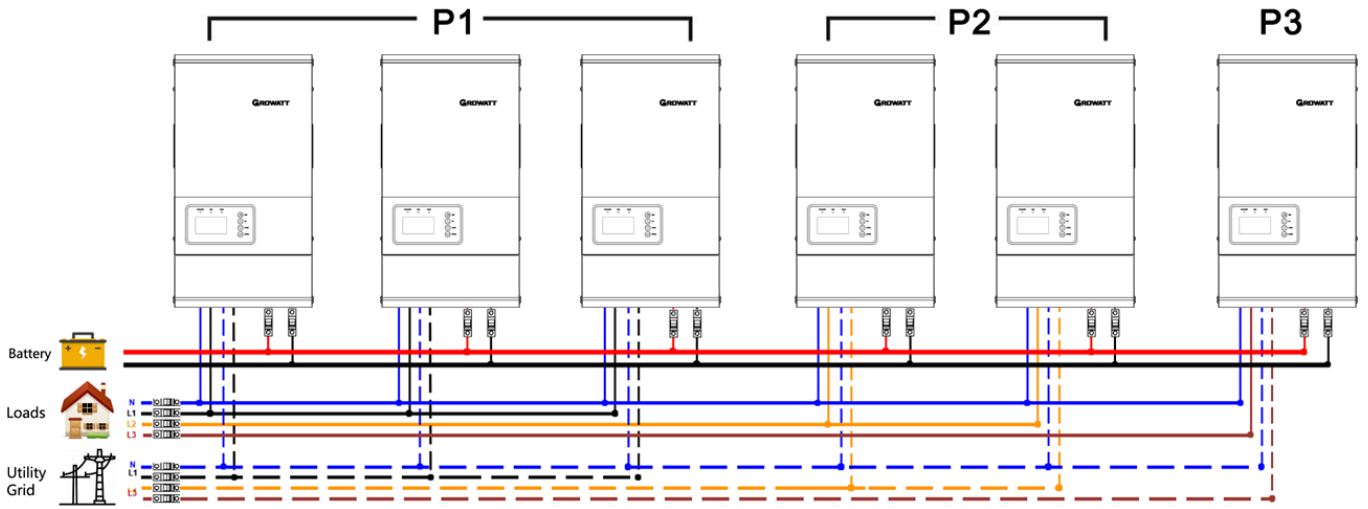
Communication Connection
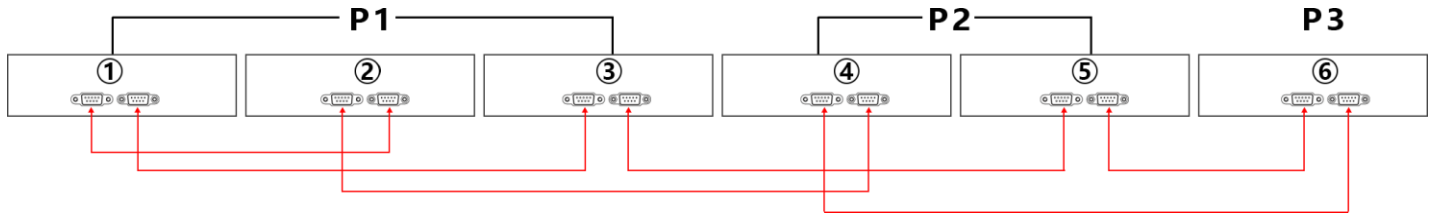
Four inverters in one phase and one inverter for the other two phases:

Power Connection
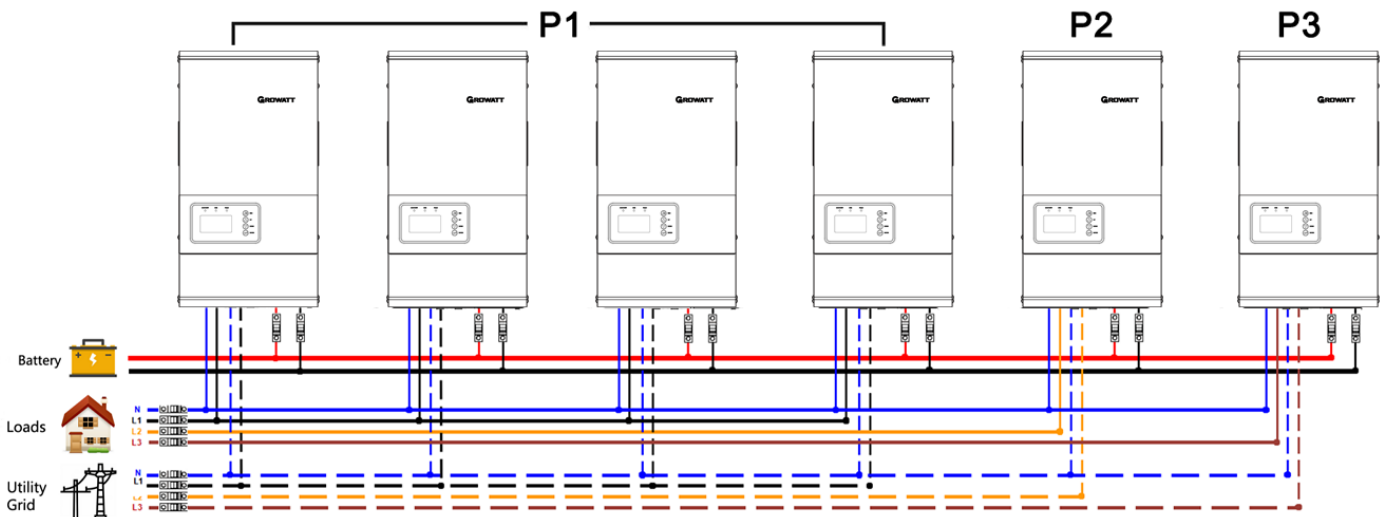
Communication Connection
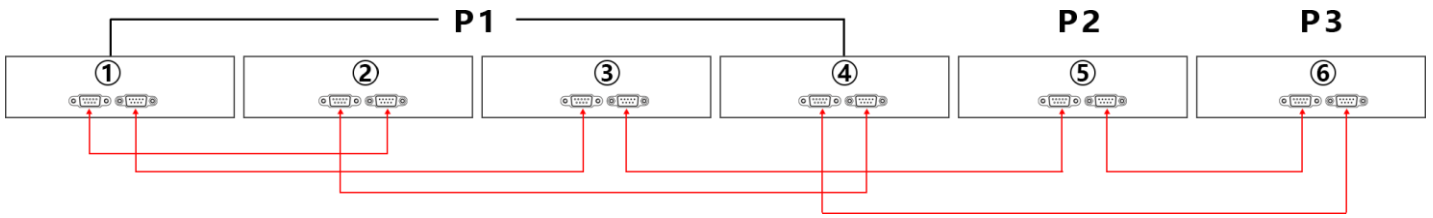
WARNING: Do not connect the current sharing cable between the inverters which are in different phases.

Otherwise, it may damage the inverters.

PV Connection

Please refer to user manual of single unit for PV Connection on Page 10.

CAUTION: Each inverter should connect to PV modules separate.

LCD Setting and Display

Refer to Program 23 on Page 20

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.

Step 3: Turn on each unit.

Growatt SPF 3000-6000T HVM-G2

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.

Growatt SPF 3000-6000T HVM-G2

LCD display in Master unit	LCD display in Slave unit

| 230ᵛ 230ᵛ 0.1%
 (plug) ⇢ ■ ⇢ 🏠
 SOL+UTI ▭
 00 56.4ᵛ HSt | 230ᵛ 230ᵛ 0.1%
 (plug) ⇢ ■ ⇢ 🏠
 SOL+UTI ▭
 00 56.4ᵛ SL1 |
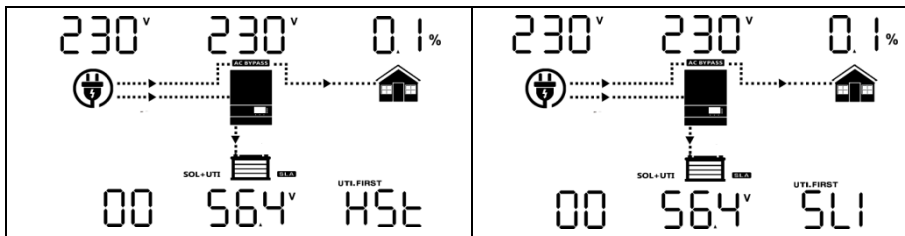
Step 5: If there is no more fault alarm, the parallel system is completely installed.

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 3P1, 3P2 and 3P3 sequentially. Then shut down all units.

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

Growatt SPF 3000-6000T HVM-G2

LCD display in L1-phase unit	LCD display in L2-phase unit	LCD display in L3-phase unit
0ᵛ 230ᵛ 0.1% ■ ⇢ 🏠 SOL+UTI ▭ 0.0ᵛ 56.4ᵛ HSt	0ᵛ 230ᵛ 0.1% ■ ⇢ 🏠 SOL+UTI ▭ 0.0ᵛ 56.4ᵛ 3P2	0ᵛ 230ᵛ 0.1% ■ ⇢ 🏠 SOL+UTI ▭ 0.0ᵛ 56.4ᵛ 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.

Growatt SPF 3000-6000T HVM-G2

LCD display in L1-phase unit	LCD display in L2-phase unit	LCD display in L3-phase unit
230ᵛ 230ᵛ 0.1% (plug) ⇢ ■ ⇢ 🏠 SOL+UTI ▭ 0.0ᵛ 56.4ᵛ HSt	230ᵛ 230ᵛ 0.1% (plug) ⇢ ■ ⇢ 🏠 SOL+UTI ▭ 0.0ᵛ 56.4ᵛ 3P2	230ᵛ 230ᵛ 0.1% (plug) ⇢ ■ ⇢ 🏠 SOL+UTI ▭ 0.0ᵛ 56.4ᵛ 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.

AC-coupling
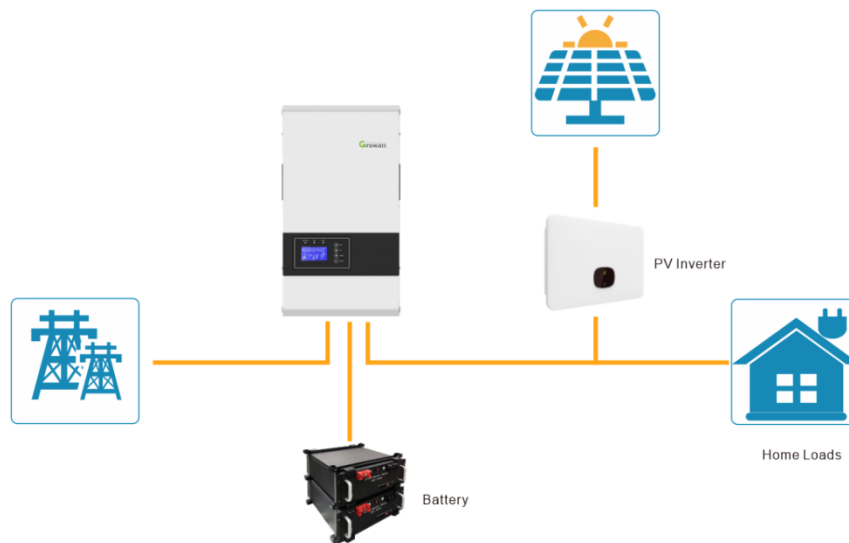
1.AC-coupling

In an AC-coupled system, a grid-tied PV inverter is connected to the output of SPF 3000T HVM-G2 and SPF 6000T HVM-G2. PV power is first used to power the loads, then to charge the battery, and any excess PV power can be fed back to the grid.

When the SPF 3000T HVM-G2 (SPF 6000T HVM-G2) is connected to the grid, this excess PV inverter power will automatically be fed back to the grid.

NOTE:The output of grid PV inverter can only be connected to the HOT1-HOT2 output of the SPF 3000T HVM-G2 (SPF 6000T HVM-G2), but not HOT1-N and HOT2-N ,only be used in a single unit.

When the SPF 3000T HVM-G2 (SPF 6000T HVM-G2) is operating in inverter-mode, disconnected from its AC input, it will create a local grid: a micro-grid. The PV Inverter will accept this micro-grid and will therefore operate even during a black-out. The PV power can even be used to charge the batteries: when there is more PV power available than used by the loads, the power will automatically run through the inverter in reverse direction and charge the batteries. It is necessary to regulate that power to prevent overcharging the batteries as well as overloading the inverter/charger. This is where 'frequency shifting' comes in to the picture, see next section.

Highlights:

（1）SPF 3000T HVM-G2 (SPF 6000T HVM-G2) can prevent feeding back PV power to grid.

（2）Systems with only a grid-tied PV inverter will fail when there is a grid black-out. A micro-grid system will continue to operate, and even keep using solar power.

（3）Most brands of PV inverters can be used for these systems, they need to be setup to support frequency shifting, often called the island-mode or micro-grid mode.

（4）If power will be fed back into the grid an anti-islanding device may have to be added to the system, depending on local regulations.

2.frequency shifting

Frequency shifting is used to regulate the output power of a Grid-tie PV Inverter, or Grid-tie Wind inverter, by changing the frequency of the AC

3. The Factor 1.0 rule

The max PV power must be equal or less than the VA rating of the inverter/charger

3.1 Rule definition

In both grid-connected and off-grid systems with PV inverters installed on the output of SPF 3000T HVM-G2 (SPF 6000T HVM-G2), there is a maximum of PV power that can be installed. This limit is called the factor 1.0 rule: 3.000 VA SPF 3000T HVM-G2 >= 3.000 Wp (6.000 VA SPF 6000T HVM-G2 >= 6.000 Wp)installed solar power.

3.2 Example and background

To understand the background, consider the following situation: the PV inverter is at full power, supplying a big load. The SPF 3000T HVM-G2 (SPF 6000T HVM-G2) is in inverter mode. Then, suddenly and at once, this load is switched off. At that moment the PV inverter will continue operating at full power until the AC frequency has been increased. Increasing this frequency will take a very short time, but during that time all power will be directed into the batteries as there is no other place for it to go. This causes the following:

（1）When batteries are (nearly) full, the battery voltage will spike, possibly causing the SPF 3000T HVM-G2 (SPF 6000T HVM-G2) to switch off in DC over-voltage alarm.

（2）The same spike will cause the AC output voltage of the SPF 3000T HVM-G2 (SPF 6000T HVM-G2) to spike, as these two are directly related, and when the spike on the battery voltage is high and fast enough, the SPF 6000T HVM-G2 can never regulate its PWMs down fast enough to prevent the spike on AC. This spike can damage the PV inverter, the SPF 3000T HVM-G2 (SPF 6000T HVM-G2) and also any connected loads and other equipment.

（3）Another problem is that the SPF 3000T HVM-G2 (SPF 6000T HVM-G2) starts charge current protection.

（4）In the best case it might switch the grid inverter off immediately by setting the AC frequency to the disconnect frequency as configured in the assistant.

4.Minimum battery capacity

The minimum battery capacity depends on the type of battery, lead or lithium.

Note that, besides the minimum battery capacity, the mentioned sizes are often also the most economical battery size. In case used for self-consumption purposes that is. In case the goal is to increase autonomy, of course installing a large battery increases the system autonomy in case of a grid failure.

4.1 Lead batteries

1 kWp installed PV power requires approximately 5kWh of lead acid battery:

Each additional 1 kWp of AC PV will require an additional proportional 5 kWh increase in lead acid battery storage.

4.2 Lithium batteries

1,5 kWp installed AC PV power requires 4.8 kWh of battery storage:

Each additional 1.5 kWp of AC PV will require an additional proportional 4.8 kWh increase in battery storage.

Inverter mode+AC bypass mode jointly output

Home Loads

Battery
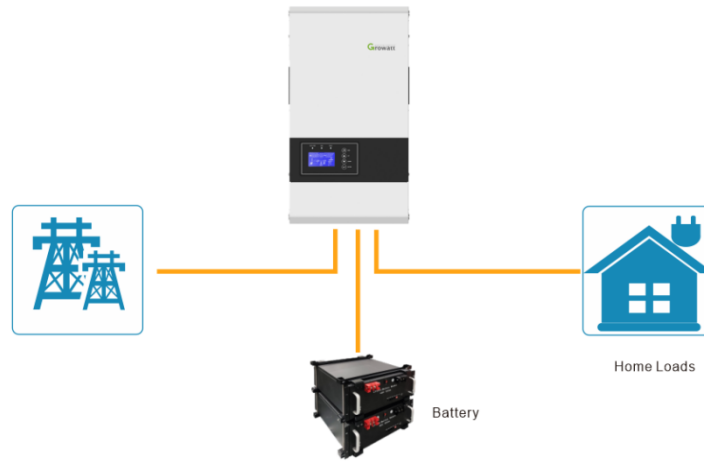
1.LCD setting

1.1 please set program 01 at SUB

LCD display in 01
SOL.FIRST UTI.FIRST ⚙ OP.Pr SUb 01
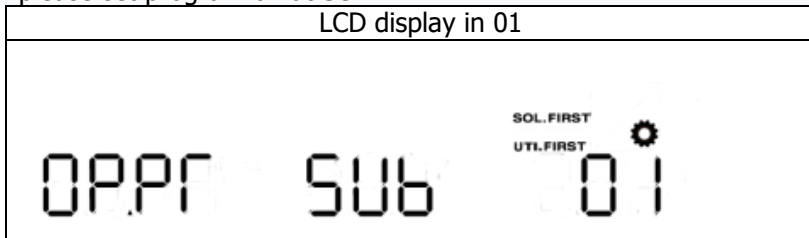
Then go into sub-program 90, set minimum voltage point for joint output (AC bypass mode+inverter mode):adjustable 44-56v

LCD display in 90
SUb.ᵛ 46.0ᵛ 90⚙
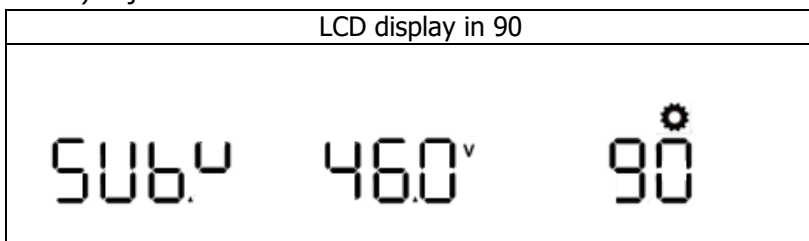
1. 2 Please set program 14 at SNU

LCD display in 14
SOL+UTI ⚙ CG.Pr SNU 14
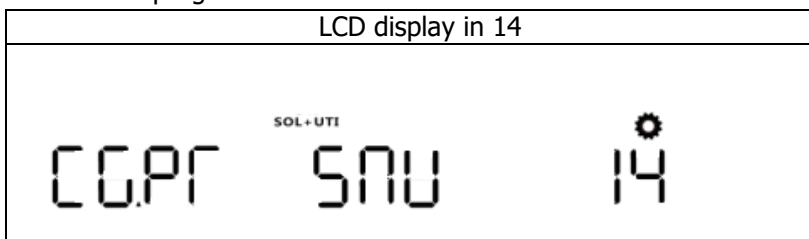
1.3 please set program 42 at BPI, then max AC input current adjustable 5-15A@3000W(5-30A@6000W) settable

LCD display in 42
bPI 30ᴬ 42⚙
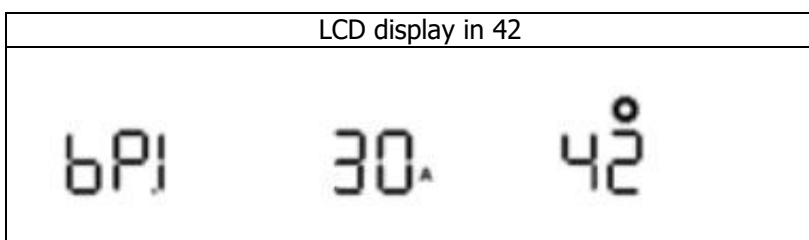
This function can only be available only when set all of above 3 steps.

Note: This function is only applicable to stand-alone mode, and cannot be used in parallel mode.

2. Overload protection：

2.1 When load current < max AC input current +max inverter mode current, It will use Ac bypass mode and inverter mode to power connected load continuously maximum at 6KW@3000W(12KW@6000W).

When battery voltage drop to setting value at program 90, battery will not discharge in SUB mode, but only use AC input current to power connected load. inverter will say 07 overload error code if load current is bigger than max AC input current at this time.

2.2 When load current>max AC input current +max inverter mode current ,inverter says 07 overload error code after 10 seconds.

Fault Code

Fault Code	Fault Event	Icon on
02	Inverter Over temperature	02
03	Battery voltage is too high	03
04	Battery voltage is too low	04
05	Output short circuited	05
06	Output voltage is abnormal. Output voltage is too high.	06
07	Overload time out	07
20	BMS communication error	20
51	Over current or surge	51
56	MOS overcurrent	56
60	Negative power fault	60
80	CAN fault	80
81	Host loss	81

Warning Code

Warning Code	Warning Event	Audible Alarm	Icon flashing
01	PV Fan is not working/ Inverter Fan is not working	Beep once every second	01
02	PV Over temperature	Beep once every second	02
04	Low battery	Beep once every second	04
07	Overload	Beep once every second	07
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 ⚠
19	Battery disconnect	Beep once every second	19 ⚠
51	PV Over current or surge	Beep once every second	51 ⚠
58	AC output low voltage	Beep once every second	58 ⚠

Trouble Shooting

Problem	LCD/LED/Buzzer	Explanation / Possible cause	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.
Buzzer beeps continuously and red LED is on. (Fault code) Buzzer beeps once every second, and red LED is flashing. (Warning code)	Warning code 01	Fan Warning	1.Check whether all fans are working properly. 2.Replace the fan.
	Fault code 02	Internal temperature of component is over 90°C.	Check if the air flow of the unit is blocked or the ambient temperature is too high.
	Fault code 03	Battery is over-charged.	Return to repair center.
		The battery voltage is too high.	Check if spec and quantity of batteries are meet requirements.
	Fault code 04	The battery voltage is too low.	1. Measure battery voltage in DC input. 2. Check battery SOC in LCD when use Li battery 3. Recharge the battery.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
	Fault code 06/58	Output abnormal (Inverter voltage below than 180Vac or is higher than 290Vac)	1. Reduce the connected load. 2. Return to repair center
	Fault code 07	Overload error. The inverter is overload 101% and time is up.	Reduce the connected load by switching off some equipment.

	Warning code 15	The input status is different in parallel system.	Check if AC input wires of all inverters are connected well.
	Warning code 16	Input phase is not correct.	Change the input phase S and T wiring.
	Warning code 17	The output phase not correct in parallel.	1. Make sure the parallel setting are the same system(single or parallel; 3P1,3P2,3P3). 2. Make sure all phases inverters are power on.
	Warning code 19	No battery alarm	Check that the battery is connected to the machine
Buzzer beeps continuously and red LED is on. (Fault code)	Fault code 20	BMS communication failed	1. Check the BMS communication wire to see if it's well connected 2. Check the transceiver signal
	Fault code 51	Over current or surge	Restart the unit, if the error happens again, please return to repair center.
	Fault code 56	MOS overcurrent	Restart the unit, if the error happens again, please return to repair center.
	Fault code 60	Negative power fault	1. Check whether the AC output connected to the grid input. 2. Check whether Program 8 settings are the same for all parallel inverters 3. Check whether all neutral wires of all parallel units are connected together. 5.If problem still exists, contact repair center.
	Fault code 80	CAN fault	1. Check whether the parallel communication cables are connected well.
	Fault code 81	Host loss	2. Check whether Program 23 settings are right for the parallel system. 3. If problem still exists, contact repair center

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.

Specifications

Table 1 Line Mode Specifications

INVERTER MODEL	SPF 3000T HVM-G2	SPF 6000T HVM-G2
Input Voltage Waveform	Pure sine wave/ same as input (bypass mode)	
Nominal Input Voltage	230Vac	
Input voltage range	184~272Vac（UPS）；154~272Vac（APL）	
Low Loss Voltage	184Vac±7V(UPS); 154Vac±7V(APL)	
Low Loss Return Voltage	194Vac±7V(UPS); 164Vac±7V(APL)	
High Loss Voltage	>272Vac±7V	
High Loss Return Voltage	<262Vac±7V	
Nominal Input Frequency	50Hz / 60Hz (Auto detection)	
Input Frequency range	45-65Hz	
Low Loss Frequency	45±1Hz	
Low Loss Return Frequency	47±1Hz	
High Loss Frequency	65±1Hz	
High Loss Return Frequency	63±1Hz	
Efficiency (Line Mode)	>95% （Rated R load, battery full charged）	
Input Current	Max 30A	Max 50A
Transfer Time	10ms typical, 20ms Max@ Single <30ms @ Parallel	

Table 2 Inverter Mode Specifications

INVERTER MODEL	SPF 3000T HVM-G2	SPF 6000T HVM-G2
Rated Output Power	3KVA / 3KW	6KVA/6KW
Output Voltage Waveform	Pure Sine Wave	
Output Voltage Regulation	230Vac±5%	
Output Frequency	50Hz	
Peak Efficiency	94%	93.5%
Overload Protection	10s@101%~150% load; 5s@≥150% load	
Surge Capacity	9KVA / 9KW	18KVA/18KW
Nominal DC Input Voltage	48Vdc	
Cold Start Voltage(Lead-Acid Mode)	Low DC Cut-Off Voltage +2Vdc	
Cold Start SOC(Li Mode)	>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)	48V	
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 (Lead-Acid Mode)	42.0Vdc (Based on Program 21, 40Vdc~48Vdc settable)	
Low DC Warning SOC (Li Mode)	Low DC Cut-off SOC +5%	
Low DC Warning Return SOC (Li Mode)	Low DC Cut-off SOC +15%	
Low DC Cut-off SOC(Li Mode)	Default 20%, 5%~49% settable	
High DC Recovery Voltage	58Vdc	
High DC Cut-off Voltage	AGM:60V, FLD:62V, USE or Li Mode: C.V. Voltage + 4.0V	
No Load Power Consumption	<20W	<35W

Table 3 Charge Mode Specifications

Utility Charging Mode		
INVERTER MODEL	**SPF 3000T HVM-G2**	**SPF 6000T HVM-G2**
Charging Algorithm	3-Step	
Max. AC Charging Current	40Amp (@V$_{I/P}$=230Vac)	60Amp (@V$_{I/P}$=230Vac)
AC Charging Current @ AC Input Voltage	@ 191V-265V, 100% charging @ 155V-190V, Max. charging current 30A @ ＞265V, no charging, recover to charge when lower to 260V	
Bulk Charging Voltage — **Flooded Battery**	58.4Vdc	
Bulk Charging Voltage — **AGM / Gel Battery**	56.4Vdc	
Floating Charging Voltage	54Vdc	
Charging Curve		
MPPT Solar Charging Mode		
Max. PV Array Power	4500W	
Max. PV Array Open Circuit Voltage	250Vdc	
Max. PV Charging Current	80A	
Bulk Charging Voltage — **Flooded Battery**	58.4Vdc	
Bulk Charging Voltage — **AGM / Gel Battery**	56.4Vdc	
Floating Charging Voltage	54Vdc	

Table 4 General Specifications

INVERTER MODEL	SPF 3000T HVM-G2	SPF 6000T HVM-G2
Operating Temperature Range	-20℃ to 50℃(fan assisted cooling)	
Storage temperature	-40℃~ 60℃	
Humidity	5% to 95% Relative Humidity (Non-condensing)	
Altitude	<2000m	
Dimension(D*W*H), mm	550 x 300 x 225	650 x 365 x 247
Net Weight, kg	27.4	38.5