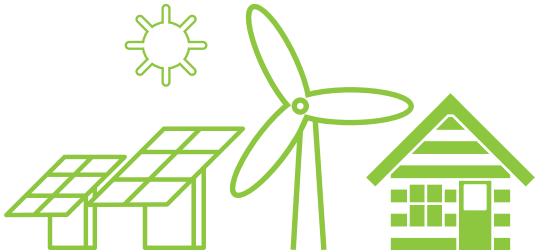
Off-Gird Inverters



Contents

powering tomorrow Growatt

Introduction

1

Need of Off-Grid Solution

Complete self-governing without main grid support

Combine different energy resources like PV etc.

Extend or change your system on a segmental basis

Support issues including, household, school, small factories, area suffer from power instability, replace the generation of diesel generators

Growatt provides services including inverter, MPPT control, Solar pump inverter and storage with 3-30 kW range

Off-Grid Inverters

SPF 5000 ES

Transformerless
120 Vac

SPF 3000TL LVM

Transformerless
230 Vac

SPF 5000TL HVM-WPV

120/240 Vac

SPF 4000-6000T DVM

SPF 3000-5000TL HVM

230 Vac

SPF 4000-12000T HVM

With Transformer

Accessories

SC 4860-48120
MPPT solar charge controller

Wi-Fi-F/GPRS-F

T: low frequency transformer,
TL: Transformerless,
M: MPPT solar charger controller
HV: 230Vac, LV: 120Vac,
DV: 120/240Vac,
P: Parallel model, WPV: PV 450Vdc model

Off-Grid Inverter Battery

Battery Case

IP55,
Wall-mounted,
12kg Cabinet

US2000

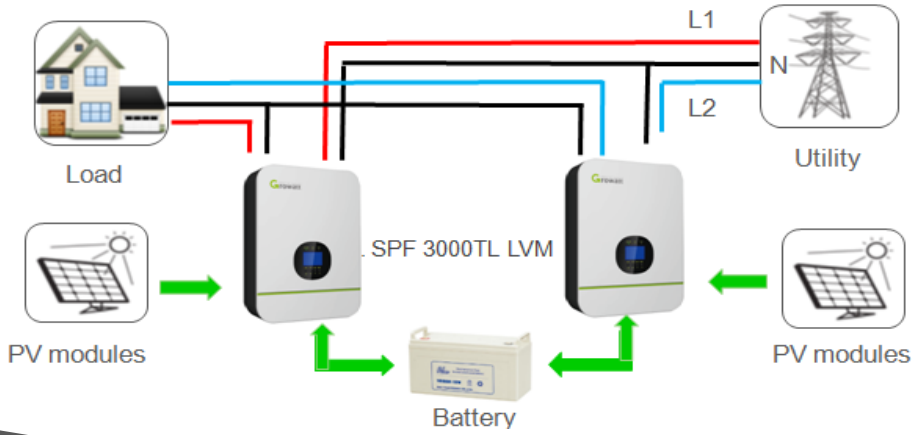
Lithium Battery (48V 50AH)

2.4kWh, 90% DoD
IP20, 24kg
Max. 8pcs

Note: Each Battery Case can install 2pcs US 2000 Lithium Battery

Key Features

SPF 3000TL LVM
(Offered Split-phase)



Support

1. Power factor 1.0
2. MPPT solar charge controller
3. WIFI/GPRS remote monitoring
4. Compatible with generator power
5. Configurable AC/solar input and charging priority
6. Parallel operation available
7. Compatible with lithium battery
8. Low voltage 120Vac output

Key Features

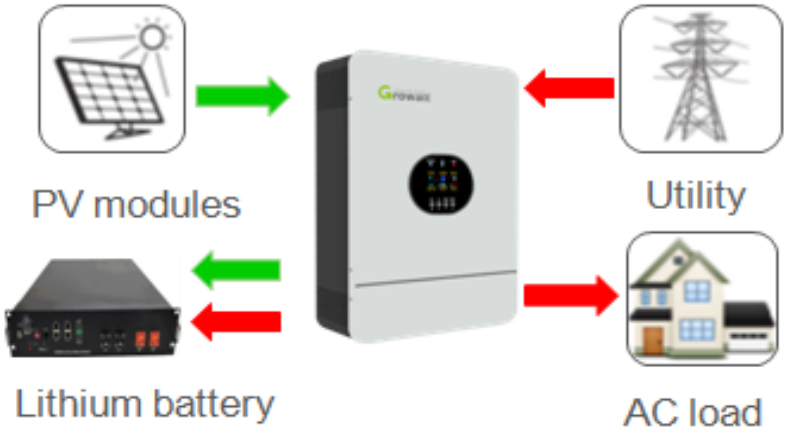
SPF 3000-5000TL HVM

Support

1. Power factor 1.0
2. MPPT solar charge controller
3. WIFI/GPRS remote monitoring
4. Compatible with generator power
5. Configurable AC/solar input and charging priority
6. Parallel operation available for 4kw/5kw
7. Compatible with lithium battery
8. High voltage 230Vac output

Key Features

SPF 5000TL HVM-WPV
(Wide PV Range)

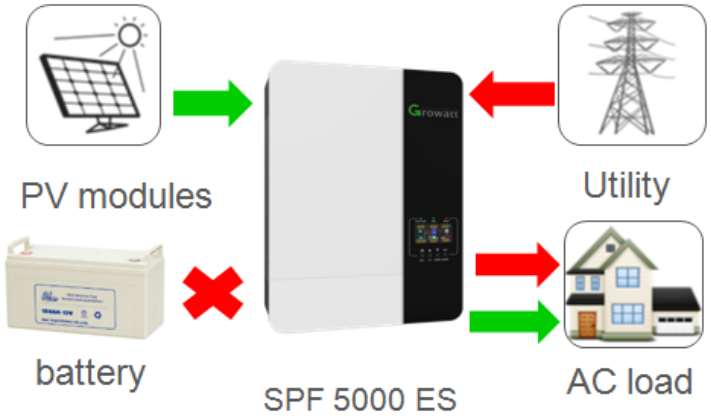


Support

1. Power factor 1.0
2. MPPT solar charge controller
3. PV input voltage up to 430VDC
4. WIFI/GPRS remote monitoring
5. Compatible with generator power
6. Configurable output and charging priority
7. Parallel operation available
8. Compatible with lithium battery

Key Features

SPF 5000ES
(New Generation)



Support

1. Power factor 1.0
2. MPPT solar charge controller
3. PV input voltage up to 430VDC
4. WIFI/GPRS remote monitoring
5. Compatible with generator power
6. Configurable output and charging priority
7. Parallel operation available
8. Compatible with lithium battery
9. Work with battery or without battery
10. Adjustable inverter charging and output time
11. Equalization charging function

Key Features

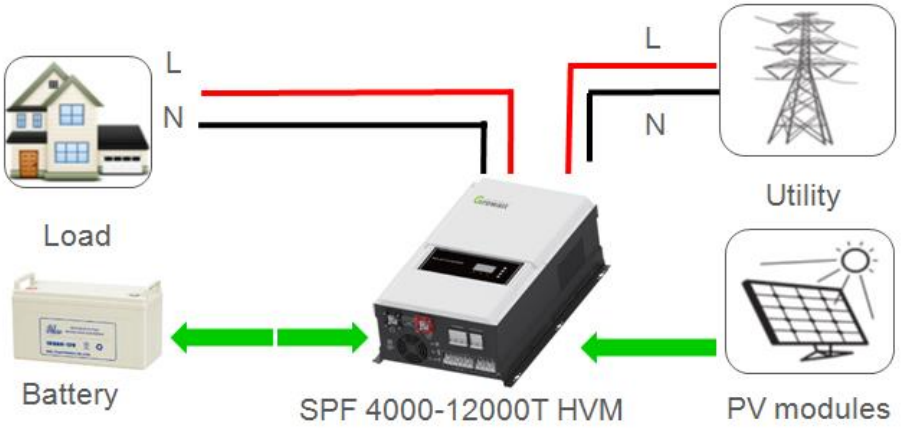
SPF 4000-6000T DVM
(Transformer 120/240Vac output)

Support

1. Power factor 1.0
2. MPPT solar charge controller
3. Built-in low frequency transformer
4. WIFI/GPRS remote monitoring
5. BTS terminal for lead-acid battery
6. Support (120/240Vac) both of them
7. Compatible with generator power
8. Configurable AC/solar input and charging priority
9. Compatible with lithium battery

Key Features

SPF 4000-12000T HVM
(Transformer 230Vac output)



Support

1. Power factor 1.0
2. MPPT solar charge controller
3. Built-in low frequency transformer
4. WIFI/GPRS remote monitoring
5. BTS terminal for lead-acid battery
6. Compatible with generator power
7. Configurable AC/solar input and charging priority
8. Compatible with lithium battery

Key Features

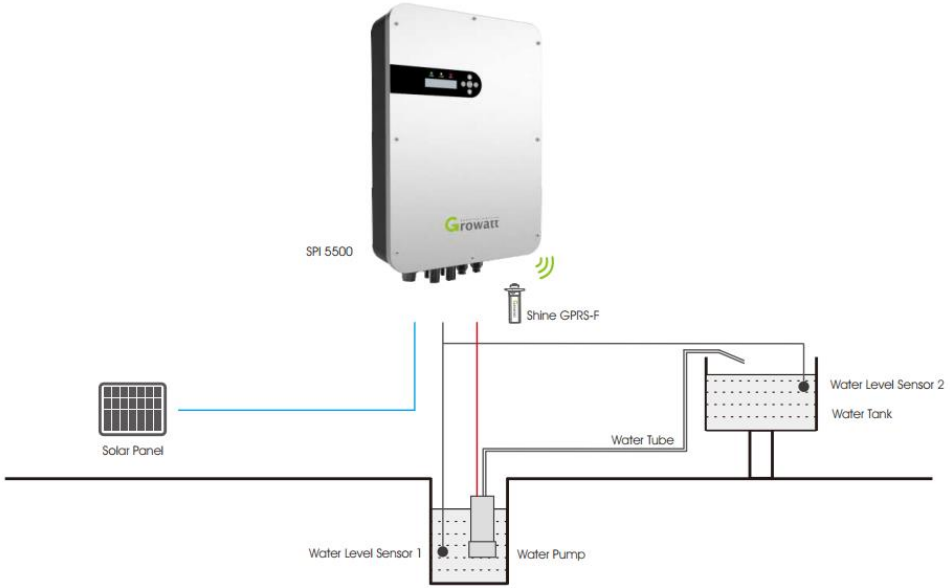
SC4860-48120
(Solar charger)

Support

1. MPPT solar charge controller
2. Compatible with12/24/48V battery voltage, charging current from 60-120A
3. BTS for battery stability
4. WIFI/GPRS remote monitoring
5. Multifunction LCD display information
6. Three-stage charging for battery
7. Maximum efficiency up to 98%

Off-Grid (Solar Pumping System)

Growatt Solar Pumping Inverter can be used for irrigation systems, swimming pool pumps, municipal and agricultural water systems



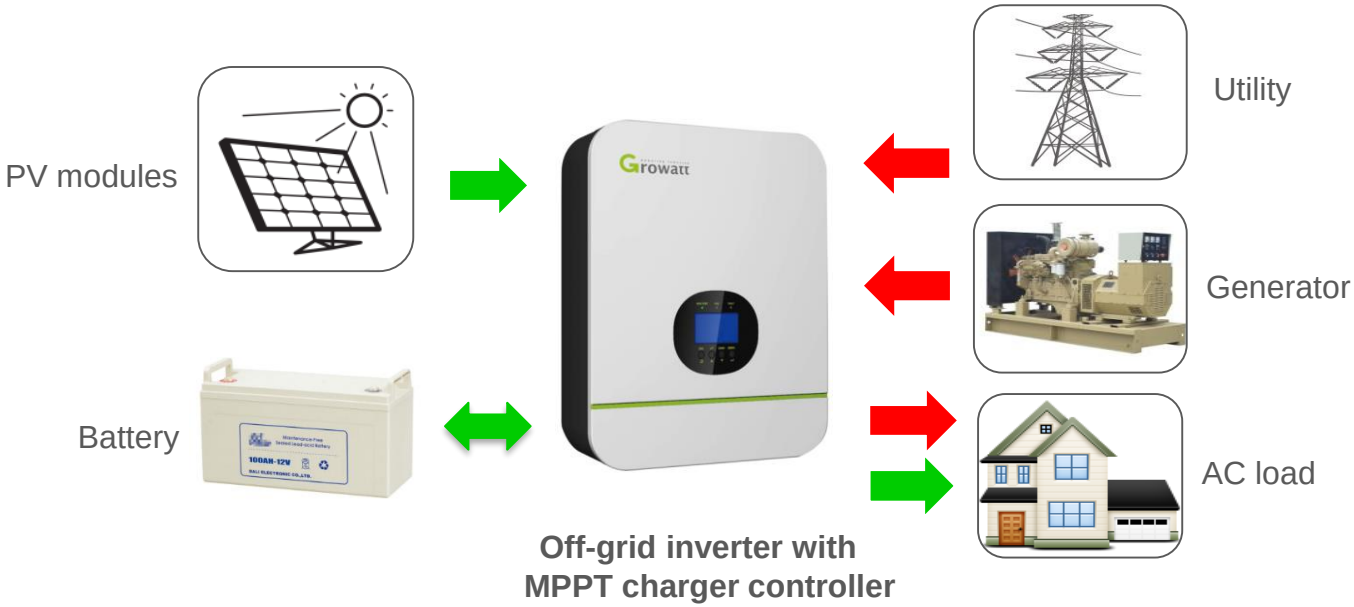
Note: WiFi-F and GPRS-F just used for off-grid inverter.

Features

1. Integrated MPPT controller
2. Smart function and parameter setting via LCD button
3. Optional GPRS remote monitoring
4. Full protection function and self-diagnosis.
5. High Efficiency. Use dynamic VI MPPT control method, MPPT efficiency 99%

Off-Grid System Overview

Off-grid energy storage system is generally consist of PV modules, off-grid inverter, MPPT charger controller (bidirectional DC/DC converter), battery, generator, monitoring devices and electrical appliances.

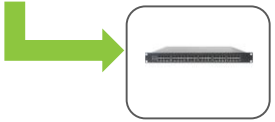


Monitoring Platform

Remote monitoring

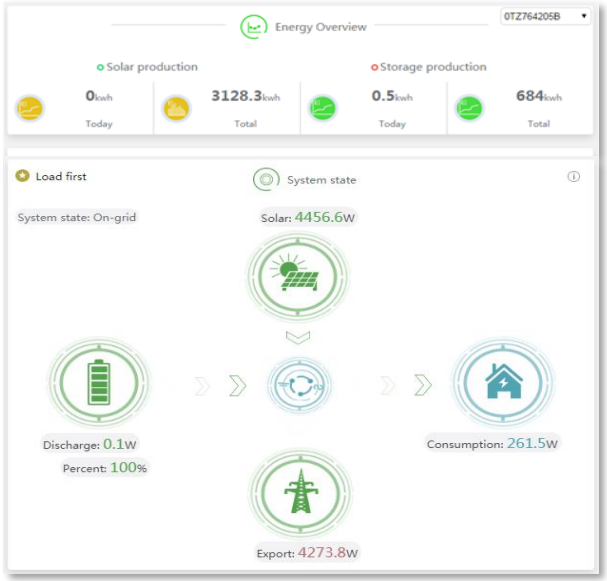
WIFI-F

GPRS-F



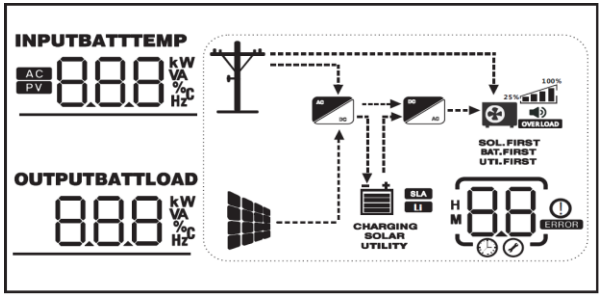
Shine Phone APP

Shine Server



Monitoring Platform

Local monitoring



1. Input information (PV voltage, AC voltage, frequency, PV generator, battery voltage, charging current)

2. Output information (Voltage, load percentage, frequency, load in VA, load in watt, discharging current)

USB cable

PC install monitoring software

PVkeeper platform

Operation

2

Operation Benefits

Power Saving Mode

When the load is pretty low or not, inverter will turn off the output (Low consumption from battery)

Battery consumption: **15W**

Power saving mode

Standard mode

Battery consumption: **>50W**

Operation Functions

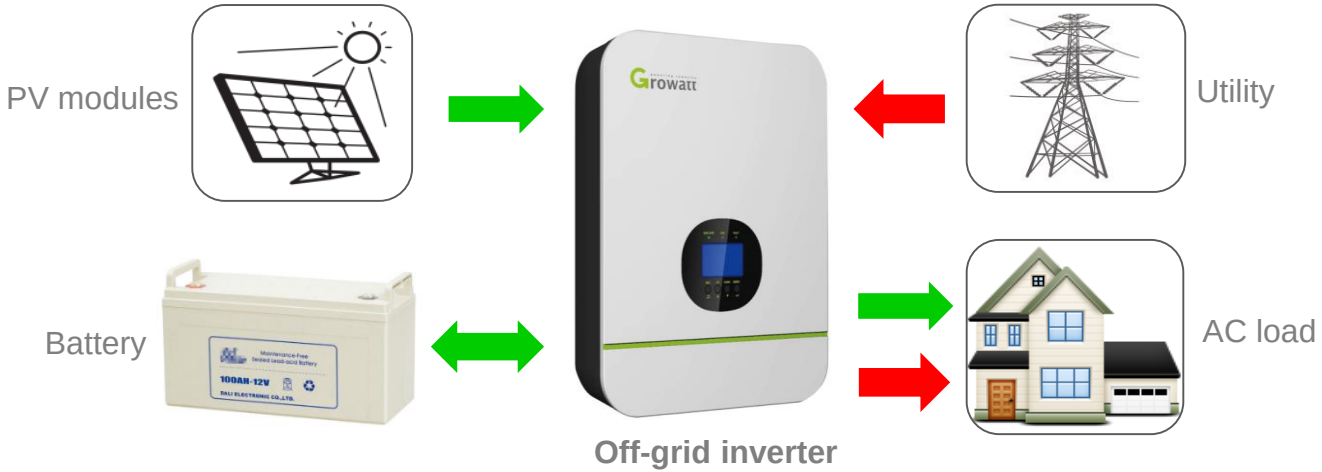
Output priority mode setting:

1. SOL first
2. UTI first
3. SBU first

Charging priority mode setting:

1. CSO first
2. CUT first
3. SNU first
4. OSO

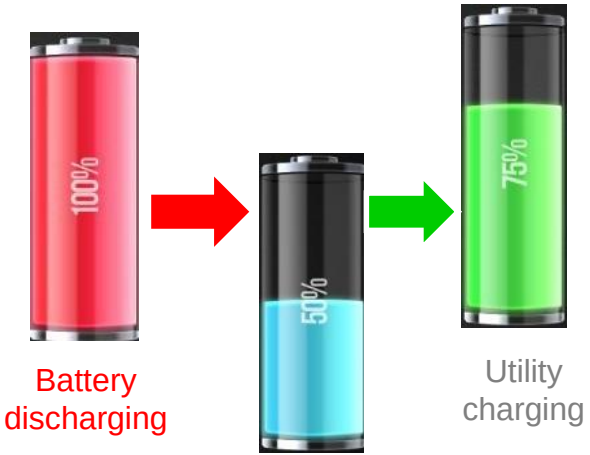
Off-Grid inverter with MPPT charge controller



Operation Functions

Mode selection setting: Utility or Battery mode:

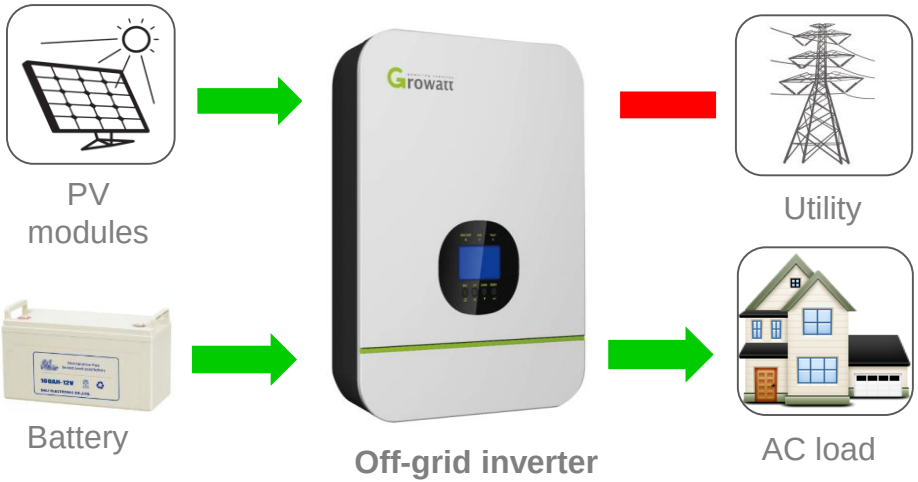
1. Back to Utility Mode (Voltage Range: 44-51.2 VDC)



Operation Functions

Mode selection setting: Utility or Battery mode:

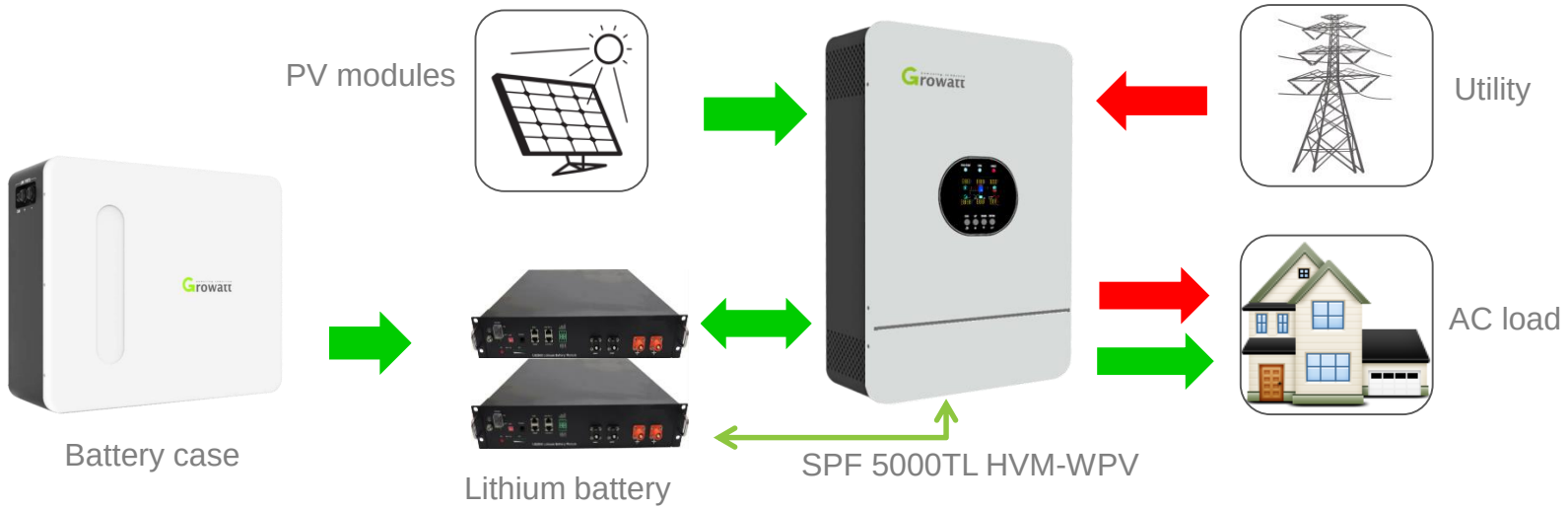
2. Back to Battery Mode (Voltage Range: 48-58VDC)



Operation Functions

Lithium battery :

SPF 5000TL HVM-WPV series provides RS 485 & CAN ports for Li battery. US2000 Li battery can parallel max. 8 PCS and Battery case can integrate 2PCS US2000 batteries inside

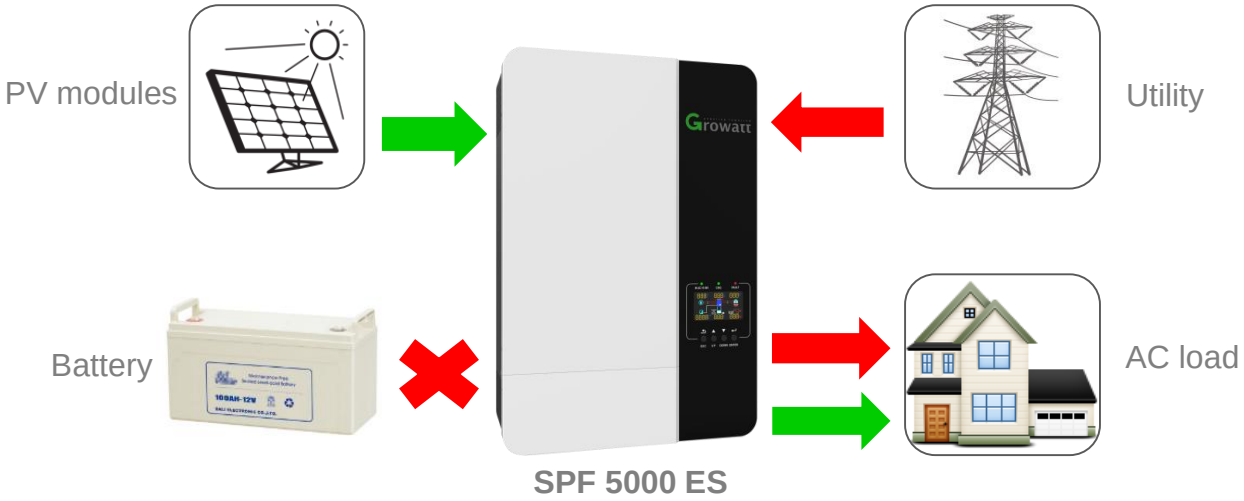


Operation Functions

Without battery operating model:

SPF 5000 ES series inverters can work without battery and have wide PV input voltage range up to 430Vdc

Easy installation, Save cost of battery & PV wire.



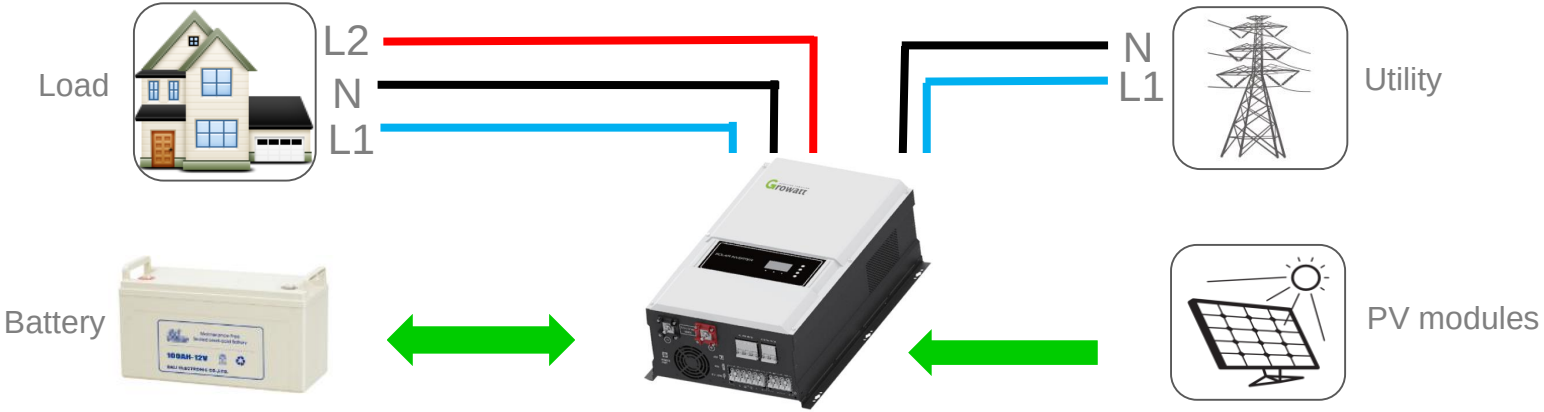
Operation Functions

Several voltage outputs:

SPF 4000-6000T DVM series inverters have different voltage output that can meet all kinds of single phase equipment require

Output voltage : L1-N=120VAC
L2-N=120VAC
L1-L2=240VAC

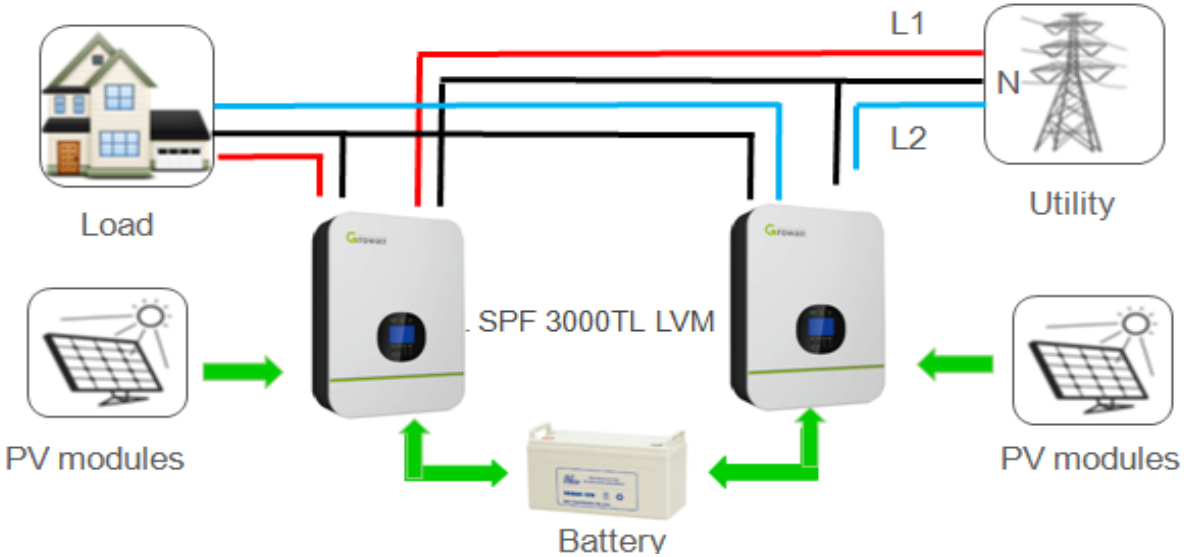
Input voltage : L1-N= 230VAC



Operation Functions

Split phase L1-N and L2-N:

For 120Vac system, SPF 3000TL LVM series inverter can configuration output L1-L2 of 240V system

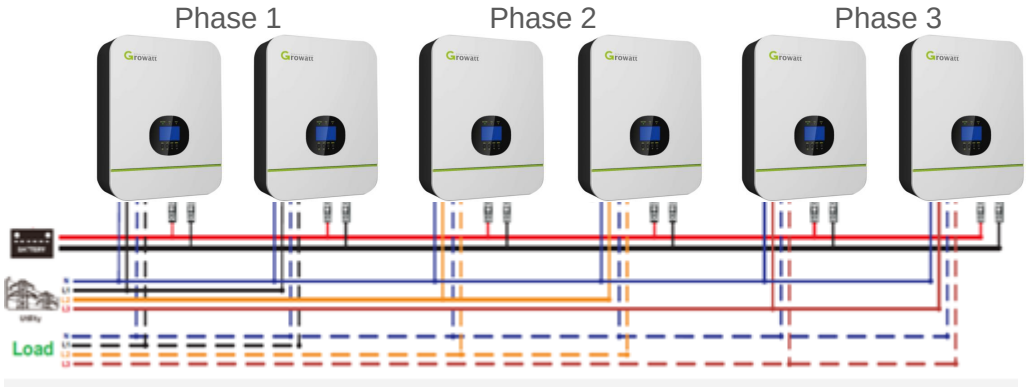


Operation Functions

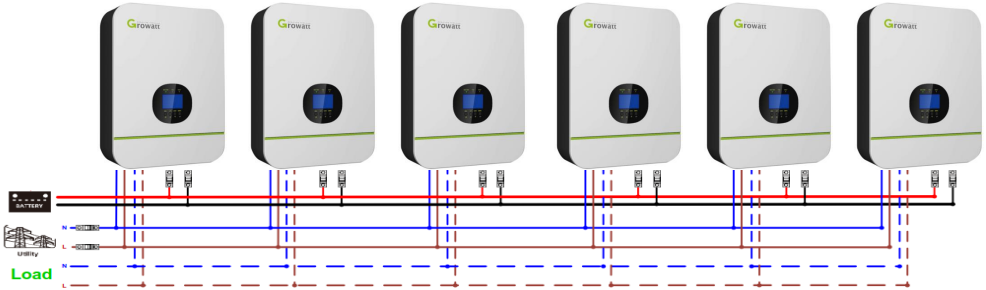
Parallel mode:

Parallel operation with up to 6 units only for 4/5KVA and 3KVA LVM series transformerless inverter, maximum capacity up to 30kW, and it can also be set to 3-phase system

Three-phase system



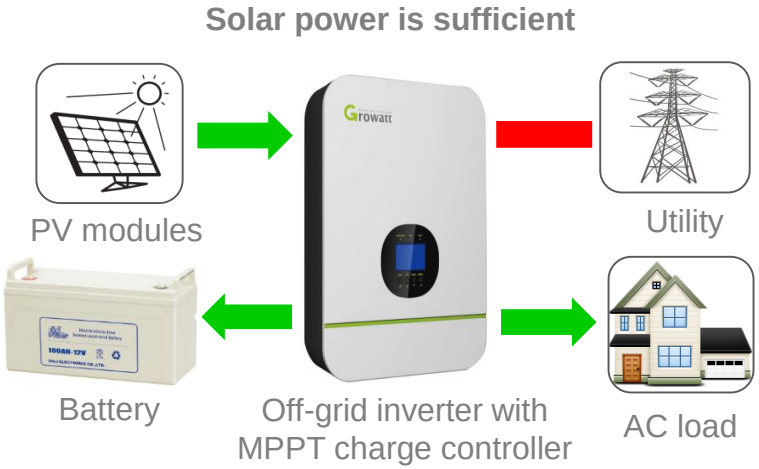
Single-phase system

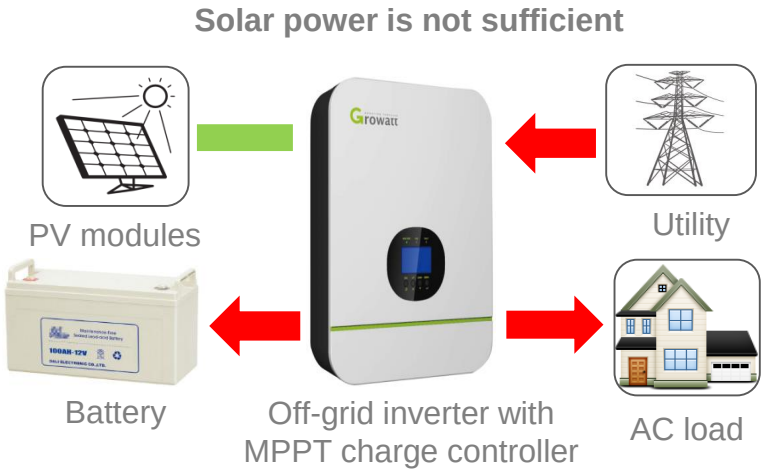


Applications

1. Enhance battery life (Output : SOL first) ➔ 3K HVM (Default mode)

Solar power is sufficient (Feed to load and also charge the battery). When solar power is not available, Utility supply power to the load and charge the battery



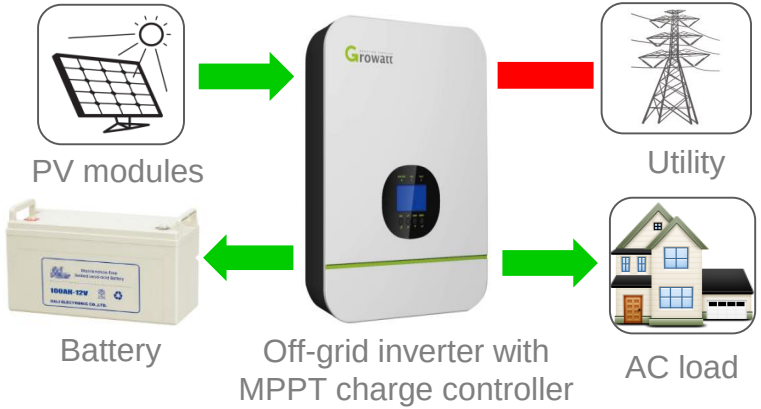


Applications

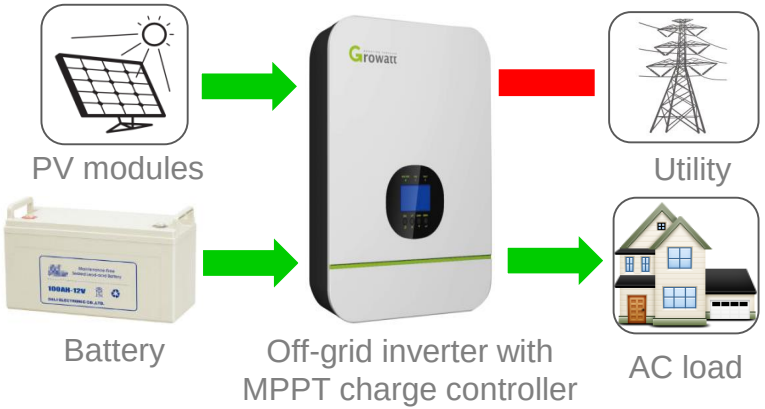
2. Support cost-effective (Output : SBU first)

When Solar power is sufficient (it feeds to load and charge the battery). For cost-effective support, Utility feeds power only if the battery feeding is under low-level warning

Solar power is sufficient



Solar power is not sufficient

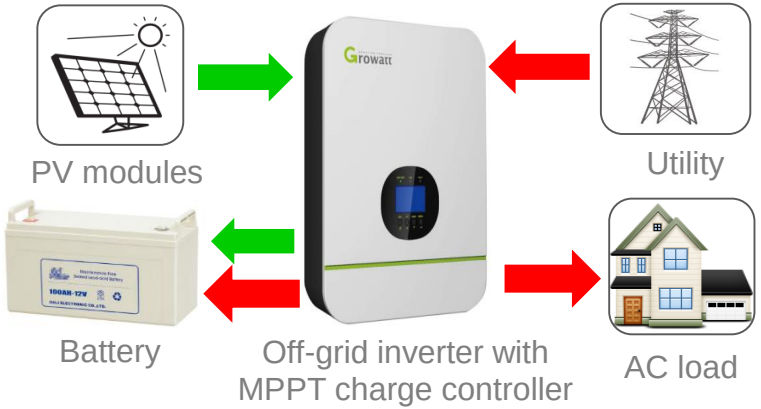


Applications

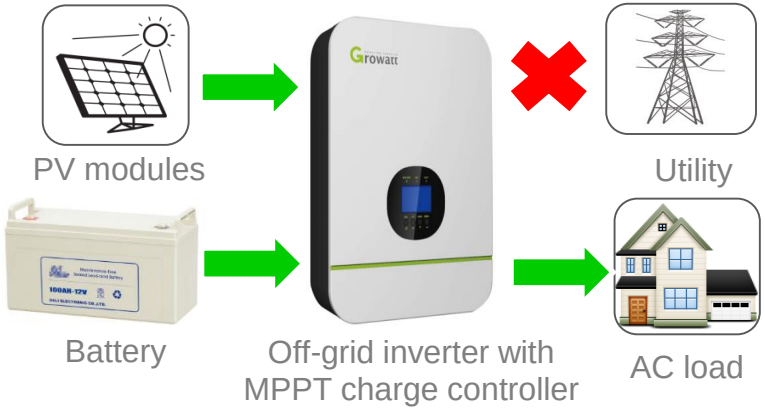
3. Unavailability of sunshine/Raining season (Output : UTI first) ➔ 5K HVM,3K LVM (Default mode)

Utility supply power to load as a priority but solar and battery only provides power to load, if the utility power is not available

Utility power is sufficient



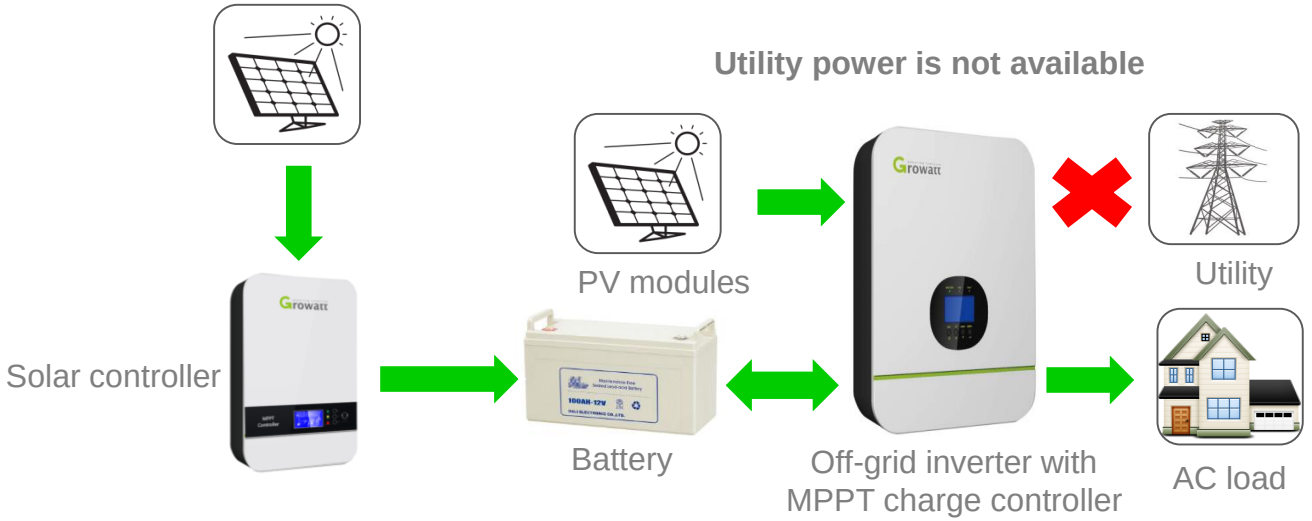
Utility power is not available



Applications

4. Utility is not available (Output: SOL first)

Solar supply power to load and also charge the battery. But when solar power is not sufficient than battery also feed power to the load. Backup support can be provided through solar controller charging for the battery



Applications

Nigeria 5kw single phase system

South Africa 30kw three phase system

Applications

South Africa 15kw there-phase system

China 15kw there-phase system

South Africa 10kw single-phase system

Selection

3

Utility Power & Load Selection

Voltage	Transformer Type	Single Phase	Three Phase	Home appliance capacity < 5kw	Home appliance capacity > 5kw
Utility Voltage: 230 VAC	Transformerless 	SPF 3000-5000TL HVM; SPF 5000TL HVM-WPV SPF 5000ES	SPF 5000TL HVM (3 PCS or more units for parallel)	SPF 3000-5000TL HVM; SPF 5000TL HVM-WPV	SPF 5000TL HVM-P SPF 5000TL HVM-WPV (2 PCS or more units for parallel)
	Transformer 	SPF 4000-6000T DVM (Input 230VAC, output 120/240VAC); SPF 4000-12000T HVM	NO	SPF 6000T DVM (Input 230VAC, output 120/240VAC); SPF 6000-12000T HVM	SPF 6000T DVM (Input 230VAC, output 120/240VAC); SPF 6000-12000T HVM
Utility Voltage: 120VAC	Transformerless 	SPF 3000TL LVM	SPF 3000TL LVM (3 PCS or more units for parallel)	SPF 3000TL LVM	SPF 3000TL LVM (2 PCS or more units for parallel)
	Transformer 	SPF4000- 6000T DVM (Input 230VAC, output 120/240VAC);	NO	SPF 4000-6000T DVM (Input 230VAC, output 120/240VAC);	SPF 6000T DVM (Input 230VAC, output 120/240VAC);

Battery Selection

Voltage	Transformer Type	Lithium Battery	BTS Sensor	Split Phase	Without battery operation
Utility Voltage: 230 VAC	Transformerless 	SPF 3000-5000TL HVM; SPF 5000TL HVM-WPV SPF 5000 ES	NO	NO	SPF 5000 ES
	Transformer 	SPF 6000-12000T HVM	SPF 4000-12000T HVM	NO	NO
Utility Voltage: 120VAC	Transformerless 	SPF 3000TL LVM	NO	SPF 3000TL LVM	NO
	Transformer 	SPF 6000T DVM (Input 230VAC, output 120/240VAC);	SPF 4000-6000T DVM (Input 230VAC, output 120/240VAC);	SPF 4000-6000T DVM (Input 230VAC, output 120/240VAC);	NO

Installation

4

Preparation

1. Tools

Multi-meter
Screw-driver
Ampere-meter
Other installation tools

2. Calculate items (It will influence inverter's capacity)

Load type: Home appliance, motor type load（3-6 times rate power).

Load working time: Peak power working time.

Back-up time: Battery discharge time.

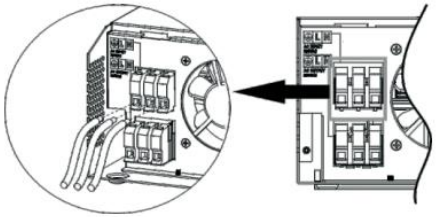
Sunlight situation: Peak radiation time per day.

Utility power situation: Grid power is available or not?

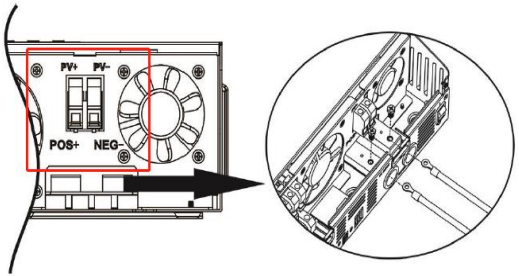
Preparation

Note:

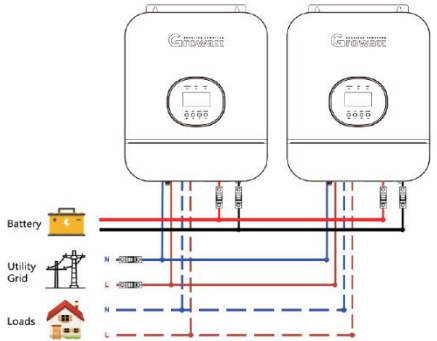
1. All wiring must be well-fastened to avoid shedding.



2. Make sure that the polarity of PV and batteries connected to the product is correct.



3. Should install utility, battery and PV input switch to ensure safety.



4. Battery and solar panel connections must be within the parameters of the product.

Preparation

Note:

5. During the operation of the system, do not disconnect the battery.

6. The number of parallel batteries should not be more than 3 groups.

7. Inverter protection degree is IP20

8. In areas with large dust, regular cleaning is required to avoid too much dust affecting heat dissipation.

Wire Selection

1. Battery Input:

Model	Max input current	Battery capacity	Wire size	Switch size
2KVA（24V）	109A	100AH	1*4AWG 2*8AWG	150A/32VDC
3KVA（24V）	164A	100AH 200AH	1*2AWG 2*6AWG	200A/32VDC
2KVA（48V）	55A	100AH	1*6AWG 2*10AWG	80A/60VDC
3KVA（48V）	82A	100AH 200AH	1*4AWG 2*8AWG	100A/60VDC
4KVA	110A	200AH	1*4AWG 2*8AWG	150A/60VDC
5KVA	137A	200AH	1*2AWG	150A/60VDC

2. PV Input:

Model	Max input current	Wire size	Switch size
2KVA/3KVA @24V model	50A	8AWG	50A/100VDC
2KVA/3KVA @48V model	30A	10AWG	32A/150VDC
4KVA	80A	6AWG	80A/150VDC
5KVA	80A	6AWG	80A/150VDC

Wire Selection

3. AC Input:

Model	Max input current	Wire size	Switch size
2KVA	12.6A	12AWG	16A/230VAC
3KVA	17A	10AWG	25A/230VAC
4KVA	30.5A	8AWG	40A/230VAC
5KVA	34.8A	8AWG	

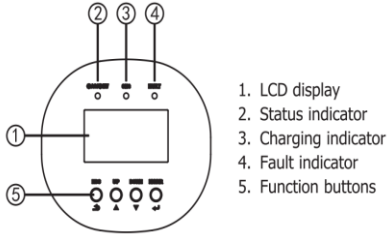
4. AC Output:

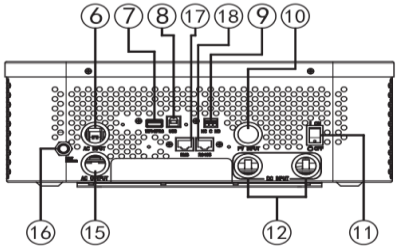
Model	Max input current	Wire size	Switch size
2KVA	8.7A	14AWG	16A/230VAC
3KVA	13A	12AWG	16A/230VAC
4KVA	17.4A	10AWG	25A/230VAC
5KVA	21.8A	10AWG	32A/230VAC

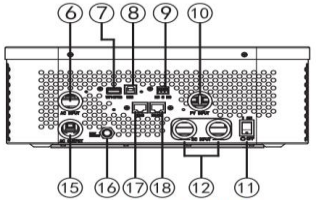
Installation Overview

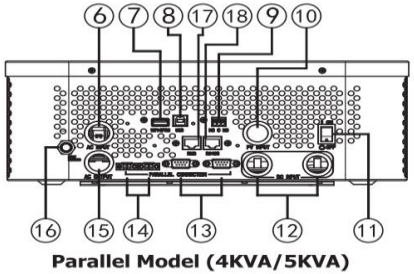
SPF 3000TL LVM

SPF 2000-5000TL HVM







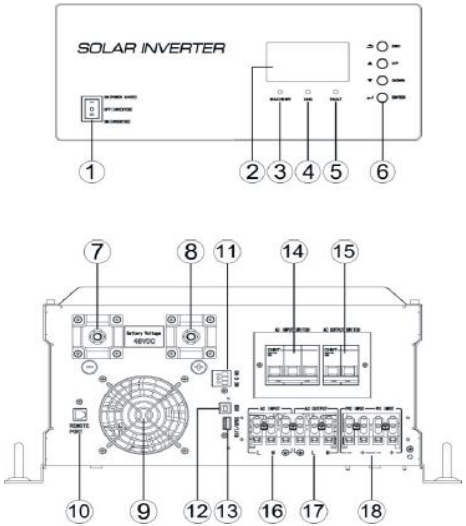


6. AC Input
8. USB communication port
10. PV Input
12. Battery Input
14. Current sharing ports (only for parallel model)
16. Circuit Breaker
18. RS485 communication port (for expansion)

7. WiFi/GPRS communication port
9. Dry Contact
11. Power on/off switch
13. Parallel communication ports (only for parallel model)
15. AC output
17. MBS Communication port (only supported the RS485 protocol)

Installation Overview

SPF 4000-6000T DVM
SPF 8000-12000T HVM

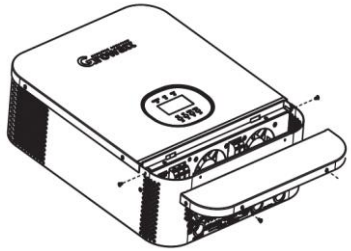


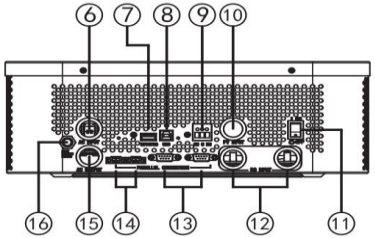
1. ON/OFF power switch
2. LCD display
3. Status indicator
4. Charging indicator
5. Fault indicator
6. Function buttons
7. Battery “-”
8. Battery “+”
9. Fan
10. Remote control port
11. Dry contact
12. USB port
13. WiFi/GPRS device port
14. AC input switch
15. AC output switch
16. AC input
17. AC output
18. PV input

Connection

SPF 3000TL LVM
SPF 2000-5000TL HVM

1. Remove bottom cover by screwdriver
2. Connect battery input
3. Turn on “Power on/off ” switch (check inverter normal working or not?)
4. Connect PV input (when step 3 inverter can normal working)
5. Connect AC input and output wire

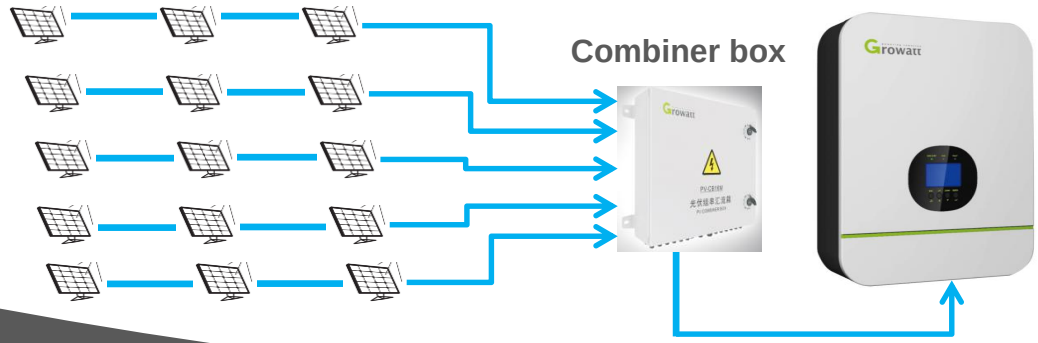




PV Connection

Solar panel specification:

Module Type	290	295	300	305	310
Max Power (Pmax/W)	290	295	300	305	310
OC Voltage (Voc/V)	39.2	39.4	39.6	39.8	40
SC Current (Isc/A)	9.36	9.47	9.58	9.69	9.80
Peak power voltage (Vmp/V)	32.6	32.7	32.9	33.1	33.2
Peak power current (Imp/A)	8.90	9.01	9.11	9.22	9.33
Module efficiency (%)	17.5	17.8	18.1	18.4	18.7



Calculation:

1. **Number of panels:**
   Max PV Power/ solar panel power
2. **Number of panels in one string:**
   Max MPPT voltage / solar panel Vmp
3. **Number of string:**
   Number of panels / Number of panels in one string

1. **4500W/300W=15PCS**
2. **115V/32.9V=3.495 ≈ 3 PCS in string**
3. **15/3 =5 Strings**

Monitoring

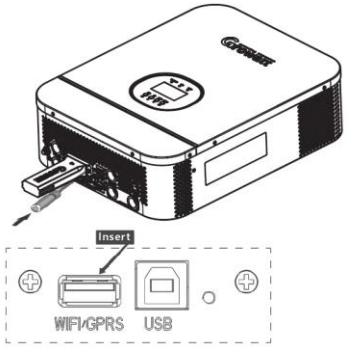
Shine Phone APP

1. Connect **“WIFI-F” device to inverter** “WIFI/GPRS” terminal.

2. Registration and adding device
Scan the QR code or **search shine phone in IOS or Google play store**.

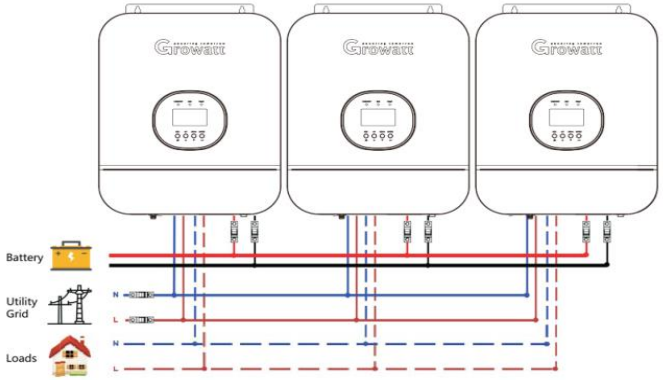
3. **Scan or input WIFI-F barcode** and check code then click register button it will **move to “ my plant ” page**.

Note： For details, please refer to the user manual.

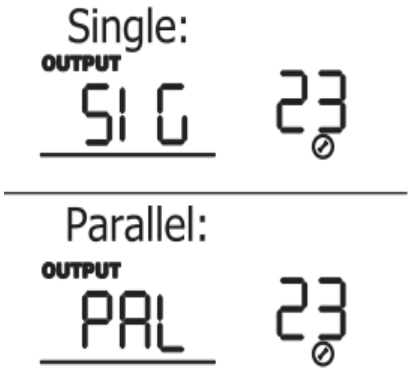


Parallel Connection

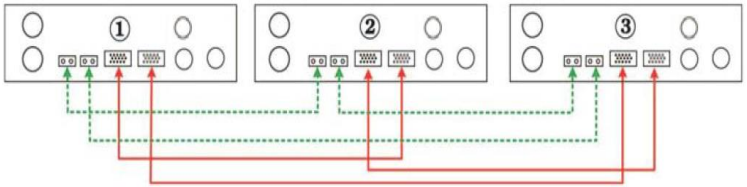
Single phase parallel:



When the units are used in **parallel with single-phase**, please **select ”PAL” in program 23.**

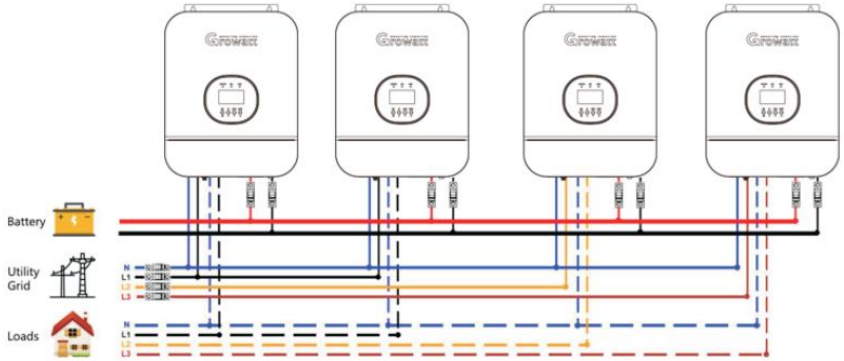


Communication connection:



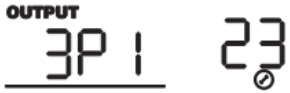
Parallel Connection

Three phase parallel:

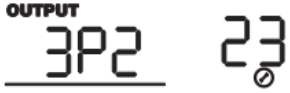


When units are used in **parallel with three-phase**, **please select ”3P1” for L1, “3P2” for L2, and “3P3” for L3 in program 23**. All neutral lines must be connected.

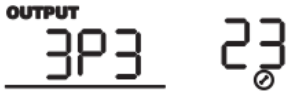
L1 phase:



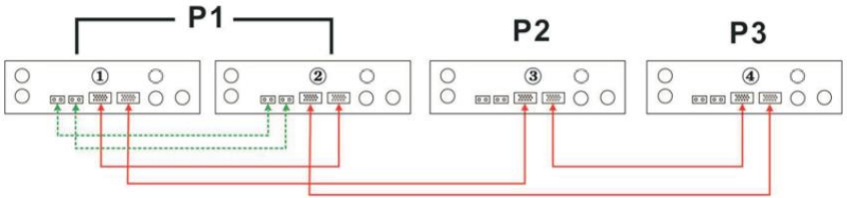
L2 phase:



L3 phase:

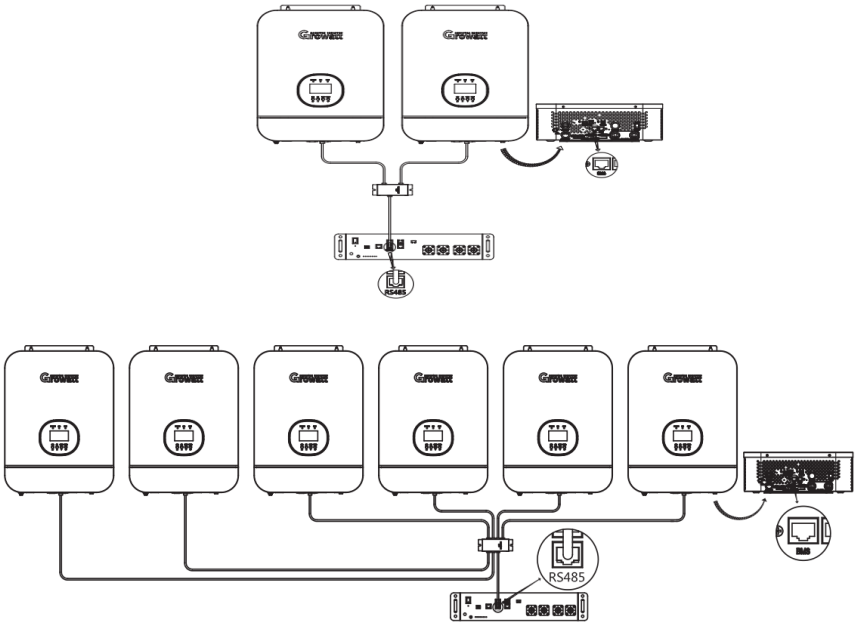


Communication connection:



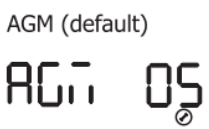
Lithium Battery Connection

Lithium battery connection and setting:



1. An external **RS485/CAN** is require between inverter and Li Battery, If it is necessary to use communication with **BMS in parallel**.
2. If you want to connect Lithium battery, must set the **Battery Type to "LI" in program 5**, also need **set SOC in program 12,13,21 and 36**, more information please check user manual Page 8.

AGM (default)



Flooded

Lithium (only suitable when communicated with BMS)

User-Defined

Maintenance

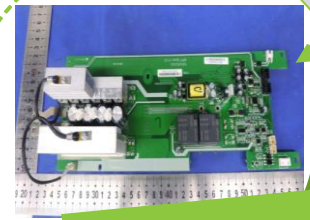
5

Spare Parts (5 kVA/3 kVA)

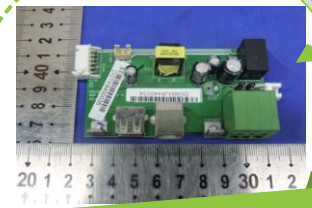
Main Board

CNTL Board

SCR Board



MPPT Board



COMM Board

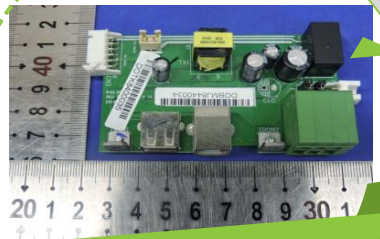
Parallel Board

Spare Parts (3 kVA)

Main Board

CNTL Board

MPPT Board



COMM Board

Troubleshooting

1. No response on the inverter (LCD does not light up and the fan does not running)

A) Check whether the **battery wiring** is in good contact;
B) Check the **polarity of a battery** connected to the product is correct or not ;
C) Check whether the **battery voltage** is within the specified range;
D) Check whether the **switch is damaged**;

2. Inverter gives no output, and after a while shut down?

A) Confirm whether the battery **voltage is more than 46V**, less voltage will not support inverter to cold start;

3. Failure 01 code (Fan lock failure)

A) Check if the **fan is stuck**.
B) Whether the wiring from the **fan to the main board** is loose or connection is not good;
C) **Fan damage**.

Troubleshooting

4. Failure 02 code (Inverter over-temperature protection)

A) Confirm whether the high **temperature** of the surrounding;
B) Confirm whether the **NTC on the mainboard** and **MPPT board** is loose or falling off;

5. Failure 03 code (Battery voltage is too high)

A) Check whether the battery voltage is **higher than 60V**;
B) Confirm whether the **external controller** is set properly;
C) If a lithium battery is used, confirm whether the **voltage set in items 19 & 20** is appropriate;
D) Restart inverter, if it still display fault code, please contact the manufacturer.

6. Failure 04 code (Battery voltage is too low)

A) Check whether the battery voltage is **lower than 44V**;

7. Failure 05 code (Output short circuit fault)

A) Confirm whether the **output is short-circuited**;
B) Confirm whether the output **connection with high power inductive load** is proper;
C) **Disconnect all load and restart inverter**, If still the same problem, please contact the manufacturer.

Troubleshooting

8. Failure 06 code (Output voltage is too low)

A) Confirm whether **connected with high power load**;
B) Disconnect all load and restart inverter.
If still the same problem, please contact the manufacturer;

9. Failure 07 code (Output overload)

A) Confirm whether **connected with high power load**;
B) Disconnect all load and restart inverter. If still the same problem, please contact the manufacturer;

10. Failure 08 code (BUS capacitor voltage is too high)

A) Check whether the **battery voltage is too high**;
B) Confirm whether the **external controller** is set properly;
C) If a lithium battery is used, confirm whether the **voltage set in items 19 & 20** is appropriate;
D) Restart inverter, if still display fault code, please contact the manufacturer;

Troubleshooting

11. Failure 09 code (BUS capacitance soft-start failure)

A) Check whether the **battery wiring** is in good connection;
B) Restart inverter, if still display fault code, please contact the manufacturer;

12. Alarm 10 code (Power output de-rating)

A) Utility power voltage is **lower than 170VAC**;

13. Alarm 13 code (PV voltage is too high)

A) Check whether the PV input voltage is **higher than 145V**;

14. Alarm 15 code (Utility power source is different in parallel system)

A) Check whether the mains input wire of each machine in the parallel system is tightened and properly connected;
B) Check whether the main **input voltage, frequency, and phase** of each inverter in the parallel system is consistent;

15. Alarm 16 code (System power input phase is inconsistent)

A) Check whether input is **connected correctly**;
B) **Change of P2 and P3** inputs for the three-phase system;
C) Restart the inverter. If you still display with the same alarm code, please contact the manufacturer.

Troubleshooting

16. Alarm 17 code (Parallel system output phase loss)

A) Confirm whether **each phase of the inverter is turned on** in the three-phase parallel system;
B) Confirm whether the **parallel communication wire** between machines of each phase are in good connection;
C) Restart inverter. If you still display with the same alarm code, please contact the manufacturer.

17. Alarm 20 code (BMS communication failure)

A) If inverter **connected with lead-acid battery**, confirm whether setting item 5 is set to LI, please **change LI to AGM**;
B) If inverter connected with lithium battery, confirm whether the **protocol of setting item 36 is selected correctly**;
C) Confirm whether the BMS communication wire is an **inappropriate connection**;
D) Confirm whether the **sequence of the BMS communication** wire corresponds to the **inverter port**.
E) Restart the inverter. If you still display the same alarm code, please contact the manufacturer.

18. Failure 52 code (BUS voltage is too low)

A) Confirm whether the connected output is a **high power load**;
B) Confirm whether the **battery capacity is sufficient**. Fault may occur if the connected load is higher than the battery capacity;
C) Disconnect all load, restart the inverter. If you still display the same alarm code, please contact the manufacturer.

Troubleshooting

19. Failure 53 code (Inverter soft start failure)

A) Confirm whether the output connected with a **high power load;**
B) Confirm whether the **battery capacity is sufficient**;
C) Disconnect all load, restart the inverter. If still display same Failure code, please contact the manufacturer.

20. Failure 56 code (Battery disconnected)

A) Confirm whether the output connected with a **high power load;**
B) Confirm whether the **battery capacity** is sufficient (Battery voltage is lower than **32V@48, 16V@24**);
C) Disconnect all load, restart the inverter. If still display same Failure code, please contact the manufacturer.

21. Failure 58 code (Output voltage is too low)

A) Confirm whether the output connected with a **high power load;**
B) Confirm whether the **battery capacity is sufficient** (battery voltage is lower than **32V@48, 16V@24**);
C) Disconnect all load, restart the inverter. If you still display the same Failure code, please contact the manufacturer.

Troubleshooting

22. Failure 60 code (Inverter output connected to AC source)

A) Confirm whether the **input and output end** is connected correctly;
B) Whether the single-phase parallel system **current sharing wire** is connected appropriately;
C) Disconnect all load, restart the inverter. If still display the same Failure code, please contact the manufacturer.

23. Failure 80 code (CAN communication failure)

A) Check whether all the **parallel communication wire** of the parallel system are **connected properly**;
B) Confirm whether the **wires are faulty**;
C) Disconnect all load, restart the inverter. If you still display the same Failure code, please contact the manufacturer.

24. Failure 81 code (Parallel system host lost)

A) Check whether all the **parallel communication lines** of the parallel system are **connected properly**;
B) Confirm whether the **wires are defective**;
C) In the three-phase parallel system, confirm whether **setting item 23** is: the **first phase is set to 3P1**, the **second phase is set to 3P2**, and the **third phase is set to 3P3**;
D) Disconnect all load, restart the inverter. If you still display with same Failure code, please contact the manufacturer.

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