

Installation and operation manual

GWL GridFree Inverter



GF-SUN-1000G2 / GF-SUN-1000G2H / GF-SUN-2000G2

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GWL GridFree Inverter Models

GWL GridFree inverters include a series of models, refer to table 1. For more information of all models, refer to the i4wifi / GWL Power website www.i4wifi.cz / www.ev-power.eu).

Table 1, GWL GridFree Inverter Models

Model Number	Rated Power (Peak/ Continuous)	DC Input Voltage	AC Output Voltage Range	AC Output Frequency Range	Peak Inverter Efficiency	Night Power Consumption
SUN-1000G2	1000W / 900W	22V~65V	190V~260V	46Hz~65Hz	90%	0.5W
SUN-1000G2H	1000W / 900W	45V~90V	190V~260V	46Hz~65Hz	92%	1.5W
SUN-2000G2	2000W / 1800W	45V~90V	190V~260V	46Hz~65Hz	92%	1.5W

Important Safety Information

READ THIS FIRST!

This manual contains important instructions to follow during installation and maintenance of GWL GridFree Inverter. To reduce the risk of electrical shock, and to ensure the safe installation and operation of the GWL GridFree Inverter, the following safety symbols appear throughout this document to indicate dangerous conditions and important safety instructions.



WARNING

This indicates a situation where failure to follow instructions may be a safety hazard or cause equipment malfunction. Use extreme caution and follow instructions carefully.



NOTE

This indicates information particularly important for optimal system operation. Follow instructions closely.

**WARNING**

Be aware that the body of the GWL GridFree Inverters is the heat sink and can reach a temperature of 80°C under extreme conditions. To reduce risk of burns, do not touch.

- ✓ Perform all electrical installations in accordance with all local electrical codes and the National Electrical Code.
- ✓ Be aware that only qualified personnel should install and/or replace GWL GridFree Inverters.
- ✓ Do not attempt to repair the GWL GridFree Inverter; it contains no user serviceable parts.

Before installing or using the GWL GridFree Inverter, please read all instructions and cautionary markings in the technical description and on the GWL GridFree Inverter and the PV-array.

Introduction of GWL GridFree Inverter

GWL GridFree Power Inverter is the world's most technologically advanced inverter for use in utility-interactive applications. This manual details the safe installation and operation of the GWL GridFree Inverter.

This integrated system maximizes energy harvest, increases system reliability, and simplifies design, installation and management.

The small type solar GridFree power inverter can obtain the solar energy from solar panel, and can tie to the grid through its output cables with no extra equipment. The installation is very convenient and reliable.

We call the system combining with small solar GridFree inverter and solar panels as 'SGPV'. The system includes solar panels and small type grid tie inverter and installation kit. Solar panels can be mono silicon, polygon silicon, non-crystal film or any other material that can transform solar energy to electric energy. The power of GridFree inverter should be matched to the power of solar panels connected. So, the power of SGPV is defined by its solar panels, it can be standardization according to the actual using. The inverter can be connected to any outlets of utility grid at house. The small GridFree inverter monitors the volume, frequency and phase of the home utility grid, then produce pure sine wave AC power that the frequency and phase are as same as the grid's, and the volume is a bit higher than the grid's, then according to the current controlled PWM, to control the output power to the grid. The small GridFree inverter just puts out power when the home grid is on. When the sun shines, the PV panel will produce DC voltage, and the GridFree inverter will change the DC voltage to AC voltage and puts out power to the home grid. When the total power of electric apparatus that are using in the house is larger than the output power of the inverters, this power from the inverters will be consumed in the house, this will slow down the power meter, otherwise, the difference of the output power of the inverter between the total used power of the apparatus will go out from the house to the out grid (if no Limiter is installed).

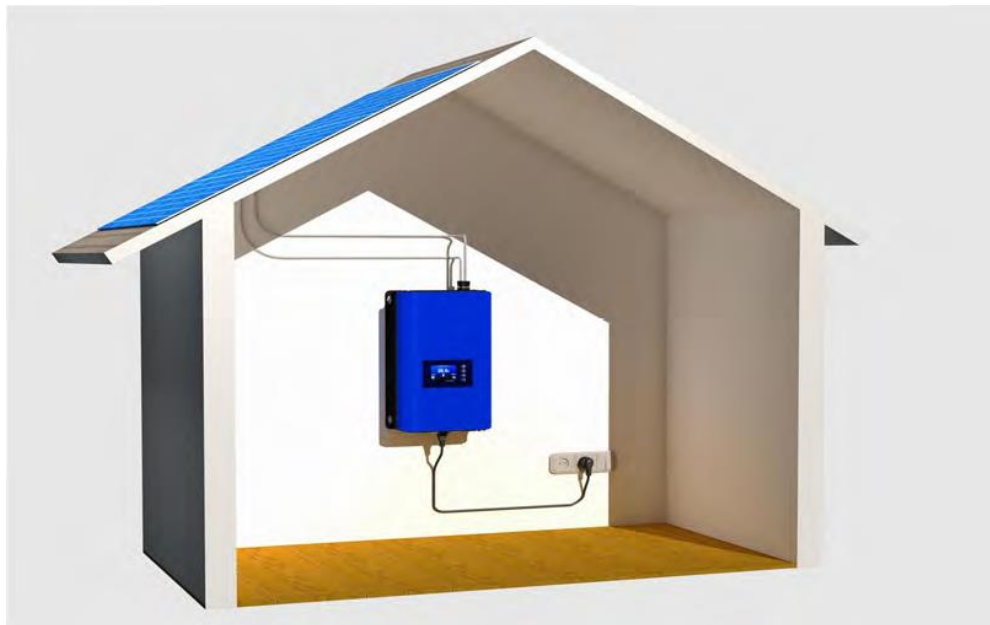
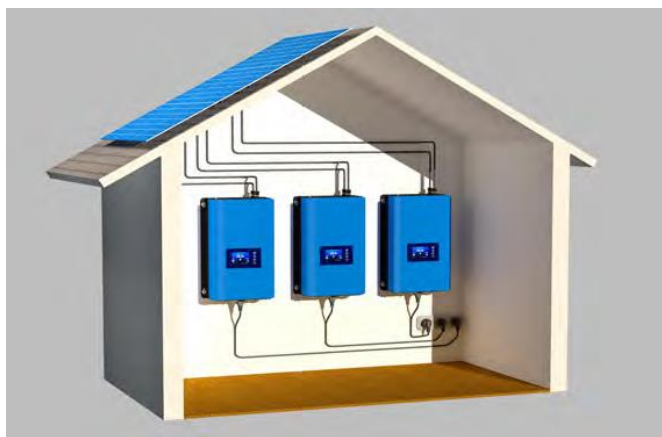


Fig 1. A Small Grid Tie Power System with the GWL GridFree Inverter



Multiple inverters can be connected in parallel to create bigger system. Plug and play installation.

Advantage of The GWL GridFree Power System

There are many advantages of SGPV compare with the traditional GridFree power system.

1. Low cost and easy installation – SGPV can make full use of all types of buildings' surface that face to the sun in the city as well as fast and easy installation of solar modules and GridFree inverter. It just needs very low maintenance costs.
2. Free combination – SGPV can be used as a separate GridFree system and can be setup as a large solar array with many of them. The quantity of SGPV in the array is just according to your desire. If you are planning to install a grid tie PV system, in a general way, the solar array and inverter need to be carefully matched to ensure that the inverter's voltage and power limits are not exceeded.

When you want to increase more solar panels, and if the total power of the solar panels exceeds the allocation Grid tie inverter, it is necessary to increase the cost of a grid tie inverter.

3. Combination of SGPV does not interact – The traditional solar grid tie system, they offer units ranging in high power output and these units are modular so you can have multiple units operating in parallel for large solar arrays. Although, the traditional grid inverter has MPPT feature (Maximum Power Point Tracking), but the maximum power point is according to the entire series in terms of solar panels array, if the performance of a piece of solar panels in the system, for some reason, such as leaves, bird droppings, dust, shadow etc. and degrades, the performance of the entire solar power system will decrease. SGPV has no such disadvantage. If the performance of a piece of solar panels in the system degrades, this just effects this piece itself, will not affect other SGPV in the system.
4. Improving the efficiency of the entire solar power system – In traditional grid tie system, the solar panels are connected in series, so the MPPT of the inverter is according to the total panels in series, not to every panel, but there is difference between every panel, so not every is working at the maximum power, this will reduce the total power of these panel in series. But SGPV has no such disadvantage. Because every inverter of SGPV has MPPT function, so every panel is working at the maximum power, this will increase the efficiency of the entire system.
5. Low power consumption – Most of the parts in the small GridFree inverter are digital ICs and low power MCU, so the power consumption of it is low, though the quantity of grid tie inverters is increased, but this will not increase the power consumption much of the entire system.

Installation Procedure of GWL GridFree inverters

Installing GWL GridFree Power System involves several key steps:

1. Considering the total capacity of the GridFree power system that you need.
2. Choosing applicable solar panels for GWL GridFree Inverter.
3. Selecting accessory for installation of the GridFree Power System.
4. Selecting correct model of GWL GridFree Inverter.
5. Installing solar panels to suitable place.
6. Installing GWL GridFree Inverter to suitable place.
7. Connecting GWL GridFree Power System with cables and connectors.
8. Grounding the system.
9. Completing PV system installation map and Connecting the PV modules.

Each of the detailed installation steps in the following sections is numerically referenced in the installation diagram below.

**WARNING**

Do not connect GWL GridFree Inverters to the utility grid or energize the AC circuit(s) until you have completed all of the installation. Be aware that installation of this equipment includes risk of electric shock. Normally grounded conductors may be ungrounded and energized when a ground fault is indicated.

STEP1. CONSIDERING THE TOTAL CAPACITY OF THE GRIDFREE POWER SYSTEM THAT YOU NEED.

The total capacity of the whole GridFree power system is according to your power consumption in the site that you want to install, or how much power that you want it to feed to the utility grid. Actually, the volume is just according to your willingness, because when the total power of electric appliances that are being used in the installation site is larger than the output power of the grid tie power system, this power from the system will be consumed in the site, this will slow down the power meter, otherwise, the difference of the output power from the system between the total used power of the appliances will feed to the utility grid.

For example, if you want to install a GridFree power system in your house, you could decide the total power volume according to the total power the appliances that you use in your house, maybe the consumption of total energy in per day is about 5KWH, then you should realize the real irradiation time in per day at your site, actually the real irradiation time is an average result, because it will vary every day according to the climate, just assume the time is 6 hours, so you can install a 1KW GridFree power system, with this capacity of the system, it can supply all power consumption in whole year.

When GridFree power system is working, sometimes, there is extra power feed to utility grid if the power from the GridFree system is larger than the power consumed by the appliances in your house, and sometimes will not when it is not larger. Of course, you can install 1kW GridFree power system or 2kW GridFree inverter, even more large capacity or more small capacity GridFree inverter, it doesn't matter. But if the capacity is too big, you should consider the volume of AC system of your house can hold the fed power.

STEP2. CHOOSING APPLICABLE SOLAR PANELS FOR GWL GRIDFREE INVERTER.**DESCRIPTION OF SOLAR PANEL**

Solar panel is an array of solar cells, it is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. When exposed to light, it can generate and support an electric current without being attached to any external voltage source.

Most solar panels consist of solar cells connected in series. Recently, main solar cells have two types, Mono and Poly, their performance is almost the same.

The main technical data of solar panels including Efficiency, P_{max} , V_{mp} , I_{mp} , V_{oc} , I_{sc} , etc. For example, the specifications of one type 245W solar panels consist of 60 PCS

156×156 Poly solar cells are shown below.

Module Efficiency: 14.8% P_{max} : 245W

V_{mp} : 29.4V I_{mp} : 8.34A

V_{oc} : 36.9V I_{sc} : 8.68A

**NOTE**

These specifications are under Standard Test Conditions (STC).
STC: Irradiance 1000W/m², Cell temperature 25°C, Air mass AM1.5
according to EN60904-3.

Module Efficiency is the converting efficiency that the module converts the energy of light into electricity power.

P_{max} is the Maximum Power of solar panels.

V_{mp} is the Rated Voltage at P_{max} .

I_{mp} is the Rated Current at P_{max} .

Voc is the Open Circuit Voltage.

Isc is the Short Circuit Current.

Because these specifications are under STC, these specifications also are sensitive with temperature of surroundings, so should consider the vary of these specifications with temperature. Please check the curves of I-V and Temperature Dependence of Isc, Voc, Pmax.

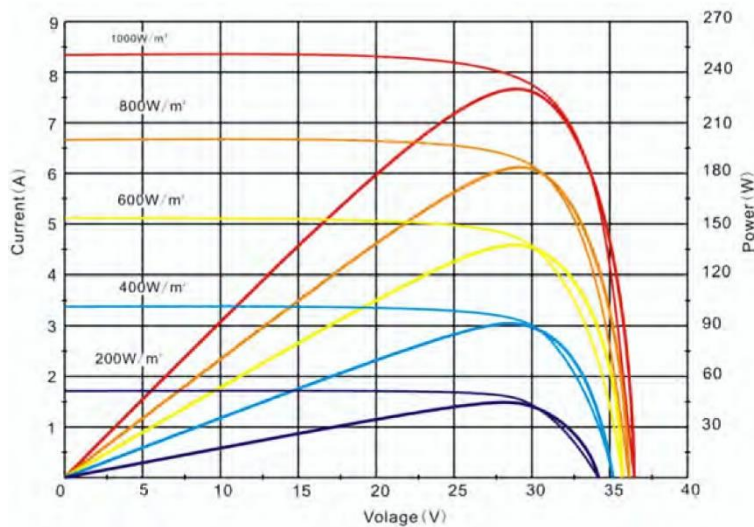


Fig 2. I-V Curves

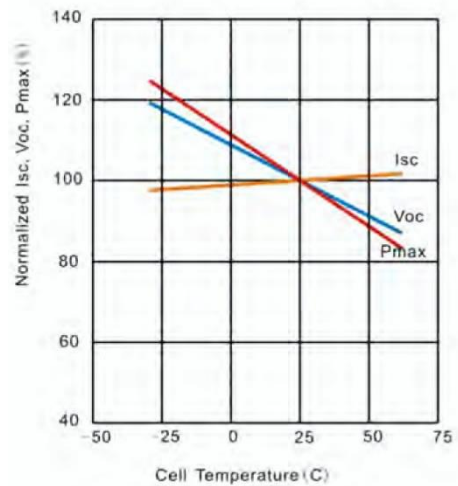


Fig 3. Temperature Dependence of Isc, Voc, Pmax

The I-V Curves shown in the Fig. 2 is a solar panel's I-V curves that the power is 230W. You can get the information from this I-V curves that different irradiance under sunshine will get different power from same solar panel, and also different power will be converted under same irradiance but the output of DC voltage is different, the solar panel just can get maximum power at one point under a certain irradiance, this point is called maximum power point(MPP). The MPP also is sensitive with temperature of surroundings. The temperature dependence of Isc, Voc, Pmax shown in the Fig. 3. You can see that the Pmax and Voc have negative temperature character, Vmp also has same character.

CHOOSING SOLAR PANELS

The most important specifications when selecting solar panels are Pmax, Voc, Vmp and Isc.

1. The total Pmax of solar panels should be equal to or less than the Rated Power(Peak) of the inverter that you will connect.
2. The total Voc of solar panels should be less than the maximum point of the DC input range of the inverter, it is according to the connecting method, if you connect solar panels in parallel, all panels must have same Voc, the Pmax of each panel can be different or same, so the total Voc is as same as one Voc, but if you connect solar panels in serial, the Isc of each solar panel must be same, the Pmax of each panel can be different or same, so, the total Voc is the summation of all solar panels connected in serial. Connecting solar panels with same specifications in a single system is the best choice.

3. The total Vmp of solar panels should above the minimum point of the DC input range of the inverter. The connecting method principle is as same as item 2 above.

STEP3. SELECTING ACCESSORY FOR GRIDFREE POWER SYSTEM INSTALLATION.

The accessory for grid tie power system including:

1. DC cables will be connected with solar panels and inverters.
2. Connectors.
3. AC cables.
4. Power meter(Optional).
5. Bracket for solar panels installation (not included in this user manual).

SELECTING DC CABLES

Before you connect the solar panels to inverter, suitable specification of cables should be selected. The selection of specifications of the cables is according to the total power of the solar panels and the connecting method of solar panels.

You should calculate the maximum current that will transit through the cables, we mark it as I_{max}. First, calculate the total P_{max} of the solar panels that will be consisted of the GridFree power system, we mark it as TP_{max}, then calculate the total V_{mp} of them, we mark it as TV_{mp}, we also can get total I_{mp}, mark it as TI_{mp}, with this, we can get the TI_{max} using a formula (1) or (2) shown below.

$$TI_{mp} = TP_{max}/TV_{mp} \text{ ----- (1)}$$

$$\text{Or } TI_{mp} = I_{mp} \times N \text{ ----- (2) } \quad N \text{ is the parallel number of solar panels}$$

After finish the calculation of I_{max}, then we can pick suitable cables according to Table 2. It's the best that you choose solar cables for outdoor use.

SELECTING CONNECTORS

When installing the SGPV system, maybe you should use some connectors for connecting solar panels and inverter. Most of these connectors are shown as below.



MC4 Connectors



Connectors for parallel connecting

SELECTING AC CABLES

AC cables will be supplied with inverters by our factory, different countries will be supplied different type AC cables, according to the standard of the area. You should provide the information to the dealer where you will install the system.

STEP4. SELECTING CORRECT MODEL OF GWL GRIDFREE INVERTER.

When finished step1 to step3, and decided the connecting method of the solar panels, then you can select a correct model of inverter. The input DC voltage range of the inverter should fit the DC output voltage of the solar panel array, the rated power of the inverter should also fit the total power of the solar panel array, and the AC output of the inverter should fit the standard of AC utility grid.

STEP5. INSTALLING SOLAR PANELS TO SUITABLE PLACE.

Installing the solar panels of the SGPV to suitable location that sunshine can irradiate on them, there must have no shadow, the installation direction of the solar panels should be according to the geography position that the system will be installed, different position should have different installation direction, the principle is to get maximum irradiation in all the year round.



WARNING

Ensure that there is no shadow at the location that solar panels will be installed, because even the shadow just covers only one cell of solar panel, maybe will cause total system stop to produce power.



WARNING

Ensure using strong bracket to fix the solar panels to avoid the danger under high wind.

STEP6. INSTALLING GWL GRIDFREE INVERTER TO SUITABLE PLACE.

Place the GWL GridFree Inverter on a surface protected from direct sunlight, high temperatures, and water. The inverter requires at least 150mm of clearance around itself for ventilation. The inverters are for indoor use, can't use at outdoor. You can use screws to fix the inverter to the surface, because some models of GWL GridFree inverter have fans on the bottom cover, so the surface should be flat.

STEP7. CONNECTING THE GWL GRIDFREE POWER SYSTEM WITH CABLES AND CONNECTORS

After finished from Step1 to Step6, you should connect the solar panels and inverters with cables and connectors to integrate the GWL GridFree System.

STEP8. GROUNDING THE SYSTEM.

Route a continuous GEC through each of the solar panels to the NEC approved AC grounding electrode. The racking and module could be grounded to this conductor using a crimp connection. An alternative method would be to connect the GridFree inverters to the grounded racking using a grounding washer approved for the racking. The ground wire of the AC cables is connected to the housing of inverter when the AC cables is connected to the inverters, so when the AC plug is inserted to the socket of AC outlet of utility grid in the house, the ground pin of the socket must be connected to the Earth ground.

**WARNING**

If you will connect the PV modules to the inverter under sunshine, you should cover the modules with no transparent material like black cloth, if the modules have been connected in serial, just cover one module, actually, just need to cover one cell of the module, but if the modules have been connected in parallel, you should cover one module of every branch, also just need to cover one cell when you cover a module. Covering the modules under sunshine just in order to avoid the sparkle when connect the cables.

STEP9. CONNECTING THE PV MODULES AFTER COMPLETE FROM STEP1 TO STEP8.**EXAMPLE OF INSTALLATION OF 1KW GRID TIE POWER SYSTEM**

In order to explain the installing operation, we assume that there is a house that the usual electricity consumption is about 5kWh per day, and the real irradiation time is about 5 hours.

1. Considering the total capacity of the GridFree power system that you need. As we stated at Step1, we can get a result that a 1kW GWL GridFree Power System is suitable for this house, so we will

establish a 1kW GridFree power system step by step, we also assume that we will install the system in the house where the utility grid is 230V/50Hz.

2. Choosing applicable Solar Panels. Because the most popular solar panels are 250Wp~270Wp poly



NOTE

The Pmax specification of solar panel is under STC, the actual power is variable according to the irradiation on the panel and the temperature surroundings. The real output power can't reach Pmax at most time in whole day.

panels with 60 PCS solar cells, so choosing this kind type panels will be more economical. The system is 1kW power system, so we should use 4 PCS 250Wp solar panels.

Most of this kind type solar panels have similar specification shown below.

Module Efficiency:14.8% Pmax:250W

Vmp: 29.9V Imp:8.35A

Voc: 37.1V Isc:8.92A

so use 4 PCS of this type panels, we can get total power:

$TP_{max} = 250Wp \times 4 = 1000Wp$ (depending on level of local irradiation) from these solar panels, it is suitable for 1kW SUN-1000G model inverter.

3. Selecting Accessory for GridFree Power System installation.

Because we should connect 4 PCS solar panels to GWL GridFree Inverter, so some connectors are necessary. Consider of the Voc, Vmp and Isc, we choose some MC4 connectors and some connectors for parallel connecting.

For the choice of DC cables, we should consider about the connecting method of solar panels, there are two methods can be chose.

Method 1: Connecting the 4 panels in parallel, so the maximum DC current will be

$$TImp = TP_{max}/TVmp = 980W/29.4V = 33.4A \text{ or}$$

$$TImp = Imp \times 4 = 8.35A \times 4 = 33.4A$$

Method 2 : Connecting 2 panels in serial consist as a pair, so 4 panels can be gotten 2 pairs,

$$TImp = TP_{max}/TVmp = 1000W/(2 \times 29.9V) = 16.7A \text{ or}$$

$$TImp = Imp \times 2 = 8.35A \times 2 = 16.7A$$

Because the DC cables will be more expensive if the diameter is big, considering about this matter, the method that can use smaller diameter cables will be a good choice.

4. 4. Selecting correct model of GWL Grid Power Inverter.

Because maybe there will be several methods of connecting solar panels to GWL GridFree Inverter, different connecting method maybe should use different model inverter. In this case, there are two connecting methods.

With method 1, because all panels are connected in parallel, so we can know that the TVoc (total Voc of the solar panels) will be same as Voc of one panel, and the TVmp also is same as Vmp of one panel. So, we can get the specifications of the solar panels array with solar panels connected

each other.

TPmax:250W×4 TVmp:29.9V

TImp:8.35A×4 TVoc:37.1V

TIsc:8.92A×4

From these specification, we should to use GF-SUN-1000G2-M-E. This is because, the DC input voltage range of this model is 22V to 65V, so the TVoc and TVmp is in the DC input voltage range. With method 2, we also can get the specifications of the solar panels array.

TPmax:245W×4 TVmp:29.4V×2

TImp:8.34A×2 TVoc:36.9V×2

TIsc:8.68A×2

From these specifications, we should to use SUN-1000G2H. This is because, the DC input voltage range of this model is 45V to 90V, so the TVoc and TVmp is in the DC input voltage range.

The two connecting method diagrams are shown in Fig.4 and Fig.5 below.

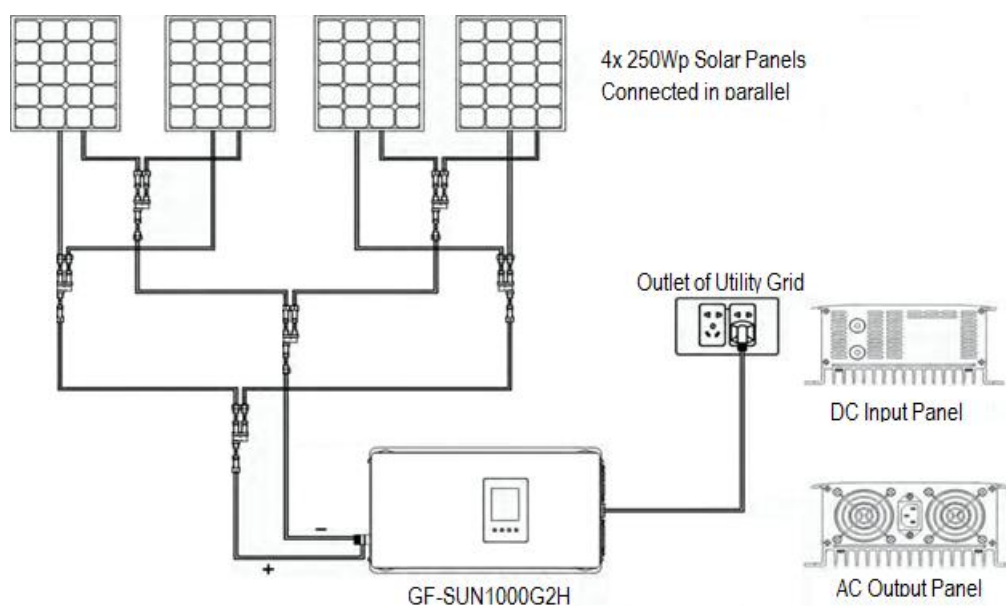


Fig.4 1kW GWL GridFree Power System Connected with Method 1

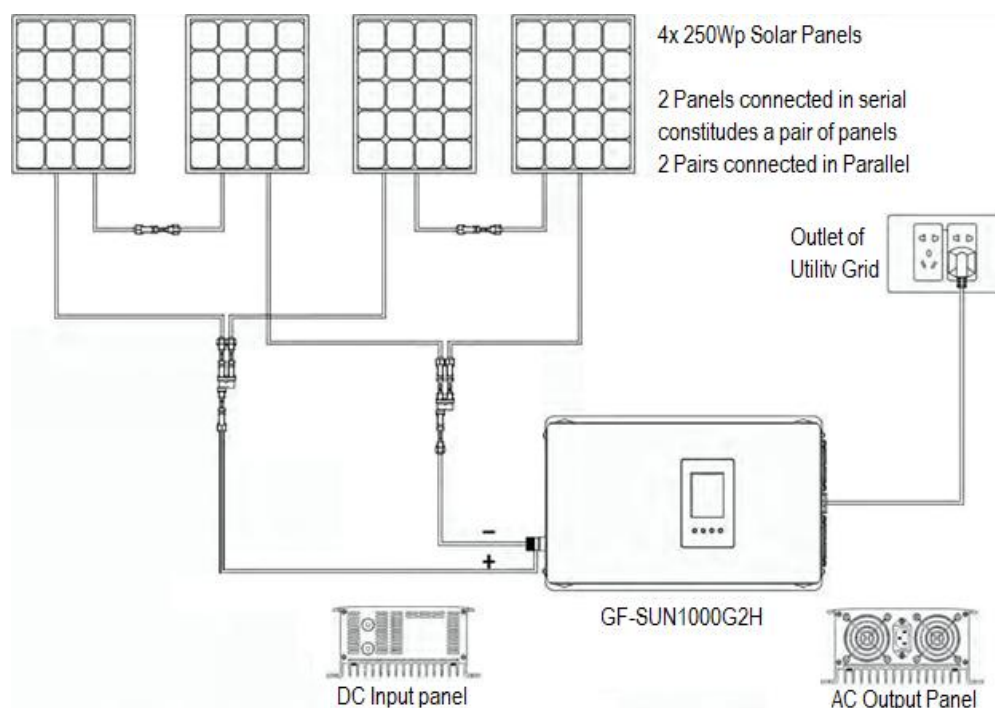


Fig.5 1kW GWL GridFree Power System Connected with Method 2

Comparing the connected method in Fig.4 and Fig5, we can see that method 2 is the good choice, because with method 1, the DC cables is more thick, so it is more expensive, and three pairs of connectors for parallel connecting plus three pairs of MC4 connectors should be used. But with method 2, the DC cables is thin, and just a pair of connectors for parallel connecting and a pair of MC4 connector should be used.

INSTALLING LARGER CAPACITY OF GRID TIE POWER SYSTEM.

Sometimes, maybe you are willing to install larger capacity of grid tie inverter in your house, this is also very easy to operate. For example, you want to install 2kW GridFree power system, you can install two 1kW GridFree power systems as shown in Fig.5, two AC output cables should be all connected to the AC outlet of the utility grid with the plugs.

You can install any capacity of GridFree power system (According to local legislation) by stack small GridFree power systems.

For example, if you want to install 8kW GridFree power system, there are many choices, you can stack four 2kW GridFree power systems, or eight 1kW GridFree systems, or stack sixteen 500W GridFree power systems, even you can mix different capacity GridFree power systems to gain large capacity system.



WARNING

Don't Connect the DC input Terminals of one GWL GridFree Power Inverter to another's. If so, neither of the inverters can find the correct maximum power point(MPP), this will reduce the efficiency of the system. Shown in Fig.7.

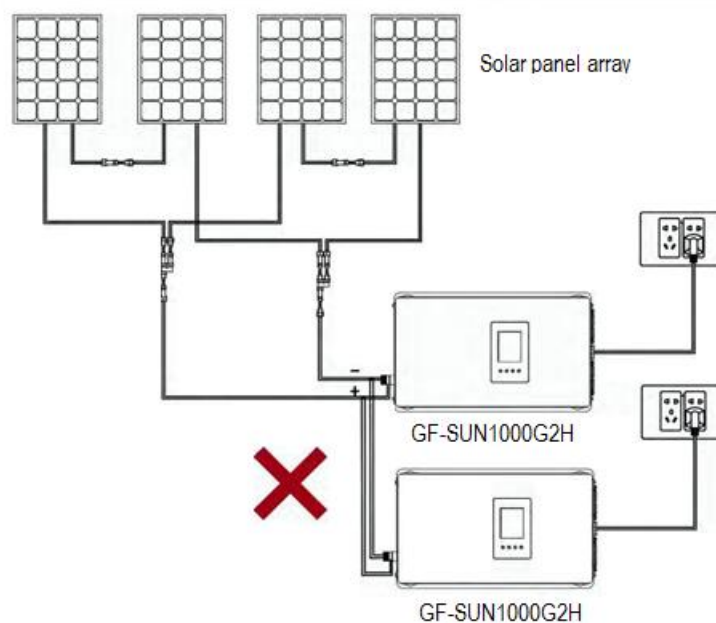


Fig.7 Error Connecting of DC Input Terminals

INSTALLING GWL GRIDFREE POWER SYSTEM TO THREE PHASES UTILITY GRID.

When the Capacity of Grid Tie Power System is larger, install all the power system to one phase of the utility grid is not reasonable, maybe this will cause unbalancing of the three phase of the utility grid.

In this section, we will explain how to install GWL GridFree Power System to three phases utility grid separately in order to balance the fed power.

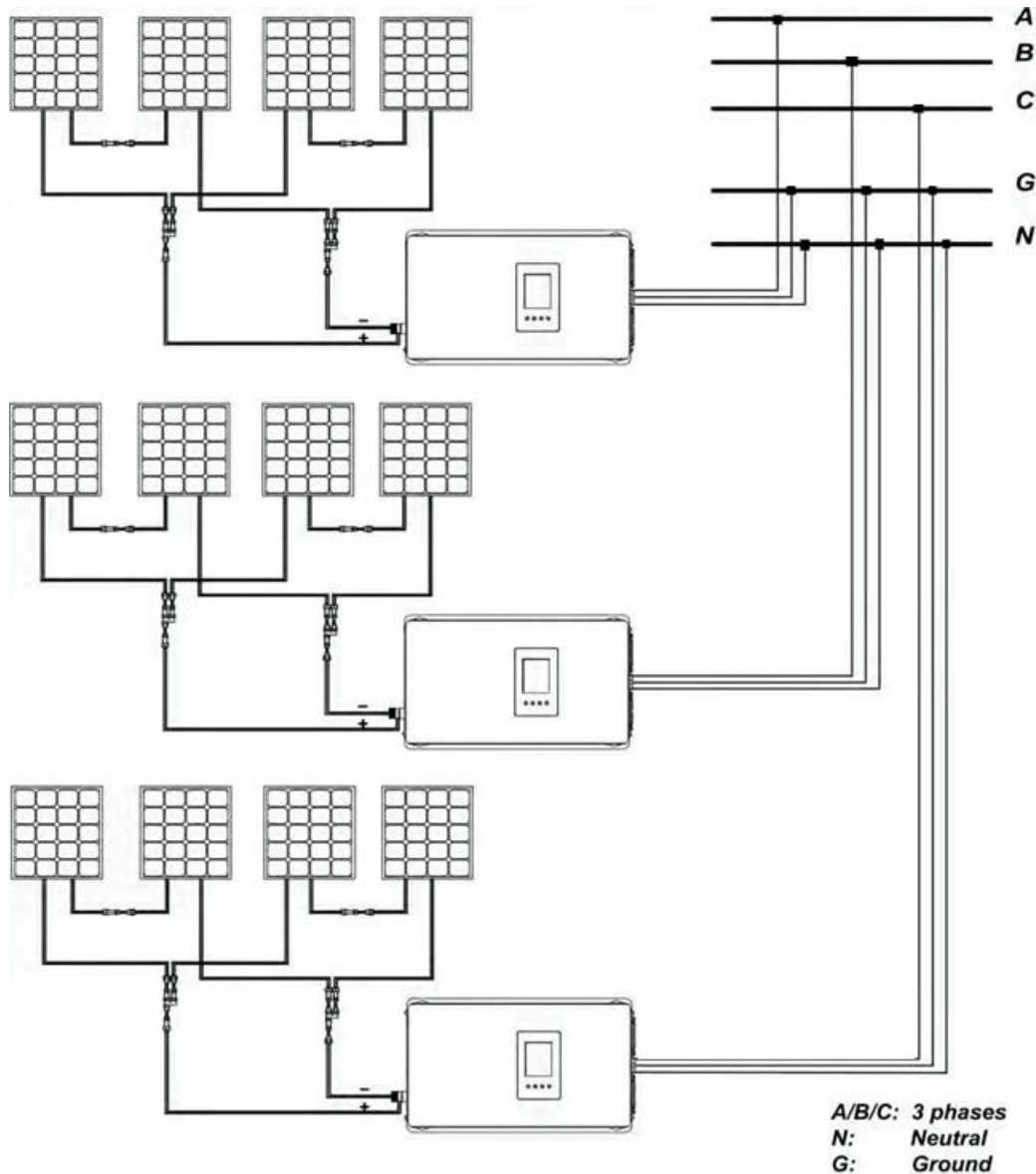


Fig.8 Three Phase GridFree System

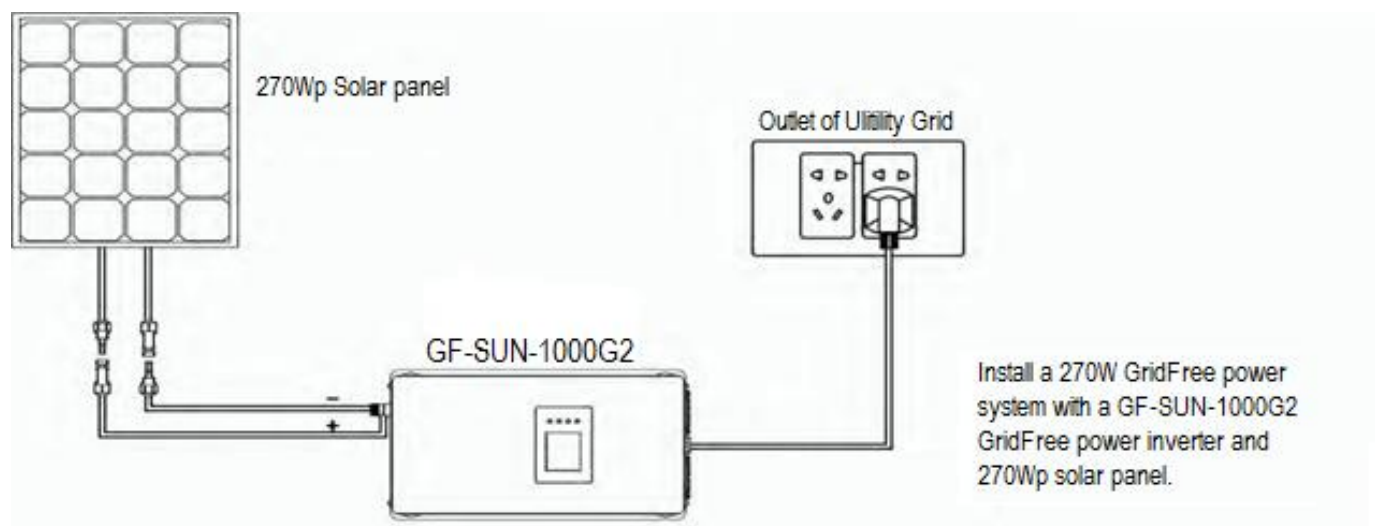
For example, installing a 3kW GridFree power system to three phase utility grid. The diagram is shown in Fig. 8, we separate 3kW power system to three power system units, every unit has 1kW power. Connecting every system unit to different phase, this can balance all grid tie power to three phases of the utility grid.

Follow this way, you can install more large grid tie power system to three phases, just separate the whole power system to three equal power system units.

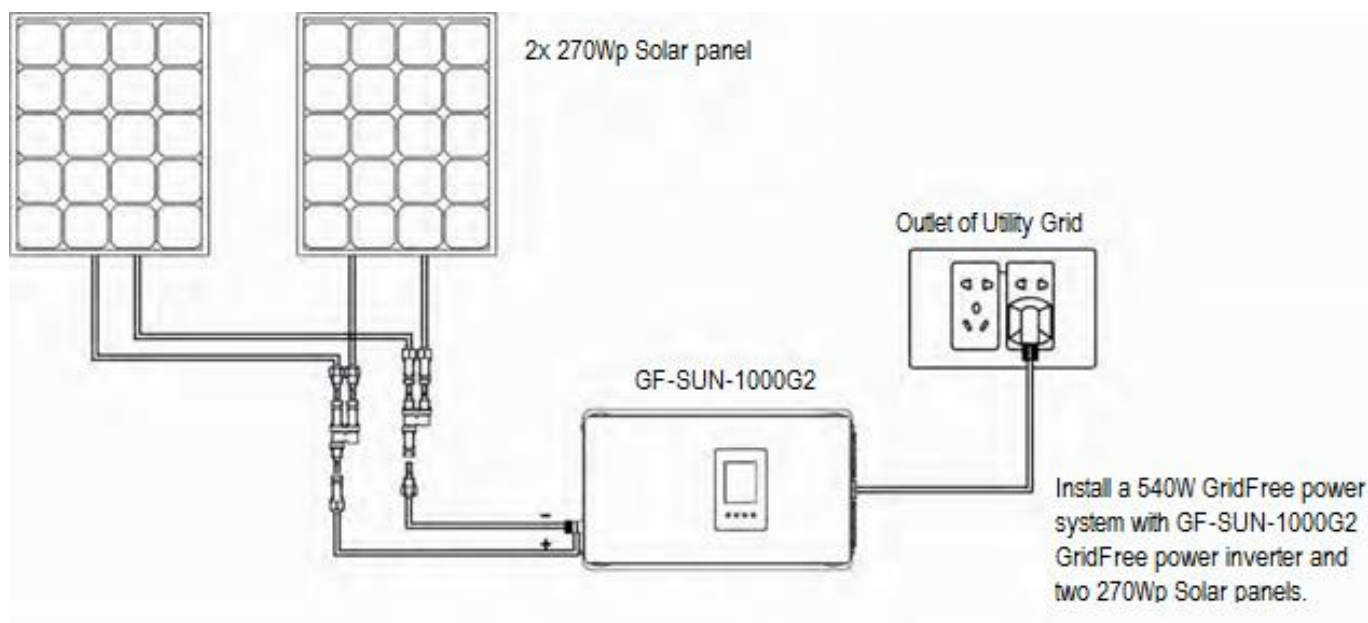
Starting DIY from small GridFree power system.

If you never have experience of installing GridFree power system before, you can start DIY (do it by yourself) from small GridFree power system.

The smallest power of SUN series GridFree power inverter is GF-SUN-1000G2, this is a power inverter that the rated output power is 900W, and the peak power can reach 1000W, so you can establish a capacity GridFree power system with this model inverter and a solar panel up to 3 solar panels, the total Pmax of solar panels should be less than 1000Wp. It's very easy to install this kind system, just need DC cables and few connectors to connect the system. For example, you can choose a 270Wp solar panel or two 270Wp solar panels (any choice up to total solar panels power 1000Wp) to connect with GF-SUN-1000G2 inverter.



Or



It doesn't matter that you connect small power solar panels like 60Wp, 85Wp or other power to the inverter, the specification of total panels must meet the specification that you choose according to the principle that mentioned in this user manual.

Layout of GWL GridFree Power Inverter

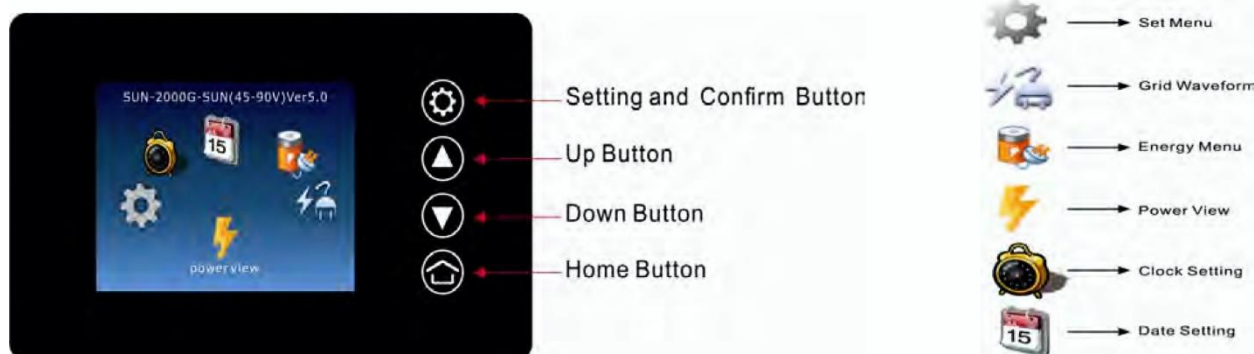
GF-SUN-1000G2(H) / GF-SUN2000G2 layout, please see the Fig.13



Fig.13 GF-SUN-1000G2(H) / GF-SUN-2000G2 Layout

- (1) DC Input Positive Terminal. This terminal will connect to the positive wire of solar cables that connected with the positive pole of the solar panels.
- (2) DC Input Negative Terminal. This terminal will connect to the negative wire of solar cables that connected with the negative pole of the solar panels.
- (3) AC socket, this socket will connect the inverter to the public grid via the AC cable.
- (4), (5) Cooling fans
- (6) Limiters sockets, allow to connect current sensor for internal limiter or external limiter

Inverter Display Instruction



The Inverter display can show many information, The main interface of the display and the icons explanation is shown above.

SET MENU:

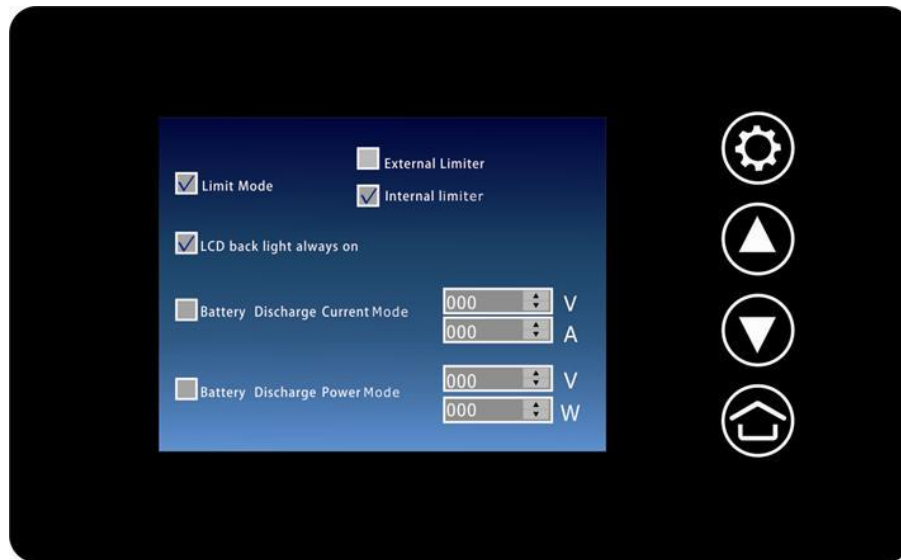
Choose the set menu icon on the main screen interface, click the confirm button to enter into the interface, show below. In this interface, you can set the LCD backlight always on or auto turn off backlight after 3 minutes no action.

The inverter also integrates with internal limiter and external limiter function which can prevent excess power from going to the public grid. Select the internal limiter mode, inverter will work under limiter mode, output power of the inverter will be determined by load power. Select the external limiter mode, inverter need an external limiter module working with it. For more details read chapter Limitation of power output.

The inverter includes three working mode:

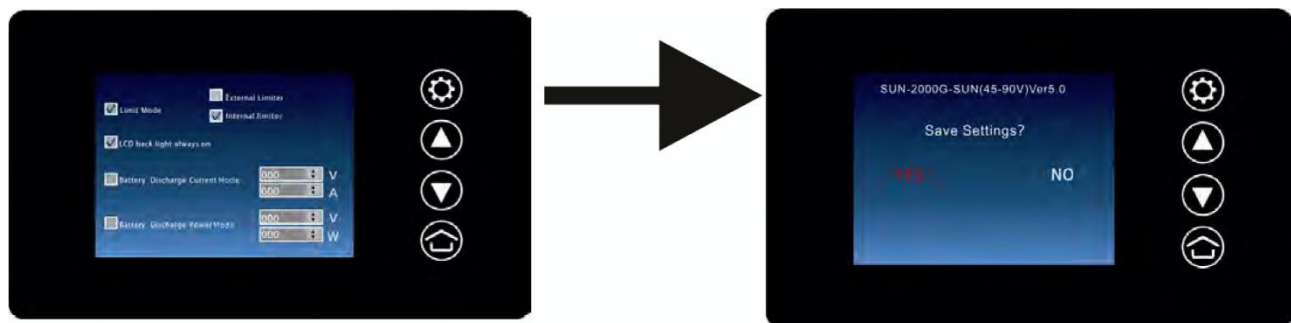
- ✓ Work as normal GridFree without power limitation.
- ✓ Work under Internal limiter mode
- ✓ Work under External limiter mode

Please make your setting on the LCD and save it.



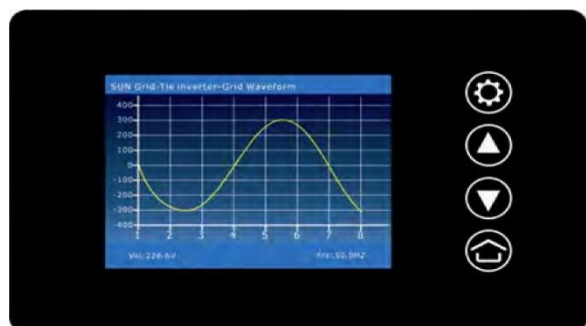
NOTE

Save the setting after you reconfigure the working mode or backlight setting.



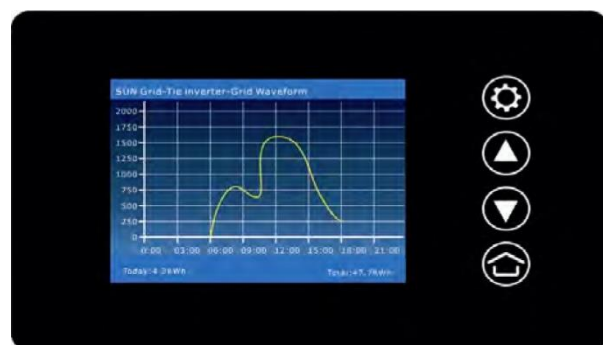
GRID WAVEFORM:

This interface will show the real-time grid waveform. The grid voltage and frequency also will show in this interface.



ENERGY MENU:

The energy interface will show the power generation curve every day.
 Today kWh and Total kWh are also show in this page.



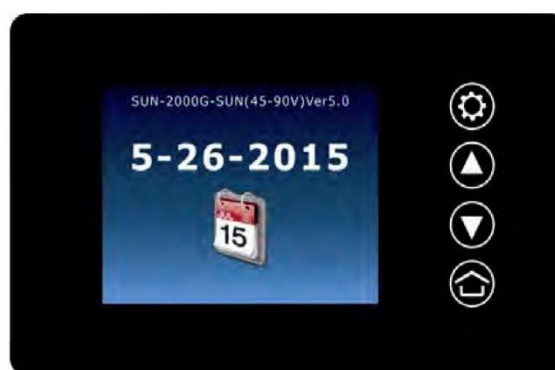
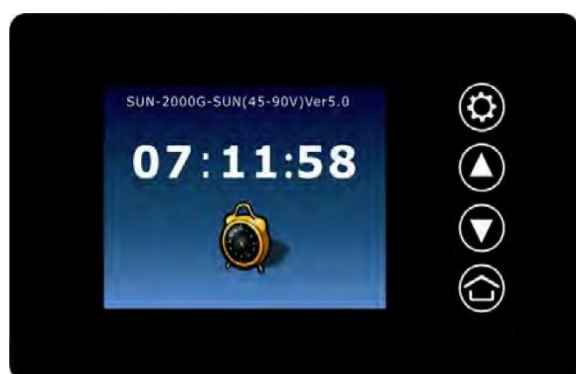
POWER VIEW:

In this interface, the display shows real time power, PV input voltage, inside temperature, date and time.
 Please mind that these are only approximate value.



CLOCK AND DATE SETTING:

Set the clock and date in this page, save the setting before exit.

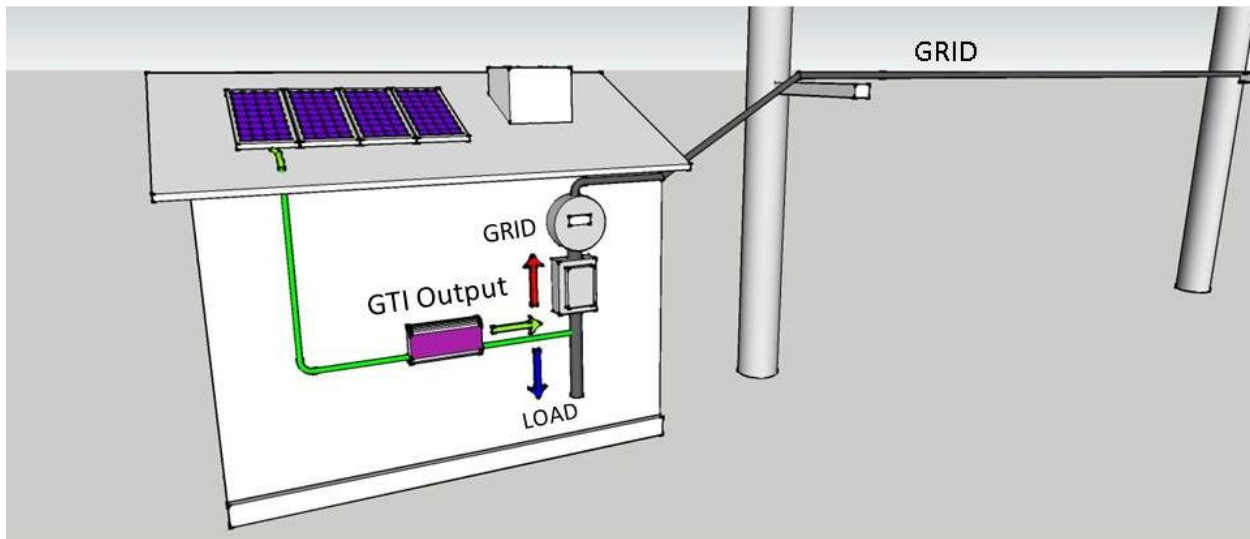


Limitation of power output

WHAT IS LIMITER FOR?

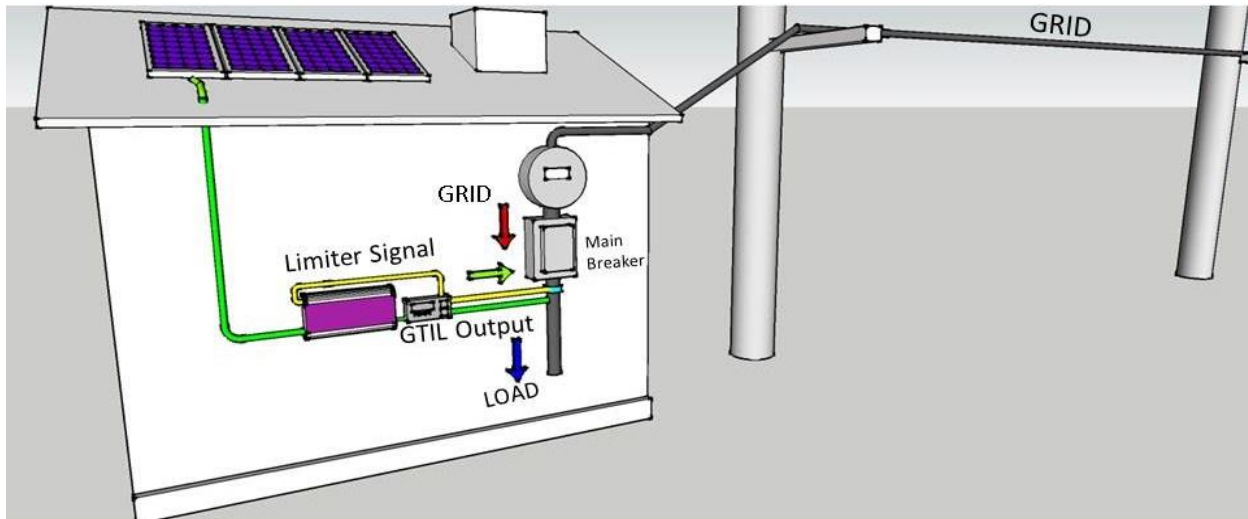
It is in response to the overwhelming clamor from customers for a product that can control the amount of power that the GridFree inverters can generate so that the amount of excess power produced by the solar panels are reduced to insignificant levels, if not eliminated, because in some countries, the producer pays for the excess power it gives to the distribution grid. This is because the electric power meters (the one provided by the electricity provider in the area) are not aware of the direction of power flow. In other words, it only adds even if power is exported to the grid, thus, the consumers will be charged for power even if it is given to the grid, and this is the problem. With the this SUN series inverters, we integrated the limit function inside. We call this internal limiter. In this way, no additional limiter module is needed, reduced customer's cost, easier for installation. But in case customer install inverter far away from the main circuit breaker, we also enable inverters to work with stand-alone limiter, we call this-external limiter. For sure, the inverter can work under normal GridFree – no limit mode, just set on the LCD and save your setting.

GRIDFREE SYSTEM USING STANDARD GRIDFREE INVERTERS WITH NO LIMITERS



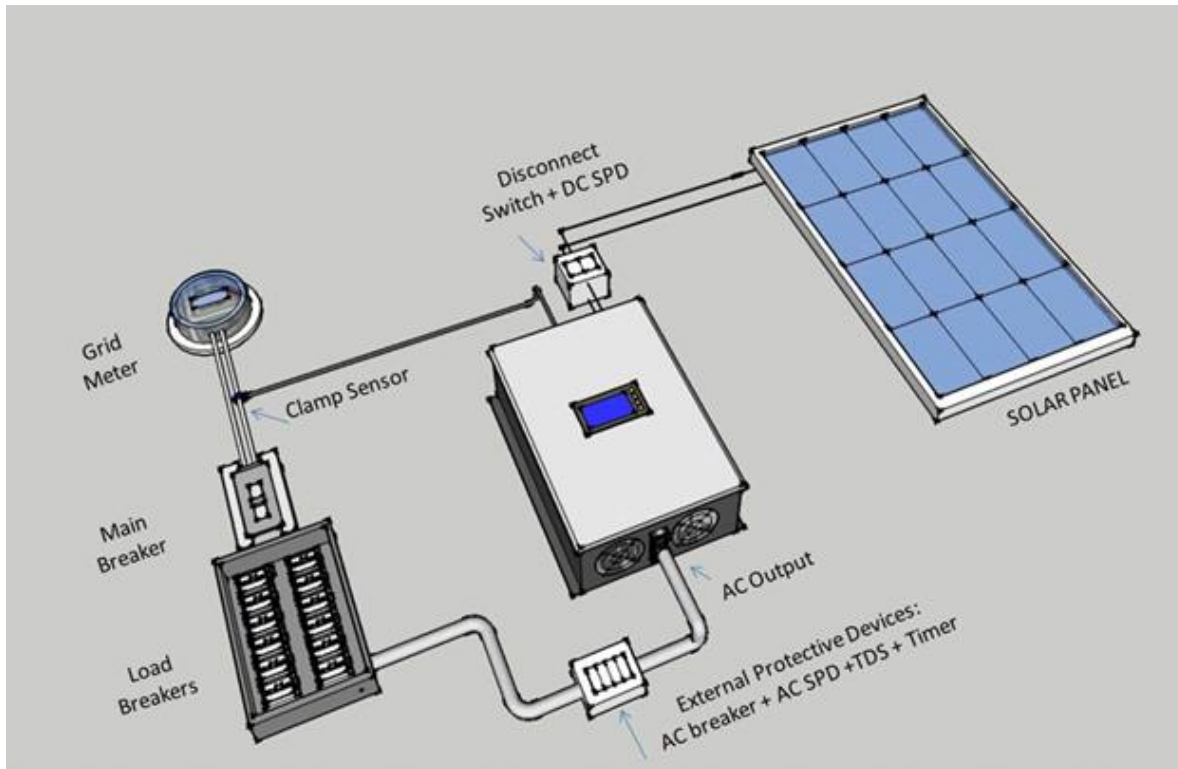
1. The GridFree inverter converts DC power produced by Solar Panels to AC, connects to the grid and feed all of the power available from the panels to the AC load.
2. All excess power that is not needed by the load is then exported to the Grid.
3. If the Grid fails, then the GridFree Inverter will turn off. When the Grid comes back on line. The GridFree Inverter will again supply power to the load and any excess power is exported to the Grid again.
4. If the Solar Panel is producing less power and the GridFree system cannot deliver all the power needed by the load, then power will be supplemented by the Grid.
5. Power Meters (Except smart meter) are not aware of the direction of Power flow. The user then pays for the power exported and delivered by the Grid.

GRIDFREE SYSTEM USING STANDARD GRIDFREE INVERTERS WITH A LIMITER



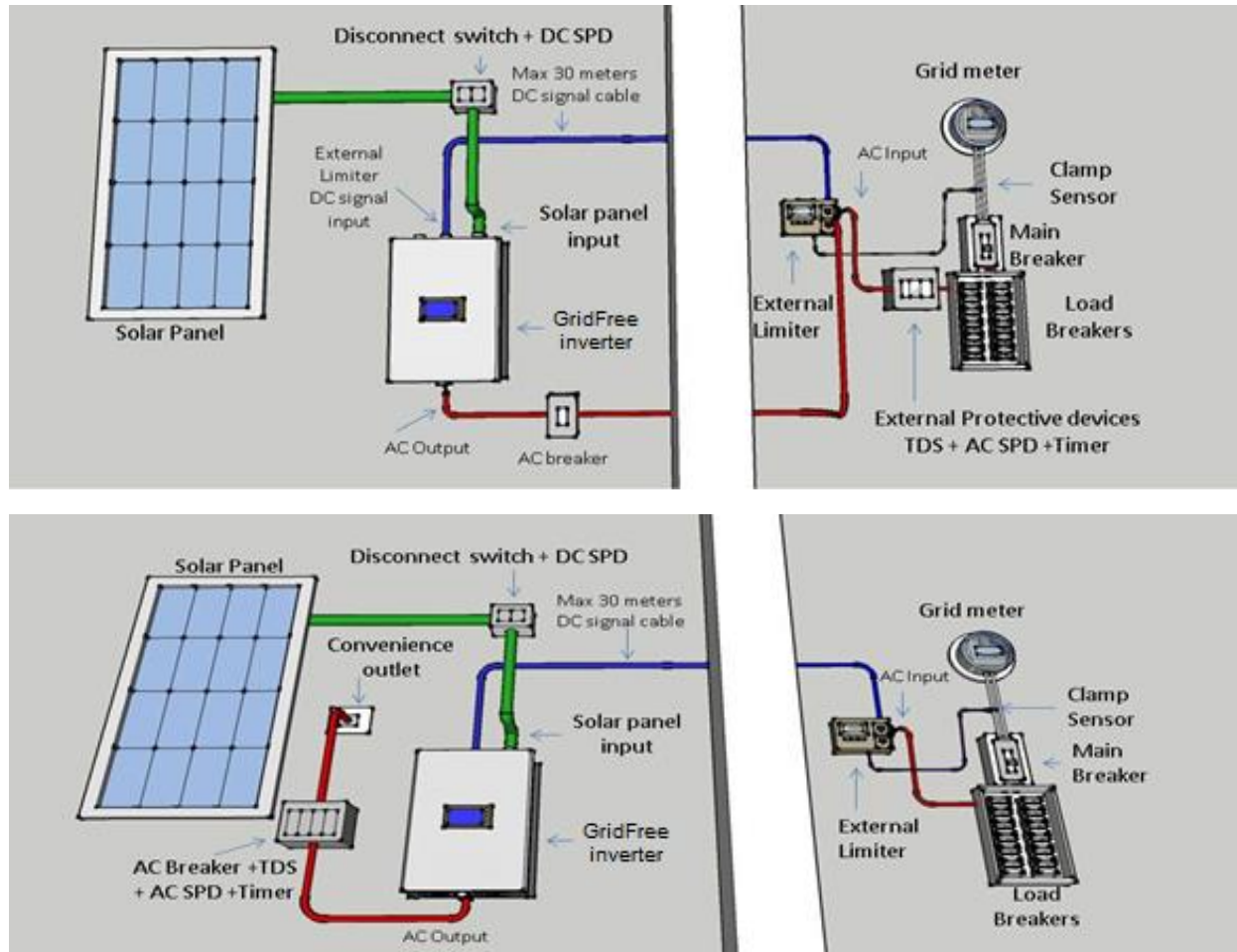
1. The GridFree Inverter with Limiter delivers only the power needed by the load and prevents delivering excess power hence avoids excess power in going back to the Grid.
2. The heart of the GridFree Inverter with Limiter is the Limiter Module (LM). The LM continuously sampled the power needed by the load through the current sensor connected after the Main Circuit Breaker. The LM then will process the signal. It then sends signal to GridFree Inverter how much power to deliver to the load in real time.
3. The user, after installing and connecting the GridFree inverter with limiter correctly, do not need to do anything and the unit will do its work automatically.

INSTALLATION OF GRIDFREE INVERTER WITH INTERNAL LIMITER



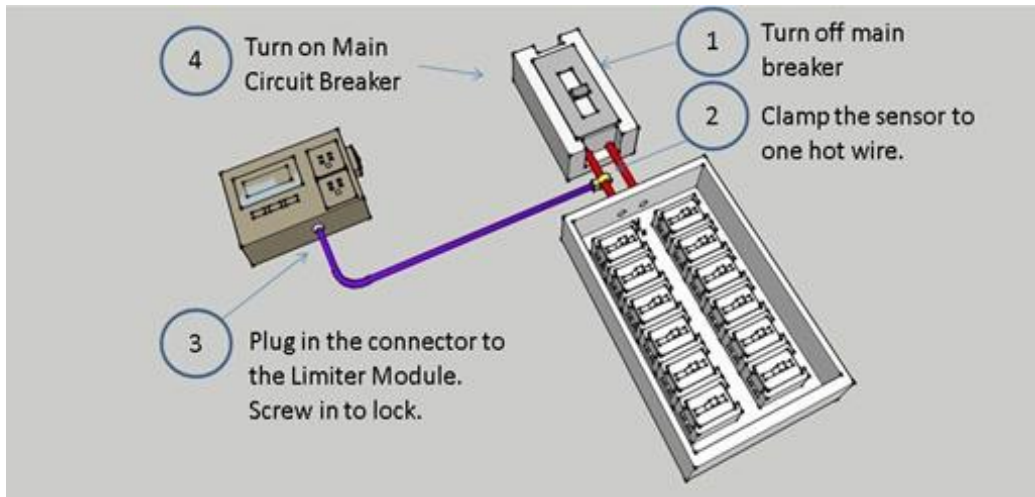
1. This installation do not require an additional limiter module, Installation is much easier. Clamp the current sensor cable to the life wire to measure the current, the internal limiter will auto detect the load power and control the inverter output power, excess power will be well controlled.
2. It is recommended to installed External protective device including DC and AC SPD (Surge protection device), DC and AC breaker, etc. to the system.

INSTALLATION OF GRIDFREE INVERTER WITH EXTERNAL LIMITER MODULE

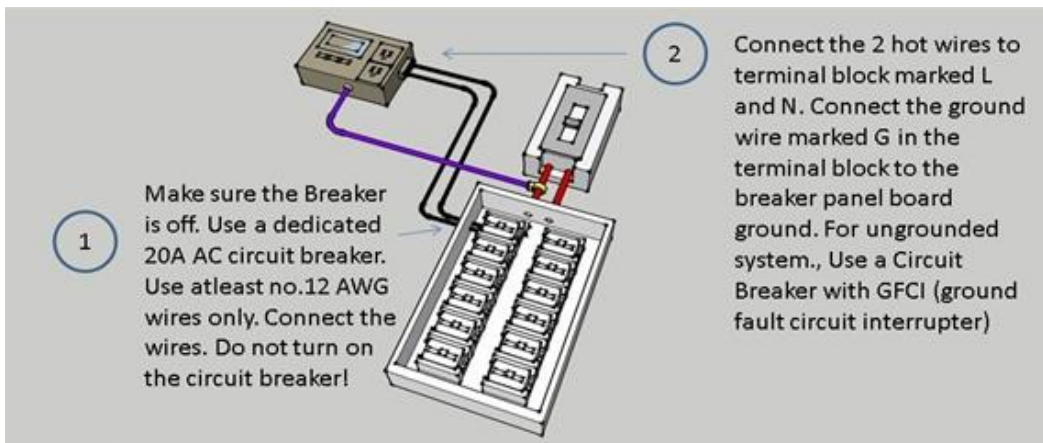


1. The installations of the GridFree system are shown above, the ac plug can either connect to the nearby AC socket or plug into the limiter socket, the dc signal cable can reach max. 30 meters length so that you can able to install the inverter far away from the limiter module. The ideal installation is that the limiter install near the GridFree inverter. The inverter unit and the Limiter Module are placed close to each other. The signal wires will be short, as supplied with the unit.
2. Use a dedicated 20 A breaker for the inverter in the Load Circuit breaker panel board
3. Wiring and connection procedure

STEP1 – CONNECTION THE AC CLAMP SENSOR: After the inverter and LM are properly installed. Shut off the main circuit breaker. Connect the clamp sensor to one hot wire after the main breaker. Connect the other end of clamp sensor signal cable to the LM. Neatly lay out the signal cable. You can now safely open the Main breaker.



STEP 2 – CONNECTING LIMITER MODULE TO GRID: Connect the LM module to grid. Using the terminal block, use at least wire no.12 AWG (20A ampacity - wire not included in the package) and connect to 20A circuit breaker dedicated for the inverter. **Make sure the 20A breaker is off while wiring. Do not turn on the breaker!**



STEP 3 – CONNECTING LIMITER MODULE TO INVERTER: Connect the DC signal cable from LM to inverter input. The connectors have threaded screw to securely fasten the connectors plug at both ends of the cable. Also, the connector plugs have dent/slot in the plugs body so it can only be connected in one direction or position.

STEP 4 – CONNECTING SOLAR PANELS CABLE TO INVERTER DC INPUT: Before connecting the solar panel cable, make sure that the solar panel disconnect switch or DC breaker is off and observe correct polarity when connecting the cable. Failure to follow will cause serious problem with the unit. Please read the manual booklet of the inverter included in the package for correct wire and circuit breaker/disconnect switch rating. Do not turn on the DC circuit breaker/disconnect switch

STEP 5 – FINAL CHECK OF ALL CONNECTION: Review all connections and make sure of the tightness of plugs and connections. Check again DC polarity connection of solar panel.

STEP 6 – TURN THE SYSTEM ON: Turn on the 20A circuit breakers to power the Limiter module. On the LM press SET button below LCD for a few seconds to let LCD light up and initialize.

Technical Data of SUN Series GridFree Power Inverter

INPUT DATA (DC)	GF-SUN-1000G2	GF-SUN-1000G2H / GF-SUN-2000G2
Peak power Tracking Voltage	25 V - 60 V	50 V - 90 V
Operating DC Voltage Range	22 V - 65 V	45 V - 90 V
Peak Inverter Efficiency	25 V - 60 V	50 V-90 V
OUTPUT DATA (AC)	GF-SUN-XXXXG2X	
Nominal Voltage/Range	230V / 185V-265V	
Frequency Range	50Hz / 47.5-51.5Hz	
Power Factor	>0.95	
Output Waveform	Pure Sine Wave	
CHARACTERISTIC DATA	GF-SUN-XXXXG2X	
MPPT Efficiency	99%	
European Efficiency	92%	
Over Current Protection	Yes	
Over Temperature Protection	Yes	
Reverse Polarity Protection	Yes	
Anti-Island Protection	Yes	
Stackable	Just for AC Output	
Operating Temperature Range	-20°C~ 50°C	
Storage Temperature Range	-40°C~ 65°C	
IP rating	IP40	

Model	GF-SUN-1000G2X	GF-SUN-2000G2
Net Weight	3.6Kg	6.0Kg
Gross Weight	4.8Kg	7.2Kg
Dimension (Package)	400mm×270mm×140mm	520mm×310mm×160mm

Outline Drawing of SUN Series GridFree Power Inverter

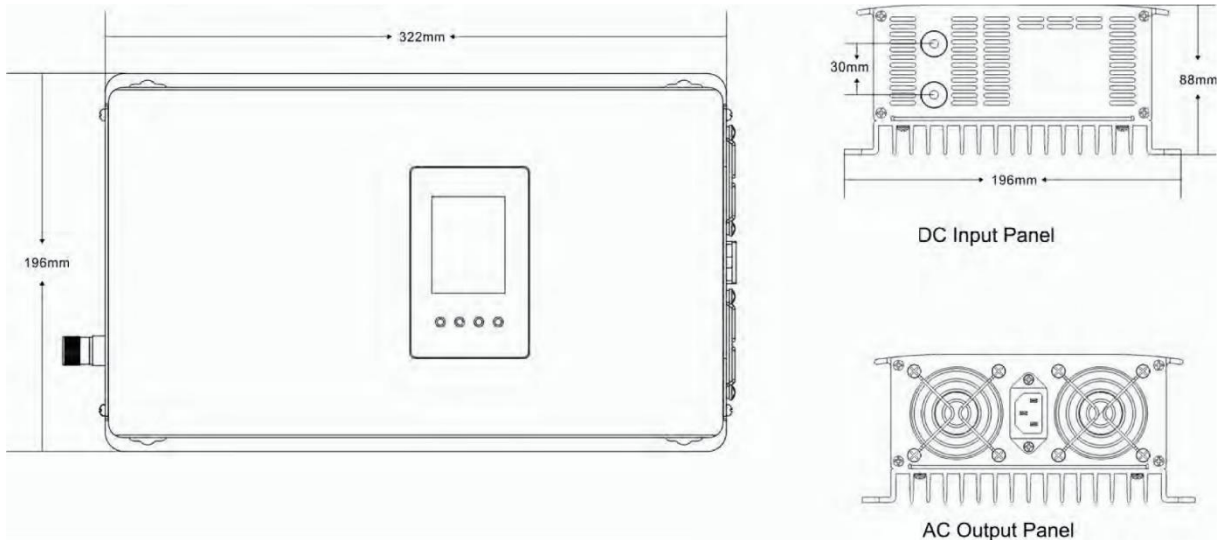


Fig. 17 GF-SUN-1000G2(H) Outline Drawing

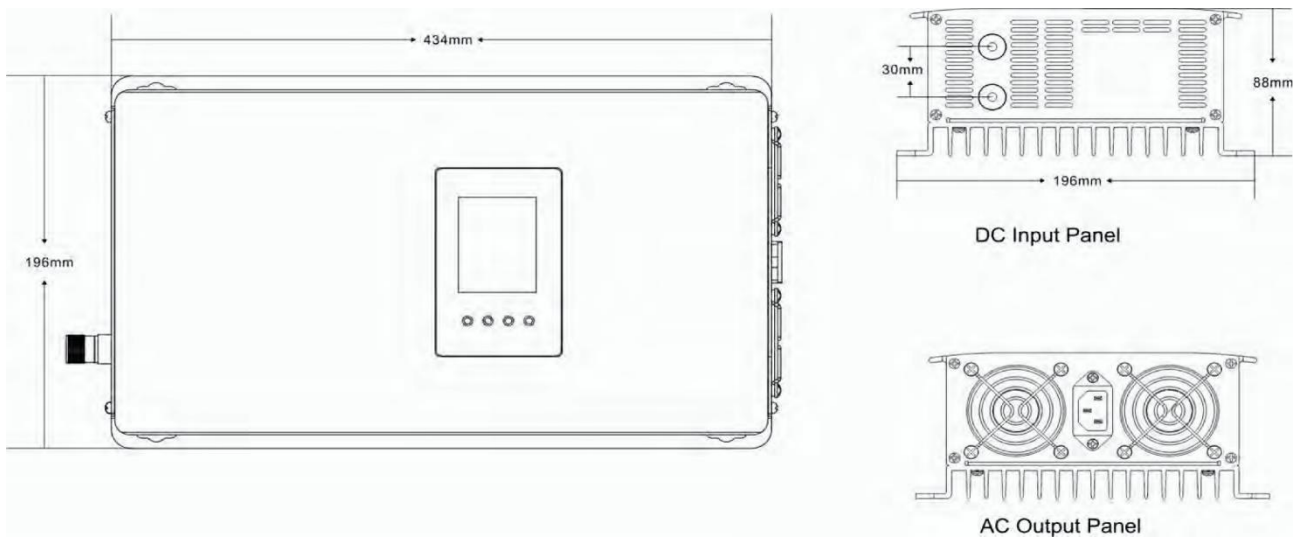


Fig. 18 GF-SUN-2000G Outline Drawing

Troubleshooting

After all installation step described throughout this manual, Qualified personnel can use the following troubleshooting steps if the GWL GridFree Power System does not operate correctly.

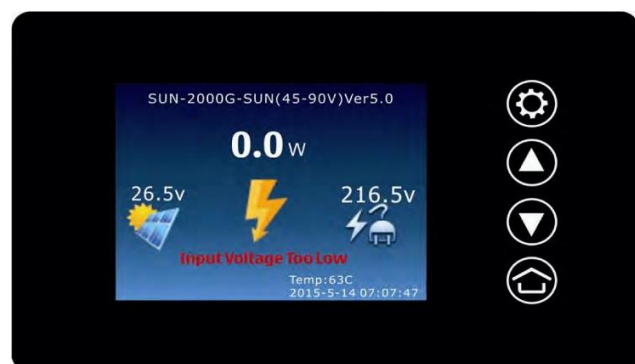


WARNING

Do not attempt to repair the GWL GridFree Inverter, it contains no user-serviceable parts. If it fails, please contact your supplier's customer service.

Status LCD Indications and Error Reporting

Each Sun series GridFree inverter has LCD that indicates status of errors in red letters.



1. Overtemperature: Inverter will stop working if temperature reach 75C inside the inverter. Make sure inverter is installed in good condition to prevent it from going overheat.
2. Input Voltage Too Low: This indicate that the DC input voltage is too low or DC connection is not good. You should measure the output voltage of the solar array.
3. Input Voltage Too High: This indicate that the DC input voltage is too high. You should adjust the connecting method according to the description in this manual.
4. Grid Error: This indicates that the AC cable is not connected with the utility grid, or AC voltage or frequency of the utility grid is out of the range of the specification of the inverter. Please check the AC cable and the outlet of the utility grid, you can use a multimeter to measure the AC voltage or frequency, then you can judge what is wrong about the AC output.
5. Dumping Load Shorted: This indicate something shorted inside the inverter or outside connection has somewhere shorted.
6. Starting Voltage Too Low: This indicate the output of the solar array is to low, please reconfigure the panels or choose suitable panels, make sure the output voltage of panel array in the inverter's input voltage range.



WARNING

Never disconnect the DC wire connectors under load. Ensure that no current is flowing in the DC wires prior to disconnecting. An opaque covering may be used to cover the module prior to disconnecting the module.

AC Output Current Waveform and PF Test Of 2000W Model

Tested 2000W model at nearly full load. Output current waveform shows good pure sine wave in oscilloscope. PF value also shows in good result, 99.8% PF value.





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