

Hybrid Solar Inverter User Manual



SAFETY INSTRUCTIONS



Before using the product, please read the warning messages instructions on the labels and user manual carefully as well as the other components connected to the product.



The product is designed to be connected with lead-acid battery only. Do not connect the product with other types of batteries



In the event flooded batteries are used, regular maintenance on the battery is required.



This product is design for indoor installation only. Please do not expose the product to direct sunlight, rainfall, or moisture.



Before performing any maintenance on the product, please disconnect all power sources (AC mains, batteries, solar panel) to avoid the risk of electrical shock.



Do not attempt to disassemble or repair the product. Only authorized personnel is allowed to perform repair.



While performing maintenance or cleaning (especially on the batteries where hazardous liquid might be touched), it's recommended to wear the necessary personal protective equipment (PPE)



The product and external batteries shall not be installed anywhere near smoke, sparks, and flames.

SCOPE OF WARRANTY

The product comes with a standard 1-year warranty. This warranty includes all defects of design, components and manufacturing. The Warranty is void and does not cover any defects or damages caused by in any of the following circumstances.

- . The product has been misused, neglected, or abused
- . Improper transportation and delivery
- . The product has been used or stored in conditions outside its electrical or environmental specifications
- . The product has been used for purposes other than for which it was designed for.
- . The product has been used outside its stated specifications, operating parameters and applications
- . Acts of third parties, atmospheric discharges, excess voltage, chemical influences, natural wear and tear and for loss and damage in transit
- . Improper testing, operation, maintenance, adjustment, repair, or any modification of any kind not authorized in writing by the supplier
- . The product has been connected to other equipment with which it is not compatible
- . Use and application beyond the definition in this manual
- . Application beyond the scope of applicable safety standards or grid codes.
- . Acts of nature such as lightning, fire, storm, flood, vandalism and etc.

The right to repair and/or replace the defective product is at the supplier's sole discretion. Any warranty claim shall be asserted in writing to the supplier within 5 working days after notice of product failure. The supplier is not responsible for damages beyond the scope of this warranty



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1. PRODUCT OVERVIEW

This is a DC-to-AC inverter with integrated solar battery charger, which can be used as a long run-time UPS (Uninterruptible Power Supply), an energy-saving solution or an automotive inverter (hereinafter referred to as "inverter").

The inverter accepts input power source from AC mains (utility), battery, and PV(solar) string and switches between various operation modes automatically depending on the operational conditions.

When used as a UPS, battery or PV(solar) string it acts as back-up power source to supply loads during the outage of AC mains.

The battery can be charged by both AC mains and PV(solar) string with intelligent charging control.

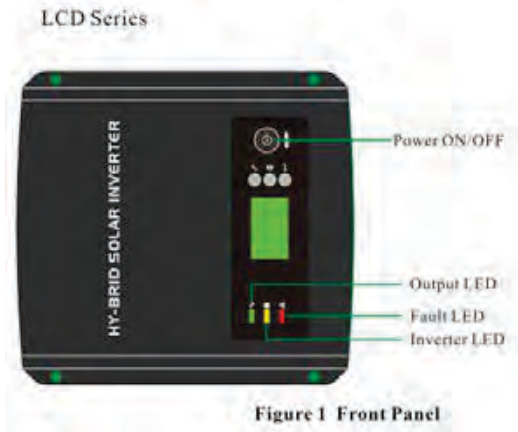
Key features:

- . Automatic line-to-battery switchover
- . Built-in enhanced AC charger
- . Built-in solar charger controller up to 50A
- . Selectable input voltage ranges / AC charging current
- . High efficient DC-to-AC conversion with minimized energy loss
- . Rack design & wall-mounted design for flexible installation
- . Intelligent 3-stage charger control for efficient charging and preventing overcharge
- . Auto restart upon AC recovery
- . User-friendly LCD and LED indications.
- . Multiple protections: low battery alarm, low battery shutdown, over charge protection, overload protection, over temperature protection, short circuit protection

1.1 Product Outlook

1. Front Panel Controls and LED Indications

Shown below are the controls and indicator lights on the front of Digital INVERTER



Power On/Off

Power ON/OFF button is shown as above. Once inverter has been properly installed and batteries have been connected. Press the Power button and inverter will turn on automatically. It works in mains mode or inverter mode according to input AC source's status. When you press this button again, inverter will turn off automatically.

Mains mode LED

The green LED will blink or light steadily when power mains is normal.

Inverter Mode LED

The yellow LED will light when power mains is abnormal. And unit will work in inverter mode.

Fault LED

The red LED will light when fault occurs.

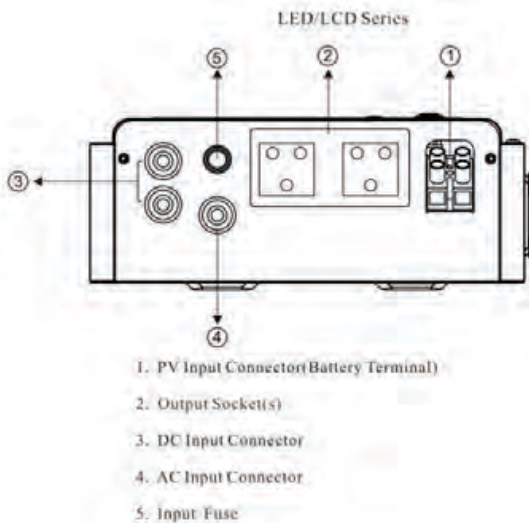
2. Front Panel Controls and LCD Indications

Shown below are the controls and indicator lights on the front of Digital inverter.











3. Rear Panel Description









Shown below are the components on the back of inverter



4. Load level definition

Load level	Load bar indication
 	0%~25%
 	25%~50%
 	50%~75%
 	75%~100%

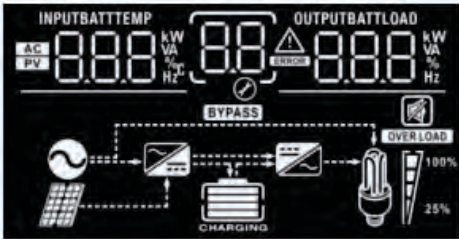
5. Battery capacity definition

Battery level	Battery bar indication
 	Battery voltage <11/22V
 	Battery voltage 11~11.5V/22~23V
 	Battery voltage 11.5~12.5V/23~24V
 	Battery voltage <12.5/25V












6. When in over load status ,the mark  will flicker every 1 second.

7. When the battery is low, the mark  will flicker every 1 second.

8. LCD Display Icons

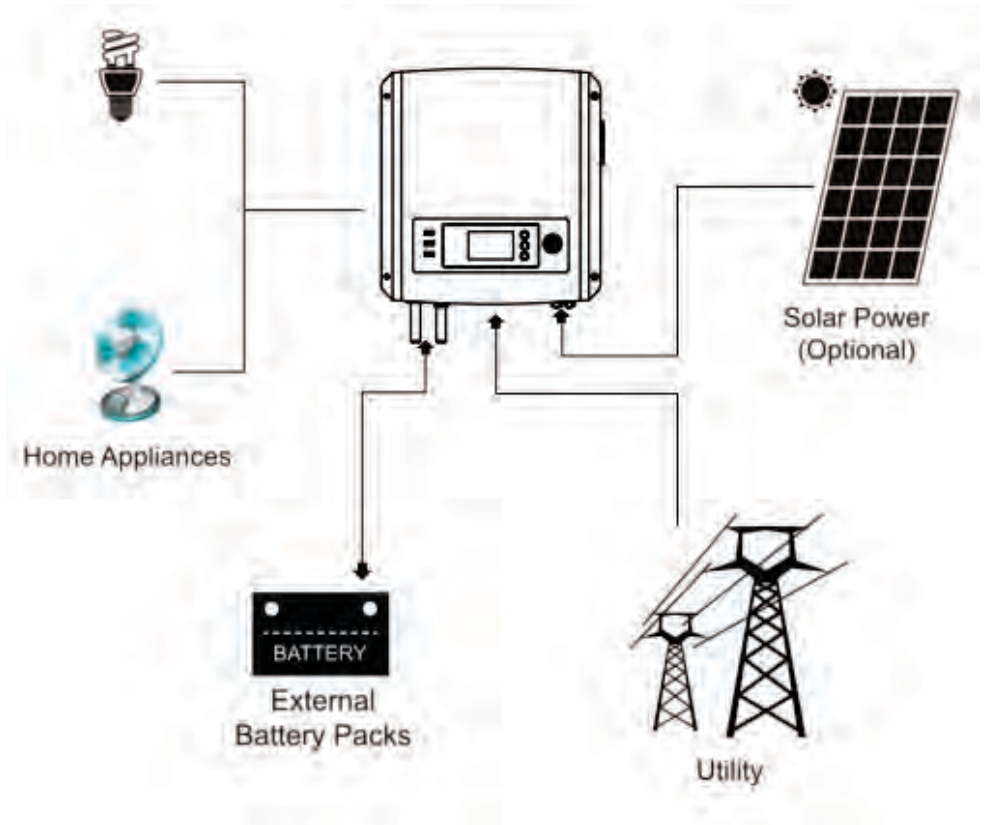


Icon	Function description
Input Source Information	
	Indicates the AC input.
	Indicates the PV input
	Indicate input voltage, input frequency, PV voltage, battery voltage.
Configuration Program and Fault Information	
	Indicates the setting programs.
	Indicates the warning and fault codes. Warning: flashing with warning code. Fault: lighting with fault code
Output Information	
	Indicate output voltage, output frequency, load in Watt
Battery Information	
	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode.

Load Information				
OVER LOAD		Indicates overload.		
  100% 25%	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%
				
Mode Operation Information				
		Indicates unit connects to the mains.		
		Indicates unit connects to the PV panel.		
BYPASS		Indicates load is supplied by utility power.		
		Indicates the utility charger circuit is working.		
		Indicates the DC/AC inverter circuit is working.		
Mute Operation				
		Indicates unit alarm is disabled.		

1.2 Typical Application

A typical application diagram for home and office applications is as shown below. The inverter can accept AC input from AC mains, and is capable of supply various loads such as lamps and appliances.

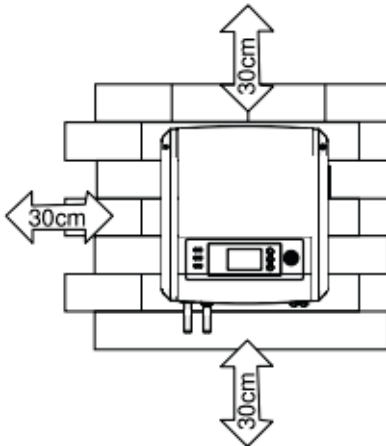


2. INSTALLATION

2.1 Safety Clearance

The minimum clearance to the wall shall be larger than 30cm in order to ensure proper ventilation.

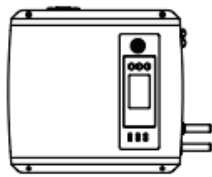
In the event the ambient temperature is high, it's recommended to increase the distance of safety clearance to improve the heat dissipation.



2.2 Mounting inverter on the wall

The inverter is designed to either be placed on horizontal surface or be mounted on the wall with various ways (as shown below). When mounting the inverter on the wall, ensure the following:

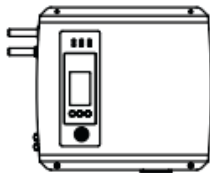
- 1) The wall shall be solid and strong enough to carry the inverter;
- 2) The location of installation shall allow the user to read the LCD easily;
- 3) Two screws shall be firstly fixed on the wall (distance as shown below) so that the inverter can be hung on the screws, recommended screw size is M4*55~65mm.
- 4) After mounting the inverter, make sure it's securely mounted and is stable.



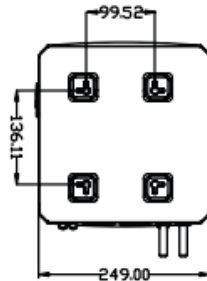
Position 1



Position 2



Position 3



Distance of two screws

2.3 Batteries

Determining the size of the battery:

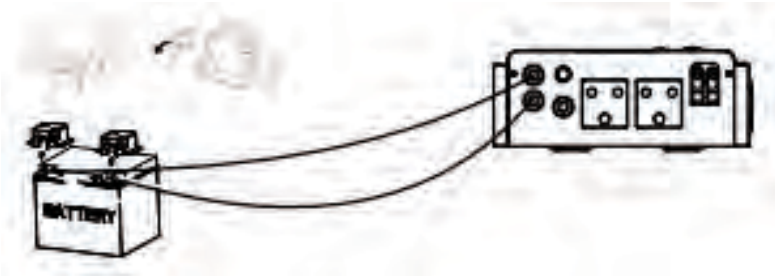
The inverter is designed with pre-set charging current and voltage. Given a fixed charging current, under-sized batteries may shorten the battery life while over-sized batteries may result in unreasonable recharging time.

It's recommended the batteries capacity shall be no less than 100Ah.

Connecting the battery cables:

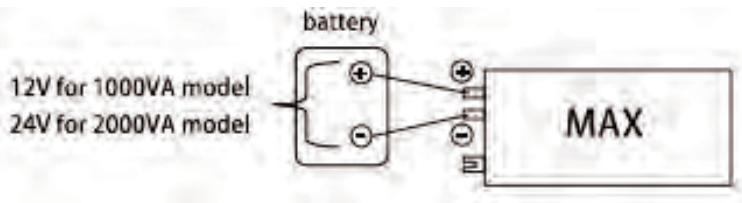
- . The gauge of battery cables shall be no less than 6 AWG with 105 °C rating.
- . No matter how the batteries are connected (in series or in parallel), make sure the cable's terminal voltage is consistent with the inverter's specification (12V for 1000VA and 24V for 2000VA model).
- . It's recommended to cover the battery terminals during the connection.

Check the polarity of cables before connecting to the inverter.
Connect the battery cables to the inverter's battery terminals as shown below.



Connecting with a single battery

Make sure the battery voltage meets the inverter's specification (12V for 1000VA model and 24V for 2000VA model)

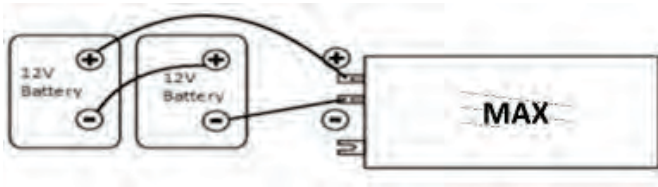


Connecting with multiple batteries:

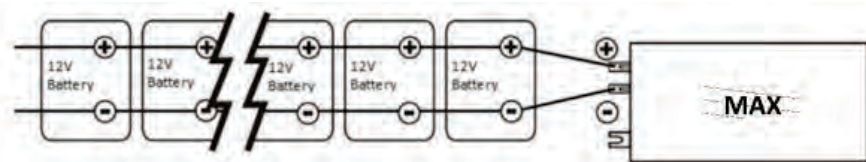


While connecting multiple batteries, use the same brand / type of all batteries. Do not mix the battery bank with different brand / type of batteries.

The user may connect the batteries in series in order to double the voltage connected to inverter. The diagram below illustrates how to connect two 12V batteries in series to make up 24V (for 2000VA model)



The user may connect the batteries in parallel in order to increase the total battery capacity without changing the battery voltage. The example below shows parallel connection of multiple 12V batteries. While the total capacity is times by the number of battery, the terminal voltage remains 12V.



Recommendation:

When the battery capacity $\leq 150\text{AH}$, please select charger current as 15A

When the battery capacity $> 150\text{AH}$, please select charger current as 20A

2.4 PV(solar) string

Selection of PV panel

PV string is a connection of PV panels whose output voltage and current vary under different illumination. And just like the battery, the PV panel can be connected in either series or parallel as required. Please consult the supplier of the PV panel so that the operational voltage and current fall within the allowed range of the inverter as set out in the specification.



Please do not use PV panel which requires one terminal connected to ground (e.g. thin-film panel).

Connecting the PV strings

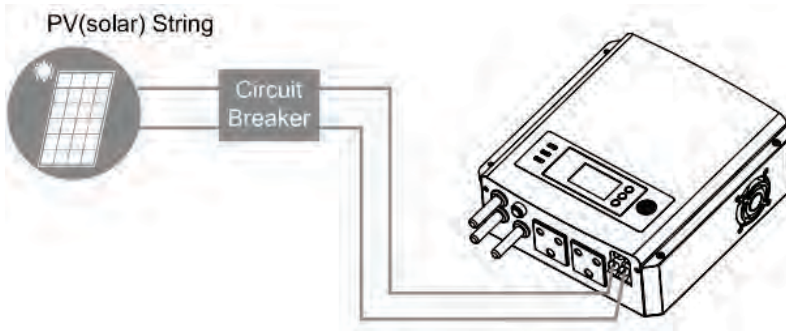


As the PV string generates power as long as illumination exists, a circuit breaker shall be installed between the PV string and inverter so that the power from PV string can be switched off when needed (e.g. regular maintenance).

Recommended PV cable size as below:

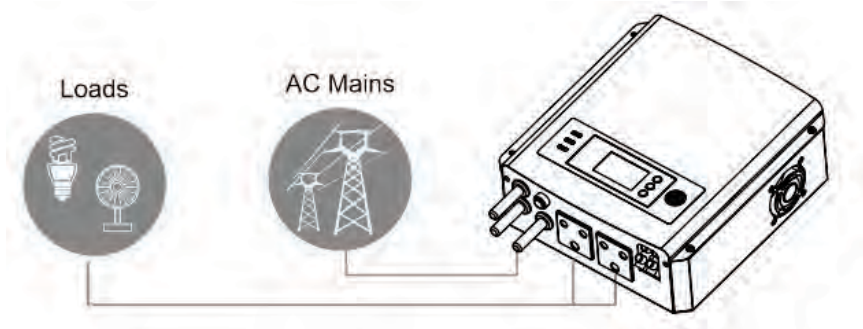
Model	Rated Current	Wire Gauge
1KVA/2KVA	50A	1*10AWG

Connect the cables from PV string to PV input terminals as shown below. Please check the polarity before connection.



2.5 Connect AC input cables and loads

Connect the AC input cables and loads to the receptacles as shown below.



Please note that the inverter's transfer time switching from Line mode to backup mode gets longer as the input voltage lowers. Under the circumstance, connecting the inverter with loads which are sensitive to transfer time (e.g. computer) might result in power interruption.

3. OPERATION

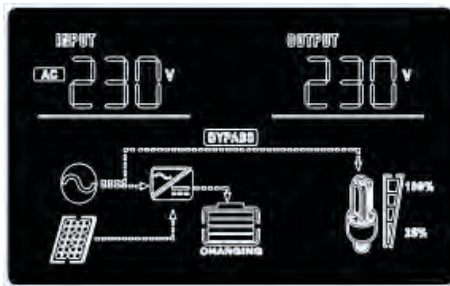
After connecting the batteries, AC input cables, and loads, the inverter is now ready to use.

3.1 Standby Charging Mode

The battery can be charged without switching on the inverter, and such operation is called Standby Charging Mode. When the AC input cable and battery is connected, the inverter will enter into Stand By Charging Mode and LCD will be turned on with the following display.








If the PV string is also connected with enough voltage, the display will be as shown below to indicate the power flow from PV string.



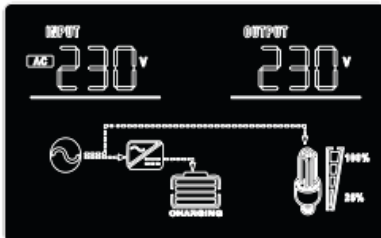
3.2 Operation Modes (after powered on)

Press the Power ON/OFF button to power on the inverter and the inverter will automatically enter into either of the operation modes according to the condition of AC input and PV input as shown in the table below.

	 PV Power present	 Less PV Power	 No PV Power
 AC Input Power Present	LINE MODE 2		LINE MODE 1
 AC Input Power Absent	BACKUP MODE 3	BACKUP MODE 2	BACKUP MODE 1

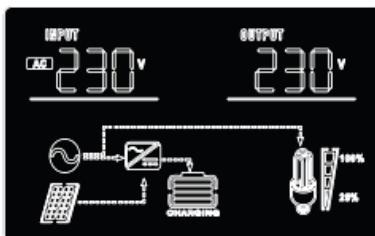
LINE MODE 1

AC input power is present but there is no PV power (e.g. night time). Load is supplied by AC input power directly.



LINE MODE 2

Both AC input and PV input are present. Load is supplied by AC input. Battery is charged both by AC input and PV input.



BACKUP MODE 1

Both AC input and PV input are absent. The backup power to load comes only from the battery. The backup time is determined by the capacity of battery.



BACKUP MODE 2

AC input is absent and PV power is not enough to support the load completely. The insufficient power is covered by battery.



The larger the PV power, the less consumption from the battery and therefore the longer backup time.

BACKUP MODE 3

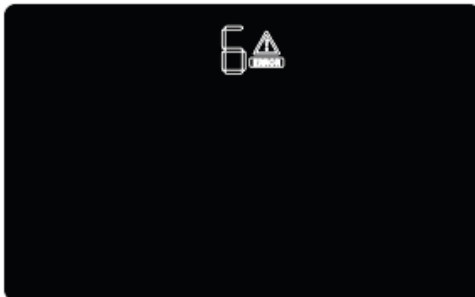
AC input is absent and PV power is strong enough to not only support the load but also charge the battery.



As long as the PV power exists, the load can be powered continuously without consuming power from battery.

3.3 Fault Mode

Inverter enters into Fault Mode when there is a fault event. The fault icon will be shown with a fault code. Please refer to fault code table in "Trouble shooting" section.



4. INVERTER SCREEN DISPLAY AND SETTING

4.1 : Key Definition Description:



Set key



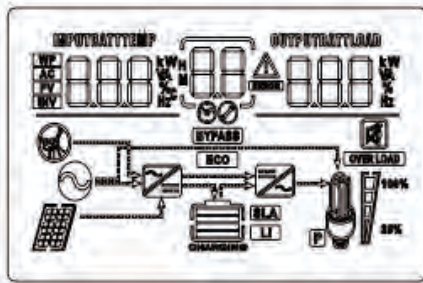
flip key



Enter

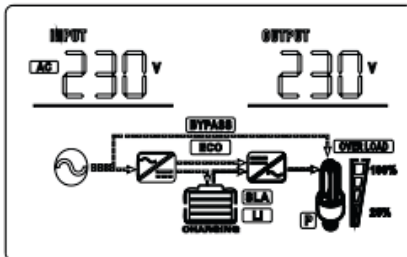
4.2 : Normal operating display page explains:

4.2.1 Reset display page:

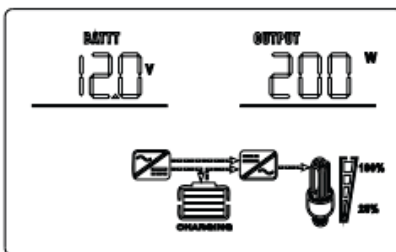


4.2.2 Inverter display page:

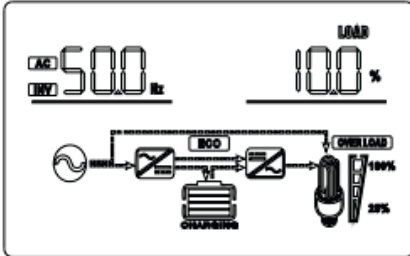
Page 1 displays input/output voltage, press the scroll key to enter the next page:



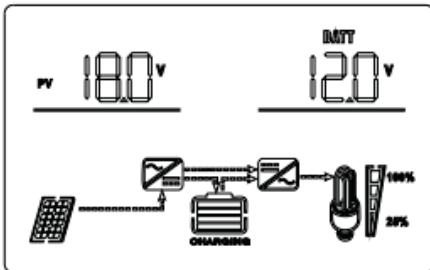
Page 2 displays the battery voltage and load capacity (W), press the scroll key to enter the next page:



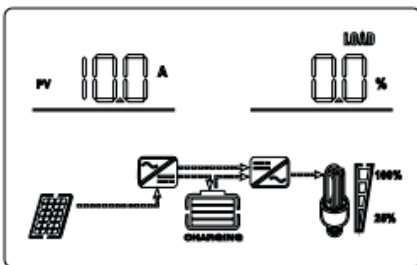
Page 3 displays AC/INV frequency (Hz) and load percent(%), press the scroll key to enter the next page:



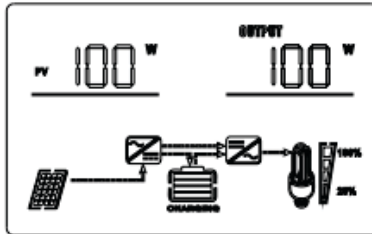
Page 4 displays the p.v voltage and battery voltage. Press the scroll key to enter the next page: (without MPPT controller, no such page display)



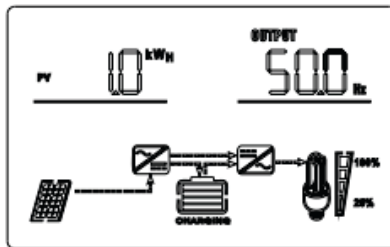
Page 5 displays the p.v current and load percent, press the scroll key to enter the next page: (without MPPT controller, no such page display)



Page 6 displays the p.v power and load capacity(W), press the scroll key to enter the next page: (without MPPT controller, no such page display)



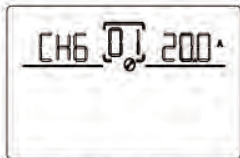
Page 7 displays the p.v power generation KWH and output frequency: (without MPPT controller, no such page display)



4.3 : Mode selection buttons and instructions for use and the page displays:

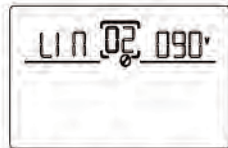
Long press the Set button to enter the setup mode page above 3S, 20S no operating under the Setting page after page to return to work:

Page 1 shows: Setting the charging current display page, default is 20A, after entering the press page key 10A 20A charging current can be set to turn settings press OK to confirm and enter next setting;



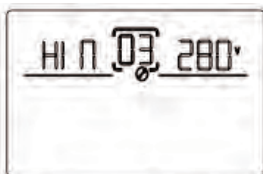
Charge Current

Page 2 shows: Set the low end of the mains voltage switching point, by default , 90V, into the press page key can be set 90V~170V, 10V each one and turn to set the item and press Enter to confirm and go to next entry is set;



Set the low end of the mains switch

Page 3 displays: Set mains voltage high switch point, by default 280W, press the page after entering the key can be set 250V~280V, 10V each one and turn to set the item and press Enter to confirm and enter next set:



Mains switch set high

Page 4 display show: Battery Low Voltage Cut Off Point, by default 10.0V (20V), after entering the press page key can be 9.8V~10.6V(19.6V~21.2V) settings, each 0.1V(0.2V) a and turn to set the item and press enter to confirm and enter next setting;

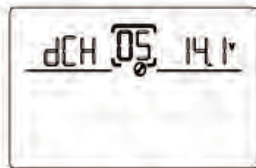


Setting the battery low alarm

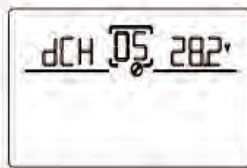


Setting the battery low alarm

Page 5 display shows: Set the battery fast charging pressure point, default is 14.1V(28.2V), after entering the press page key can be 14.1V(28.2V) 14.5V(29V) settings, go to settings press OK key to confirm and enter next setting;

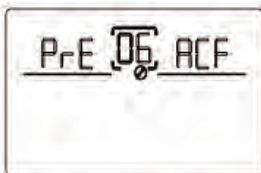


Fast charging voltage set point

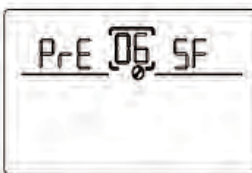


Fast charging voltage set point

Page 6 is displayed: Set Solar priority / Mains priority by default to mains (ACF) first, into the press page key SF ACF can be set to turn settings press OK to confirm and enter next setting;



The solar / mains priority



The solar / mains priority

1. ACF mode, solar inverter and inverter have no relation and work separately;
 - a: No AC, solar charge the battery and battery backup
 - b: With AC, solar and AC charge the battery at the same time, no battery backup.

1. SF model:

a: Without solar input, inverter works normally.

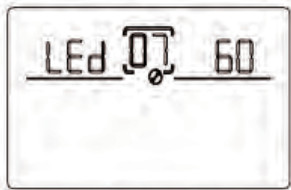
b: Without AC input, solar charges the battery and battery backup.

c: With AC & Solar input:

Battery voltage < 13.6V, solar charges battery, and no battery inversion, load work with AC.

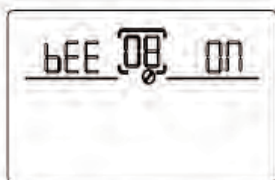
Battery voltage > 13.6V, solar charges battery, and battery backup. No AC charging until battery voltage < 11.5V, it change to AC charging only.

Page 7 shows: Set LCD backlight time, default is 60s, press the page after entering the key can be 0 10 30 60 120 settings, go to settings press OK to confirm and enter next setting;



Setting the backlight time

Page 8 is displayed: Set the buzzer switch is turned on by default (ON), press the scroll key after entering ON OFF can be set to turn settings press OK to confirm and enter next setting;



Setting the buzzer switch

Page 9 is displayed: Set up inverter's output frequency, press OK to confirm and enter next setting;



Page 10 shows: Restore factory settings, enter the ENT, press the Enter key or 20S to exit the setting page. All setting parameters will be restored to factory settings.



After setting the required parameter to complete, long press Set 1S or more settings to save and exit the setting page, if the parameter options are not set long press Set 1S more pages back to work, to be set after page Exit 20S parameters It will be saved.

NO.	Fault mode	Fault code on LCD
1	Overload 1 (Vout < 195V)	FAULT 1
2	Overload 2 (Vout ≥ 195V)	FAULT 2
3	Output voltage RMS low	FAULT 3
4	Output voltage RMS high/Peak output voltage high	FAULT 4
5	Short circuit	FAULT 5
6	Fan locked	FAULT 6
7	Over Charge Protect	FAULT 7
8	BATT LOW	FAULT 8
9	BATT CHANGE	FAULT 9
10	TEMP. HIGHT	FAULT 10
11	CHARGER CURRENT OVER	FAULT 11
12	CHARGER MOSFET BREAK	FAULT 12
13	WR EEPROM ERR.	FAULT 13

5. SPECIFICATION

MODEL		1000VA(800W) 12V	2000VA(1600W) 24V
INPUT	Nominal Voltage	220~240VAC	
	Input Voltage Range	90~280VAC	
	Nominal Frequency	50Hz or 60Hz(Auto Detection)	
SOLAR	Nominal Voltage	18Vdc	36Vdc
	Charging Current	50A±1A max.	
OUTPUT	Voltage	230VAC ±10%	
	Frequency	50/60Hz 0.1Hz	
	Waveform	Modified Sine-wave	
	Efficiency(AC to AC)	>95%	
	Efficiency(DC to AC)	>80%	
BATTERY	Nominal Voltage	12Vdc	24Vdc
CHARGER	Charging Voltage	14.4Vdc	28.8Vdc
	Charging Current	10A/20A±2A max.	10A/15A±1A max.
	Overcharging Protection	16.0V	32.0V
TRANSFER	Transfer Time	15-20ms typical(narrow range); 40ms max(wide range)	
AUDIBLE ALARM	Low Battery Voltage in battery mode	Buzzing every 2 seconds	
	Overload	Buzzing every 0.5 seconds	
	Fault	Buzzing continuously	
ENVIRONMENT	Temperature	0~40℃	

6. TROUBLES SHOOTING

Problem	Possible Cause	Remedy
No LED/LCD display	1. Battery Weak	1. Re-charge battery cable and DC input connection
	2. Battery defect	2. Battery replacement
	3. Power switch is not pressed	3. Press and hold Power switch.
Mains normal but works in inverter mode	1. AC input is missing	1. Check AC input connection
	2. Input protector is effective	2. Reset the input protector
Alarm buzzer beeps continuously	1. Overload	1. Verify that the load matches the capability specified in the specs
Backup time is not enough	1. Overload	1. Remove some non-critical load.
	2. Battery voltage is too low.	2. Charge battery for 8 hours or more.

If any abnormal situations occur that are not listed above, please contact Gentech industries for technical support.

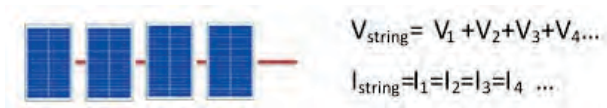
APPENDIX A How to Select and Configure PV Panels

The following parameters can be found in each PV panel's specification:

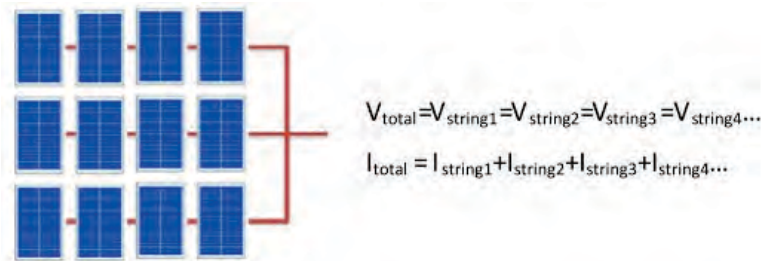
- . Pmax: Max output power(W) . Vmp: max power voltage(V)
- . Voc: open-circuit voltage (V) . Imp: max power current(A)
- . Isc: short-circuit current (A)

PV panels can be connected in series or parallel in order to obtain the desired output voltage and current which meets the inverter's allowed range.

When connecting PV panels in series, the max voltage and current of the string is



When connecting the above PV string in parallel, the max voltage and current of the total string is



In either case, the total output power is $P_{total} = P_{panel} \times \text{Number of PV panel}$

The guideline to select and configure PV string is

- . Ptotal shall be equal or slightly larger than the max. capacity of solar battery charger (600W for 1000VA model and 1200W for 2000VA model), Surplus capacity of PV string does not help the solar charger's capacity and only result in higher installation cost.
- . Total Vmp of the string shall be within the operating voltage range of solar battery charger (18~25V for 1000VA model and 36~50V for 2000VA model are recommended).

- Total Imp of the string shall be less than the max. charging current of the solar battery charger (50A for both 1000VA and 2000VA model)
- Total Voc of the string shall be less than the max. PV input voltage of the solar battery charger (25V for 1000VA, 50V for 2000VA).
- Total Isc of the string shall be less than the max. PV input current of the solar battery charger(50A for both 1000VA and 2000VA model).

Example 1- How to connect 1000VA model to PV panels with the following parameters?

- Pmax: 150W
- Voc:21.6V
- Isc: 9.09A
- Vmp:18V
- Imp: 8.34A

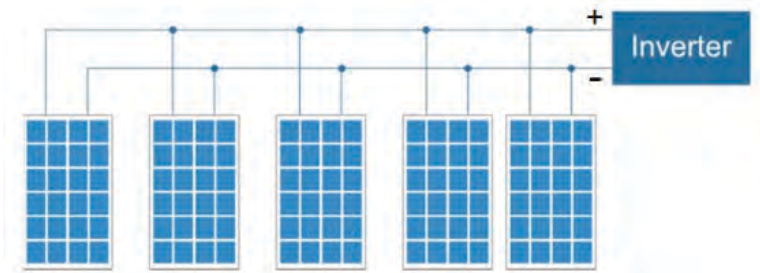
(1) Max.charging current is 50A

$$50A/8.34A = 5.99 \rightarrow \text{max.number of PV panel in parallel is 5.}$$

(2) Operating Voltage Range is 18~25V,

$$\text{One PV panel Vmp 18V is between 18~25V} \rightarrow \text{max number of PV panel in series is 1.}$$

(3) Taking (1)~(2) into consideration, and the optimized configuration is 5 PV panels in parallel, as shown below



(4) Check again the Voc and Isc of PV string,

$$\text{Voc of string is } 21.6V < 25V(\text{Max. PV input voltage}) \rightarrow \text{OK}$$

$$\text{Isc of string is } 5 \times 9.09A = 45.45A < 50A(\text{Max. PV Input current}) \rightarrow \text{OK}$$

Example 2- How to connect 2000VA model to PV panels with the following parameters?

- Pmax: 150W
- Vmp:18V
- Voc:21.6V
- Imp: 8.34A
- Isc: 9.09A

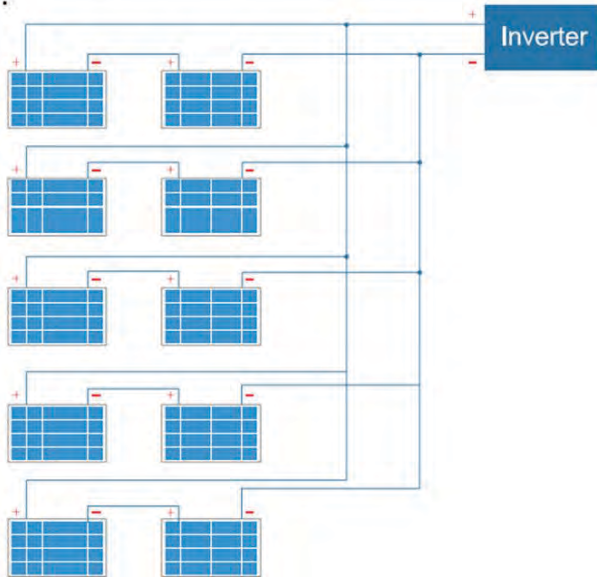
(1) Max.charging current is 50A

$50A/8.34A= 5.99 \rightarrow$ max.number of PV panel in parallel is 5.

(2) Operating Voltage Range is 36~50V,

$2*18V = 36V$ near 36~50V \rightarrow max number of PV panel in Series is 2

(3) Taking (1)~(2) into consideration, the optimized configuration is 2 PV panels in series as a string, and 5 strings in parallel (as shown below).



(4) Check again the Voc and Isc of PV string,

Voc of string is $2*21.6V=43.2V < 50V$ (Max. PV input voltage) \rightarrow OK

Isc of string is $5*9.09A = 45.45A < 50A$ (Max. PV Input current) \rightarrow OK

OK

DISPOSAL

In the event the product reaches the end of its service life, please contact the local dealer for disposal instructions.



The product must not be disposed of with the household waste.



Disposal of the product at the end of its service life shall be done in accordance with appliance disposal regulations for electronic waste.



1|YEAR

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