Single Phase Grid Tie Inverter

User Manual

Contents

1. Safety Introduction

This user manual contains very important safety instruction and operation guide, please read it, understand it, follow it along installation and maintenance and keep it well for any time check.

Before installation：

Double check the inverter without damage, any question contact the dealer freely without hesitation

Installation：

To keep the safety, please follow the manual steps. And please keep attention that both ends of the inverter with electricity, DC input and AC output;

Switch off state grid：

Switch off the state grid and PV DC input before operating the inverter, to make sure that the inverter is switched off, and using the multimeter to double check the equipment is without voltage, and the equipment can be work again till waiting for minimum 5 minutes.

Maintain and revised：

Only the authorized staff can repair and revised the inverter. To keep the safety, please use equipment from the original manufacture. If the equipment not comes from the original, it should be have the certification of EMC and so on

Function and safety date:

Without the permission of the state grid and original manufacture, change inverter data is not allowed

When you use this product, please keep in mind the safety method to avoid the fire, electricity or shock or the equipment damage.

Warning: Ensure solar PV string output voltage is lower than inverter maximum DC input range, DC voltage from PV string higher than inverter DC input range will result in serious damage on inverter or other loss, and this damage will not be in warranty condition, also inverter supplier is not responsible to it.

Warning: Only inverter professional staff can open the inverter case for maintenance! And this job must be under processed only when state grid and DC input are completely disconnected with inverter.

1.1 Installation Preparation

The installation, maintenance or check of this inverter, can be only finished by qualified technicians who must be qualified as below:

1) Authorized and well trained technician.

2) Must wear safety suit, insulating gloves, safety hat, protective glasses and face mask etc.

3) Emergency measures can be done if needed.

1.2 Warning Tips

1) Do not touch inverter outside interfaces along installation or operation to avoid contacted with current which may result in serious damages or death.

2) Do not operate this inverter when the case is open to avoid electric shock or electricity charging outside the inverter.

3) Do not operate this inverter if wet hand to avoid short circuit.

4) Do not open this inverter case when switch on / off the inverter, please stop operation or wait for the inverter completely powered off if you must need to open this inverter case.

5) Do not open this inverter case unless you have to or you need to do product routine check. Please wait for at least 10 minutes after inverter to ensure it is powered off if you do connection or routine check.

6) Do not put any heavy item on inverter wirings, which may result in wiring insulation failed.

7) Stay inverters away from inflammables which leads to fires if it is too close to inverters and power off inverters and contact us immediately if gets fire.

8) Cut off power from solar panel strings and stop inverter AC output immediately if inverter encounters fault to avoid getting fire.

9) Do not touch inverter in 10 minutes since inverter is powered off as it is still hot

10) Stop power input when inverter or components get damaged which may result it electric shock.

11) Avoid any screws, metals, water or oil stay in inverter which may result in fire.

1.3 Guide

1) Logistic

   ◆ Please choose proper logistic based on inverter weight

   ◆ Please confirm inverter proper outlook

   ◆ Please do not open inverter case along shipment, and do not drop, shake or beat inverter as its inside structure is very complicated

2) Usage

   ◆ Inverter auto operation function is based on inverter basic set, inverter will be auto operated if operation voltage is higher than its rated voltage.

   ◆ Please press off key on inverter to let inverter stop working

   ◆ Please manually switch on inverter after damaged components is replaced

   ◆ Please do not change inverter inside structure

   ◆ Please set necessary data again before doing initialization, once inverter is initialized, all data will be changed accordingly

3) Troubleshooting

   Install emergency brake to avoid inverter damage or out of control

4) Maintenance and Repair

   Inverter does not execute large scale test control circuit which may result in damage or loss, to check inverter, please follow below guide in this user manual

5) Disposal

   Treat as normal industry waste

1.4 Installation Tips

1) Please follow this user manual along installation process

2) This inverter can be installed either inside or outside

3) Keep this inverter away from humidity, powder, high temperature or direct solar radiation

4) If inverter is installed inside, the inverter safety space from up to down should be minimum 20CM.

5) If inverter is installed outside, the inverter safety space from bottom should be minimum 1M.

6) Installation direction must follow the standard showed in this user manual

7) This inverter requires 3 level grounding (220V，grounding resistance should be lower than100Ω）and special 3kinds (400V，grounding resistance is lower than 10Ω）。

8) Avoid putting any other electric appliances near to inverters which may result in product abnormal and noise.

9) Please cut off power and be careful of the wirings before installing the inverter

10) Before installing inverter, please install a solar panel (DC) breaker，and keep solar panel power off to avoid fault happens to inverter

1.5 Wiring

1) Must have professional staff to do wirings and check

2) Do wiring after inverter is installed

3) Wrong wiring will result in inverter failure

4) Wrong power polarity (+/-) will lead damage or accident to inverter

1.6 Operation Adjustment

1) Please follow this user manual guide along operation test

2) Ensure inverter has proper display from LCD

2.Product Introduction

2.1 Product Confirmation

Please ensure this inverter matches your requirement from the specification stick on inverter side or specification from inverter carton.

2.2 Prepare Installation Equipment

Make sure all needed installation materials or tools are ready.

2.3 Installation Environment

Please ensure inverter has got right installation direction, proper environment before installation

2.4 Circuit

Connect power sensor into circuit board, wrong connection will result in damages on inverter, please pay attention to polarity "+ -".

2.5 Product Feature

1) High Efficiency

Inverter has high efficient power invert ability, IGBT semi conduct and 96% high efficient motor.

2) Digital Control

Digital control can reach convenient, high speed and high efficient control through inverter LCD display, keyboard and dynamic icons including Input, Output, Back or Stop etc and inverter can automatically power on or off based on high sensitivity to solar panels.

3) MPPT Maximum Power Point Tracking

When un-balanced current happens, inverter will have MPPT to track solar panel maximum power efficiency under different temperature, humidity or other ambient condition.

4) Easy Parallel

Inverters can be connected in parallel when solar panels quantity is increased

5) Easy Installation and Operation

You can connect the inverter with solar panels by following inverter LCD guide, and also check solar power system working status through inverter LCD display

6) Low Noise

This inverter has the best components which reach lowest noise under the worst condition

7) Remote Monitoring System

We can success in monitoring inverter output power, working status, temperature and ambient conditions through internet communication and data collector

8) Inverter Specification

Model	GrandSolar TL1000	GrandSolar TL1500	GrandSolar TL2000	GrandSolar TL3000	GrandSolar TL4000	GrandSolar TL5000	GrandSolar TL6000	GrandSolar TL8000	GrandSolar TL10000
DC Input									
Max.DC Input Power（KW）	1100	1600	2300	3200	4200	5400	6500	8700	10900
Max. DC Input Voltage (V)	500VDC								
Max. DC Input Current	9	10	11	13	21	26	28	43	50
MPPT Voltage Range（Under Rated Power）	180-500VDC								
MPPT #	1	1	1	1	1/2				
Power On/Off Voltage	70-100VAC								
AC Output									
Power	1000W	1500W	2000W	3000W	4000W	5000W	6000W	8000W	10000W
Voltage Range	Rated ±40V								
Rated Voltage	AC110V / AC230V								
Frequency	50HZ / 60HZ								
Phase	Single phase								
Power Factor	1.0								
Max. Current	5A	7A	9A	14A	18A	23A	27A	36A	45A
THD	@ Rated Power and Pure Since Wave< 3.5%								
Max. Efficiency	98.5%								
EU Efficiency	98%								
MPPT Efficiency	99.90%								
Structure									
Waterproof	IP65/NEMA 4X						IP20		
Cooling Method	Natural Cooling						Forced Fan		
Noise	<50db								
Communi-cation	RS 232C (/WIFI Module Optional)								
Insulation	Non-insulated								
Standby Power	0W								

| Protection								
Inverter	Over Input Voltage, Output Short Circuit, Over-heat, Over-load							
State Grid	Anti-island(IEEE1547), State Grid Over/Low Voltage, High/Low Frequency							
General								
Size(W*H*T) MM	360*338*130	360*338*130	360*338*130	410*338*150	430*410*180	460*410*180	610*535*240	810*535*240	810*535*240
G.W(KG)	10.8KG	12KG	15KG	16.5KG	16.6KG	22KG	24KG	26KG	30KG
Interface	MC4								
Working Amb. Temp.	Air Flow, -10℃~40℃（50℃）								
Storage Temp	-25℃~60℃								
Relative Humidity	0~100%								
Environment	No flammable Gas, Corrosive Gas, Oil, Dust, etc								
Altitude	3000M								

3.Installation

3.1 Inverter Working Scheme
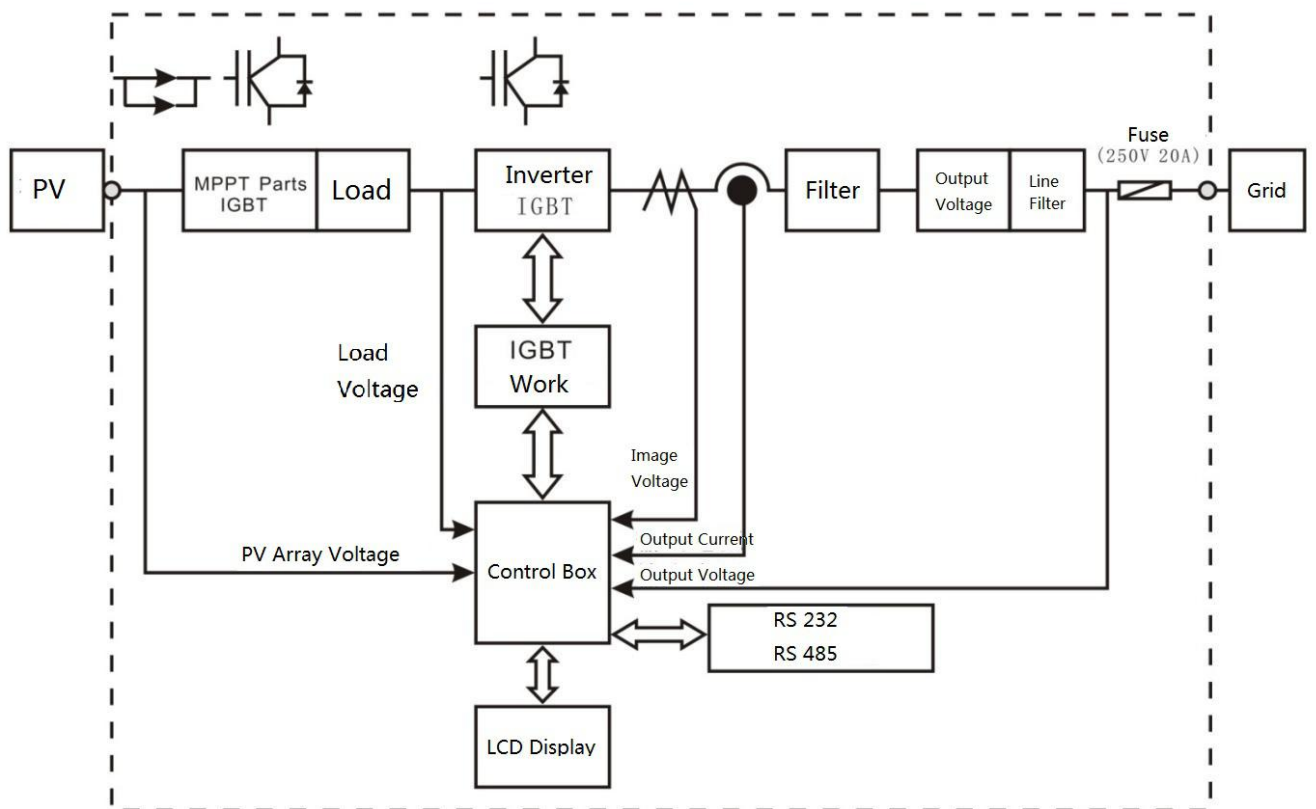
1) Installation Conditions Need to be Met

◆ Inverter is indoor product, please do not install outside, as inverter life mostly depends on the surrounding environment .the surrounding temperature please do not more than or below (10～40 ℃)

◆ Please avoid high temperature and humidity environment .（Relatively humidity below 90%，and do not cling drew）.

◆ Inverter is installed in place where there is no vibration.

◆ Inverter is a high temperature heating device; the non combustible material is used.

◆ Enough space is required for the installation, to make sure that the inverter can be fully heat dissipated

◆ Please store it without oil mist, flammable gas, fiber particles, dust, water, etc, with the specified size to install to fix the button.

◆ Inverter should be installed in a well-ventilated location

3.2 Inverter Connection Interfaces

You can see below inverter main board interfaces when you open the inverter case, please follow this guide when you do wiring connection
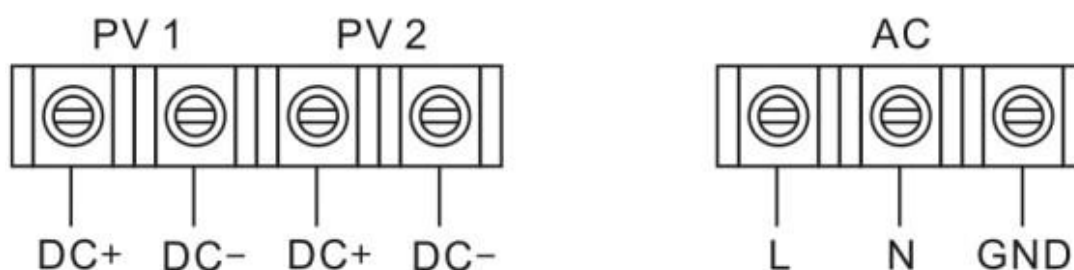
Icon	Interface Name	Explanation
PV1,2[+]	PV Power Input +	Connect to Solar PV Panel Strings
PV1,2[-]	PV Power Input -	Connect to Solar PV Panel Strings
L	Grid Power	Inverter Connect to Grid Power
N	Grid Power	Inverter Connect to Grid Power
GND	Grounding	Inverter to be grounded

Note：

Please connect PV string "-" to inverter "-", and PV string "+"to inverter "+", different inverter

will have different polarity design, please follow installation guide.

Any wrong connection between solar panels and inverter will result in damage on inverter, and please contact inverter supplier if any damages happen.

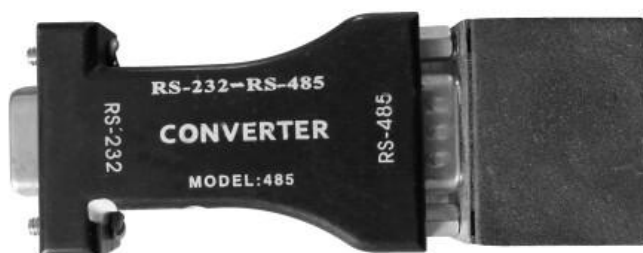1) Keyboard with Communication Interfaces RS232 and RS485,

A. RS232   B.RS485

(Is dangerous to touch any metal part on these interfaces!)

C. If you need RS485, you need an interface converter between RS232 / RS485

RS485/RS232 Converter

3.3 Wiring

1) Main Board Wiring

When input power is ready, connect the positive contact (PV) [+] and negative contact (PV [-]) on inverter, and then get input power connected, wrong connection will damage the inverter.

Please double check wirings when encounters wiring problem, and please wait for couple minutes to operate the inverter as there is still electricity in inside inverter even the inverter is powered off.

◆ To avoid electricity leakage, inverter must be 3-class grounded, and resistance is no less than 10Ω

◆ Inverter should be grounded by grounding interfaces instead of screws

◆ Better use thicker wiring, and connection point should be as near as possible to inverter

2）Please use wirings thicker than below suggestion:

Inverter input wiring([+],[-],L-1,L-2)，wiring interface screw details as below:

Inverter Appliance		Screw	(Kgf·cm) Screw Torsion	Wire*c2 Wiring mm²
1Ø,220V	1.5～3KW	M4	15	4.0
	5KW	M4	15	6.0
	10KW	M4	15	10.0

Note 1：

Screw terminal torsion shall be adjustable; too lose torsion will result in short circuit, and too tight

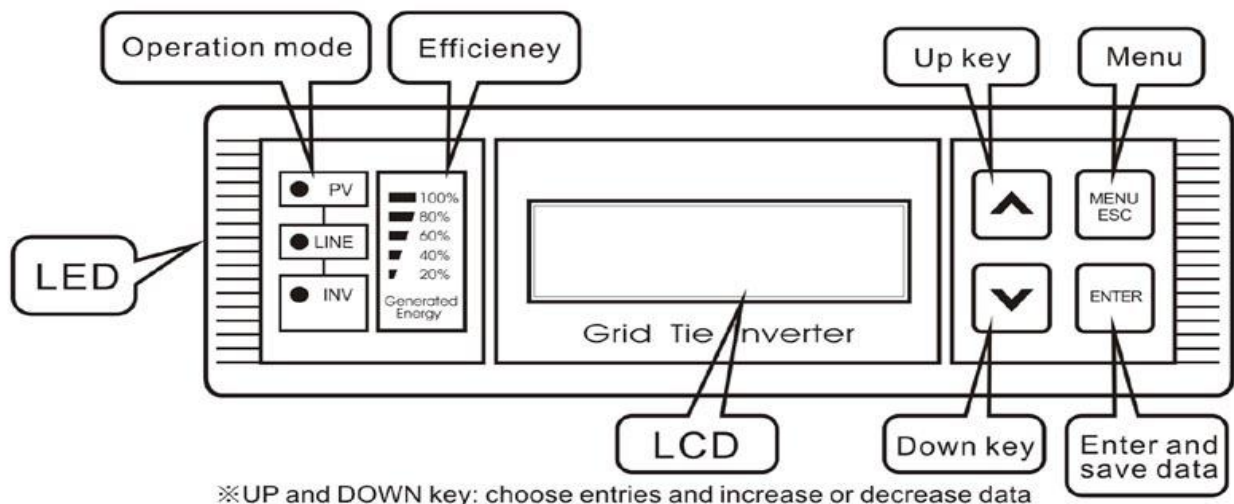will result in terminal damaged or inverter fault.

Note 2：

Capacity	Grounding Diameter(mm²)
1.5～3kW	4.0
5KW	6.0

Please use copper wirings >600V/75℃

4.Operation

4.1 Keyboard Function Explanation

1) Keyboard Outlook

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2) Key Function and LED Display

Keyword	Explanation
Menu /ESC	Installation menu display model "Access" or "Back"
∧ (Up Key)	Go up in the menu
∨ (Down Key)	Go down in the menu
Enter	From sub-menu to main menu Select from sub-menu data setting, data saving

LED Status	Contents
PV	Status display (green light on, solar PV power input is normal)
LINE	State grid status display (green light on, state grid power is normal)
INV	Inverter operation status display (green light on, inverter works normal, red light on, inverter works abnormal)

LED Indict Total Harvest Power	Explanation
100%LED	When rated 81-100%，100% display，when below rated 90%，100% LED glitter
80%LED	When rated 61-80%，80% display，when below rated 70%，80% LED glitter
60%LED	When rated 41-60%，60% display，when below 50%，60% LED glitter
40%LED	When rated 21-40%，40%display ,when below 30%，40%LED glitter
20%LED	When rated 5-20%，20% display，when below 10%，20%LED glitter

4.2 Basic Display Mode (2 Line 16 Characters, LED Display V2.4)

1) When inverter is working, click "∧" or "∨" for checking below data including solar PV input voltage, current, frequency, total power, daily average power, rated power, summit power and DC voltage.

```
Run         0.0kW        RD
PV           --V         0.0A
```

```
Run         0.0kW        RD
--HZ         --V         0.0A
```

```
Run         0.0kW        RD
Total                    ---kwh
```

```
Run         0.0kW        RD
One day                  ---kwh
```

```
Run         0.0kW        RD
Today                    ---kwh
```

```
Run         0.0kW        RD
 Peak       ---kwh
```

```
Run         0.0kW        RD
Vdc          --V         --℃
```

4.3 Specification Setting

No one can change inverter factory setting or initialize it without inverter supplier permission.

5.Function

5.1 Function Table: Power Control System Function Table

Selection mode	Parameter	Range	Delivered value [Unit]
Operation set (Operation parameter)	Rated PV vtg.	200～400	200 [V]
	Fault high vtg.	5～20	11 [%]
	Fault low vtg.	5～20	13 [%]
	Fault high freq	0.3～5.0	0.6 [%]
	Fault low freq.	0.3～5.0	0.6 [%]
	Maximum current	80～120	110 [%]
	Overvoltage	450～500	500 [V]
	Line tran. time	10～500	310[sec]
	Total power	0～9999999	0 [kWh]
Calibration set (Control value proofreading)	PV1 vtg. Gain	90.0～110.0	100.0 [%]
	PV2 vtg. gain	90.0～110.0	100.0 [%]
	PV1 cur. gain	90.0～110.0	100.0 [%]
	PV2 cur. gain	90.0～110.0	100.0 [%]
	Vdc vtg. gain	90.0～110.0	100.0 [%]
	Ripple ctr gain	0～500	0[%]
	Line vtg. gain	90.0～110.0	100.0 [%]
	Line cur. gain	90.0～110.0	100.0 [%]
	Cur. ctl. gain	20～500	100.0 [%]
	Anti-ISD speed	10～100	36
	Rated voltage	100～240	220 [V]
	Rated power	1.0～10.0	3.0 [kW]
Selection set (Operation condition)	Auto-run mode	Auto mode / Manual mode	Auto mode
	Multi PV mode	Parallel mode / Multi-string	Parallel mode
	Operation mode	Line connection / Stand alone	Line connection
	Line frequency	60Hz /50 Hz	60Hz
	Baud rate	2400/4800/9600/ 14400/19200	9600[bps]
Initialize	Parameter init.	It initialized all parameters by factory delivered value.	
	Fault init.	Past, information of fault state is all deleted.	
Fault scan		It can get information that fault state of 100kinds.	
Etc. set	ID number ID	0～999	0
	Switching freq.	10.0～20.0	17.0 [kHz]
	Fault count No.	1～10	2

5.2 Function Explanation

1) State Grid Monitor

The state grid voltage status is decided based on state grid different conditions (high fault VTG, low fault VTG)，the inverter working status depends on this data too. If state grid frequency voltage in the selected range is higher than wiring fault frequency, inverter will stop. If state grid power is in normal situation, the solar power will be connected into state grid, and state grid power voltage and frequency can be installed by following the selected frequency range.

2) MPPT Control and Total Power Harvest

Solar PV panel power output fluctuates based on ambient temperature, humidity, solar radiation or MPPT (Maximum Power Point Tracking and etc. MPPT is very good for small current ripple. It tracks solar panel voltage, inverter will stop if solar panel power generation is not enough, and inverter also can memorize total generated power.

3) Initialization and Repair

◆ When inverter stops working, there will have mark from left side in line 1, and have reminding for re-start in SET from LED display. The inverter will re-start if pressing SET.

◆ This inverter will store 10 repair message ranking from 0 to 9, and will re-start from 0 if more repair messages happened, you can press $\triangle, \triangledown$ to check repair message record.

◆ When inverter stops, you can adjust data from keyboard. Initialization can initialize inverter setting and repair record. Initialized data is based on factory setting.

4) Fault Explanation

◆ Inverter system will shut down the inverter if encountering over-voltage from solar panel.

◆ Inverter system will shut down the inverter to avoid over-heated if encountering over-current from solar panel.

◆ Grounding fault

◆ Wiring fault

◆ Inverter system will stop output if encountering abnormal state grid based on inverter anti-island, state grid over-voltage, system low-voltage, over-frequency function.

◆ Inverter will stop if there is DC output.

◆ Inverter will stop if the fuse in output interface is damaged.

6. Protection and Repair

No.	Problem	Mark	Cause	Troubleshooting
1	Input overvoltage	Over voltage	solar panel voltage is over regulated voltage	Operate inverter after finishing checking the solar panels. If the inverter still cannot operate, please contact service center.
2	Output over current	Over current	When inverter output is over current state	Check if it is short circuit or operation factor. If the inverter still cannot operate, please contact service center.
3	Output overload	Over load	Inverter's rating electric power is abnormal	Check if it is overload or operation factor. If the inverter still cannot operate, please contact service center.
4	Inverter overheat	Over heat	Excess85℃of inverter internal temperature	Put the inverter in cool place. If the inverter still cannot operate, please contact service center.
5	Ground connection singularity	Earth fault	Leakage of electricity	Check the ground connection and insulation of wire. If the inverter still cannot operate, please contact service center.
6	Grid abnormity	Line Failure	Abnormity of grid power	Check if the grid power is abnormal or not. And if it comes from the grid power When does not re-operation, inquire to service center
7	Fuse cut off	Fuse Open	Inverter output terminal fuse melts and is cutoff.	Check if the grid power is abnormal or not. And if it comes from the grid power When does not re-operation, inquire to service center