

KSTAR

KSG-1K/1.5K/2K/3K-SM

Solar Inverter

User Manual

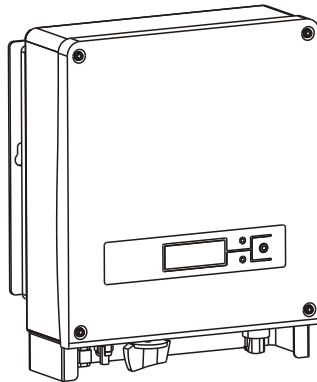


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1 User Guide



It is appreciating that you purchase single-phase grid-connected inverter produced by our company. The product is non-transforming type inverter, features reliable performance and advanced technology. It converts DC currents from solar arrays into AC currents then fed to municipal Electrical Grid.

This manual contains important safety and operational instructions that must be accurately understood and followed before operating the products.

Please refer to this manual once there is any problem during installation or operation. Please contact your local distributors or agent if not recovered by yourselves.

Thank you again for using our products, please read this manual completely and hope you are satisfied with our products.

Please retain this manual for future reference.

2 Safety Instructions



1. Electric Shock

The product has alternating current (AC) and direct current (DC) connections, in order to avoid any electric shocks during maintenance or before installation, please make sure the disconnection of these AC or DC ports, grounded for solar system and inverter.



2. Operation of Inverter

The product can be only operated or maintained by professionals. The inverter can only be activated under such situation: the housing or cover in good condition without any damages, all screws are tightened in right positions.

Before opening the inverters, it must be disconnected with solar array and Grid. In order to discharge completely from storage capacitance, you can't touch the inverter within at least 5 minutes after disconnection.



3. Requirement for Grid Connections

These inverters are only used for supply power for municipal power grid, and don't try to connect any other energy resources with this inverter.



4. High Temperature Protection

During normal operation period, some parts (such as cooling fins and cover) is heating. Sometimes it will reach 60°C. Please don't touch these parts to avoid scald.



Only qualified electricians are allowed to operate on the inverter.

Only qualified electricians are allowed to install the inverter.

Do not carry out any wiring and inspection or changing components when the power supply is applied. Hazardous voltages may still be present in the inverter even if the AC and DC main switches are switched off. Wait at least 5

minutes after switching off the inverter. This ensures that the capacitors are electrically discharged.



This product can cause a d c current in the external protective earth conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is strongly recommend to used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product;



Must be grounded before operation.



Ensure the proper grounding of the inverter, otherwise, improper connection or no grounding may cause stop of the inverter.

Ensure reliable installation and electrical connection.

When the photovoltaic generator cells are exposed to light (even if it is dim), the generator supplies DC voltage to the inverter.



The recommended solar modules need to comply with IEC61730 Class A rating.

The grid-tied solar inverters are only for crystalline silicon solar modules.



In order to protect the PCE, user and installer, external DC and AC circuit breaker shall be equipped at the end-use application;

The wiring shall be according local electric code. Choose proper cable for power input and output lines. Input and output cable shall be PV private cables suitable for outdoor use.



Only qualified cables under the local electrical safety laws and regulations are allowed to connect.

3 Product Warranty

If you like to extend your warranty period, you can apply for it and keep up warranty card well. The maintenance is free of charge during warranty period. The packing material should be original or similar material when the defective inverter is returned back to factory for repairing.

This product is guaranteed to cover all shortage or damage due to design, production, or components. But the warranty doesn't cover the followings:

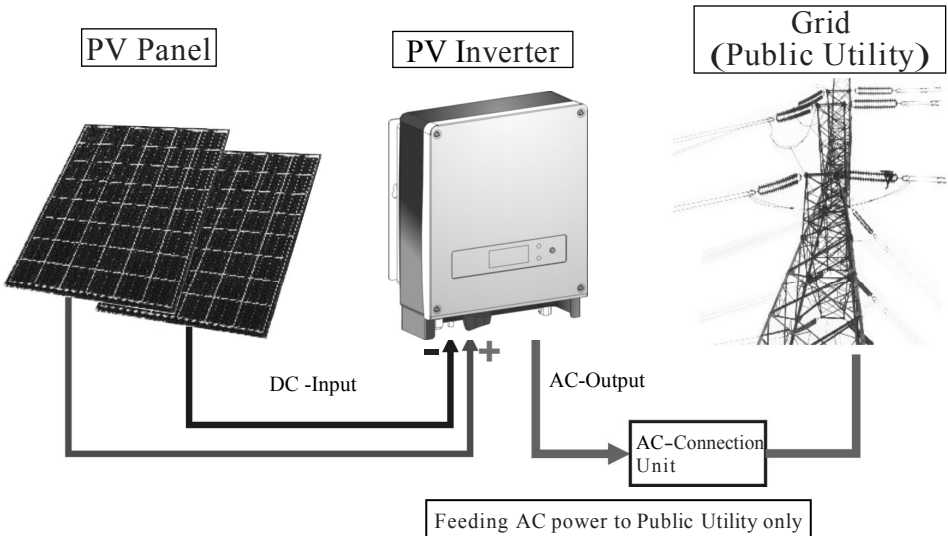
- * Beyond warranty period
- * No effective warranty card and product's series number
- * Damage caused improper delivery
- * Damage caused improper installation, unauthorized modification, maintenance, or test, etc.
- * Damage caused by working in terrible environment which is not complied with stipulations in this manual
- * Damage caused not comply with installation and operation range in relative international standards or regulations
- * Damage caused by unnatural environment

4 Overview

4.1 Introduction of Grid-connected System

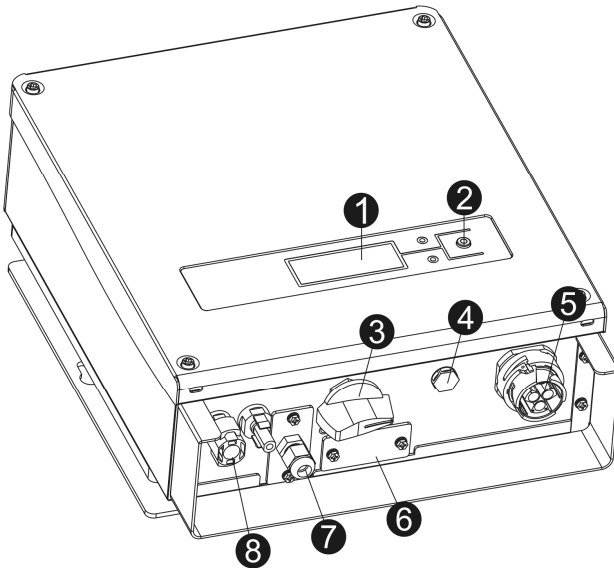
Basically Grid-connected system is comprised of 4 portions: PV array, PV inverter, AC connection unit and Public Grid connection unit.

Once PV arrays receive sun shines, they will generate DC current and feed into PV inverter which is configured between DC input and municipal AC grid. Through converting DC into AC, the solar energy is transmitted into municipal Electrical Grid.



4.2 Brief Introduction of PV Inverter

The inverter converts DC current from solar units into AC current, and feeds to Municipal Electrical Grid. The inverter is designed and produced as per relative requirement of laws and regulations. The shape and functions of relative parts is described as follows:



+

- | | |
|--------------------------|--------------------|
| 1 . LCD display panel | 5 . AC output port |
| 2 . LED & Button | 6 . RS232 port |
| 3 . DC-Switch | 7 . RS485 port |
| 4 . Waterproof air valve | 8 . DC input ports |

1. LCD display panel: display working status and power efficiency etc information.
2. LED and button: 2 LED indicates current working status, 1 button is used to switch current LCD display information.
3. DC-Switch.
4. Waterproof air valve : To balance the internal and external atmosphere.
5. AC output ports: The equipment is connected with municipal Grid through these ports. Please refer to “installation” section to make clear of connection diagram.
6. RS232 port: By this interface, user can use computer to communicate with the equipment. There is water proof cover to protect RS232 connectors.
7. RS485 port : To realize single inverter or multiple communications via RS485 port or optional WIFI data logger.
8. DC input ports: Inverters have 2 pairs of DC ports, each pair of input ports have positive (+) and negative (-) connector. Please identify the positive and negative position by refer to “installation” section.

4.3 Features Description

- * Beautiful shape design, easy installation
- * Convenient maintenance, easy operation
- * High transfer efficiency
- * High MPPT, Max MPPT>99.5%
- * High reliability
- * Rich Man-Machine interface, LCD display and LED indication
- * Standard RS232 connection and optional RJ45 communication
- * Outdoor IP65 protective level

5 Installation

5.1 Packing

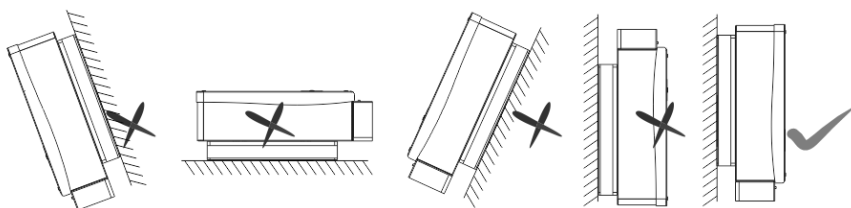
Please check carefully before opening the package of the equipment. It may cause the inverter damage in case the packing material is found damage, please contact with forwarder for claim. If necessary, Please feel free to contact us.

5.2 Installation of Inverter

Please read the following installation instruction before you start your work so as to achieve best effect of the inverter.

1. In order to keep long life of inverter, the installation site should be always kept dry.
2. Select suitable location to install the inverter, where is not so easy for pedestrian to touch, but consider easy installation and easy maintenance as well.
3. Make sure the inverter should be kept at least 30CM away from other stuff.
4. Don't directly expose the inverter under the sun light; high temperature will affect the inverter's working efficiency. When the temperature keeps below 40℃, the inverter will be in best Working status, the life of inverter will be maximum.
5. Keep good ventilation so as to reduce heat accumulation
6. Once installing inverter in living environment, don't mount it in plastics plate or wooden plate to avoid noise, it is better to mount it on the wall.
7. The inverter generates heat during normal working status; don't install it on flammable objects or near the place to store flammable materials. Don't install it near potential explosion area.

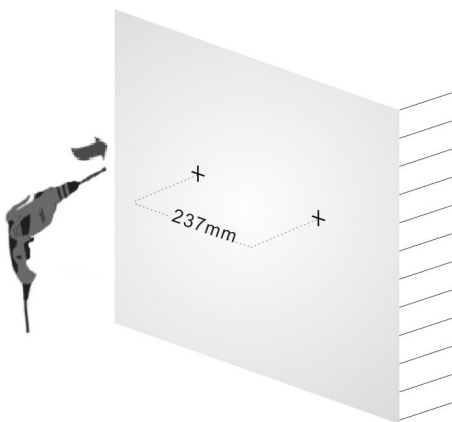
5.3 Installation Location



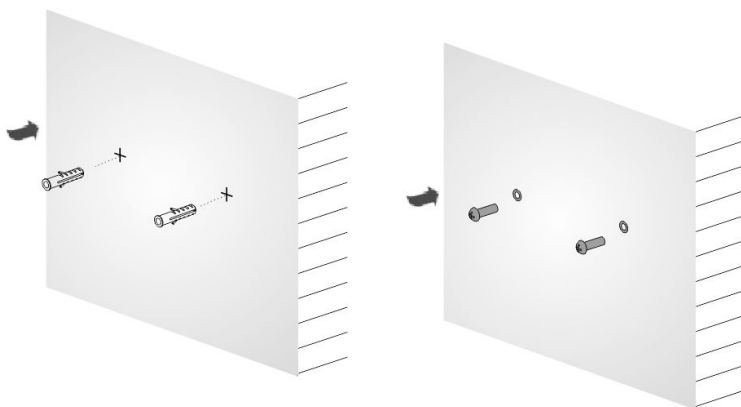
1. The inverter is suitable to be installed on vertical wall as shown above.
2. Don't install inverter on forward tilt wall.
3. Don't install inverter on horizontal wall.
4. Mount the inverter at height same as eyesight for easy operation and data reading.

5.4 Installation Procedure

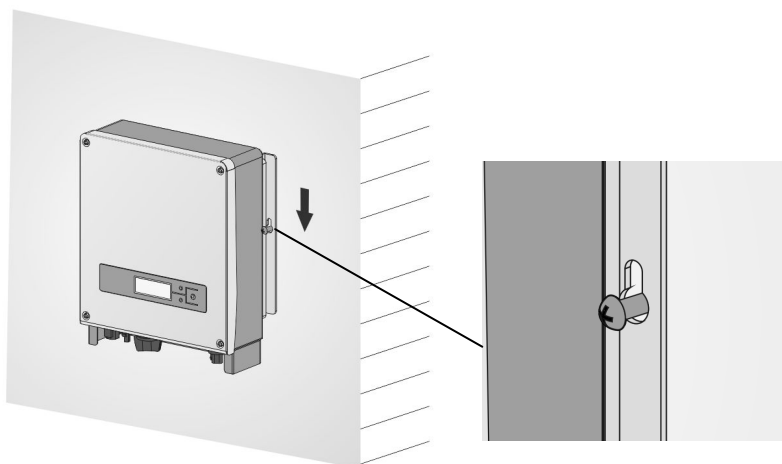
1. Use $\Phi 10$ driller kit to drill installation holes as per below picture. Please follow it exactly.



2. Clean the dust inside the holes, and insert expansion pipe into the holes. then turn the screw into the expansion pipe. The distance between nut and wall should be 10mm atleast.

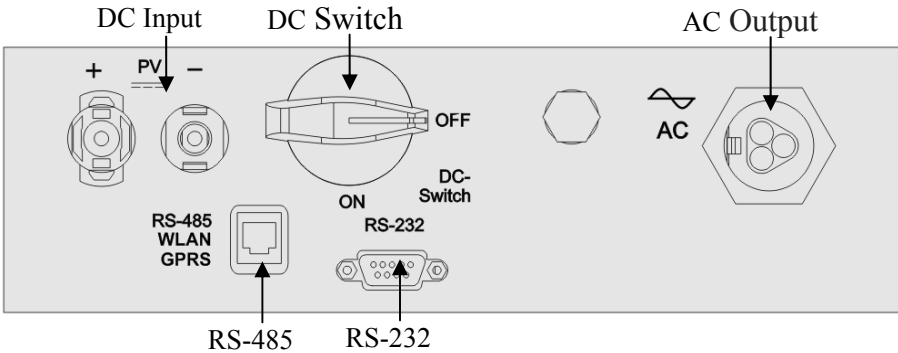


3. Hang the inverter onto screws(from top to bottom), and check both sides and keep the inverter in right position, then tighten screws as shown in following pictures.



5.5 Wiring

Remove wiring cover in the inverter, you will see below shown connection ports:



DC Input	Connector for DC input, the polarity sequence is positive, negative (+,-). Please find label with polarity markers.
RS-232	RS232 communication interface
DC Switch	To connect or disconnect “+” and “-” of PV array input.
RS-485	RS485 can be connected with PC via RS485/RS232 adaptor, or connected with monitoring software via a data logger in the form of daisy chain.
AC Output	Connector for AC output, they are L, N and PE lines

Attention:

1. The wire connection can only be done after the inverter is fixed in proper position on the wall.
2. Make sure the Max. open circuit voltage and short circuit current of solar arrays are not exceeded the stipulated range of the inverter.
3. Select the inner diameter of 12AWG (4mm²) and the outer diameter of Φ6mm of the photovoltaic cable as the connecting line of the PV input terminal. Select the inner diameter of 12AWG

(4mm²) and the outer diameter of Φ13mm of the photovoltaic cable as the connecting line of the AC output terminal. Cables should avoid high temperature, flame and rain water whenever possible.

4. During connecting the inverter, make sure no connection among AC, DC and any power resources. They also can not be connected when any accident occurs.
5. Identify the polarity of wires and connection ports first, then connect the inverter with solar arrays and municipal Electrical Grid.



- Only qualified cables under the local electrical safety laws and regulations are allowed to connect.

Miniature circuit breakers

It is recommended strongly to install circuit breakers or fuses at the DC input and AC output to ensure safe installation and running.



- In order to protect the PCE, user and installer, external DC and AC circuit breaker shall be equipped at the end-use application;
- The wiring shall be according local electric code. Choose proper cable for power input and output lines. Input and output cable shall be PV private cables suitable for outdoor use.

Table: Miniature circuit breakers specifications

Model	DC input	AC output
	Recommended DC breakers	Recommended AC breakers
KSG-1K-SM	800V/16A	16A
KSG-1.5K-SM	800V/16A	16A
KSG-2K-SM	800V/16A	16A
KSG-3K-SM	800V/16A	16A

Table: Wiring cable specifications

Model	DC input	AC output
	Recommended DC cable	Recommended AC cable
KSG-1K-SM	2.5mm ² -4mm ²	2.5mm ² -4mm ²
KSG-1.5K-SM	2.5mm ² -4mm ²	2.5mm ² -4mm ²
KSG-2K-SM	2.5mm ² -4mm ²	2.5mm ² -4mm ²
KSG-3K-SM	2.5mm ² -4mm ²	2.5mm ² -4mm ²

5.6 Connection Procedure

1. Connection with Municipal Electrical Grid

First disconnect with municipal Grid by breaker, make sure it will not be connected again even due to accident. Put the terminal of L, N, and PE into the port which is with mark. Then take the plug to the inverter

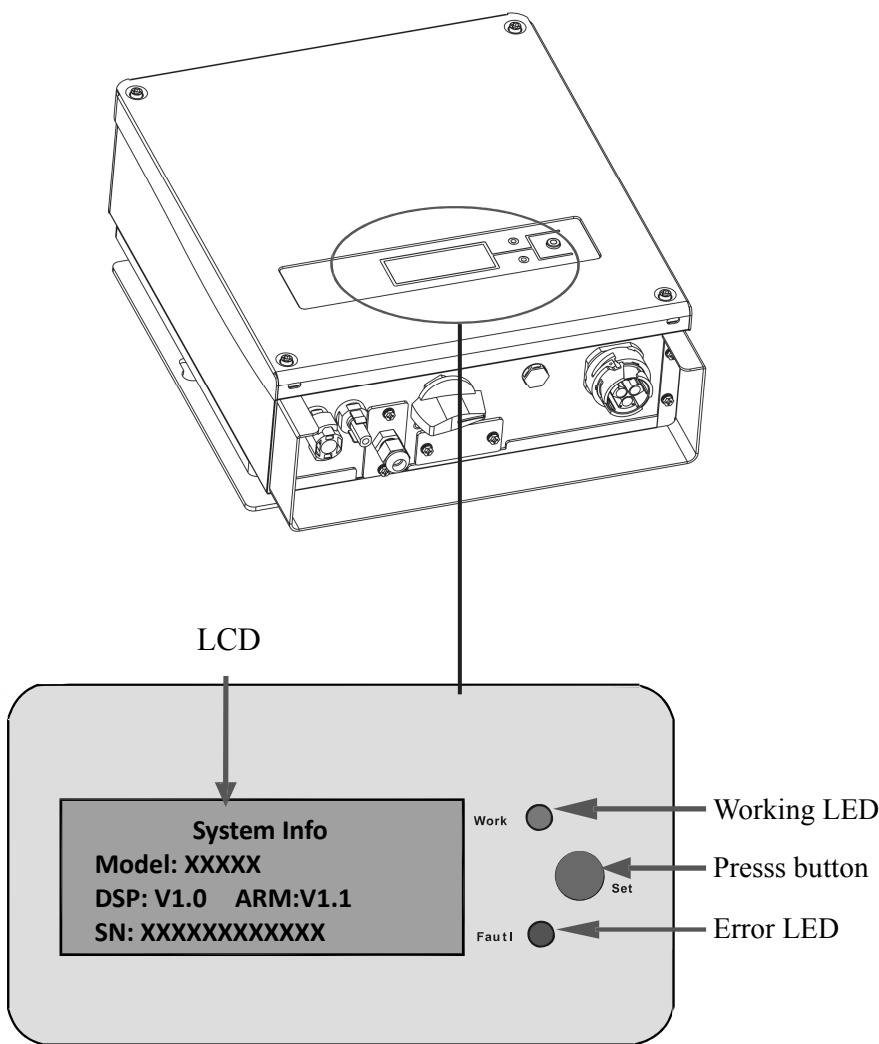
2. Connection with Solar Array

In order to guarantee installation and operation of system safety, external manual breaker has to be configured at DC side. The selection of breaker should meet basic current and voltage capacity. Meanwhile, disconnect AC current first before disconnect DC units.

Before connect the inverter with solar Arrays, test max series voltage of solar Arrays, whose value should not be over max input voltage of inverter. Meanwhile the short current of solar Arrays is better not to exceed max DC current. Please check the polarity of solar Arrays before the connection.

The positive of solar Arrays should be connected to positive port in the inverter and the negative of solar Arrays should be connected to negative port in the inverter.

6 Operation of Grid-connected Inverter



6.1 Trial Operation

The inverter can be activated only after the following inspections are well executed:

1. Correct connection for AC cables.
2. All solar arrays are connected with the inverter correctly.
3. Tighten all screws.
4. Turn on the breaker between DC and AC.
5. The inverter will automatically get started once PV arrays generate enough voltage.

6.2 Working Status

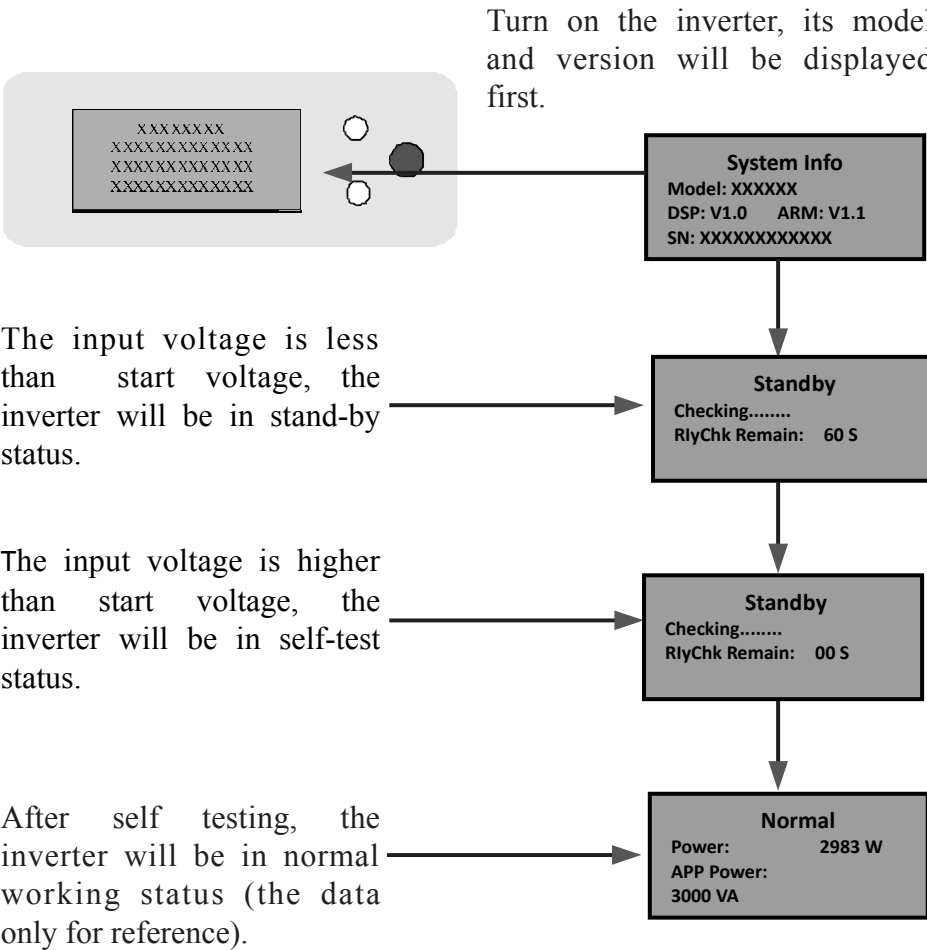
Working status is divided into 3 kinds: normal working status, faulty status, and termination status.

1. Normal Working Status

There are two modes: standby status and running status for this stage. Under this mode, the system is running in normal status. Meanwhile tracking all functioning data to keep the system running in its best status.

Once PV array's voltage is less than start voltage, the inverter will be in standby status, at this period the inverter starts to run and all test functions get ready, but it doesn't feed power to municipal Electrical Grid. When PV array's voltage is higher than start voltage, the inverter will transfer to running status after self test, and meanwhile start to feed energy to municipal Grid.

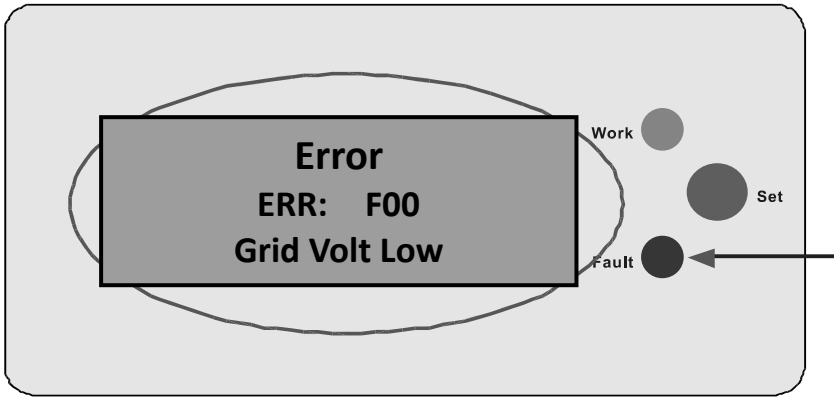
The following example shows the process when PV voltage is increased from 120V:



Attention: Before connecting to DC, please make sure input positive (+) and negative (-) connections are correct, otherwise the component of inverter will be damaged, which may cause the inverter in abnormal operation status.

2. Fault Status

Inverter is always under intelligent monitoring condition after it gets started. It will become faulty status when any fault occurs (such as municipal voltage is overload, frequency is over range) or components failure. The faulty information can be displayed by LCD, at that time the red LED is on.



3. Termination Status

When the output voltage from PV array is lower than a certain threshold, the inverter will be in termination status. All LCD or LED light will be off, and no energy from inverter fed to municipal Grid. Meanwhile no energy consumption for inverter itself, any actions on the keys (buttons) are invalid.

6.3 LED Display

In the front panel, here are 2 LED displays: RED light and GREEN light. Under normal working condition, GREEN light keeps on. The display functions of these 2 LED lights are as follows:

Working (GREEN light): it will be on during normal working status. But it will be off during night time when no current is from solar Arrays.

Error (RED light): it will be on when fault alarm occurs or components failure. If you like to realize more error information, please refer to below chapters.

6.4 LCD Display

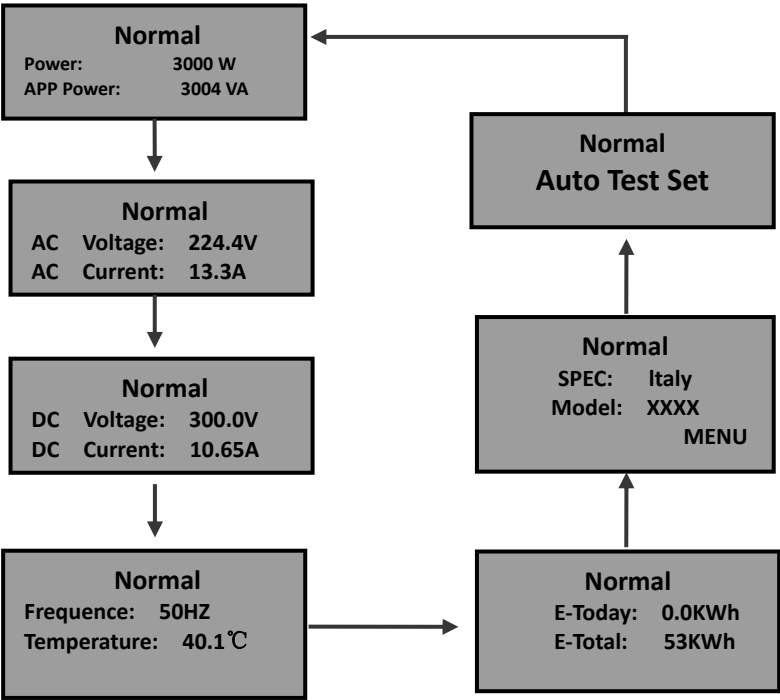
1. Button and Back Lighting Operation

There are two types of button press, short time press means pressing the button less than 0.5 second, and long time press means pressing the button more than 1 seconds. The short time press is used for page up, moving the cursor; the long time press is used for locking the screen, selecting item, setting and returning to upper menu.

The LCD back lighting will be turned off 180 seconds after the latest button press operation. To lighten the LCD back lighting, please press the button again.

2. Working Mode Display

When the inverter is running in working mode, the short time button press can change the LCD display. What the LCD will display when you press the button is showed below.



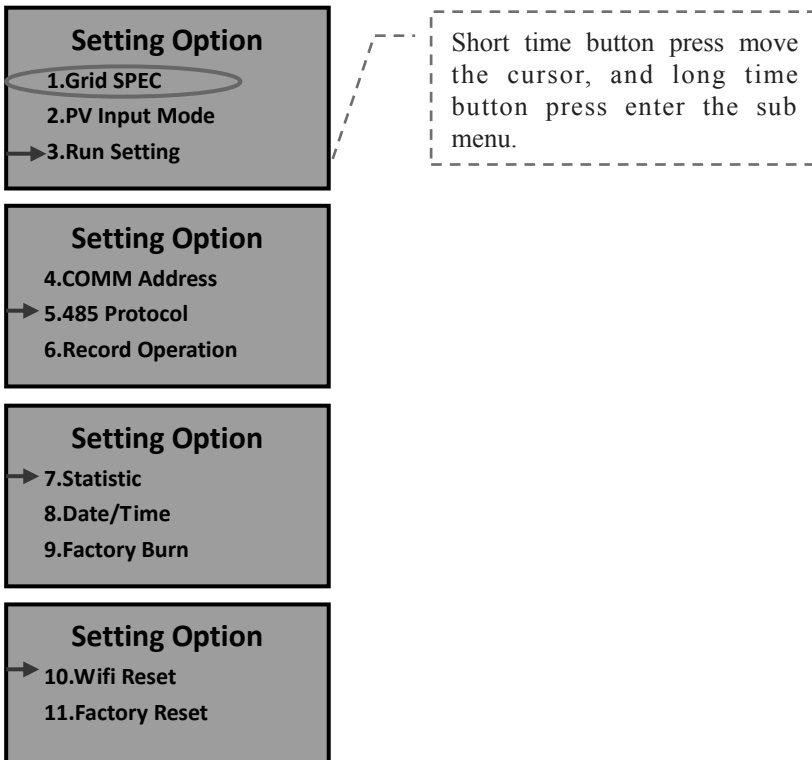
If there is long time button press happened when the display stays in some page, then this page of display will be locked. In the same way, long time button press can make a page of display switch between lock and unlock status. The LCD display will return to the first page “Power & Etotal” automatically if there is no any button press operation for a long time and the LCD is not in lock status.

“Auto Test Set” display page will only be shown when the inverter is set to “Italy” mode.

3. Setting Mode Display

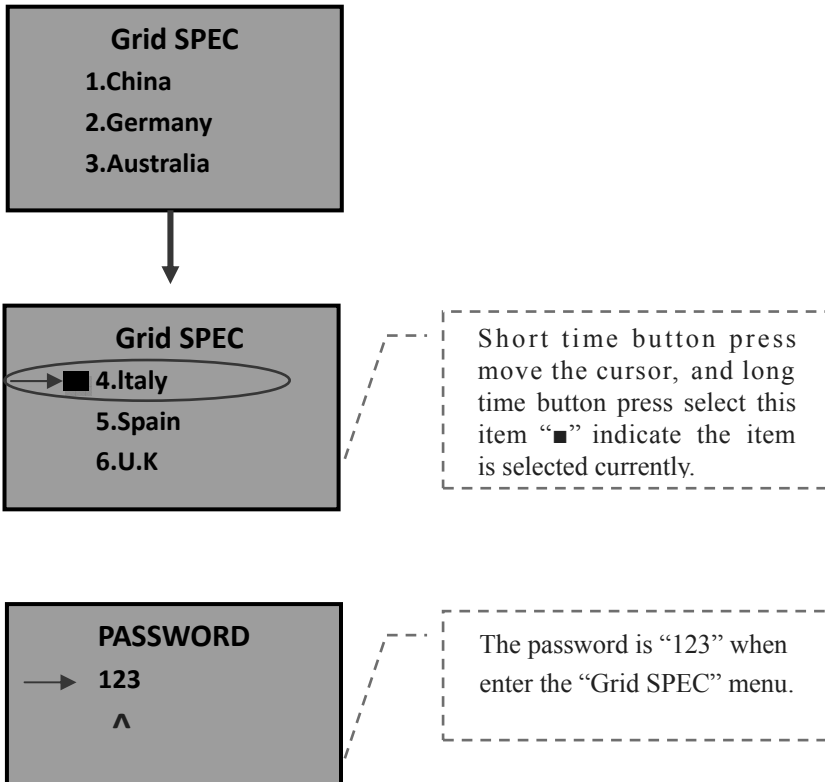
The inverter could enter the setting mode by long time button press when "MENU" showed on the LCD. The long time button press can make the display return to the upper level menu or exit the setting mode ,when the cursor point to the title of a page(top line of the page).

● Setting Main Menu

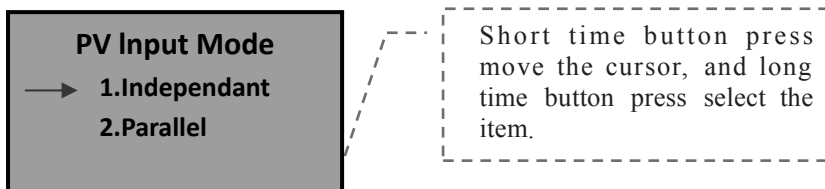


● Grid Specification Setting Sub Menu

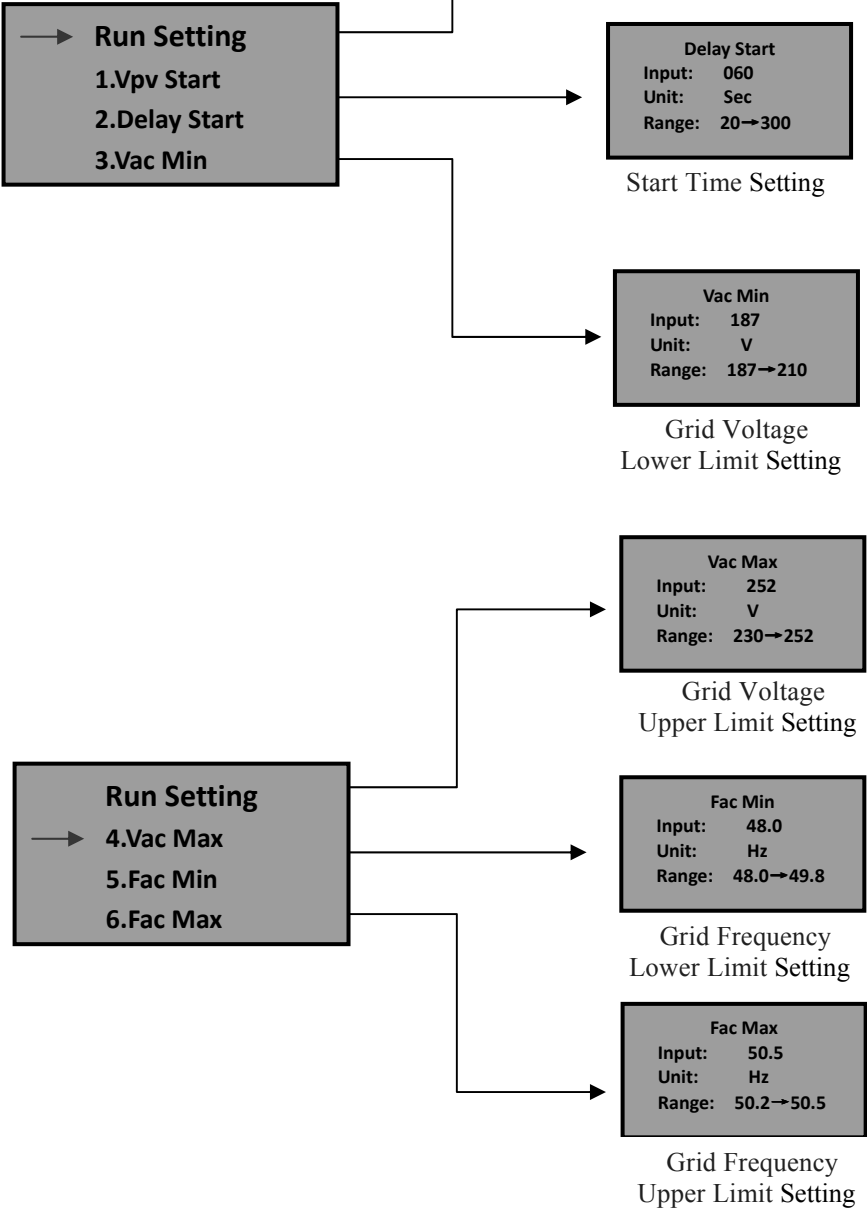
Attention : Please check the LOCAL of inverter grid specification (Table9.2) whether meet the actual requirement and reset if not !

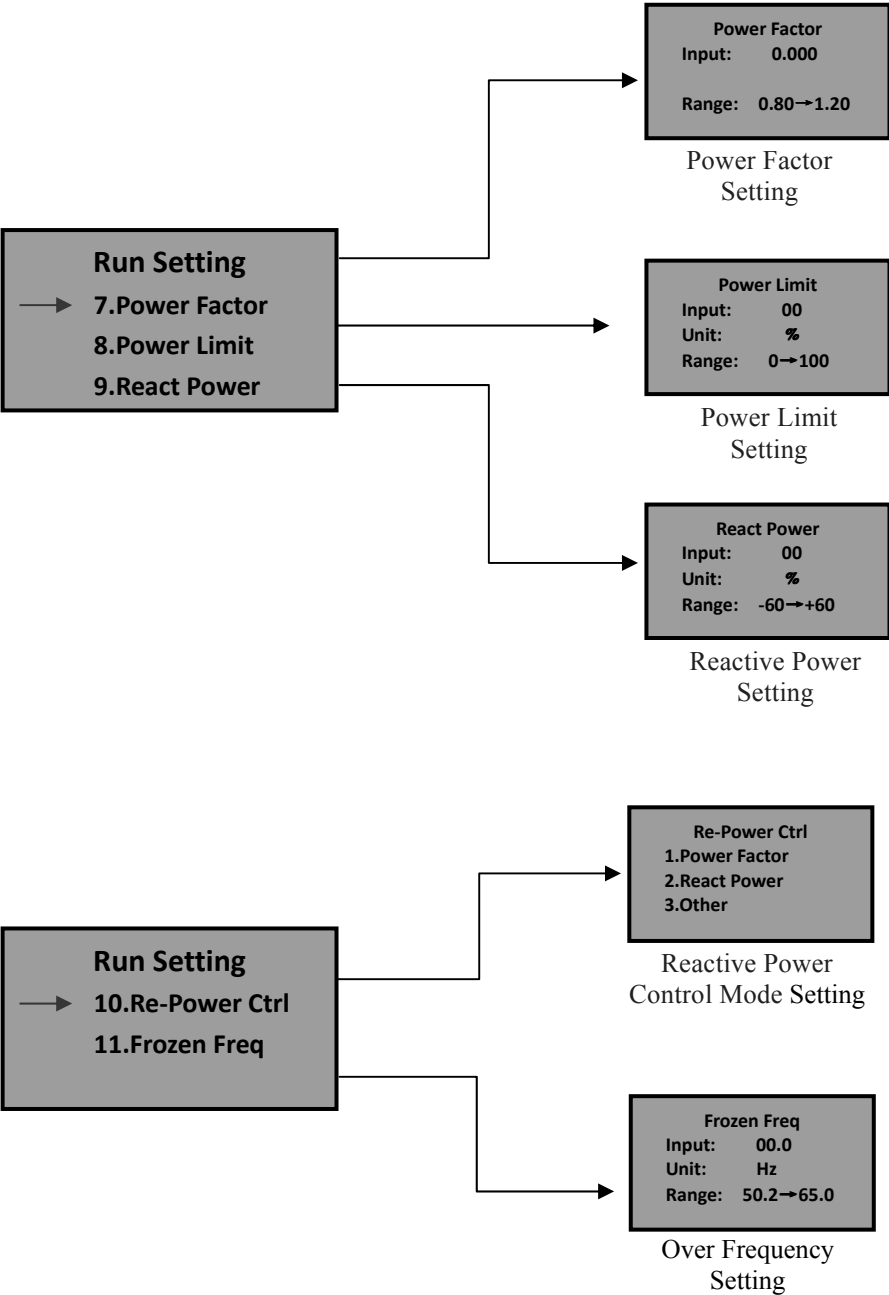


● PV Input Mode Setting Sub Menu

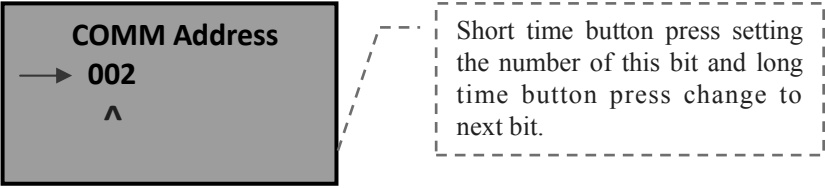


● **Run Setting Sub Menu**

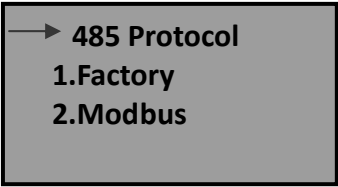




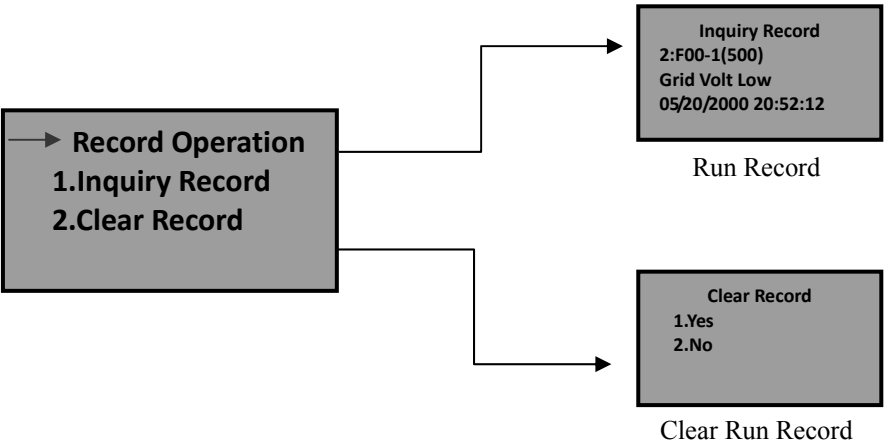
● **485 Address Setting Sub Menu**



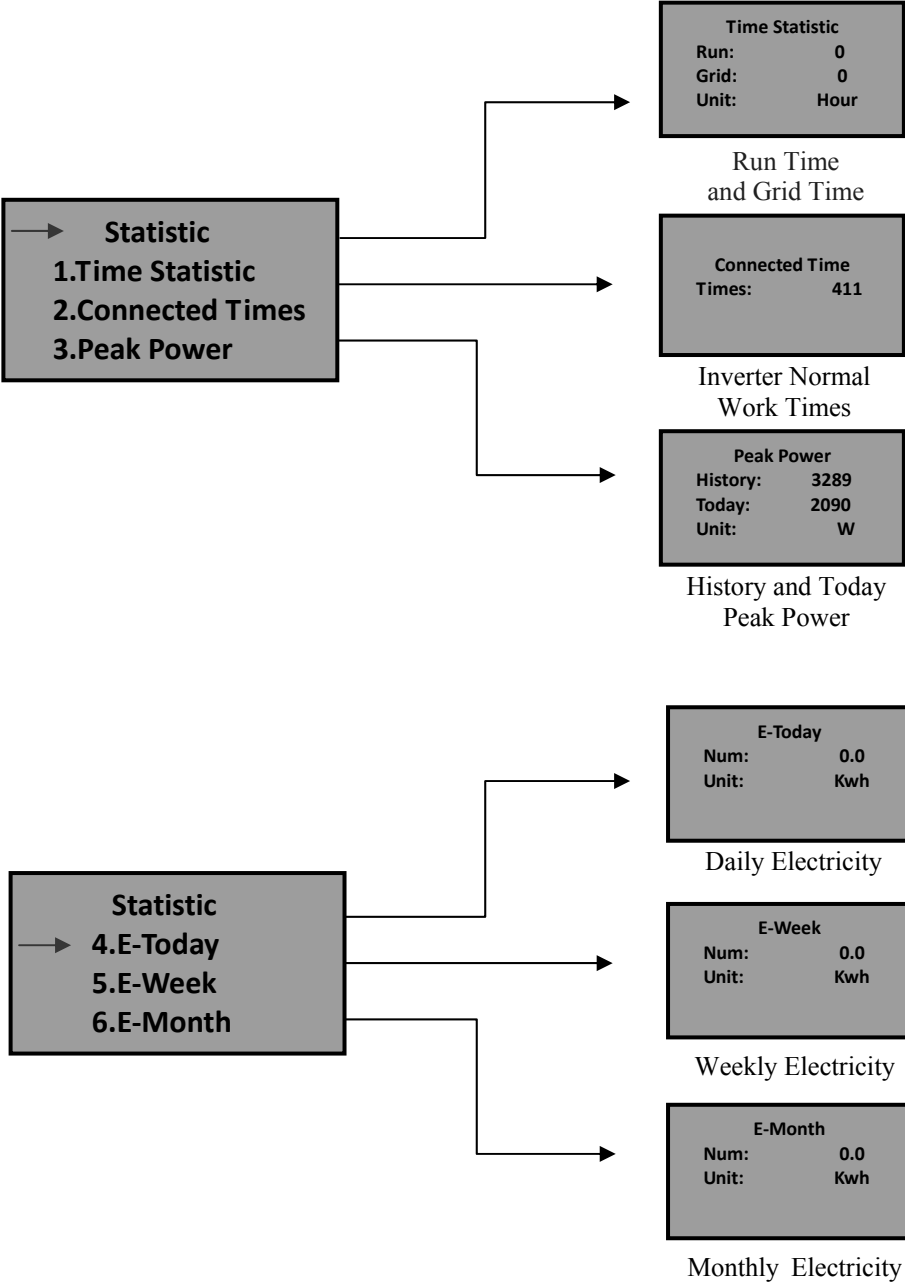
● **485 Protocol Setting Sub Menu**

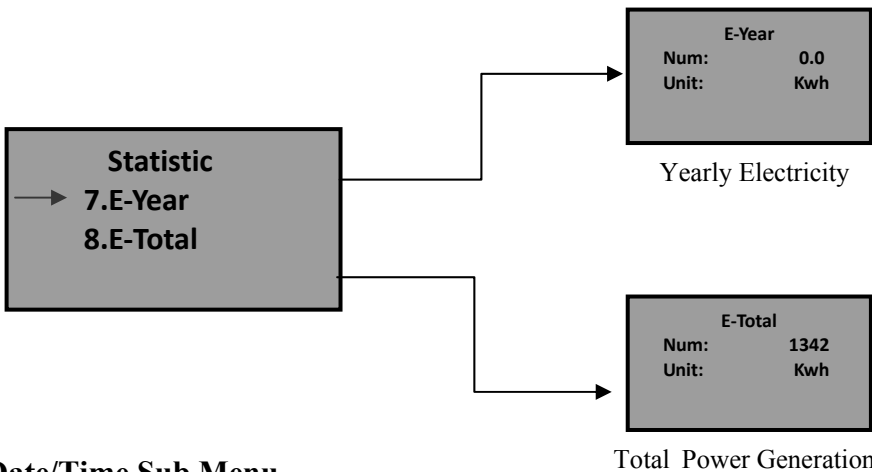


● **Record Operation Sub Menu**

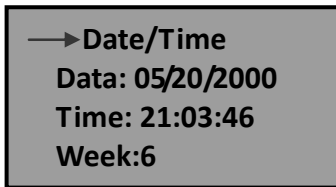


●Statistic Sub Menu

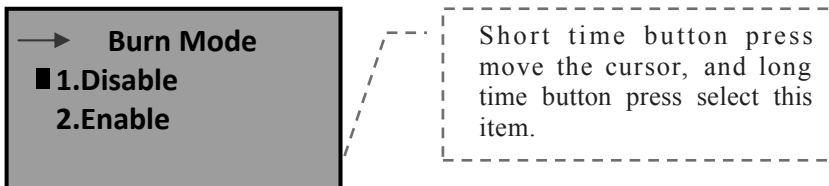




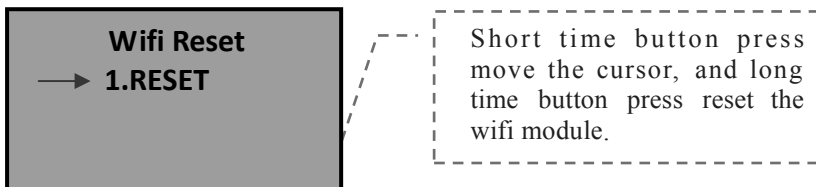
●Date/Time Sub Menu



●Burn Mode Sub Menu



● Wifi Reset Sub Menu



●Factory Reset Sub Menu

→ **Factory Reset**
1.RESET

4. Identification of LCD Display Information

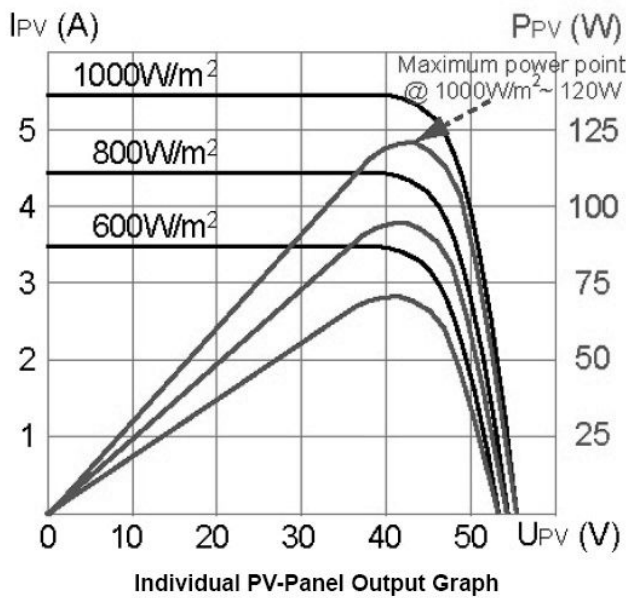
Working Conditions	Message display in English	Description
Normal working status		
Not Functioning Period	No display	PV voltage < 70V, the inverter is switched off
Stand-by	Stand-by	PV voltage < start voltage*
Self-test	Checking	PV voltage > 150V, the inverter get started and self test all modules
Normal Power Generation, MPPT	Normal	Generate AC power and feed to municipal. Grid after self test is completed.
Monitoring parameter display		
Instant Power Rate & Volume Of Electricity Power	X X X X W / XXXXX Kwh	Instant power rate & volume of electricity power
Voltage And Current Of Input DC	DC XXX.X V/ XXX.X A	Voltage and current from PV arrays
Voltage And Current Of Output AC	AC XXX.X V/ XXX.X A	Municipal Grid voltage and current at the moment with input of solar energy
System faulty display		
Grid Volt Low	F00	AC Voltage is too low.
Grid Volt High	F01	AC Voltage is too high.
Grid Frequency Low	F02	AC frequency is too low.
Grid Frequency High	F03	AC frequency is too high.
Bus Voltage Low	F04	Bus voltage is too low.
Bus Voltage High	F05	Bus voltage is too high.
Bus Volt Unbalance	F06	Bus voltage unbalance.
Isolation Fault	F07	PV arrays Insulation impedance is too low.
Input Current Over	F08	PV Input current is too high.
Hardware Curr Over	F09	Hardware current is too high.
Inverter Curr Over	F10	Inverter current is too high.

Inverter DCI Over	F11	Inverter DC current is too high.
Amb Temperatur Over	F12	Ambient temperature is too High.
Sink Temperatur Over	F13	Heatsink temperature is too High.
AC Relay Fault	F14	AC relay is abnormal.
PV Loss Fault	F15	One of PV input is idle when inverter is set on parallel mode.
Remote Off	F16	Status of inverter is on remote off.
Reserved	F17	Reserved
SPI Communicat Fault	F18	Communication fault on control board.
Reserved	F19	Reserved
GFCI Over Fault	F20	Leakage current is too high.
GFCI Device Fault	F21	Self-checking Failure of Leakage Current.
Volt Consistnt Fault	F22	Inconsistent voltage between primary CPU and secondary CPU.
Freq Consistnt Fault	F23	Inconsistent frequency between primary CPU and secondary CPU.
DSP Operation Fault	F24	DSP communication faulty on control board.
DSP Communicat Fault	F32	DSP communication faulty on control board.

*: 1KW is 120V, other capacity 150V. It could be set.

6.5 Max Power Point Tracking (MPPT)

Under any arrays or any conditions, the system can be rapidly tracked the max. power from the arrays. When the output power is trending to be stable, which expresses that the inverter reach its Max power, meanwhile maximum power will be received and transferred into AC to feed to municipal electricity Grid by the inverter. When the output power is displayed as floating, which means, the inverter is adjusting its own status by tracking maximum power output from Arrays any time.



7 Communication Interface

This product provides RS232 and RS485 communication modes, WLAN communication optional.

7.1 RS232

There is water proof RS232 (DB9 type) communication port. Please open the water proof cover before using RS232 port. RS232 port is only used for the online upgrade of the inverter software, the connection between inverter and the computer should be less 15M.

The pin definitions of the RS232/RS485 port:

RS232		RS485
Pin	Signal Assignment	Signal Assignment
1	N.C.	(A)T/R+
2	TxD	(B)T/R-
3	RxD	N.C
4	N.C.	N.C
5	Common	Common
6	N.C.	Common
7	N.C.	5V
8	N.C.	5V
9	N.C.	

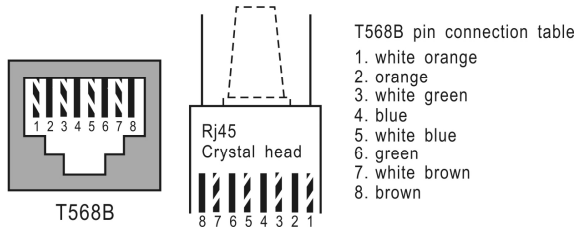
7.2 RS485

RS485 can be used for inverter communications. Inverter comes with a RJ45 port which can be communication port of RS485. Max distance is 1000 meters.

Please purchase external WIFI/GPRS module from us if WLAN/GPRS function is required on inverter which has been purchased with RS485 port.

WIFI/GPRS			Inverter	
1	(A) R/T+	→	1	(A) R/T+
2	(B) R/T-	→	2	(B) R/T-
3	NC	→	3	NC
4	NC	→	4	NC
5	GND	→	5	GND
6	GND	→	6	GND
7	5V	→	7	5V
8	5V	→	8	5V

Pin corresponding relationship between inverter and GPRS/WIFI unit.



7.3 Remote control

The inverter can realize the remote SHUTDOWN and ON and power limit regulatory function by the associated monitoring software.

8 Trouble Shooting

It is very easy for the inverter's maintenance. When you meet any problems, please refer to the following trouble shooting first, please contact your local distributor if the problem can't be solved by yourself.

The following sheet lists some basic questions may encounter in the operation.

Trouble Shooting		
	Alarm Message	Solutions
System Faulty Or Failure Type	AC voltage & frequency are too high or too low.(F00-F03)	1)Please check mains voltage whether it is complied with local, safety standard. 2)Please check the AC output line is properly connected. Make sure its output voltage to see if it is normal. 3)Disconnect PV input and restart the inverter and check whether fault still exists. 4)Contact with your local distributor if the fault still exists.
	Bus voltage is too high or too low(F04-F05)	1)Please check the setting of input mode. 2)Disconnect PV input and restart the inverter and check whether fault still exists. 3)Contact with your local distributor if the fault still exists.
	Bus voltage is Unbalance(F06)	1)Please check the setting of input mode. 2)Disconnect PV input and restart the inverter and check whether fault still exists. 3)Contact with your local distributor if the fault still exists.
	Insulation impedance Fault(F07)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Please measure impedance of PV+/PV- to ground whether is over than 500K Ω . 3)Please contact your local distributor if impedance is less than 500K Ω .
	Input Current High(F08)	1)Please check the setting of input mode. 2)Disconnect PV input and restart the inverter and check whether fault still exists. 3)Contact with your local distributor if the fault still exists.
	Hardware Current High(F09)	1)Disconnect PV input and restart the inverter after few minutes and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.

Inverter Current High (F10)	1)Disconnect PV input and restart the inverter after few minutes and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
Inverter DC Current high (F11)	1)Disconnect PV input and restart the inverter after few minutes and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
Amb Temperatur Over(F12)	1)Disconnect PV input and cool down the inverter then restart the inverter to see if it is back to normal operation. 2)Please check environmental temperature whether out of working temperature. Contact with your local distributor if the fault still exists.
Heatsink Temperature High(F13)	3)Disconnect PV input and cool down the inverter then restart the inverter to see if it is back to normal operation. 4)Please check environmental temperature whether out of working temperature. 5)Contact with your local distributor if the fault still exists.
AC Relay Fault(F14)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
PV Input Voltage Low(F15)	1)Please check the configuration of PV input, one of PV input is idle when inverter is set on parallel mode. 2)Disconnect the PV input and restart the inverter and check whether fault still exists. 3)Contact with your local distributor if the fault still exists.
Remote Off (F16)	The inverter is on remote OFF status, the Inverter can be turned,off/on remotely by monitoring software.
SPI communication Fault (F18)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
Leakage Current High (F20)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
Leakage Current Self-Checking Failure (F21)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
Consistency Voltage Fault (F22)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.

	Consistency Frequency Fault (F23)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
	DSP Operation Fault(F24)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.
	DSP communication Lost (F32)	1)Disconnect PV input and restart the inverter and check whether fault still exists. 2)Contact with your local distributor if the fault still exists.

9 Specification

Table 9.1 Technical Data

Model	KSG-1K-SM	KSG-1.5K-SM	KSG-2K-SM	KSG-3K-SM
DC-Input Parameters				
Max. Input Power (W)	1150	1600	2100	3100
Max. Input Voltage (Vdc)	500			
MPPT Operating Range (Vdc)	100-490			
Max.input current per MPPT tracker (A)	11	11	11	13
Rated Input Voltage (Vdc)	380			
Numbers of Input	1			
MPPT Channel	1			
AC-Output Parameters				
Max. Output Power (W)	1000	1500	2000	3000
Rated Output Power (W)	1000	1500	2000	3000
Output Voltage Range (Vac)	Refer to Table 9-2			
Max. Output Current (A)	4.5	7	9	14
Rated Output Voltage (Vac)	220/230			
Rated Output Current (A)	4.5	7	9	14
Output Frequency Range (Hz)	Refer to Table 9-2			
Power Factor	>0.99			
Current Harmonic Distortion (THDi)	<3%			
Max. Efficiency	97.0%	97.5%	97.5%	97.6%
European Efficiency	96.5%	97.0%	97.0%	97.0%
Environment				
Protective Level	IP65			
Working Temperature Range (℃)	-25~+60			
Humidity	0~95%, no condensation			
Altitude (m)	≤2000			
Ventilation	natural cooling			
Consumption During Night Time (W)	<0.2			

Noise (dB)	<25			
Communication				
LCD	4 lines characters display, the content can be exchanged by pressing button			
Communication Interface	RS232 & RS485			
Mechanical Parameters				
Dimensions (W×D×H) mm	265×126×325			
Weight (Kg)	7.6	8.1	8.1	8.6

Table 9.2 Grid Specification(single-phase)

Grid Specification	Output Voltage Range (Vac)	Output Frequency Range (Hz)	Boot wait time (S)
China	187 - 252	48 - 50.5	60
Germany	196 - 264	47.5 - 51.5	60
Australia	180 - 265	47 - 52	60
Italy	184 - 276	49.7 - 50.3	60
Spain	196 - 253	48 - 50.5	180
U.K.	184 - 264	47 - 52	180
Hungary	196 - 253	49 - 51	300
Belgium	184 - 264	47.5 - 51.5	60
New Zealand	180 - 265	45 - 52	60
Greece	184 - 264	49.5 - 50.5	180
France	184 - 264	47.5 - 50.4	60
Metro	150 - 264	49 - 51	150
Thailand	150 - 264	47 - 52	60
Local	150 - 280	45 - 55	60
60Hz	184 - 276	59.5 - 60.5	60

Table 9.3

Model	KSG-1K-SM	KSG-1.5K-SM	KSG-2K-SM	KSG-3K-SM
Vmax PV (Vdc)	500	500	500	500
Isc PV (Ade)	13,2	13.2	13.2	15.6
Max. continuous input	11	11	11	13

current (A _{dc})				
MPPT tracker / strings	1 / 1	1 / 1	1 / 1	1 / 1
MPPT range (full load) (V _{dc})	105 ~ 400	145 ~ 400	190 ~ 400	240 ~ 400
Nominal AC Frequency (Hz)	50	50	50	50
Nominal AC voltage (V _{ac})	230	230	230	230
Power factor (full load)	>0.99	>0.99	>0.99	>0.99
Protective class	I			
Maximum output overcurrent protection (A _{dc})	21	21	21	21
Ingress protection	IP65			
Relative humidity	4% ~ 100%., no Condensation			
Overvoltage category:	II(DC side), III(AC side)			

In the running process, errors such as AC overvoltage, AC undervoltage, AC overfrequency and AC underfrequency occur, the series goes to boot wait time directly when the power grid returning to normal.