5K Single Phase String Inverter

User Manual

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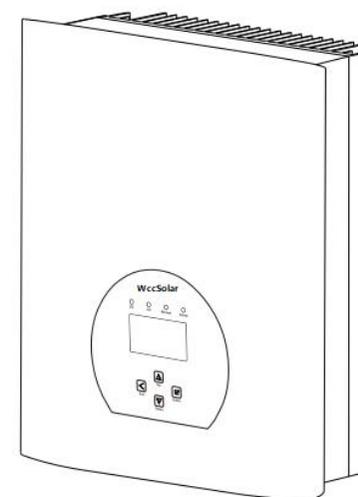
CONTENTS

1. Introduction

1.1 Appearance

SUN-5K single phase grid tie string inverter is the device which can convert dc power from the solar array into AC power and inject them into the utility grid.Please check the appearance below.

Picture 1.1 Front View

DC Switch Options

Inverter Mouting Bracket
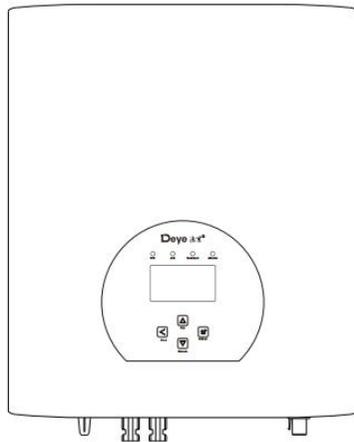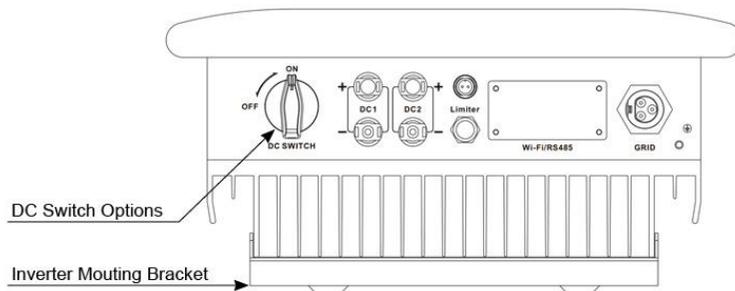
Picture 1.2 Side View

1.2 Accessories List

Please check and make sure all accessories are included after you received the package.The packing list including below things:

1   2   3   4   5

6   7   8   9   10
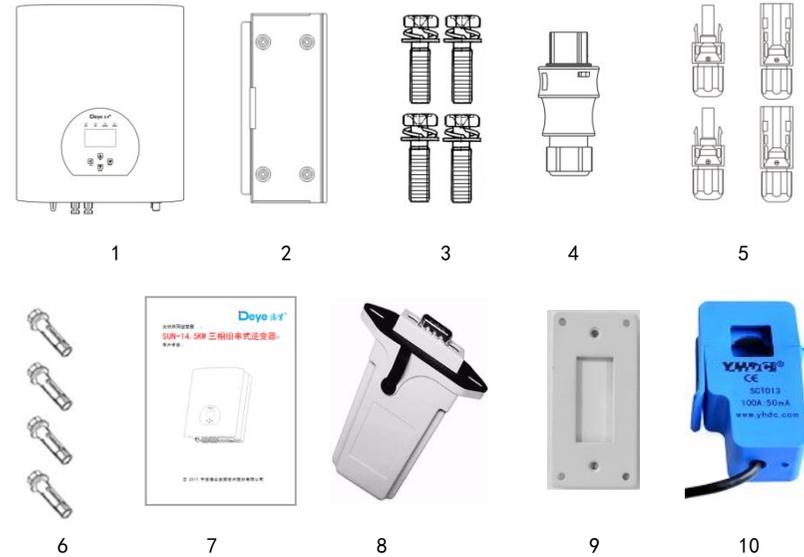
Pic 1.3 Accessories

No.	Description	Qty
1	Inverter	1
2	Hanging panel	1
3	Installation screws M4*20 stainless steel	4
4	AC Connector	1
5	MC4 Connector	2 pairs

6	Expansion bolt M6*80	4
7	User Manual	1
8	Wifi-Plug（Optional）	1
9	Seal Panel	1
10	Current Sensor（Optional）	1

Table 1.1 Accessories

2.Safety warnings and instructions

Improper use of the inverter will cause electric shock and burn.During the installation and maintain,Please operate the unit in strict accordance with the user manual.Please read the user manual carefully before using the inverter.And please take care of the manual for afterwards use.

2.1 Safety signs

Safety signs is used to emphasize potential safety risk and important safety information.The manual include below sings:

Warning：
Safety warning——Indifference of the signs in the manual may cause injure or even death.

Shock Hazard：
Shock warning sign,Incorrect follow of this sign may get shocked，

Safety Hint：
Prudent operation——Incorrect follow of the safety operation hints in this manual may cause inverter defective.

High Temperature Hazard：
Inverter's local temperature may exceed 80℃ while under operating.Please do not touch the inverter case.

2.2 Safety Guides

Warning：
Electrical installation of the inverter must conform to the safety operation rules of the country or local area.

SUN-5K string inverter is non-isolated topology structure,hence must insure dc input and ac output are electrical isolated before operating the inverter.Strictly prohibit to ground the input positive and negative.otherwise will cause inverter malfunction

Shock Hazard：
Prohibit to disassemble inverter case,exist shock hazard,cause severe injury or death,Please ask qualified person to maintenance.

Shock hazard：
When solar array expose to sunshine,will create dc voltage on its output,prohibit to touch,exist shock hazard.

Shock Hazard：
While disconnect the input and output of the inverter for

maintenance,Please at least wait 5 mins until the Inverter discharge the remnant electricity.

High Temperature hazard：
The temperature on the surface of the inverter may reach 80 ℃ while under operation.Please do not touch the case to avoid injury.

2.3 Notes for using

The SUN-5K single phase inverter which manufactured by Ningbo deye inverter technology Co.,Ltd is designed and tested under related safety regulations.But as a electric device,It may cause shock or injury by incorrect operation.Please must operate the unit under below requirements:

1. Inverter should installed and maintained by qualified person under local standards and regulations.
2. Must disconnect the ac side first,then disconnect dc side while doing installation and maintenance,after disconnecting,please at least wait 5 mins to avoid shock.
3. Local temperature of the inverter may exceed 80 ℃ while under operating.Do not touch,avoid injury.
4. All electrical installation must accord with local electrical standards,And achieved permission of local power company.
5. Please take appropriate anti-static measure.
6. Please install where children can not touch.
7.When start the inverter,switch on the ac first,then switch on dc.When stop the inverter,switch off ac first,then switch off dc.
8. Prohibit to disconnect and reconnect the ac and dc while inverter under normal operating.

9. The input voltage can not exceed the maximum input voltage of the inverter.

3.Operation Interface

3.1 Interface View
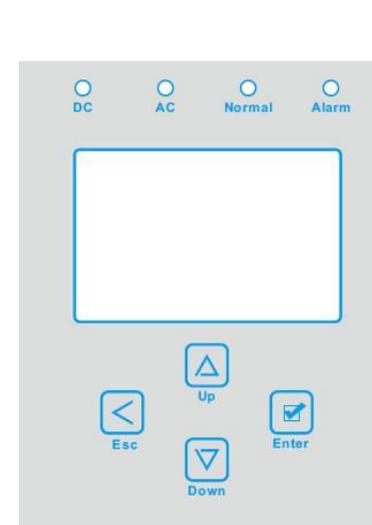
PIC 3.1 Operation panel

3.2 Status Indicator

The inverter panel has 4 indicators,the left one is dc input indicator,green indicate normal dc input.beside is the AC indicator,green indicate normal ac connecting.beside the AC indicator is the operating indicator,green indicate normal output.the right indicator is alarm.red indicate alarming.

Indicator	status	Explanation
● DC	on	Inverter detected input
	off	DC low voltage
● AC	on	Grid Connected
	off	Grid Unavailable
● NORMAL	on	Under normal operating
	off	Stop operating
● ALARM	on	Detected faults or report faults
	off	Under normal operating

3.3 Buttons

There are four buttons on the inverter panel：Above is Up and increase button（UP）,Below is down and decrease button（DOWN），Left is ESC button（ESC），Right is Enter button（ENTER）。Can achieve below functions by the four buttons：

- Page Turning（Use UP and DOWN Button）
- Modify adjustable parameters（Use ESC and ENTER button）

3.4 LCD Display

SUN-5K single phase string inverter use 256*128 dot formation display，Display below content：

- Inverter operation status and information
- Operating information
- Warning message and malfunction display.

4. Product Installation

4.1 Select installation location

After you received the inverter and prepare to install it,please select a suitable location,should consider below factors:

- Ventilation—Must insure the air ventilation of the installation location,improper installation may cause overheating and effect the working efficiency and lifespan.
- Sun-shade—Expose the inverter under sunshine will cause it overheating and effect the working efficiency.
- Shelter for rain and snow—Even though the inverter is IP65 waterproof.We still recommend install the inverter at the ventilate place where has shelter for rain and snow.It can help extend the lifespan of the inverter.
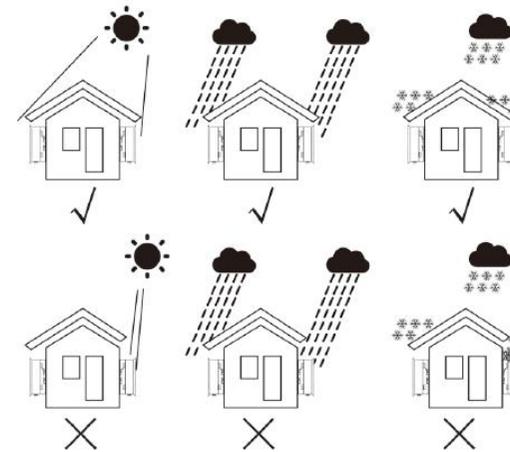
Pic 4.1 Recommended installation place

- Please select the wall with certain bearing capacity.
- When do the installation,vertical slope can not exceed +/-5°，Make sure no lateral tilt。Otherwise will effect the function of the heat sink.cause the output power lower than expected.

● If install more than one inverter,must leave at least 500mm gap between each inverter.and each inverter must leave at least 500mm from above and below.And must install the inverter at the place where children can not touch.Please see pic 4.2

●Consider whether the installation environment is helpful to see the inverter LCD display and indicator status。

● Must offer a ventilate environment if inverter installed in the house.
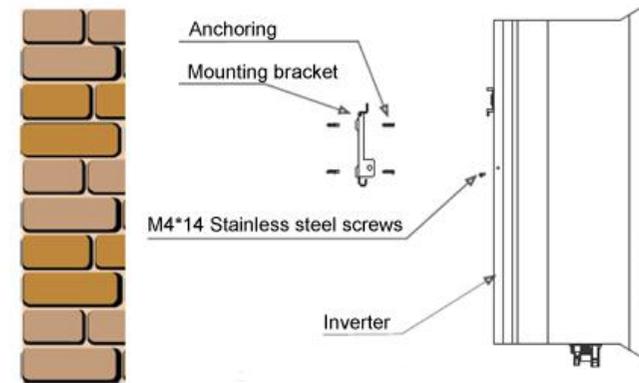
Safety Hints：
Do not place or store any items next to the inverter
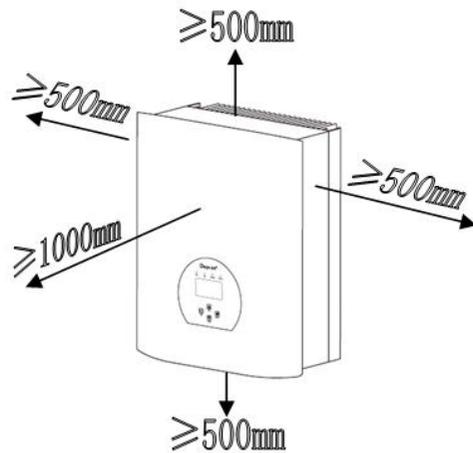
Pic 4.2 Installation gaps

4.2 Inverter Installation

The inverter is designed according to the wall mounted type installation, please use the wall mounted (the brick wall of the expansion bolt) .

Pic 4.3 Installation

Inverter should vertically installed,as shown in   pic 4.3， Install procedure show below:

1. Position the bolts on the appropriate wall according to the bolt positions on the mounting shelves and mark the holes. On the brick wall, the installation must be suitable for the expansion bolt installation.

2. Ensure that the position of the installation holes on the wall (A, B, C, D) are the same position of the install plate (figure 4.3), and the mounting level is guaranteed.

3. Hang the inverter to the top of the mounting rack and then use the M4 screw in the accessory to lock E and F (figure 4.3) to ensure that the inverter does not move.
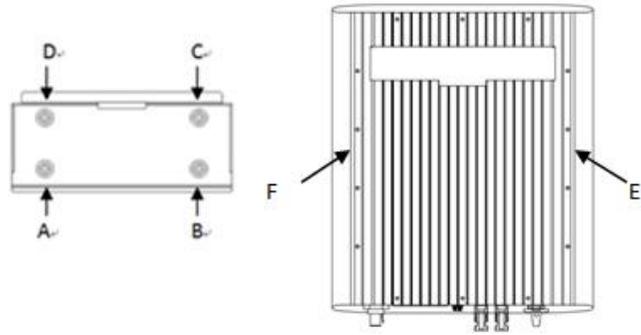
Pic 4.4 Mounting Bracket

5 Electrical Connection

SUN-5K inverter has considered the convenience of the electrical connection while designing.we design fast connection for both dc and ac ,all electrical connections conform to country related standards.

5.1 Input connection

In order to safe connection,the electrical connection must follow below steps：

1.Switch off the AC breaker

2.Switch off the DC breaker

3.Connect inverter to the solar panel

a). Make sure that the polarity of the output voltage of the solar panel is consistent with the polarity identified by the inverter

b). Connect dc positive and negative to the inverter input terminal. Figure 5.1 is shown in figure 5.2。

Insulation Shell   Lock Terminal
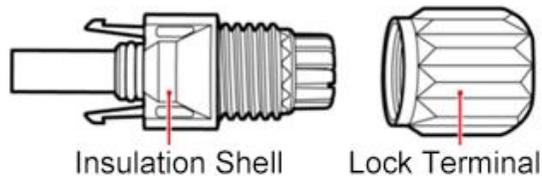
Pic 5.1 Panel positive connector

Insulation Shell   Lock Terminal
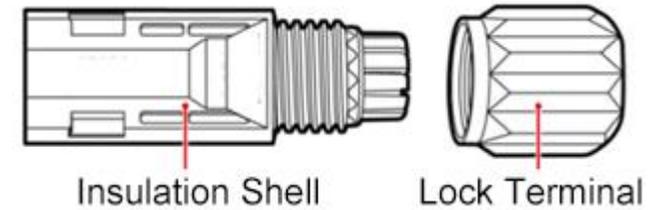
Pic 5.2 Panel negative connector

c).Embed the wire hardness into the terminal,Twist to fasten the terminal.

d).Plug the DC connector into the inverter's dc input,show as below
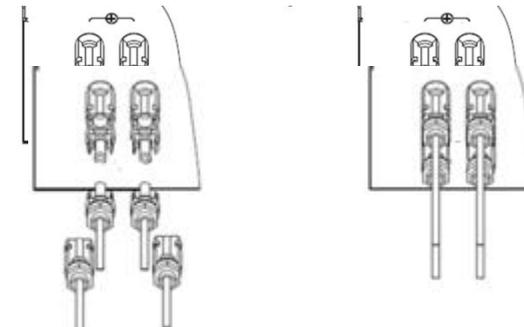
Pic 5.3 dc input connection diagram

Special Remind:Solar panel will generate voltage when expose to sunshine.After series connection,high voltage may lead to life-threatening.So before connect the dc input,please cover the solar panel by some opaque materials . and make sure the inverter dc switch is on "OFF" state, otherwise high inverter voltage can lead to life-threatening.

5.2 Connection of AC connectors

After DC are connected,please do not switch on the dc breaker,Do connect the AC,The AC side equipped with single phase terminal of the original plant.Very convenient for connection.In order for easier connection,we recommend soft cables,cable details and suitable breakers please check in table 5.1.

⚠️ .Warning：

It is forbidden to use a circuit breaker for multiple inverters, and it is forbidden to load between inverters and circuit breakers。

	Cable Diameter	Cable sectional area	Cable external diameter	AWG
Item parameter	2.5mm	6 mm^2	15-18mm	10
Applicable model	SUN-5K			
Applicable Breaker	30A/400V			
Maximum AC cable	Outdoor cable(2+PE)Length 20m			

Table 5.1 Cable parameter table
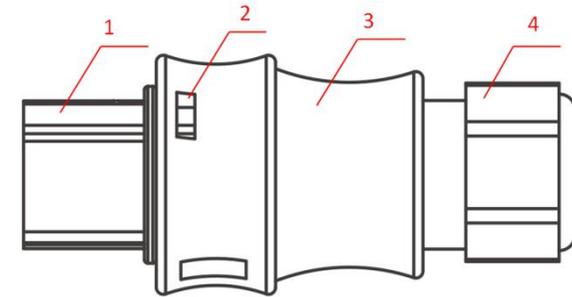
1. Socket   2.Socket lock   3.Sleeve   4.Seal

Pic 5.4 AC Connector Structure

The ac output connector is divided into three parts: matching socket, sleeve and sealing sleeve, as shown in Picture 5.4, The steps are as follows:

Step 1 screw the cable sealing ring and sleeve in sequence from the ac connector.

Step 2 use strippers to strip the protective sheath and insulation layer of the ac cable to the right length.

⚠️ . Warning：

Be careful to distinguish the L, N and PE of the ac cables

Step 3: connect the cable (L, N, PE) into the sealing sleeve and sleeve.

Step 4: use the hexagon screwdriver, loosen the bolts of the socket in turn, and insert each cable core into the corresponding jack, and set each screw.

Step 5:Fix the sleeve and seal to their respective positions.

Step 6: Connect the ac terminals to the inverter as shown in figure 5.5. When you hear the "click" sound, it indicates a reliable connection.
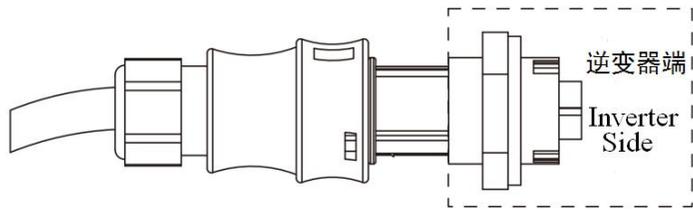
Pic 5.5 AC connection diagram

5.3 Other Connections

　　Good grounded is important for resist the surge voltage shock.improving EMI's performance,So before the connection of AC,DC,communication connections,need to ground first. For a single system, just ground the PE cable; For multiple machine systems, all PE cables of the inverter need to be connected to the same grounding copper platoon to ensure the equipotential connection.

Safety Hints：
　　Inverter has built-in leakage current detection circuit, if the external connect leakage current protection device, the current action must be greater than 300mA or higher, otherwise inverter may not work properly.

6. Startup and Shutdown

　　Before start the inverter need to ensure that meet the following conditions, otherwise may cause fire or damage the inverter without quality assurance,at the same time the situation on our company does not undertake any responsibility. At the same time, to optimize the system configuration, it is recommended that the two inputs be connected to the same number of photovoltaic modules.

　　a). The maximum open voltage of each set of photovoltaic modules shall not exceed 600VDC under any conditions.

　　b). Each input of the inverter must use the same type of photovoltaic module in series.

　　c). Total output power of pv shall not exceed the maximum input power of inverter, each photovoltaic modules shall not exceed the rated power of each channel.

　　d). The short circuit current of each series of photovoltaic modules cannot be greater than 10A at any time.

6.1 Start up the inverter

When start up the SUN-5K,should fellow below steps：

　　1. First switch on the AC breaker.

　　2. Turn on the dc switch of the photovoltaic module, and if the panel provides sufficient starting voltage and power, the inverter will start.

　　3. When the ac voltage and dc voltage are normal, the inverter start-up is ready to begin. The inverter will first check the internal parameters and the grid parameters, while the liquid crystal will show that the inverter is self-checking.

　　4. If the parameter is within acceptable range, the inverter will generate the normal grid. NORMAL indicator light is on.

6.2 Inverter Shutdown

　　Must follow below steps while Shutting down the SUN-5K:

　　1. Switch off the AC breaker。

　　2. Wait for 30 seconds, turn off the dc switch (if any), or simply disconnect the dc input connector. The inverter will close the LCD and all

leds within two minutes.

7. Limit function

The SUN-5K inverter integrate with build in limiter which can prevent excess power going to the grid.Inverter will auto detect the load consumption status and send the signal to the inverter,then inverter will adjust the output power.This limit function is optional.If you buy the inverter with limiter,An current sensor will be included in the package.

7.1 Connection diagram of limiter.

When you are reading this, we believe that you have completed the connection according to the requirements of chapter 5, if you has been running your SUN-5K at this time, and you want to use the limiter function, at this time please turn off inverter ac and dc switch, and wait for 5 minutes until the inverter completely discharged. Then connect the current sensor to the inverter Limiter interface.Make sure they are reliably connected, and the current sensor should clamp to one of the live wire or zero line of the incoming line.

In order to make you more convenient to use SUN - 5 K's built-in limit function, we specifically gives the wiring diagram, as shown in figure 7.1, the red lines connected to the utility grid said wire (L), blue line shows the zero line (N), yellow green line shows the ground wire (PE). We recommend install a AC switch between the inverter outlet and the utility grid, the specs of the AC switch is determined according to the load capacity. The output of the SUN-5K inverter we recommend use the ac switch which rated 400VAC/ 30A. If there is no integrated dc switch in the inverter which you choose to buy, similarly, we recommend that you install the dc switch, and the voltage&current of the switch depends on the pv array you are accessing.
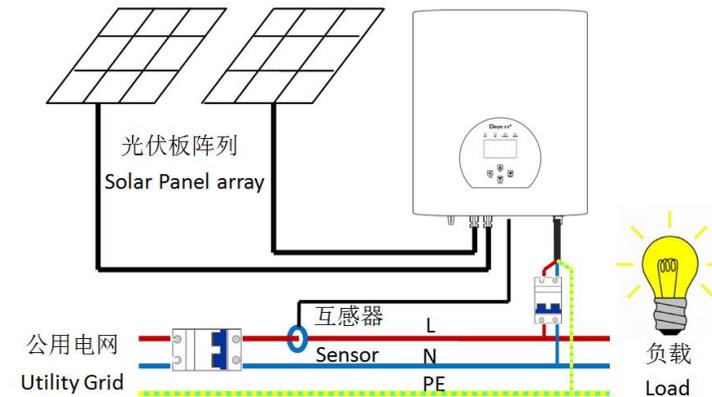
PIC 7.1 Diagram of limiter connection

7.2 How to use the limiter function

When the connection is completed, the following steps are required to use this function:

1. Switch on the AC.
2. Switch on the DC,Waiting inverter LCD light up.
3. Press Enter button on the LCD panel in the main interface into the menu options, select [parameter setting] to Enter setup submenu, and then select[running parameters], select [limiter Settings], back to the main interface.

4.If limit function has already opened,just press up and down button to enter into[output data]page,The[grid power]will show under grid voltage.That means limit is turned on.

5.Need to understand,[grid power]showing positive means this power

is come from the grid.No overflow power to the grid.If [grid power]is negative,it means inverter has overflow power to the grid or the orientation of the current sensor clamp wrong.Please realize more on chapter 7.3.

    6.After properly connection is done,wait for inverter start,If the load power is higher than the PV generating power,PV power will offset some proportion and rest supplement from the grid.

7.3 Notes while using limit function

For your safety and the operation of limiter function of the SUN-5K inverter, we put forward the following Suggestions and precautions:

Hint：
In limit function we strongly recommend that the two photovoltaic arrays are formed by the same number of photovoltaic panels of the same size, which will make the inverter more responsive to limit the power.

Warning：
When using limit function, you need to ensure that the opening voltage of PV input is no more than 480V, Otherwise may cause inverter malfunction.Do not have this limitation if not working under limit function.

Hint：
While the grid power is negative and inverter has no output power,That means the orientation of the current sensor is wrong,pls turn off the inverter and change orientation of the current sensor.

Warning：
The current sensor can clamp either to the hot line or the zero line,can not clamp to the PE line,otherwise inverter can not able to normal operate.

8. Repair and Maintenance

SUN-5K string type inverter don't need to carry out regular maintenance.However, debris or dust will affects radiator cooling performance.Therefore, can be clean with a soft brush.If the surface of the inverter is too dirty, affect the reading LCD and LED lamp, can use wet cloth to clean up.

Warning:
when the device is running, the local temperature is too high and the touch can cause burns. Turn off the inverter and wait for it to cool and then clean and maintain.

Warning：
When cleaning any part of the inverter, no solvent, abrasive materials or corrosive materials shall be used for cleaning.

9. Troubleshooting information and processing

SUN-5K inverter is designed accordance with grid tie operating standards,   meeting the requirement of safety and electromagnetic

compatibility requirements. Before leaving the factory,all inverters have had a rigorous testing to ensure the long time   reliable operation.

If a fault occurs, LCD and LED will be prompted show fault information.Under the condition of alarm, inverter may stop power.The fault table are shown in table 7.1 below:

Safety hints：
If your SUN – 5k string type inverter appeared any fault information   as shown in table 8-1, and after the restart still not eliminate the fault, please contact your local dealer or service center.You need to prepare the following information.:

1. Inverter serial number.
2. Inverter distributor or service centre (if any);
3. Date of start grid tie.
4. Description (including fault code displayed on the LCD and light) in detail as much as possible.
5. Your contact details

In order to make you more clear understanding of the inverter fault information, We put all fault code and instructions in below table   when the inverter is not normal working.

Fault information	Instruction
F01	Dc input polarity reverse fault
F02	Dc insulation impedance permanent fault
F03	Dc leakage current fault

F04	Ground fault GFID (battery end grounding)
F05	Read the memory error
F06	Write the memory error
F07	GFDI Blown Fuse
F08	GFDI Grounding contact failure
F09	IGBT damage by excessive drop voltage
F10	Auxiliary switch power supply failure
F11	Ac main contactor errors
F12	Ac auxiliary contactor errors
F13	reserved
F14	DC firmware over current malfunction
F15	AC firmware over current malfunction
F16	GFCI(RCD) Ac leakage current fault
F17	Three phase current,over-current fault
F18	AC over current fault of hardware
F19	All hardware failure synthesis
F20	DC over current fault of the hardware
F21	Dc leakage flow fault
F22	Crash stop (if there is a stop button)
F23	Ac leakage current is transient over current
F24	Dc insulation impedance failure
F25	Dc reverse irrigation failure
F26	The dc bus is unbalanced
F27	Dc end insulation error
F28	Inverter 1 dc high fault
F29	Ac load switch failure
F30	Ac main contactor failure
F31	Ac secondary contactor failure

F32	Inverter 2 dc high fault
F33	AC Current over current
F34	AC Overload
F35	AC Grid Unavailable fault
F36	AC grid phase error
F37	Ac three-phase voltage imbalance failure
F38	Ac three phase current unbalanced
F39	AC Over current failure
F40	DC Over current failure
F41	AC Line W,U over voltage
F42	AC Line W,U low voltage
F43	AC Line W,V over voltage
F44	AC Line W,V low voltage
F45	AC Line U,V over voltage
F46	AC Line U,V low voltage
F47	AC Over frequency
F48	AC Low frequency
F49	Phase U grid current dc current high
F50	Phase V grid current dc current high
F51	Phase W grid current dc current high
F52	AC inductor A,phase current dc current high
F53	AC inductor B,phase current dc current high
F54	AC inductor C,phase current dc current high
F55	DC bus voltage is too high
F56	DC bus voltage is too Low
F57	AC reverse irrigation
F58	AC grid U over current
F59	AC grid V over current

F60	AC grid W over current
F61	Reactor A phase current high
F62	Reactor B phase current high
F63	Reactor C phase current high
F64	IGBT Heat sink low temperature

Table 8.1 Fault messages

10. Technical parameter

Model	SUN-5K
Max. input dc voltage	600Vdc
MPPT voltage Range	150--480Vdc
Max. DC Input Current	10A+10A
MPPT Number/Max. String Number	2/1
Rated Output Power	5KW
Rated AC Grid Voltage	220V
AV Grid Voltage Range	180--265Vac（Adjustable）
Operating Phase	Single Phase
Output Power Factor	>0.99
Grid Current THD	<5%
Rated Grid Frequency	50/60Hz
Frequency Range	47.5-51.5Hz（Adjustable）
Max.Efficiency	97.2%
Protections	DC Reverse polarity；AC Shorted Circuit；Temp protection；Anti-lightning；Anti-Islanding；
Dimension	385*455*165mm
Net Weight	13.5Kg
Topology	Transformerless
Internal Consumption	<6W(Night)

Running Temperature	-25--60°C
Ingress protection	IP65
Interface	RS485 RS232
Standard	NB-T32004
Environment humidity	0--95%

Table 9.1 Technical Parameter