Hopewind

hopeSun Series

String Inverter

(100KTL, 110KTL, 125KTL-M, 136KTL-M)

User Manual

Version: V1.1

Shenzhen Hopewind Technology Co.,Ltd

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Thank you for purchasing products designed and manufactured by Shenzhen Hopewind Electric Co., Ltd. (hereinafter referred to as “Hopewind”). We hope our products and this manual can meet your demands. Any suggestion for improvement shall be appreciated.

About this manual

For Readers

This manual is helpful for technicians who install, commission, operate and maintain string inverters of Hopewind. Suggest you view this manual carefully before use relative devices. Readers are required to have basic knowledge on electric components, wiring, signs and mechanical drawings.

Outlines

Chapter	Contents
1 Safety Precautions	Must be observed when transporting, storing, installing, running and maintaining the Inverter
2 Product Description	Introduce the product outlines, principles and parameters.
3System Installation	Unpacking inspection, installation tools, installation environment, reserved space, fixing method, cable connection.
4 Commissioning Guide	Introduce the methods and precautions of electrifying, debugging and running.
5 Maintenance and Troubleshooting	The daily maintenance methods, maintenance intervals, and troubleshooting of the product are introduced.
6Inverter Processing Guide	Basic requirements and precautions when disassembling, replacing, and scrapping the inverter.

Warning Signs in this Manual

 **DANGER**	Major potential danger, if fail to observe the rules, it might cause serious and major body hurt or property loss, especially indicate the high voltage danger.
 **CAUTION**	Ordinary potential danger, if fail to observe the rules, it might cause ordinary equipment damage or property loss.

Glossaries and Abbreviations

Glossaries/Abbreviations	Description
MPPT	Maximum Power Point Tracking
Photovoltaic string	Multiple series and parallel solar cells
EEPROM	Electrically Erasable Programmable Read-Only Memory
hopeInsight	Hopewind Electric background monitoring and debugging software

Contents

1 Safety Precautions

In this chapter, it describes the safety precautions that must be observed when installing, operating and maintaining the inverter. Please read them carefully before operation and follow them in operation process; otherwise it might cause damage to the inverter, generator, related equipments and/or serious injury or loss of life.

When you use and operate the inverter, please take special attention to:

DANGER
1. Only the qualified personnel are allowed to install, operate and maintain the inverters. 2. Please be slow when hoisting or placing the inverter as fast operation might damage the inverter; do NOT incline or collide the product in transportation. 3. Do NOT make any liquid, sundries or rubbishes enter inside as they might cause short circuit inside the inverter. 4. Inverter must be disconnected with AC grid before completion of installation and maintenance. 5. Related protective measures are required to avoid electric shock or fire accident.

1.1 Transport

CAUTION
1) When transporting, it is necessary to ensure that the inverter is packaged properly and the cabinet is fixed upwards to avoid strong vibration and collision. 2) In order to keep the inverter in good condition during transportation, it is important to use packaged transport and operate according to the label on the package. For the meaning of the logo, please refer to "**2.6 Signs on Package** ". 3) The transportation environment must meet the requirements. Please refer to "**2.10 Environmental Requirements**".

1.2 Storage

CAUTION
The storage environment of the string inverter must meet the corresponding requirements. Please refer to "**2.10 Environmental Requirements**". **About long-term storage:** Before or after the installation and commissioning,if the string inverter is in the no-power supply state for more than three weeks, it is regarded as long-term storage. Long-term storage of string inverters requires attention to the following issues: ● Put the desiccant into the cabinet and package the whole machine with packaging materials. ● When storing equipment, pay attention to ventilation and moisture. It is strictly forbidden to store water in the storage environment. ● Pay attention to the harsh environment around you, such as quenching, sudden heat, collision, dust, etc., to avoid damage to the string inverter. ● Regular inspections, usually not less than once a week, to check whether the packaging is intact, to avoid pest bites. If it is damaged, it needs to be replaced immediately. ● If the storage time exceeds half a year, the package should be opened for inspection, repackaged, and desiccant replaced. ● It is strictly forbidden to store without packaging.

1.3 Installation

DANGER

1. Before operating the internals of the string inverter, it must be confirmed that the input switch DC Switch of the string inverter and the circuit breaker corresponding to the AC side of the inverter are in the off state, and the string inverter is guaranteed. The housing is reliably grounded.
2. The string inverter must be grounded according to the specifications. The size of the grounding conductor must meet the requirements of safety regulations to ensure the safety of personnel.

CAUTION

1. During installation, it is necessary to ensure that the string inverter installation environment is well ventilated and heat-dissipating, and should not be directly exposed to sunlight.
2. The fixing of the string inverter is recommended by two people working together to avoid mechanical damage. During the installation process, safety measures should be taken to prevent bruises.
3. During installation and maintenance, it is necessary to prevent liquid, dust or debris from entering the inside of the string inverter. Conductive liquids and debris may cause internal short circuit of the string inverter, resulting in equipment damage.
4. When connecting the wiring of the external cable to the string inverter, the installation torque of the power cable must be ensured. Excessive torque may cause fatigue damage of the screw. Too small torque may cause the contact resistance to become large, resulting in overheating.
5. The power cable terminals connected to the string inverter must comply with national standards. If the terminals are not in accordance with the standard, the power cable may be overheated. In severe cases, a fire may occur.
6. The installation site must meet the requirements of the operating environment. Please refer to “**2.10 Environmental Requirements**”.

1.4 Operating

DANGER

1. During the operation of the string inverter, it is necessary to ensure that the string inverter door panel is locked to prevent personal injury such as electric shock, and to prevent salt, moisture, dust or other conductive substances in the air from entering the string type. Inside the inverter.
2. During the energization of the string inverter, it is forbidden to contact the internal boards, devices, cables and terminals of the string inverter.
3. When the string inverter fails and an abnormal smell or sound occurs, immediately disconnect the input switch DC Switch of the string inverter and the inverter AC side breaker.

CAUTION

1. The string inverter is allowed to be powered up after all installation work is completed and the cable is not connected correctly.
2. It is forbidden to perform any insulation resistance test or withstand voltage test on the string inverter. The wrong withstand voltage test will damage the string inverter.
3. When performing insulation withstand voltage test on the external equipment of the string inverter, the wiring of the string inverter and external equipment must be disconnected.

1.5 Maintenance

DANGER
1. Before maintenance, the AC output side circuit breaker must be disconnected, then the input switch DC Switch must be disconnected, and then wait for at least five minutes to operate the string inverter. 2. In the maintenance process, please try to avoid unrelated personnel entering the maintenance site. 3. Maintain the string inverter under the condition that you are familiar with the contents of this manual and have the appropriate tools and testing devices. 4. For personal safety, please wear insulating gloves and wear shoes.

CAUTION
It is necessary to check and maintain the string inverter periodically, and refer to the "**5 Maintenance and Troubleshooting**" for the specific operation.

--End of the chapter--

2 Product Description

2.1 Product Introduction

The hopeSun series string inverter is a three-phase string-type grid-connected inverter independently developed by Hopewind Electric. Its main function is to convert the DC power generated by the PV string into AC power and feed it into the power grid.

The four models are all 20-input string inverters. Among them, hopeSun 100KTL and hopeSun 110KTL are suitable for low-voltage grid-connected scenarios; hopeSun 125KTL-M and hopeSun 136KTL-M are suitable for medium-voltage grid-connected scenarios.

2.1.1 Schematic

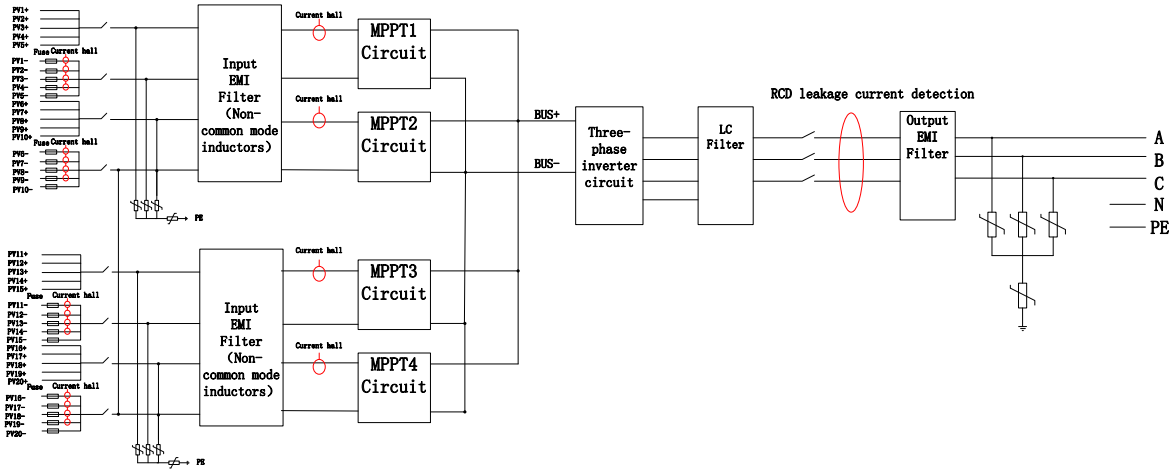


Figure 2-1 Schematic diagram

2.1.2 Operating mode

hopeSun three-phase string inverter has three working modes: standby mode, running mode, and shutdown mode. The three mode switching conditions are shown in Figure 2-2.

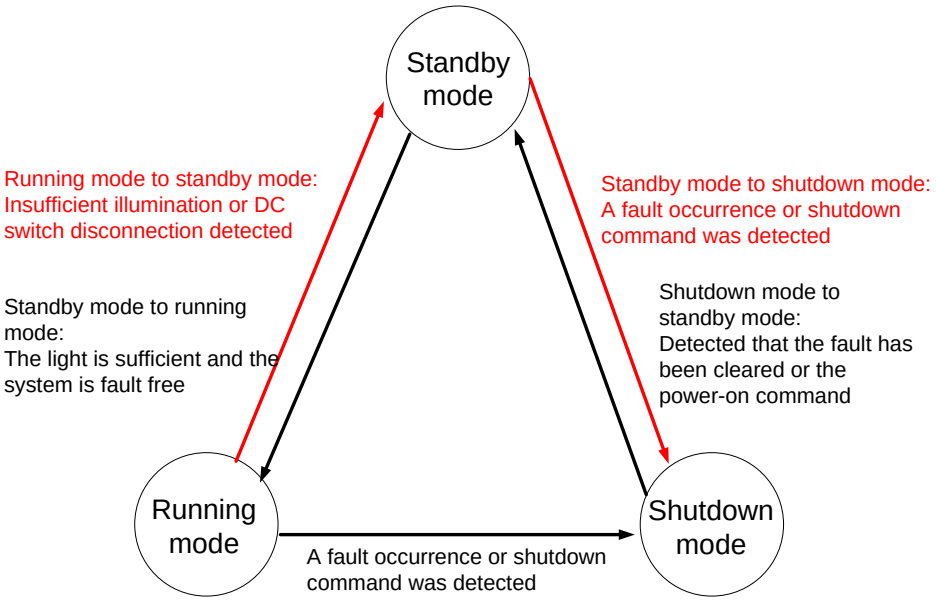


Figure 2-2 Operating mode

Operating mode	Description
Standby	1) Standby mode mainly means that the external environment does not meet the operating conditions of the inverter. If the light is insufficient, the DC input

	switch is disconnected. In this mode, the inverter continuously self-tests and enters the operating mode once the operating conditions are met. 2) In the standby mode, if the inverter detects a shutdown command or finds a fault after the power-on detection, it enters the shutdown mode.
Operation	In the operating mode, the inverter converts the DC power of the PV string into AC power and feeds it into the grid. The inverter performs MPPT operation to output the maximum power of the PV string. If the inverter detects a fault occurrence or shutdown command, it enters the shutdown mode. If it is detected that the PV string input power is lower than the grid-connected power generation condition, it enters the standby mode.
Shutdown	If the inverter detects a fault occurrence or shutdown command during standby or operation, it enters shutdown mode. In the shutdown mode, if the inverter detects that the fault has been cleared or the power-on command, it enters standby mode.

2.2 System Configuration and Application

2.2.1 Application Description

Figure 2-3 shows the application diagram of the string inverter network, Figure 2-4 shows the design scheme of the large-scale ground PV power plant, and Figure 2-5 shows the design scheme of the distributed PV power plant.

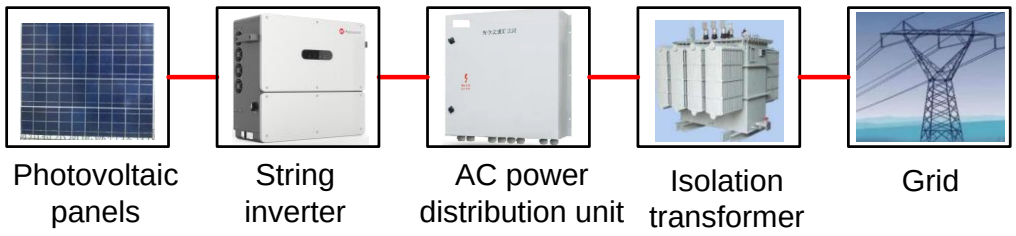


Figure 2-3 Schematic diagram of string inverter application

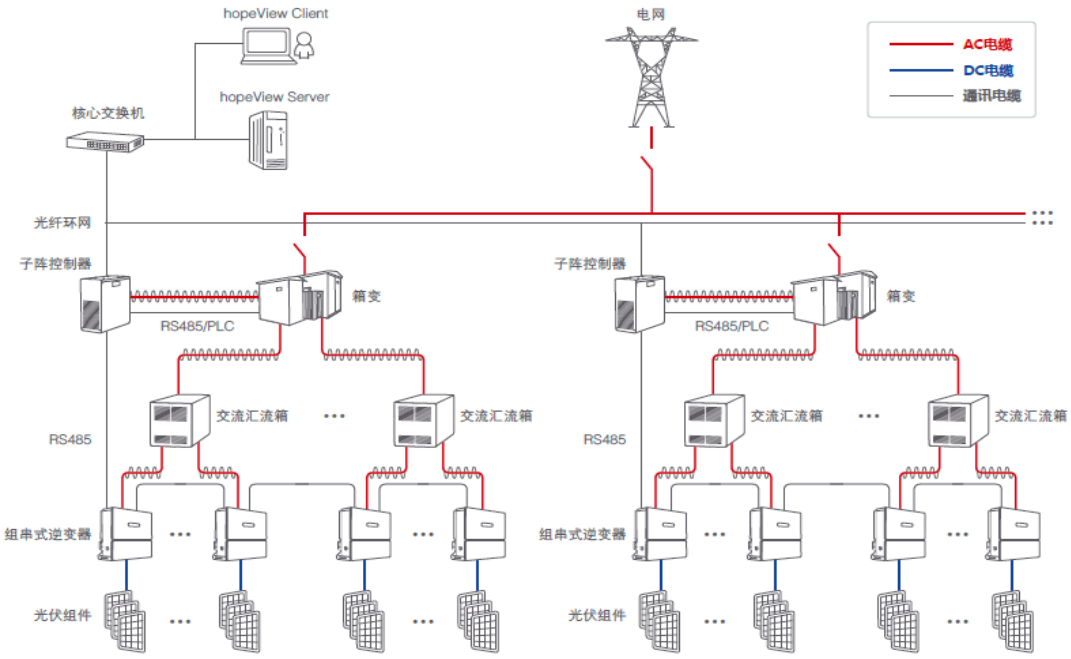


Figure 2-4 Large-scale ground photovoltaic power plant networking design

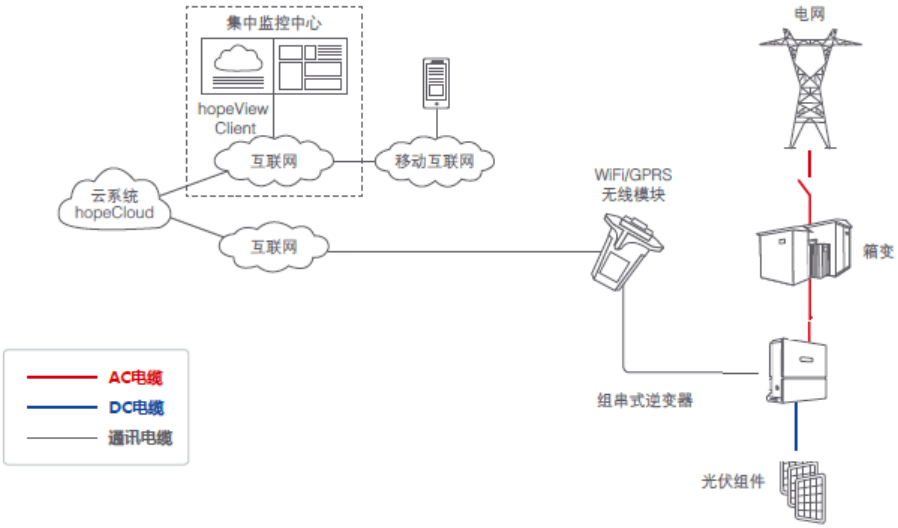


Figure 2-5 Distributed photovoltaic power plant networking design

2.2.2 Supported grid form

hopeSun 100KTL and hopeSun110KTL support TN-S, TN-C, TN-C-S, TT; hopeSun 125KTL-M and hopeSun136KTL-M support IT, TN-S, TN-C, TN-C-S, and TT grids.

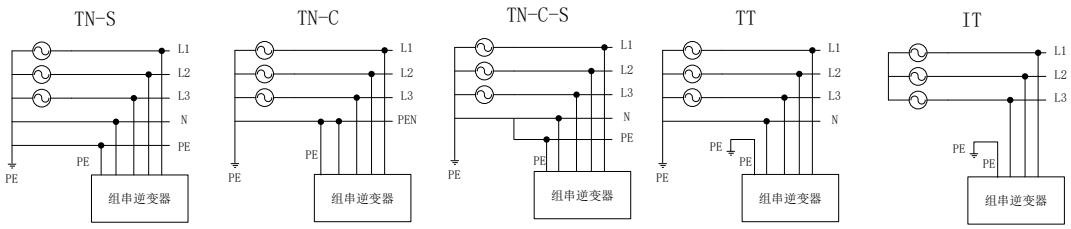


Figure 2-6 Schematic diagram of various grid forms

2.3 Naming Rules

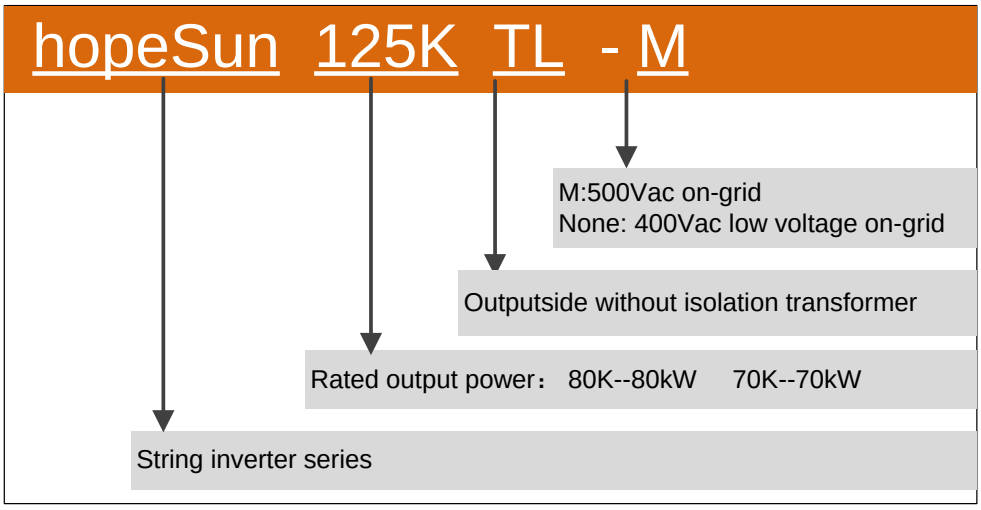


Figure 2-7 Naming rules

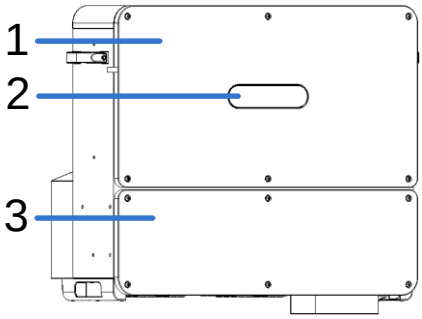
2.4 Nameplate label

(Note: The data is for reference only, please refer to the physical or technical agreement of the corresponding product)

2.5 Machine configuration

This section shows the internal components of the string inverter, the back device, and the bottom interface.

CAUTION
There are components on the board that are very sensitive to static electricity. Anti-static measures must be taken before touching the board. When touching the board, be careful not to scratch the electrical components.



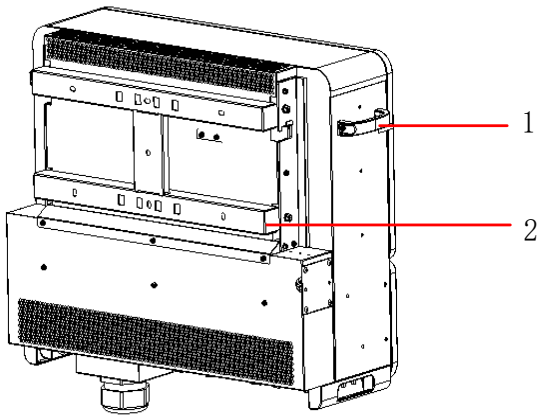
No.	Label	Device name
1		Upper door
2		LED indicator
3		Lower door

Figure 2-8 Front view of the whole machine

The LED indicators from left to right are described as follows:

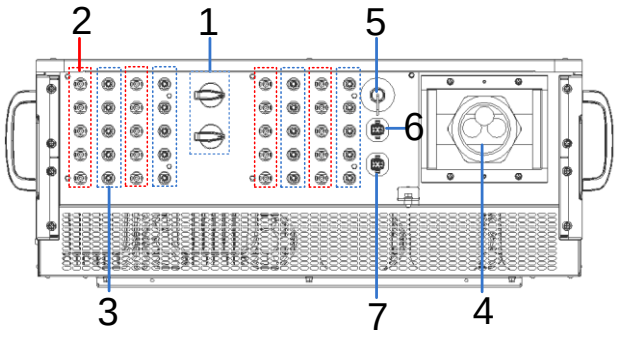
Table 2-1 LED Indicator Description

Indicator light	Meaning	Status	Meaning
POWER	PV and grid connection	Blue light	The voltage of PV side is more than 200V, and the power grid connection is normal.
		Blue light flashing	The grid connection is normal, but the input voltage of PV side is less than 200V.
		Blue light flashing slowly	The input voltage of PV side is greater than 200V, but the power grid is not connected.
		Blue lights out	PV and power grid are not connected
RUN	On-grid operation	Blue light	Inverter is in grid-connected start-up state
		Blue lights out	Unconnected Inverter Start-up
COM.	Communication indication	Blue light flash	Normal communication
		Blue lights out	Abnormal communication
ALARM	Alarm indication	Red light flashing slowly	Warning: Working instruction of PID power supply
		Red light flashing	Abnormal Warning: Conventional Warning
		Red light always on.	Serious Alarm: Malfunction
Remarks: **Slow flash** is defined as follows: 1 second bright, 2 seconds out; **Flash** is defined as follows: 0.5 seconds bright, 0.5 seconds out.			



No.	Label	Device name
1		Handle
2		Mounting rack

Figure 2-9 Back view of the whole machine



No	Label	Device name
1	DC SWITCH	DC SWITCH
2		PV- terminals
3		PV+ terminals
4	AC OUTPUT	AC output terminal
5		Wi-Fi/GPRS interface
6		Anti-backflow interface
7		RS485 interface

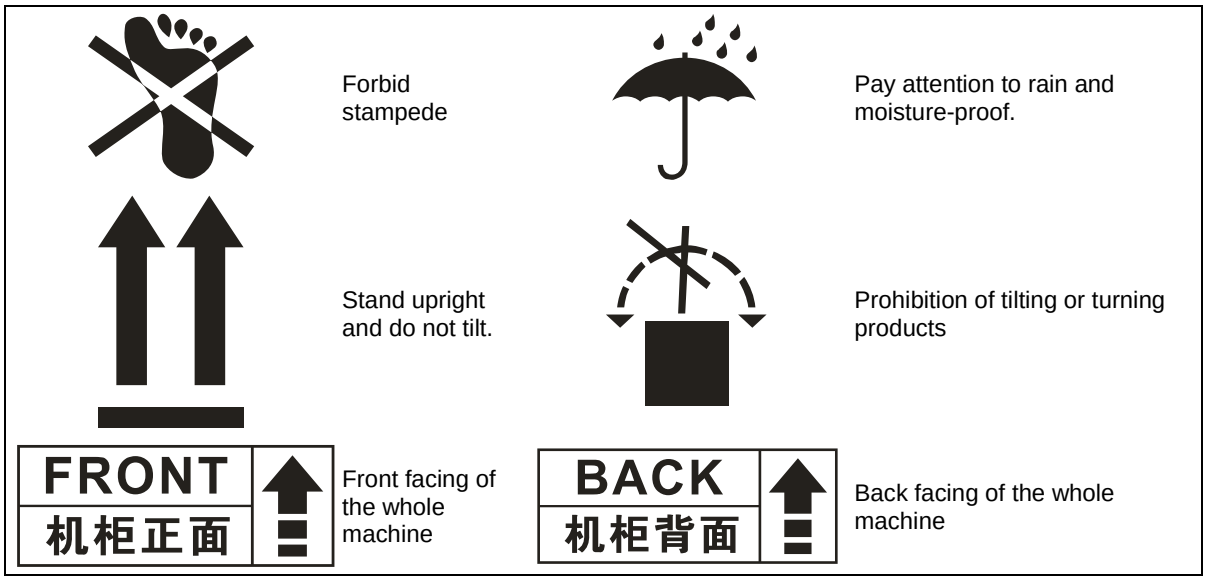
Figure 2-10 The bottom diagram of the whole machine (interface description)

2.6 Identification on the package

On the outer packaging of the product, there are some labels to guide the user to transport and store the product. The meanings indicated by the logo are as follows:

Do not stack or backlog

Handle with care and avoid damage caused by severe collision or friction during transportation.



2.7 Warning Labels in Inverter

In order to ensure the safety of the person and property when using the product and to avoid accidents, the following warning labels may be provided inside and outside the body of the string inverter to remind the user of the safety precautions during operation.

	**PE：** Here, the protective grounding terminal requires reliable grounding to ensure the safety of operators and equipment.
	**Warning:** This component may present a hazard other than high voltage, which the user should pay attention to.
	**High voltage hazard:** This component may present a high voltage hazard and the user must pay special attention.
	**Hot surface:** Pay attention to the hot surface to prevent burns.
	**Refer to the user manual:** Please refer to the corresponding instructions in the user manual before operation.
	**Discharge identification:** This equipment has an energy storage device. Before maintenance, it is necessary to wait for the energy storage device to discharge and prevent electric shock. The waiting time is not less than the indicated discharge time.

2.8 Technical Data

	Model	100KTL	110 KTL	125KTL-M	136KTL-M
Input parameters	Maximum input voltage	1100V			
	Minimum working voltage	180V			
	Working voltage range	200V~1000V			
	MPPT full load working voltage range	550V~850V		600V~850V	
	Rated input voltage	600V		720V	
	Maximum input current per MPPT	65A（13*5）			
	Maximum short circuit current per MPPT	100A（20*5）			
	Maximum input path	20			
	Number of MPPT	4			
Output parameters	Rated output power	100kW	110kW	125kW	136kW
	Maximum output apparent power	110kVA	121kVA	137.5kVA	149.6kVA
	Maximum active power	110kW	121kW	137.5kW	149.6kW
	Rated output voltage	3*230/400V 3W+N+PE		3*288V/500V 3W+PE	
	Output voltage range	300V~480V		375V~600V	
	Rated output frequency	50Hz/60Hz			
	Rated output current	144.3A	158.8A	144.4A	157.0A
	Maximum output current	158.8A	174.6A	158.8A	172.7A
	Power factor	-0.9~+0.9			
	Maximum total harmonic distortion	<3%			
Efficiency	Maximum efficiency	98.60%		98.82%	
	Chinese Efficiency	98.30%		98.52%	
Protection	Input DC switch	Supported			
	DC polarity reverse protection	Supported			
	DC surge protection	Class 2			
	Insulation impedance test	Supported			
	AC short circuit protection	Supported			
	Output surge protection	Class 2			
	String fault detection	Supported			
	Protection against PID	Supported(night repair method)			
	RCD detection	Supported			
Display and communication	Display	LED, WLAN + APP			
	RS485 communication	Supported			
	PLC communication	Supported			
	Communication interface	WIFI + APP			
Conventional parameters	Dimensions (width * height * depth)	800*680*330mm			
	Weight	≤89kg			
	Working temperature	-40℃~+60℃			
	Maximum working altitude	4000m			
	Noise index	≤70dB			
	Cooling mode	Smart air cooling			
	Protection grade	IP65			
	topological structure	No transformer			
	Input terminal	MC4 plugging terminal			
	Output terminal	OT/DT terminal			
Technical indicators	Standard of satisfaction	NB/T 32004-2020			

2.9 Mechanical Parameters

Size and weight

Model	Width * height * depth (mm)	Net weight (kg)
hopeSun 100KTL	880*680*330mm	≤89
hopeSun 110KTL		
hopeSun125KTL		
hopeSun 136KTL-M		

Note: size does not contain hangers, handles, pads and other components. Dimensional error: + 10mm.

Inverter structure and mounting rack installation size

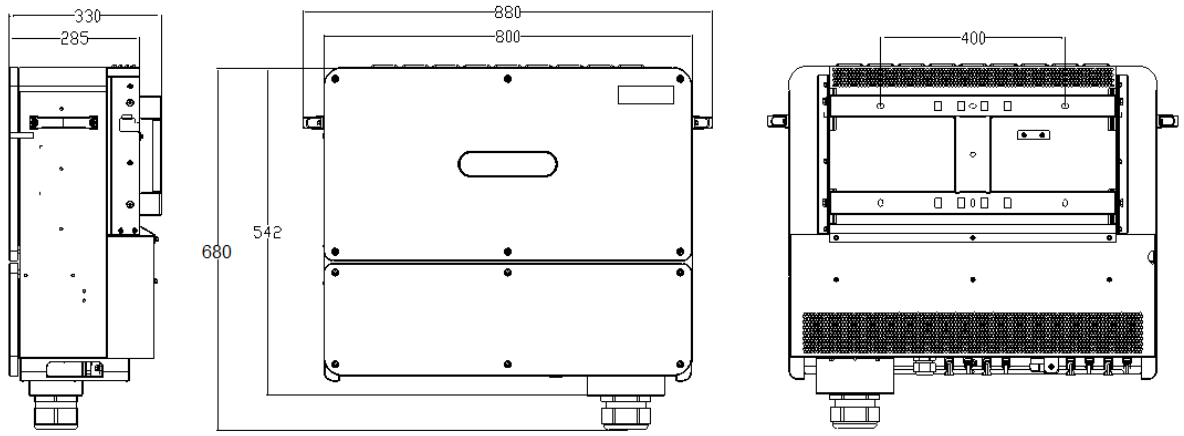


Figure 2-1 Structural dimensions of hopeSun series (right, front, back, unit: mm)

2.10 Environmental requirements

Transportation environment	**Requirements**	
Type of shipping	Waterways, railways, highways, aviation, etc.	
Ambient temperature	-40℃~+70℃	
Relative humidity	≤95%, at +40° C	
Mechanical condition	The vibration should not exceed the following limits: 2Hz≤f<9Hz, displacement 7.5mm; 9Hz≤f<200Hz, acceleration 20m/s^2; 200Hz≤f<500Hz, acceleration 40m/s^2;	
Storage environment	**Requirements**	
Storage place	Store in a warehouse with air circulation, no harmful gases, no flammable or explosive materials, and no corrosive materials. Avoid strong mechanical vibrations and shocks; stay away from strong magnetic fields.	
Ambient temperature	-40℃~+70℃	
Relative humidity	≤95%	
Mechanical condition	The vibration should not exceed the following limits: 10Hz≤f＜57Hz，displacement0.075mm； 57Hz≤f＜150Hz，acceleration10m/s^2；	
Working environment	**Requirements**	
	Normal operation	**Shutdown state**
Installation place	Do not install the inverter in an area where flammable or explosive materials are stored. The installation site can be indoors or outdoors, preferably in a well ventilated environment. Avoid direct sunlight, rain and snow to extend the life of the inverter. It is recommended to install it in a sheltered location. If it is not possible, install an awning.	
Ambient temperature	-40 °C ~ +60 °C (after 40 °C, the maximum continuous input power and branch current derating 2% per °C)	-40℃~+70℃
Relative humidity	Relative humidity: 5%~95%	
Altitude	≤5000m, more than 4000m must be derated	
Mechanical condition	The vibration should not exceed the following limits: 10Hz≤f＜57Hz，displacement 0.075mm； 57Hz≤f＜150Hz，acceleration 10m/s2；	

--End of the chapter --

3 System Installation

3.1 Unpacking Inspection

In the case of confirming that the outer packaging is intact, please carry out the unpacking inspection. Unpack the box and check that the string inverter looks good. When opening the package, be careful to use the tool to avoid scratching the string inverter;

The string inverter has been rigorously tested and inspected at the factory, but there may be accidental damage during transportation, so please check the string inverter the first time after receiving the goods. . If you find any damage or omission, please contact Hopewind Electric as soon as possible, our staff will be happy to serve you in the first time.

3.2 Installation Tool Preparation

Tool or device	Use	Remarks
4#Inner hexagon spanner	Lower doorplate disassembly	
Phillips screwdriver (PH2)	Fasten the grounding screws and pegboard screws	Bolt specifications: M6 and M8
Tube type crimping pliers	Tube type crimping pliers	
Socket wrench	Output cable connection	Bolt specifications：M8
MC4 crimping pliers	Crimp the MC4 terminals	The input cable needs to be crimped into the MC4 terminal before it can be connected to the PV+/PV- terminal on the inverter
MC4 removal tool		
Wire stripper		
Multimeter	Measure voltage to ensure wiring and installation safety	
Safety equipment	Necessary labor protection for construction	Insulating shoes, gloves, etc

3.3 Installation Environment Requirements

- The environmental requirements for the installation of string inverter are shown in "**1 Safety Precautions**".
- The installation mode and position must be suitable for the weight and size of the string inverter. See "**2.9 Mechanical Parameters**".
- The string inverter should be installed in a well ventilated environment to ensure good heat dissipation. Avoiding inverter direct sunlight, rain and snow can prolong the life of inverter. It is recommended to choose sheltered installation sites. If they can not be satisfied, please set up a sun shading shelter.
- During the operation of the string inverter, the temperature of the chassis and the radiator will be relatively high. Do not install the inverter in the position which will be touched unintentionally.

3.4 Reserved Space Requirement

When installing the string inverter, the space around the string inverter must be reserved for heat dissipation and maintenance.

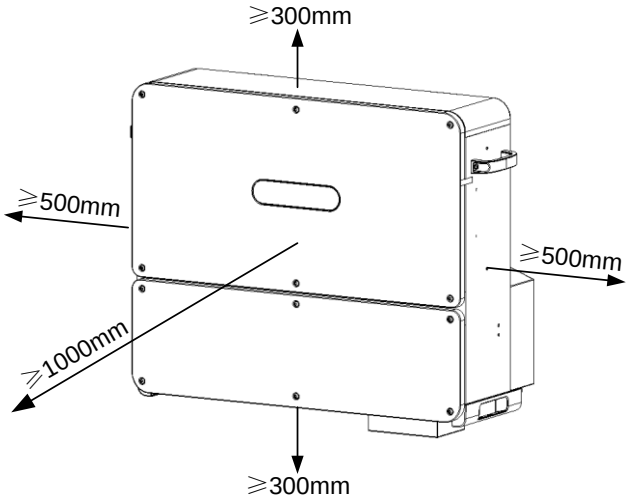


Figure 3-1 string inverter installation space

3.5 Fixed method

A hanging board is attached to the package of the string inverter. Fixed hanging board should be installed before the inverter is mounted and fastened on the hanging board. According to the actual installation environment, two installation modes can be selected, i.e. column-holding/rod-holding and wall-hanging.

CAUTION	
1.	For the precautions when installing the inverter, refer to "1 Safety Precautions"; for installation environment requirements, please refer to "3.3 Installation Environment Requirements".
2.	During installation, it must be confirmed that the site installation location can carry the total weight of the inverter and accessories to avoid falling during installation or use.
3.	The fixing of the inverter is recommended to be operated by 2 people together to avoid mechanical damage. During the installation process, safety measures should be taken to prevent bruises.
4.	Install it vertically or at least 15° backwards to help dissipate heat from the machine. Do not install the inverter obliquely (forward tilting, backward tilting too large, tilting), horizontal installation, or inverted installation. .

3.5.1 Hoop Mounting

Installation steps

1. Take out the hanging plate in the package and confirm the front, back, and top of the hanging plate;
2. Use at least 2 PCS hoops on the back side of the slats through the ferrule mounting holes (customer-supplied by the hose clamp);
3. Place the hanging plate in the installation position and fasten the band;
4. Before hanging the inverter, please confirm that the bearing range meets the requirements;
5. Hang the inverter on the hanging plate and fasten the connecting plate and inverter from both sides with 4 PCS M8 screws (supplied accessories)；
6. The installation process ends and the actual effect is as shown below:

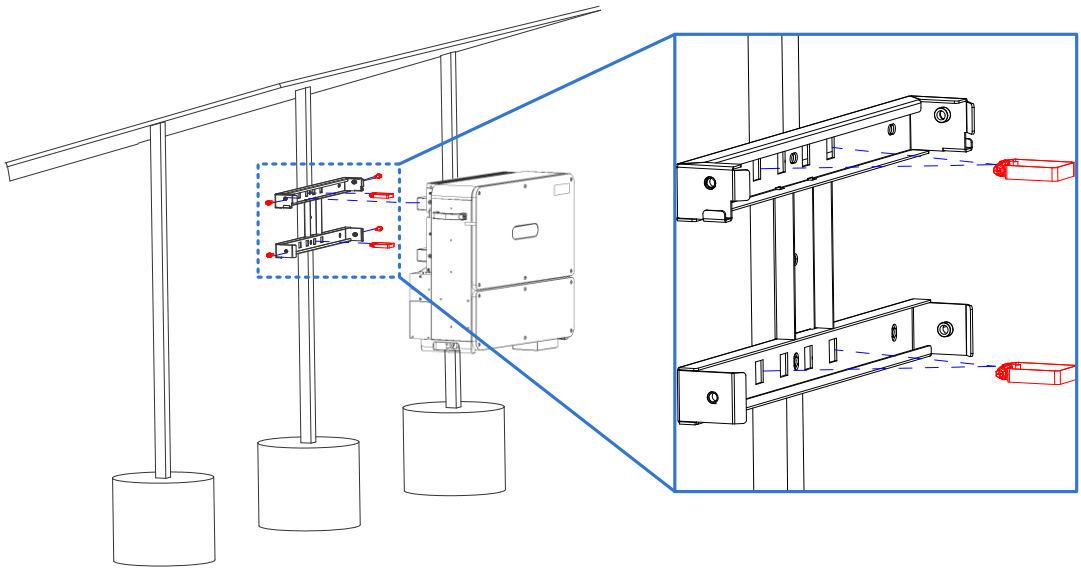


Figure 3-2 String inverter hoopmounting diagram

3.5.2 Screw Rod Mounting

Installation steps

1. Take out the hanging plate in the package and confirm the front, back, and top of the hanging plate;
2. Use the 3 PCS M8 screws (supplied accessories) to secure the pendant to the mounting position;
3. Before hanging the inverter, please confirm that the bearing range meets the requirements;
4. Hang the inverter on the hanging plate and fasten the connecting plate and inverter from both sides with 4 PCS M8 screws (supplied accessories);
5. The installation process ends and the actual effect is as shown below:

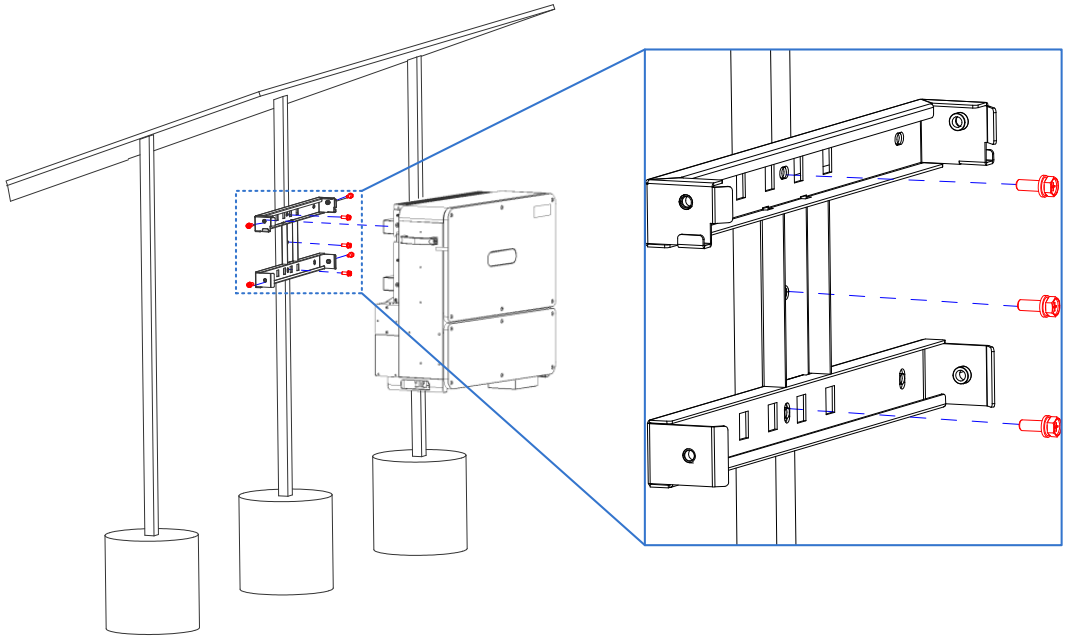


Figure 3-3 String inverter screw mounting diagram

3.5.3 Bracket Mounting

This type of mounting allows the inverter to be mounted on a load-bearing wall or bracket. If you need to install the wall, please purchase the M8 expansion nails on the wall according to the installation environment and wall load.

Installation steps

1. Take out the hanging plate in the package and confirm the front, back, and top of the hanging plate;
2. If necessary, punch holes in the wall or bracket according to the size of the mounting hole of the hanging plate;
3. Wall mounting: Fasten the mounting plate to the wall using 4 PCS M8 expansion pins;
4. Bracket mounting: Fasten the mounting plate to the bracket using 4 PCS M8 screws (supplied accessories);
5. Before mounting the inverter, please ensure that the installation surface is strong and meets the load-bearing requirements;
6. Hang the inverter on the hanging plate and fasten the connecting plate and inverter from both sides with M8 screws (supplied accessories);
7. The installation process ends and the actual effect is as shown below:

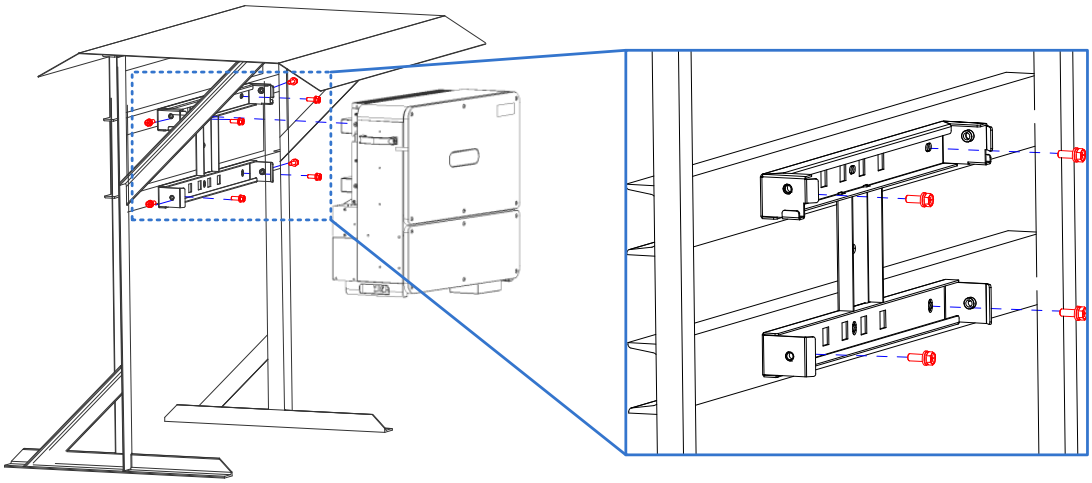


Figure 3-4 String inverter wall mounting diagram

3.6 Electrical connections

3.6.1 Cable requirements

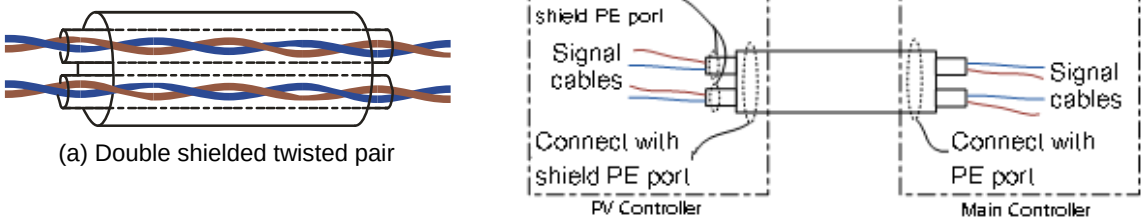
The choice of cable should comply with relevant national standards and meet the load requirements.

Power cable requirements

Refer to the electrical data in the product data, and then consider the ambient temperature, current, margin and other factors to select the cable specifications.

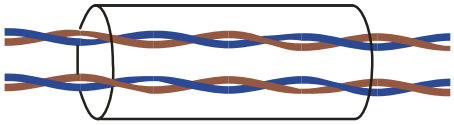
Communication cable requirements

Because weak communication signals are susceptible to external interference, the communication cable requires a shielded cable and grounds its shield as shown in the following figure. Also refer to the relevant document "GB 50217-2007 Cable Design Specification".

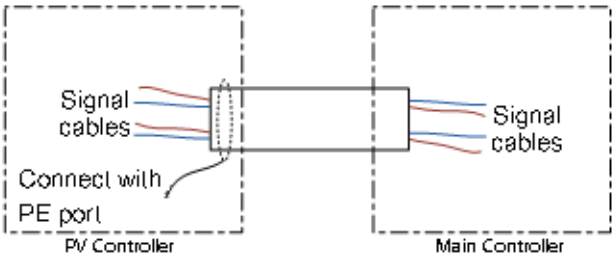


(a) Double shielded twisted pair

When the cable is insulated by two layers, the outermost shield is grounded at both ends, and the inner shield is equipotentially grounded.



(b) Multiple pairs of twisted pairs of single shield



When the cable is insulated and shielded by a single screen, in order to prevent the potential difference from being formed, the shield can be equipotentially grounded at one end.

Figure 3-5 Twisted pair with shield

The RS485 communication cable generally has four thin wires (blue, brown, gray, and black, respectively) and one shielded grounded copper wire. When wiring, cut off the gray line, use the blue line, brown line and black line, as shown below, and wrap the shield grounding copper wire on the black line (need to ensure that the copper wire is longer than the black line, To prevent the copper wire from being pulled off, connect the RS485 PE terminal.

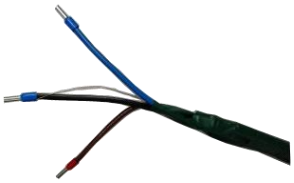


Figure 3-6 RS485 communication cable schematic

3.6.2 Cable Selection

Name	Label	Recommended Cable Specifications	Note
PV branch input cable		It is recommended to use a cable with a cross-section of 4.0 mm2 for each PV+ and PV- branch.	--
AC output cable	A、B、C、N	4 core outdoor cable (A, B, C, N) or 3 core outdoor cable (A, B, C) Recommended cross sectional area of conductor (Tong Xianlan): 50mm^2	The AC output has only 1 waterproof lock head, the specification is 65mm~70mm. Please use the sleeve to adjust the force when locking the screws.
RS485 communication cable		It is recommended to use a special communication cable or 4-core or 2-core shielded twisted pair cable with a cross-sectional area of not less than 0.75mm2.	
PE ground cable	PE	It is recommended to use at least one grounded dedicated cable with a cross-sectional area of 25 mm^2.	--

3.6.3 Torque requirement

When tightening the cable connections, the tightening torque needs to meet the requirements of the table below.

Table 3-1 Threaded tightening torque list

Thread specification	Performance level 4.8		Performance level 8.8		Unit
	General connection	High tightness connection	General connection	High tightness connection	
M3	6	8			kgf.cm
M4	12	14			kgf.cm
M5	25	30			kgf.cm
M6	50	60			kgf.cm
M8			110	150	kgf.cm
M10			300	390	kgf.cm
M12			550	650	kgf.cm
M16			1600	2000	kgf.cm

Note: The internal bolts of our series string inverters with external nominal diameter of 8mm or more are 8.8 grade Dacromet bolts.

3.6.4 Preparation before operation

DANGER

1. When connecting cables, do not operate energized and follow the relevant requirements in "**1 Safety Precautions**".
2. Before connecting the cables, please complete the following preparations to avoid personal injury.
   1) Before making electrical connections, make sure that the "DC SWITCH" of the inverter is in the "OFF" state, otherwise the high voltage of the inverter may cause a shock hazard.
   2) Determine the positive and negative poles of the input cable and mark them. Make sure the input cable is disconnected from the PV string.
   3) Verify that the open circuit voltage of the PV string does not exceed the specified limit.
3. When connecting the input cable, make sure that the positive and negative terminals of the input cable correspond to the positive and negative terminals of the PV inverter of the string inverter.

3.6.5 Connect to ground

By protecting the ground wire, the inverter is connected to the grounding bar to achieve the purpose of grounding protection. The ground wire connection is affixed with a PE mark. The ground cable diameter is not less than 16mm^2. The bolt size is M6.

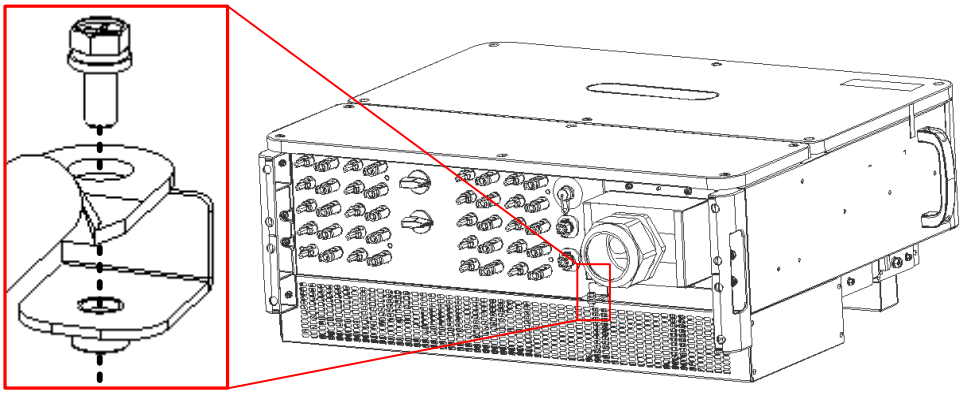
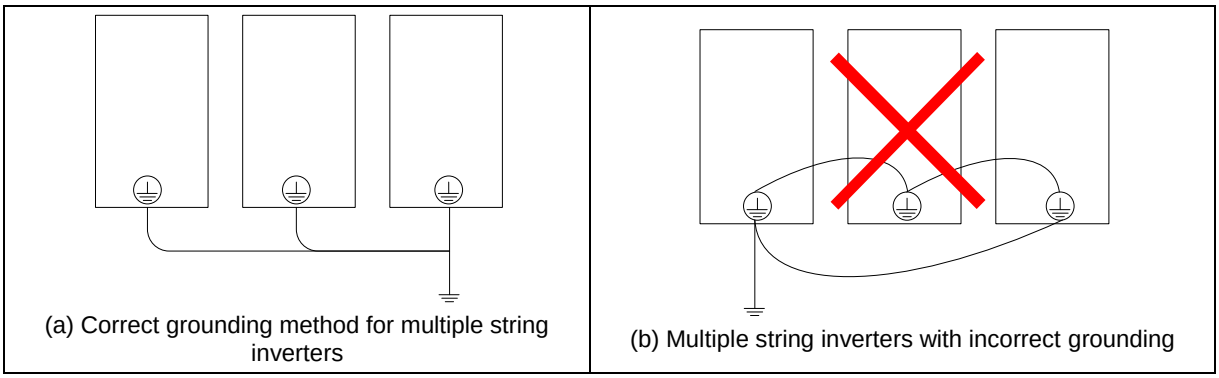


Figure 3-7 Protective grounding

For the grounding of multiple string inverters, use a single point grounding instead of winding the ground wire into a ring shape. As shown below.



(a) Correct grounding method for multiple string inverters

(b) Multiple string inverters with incorrect grounding

Figure 3-8 Multi-string inverter grounding

3.6.6 Open the lower door

CAUTION	
1)	Do not open the chassis door on the top of the inverter.
2)	Before the inverter opens the door, it must be ensured that the AC and DC are powered off.
3)	Please keep the 6 screws on the chassis door. Do not leave unused screws inside the chassis.

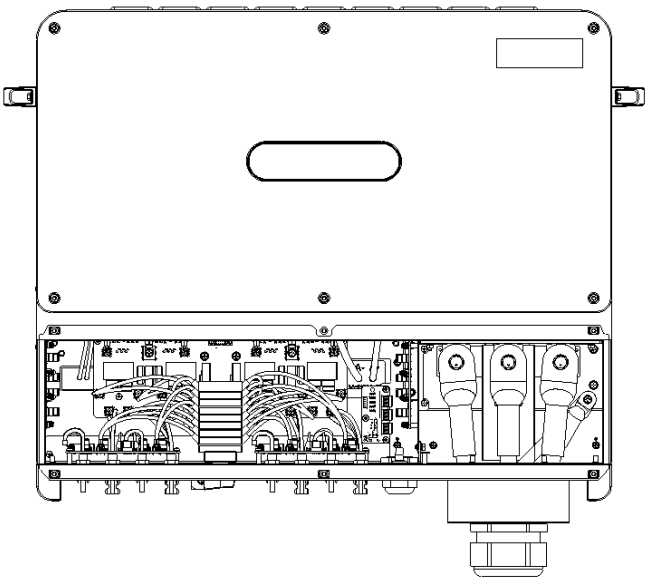


Figure 3-9 Disassemble the lower door panel

3.6.7 Connect the AC output cable

Precautions

- An independent three-phase circuit breaker is required outside the AC side of each inverter to ensure reliable disconnection between the inverter and the power grid. And the circuit breaker specifications meet the technical requirements.
- It is forbidden to share one circuit breaker for multiple inverters
- It is forbidden to connect the load between the inverter and the circuit breaker.
- The user must prepare the OT terminal by himself, the model number is M10.

Operation steps

1) Crimp the OT terminal and wrap the crimp with a heat shrink tubing or insulating tape.
2) Unscrew the locking cap on the “AC OUTPUT” waterproof lock on the bottom of the inverter.
3) Pass the completed AC cable into the lock cap and the “AC OUTPUT” waterproof lock on the bottom of the inverter.

4) Connect the AC cable to the tightening torque of 8N*m on A, B, C, and N of the AC terminal block.
5) Lock the locking cap. Check for gaps in the waterproof lock. If there is a gap in the waterproof lock, use a fireproof mud to block the gap.

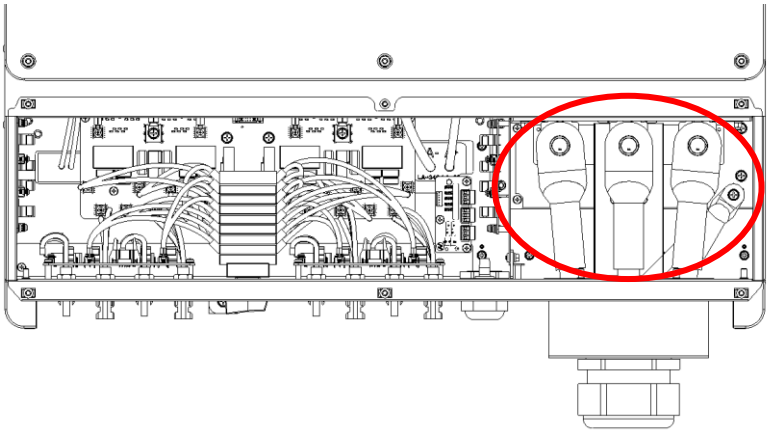


Figure 3-10 AC terminal block connection

3.6.8 Connect communication cable

Cable connection instructions

The inverter can be connected to communication equipment (such as a data acquisition cabinet or a PC.) through the RS485 communication cable.The anti-backflow function of the inverter can prevent photovoltaic panel energy from flowing to the grid. The RS485 interface and the anti-backflow interface are located at the bottom of the chassis (the RS485-1 is the RS485 communication interface while the RS485-2 is the anti-backflow interface), as shown in the figure below.

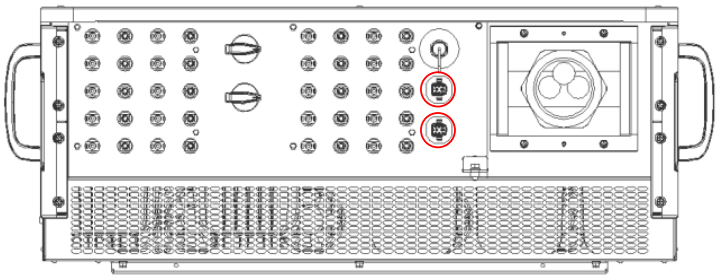
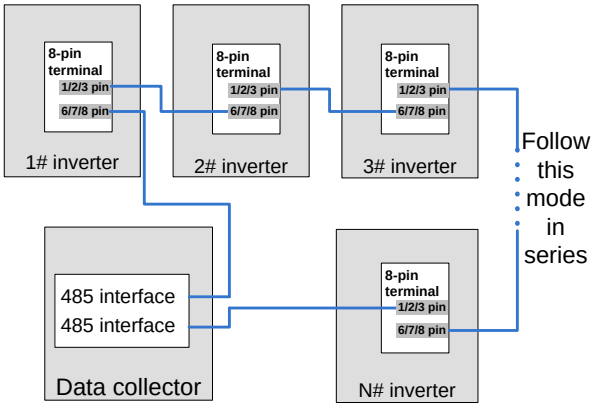


Figure 3-11 Location of RS485 and anti-backflow interfaces

The connection of multiple inverters is suggested to be connected in series in the following diagram.



Lock the locking cap when the connection is complete. Check for gaps in the waterproof lock. If there is a gap in the waterproof lock, use a fireproof mud to block the gap.

3.6.9 Connect the DC input cable

🕮 In order to make full use of the DC input power, the PV strings of the same input MPPT should be identical in structure, including the same model, the same number of panels, the same tilt angle, and the same azimuth.

DANGER

1. When the sun shines on the panel, it will generate voltage, which may cause life-threatening. Therefore, if the DC input line is connected under light conditions, you need to ensure that the input line is not charged (you can cover the panel with an opaque cloth and then proceed operating)
2. Before connecting the input line, make sure that the DC side voltage is within the safe voltage range (ie within 60 VDC) and the inverter "DC SWITCH" is in the "OFF" state, otherwise the high voltage generated may cause a shock hazard.
3. When the inverter is running in the grid, it is forbidden to perform maintenance operations on the DC input line, otherwise it will cause electric shock hazard.
4. If you want to remove the positive and negative connectors, make sure that "DC SWITCH" has been placed in the "OFF" state.

CAUTION

Please ensure that the following conditions are met, otherwise it may cause a fire hazard.

- Each component of the string in series is of the same specification.
- The maximum opening voltage of each PV string cannot be greater than 1100 VDC under what circumstances.
- The maximum short-circuit current of each PV string shall not exceed 15A under any conditions.
- Ensure that the polarity input on the DC input side is correct, that is, the positive pole of the PV module is connected to the positive pole of the DC input terminal of the inverter, and the negative pole is connected to the cathode of the DC input terminal of the inverter.

Precautions for grounding the PV string

If the inverter is directly connected to the N-line of the power grid and connected to the PGND line (such as the low-voltage distribution network or the N-line and ground-connected power grid), the positive or negative pole of the PV string is prohibited from being grounded, otherwise the inverter will not be able to normal work.

DC input terminal selection

Number of input channels	Combiner box DC input terminal
1	PV1
2	PV1、PV2
3	PV1、PV2、PV3
4	PV1 ~ PV3、PV4
5	PV1 ~ PV4、PV5
6	PV1 ~ PV5、PV6
7	PV1 ~ PV6、PV7
8	PV1 ~ PV7、PV8
9	PV1 ~ PV8、PV9
10	PV1 ~ PV9、PV10
11	PV1 ~ PV10、PV11
12	PV1 ~ PV11、PV12
13	PV1 ~ PV12、PV13
14	PV1 ~ PV13、PV14
15	PV1 ~ PV14、PV15
16	PV1 ~ PV15、PV16

17	PV1 ~ PV16、PV17
18	PV1 ~ PV17、PV18
19	PV1 ~ PV18、PV19
20	PV1 ~ PV19、PV20

Crimp MC4 terminal step

The input cable needs to be crimped into the MC4 terminal for connection to the string inverter PV+/PV- terminals. Before operation, ensure that "**3.6.4 Preparation before Operation**" has been completed.

1. The positive and negative poles of the input cable are determined and identified.

Note: Please do not judge the positive and negative according to the cable color in this manual. Be sure to take the actual measurement as the standard.

2. Use a wire stripper to strip the wire.

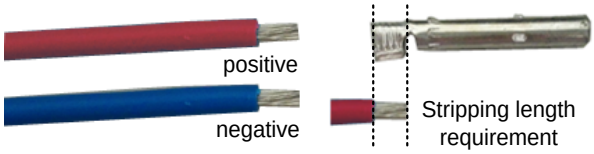


Figure 3-12 Stripping

3. According to the correct polarity, crimp the cable to the corresponding core.

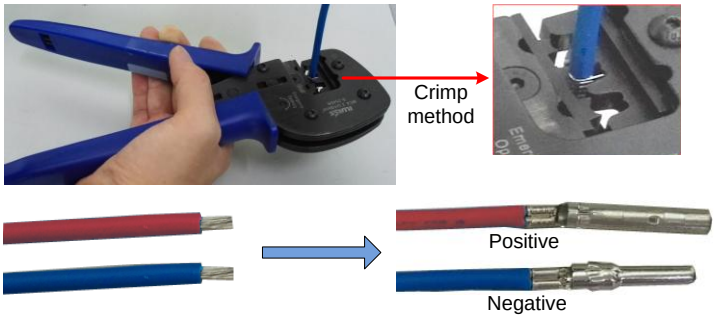


Figure 3-13 Crimp terminal

4. With the correct polarity, insert the core into the male and female ends of the MC4 connector and tighten the connector back cover.

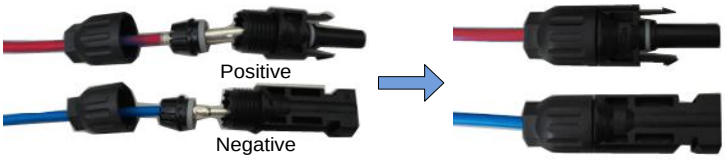


Figure 3-14 Assembly connector

Insert MC4 terminal

Insert the positive and negative connectors into the positive and negative terminals of the DC input terminal of the inverter until you hear a "click", indicating that the terminal is stuck in place.

CAUTION
After the cable connection of the string inverter is completed, check if there is a gap at the waterproof lock. If there is a gap in the waterproof lock, use a fireproof mud to block the gap. If there are unconnected input terminals, seal the unconnected input terminals.

--End of the chapter--

4 Commissioning Guide

4.1 Check before starting

DANGER

- Before proceeding to the next step of power on, please read carefully this manual "1 safety precautions" and do a detailed check according to the table below.
- In order to avoid danger, the multimeter and other instruments must be used to detect the voltage of the metal parts inside the casing (protective ground) of the string inverter.

Once the string inverter is installed, the following items need to be checked carefully before power up.

Mechanical inspection

- □ Please read "1 Safety Precautions" carefully.
- □ Ensure that the environment of the string inverter is in the normal range.
- □ Are there any foreign objects in the top and bottom of the string inverter cabinet?
- □ The string inverter has enough space around for maintenance and heat dissipation.
- □ The cables are clearly marked and correct.
- □ It is confirmed that there is no condensation inside the string inverter. If it has been found, it will be removed with heating tools.
- □ Ensure that all wiring screws are tightened according to torque requirements.
- □ Ensure RS485 wiring is correct and reliable.
- □ Make sure there is no gap between the input terminal and the waterproof lock.

Electrical inspection

- □ Ensure that the connection of the string inverter is reliable and the polarity is correct.
- □ The power cables and signal lines are all in conformity with the electrical safety regulations.
- □ Signal terminals and power lines are properly matched with terminals.
- □ The isolation area and warning signs have been set up around the string inverter to prevent others from misoperation or proximity.

4.2 Power-on system

To ensure that the electrical connection is completed, the power on operation can be performed and the inverter will be turned on.

Step 1: Close the AC circuit breaker between the inverter and the power grid.

Step 2: Put the inverter's "DC SWITCH" in the "ON" state.

Carry out the above steps, if the system does not have faults, the inverter will start automatically when the starting condition is satisfied.

4.3 System shutdown

Attentions

- After the inverter is powered off, there will be residual electricity and residual heat in the case, which may cause electrical shock or burns. Please be sure to operate the inverter after 5 minutes in the inverter system.
- When the power system is running, please follow the instructions and safety rules in this chapter.

Step 1: Turn off the inverter by means of data collector or APP software.

Step 2: Disconnect the circuit breaker between the inverter and the power grid.

Step 3: Put the inverter's "DC SWITCH" in the "OFF" state.

--End of the chapter--

5 Maintenance and troubleshooting

5.1 Maintenance project and cycle

DANGER
1. Please read "**1 Safety Precautions**" carefully before maintenance, and use a multimeter and other instruments to detect the voltage between the metal parts that need to be touched and the metal parts that may be in contact with the grounding copper bars to avoid electric shock. 2. When maintaining, please pay attention to the string inverter warning label, beware of high voltage and personal injury. 3. During maintenance, make sure that the DC input switch DC Switch is off. 4. After maintenance is complete, make sure the DC input switch DC Switch is closed before closing the inverter-side DC input switch.

String inverters need to be regularly maintained. Common maintenance items and cycles are shown in the table below.

Table 5-1 String inverter maintenance project and cycle

Check parts	Check item	Check item	Treatment	Inspection cycle
Overall inspection	Appearance	Observe whether the inverter appearance is damaged or deformed.	Please replace it in time when it is serious.	Once every six months to one year.
	System cleaning	Is there any foreign body or dust on the surface of inverter box?	Cleaning up foreign matter and dust	
		The heat sink is covered with dust and dirt.	Remove occlusion and dust removal	
System running	Operating status	Does the inverter have abnormal noise during operation?	In case of seriousness, please replace it in time.	Once every six months to one year.
	Operating parameters	When the inverter is running, check that the parameters are set correctly.	Exclude exception settings	
Connection part	Fall off, loose	Check if the cable connection is disconnected or loose.	Fasten the connection as specified	Half a year after the first commissioning, and once every six months to one year thereafter.
	Damage	Check the cable for damage. Focus on checking the surface of the cable that is in contact with the metal surface for traces.	In case of seriousness, please replace it in time.	
	Terminal	Check if the waterproof cover of the unused RS485, RJ45, etc. port is locked.	Guaranteed to be sealed	

🕮 Note: Before wiping the heat sink, turn off the inverter normally, then disconnect the circuit breaker between the inverter and the grid, and then put the "DC SWITCH" of the inverter into the "OFF" state. After powering off, wait at least 5 minutes before wiping the heat sink to avoid accidents.

5.2 Troubleshooting

Boost side

Fault word	ID	Fault name	Fault/alarm reason	Troubleshooting
Fault word 1	0	Auxiliary power supply overvoltage fault	±12V of auxiliary power supply is too high	Check if the auxiliary power hardware signal is normal;
	1	Auxiliary power supply undervoltage fault	±12V of auxiliary power supply is too low	Check if the auxiliary power hardware signal is normal;
	2	Output hardware overvoltage	The output voltage exceeds the protection point set by the hardware.	1. Normal work after resetting. 2. If it occurs frequently, please contact the Wangwang technician.

Fault word	ID	Fault name	Fault/alarm reason	Troubleshooting
	3	Hardware overcurrent (secondary)	Unit inductor current is too large	1. Normal work after resetting. 2. If it occurs frequently, please contact the Wangwang technician.
	4	Unit 1 hardware overcurrent	Unit 1 current overcurrent and hardware-by-wave current limit time	1. Normal work after resetting. 2. If it occurs frequently, please contact the Wangwang technician.
	5	Unit 1 hardware overcurrent	Unit 1 current overcurrent and hardware-by-wave current limit time	1. Normal work after resetting. 2. If it occurs frequently, please contact the Wangwang technician.
	6	Unit 1 hardware overcurrent	Unit 1 current overcurrent and hardware-by-wave current limit time	1. Normal work after resetting. 2. If it occurs frequently, please contact the Wangwang technician.
	7	Unit 1 hardware overcurrent	Unit 1 current overcurrent and hardware-by-wave current limit time	1. Normal work after resetting. 2. If it occurs frequently, please contact the Wangwang technician.
Fault word 2	2	EEPROM parameters back to default values	EEPROM read and write error	Fault reset or power-off processing
	3	Historical fault storage failed	Historical fault storage failed	Fault reset or power-off processing
	12	Input polarity reverse	Input polarity reverse	Check if the access is reversed
	13	Positive busbar grounding fault	Abnormal insulation resistance of positive bus to ground	Check whether there is grounding fault in the positive bus.
	14	Insulation failure of negative bus to ground	Abnormal insulation resistance of nagetive bus to ground	Check whether there is grounding fault in the negative bus.
Warning word 1	0	Lightning arrester alarm	Fault or status error of feedback lightning arrester	1. Check whether the state feedback of lightning arrester is normal. 2, replace lightning arresters to locate faults.
	6	Booster side alarm	Boost unit open circuit	1. Check whether the main circuit related devices, such as negative fuse, are open. 2, detect abnormal voltage and current sampling.
	7	Boost side short circuit alarm	Boost unit short circuit	1, check whether the main circuit related devices are short circuited. 2, detect abnormal voltage and current sampling.
	8	Abnormal alarm of battery string	Battery string exception	1, check whether the battery string configuration is abnormal. 2. Check whether the battery board access is abnormal. 3, confirm whether the battery string current sampling is abnormal.
	9	Alarm of positive bus to ground insulation	Abnormal impedance of positive bus to ground insulation	Find the cause of impedance anomaly
	10	Alarm of negative bus to ground insulation	Abnormal impedance of negative bus to ground insulation	Find the cause of impedance anomaly

Inverter side

Fault word	ID	Name of failure / alarm	Fault/alarm reason	Troubleshooting
System fault status word	0	RAM self test failed	Check RAM chip read and write error	Replace the DSP control board
	1	EEPROM parameters back to default values	Added EEPROM parameter list and re-upgrade code. The default value after initialization is different from the default value in EEPROM.	Manual reset
	2	EEPROM read and write failed		Replace the control panel

Fault word	ID	Name of failure / alarm	Fault/alarm reason	Troubleshooting
	3	FPGA version does not match	FPGA and DSP versions do not match	Upgrade the FPGA or replace the control board。
	4	Historical fault storage failed	Historical fault storage failed	Replace the control panel
	5	Internal communication failure	Internal communication failure	Upgrade or replace the control panel
Hardware fault status word	0	Hardware overcurrent (secondary)	Inductor current peak exceeds hardware protection threshold	1. Normal work after resetting. 2. If it occurs frequently, please contact the Hopewind technician.
	3	Phase A hardware overcurrent	Phase A inductor current triggers wave-by-wave current limiting protection	1. Normal work after resetting. 2. If it occurs frequently, please contact the Hopewind technician.
	4	Phase B hardware overcurrent	Phase B inductor current triggers wave-by-wave current limiting protection	1. Normal work after resetting. 2. If it occurs frequently, please contact the Hopewind technician.
	5	Phase C hardware overcurrent	Phase C inductor current triggers wave-by-wave current limiting protection	1. Normal work after resetting. 2. If it occurs frequently, please contact the Hopewind technician.
	6	Busbar hardware overvoltage	Bus voltage exceeds hardware overvoltage threshold	1. Normal work after resetting. 2. If it occurs frequently, please contact the Hopewind technician.
	7	Busbar midpoint overvoltage	Bus midpoint voltage exceeds hardware overvoltage threshold	1. Normal work after resetting. 2. If it occurs frequently, please contact the Hopewind technician.
Grid fault status word	0	Grid AB line voltage overvoltage	The AB line voltage of the power grid exceeds the overvoltage point set by the system.	1, confirm whether the sampling of the inverter grid voltage is normal. 2, confirm the failure time, whether the AC side such as box change tripping and other failures. 3, confirm whether the inverter has undergone high voltage ride through.
	1	Grid BC line voltage overvoltage	The BC line voltage of the power grid exceeds the overvoltage point set by the system.	1, confirm whether the sampling of the inverter grid voltage is normal. 2, confirm the failure time, whether the AC side such as box change tripping and other failures. 3, confirm whether the inverter has undergone high voltage ride through.
	2	Grid CA line voltage overvoltage	The CA line voltage of the power grid exceeds the overvoltage point set by the system.	1, confirm whether the sampling of the inverter grid voltage is normal. 2, confirm the failure time, whether the AC side such as box change tripping and other failures. 3, confirm whether the inverter has undergone high voltage ride through.
	3	AB line voltage undervoltage	The grid AB line voltage is lower than the undervoltage point set by the system.	1. Confirm whether the inverter grid voltage sampling is normal; 2. Confirm whether the inverter has a phase loss or whether the box change contacts are suitable.
	4	BC line voltage undervoltage	The grid BC line voltage is lower than the undervoltage point set by the system.	11. Confirm whether the inverter grid voltage sampling is normal; 2. Confirm whether the inverter has a phase loss or whether the box change contacts are suitable.
	5	CA line voltage undervoltage	The grid CA line voltage is lower than the undervoltage point set by the system.	1. Confirm whether the inverter grid voltage sampling is normal; 2. Confirm whether the inverter has a phase loss or whether the box change contacts are suitable.

Fault word	ID	Name of failure / alarm	Fault/alarm reason	Troubleshooting
	6	Grid abnormality	Grid frequency and voltage exceed system setting range	1. Confirm whether the access to the grid is the nominal grid of the inverter; 2. Confirm whether the grid is connected
	7	Grid voltage imbalance exceeds limit	Grid voltage imbalance exceeds system threshold	Confirm whether the grid is abnormal
	8	Grid overfrequency	The grid frequency exceeds the over-frequency point set by the system	1. Check whether there is a fault such as a box trip on the AC side of the inverter through fault recording and event recording. 2. Confirm the frequency range and confirm the time setting is reasonable.
	9	Grid underfrequency	The grid frequency is lower than the underfrequency point set by the system	1. Check whether there is a fault such as a box trip on the AC side of the inverter through fault recording and event recording. 2. Confirm the frequency range and confirm the time setting is reasonable.
	10	Grid phase sequence	Grid phase sequence is negative sequence	1. Check whether the three-phase power cable connection of the power grid is correct; 2. Check if the grid voltage sampling cable connection is correct.
	11	Island effect protection	Loss of power in the grid	Detecting the cause of grid voltage loss, such as box tripping, etc.。
	13	Grid voltage anomaly	Grid voltage abrupt change	Confirm that the grid is normal
	14	Low voltage ride through protection	Grid voltage exceeds low penetration protection threshold	Confirm that the grid is normal
	15	High voltage ride through protection	Grid voltage exceeds high wear protection threshold	Confirm that the grid is normal
Inverter fault status word	0	Module A phase software overcurrent	Inductor current RMS exceeds protection threshold	Fault reset
	1	Module B phase software overcurrent	Inductor current RMS exceeds protection threshold	Fault reset
	2	Module C phase software overcurrent	Inductor current RMS exceeds protection threshold	Fault reset
	3	Module current imbalance	Three-phase current imbalance exceeds the threshold	Confirm that the grid is normal
	5	Module temperature is too high	The radiator temperature is higher than the protection threshold.	Confirm that the spoiler fan is normal
	6	High temperature inside the machine	Ambient temperature is higher than protection temperature.	Confirm that the spoiler fan is normal
	9	Residual current abnormality	Residual current overrun	1. If it happens accidentally, it may be caused by the accidental abnormality of the external line. After the fault is cleared, it will resume work without manual intervention. 2, if frequent or long time can not be restored, please check whether the PV impedance is too low.
	11	Unit temperature is high.	Over temperature and load shedding	Confirm that the scrambling fan is running normally.
Bus fault word status	1	Bus operation short circuit	Bus voltage drop overrun	Detecting whether the bus bar is short circuited

Fault word	ID	Name of failure / alarm	Fault/alarm reason	Troubleshooting
	5	Bus overrunning	The bus voltage exceeds the set threshold.	1, check whether the hardware related to bus voltage sampling is normal. 2, confirm the DC source or battery panel configuration is normal.
	6	Bus operation under voltage	The bus voltage is below the set threshold.	1, check whether the hardware related to bus voltage sampling is normal. 2, detect whether the bus bar has short circuit and other faults.
	7	The bus voltage is unbalanced.	Positive and negative bus voltage imbalance exceeds the set threshold.	1, check whether the hardware related to bus voltage sampling is normal. 2, detect whether the bus bar has short circuit and other faults.
	8	DC high input voltage	DC input voltage exceeds the setting threshold.	1, whether the detection module is over allocated. 2, check whether the input voltage detection circuit is normal.
	9	DC low input voltage	DC input voltage is below the setting threshold.	Check whether the switch is disconnected.
Other	0	Grid connected relay failure	Relay status error	Detecting master slave relay status
	3	AC side SPD alarm	Check the feedback state error of the AC side SPD.	Detect SPD status
	4	Internal fan fault	Fan failure or abnormal feedback signal	1, check whether the fan drive circuit is normal. 2, check whether the fan itself is normal.

--End of the chapter--

6 Inverter Instruction

6.1 Remove inverter

Before operating, make sure that the circuit breaker between the inverter and the grid is disconnected, and the "DC SWITCH" is placed in the "OFF" state.

1) Disconnect all electrical connections to the inverter, including the AC output line, RS485 communication line, DC input line and protective ground.
2) Remove the inverter from the backplane.

6.2 Replacement of inverter

After the old inverter is dismantled, if the new inverter needs to be replaced, the order of operation in Chapter 4,5,6 can be achieved.

6.3 Packaging inverter

- If you still keep the original packaging of the inverter, please put it in the original packaging, and pack it firmly with adhesive tape.
- If you can't find the original package, pack it firmly in a hard carton suitable for the inverter's weight and size.

6.4 Scrapped inverter

- When the service life of the inverter expires or failures are replaced, it can be disposed of in accordance with the applicable electrical waste disposal bills in the place where the inverter is installed, or it can be handed over to Ho Wang Electric Customer Service Personnel.

--End of the chapter--

Appendix

Warranty

If the product has any fault in the warranty period, we shall provide cost-free repair or replacement service.

Any faults arising from the following conditions shall be out of the warranty:

- Dismantle the product without our permission or maintain in wrong way;
- Out of the warranty period;
- Use the product out of the application scope stipulated in related international standard;
- Fail to install and operate the product according to the user manual;
- Use the product in improper environment;
- Use non-standard or those components/software not provided by our company;
- Damaged due to the failure of external devices;
- Any accidental damage arising from personal dismantlement or maintenance by yourself.

When the client requires repair service for abovementioned faults, we shall offer paid repairservice after it’s determined by our service department. Please contact us in advance if you wantrepair or alteration service.

Contact Us

Shenzhen Hopewind Electric Co., Ltd.
Address: Building 5, Guanlong No. 2 Industrial Park, Xili, Nanshan District, Shenzhen, PR.China
Website: www.hopewind.com
E-mail:hopewind@hopewind.com
Tel: +86-(0)755-8602 6786
Fax: +86-(0)755-2651 8311

Add: Building No. 11, Guanlong Second Industry Park, Xili Town, Nanshan District,
Shenzhen, China 518055
Tel: +86-(0)755-8602 6786
Web: www.hopewind.com