HOPEWIND

HSSP Series
PV String Grid-Tied Inverter

(HSSP3K-G01, HSSP4K-G01, HSSP5K-G01, HSSP6K-G01, HSSP8K-G01, HSSP10K-G01)

User Manual

Version: 1.4

Shenzhen Hopewind Electric 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, debug, operate and maintain string inverters of Hopewind. Please read this manual carefully before operating the product. Readers are required to know the basic knowledge about electric components, wiring, signs and mechanical drawings.

➢ Outlines

Chapter	Contents
1 Safety Precautions	This chapter describes the safety precautions when transporting, storing, installing, running and maintaining the Inverter.
2 Product Description	This chapter describes the basic principles, naming rules, product configuration and data.
3 System Installation	This chapter describes the unpacking inspection, installation tools, installation environment, reserved space, fixing method, cable connection.
4 Commissioning Guide	This chapter describes the inspection before startup, commissioning and startup of string inverter.
5 Maintenance and Troubleshooting	This chapter describes the daily maintenance methods, maintenance intervals and troubleshooting of the product.
6 Inverter Disposal	This chapter describes the basic requirements and precautions when removing, replacing, packing and disposing the inverter.

➢ Warning Signs in This Manual

DANGER	**Major potential danger (especially a high voltage danger)**. Failure to observe the rules might cause serious personal injury or property loss.
WARNING	**Ordinary potential danger**. Failure to observe the rules might cause personal injury or property loss.
CAUTION	**Ordinary potential risk**. Failure to observe the rules might cause malfunction of the equipment or property loss.

➢ Glossaries and Abbreviations

Glossaries/Abbreviations	Description
MPPT	Maximum power point tracking
PV string	Multiple solar cell arrays in parallel or series
EEPROM	Electrically erasable programmable read-only memory

Content

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 installation and maintenance and follow them in operation process, otherwise it may cause personal injury or damage to the converter, the generator as well as other related equipment.

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. 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.

 **WARNING**
Please do not place inflammables and explosives around the inverter to ensure environmental safety.

1.1 Transportation

 **WARNING**
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 labels on the package. For the meaning of the logos, please refer to **2.5 Package Labels**.
3. The transportation environment must meet the requirements. Please refer to **2.9 Ambient Requirements**.

1.2 Storage

WARNING

The storage environment of the string inverter must meet the corresponding requirements. Please refer to **2.9 Ambient 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:

- When storing equipment, pay attention to ventilation and moisture. Stagnant water is strictly forbidden in the storage environment.
- Pay attention to the harsh environment, such as quenching, sudden heat, collision, dust, etc., to avoid damage to the string inverter.
- Regular inspections are required, usually not less than once a week. Check whether the packaging is intact to avoid pest bites. If it is damaged, it needs to be replaced immediately.
- It is strictly forbidden to store the device 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 housing of the inverter is reliably guaranteed.
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.

WARNING

1. During installation, it is necessary to ensure that the string inverter’s installation environment is well ventilated and heat-dissipating, and the device 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 while 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 standards, the power cable may be overheated. In severe cases, a fire may occur.
6. Do not ground the PV input power cables as they are not designed for default grounding.
7. The installation site must meet the requirements of the operating environment. Please refer to **2.9 Ambient Requirements**.

1.4 Operation

DANGER

1. During the operation of the string inverter, it is necessary to ensure that the door panel of the string inverter 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 inverter.
2. When the string inverter is powered on, it is prohibited to touch the internal single boards, devices, cables and terminals of the string inverter and to plug and unplug the external terminals.
3. In case of any fault, abnormal smell or sound of the string inverter, please immediately switch off the DC switch of the string inverter and the circuit breaker on the AC side of the inverter.

WARNING

1. Power on the string inverter only after all installation work is completed and cables are not connected incorrectly.
2. It is prohibited to conduct any insulation resistance test or voltage withstand test on the string inverter. Wrong voltage withstand test will damage the string inverter.
3. When conducting insulation withstand voltage test on external equipment of the string inverter, the wiring between the string inverter and the external equipment must be disconnected.

1.5 Maintenance

DANGER

1. Before maintenance work, you must first disconnect the AC output side circuit breaker, then disconnect the input DC switch, and wait at least 5 minutes before operating the string inverter.
2. During the maintenance process, try to avoid irrelevant personnel from entering the maintenance site.
3. Please maintain the string inverter under the condition that you are familiar with and understand the contents of this manual, and have suitable tools and test equipment.
4. For personal safety, please wear insulating gloves and anti-smashing shoes.

WARNING

The string inverter must be checked and maintained regularly. For details, refer to **5 Maintenance and Troubleshooting**.

--End of the chapter--

2 Product Description

2.1 Product Introduction

HSSP series single-phase string inverters are independently developed by Hopewind, mainly including six models: HSSP10K-G01, HSSP8K-G01, HSSP6K-G01, HSSP5K-G01, HSSP4K-G01, and HSSP3K-G01. HSSP10K-G01 and HSSP8K-G01 are inverters with 3 input interfaces. HSSP6K-G01, HSSP5K-G01 and HSSP4K-G01 are inverters with 2 input interfaces; HSSP3K-G01 is the inverter with one input interface; and the grid-connected voltage levels of the six models are all 220 V AC. The maximum DC input voltage is 600 V DC. The main function is to convert the direct current generated by the photovoltaic string into alternating current and feed it into the grid.

2.1.1 Schematic Diagram

HSSP10K-G01 and HSSP8K-G01 access 3 PV strings (HSSP6K-G01 and HSSP5K-G01 access 2 PV strings), and there are 2 MPPT circuits inside the inverter to track the strings. HSSP4K-G01 accesses 2 PV strings (HSSP3K-G01 accesses only one PV string), and there is one MPPT circuit inside the inverter to perform MPPT tracking on the string, then convert the DC current to single-phase AC current through the inverter circuit. And there is the lightning protection function on both the DC and AC sides. The schematic diagrams are shown below.

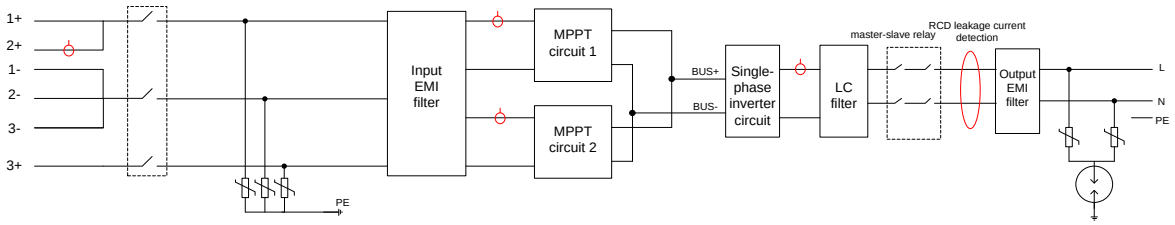


Figure 2-1 Schematic diagram of HSSP10K-G01 and HSSP8K-G01

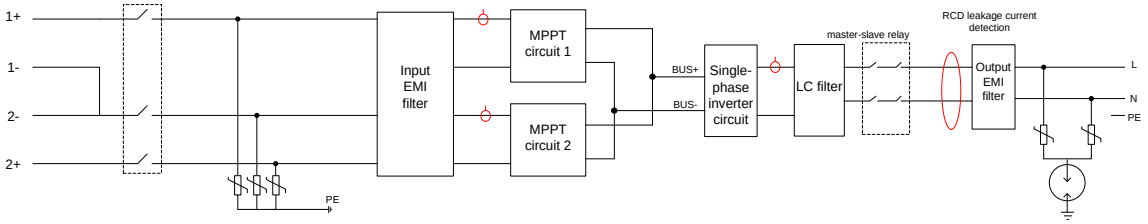


Figure 2-2 Schematic diagram of HSSP6K-G01 and HSSP5K-G01

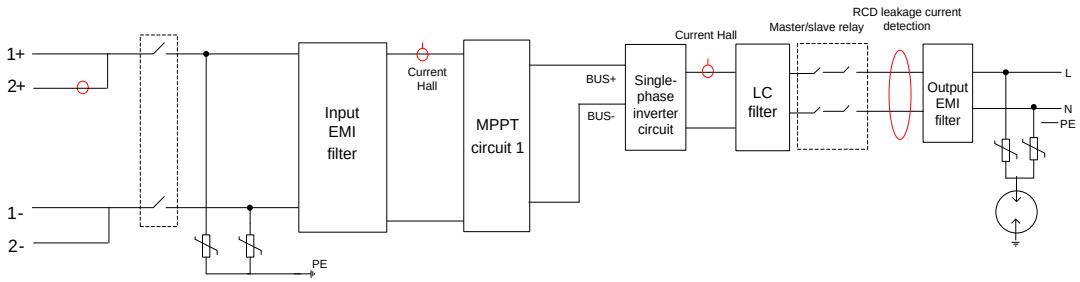


Figure 2-3 Schematic diagram of HSSP4K-G01

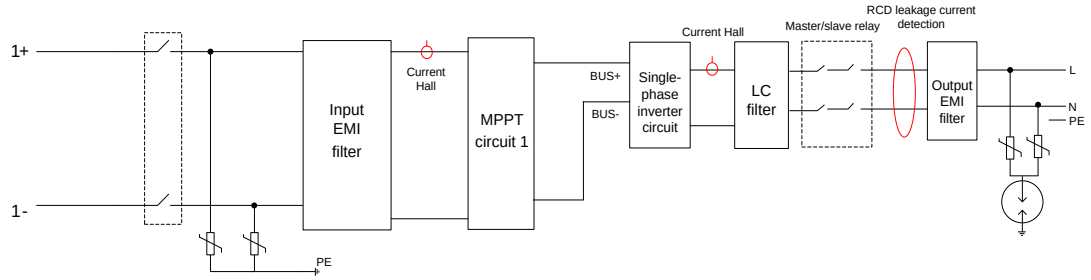


Figure 2-4 Schematic diagram of HSSP3K-G01

For the AC switch, it is recommended to use AC air switch or AC circuit breaker. Similarly, for the DC switch, it is recommended to use DC air switch or DC circuit breaker.

2.1.2 Working Mode

HSSP3K~10K-G01 series single-phase string inverter has three working modes: standby mode, operating mode, and shutdown mode. The switching conditions for these three modes are shown as follows.

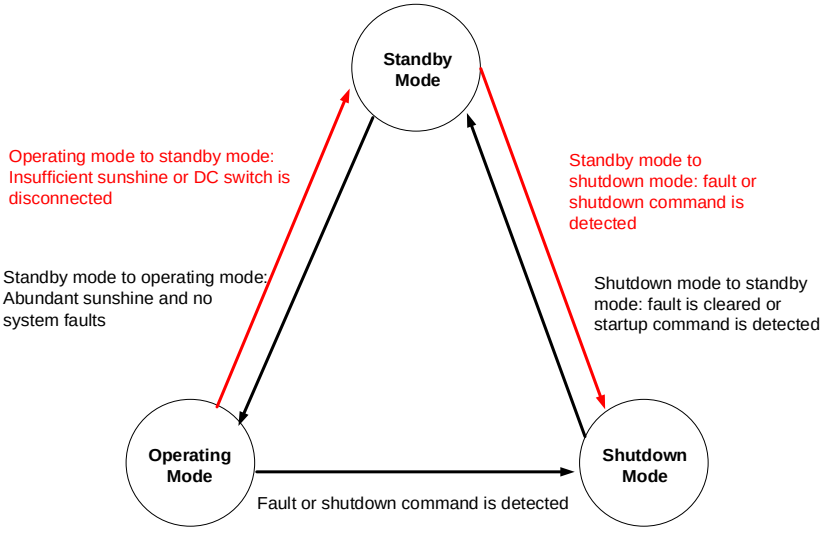


Figure 2-5 HSSP4K-G01 series inverter operating mode

Working mode	Description
Standby	1） Standby mode mainly means that the external environment does not meet the operating conditions of the inverter such as insufficient light and the disconnection of DC input switch. 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 test, it enters the shutdown mode.
Operating	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 make the PV string output maximum power. If the inverter detects a fault or a shutdown command, it enters the shutdown mode. If it is detected that the input power of the PV string is lower than the grid-connected power generation condition, it enters the standby mode.
Shutdown	If the inverter detects a fault or a shutdown command during standby or operation, it switches to the shutdown mode. In the shutdown mode, if the inverter detects that the fault has been cleared or a power-on command, it enters the standby mode.

2.2 System Configuration and Networking Application

2.2.1 Networking Description

Figure 2-6 shows the application diagram of the string inverter.

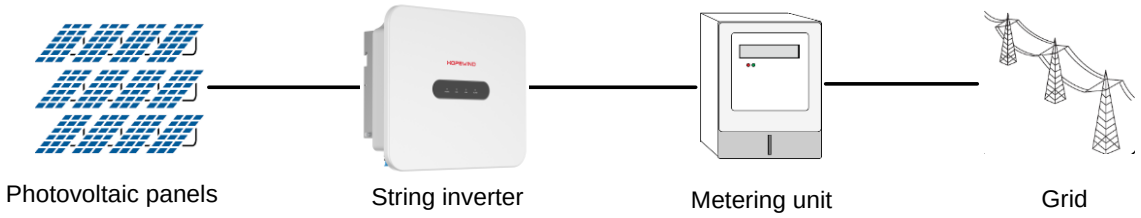


Figure 2-6 Application schematic diagram of string inverter

2.2.2 Supported Grid Forms

The power grid forms supported by HSSP3K-G01, HSSP4K-G01, HSSP5K-G01, HSSP6K-G01, HSSP8K-G01 and HSSP10K-G01 include TN-S, TN-C, TN-C-S and TT.

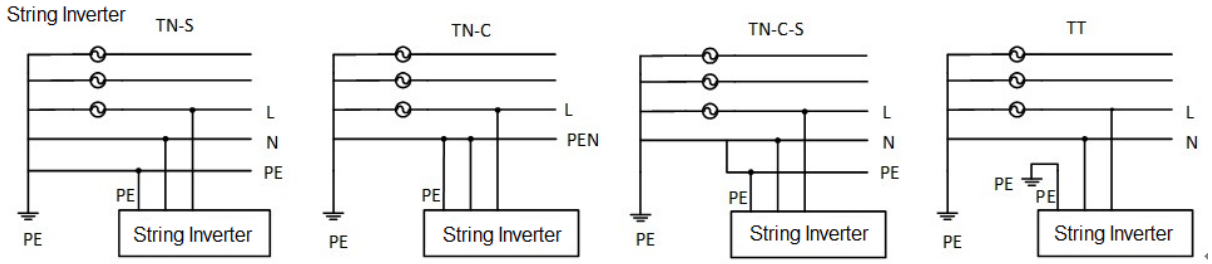


Figure 2-7 Schematic diagram of various power grid forms

2.3 Naming Rules

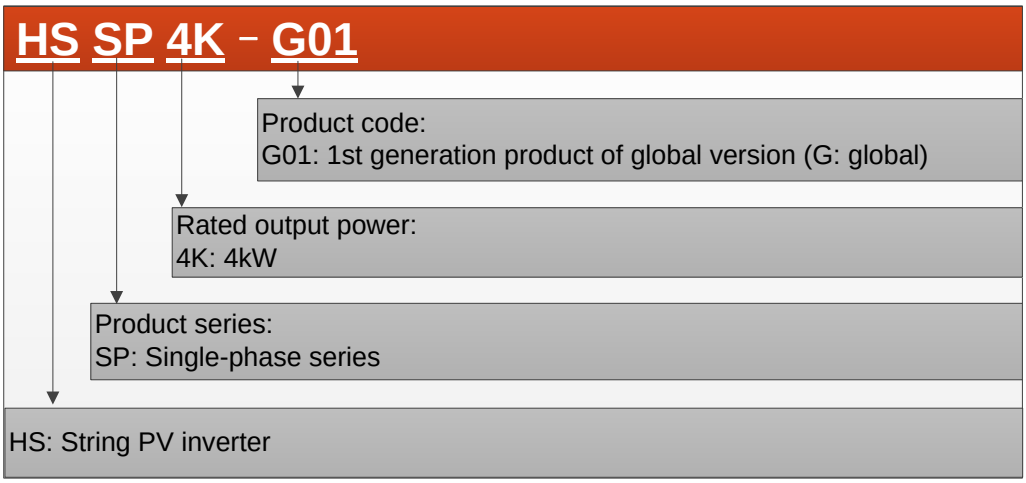
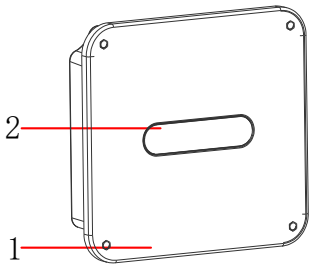


Figure 2-8 Naming rules

2.4 Inverter Configuration

This section describes the appearance, relevant components and bottom interfaces of the inverter.

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.



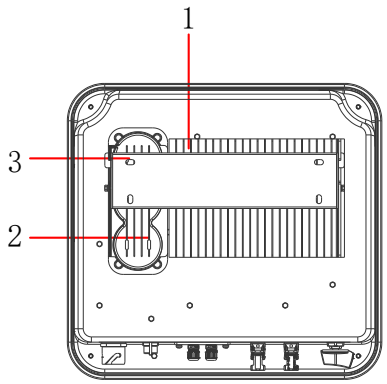
No.	Label	Name
1		Door panel
2		LED indicator

Figure 2-9 Front view of the inverter

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

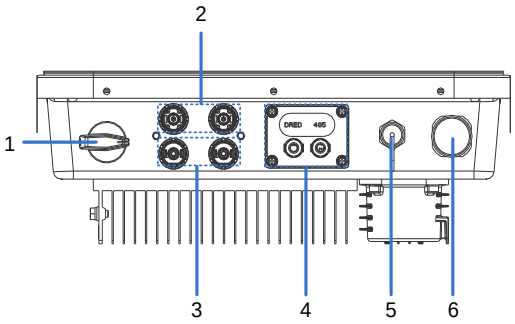
Table 2-1 LED Indicator description

Indicator	Description	State	Description
POWER	PV and grid connection	Blue light on	Both PV side and grid side are normal.
		Blue light slow blinking	PV side is normal while grid side is not connected.
		Blue light off	Both PV side and grid side are not connected.
RUN	Grid-connected operation	Blue light on	Inverter in grid-connected power-on state.
		Blue light off	Inverter neither grid-connected nor powered on.
COM.	Communication indication	Blue light fast blinking	Communication normal.
		Blue light off	Communication abnormal.
ALARM	Alarm indication	Red light fast blinking	Abnormal alarm.
		Red light solid on	Fault alarm.
Remarks: **Slow blinking:** 1 second on and 2 seconds off in cycles; **Fast blinking:** 0.5 seconds on and 0.5 seconds off in cycles.			



No.	Label	Name
1		Radiator
2		Inductor
3		Mounting plate

Figure 2-10 Back view of the HSSP4K-G01 inverter



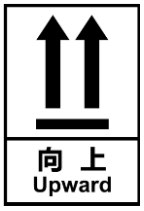
No.	Label	Name
1	DC SWITCH	DC SWITCH
2	1+ to 2+	PV+ terminal
3	1- to 2-	PV- terminal
4	DRED、485	DRED and 485 zero export communication interface
5		Wi-Fi/4G communication interface
6	AC OUTPUT	AC output terminal

Figure 2-11 Bottom view of the HSSP4K-G01 inverter

Note: The terminal positions and sequences of HSSP3K-G01, HSSP5K-G01, HSSP6K-G01, HSSP8K-G01, HSSP10K-G01 shall be subject to the actual objects!

2.5 Package Labels

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

	Place vertically upwards		Handle with care to avoid damage to the string inverter caused by violent collision or friction during transportation and movement.
	No stepping		Keep dry. Prevent the inverter from getting wet or damp.
	Keep dry. Prevent the inverter from getting wet or damp.		Stack no more than 7 layers.

2.6 Enclosure Labels

In order to ensure the personal and property safety of users when using this product and avoid accidents, the following warning labels may be placed inside and outside the string inverter to remind users of safety precautions during operation.

	**PE:** Grounding point indicating the position for connecting the PE cable
	**Danger:** High voltage hazard. Failure to observe the rules might cause serious personal injury or property loss.
	**Warning:** Ordinary potential hazard. Failure to observe the rules might cause personal injury or property loss.
	**Hot surface sign:** Pay attention to the hot surface to prevent being burnt.
	**Refer to the user manual:** Please refer to the user manual for detailed instructions.
	**Discharge sign:** Do not touch the live parts until 10 minutes after disconnection from the power source to prevent electric shock.

2.7 Technical Parameters

	Model	HSSP3K-G01	HSSP4K-G01	HSSP5K-G01	HSSP6K-G01	HSSP8K-G01	HSSP10K-G01
Input parameters	Maximum input voltage	600 V*					
	Minimum starting voltage	1） The starting voltage of the DC auxiliary voltage is set to 45 V, and the shutdown voltage is 35 V 2） The inverter startup voltage is 55 V					
	MPPT working voltage range	55–550 V					
	MPPT full load working voltage range	170–520 V	210–520 V	200–520 V	235–520 V	210–520 V	260–520 V
	Rated input voltage	360 V					
	Maximum input current per MPPT	20 A	22 A	20 A/20 A	20 A/20 A	26 A/20 A	26 A/20 A
	Maximum short circuit current per MPPT	30 A	33 A	30 A/30 A	30 A/30 A	39 A/30 A	39 A/30 A
	Max. inverter backfeed current to the array	0 A	0 A	0 A	0 A	0 A	0 A
	Maximum input path	1	2	2	2	3	3
	Number of MPPT	1	1	2	2	2	2
Output parameters	Rated output power	3 kW	4 kW	5 kW	6 kW	8 kW	10 kW
	Maximum output apparent power	3.3 kVA	4.4 kVA	5.5 kVA	6.6 kVA	8.8 kVA	11 kVA
	Maximum active power	3.3 kW	4.4 kW	5.5 kW	6.6 kW	8.8 kW	11 kW
	Rated output voltage	220 V/230 V L+N+PE					
	Output voltage range	165–275 V					
	Rated output frequency	50 Hz/60 Hz					
	Rated output current	13.6 A	18.2 A	22.7 A	27.3 A	36.4 A	45.5 A
	Maximum output current	15 A	20 A	25 A	30 A	40 A	50 A
	Current (inrush)	45 A	45 A	63 A	63 A	95 A	95 A
	Maximum output fault current	65 A	65 A	100 A	100 A	150 A	150 A
	Maximum output overcurrent protection	15 A	20 A	25 A	30 A	40 A	50 A
	Power factor	0.8 (Leading.) to 0.8 (Lagging.)					
	Maximum total harmonic distortion	<3%					
Efficiency	Maximum efficiency	97.80%					

	Model	HSSP3K-G01	HSSP4K-G01	HSSP5K-G01	HSSP6K-G01	HSSP8K-G01	HSSP10K-G01
	European Efficiency	96.80%		97.00%		97.10%	
Protection	Input DC switch	Supported					
	DC reverse polarity protection	Supported					
	DC surge protection	Type 2					
	Insulation impedance test	Supported					
	Output surge protection	Type 2					
	String fault detection	Supported					
	RCD detection	Supported					
Display and communication	Display	LED instructions; Serial port + WIFI/4G					
	WIFI/4G module	WIFI module/4G					
	PLC communication	Unsupported					
Conventional parameters	Dimensions (width * height * depth)	425*400*146mm		425*400*167mm		512*438*177mm	
	Weight	≤ 8.5 kg	≤ 9 kg	≤ 13 kg		≤ 16 kg	≤ 16.5 kg
	Working temperature	-25℃ to +60℃					
	Maximum working altitude	≤ 4000 m (> 3000 derate)					
	Noise index	≤ 30 dB					
	Cooling mode	Natural cooling					
	Protection grade	IP66					
	Protective class (I, II, or III)	I					
	Overvoltage category	AC: 3 DC: 2					
	Pollution degree	External:3 Internal: 2					
	Topological structure	Transformerless					
	Input terminal	MC4 plugging terminal					
	Output terminal	AC plugging terminal					
Technical indicators	Standard	EN/IEC 62109-1					
		EN/IEC 62109-2					
		NB/T 32004-2018					

* When the input voltage ranges from 550V~600V, the inverter enters standby state.

2.8 Mechanical Parameters

➢ Dimensions and Weight

Model	Width*Height*Depth (mm)	Transverse distance of installation holes (mm)	Longitudinal distance of installation holes(mm)	Weight (kg)
HSSP3K-G01	425*400*146	255	50	≤ 8.5
HSSP4K-G01				≤ 9
HSSP5K-G01	425*400*167			≤ 13
HSSP6K-G01				
HSSP8K-G01	512*438*177	300	75	≤ 16
HSSP10K-G01				≤ 16.5

🕮 Note: The size does not include hanging ears, handles, foot pads, cable glands and other parts. Dimension error: ± 10mm.

➢ Structure Dimension of the Inverter

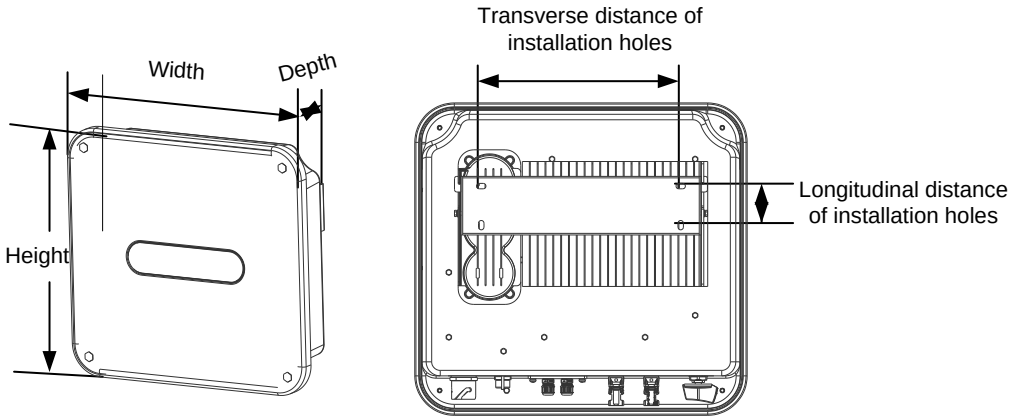


Figure 2-12 Structural Dimensions of HSSP Series

2.9 Ambient Rquirements

Transportation environment	**Requirements**
Type of shipping	Waterways, railways, highways, aviation, etc.
Ambient temperature	-25℃ to +70℃
Relative humidity	≤ 100%, no condensation
Mechanical condition	The vibration should not exceed the following limits: 2 Hz ≤ f ≤ 3 Hz, acceleration spectrum density 30 $(m/s^2)^2$/Hz; 10Hz ≤ f ≤ 20 Hz, acceleration spectrum density 3.0 $(m/s^2)^2$/Hz; 500 Hz ≤ f≤ 2000 Hz, acceleration spectrum density 1 $(m/s^2)^2$/Hz.
Storage environment	**Requirements**
Storage place	Store the product in a warehouse with air circulation, no harmful gases, no flammable or explosive materials, and no corrosive materials. Avoid strong mechanical vibrations and shocks and stay away from strong magnetic fields.
Ambient temperature	-40℃ to +70℃
Relative humidity	≤ 100%, no condensation

Mechanical condition	The vibration should not exceed the following limits: 10 Hz ≤ f ＜ 57 Hz, displacement 0.075 mm; 57 Hz ≤ f ＜ 150 Hz, acceleration 10 m/s$^{2.}$	
Working environment	**Requirements**	
	Normal operation state	**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	-25°C to +60°C (Derating is required while the temperature is above 45°C)	-25℃ to +70℃
Relative humidity	≤ 100%, internal condensation is not allowed.	
Altitude	≤ 4000 m; derating is required when the altitude is above 3000m.	
Mechanical condition	The vibration should not exceed the following limits: 10 Hz ≤ f ＜ 57 Hz, displacement 0.075 mm; 57Hz ≤ f ＜ 150 Hz, acceleration 10 m/s^2.	

--End of the chapter--

3 System Installation

3.1 Receiving Inspection

After confirming that the outer packaging is intact, please carry out the unpacking inspection. Unpack the packaging box and check whether the appearance of the string inverter is in good condition. When opening the package, be careful to use the tool to avoid scratching the string inverter.

Although the inverter has been strictly tested and inspected before leaving factory, accidental damage might happen during transportation. Please inspect and check the product as soon as you receive it. If there is any damage or omission, please contact us and we will help you as soon as possible.

3.2 Preparing Installation Tools

Tool or device	Purpose	Remarks
Phillips screwdriver (PH2/PH3)	Fasten the grounding screws and hanging plate screws	Bolt specifications: M4 and M6
Socket wrench	Fix the expansion screws	Bolt specification：M6
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	Strip the wires	
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 dimension of the string inverter. See **2.8 Mechanical Parameters**.
- The string inverter should be installed in a well ventilated environment to ensure good heat dissipation. Avoiding direct sunlight, rain and snow can prolong the life of the inverter. It is recommended to choose sheltered installation sites. If that cannot be satisfied, please set up a sun shading shelter (optional accessory).
- During the operation of the string inverter, the temperature of the chassis and the radiator will be relatively high, so do not install the inverter in the position that will be touched unintentionally.

3.4 Installation Clearance Requirements

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

If multiple inverters need to be installed at the same time, at least 500 mm space shall be reserved between the two inverters, and more than 300 mm space shall be reserved from the bottom of the inverter to the ground.

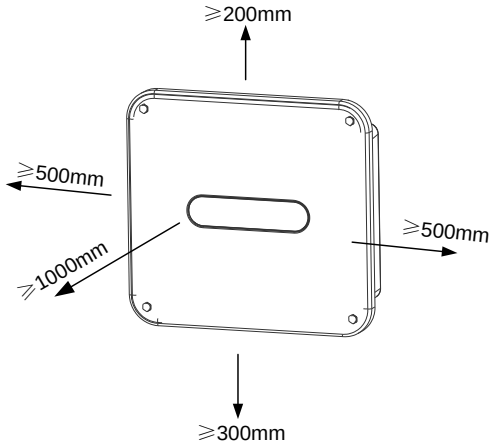


Figure 3-1 Reserved space requirements

3.5 Installation Method

The package of the string inverter is attached with a hanging plate. During installation, the fixed hanging plate shall be installed first, and then the inverter shall be hung and fastened on the hanging plate.

WARNING	
1.	Please refer to **1 Safety Precautions** for precautions during inverter installation. For installation environment requirements, please refer to **3.3 Installation Environment Requirements**.
2.	During installation, it must be confirmed that the site installation position can bear the total weight of the inverter and accessories to avoid falling during installation or use.
3.	It is recommended that two people work together to fix the inverter to avoid mechanical injury. During installation, safety measures shall be taken to prevent injuries.
4.	Please install it vertically or tilt it back 15° at most to facilitate heat dissipation of the machine. Do not tilt the inverter (tilt forward, tilt back too much, roll), horizontally or upside down.
5.	If it is impossible to avoid direct sunlight, please add a sunscreen.

- Installation Steps

1. Use a drill with a diameter of 8 mm to drill holes on the wall or bracket according to the dimensions of the mounting plate and the mounting holes, hole depth on the wall: 60 ± 5 mm.
2. Install the mounting plate on the wall with 4 pcs nylon expansion bolts and 4 pcs ST5.5×55 self-tapping screws, or install the mounting plate on the bracket with 4 pcs M6×25 bolt assemblies and fix it with washers and nuts.

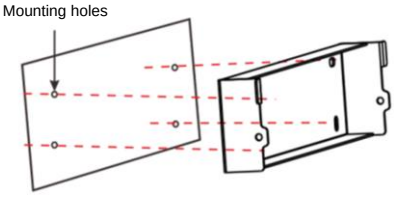


Figure 3-2 Installing the mounting plate

3. Before hanging the inverter, ensure that the installation surface is firm enough to meet the load-bearing requirements.
4. Hang the inverter on the mounting plate and secure the heat sink to the mounting plate using M4× screws on both sides to prevent the inverter from shaking.

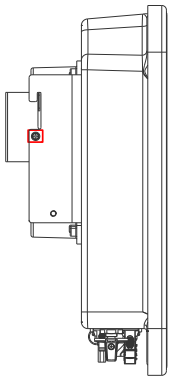


Figure 3-3 Position of the fixing screws

3.6 Electrical Connection

3.6.1 Cable Requirements

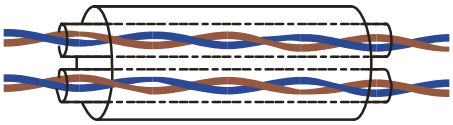
The choice of cable should comply with relevant national standards and meet the load requirements.

➢ Power Cable Requirements

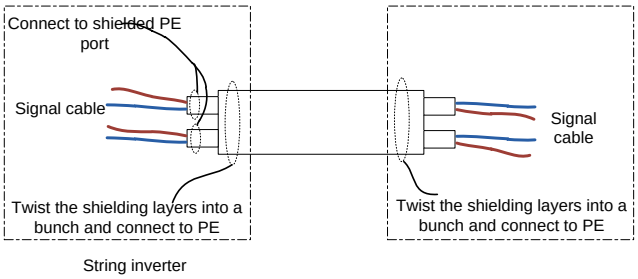
Please refer to the electrical data of the product, and then comprehensively consider the ambient temperature, current, margin as well as other relevant factors to select the cable.

➢ Communication Cable Requirements

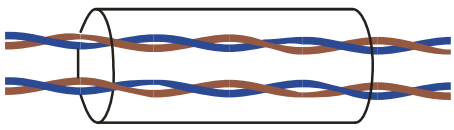
Since weak communication signals are susceptible to external interference, it is necessary to adopt communication cables with shielding layers, and the shielding layer should be grounded reliably. You can refer to the relevant document of *GB 50217-2007 Code for Design of Cables of Electric Engineering*.



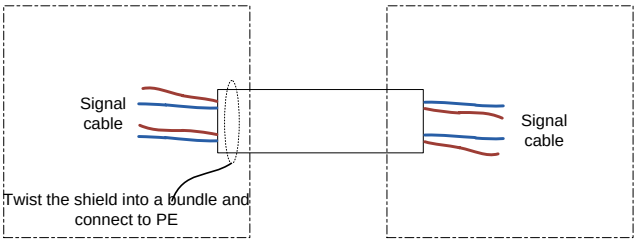
（a） Double-shielded twisted pair



When double shielding layers are adopted, both ends of the outer shielding layer need to be grounded, and one end of the inner shielding layer needs equipotential grounding.



（b） Single-shielded twisted pair



When the single shielding layer is adopted, one end of the shielding layer needs equipotential grounding in order to prevent the formation of potential difference.

Figure 3-4 Twisted pair with shielding layer

3.6.2 Cable Selection

Name	Tag Number	Recommended Cable Specifications	Remarks
PV input cable	1+ to 3+ 1- to 3-	Industry general PV cable, model: PV1-F, cross-sectional area: 4.0 mm^2–6.0 mm^2	None
AC output cable	L, N, PE	3K~6K: 3-core outdoor copper cable Recommended cross-sectional area of the conductor: 2.5 mm^2–6 mm^2. 8–10K: 3-core outdoor copper cable Recommended cross-sectional area of the conductor: 8KW: 6 mm^2–8 mm^2 10KW: 8 mm^2–13 mm^2	3–6K: The AC output has only one connector plug, and the OD specification is 8 mm–14 mm. 8–10K: The AC output has only one connector plug, and the OD specification is 13 mm-18 mm.
RS485 communication cable		It is recommended to use a special communication cable or 3-core or 2-core shielded twisted pair cable with a cross-sectional area of not large than 0.205 mm^2.	The RS485 communication input interface is a cable gland, and the OD specification is 3 mm–6 mm.
PE cable	PE	It is recommended to use a fixed connection and the cross-sectional area of the copper ground cable is not less than 4 mm^2.	None

3.6.3 Torque Requirements

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

Table 3-1 Torque requirements for cable connection

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 performance rating for all the bolts with a nominal external thread diameter of 8 mm and above used by Hopewind’s string inverters is 8.8.

3.6.4 Preparation before Operation

DANGER

1. When connecting cables, do not operate when the product is energized and please follow the relevant requirements in **1 Safety Precautions**.
2. Before connecting the cables, please complete the following preparations to avoid personal injury.
   1) Before electrical connections, please 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, and make sure that the input cable is disconnected from the PV string.
   3) Please confirm that the open circuit voltage of the PV string does not exceed the specified limit.
3. When connecting the input cable, please make sure that the positive and negative poles of the input cable correspond to those of the string inverter PV terminals.

3.6.5 Connecting PE Cables

Please connect the inverter to the grounding bar through the PE cable to achieve the grounding protection. The PE mark is affixed to the PE terminal. The cross-sectional area of the PE cable (copper wire) is not less than 4 mm^2 and the bolt specification is M6.

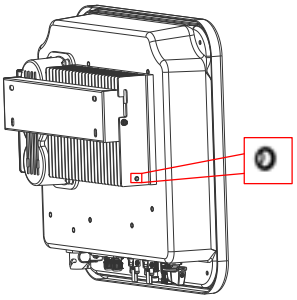
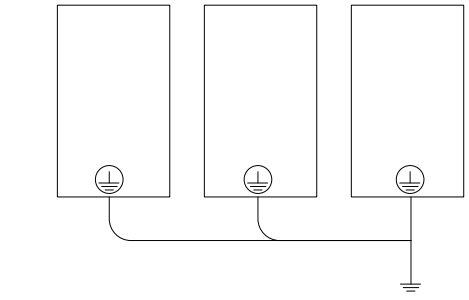
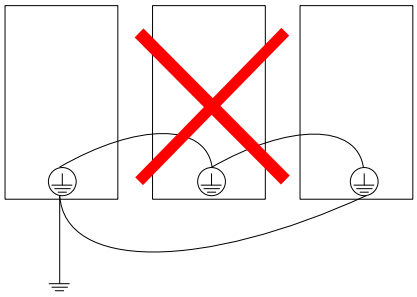


Figure 3-5 PE connection

For the grounding of multiple string inverters, use 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） Wrong grounding method for multiple string inverters

Figure 3-6 PE connection of multiple string inverters

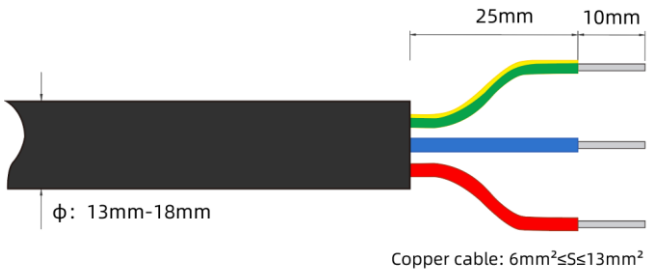
3.6.6 Connecting AC Output Cables

➢ Precautions

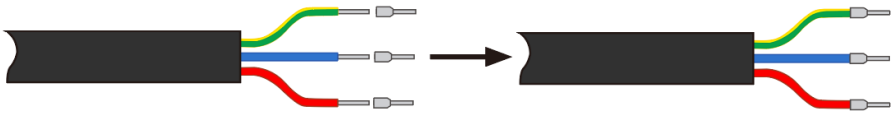
- An independent single-phase circuit breaker must be configured outside the AC side of each inverter to ensure reliable disconnection of the inverter from the grid. And the circuit breaker specifications meet the technical requirements.
- It is forbidden to share one circuit breaker for multiple inverters.
- It is forbidden to connect the load between the inverter and the circuit breaker.
- The user must prepare the cable of Users should prepare cables with appropriate cross-sectional area according to different models (please refer to "3.6.2 Cable Selection" for more details).

➢ Steps（Take 3–6 kW as an example）

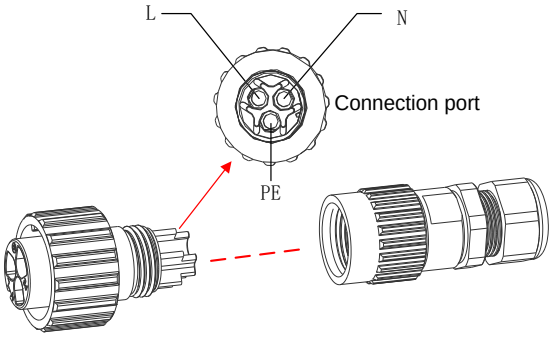
1) Strip off the insulation layer of the AC cable to an appropriate length



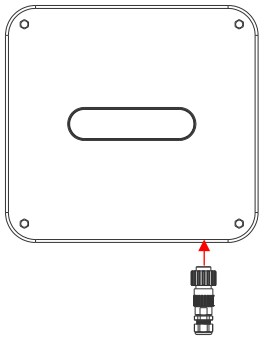
2) (Optional) If a multi-core cable is used, use an appropriate crimping tool to crimp the tubular terminals at the ends of the core wires; if a single-core cable is used, skip this step.



3) Disassemble the connector, thread the AC cables through the nut and protective shell of the connector and into the corresponding terminal wiring holes, tighten the screws, and reassemble the connector.



4) Connect the AC connector to the AC terminal of the inverter and turn it clockwise for tightening



3.6.7 Connecting Communication Cables

- Choice of Communication Method

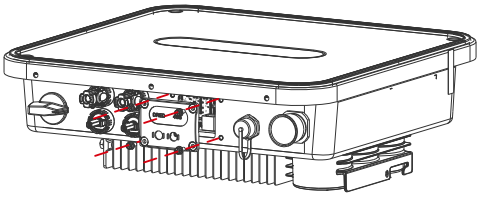
  The inverters support WIFI/4G communication mode.

- Cable Connection Instructions

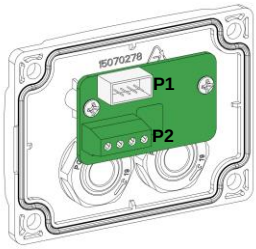
Connect the WIFI/4G module in the delivery accessories to the 4-PIN port of the inverter, and pay attention to check whether it is firm to avoid loose installation. After the connection is completed, check whether there is a gap in the connection. If there are any gaps, plug them with fireproof mud.

- Zero export communication connection

1）Remove the DRED and 485 zero export adapter plate.



2） Pass the communication cable through the cable gland corresponding to the silk screen 485, connect it to the terminal P2 of the communication adapter board X2, and tighten the screws.



The pins of P2 terminal are defined as follows:

1 Pin	485+
2 Pin	GND
3 Pin	485-
4 Pin	NC

3）Reinstall the DRED and 485 zero export adapter plate.

3.6.8 Connecting DC Input Cables

🕮 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 angle.

DANGER

1. When the sun shines on the battery panel, it will generate voltage which may cause life-threatening dangers. 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 cable, make sure that the DC side voltage is within the safe voltage range which is within 60 V DC, and the 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 cable, 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 and there is no current output from the PV branch.

WARNING

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 PV modules used with the inverter must have an IEC61730 class A rating.
- The maximum opening voltage of each PV string cannot be greater than 600 VDC under any circumstances. For models of HSSP3K-G01, HSSP4K-G01, HSSP5K-G01, HSSP6K-G01, HSSP8K-G01 and HSSP10K-G01, when the input voltage ranges from 550V~600V, the inverter enters standby state. When the voltage returns to the MPPT operating voltage range 55 V–550 V, the inverter returns to normal operation.
- The maximum short-circuit current of each PV string shall not exceed 30 A 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 negative pole of the DC input terminal of the inverter.

➢ Precautions for Grounding the PV String

In the power grid connected to the inverter (such as the low-voltage distribution grid), if the neutral cable is connected to the PE cable, the positive or negative pole of the PV string is prohibited from being grounded, otherwise the inverter will not be able to work normally.

➢ DC Input Terminal Selection

Number of input channels	Combiner box DC input terminal
1	PV1
2	PV1、PV2
3	PV1、PV2、PV3

➢ Steps to Crimp MC4 Terminal

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. Ensure that 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. Strip the wire with a wire stripper.

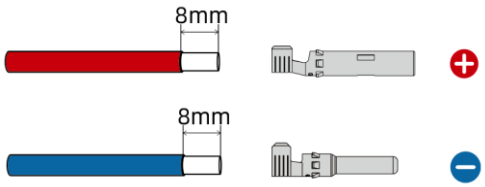


Figure 3-7 Strip the cable

3. According to the correct polarity, crimp the cable with the metal terminal of the connector.

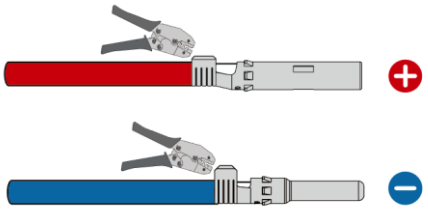


Figure 3-8 Crimp the terminal

4. Disassemble the DC connector, insert the crimped DC cable into the connector, and then reassemble the connector.

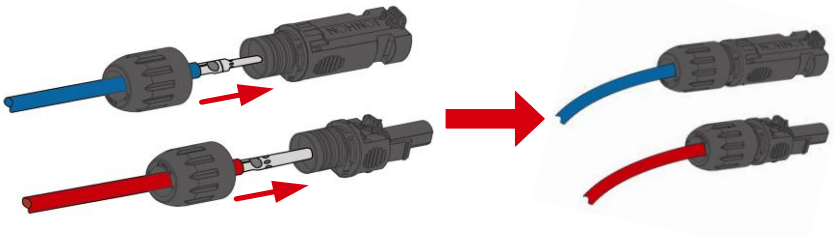


Figure 3-9 Assemble the connector

➢ Insert MC4 Terminals

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
Please use the MC4 terminals configured in the delivery accessories of the inverter. Device damage due to incompatible MC4 terminals is not covered by the warranty. After the cable connection of the string inverter is completed, check if there is a gap at the cable gland. If there is a gap in the cable gland, 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 Checking before Power-On

DANGER

- Please read **1 Safety Precautions** carefully and do a detailed check according to the table below before power on.
- Before operating or maintaining the internal metal parts, please use multimeter to measure their voltage to the enclosure (protective earthing) in order to avoid any danger.

After the inverter is installed, the below items need to be checked carefully before power on.

Mechanical inspection

- □ Please read **1 Safety Precautions** carefully.
- □ Ensure that the environmental safety of the string inverter.
- □ Check if there are any foreign objects left inside and on the top of the string inverter cabinet.
- □ Ensure that the string inverter has enough space reserved around for maintenance and heat dissipation.
- □ The cables are marked clearly and correctly.
- □ Check if there any condensation inside the string inverter. If there is, remove it 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 cable gland.

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 Powering on the System

After the electrical connection is completed, the inverter can be powered on.

Step 1: Set the DC SWITCH of the inverter to the “ON” state.

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

After performing the above steps, if the system has no faults and meets the startup requirements, the inverter will start.

4.3 Powering off the System

- Precautions
  - After the inverter is powered off, there will be residual electricity and residual heat on the enclosure, which may cause electrical shock or burns. Therefore, please wait at least 5 minutes before you operate the inverter.
  - When powering off the system, please follow the sequence of operation instructions and safety regulations in this chapter.

Step 1: Issue the shutdown command to the inverter through the data collector or near-end APP software.

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

Step 3: Set the DC SWITCH of the inverter to the “OFF” state.

--End of the chapter--

5 Maintenance and Troubleshooting

5.1 Maintenance Items and Cycle

DANGER

1. Please read **1 Safety Precautions** carefully before maintenance, and use a multimeter and other relevant instruments to detect the voltage between the metal parts that need to be or maybe touched and the grounding copper bars so as to avoid electric shock.
2. During maintenance, please pay attention to the warning labels of the string inverter to avoid personal injury due to high voltage.
3. During maintenance, please make sure that the DC Switch is in off state, and the circuit breaker between the inverter and the grid is disconnected.
4. After the maintenance, close the DC input switch of the inverter and the circuit breaker between the inverter and the grid.

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

Table 5-1 Maintenance items and cycles of the string inverters

Parts	Item	Description	Solutions	Maintenance 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	Check if there are dusts and foreign matters on the surface of the inverter.	Clean up the foreign matters and dusts.	
		The heat sink is covered with dust and dirt.	Remove occlusion and clean dusts.	
System running	Operating state	Check if there is any abnormal noise while the inverter is running.	If the problem is serious, please replace it in time.	Once every six months to one year
	Operating parameters	When the inverter is running, check whether the parameters are set correctly.	Troubleshoot abnormal settings.	
Connection parts	Fall off or loose	Check if the cable connection is disconnected or loose.	Tighten connections as specified.	Once every six months to one year
	Damage	Check if there is any damage on the cable. Especially check the surface of the cable that is in contact with the metal surface for traces.	If the problem is serious, please replace it in time.	
	Terminal	Check if the waterproof covers of the unused RS485, RJ45 or other terminals are locked tightly	Ensure that they are sealed well.	

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

5.2 Troubleshooting

➢ Boost Side

Fault word	ID	Fault/alarm name	Fault/alarm reason	Troubleshooting
Fault word 1	0	Auxiliary power fault	±12V of the auxiliary power supply is too high or too low	1. Check whether it can work normally after reset. 2. If it occurs frequently, please contact the Hopewind technician.
	2	Output hardware overvoltage	The output voltage exceeds the protection point set by the hardware.	1. Check whether it can work normally after reset. 2. If it occurs frequently, please contact the Hopewind technician.
	3	Hardware overcurrent (secondary)	MPPT inductor current is too large	1. Check whether it can work normally after reset. 2. If it occurs frequently, please contact the Hopewind technician.
	4	MPPT1 hardware overcurrent	MPPT1 overcurrent and reaches the hardware CBC time	1. Check whether it can work normally after reset. 2. If it occurs frequently, please contact the Hopewind technician.
	5	MPPT2 hardware overcurrent	MPPT1 overcurrent and reaches the hardware CBC time	1. Check whether it can work normally after reset. 2. If it occurs frequently, please contact the Hopewind technician.
Fault word 2	2	EEPROM parameters back to default values	EEPROM read and write error	Fault reset or power off
	3	Historical fault storage failed	Historical fault storage failed	Fault reset or power off
	12	Reverse input polarity	Input polarity reverse	Check whether the polarity of the connection is reversed
	13	Positive busbar to grounding insulation fault	Abnormal insulation impedance of the positive bus to the ground	Check whether the positive bus has grounding fault
	14	Negative busbar to grounding insulation fault	Abnormal insulation resistance of the negative bus to the ground	Check whether the negative bus has grounding fault
Alarm word 1	6	Boost open circuit alarm	Boost open circuit	Please contact the Hopewind technician.
	7	Boost short circuit alarm	Boost short circuit	Please contact the Hopewind technician.
	8	Battery string abnormal alarm	Abnormal battery string	1. Check whether the battery string configuration is abnormal 2. Check whether the access of the battery board is abnormal 3. Check whether the current sampling of the battery string is abnormal
	9	Positive busbar to grounding insulation alarm	Abnormal insulation impedance of the positive bus to the ground	Find out the cause of abnormal impedance
	10	Negative busbar to grounding insulation alarm	Abnormal insulation impedance of the positive bus to the ground	Find out the cause of abnormal impedance

➢ Inverter Side

Fault word	ID	Fault/alarm name	Fault/alarm reason	Troubleshooting
System fault status word	0	RAM self test failed	Check RAM chip read and write error	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	1	EEPROM parameters back to default values	Add EEPROM parameter list and upgrade the code again. After initialization, the default value is different from that in EEPROM	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	2	EEPROM read and write failed		1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	3	FPGA version does not match	FPGA version does not match with that of DSP	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	5	Internal communication fault	Internal communication fault	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
Hardware fault status word	0	Hardware overcurrent (secondary)	Inductor current peak exceeds hardware protection threshold	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	3	Grid hardware overcurrent	A-phase inductor current triggers CBC protection	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	6	Busbar hardware overvoltage	Bus voltage exceeds hardware overvoltage threshold	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	7	Busbar neutral-point overvoltage	Bus neutral-point voltage exceeds hardware overvoltage threshold	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
Grid fault status word	0	Grid overvoltage	The grid voltage exceeds the overvoltage point set by the system	Confirm whether faults such as box transformer tripping occur at the AC side
	3	Grid undervoltage	The grid voltage is lower than the undervoltage point set by the system	Check whether the inverter has a phase loss or whether the box change contacts are suitable.
	6	Grid abnormal	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 threshold exceeded	Grid voltage imbalance exceeds system threshold	Check whether the grid is abnormal

Fault word	ID	Fault/alarm name	Fault/alarm reason	Troubleshooting
	8	Grid overfrequency	The grid frequency exceeds the overfrequency point set by the system	1. Confirm whether the box transformer tripping and other faults occur on the AC side of the inverter through fault recording and event recording 2. Confirm whether the frequency range and the time setting is reasonable
	9	Grid underfrequency	The grid frequency is lower than the underfrequency point set by the system	1. Confirm whether the box transformer tripping and other faults occur on the AC side of the inverter through fault recording and event recording 2. Confirm whether the frequency range and the time setting is reasonable
	11	Anti-islanding protection	Grid voltage loss	Detect the causes of grid voltage loss, such as box transformer tripping, etc.
	13	Grid voltage abnormal	Sudden change of grid voltage	Check if the grid is normal
	14	LVRT protection	Grid voltage exceeds LVRT protection threshold	Check if the grid is normal
	15	HVRT protection	Grid voltage exceeds HVRT protection threshold	Check if the grid is normal
Inverter fault status word	0	Grid software overcurrent	Inductor current effect value exceeds protection threshold	Reset the fault
	3	Module current imbalance	Three-phase current imbalance exceeds the threshold	Reset the fault
	5	Module overtemperature	The radiator temperature is higher than the protection threshold.	Check whether the spoiler fan is normal
	6	Internal overtemperature	Ambient temperature is higher than protection temperature.	Check whether the spoiler fan is normal
	9	Residual current abnormal	Residual current exceeds the limit	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 it occurs frequently or cannot be recovered for a long time, please check whether the ground impedance of the PV string is too low.
Bus fault word status	1	Bus short circuit	Bus voltage sag exceeds limit	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	5	Bus overvoltage	The bus voltage exceeds the set threshold	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	6	Bus undervoltage	The bus voltage is below the set threshold	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician

Fault word	ID	Fault/alarm name	Fault/alarm reason	Troubleshooting
	7	Bus voltage imbalance	Positive and negative bus voltage imbalance exceeds the setting threshold.	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	8	High DC input voltage	DC input voltage exceeds the setting threshold.	1. Check whether the components are over matched 2. Check whether the input voltage detection circuit is normal
	9	Low DC input voltage	DC input voltage is below the setting threshold.	Check whether the switch is disconnected
Other	0	Grid-connected relay fault	Relay status error	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician
	4	Internal fan fault	Fan failure or abnormal feedback signal	1. Check whether it can work normally after reset 2. If it occurs frequently, please contact the Hopewind technician.

--End of the chapter--

6 Inverter Disposal

6.1 Removing the Inverter

Before operation, 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 cable, RS485 communication cable, DC input cable and PE cable.

2) Remove the inverter from the hanging plate.

6.2 Replacing the Inverter

After disassembling the old inverter, if it is necessary to replace it with a new one, please follow the operation instructions in Chapter 3 and 4.

6.3 Packing the Inverter

1) If you still keep the original package of the inverter, please put it into the original package and firmly seal it with tapes.

2) If you can't find the original package, please use a hard carton suitable for the weight and dimension of the inverter to firmly package it.

6.4 Disposing of the Inverter

When the service life of the inverter expires or the inverter is replaced due to failure, it can be disposed according to the applicable electrical waste disposal laws of the place where the inverter is installed, or it can be handed over to Hopewind customer service personnel.

--End of the chapter--

Appendix

- Warranty

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

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

- Users dismantle the product arbitrarily or maintain it in the 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 modification or maintenance by users.

If you need to repair the inverter due to above reasons, we will offer paid repair service after it is determined by our service department. If you need to repair or modify this product, please contact our company in advance.

- Contact Us

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