sunways

Grid-connected PV Inverter
Single Phase Dual MPPT

User Manual

STS-3K/3.6K/4.2K/4.6K/5K/6KTL

Ningbo Sunways Technologies Co., Ltd.

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1.Preface

1.1 Overview

This manual is an integral part of Sunways STS 3-6kW series single-phase inverters (hereinafter referred to as the inverters). It mainly introduces the assembly, installation, electrical connection, debugging, maintenance and troubleshooting of the products. Before installing and using inverters, please read this manual carefully, understand the safety information and be familiar with the functions and characteristics of inverters.

1.2 Target Groups

This manual is applicable to the electrical installers with professional qualifications and the people who bought this inverter. If there are any problems in the installation process, please call Sunways service telephone at +86 400-9922-958 or email Sunways at service@sunways-tech.com for consultation.

2.Safety Instructions

2.1 Safety Notes

2.1.1 Before installation, you should read this manual carefully and follow the instructions in this manual strictly.

2.1.2 Installation operators need to undergo professional training or obtain electrical related professional qualification certificates.

2.1.3 When installing, do not touch any part of the inner part of the inverter except the terminals.

2.1.4 All electrical installations must conform to local electrical safety standards.

2.1.5 If the inverter needs maintenance, please contact the local designated personnel for system installation and maintenance.

2.1.6 To use this grid-connected inverter for power generation needs the permission of the local power supply authority.

2.1.7 During the operation of the inverter, the surface temperature may be higher and there is a risk of burns. Do not touch.

2.1.8 When installing photovoltaic panels in the daytime, the photovoltaic panels should be covered with opaque materials to avoid the risks and danger of high voltage at the panel end in sunlight.

2.2 Statement

Ningbo Sunways technologies Co., Ltd. has the right not to undertake quality assurance in any of the following circumstances:

2.2.1 Damages caused by irregular transportation.

2.2.2 Damages caused by incorrect storage, installation or use.

2.2.3 Damages caused by installation and use of equipment by non-professionals or untrained personnel.

2.2.4 Damages caused by failure to comply with the instructions and safety warnings in the products and documents.

2.2.5 Damages of running in an environment that does not meet the requirements stated in the document.

2.2.6 Damages caused by operation beyond the parameters specified in applicable technical specifications.

2.2.7 Damages caused by unauthorized disassembly, alteration of products or modification of software codes.

2.2.8 Damages caused by abnormal natural environment (force majeure, such as lightning, earthquake, fire, storm, etc.).

2.2.9 Any damages caused by the process of installation and operation which don't follow the local standards and regulations.

2.2.10 Products beyond the warranty period.

2.3 Important Safety Matters

The following symbols may appear in this manual, which represent the following meanings:

Symbol	Description
 Danger	Used to warn of urgent dangerous situations, if not avoided, it could result in death or serious personal injury.
 Warning	Used to warn of potentially dangerous situations, if not avoided, it may result in death or serious personal injury.
 Caution	Used to warn of potentially dangerous situations, if not avoided, it may result in moderate or minor personal injury.
 Attention	Used to transmit the safety warning information about equipment or environment, if not avoided, it may cause equipment damage, data loss, equipment performance degradation or other unpredictable results. "Attention" does not involve personal injury.
 Note	Used to highlight important information, best practices and tips, etc. it's not warning, doesn't involve personal injury and equipment damage information.

2.4 Symbols Explanation

This chapter mainly elaborates the symbols displayed on the inverter, nameplate and packing box.

2.4.1 Symbols on the Inverter

Symbol	Description
	Inverter status indicator.
	Inverter running indicator.
	Grounding symbol, the inverter casing needs to be properly grounded.

2.4.2 Symbol on the Inverter nameplate

Symbol	Description
	The inverter cannot be disposed of with household waste.
	Please read the instructions carefully before installation.
	Do not touch any internal parts of the inverter until 5 min after being disconnected from the mains and PV input.
	CE mark, the inverter complies with the requirements of the applicable CE guidelines.
	TUV certification.
	SAA certification.
	Danger. Risk of electric shock!
	The surface is hot during operation and no touch is allowed.
	Electric shock hazard, it is strictly forbidden to use the person to disassemble the inverter casing.

2.4.3 Symbol on the Packing box

Symbol	Description
	Handle with care.
	This side up.
	Keep dry.
	Stacked layers.

3. Product Introduction

3.1 Basic Features

3.1.1 Function

The Sunways STS 3~6kW series is a single-phase grid-connected PV inverter which used to efficiently convert the DC power generated by the PV string into AC power and feed it into the grid.

3.1.2 The STS 3~6kW series inverter contains 6 models which are list below:

STS-3KTL, STS-3.6KTL STS-4.2KTL, STS-4.6KTL, STS-5KTL, STS-6KTL.

3.1.3 Applicable grid type

The applicable grid types for the Sunways STS 3~6kW series are TN-S, TN-C, TN-C-S and TT. When applied to the TT grid, the voltage of N to PE should be less than 30V. See Figure 3-1 for details:

3.1.4 Storage conditions

1) Inverter must be stored in its original packaging.

2) The storage temperature should be in the range of -30 ° C and + 60 ° C, and the relative humidity stored is less than 90%.

3) If a batch of inverters needs to be stored, the height of each pile should be no more than 6 levels.

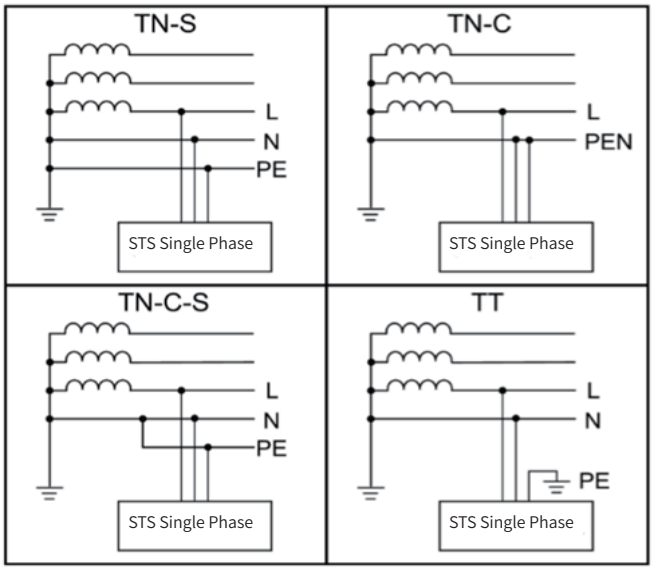


Figure 3-1 Applicable grid type

3.2 Appearance Introduction

3.2.1 Inverter front view, as shown in Figure 3- 2:

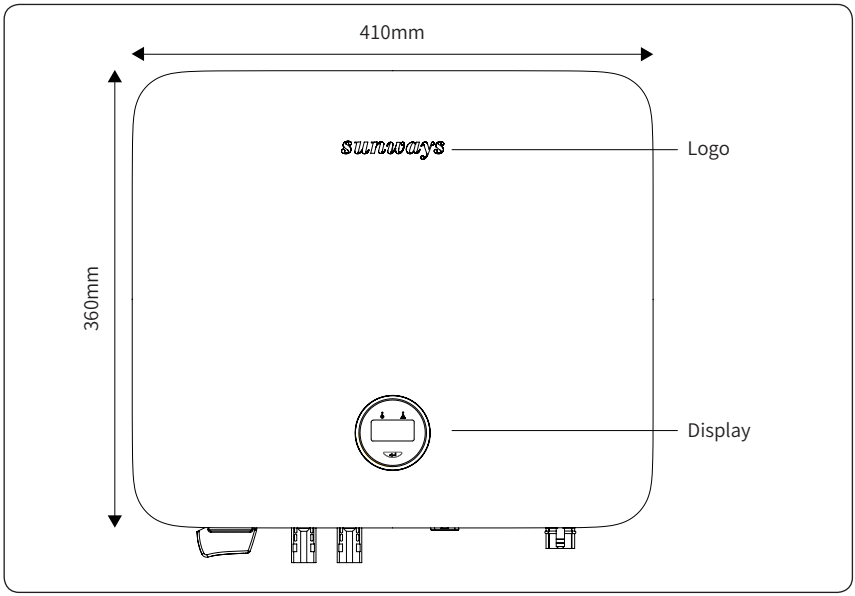


Figure 3- 2 Front view

3.2.2 Inverter side view, as shown in Figure 3-3:

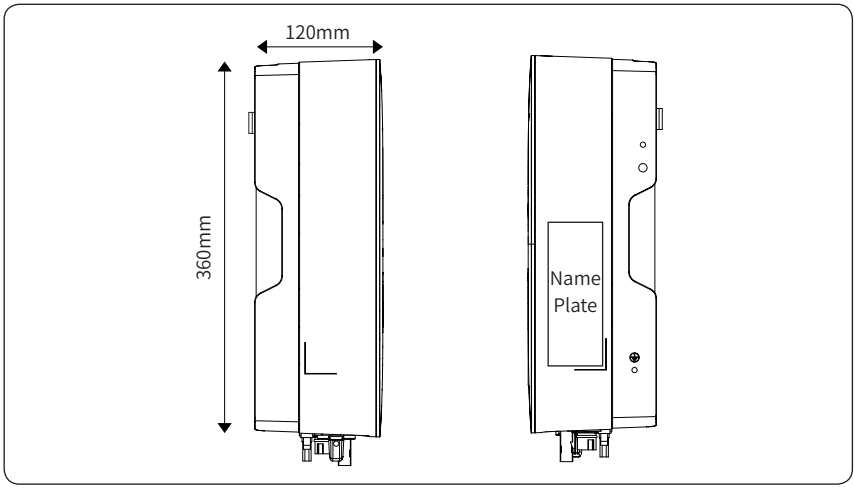


Figure 3- 3 Side view

3.2.3 Inverter bottom view, as shown in Figure 3- 4:

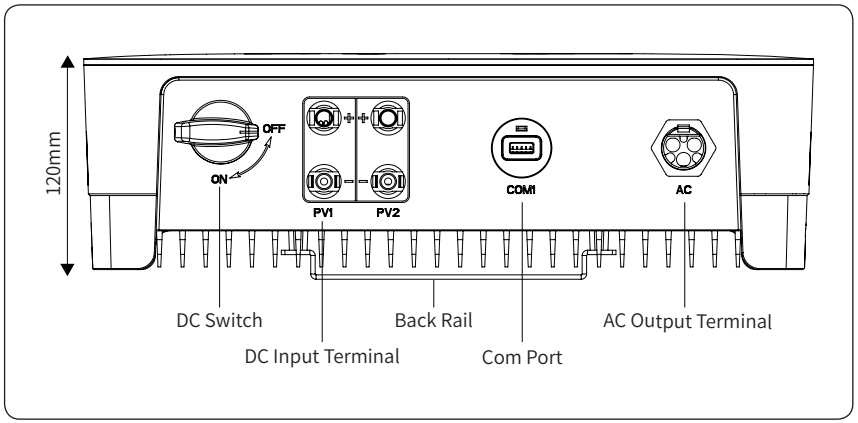


Figure 3-4 Bottom view

3.2.4 Inverter back view, as shown in Figure 3- 5:

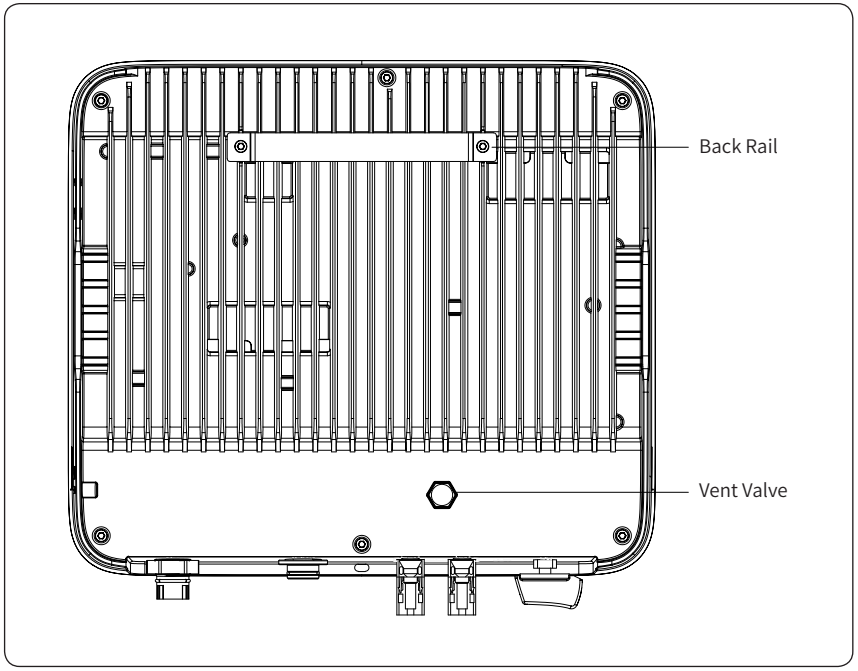


Figure 3-5 Inverter back view

3.3 Display Interface

Figure 3-6 Display interface

Item	Indicator	Status	Description
1	Power Indicator	Off	No input voltage detected or input voltage is too low.
		Slow flashing	Inverter powered on, waiting for the grid connection.
		Quick flashing	Inverter detected grid power and entered self-test status.
		Always on	Normal, grid-connected and power generated.
2	Alarm Indicator	Always on	An alarm or fault is detected, and the display can view the specific fault information.
		Off	The inverter is running normally.
		Slow flashing	The monitoring device is not connected to the router or is not connected to the base station.
		Quick flashing	The monitoring device is connected to the router or connected to the base station but not connected to the server.
3	OLED Display	On	Display the inverter operating information.
		Off	If the button pressed without any response, the screen is faulty or not well connected.
4	Button	Physical button	Switch OLED display information and set parameters by short press and long press.

3.4 Packing list

The package of the inverter includes the following accessories. Please check whether the accessories in the packing box are complete at the first time when receiving the goods. See Figure 3-7 for the packing list:

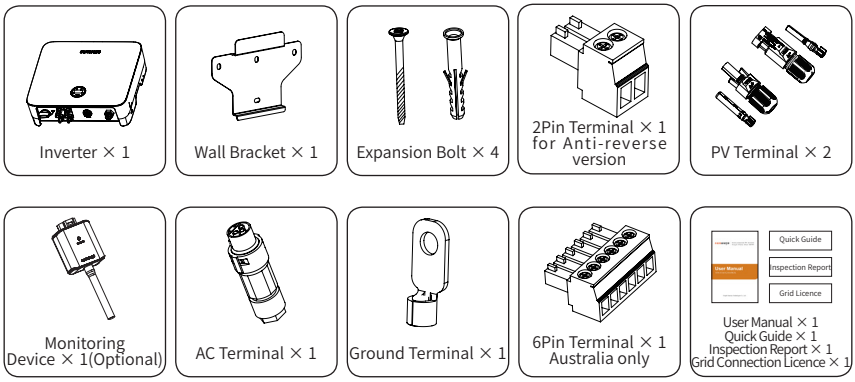


Figure 3- 7 Packing list

4. Product Installation

4.1 Selection of Installation Location

The Sunways STS 3~6kW series is designed with IP65 protection for indoor and outdoor installations. When selecting an inverter installation location, the following factors should be considered:

1) The wall on which the inverter is mounted must be strong and can withstand the weight of the inverter for a long time.

2) The inverter needs to be installed in a well-ventilated environment.

3) Do not expose the inverter directly to strong sunlight to prevent the power derating due to excessive temperature.

4) The inverter should be installed in a place with shelter to prevent direct exposure to sunlight and rain.

5) Install the inverter at the eye level for easy inspection of screen data and further maintenance.

6) The ambient temperature of the inverter installation location should be between -30 ° C and 60 ° C.

7) The surface temperature of the inverter may reach up to 75 ° C. To avoid risk of burns, do not touch the inverter while it's operating and inverter must be installed out of reaching of children.

4.1.1 Recommended installation location of the inverter, as shown in Figure 4-1:

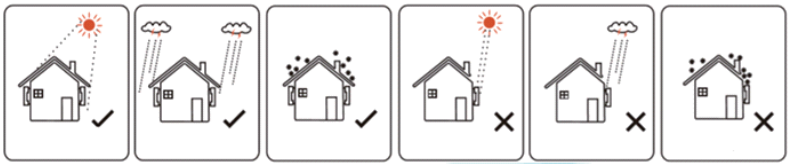


Figure 4-1 Recommended installation location

Warning	Do not put flammable and explosive articles around the inverter.

4.1.2 The requirements for inverter installation spacing are shown in Figure 4-2:

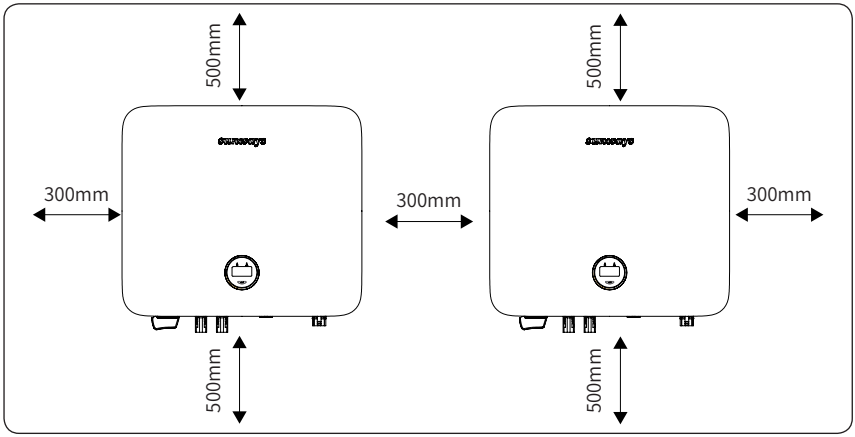


Figure 4-2 Recommended installation space

4.1.3 The installation angle of the inverter is recommended as shown in Figure 4-3:

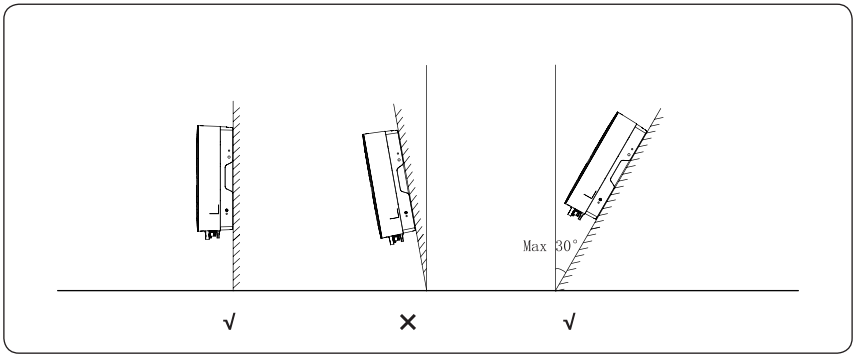


Figure 4-3 Recommended installation angle

4.2 Mounting the Inverter

4.2.1 Wall bracket installation

Dimensions of wall bracket, see Figure 4-4:

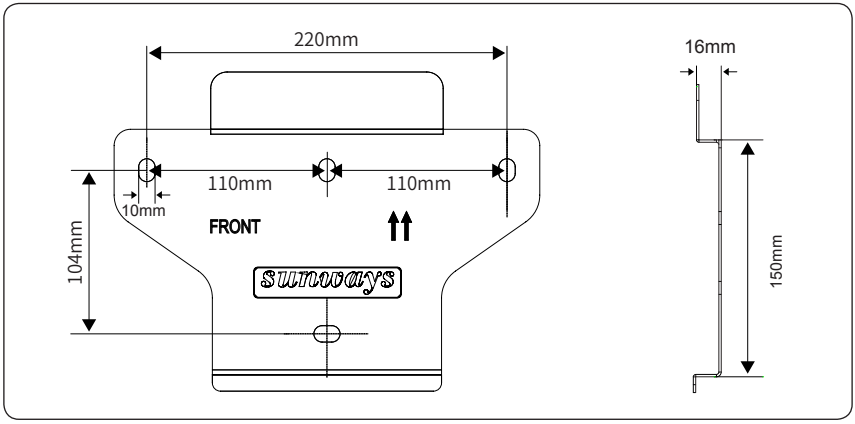


Figure 4-4 Dimensions of wall bracket

1) Use the wall bracket as the template to mark the position of 4 holes on the wall. See Figure 4-5 for details:

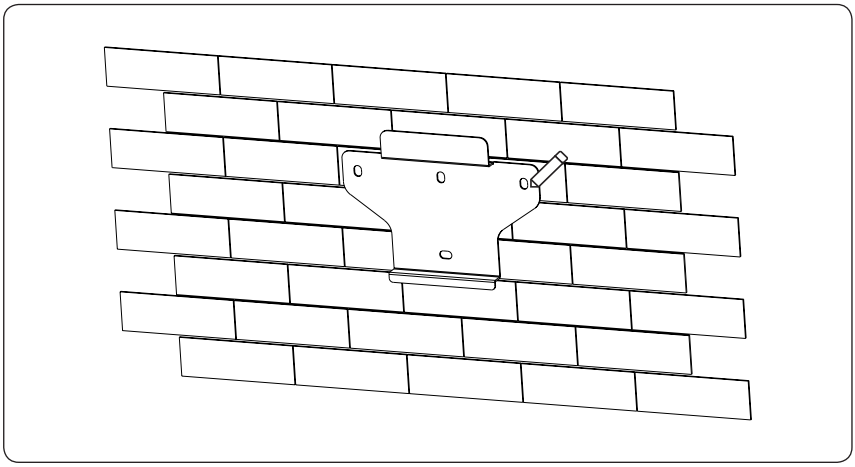


Figure 4-5 Mark the hole position

2) Use an electrical driller with 10mm diameter bit to drill 4 holes on the wall and make sure hole depth is 80mm.

Warning	Before drilling, make sure to avoid the buried water tube and electric wires in the wall to avoid danger.

3) Insert the expansion tubes into the holes and tighten them, then fix the bracket onto the wall with expansion screws by using a cross screwdriver, as shown in Figure 4-6:

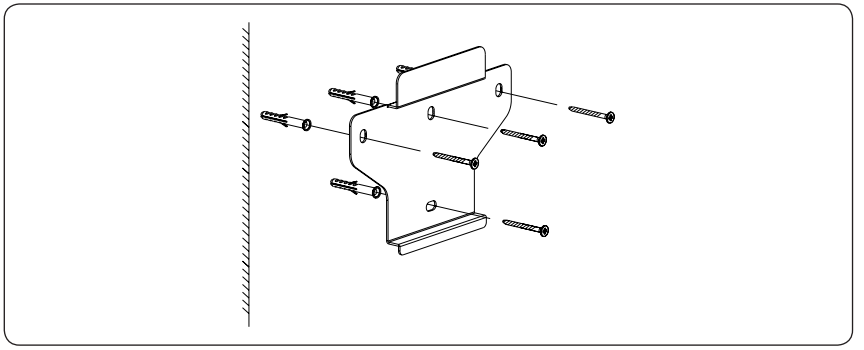


Figure 4-6 Fix the wall bracket

4.2.2 Mounting the inverter

Lift up the inverter with both hands, hang the back rail on the fixed wall bracket carefully, see Figure 4-7 for details:

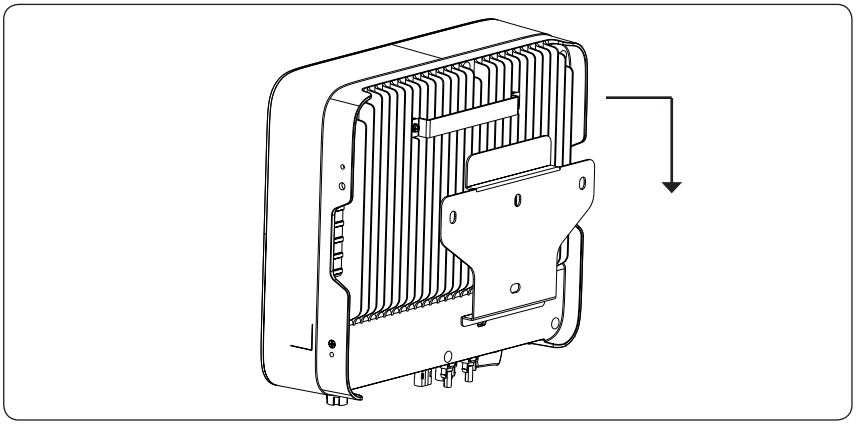


Figure 4-7 Mounting the inverter

4.3 Electrical Connection

Danger hint

Danger	A high voltage in the conductive part of the inverter may cause an electric shock. When performing any installation on the inverter, make sure that the AC and DC sides of the inverter are completely de-energized.
Warning	Do not ground the positive or negative pole of the PV string, otherwise it will cause serious damage to the inverter.
Warning	Static may cause damage to the electronic components of the inverter. Anti-static measures should be taken during the repairing or installation.
Attention	Do not use other brands or other types of terminals other than the terminals in the accessory package. Sunways has the right to refuse all damages caused by the mixed-use of terminals.
Attention	Moisture and dust can damage the inverter, ensure the cable gland is securely tightened during installation. The warranty claim will be invalided if the inverter damaged by the cable connector not well installed.

4.3.1 Inverter PV string connection

4.3.1.1 The following principles must be considered when making electrical connections to the inverter:

1) Disconnect the AC breaker on the grid side.

2) The DC switch of the inverter must be turned to the "OFF" position.

3) The number and type of the PV panels connected in each PV string best to be same.

4) Make sure the maximum output voltage of each PV string does not exceed 600V.

4.3.1.2 DC connector assembly procedure

1) Select the appropriate photovoltaic cable:

Cable type	Conductor transverse area（mm^2）	
General photovoltaic cable	Scope(mm^2)	Recommended value (mm^2)
	2.5-4.0	4.0

2) Peel off the DC cable insulation sleeve for 7 mm, as shown in Figure 4-8:

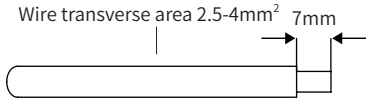


Figure 4-8

3) Disassemble the connector in the accessory bag, as shown in Figure 4-9:

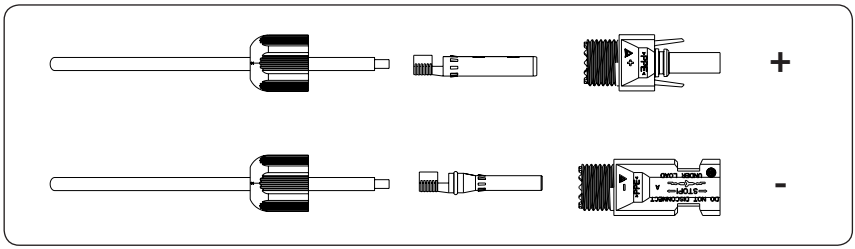


Figure 4-9

4) Insert the DC cable through the DC connector nut into the metal terminal and press the terminal with a professional crimping plier (pull back the cable with some power to check it's tight enough or not), as shown in Figure 4-10:

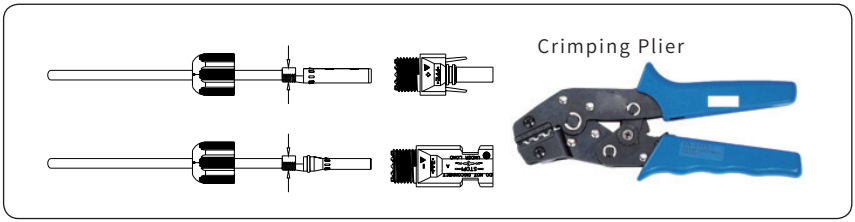


Figure 4-10

5) Insert the positive and negative cables into the corresponding positive and negative connectors, pull back the DC cable to ensure that the terminal is tightly attached in the connector.

6) Use an open-end wrench to screw the nut to the end to ensure that the terminal is well sealed, as shown in Figure 4-11:

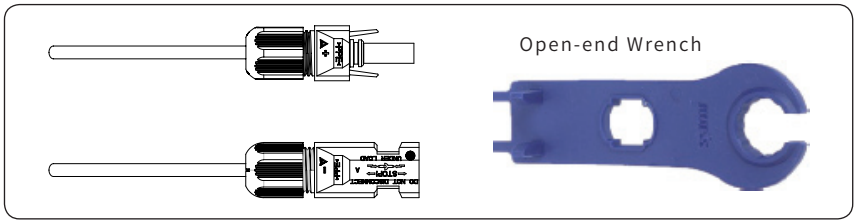


Figure 4-11

Warning	1.Before assembling the DC connector, make sure that the cable polarity is correct.
	2.Use a multimeter to measure the voltage of the DC input string, verify the polarity of the DC input cable, and ensure that each string voltage is within 600V.

7) Insert the positive and negative connectors into the inverter DC input terminals respectively, and when you hear the "click" sound represents the assembly in place, as shown in Figure 4 -12:

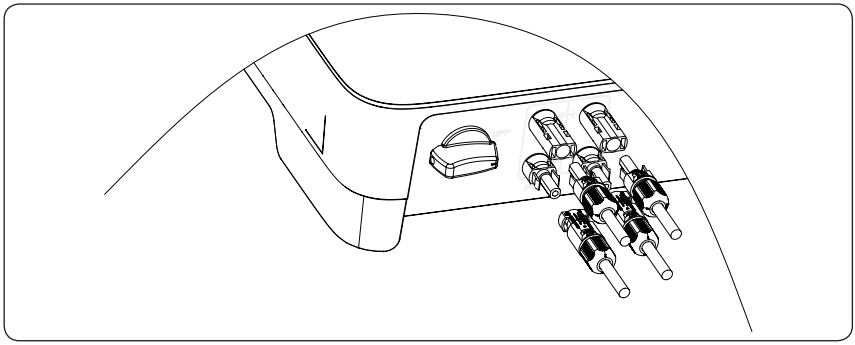


Figure 4-12

4.3.2 Connection of AC output

The Sunways STS 3~6kW series single phase inverter applies to the single-phase power grid with a voltage of 220/230V and a frequency of 50/60Hz.

The recommended cable and AC breaker for the Sunways STS 3~6kW series single phase inverter are shown in the following table:

Model	STS-3KTL	STS-3.6KTL	STS-4.2KTL	STS-4.6KTL	STS-5KTL	STS-6KTL
Cable	4mm^2	4mm^2	4mm^2	4mm^2	6mm^2	6mm^2
Breaker	20A	25A	32A	32A	40A	40A

Warning	An AC breaker must be connected on the AC side of the inverter. Any loads cannot be directly connected to the inverter.

4.3.2.1 AC connector connection steps

1) Take the AC connector out of the accessory bag and disassemble it, as shown in Figure 4-13:

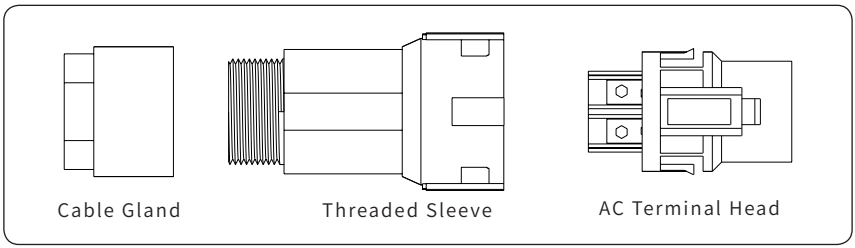


Figure 4-13

2) According to the table above, select an appropriate cable, peel the insulation sleeve of AC cable off for 50mm, and peel off the end of L /PE / N wires for 8mm, as shown in Figure 4-14:

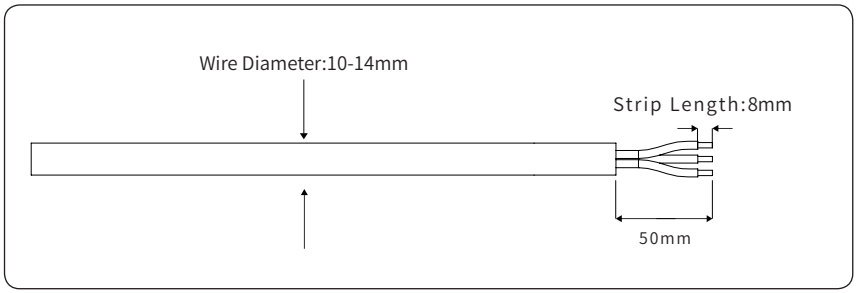


Figure 4-14

3) Insert the stripped end of each three wire into the appropriate hole of the terminal head (yellow green wire to PE port, red or brown wire to L port, and blue or black wire to the N port). Please try to pull out the cable to make sure it's well connected. As shown in Figure 4- 15:

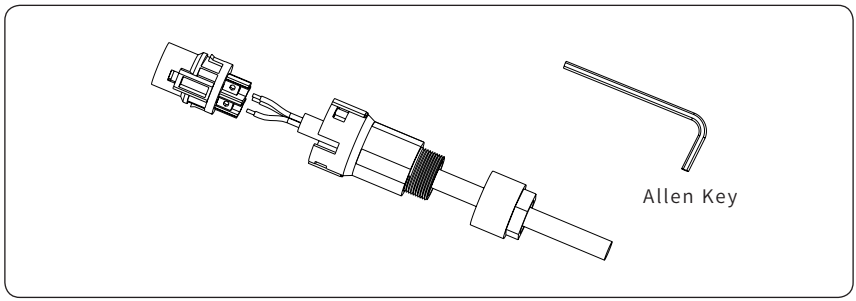


Figure 4-15

4) According to the arrow direction push the threaded sleeve to make it connected with the AC terminal head and then rotate the cable gland clockwise to lock it. As shown in figure 4-16:

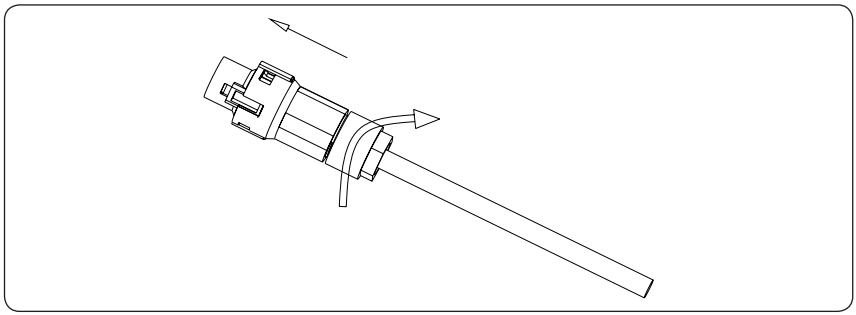


Figure 4-16

5) Connect the AC connector to the inverter AC terminal, and the slight click represents the connection is in the place. As shown in figure 4-17:

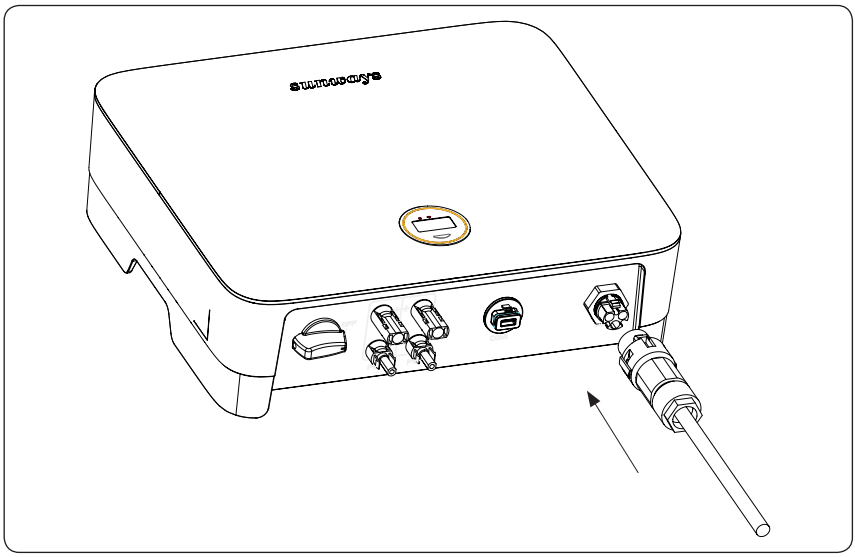


Figure 4-17 Connect the AC connector

4.3.3 External ground connection

Danger	Do not connect the N-wire as a protective ground wire to the inverter casing. Otherwise, it may cause electric shock.
Attention	Good grounding is good for resisting surge voltage shock and improving EMI performance. Inverters must be well-grounded. For a system with only one inverter, just ground the PE cable. For a multi-inverter system, all inverters PE wire need to be connected to the same grounding copper bar to ensure equipotential bonding.

Ground terminal connection steps:

1) The external grounding terminal is located in the lower right side of the inverter.

2) Fix the grounding terminal to the PE wire with a proper tool and lock the grounding terminal to the grounding hole in the lower right side of the inverter. As shown in Figure 4-18:

3) The transverse area of the external grounding cable is 4mm^2.

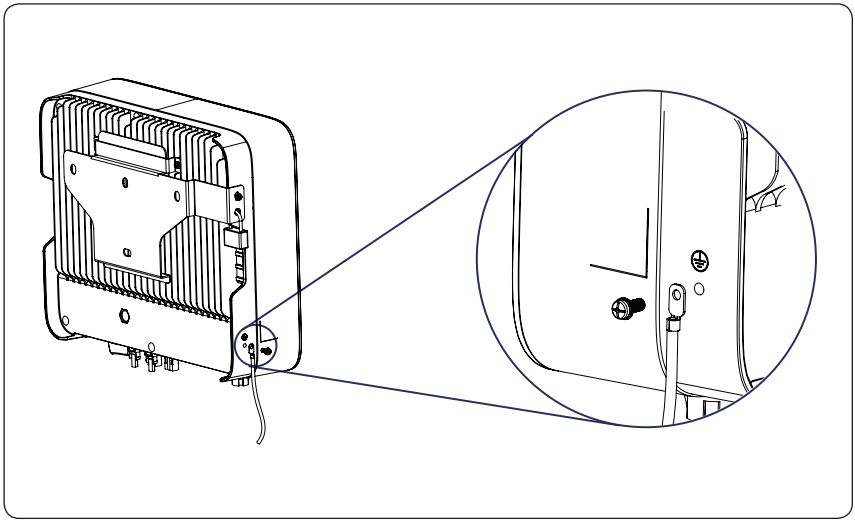


Figure 4-18 Grounding terminal connection

4.4 Monitoring Device Installation

Sunways STS 3~6kW series single phase inverter supports WiFi, GPRS and RS485 communication, you can choose according to your specific needs.

Plug the WiFi or GPRS module into the COM port in the bottom of inverter by following the direction the side with indicator is up (as shown in Figure 4-19). A slight “click” sound during the installation represents that the assembly is in place.

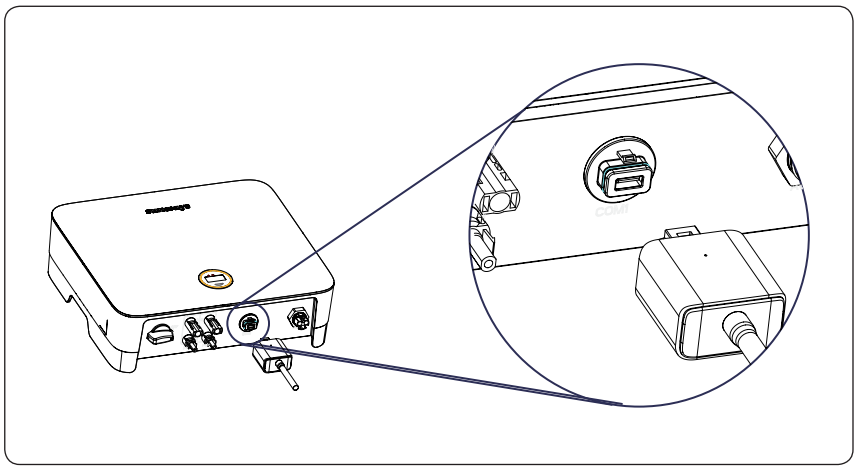


Figure 4-19 Monitoring device installation

Note	1.The GPRS version module does not need to be configured. 2.The WiFi version module needs to be configured to the router for the first installation, and if the router name or password changed, you need to configure it again. For details, please refer to the [QUICK INSTALLATION GUIDE] which attached in the accessory bag.
Attention	Don't touch the waterproof plug in the card slot unless replace the SIM card. If the SIM card needs to be replaced, please make sure the card slot iscompletely sealed by waterproof plug after replacing. Any damages caused by the waterproof plug sealing problem will be invalid of warranty.

4.5 Power Limiting Device & DRED Connection

An external CT is needed to realize the power export limiting function on Sunways STS 3-6kW series inverter. You may refer to the diagram and steps below to complete the CT installation. See Figure 4-20:

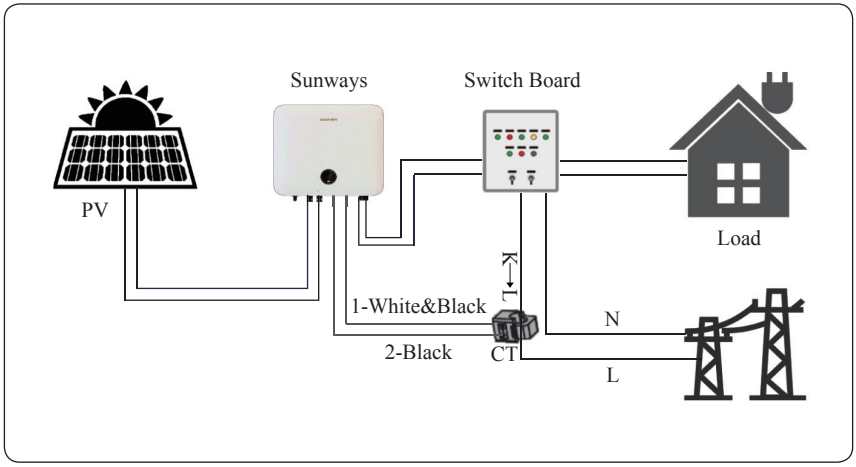


Figure 4-20

4.5.1 CT connection steps:

1) Remove the CT plate in the bottom of the inverter with cross screwdriver.

2) Put the two cables which attached in the CT through the components in the following order: screw cap, sealing ring, insulator, metal plate, nut and 2pin connector, as shown in Figure 4-21.

3) Insert the white black cable to the port No.1 in the 2pin connector and the black cable to the port No.2 in the 2pin connector and fasten with screwdriver.

4) Insert the 2pin connector to the other 2pin connecter which integrated inside the inverter,

put the CT plate back with a cross screwdriver, as shown in Figure 4-22.

5) Please pay attention to the CT direction and position when installing, CT should always install in the L wire between load and grid and follows the direction K to Load and L to grid.

6) After the physical connection completed, you need to set the power limit on the inverter display by referring the display operation flow on chapter 6.

4.5.2 DRED Connection

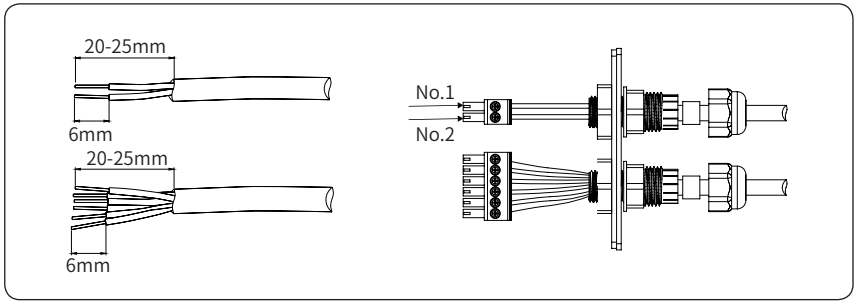


Figure 4-21

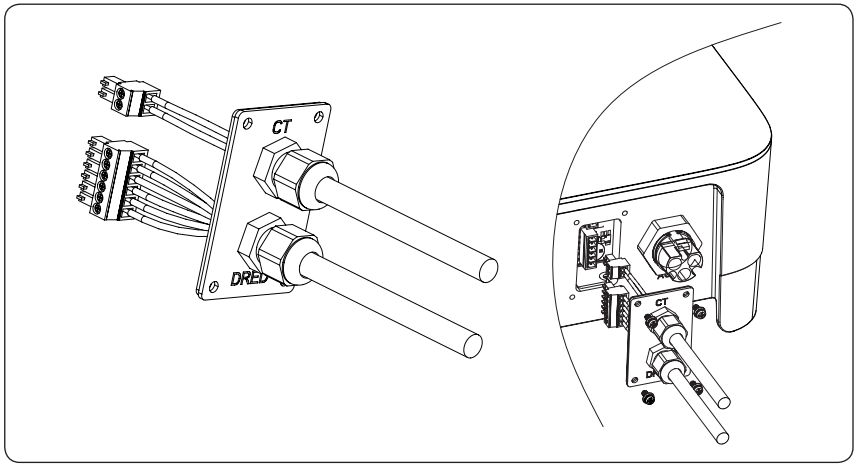


Figure 4-22

DRED means demand response enable device. The AS/NZS 4777.2:2015 requires inverters to support demand response mode (DRM). This function is for inverter that comply with AS/NZS4777.2:2015 standard. Sunways STS 3-6kW series single phase inverter is fully complied with all DRM. The 6pin connector in the bottom of inverter is used for DRM connection.

Note:

1) DRED connection only applies to Australia and New Zealand market.

2) Support DRM command: DRM0, DRM5, DRM6, DRM7, DRM8.

4.6 System Layout of Units Without Integrated DC Switch

Local standards or codes may require that PV systems are fitted with an external DC switch on the DC side. The DC switch must be able to safely disconnect the open-circuit voltage of the PV array plus a safety reserve of 20%.Install a DC switch to each PV string to isolate the DC side of the inverter. We recommend the following electrical connection, as shown in Figure 4-23:

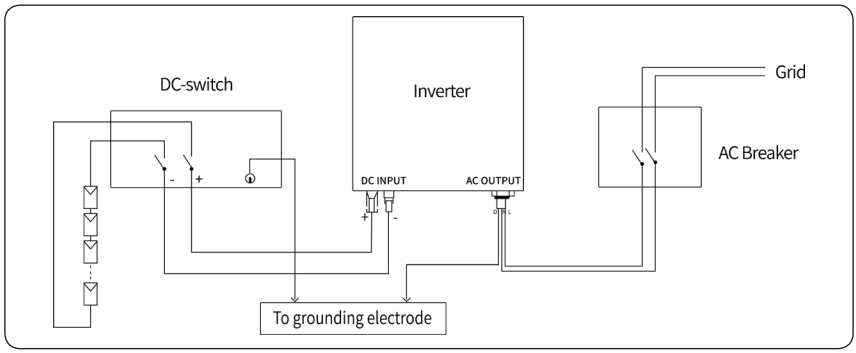


Figure 4-23

5. Start and Stop

5.1 Start the Inverter

When starting the inverter, follow these steps:

1) Turn on the AC breaker first (close the AC circuit breaker).

2) Turn on the DC switch in the bottom. If the PV string voltage higher than the inverter start-up voltage, the inverter will start.

3) When both AC and DC power supply are normal, the inverter is ready to start. The inverter will initiate from checking its internal parameters and grid parameters, if it's within the range, the green light on the left side of the screen begins to flash, and the "Waiting" message will be displayed on the OLED display.

4) After 30 seconds, the inverter will start generating electricity, the green light will remain on, and the OLED display will display real-time power information.

5.2 Stop the Inverter

When turning off the inverter, please follow the steps below:

1) Turn off the AC breaker first.

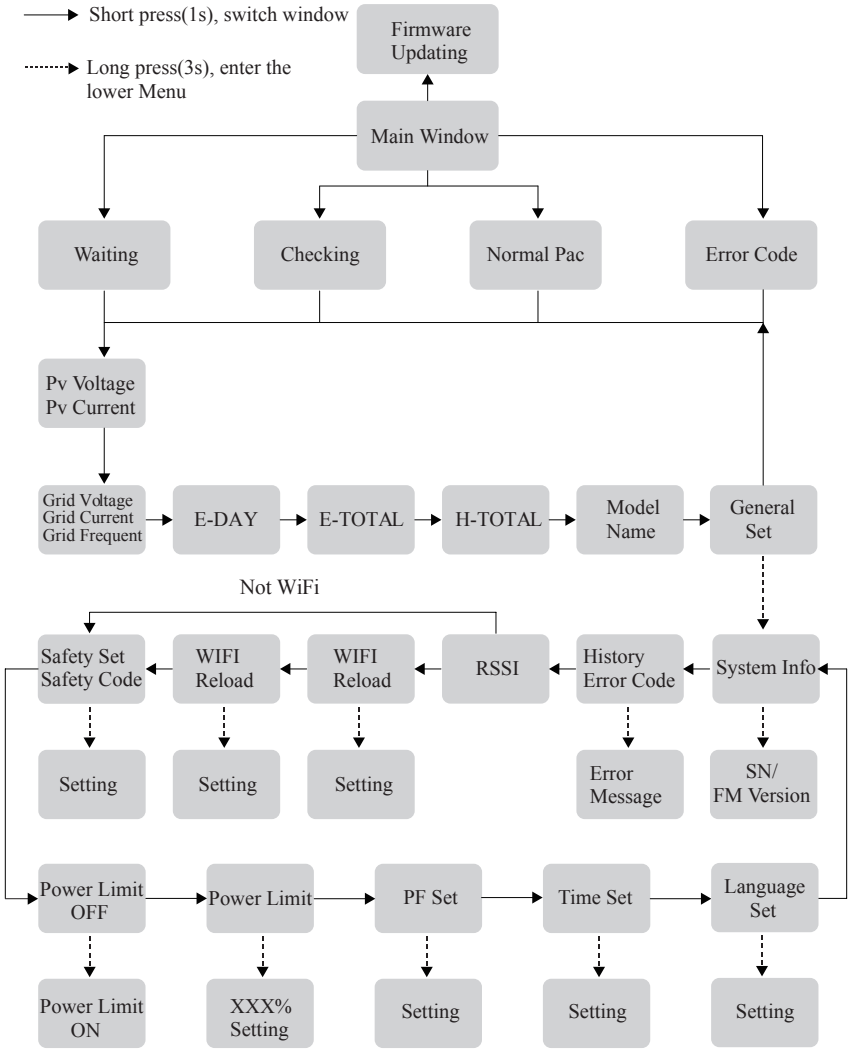
2) Wait 30 seconds and then turn the DC switch to the "OFF" position. At this time, there is remaining power in the inverter capacitor. Wait for 5 minutes until the inverter is completely de-energized before operating.

3) Disconnect the AC and DC cables.

6. General Operation

6.1 Display Operation

When the inverter is turned on, the following interfaces will be displayed on the OLED display, and you can check the information and modify the parameters of the inverter by short or long pressing the button. Please refer to the following display operation flow for details:



Tip: After every setting completed, wait for 10 seconds and the inverter will automaticaly save your settings or modifications.

7. Troubleshooting

7.1 Fault Messages

Sunways STS 3~6kW series single phase inverter is designed in accordance with grid operation standard, and conform to the requirements of the safety and EMC. The inverter had passed a series of rigorous tests to ensure it runs sustainably and reliably before shipment.

When a fault occurs, the corresponding fault messages will display on the OLED display, and in this case, the inverter might stop feeding into grid. The fault messages and their corresponding troubleshooting methods are listed below:

Error Message	Solution
Mains Lost	1. Check whether the mains supply is lost. 2. Check whether the AC breaker and terminal are well connected.
Grid Voltage Fault	1. Check whether the impendence of the AC cable is too high to lead the grid voltage increased. Change a thicker AC cable if it is. 2. Extend the voltage protection range if it is allowed by the electricity company.
Grid Frequency Fault	1. Check whether the AC cable is correct and well connected. 2. Change to another country with wider protection range if it's allowed by the local electricity company.
DCI Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
ISO Over Limitation	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
GFCI Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
PV Over Voltage	Reduce the number of PV panels to make sure the open-circuit voltage of each string is lower than the verter max allowed input voltage.
Bus Voltage Fault	1. Check whether the input voltage is over the limitation. 2. Seek for help from the installer or manufacture.
Inverter Over Temperature	1. Check whether the input voltage is over the limitation. 2. Seek for help from the installer or manufacture.
SCI Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
SPI Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
E2 Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
GFCI Device Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
AC Transducer Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
Relay Check Fail	1. Restart the inverter. 2. Seek for help from the installer or manufacture.
Flash Fault	1. Restart the inverter. 2. Seek for help from the installer or manufacture.

8. Technical Parameters

	Model	STS-3KTL	STS-3.6KTL	STS-4.2KTL	STS-4.6KTL	STS-5KTL	STS-6KTL
DC Input	Start-up Voltage (V)	120	120	120	120	120	**120**
	Max. DC Input Voltage (V)	600	600	600	600	600	**600**
	Rated DC Input Voltage (V)	360	360	360	360	360	**360**
	MPPT Voltage Range (V)	100~550	100~550	100~550	100~550	100~550	100~550
	Full power MPPT voltage range (V)	130~500	150~500	180~500	190~500	210~500	250-500
	No. of MPP Trackers	2	2	2	2	2	2
	No. of DC Inputs per MPPT	1/1	1/1	1/1	1/1	1/1	1/1
	Max. Input Current (A)	12.5/12.5	12.5/12.5	12.5/12.5	12.5/12.5	12.5/12.5	12.5/12.5
	Max. Short-circuit Current (A)	15	15	15	15	15	15
	backfeed current to the array (A)	0	0	0	0	0	0
AC Output	Rated Output Power (W)	3000	3600	4200	4600	5000	6000
	Max. Output Power (W)	3300	3960	4600	4600	5500	6600
	AC Output Rated Apparent	3000	3600	4200	4600	5000	6000
	Max. Apparent Power (VA)	3300	3960	4600	4600	5500	6600
	Rated Output Voltage (V)	220/230	220/230	220/230	220/230	220/230	220/230
	Rated AC Frequency (Hz)	50/60	50/60	50/60	50/60	50/60	50/60
	AC Output Rated Current(A)	13	15.7	18.3	20	21.7	26.1
	Max. Output Current (A)	15	18	21	21	25	28.7
	The Measured Inrush Current (A)	13.5A@44μs	13.5A@44μs	31.5A@55μs	31.5A@55μs	31.5A@55μs	31.5A@55μs
	Max. output fault current (A)	50	50	50	50	50	50
	Max. output overcurrent protection	50	50	50	50	50	50
	Power Factor	0.8 leading …0.8 lagging					
	Max. total harmonic distortion	<3% @Rated Output Power					
	DCI	<0.5%In					

	Model	STS-3KTL	STS-3.6KTL	STS-4.2KTL	STS-4.6KTL	STS-5KTL	STS-6KTL
Effi-ciency	Max. Efficiency	98.1%	98.1%	98.1%	98.1%	98.1%	98.1%
	European Efficiency	97.5%	97.5%	97.5%	97.5%	97.5%w	97.5%
	MPPT Efficiency	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
Pro-tection	DC Reverse Polarity Protection	Integrated					
	Insulation Resistance Protection	Integrated					
	DC Switch	Integrated					
	Surge Protection	Integrated					
	Over-temperature Protection	Integrated					
	Residual Current Protection	Integrated					
	Islanding Protection	Frequency shift, Integrated					
	AC Short-circuit Protection	Integrated					
	AC Over-voltage Protection	Integrated					
General Data	Dimensions (mm)	410W*360H*120D					
	Weight (KG)	13					
	Protection Degree	IP65					
	Self-consumption at Night (W)	<1					
	Topology	Transformerless					
	Operating Temperature Range (°	-30~60					
	Relative Humidity	0~100%					
	Operating Altitude (m)	3000					
	Cooling	Natural Convection					
	Noise Level (dB)	<25					
	Display	OLED & LED					
	Communication	RS485, WiFi/ GPRS/LAN(Optional)					
	Compliance	NB/T 32004、IEC62109、IEC62116、VDE 4105、VDE 0126、AS4777、RD1699、NBR16149、IEC61727、IEC60068、IEC61683、EN50549、EN61000					

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