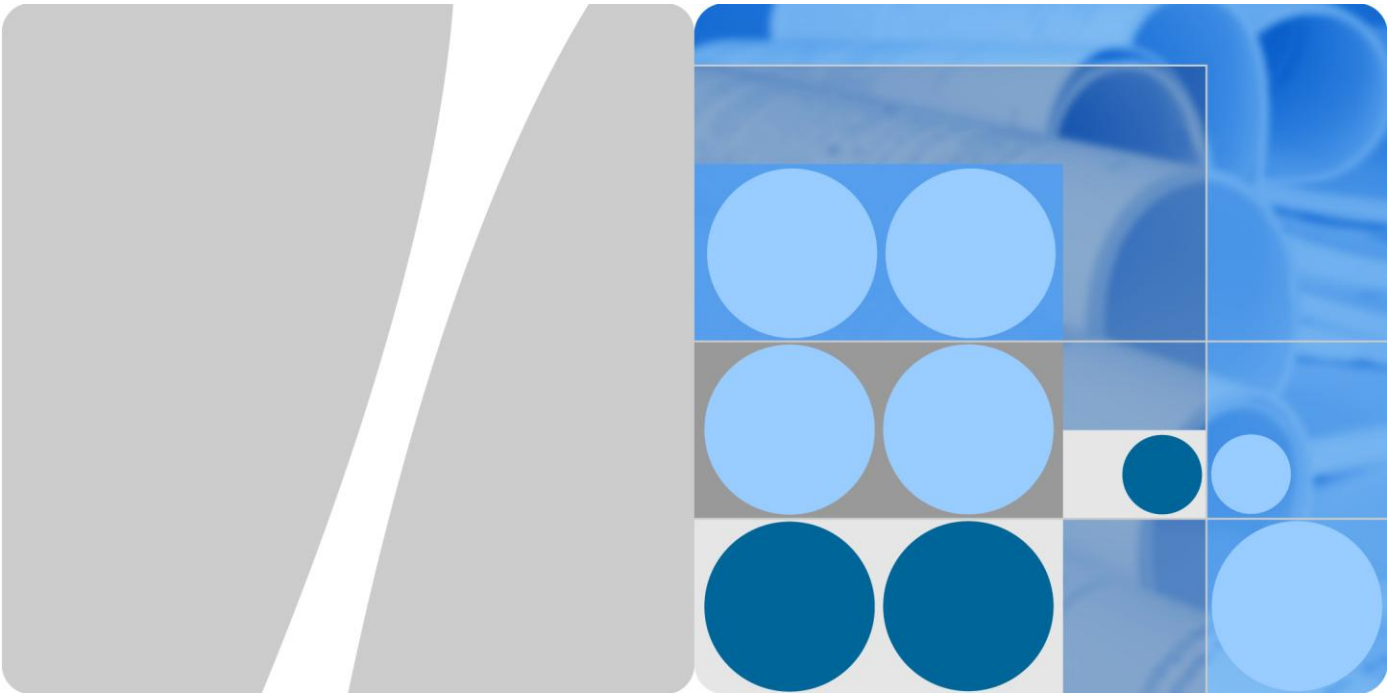

SUN2000-60KTL-HV-D1

User Manual (China Edition)

Issue	**Draft A**
Date	**2017-02-10**

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About This Document

Purpose

This document describes the SUN2000-60KTL-HV-D1 (SUN2000 for short) in terms of its installation, electrical connections, commissioning, maintenance, and troubleshooting. Read this manual carefully to understand the safety information and get familiar with the SUN2000 functions and features before installing and operating the SUN2000.

Intended Audience

This document is intended for photovoltaic (PV) power plant personnel and qualified electrical technicians.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Calls attention to important information, best practices and tips. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Issue Draft A (2017-02-10)

This issue is used for first office application (FOA).

Contents

1 Safety Precautions

NOTICE

Before performing operations, read through this manual and follow all the precautions to prevent accidents. The safety precautions provided in this document do not cover all the safety precautions. Huawei shall not be liable for any consequence caused by the violation of the safety operation regulations and design, production, and usage standards.

Declare

Huawei shall not be liable for any consequence caused by any of the following events.

- Transportation
- The storage conditions do not meet the requirements specified in this document.
- Violate the operation instructions and safety precautions in this document for installation, cable connecting, and maintenance.
- Operation in extreme environments which are not covered in this document
- Unauthorized modifications to the product or software code
- Installation or use in environments which are not specified in related international standards

Personnel Requirements

Only qualified electrical technicians are allowed to install and operate the SUN2000.

- Operation personnel should receive professional training.
- Operation personnel should read through this document and follow all the precautions.
- Operation personnel should be familiar with the safety specifications about the electrical system.
- Operation personnel should understand the composition and working principles of the grid-tied PV power system and local regulations.

Sign Protection

- Do not tamper with any warning signs on the inverter enclosure because these signs contain important information about safe operation.
- Do not tamper with the nameplate on the inverter enclosure because it contains important product information.
- Do not remove the warranty label from the inverter enclosure. Otherwise, product warranty will be forfeited.

Installation

- Ensure that the inverter is not connected to a power supply and is not powered on before starting installation.
- Ensure that there are no objects within 200 mm, 300 mm, 500 mm, 600 mm, and 1000 mm of the left, right, top, bottom, and front of the inverter, respectively. This is to allow sufficient space for installation and heat dissipation. For ease of installation, ensure that the inverter bottom is at most 730 mm above the floor. If you have any questions about the distance, consult the local technical support engineers.
- Ensure that the inverter is installed in a well ventilated environment.
- Ensure that the inverter heat sinks are free from blockage.
- Open the maintenance compartment door of the chassis before connecting cables. Do not perform any operation on other components inside the chassis except connecting AC power cables and communications cables.

Cable Connections

DANGER

Before connecting cables, ensure that the inverter is securely positioned and not damaged in any way. Otherwise, electric shocks or fire may occur.

- Ensure that all electrical connections comply with local electrical standards.
- Obtain approval from the local power supply department before using the inverter to generate electricity in grid-tied mode.
- Ensure that the cables used in a grid-tied PV power system are properly connected and insulated and meet specifications.

Operation

DANGER

High voltages may cause electric shocks and serious injuries during inverter operating. Strictly comply with the safety precautions in this document and associated documents when operating the inverter.

- Do not touch an operating inverter because the heat sinks may have a temperature of greater than 60 ℃ and may cause burns when the inverter is operating.

- Follow local laws and regulations when operating the equipment.

Maintenance and Replacement

DANGER

High voltages may cause electric shocks and serious injuries during inverter operating. Therefore, before maintenance, power off the inverter and strictly comply with the safety precautions in this document and associated documents to operate the inverter.

- Maintain the inverter with sufficient knowledge of this document and proper tools and testing equipment.
- Before performing maintenance tasks, power off the inverter and wait at least 5 minutes.
- Place temporary warning signs or erect fences to prevent unauthorized access to the maintenance site.
- Rectify any faults that may compromise the inverter security performance before powering on the inverter again.
- Observe ESD precautions during the maintenance.
- For personal safety, wear insulation gloves and protective shoes.

2 Overview

2.1 Introduction

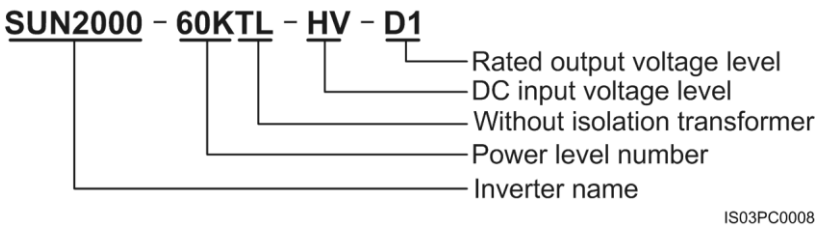
Function

The SUN2000 is a three-phase grid-tied PV string inverter that converts the DC power generated by PV strings into AC power and feeds the power into the power grid.

Models

Figure 2-1 describes the model number.

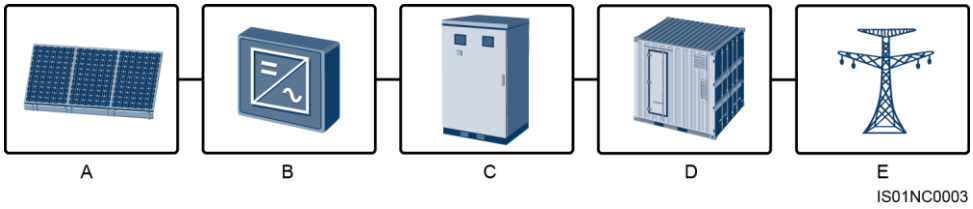
Figure 2-1 Model number description



Network Application

The SUN2000 applies to grid-tied PV power systems for commercial rooftops and large power stations. Typically, a grid-tied PV power system consists of PV strings, grid-tied inverters, AC power distribution unit, and isolation transformer.

Figure 2-2 Network application



(A) PV string (B) SUN2000

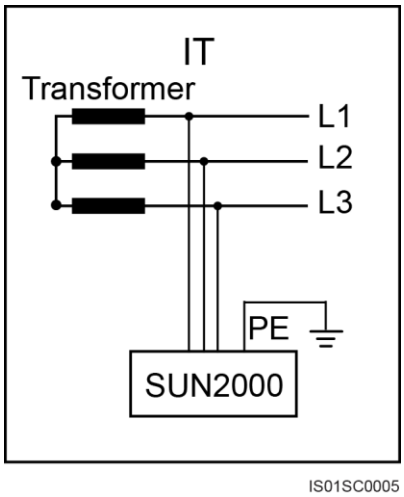
(C) ACDU (D) Isolation transformer

(E) Power grid

Supported Power Grids

The SUN2000 only supports the IT power grid mode, as shown in Figure 2-3.

Figure 2-3 Power grid modes



NOTE

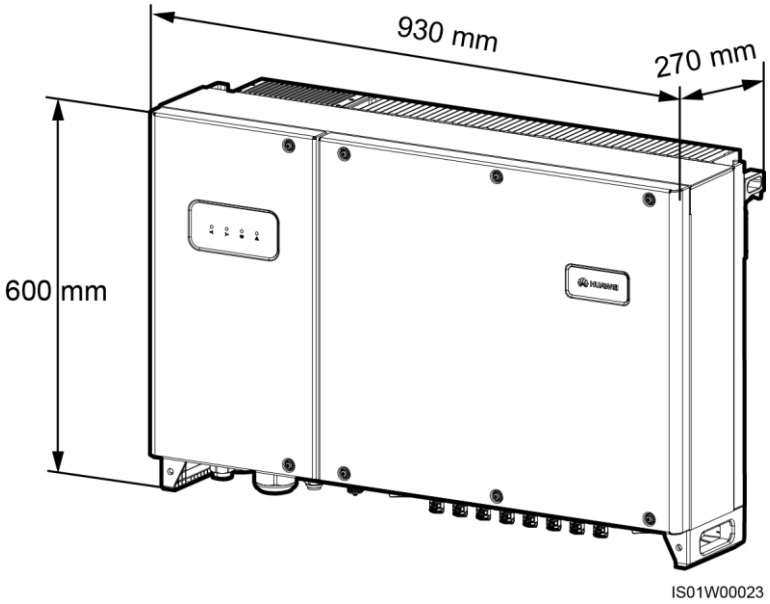
The SUN2000 is mainly used for medium-voltage power grids. It delivers three-phase, three-wire output, which is then fed to a medium-voltage power grid through a step-up transformer.

2.2 Appearance

SUN2000 Dimensions

Figure 2-4 shows the SUN2000 dimensions.

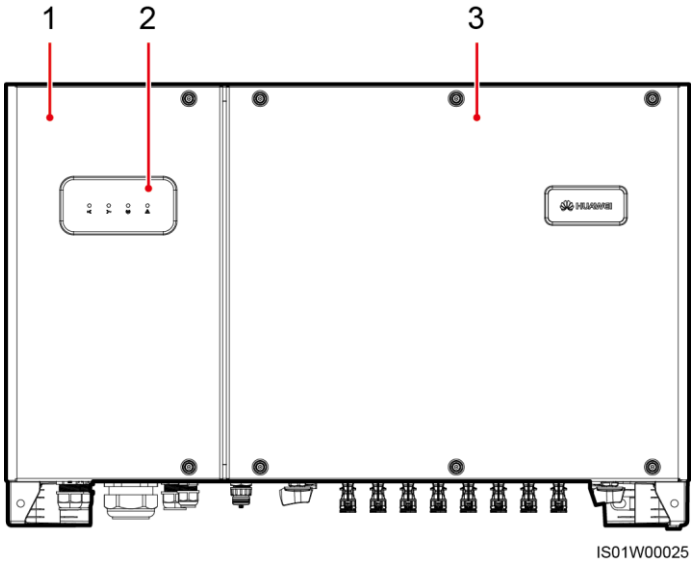
Figure 2-4 SUN2000 dimensions



Front view

Figure 2-5 shows the SUN2000 front view.

Figure 2-5 Front view



(1) Maintenance compartment door (2) LED indicator (3) Host panel

Table 2-1 describes the LED indicators.

Table 2-1 LED indicator description (from left to right)

Indicator	Status		Meaning
PV connection indicator 	DC input detection status	Blinking green	The DC input is normal.
		Blinking red	DC input detection is in progress.
		Steady red	The DC input is abnormal.
	PV string connection status	Steady green	At least one PV string is properly connected, and the DC input voltage of the corresponding maximum power point tracking (MPPT) circuit is higher than or equal to 600 V.
		Green off	The SUN2000 disconnects from all PV strings, or the DC input voltage of each MPPT circuit is less than 600 V.
Grid-tied indicator 	Steady green		The SUN2000 connects to the power grid.
	Green off		The SUN2000 does not connect to the power grid.
Communications indicator 	Blinking green		The SUN2000 receives data over RS485/PLC communication.
	Green off		The SUN2000 has not received data over RS485/PLC communication for 10 seconds.
Alarm/Maintenance indicator 	Alarm status	Blinking red at long intervals (on for 1s and then off for 4s)	A warning alarm is generated.
		Blinking red at short intervals (on for 0.5s and then off for 0.5s)	A minor alarm is generated.
		Steady red	A critical alarm is generated.
	Local maintenance status	Blinking green at long intervals (on for 1s and then off for 1s)	Local maintenance is in progress.
		Blinking green at short intervals	Local maintenance fails.

Indicator	Status		Meaning
		(on for 0.125s and then off for 0.125s)	
		Steady green	Local maintenance succeeds.

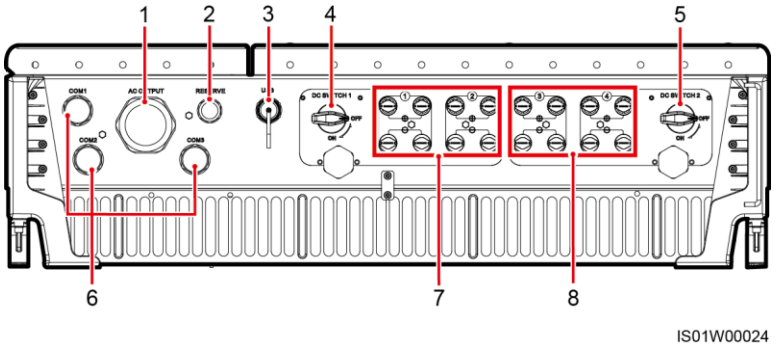
NOTE

- If both DC switches are OFF, the PV connection indicator indicates the DC input detection status. If one or two DC switches are ON, the PV connection indicator indicates the PV string connection status.
- Local maintenance refers to operations performed after a universal serial bus (USB) flash drive, Bluetooth module, or USB data cable is inserted into the USB port of the SUN2000. For example, local maintenance includes data import and export using a USB flash drive and connecting to the SUN2000 APP over a Bluetooth module or USB data cable.
- If alarming and local maintenance happen concurrently, the alarm/maintenance indicator shows the local maintenance state first. After the USB flash drive, Bluetooth module, or USB data cable is removed, the indicator shows the alarm state.

Bottom View

Figure 2-6 shows the SUN2000 bottom view.

Figure 2-6 Bottom view



No.	Component	Silk Screen
1	Waterproof cable connector (inner diameter: 37–44 mm)	AC OUTPUT
2	Waterproof cable connector (inner diameter: 10–15 mm)	RESERVE
3	USB port	USB
4	DC switch 1	DC SWITCH 1
5	DC switch 2	DC SWITCH 2
6	Waterproof cable connector (inner diameter: 14–18 mm)	COM1, COM2, COM3

No.	Component	Silk Screen
7	DC input terminal (controlled by DC SWITCH 1)	+/–
8	DC input terminal (controlled by DC SWITCH 2)	+/–

NOTE
Waterproof cable connector is abbreviated as waterproof connector in the following text.

2.3 Label Description

Symbols

Table 2-2 describes the labels on the SUN2000 chassis and their meanings.

Table 2-2 Label description

Symbol	Name	Meaning
	Running warning	Potential hazards exist after the SUN2000 is powered on. Take protective measures when operating the SUN2000.
	Burn warning	Do not touch a running SUN2000 because it generates high temperatures on the shell.
	Delay discharge	• High voltage exists after the SUN2000 is powered on. Only qualified and trained electrical technicians are allowed to perform operations on the SUN2000. • Residual voltage exists after the SUN2000 is powered off. It takes 5 minutes for the SUN2000 to discharge to the safe voltage.
	Refer to documentation	Remind operators to refer to the documents shipped with the SUN2000.

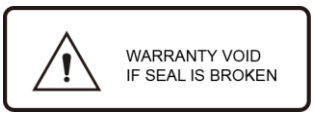
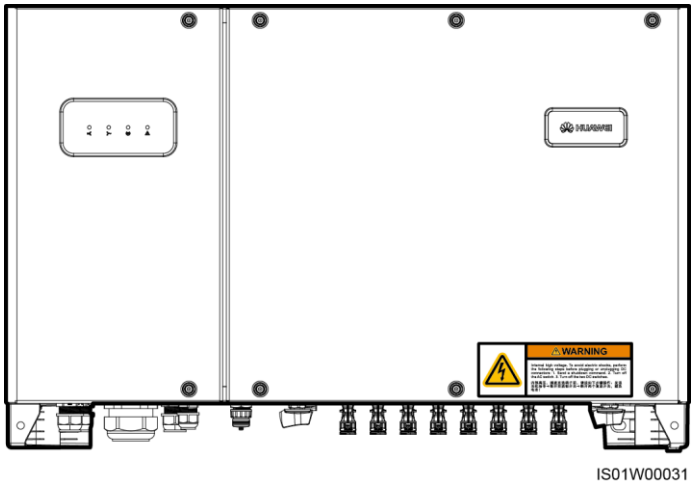
Symbol	Name	Meaning
	Grounding	Indicates the position for connecting the protection ground cable.
	Operation warning	Do not remove the DC input connector when the SUN2000 is running.
	DC terminal operation warning[a]	High voltage exists after the SUN2000 is powered on. To avoid electric shocks, perform the following system power-off operations before plugging or unplugging DC input connectors of the SUN2000: 1. Send a shutdown command. 2. Turn off the downstream AC switch. 3. Turn off the two DC switches at the bottom.
	Warranty label	The warranty will be voided if the label is damaged.
	SUN2000 serial number label	Indicates the SUN2000 serial number.
	Weight label	The SUN2000 needs to be carried by more than one person or using a pallet truck.
Note a: Fittings delivered with the SUN2000 contain the label of DC terminal operation warning. You are advised to attach the label at the bottom of the SUN2000 front side, as shown in Figure 2-7. You can also select an appropriate place for attaching the label based on site requirements.		

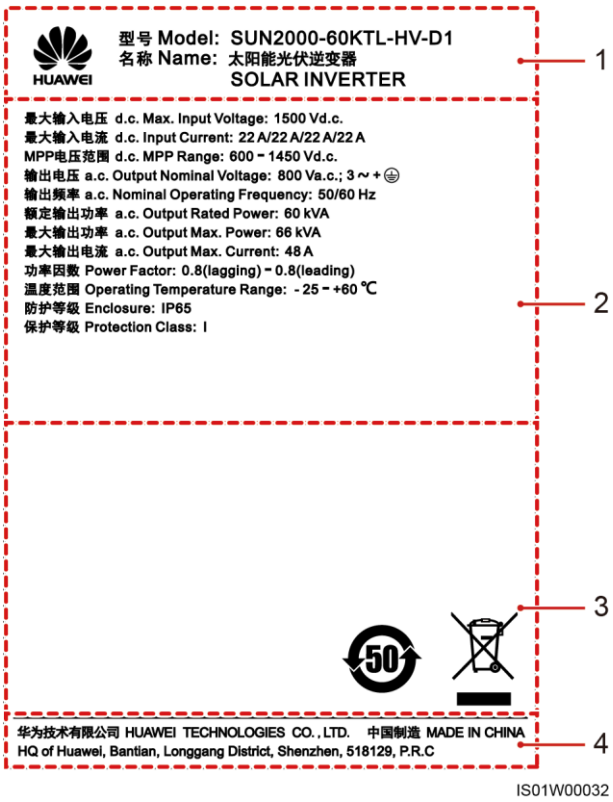
Figure 2-7 Place for attaching



Nameplate

The SUN2000 is labeled with a nameplate on the side that contains the model information, technical specifications, and compliance symbols, as shown in Figure 2-8.

Figure 2-8 Nameplate



(1) Trademark and product model (2) Important technical specifications

(3) Compliance symbols (4) Company name and country of manufacture

Table 2-3 describes the compliance symbols.

NOTE
The certification marks on the nameplate will be subject to the actual product.

Table 2-3 Compliance symbols

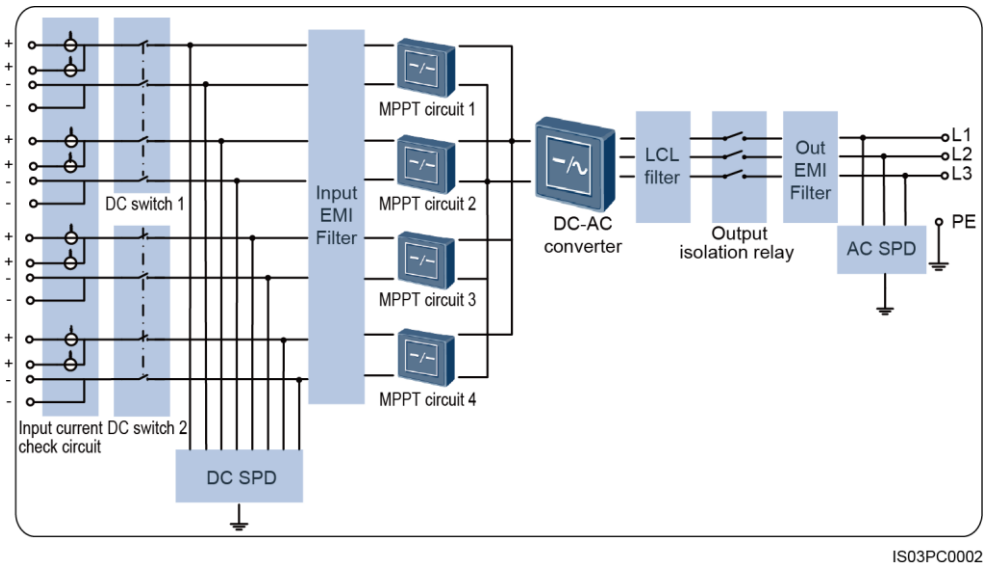
Symbol	Name	Meaning
	Environmentally friendly use period (EFUP) label	The SUN2000 does not pollute the environment during the specified period.
	EU waste electrical and electronic equipment (WEEE) label	Do not dispose of the SUN2000 as household garbage.

2.4 Working Principle

Conceptual Diagram

The SUN2000 receives inputs from eight PV strings. Then the inputs are grouped into four MPPT routes inside the SUN2000 to track the maximum power point of the PV strings. The DC power is then converted into three-phase AC power through an inverter circuit. Surge protection is supported on both the DC and AC sides. Figure 2-9 shows the SUN2000 conceptual diagram.

Figure 2-9 SUN2000 conceptual diagram



Working Modes

The SUN2000 can work in standby, operating, or shutdown mode. Figure 2-10 shows the relationship between the three working modes.

Figure 2-10 SUN2000 working modes

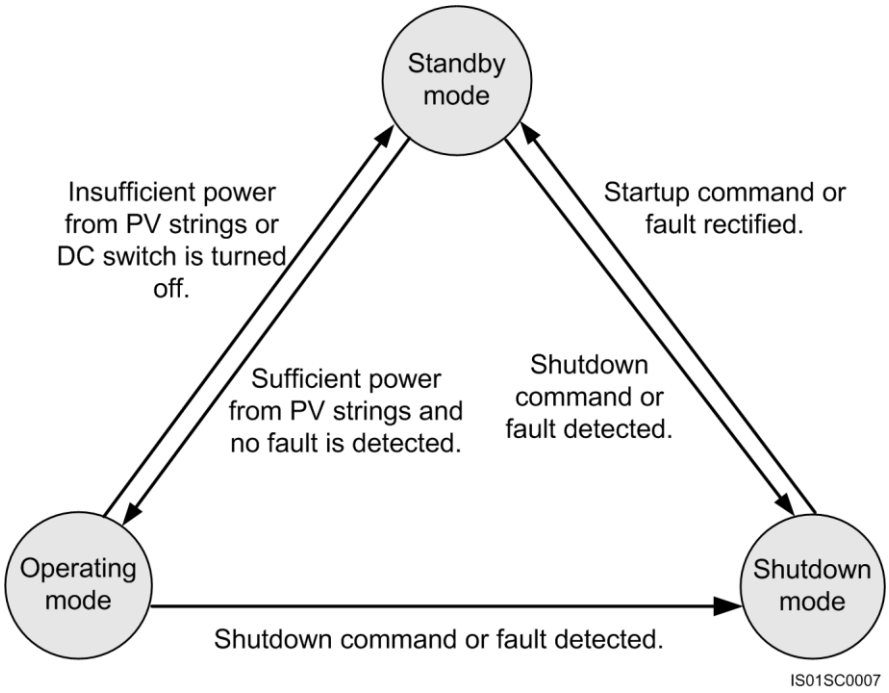


Table 2-4 describes the three working modes shown in Figure 2-10.

Table 2-4 Working mode description

Working Mode	Description
Standby	The SUN2000 enters the standby mode when the external environment does not meet the requirements for starting the SUN2000. In standby mode: • The SUN2000 continuously performs self-check and enters the operating mode once the operating requirements are met. • If the SUN2000 enters the shutdown mode after detecting a shutdown command or a fault after startup.
Operating	In operating mode: • The SUN2000 converts DC power from PV strings into AC power and feeds the power to the power grid. • The SUN2000 tracks the maximum power point to maximize the PV string output. • The SUN2000 enters the shutdown mode after detecting a fault or a shutdown command, and enters the standby mode after detecting that the PV string output power does not meet the requirements for grid-tied electricity generation.

Working Mode	Description
Shutdown	• In standby or operating mode, the SUN2000 enters the shutdown mode after detecting a fault or shutdown command. • In shutdown mode, the SUN2000 enters the standby mode after detecting a startup command or that a fault is rectified.

3 Inverter Storage

The following requirements should be met if the SUN2000 is not put into use directly:

- Do not unpack the inverter.
- Keep the storage temperature at –40 ℃ to +70 ℃.
- The inverter should be stored in a clean and dry place and be protected from dust and water vapor corrosion.
- A maximum of five inverters can be stacked.
- Periodic inspections are required during the storage. If any rodent bites are found, replace the packing materials immediately.
- If the inverter has been long-term stored, inspections and tests should be conducted by qualified personnel before it is put into use.

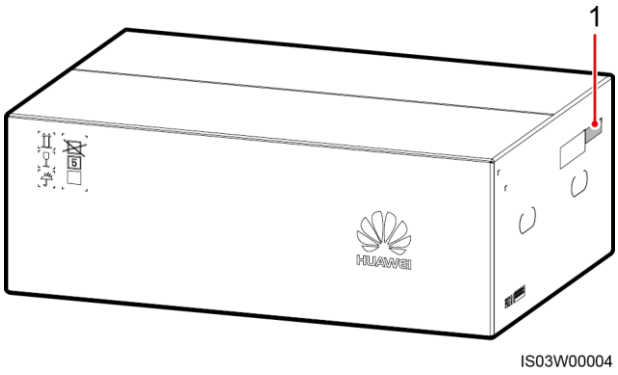
4 Installation

4.1 Checking Before Installation

Outer Packing Materials

Before unpacking the inverter, check the outer packing materials for damage, such as holes and cracks, and check the inverter model. If any damage is found or the inverter model is not what you require, do not unpack the package but contact the dealer as soon as possible.

Figure 4-1 Position of the inverter model label



(1) Position of the model label

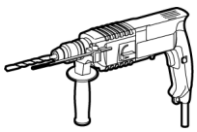
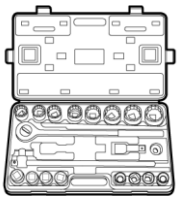
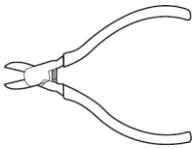
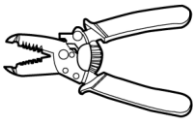
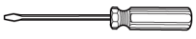
NOTE
You are advised to remove the packing materials within 24 hours before installing the inverter.

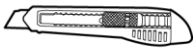
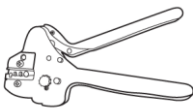
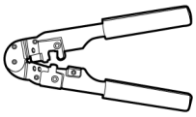
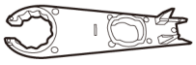
Deliverables

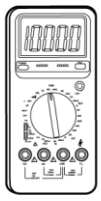
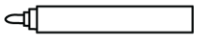
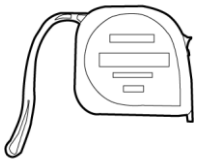
After unpacking the inverter, check that the deliverables are intact and complete. If any damage is found or any component is missing, contact the dealer.

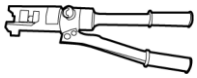
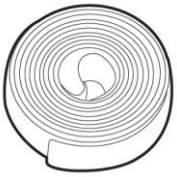
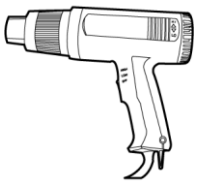
NOTE
For details about the number of deliverables, see the *Packing List* in the packing case.

4.2 Tools

Name	Model	Purpose
Hammer drill 	Drill bit: Φ14 mm and Φ16 mm	• Φ14 mm drill bit: Drills holes in supports. • Φ16 mm drill bit: Drills holes in walls.
Socket wrench 	Works with a torque wrench.	Secures bolts and AC output terminals.
Torque wrench 	Works with a socket wrench set.	Secures bolts and AC output terminals.
Diagonal pliers 	N/A	Cut cable ties.
Wire stripper 	N/A	Peels off cable jackets.
Flat-head screwdriver 	Head: 0.6 mm x 3.5 mm	Tightens screws.

Name	Model	Purpose
Rubber mallet 	N/A	Hammers expansion bolts into holes.
Utility knife 	N/A	Removes packaging.
Cable cutter 	N/A	Cuts cables.
Crimping tool 	H4TC0001 Manufacturer: AMPHENOL	Crimps metal terminals during DC input power cable preparation.
RJ45 crimping tool 	N/A	Prepares RJ45 connectors for communications cables.
Removal wrench 	H4TW0001 Manufacturer: AMPHENOL	Removes DC connectors from the SUN2000.

Name	Model	Purpose
Vacuum cleaner 	N/A	Cleans up dust after drilling holes.
Multimeter 	DC voltage measurement range ≥ 1500 V DC	Measures voltages.
Marker 	Diameter ≤ 10 mm	Marks signs.
Measuring tape 	N/A	Measures distances.
Level 	N/A	Levels hole positions.
Protective gloves 	N/A	Protect your hands during installation.

Name	Model	Purpose
Safety goggles 	N/A	Protect your eyes during hole drilling.
Anti-dust mask 	N/A	Protects you from dust inhalation during hole drilling.
Hydraulic pliers 	N/A	Crimp OT terminals.
Heat shrink tubing 	N/A	Wraps the cable crimping area of an OT terminal.
Heat gun 	N/A	Heat-shrinks a tube.
Cable tie 	N/A	Binds cables.

4.3 Determining the Installation Position

Basic Requirements

- The SUN2000 is protected to IP65 and can be installed indoors or outdoors.
- Do not install the SUN2000 in a place where personnel are easy to come into contact with its chassis and heat sinks, because these parts are extremely hot during operation.
- Do not install the SUN2000 in areas with flammable or explosive materials.

Installation Environment Requirements

The SUN2000 must be installed in a well ventilated environment to ensure good heat dissipation. When installed under direct sunlight, performance de-rate may be initiated due to additional temperature rise.

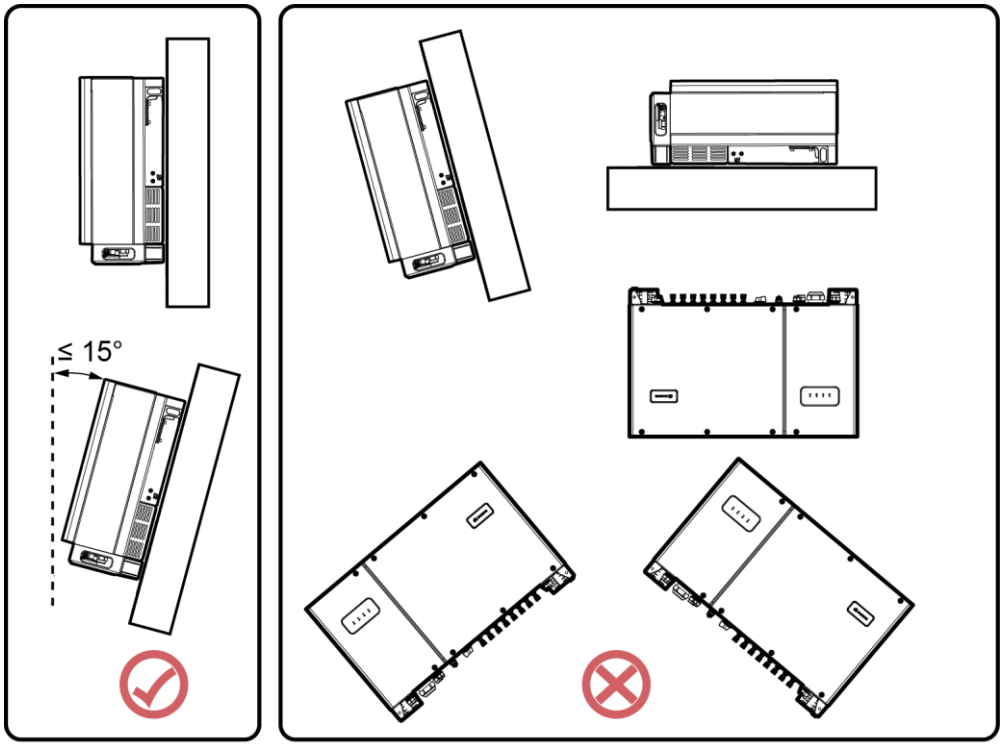
Carrier Requirements

- The carrier where the SUN2000 is installed must be fireproof.
- Do not install the SUN2000 on flammable building materials.
- The SUN2000 weighs 60 kg. Ensure that installation surface is solid enough to bear the SUN2000.
- In residential areas, do not install the SUN2000 on gypsum boards or walls made of similar materials which have a weak sound insulation performance because the noises generated by the SUN2000 will disturb residents.

Installation Angle Requirements

- Install the SUN2000 vertically or at a maximum back tilt of 15 degrees to facilitate heat dissipation.
- Do not install the SUN2000 at a front tilt, excessive back tilt, side tilt, horizontally, or upside down.

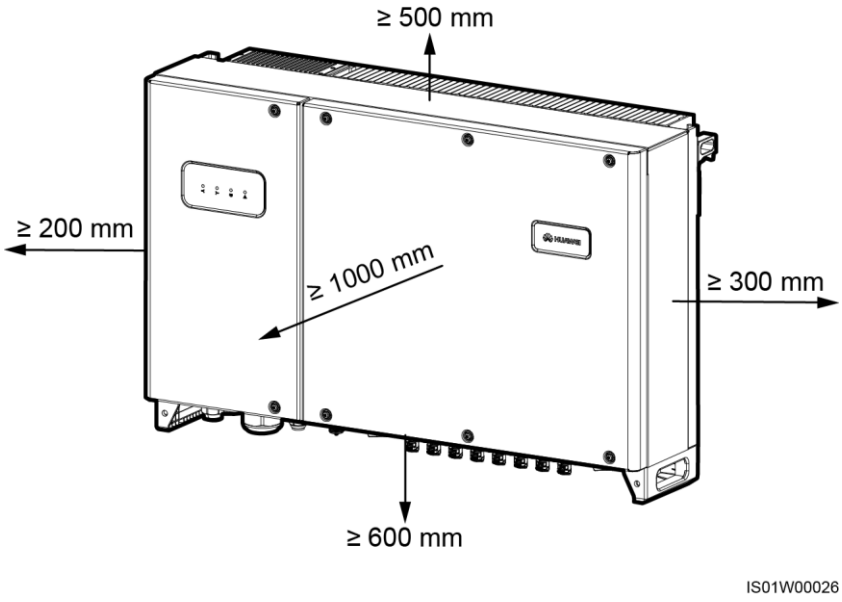
Figure 4-2 Installation angle



Installation Space Requirements

- The SUN2000 dimensions (W x H x D) are 930 mm x 600 mm x 270 mm. Reserve enough clearance around the SUN2000 to facilitate installation and heat dissipation.

Figure 4-3 Installation space requirements



NOTE

For ease of installing the SUN2000 on the mounting bracket, connecting cables to the bottom of the SUN2000, and maintaining the SUN2000 in future, it is recommended that the bottom clearance be between 600 mm and 730 mm. If you have any questions about the clearance, consult the local technical support engineers.

- When installing multiple SUN2000s, install them in horizontal mode if sufficient space is available and install them in triangle mode if no sufficient space is available. Stacked installation is not recommended.

Figure 4-4 Horizontal installation mode (recommended)

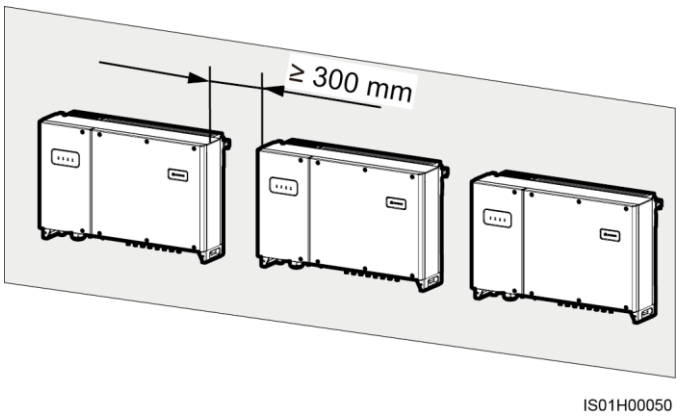


Figure 4-5 Triangle installation mode (recommended)

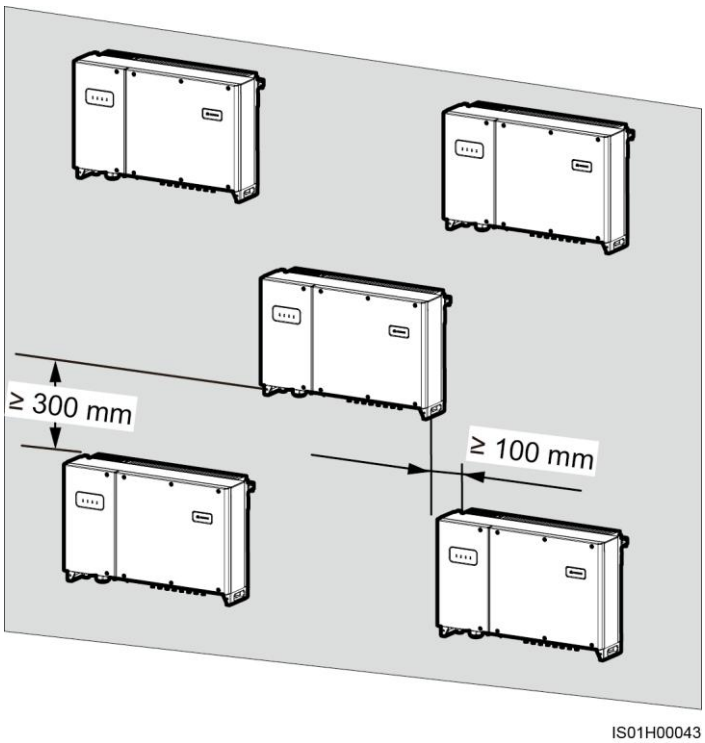
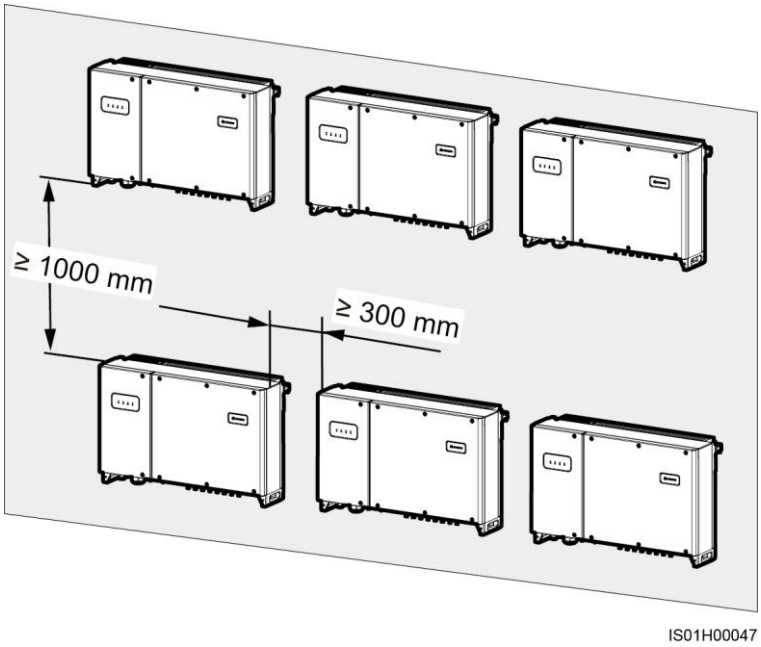


Figure 4-6 Stacked installation mode (not recommended)

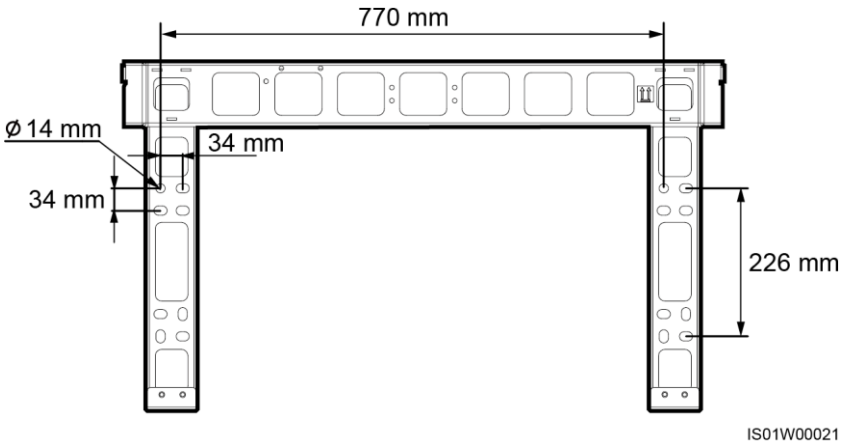


4.4 Installing the Mounting Bracket

Context

Figure 4-7 shows the SUN2000 mounting bracket dimensions.

Figure 4-7 Mounting bracket dimensions

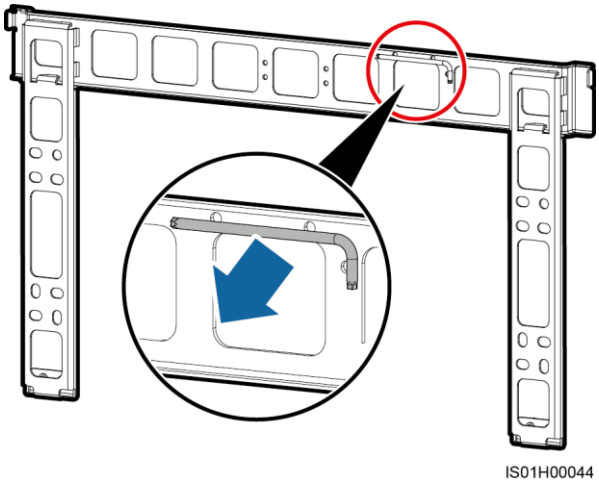


NOTE

The SUN2000 mounting bracket has four groups of tapped holes, each group containing four tapped holes. Mark any hole in each group based on site requirements and mark four holes in total. Two round holes are preferred.

Before installing the mounting bracket, remove the security torx wrench from the mounting bracket and set it aside.

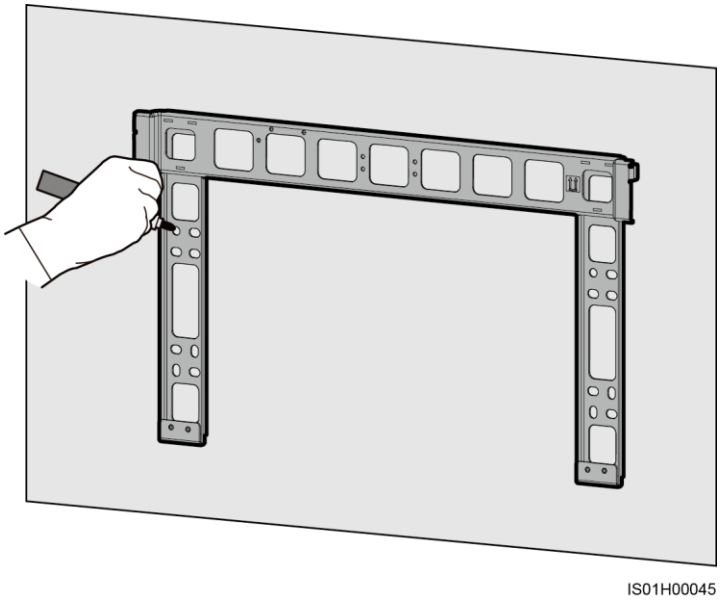
Figure 4-8 Removing a security torx wrench



Wall-mounted Installation

Step 1 Determine the positions for drilling holes using the mounting bracket. Level the hole positions using a level, and mark the hole positions using a marker.

Figure 4-9 Determining hole positions

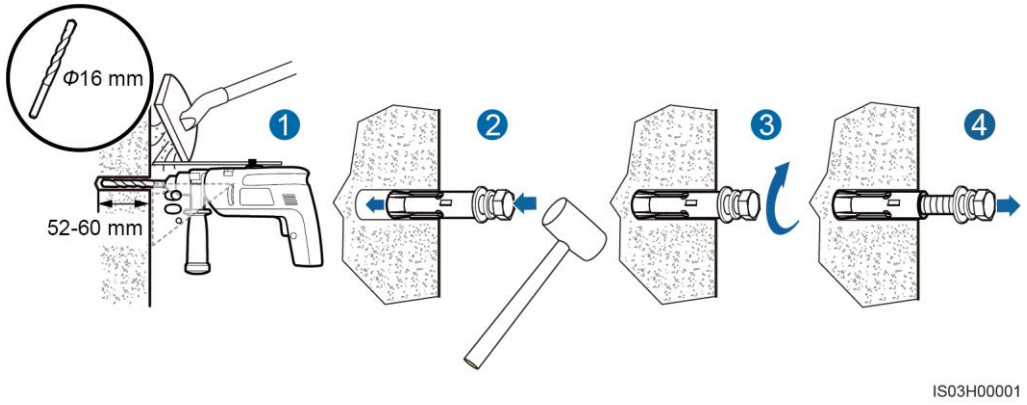


Step 2 Drill holes using a hammer drill and install expansion bolts.

NOTE

You need to prepare expansion bolts. M12x60 stainless steel expansion bolts are recommended.

Figure 4-10 Drilling a hole and installing an expansion bolt



WARNING

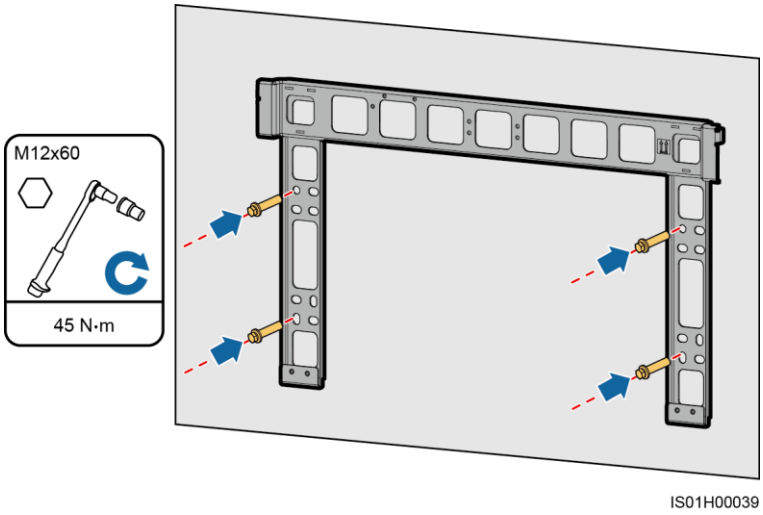
Avoid drilling holes in the water pipes and power cables buried in the wall.

NOTICE

- To prevent dust inhalation or contact with eyes, wear safety goggles and an anti-dust mask when drilling holes.
- Clean up any dust in and around the holes using a vacuum cleaner and measure the hole distance. If the holes are inaccurately positioned, drill holes again.
- Level the head of the expansion sleeve with the concrete wall after removing the bolt, spring washer, and flat washer. Otherwise, the mounting bracket will not be securely installed on the concrete wall.

Step 3 Align the mounting plate holes with the drilled holes, insert expansion bolts into the holes through the mounting plate, and then tighten the expansion bolts.

Figure 4-11 Securing a mounting bracket

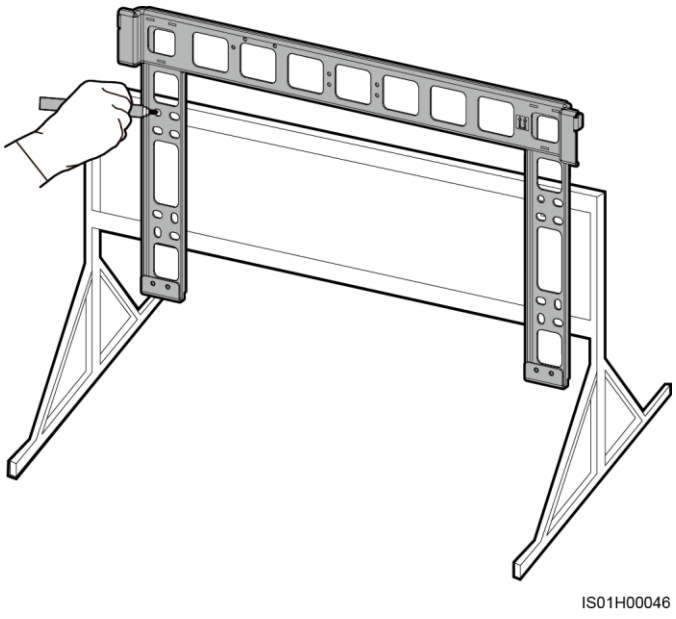


----End

Support-mounted Installation

Step 1 Determine the positions for drilling holes using the mounting bracket. Level the hole positions using a level, and mark the hole positions using a marker.

Figure 4-12 Determining hole positions

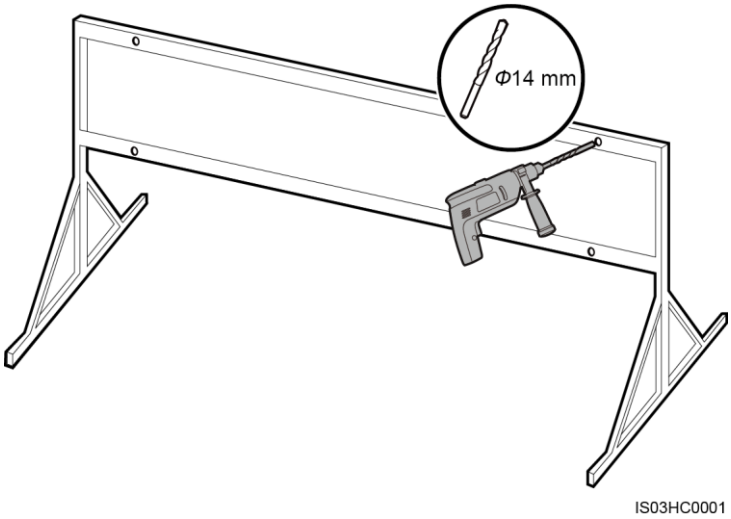


Step 2 Drill holes using a hammer drill.

NOTE

You are advised to apply anti-rust paint on the hole positions for protection.

Figure 4-13 Drilling holes

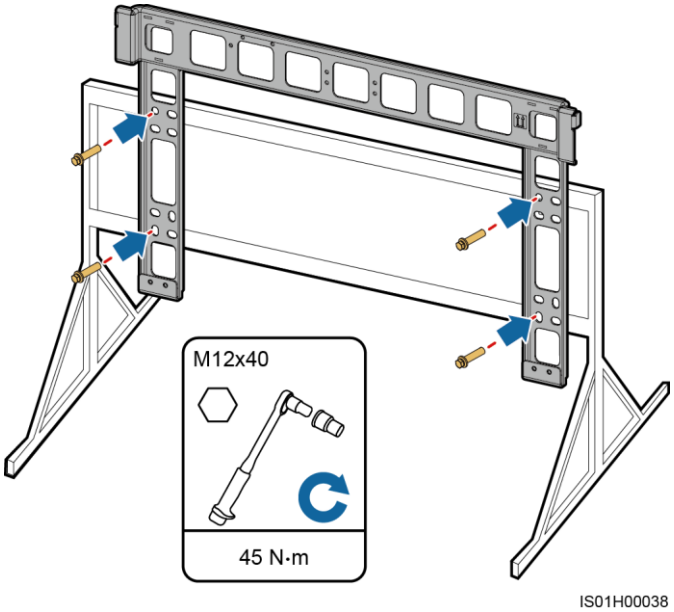


Step 3 Align the mounting plate holes with the drilled holes, insert bolt assemblies (flat washers, spring washers, and M12x40 bolts) into the holes through the mounting plate, and secure them using the shipped stainless steel nuts and flat washers.

NOTE

The SUN2000 is delivered with M12x40 bolt assemblies. If the bolt length does not meet the installation requirements, prepare M12 bolt assemblies by yourself and use them together with the delivered M12 nuts.

Figure 4-14 Securing a mounting bracket



----End

4.5 Installing the SUN2000

Prerequisites

Before installing the SUN2000, take it out from the packing case and move it to the installation position.

NOTICE

- To prevent device damage and personal injury, keep balance when moving the SUN2000 because it is heavy.
- Move the SUN2000 with the help of other three persons or using an appropriate transportation tool.
- Do not place the SUN2000 with its wiring terminals at the bottom contacting the floor or any other object because the terminals are not designed to support the weight of the SUN2000.
- When placing the SUN2000 on the floor, put foam or paper under the SUN2000 to protect its cover.

Procedure

Step 1 If the installation position is low and you can mount the SUN2000 onto the mounting bracket, go to Step 3 and then Step 5.

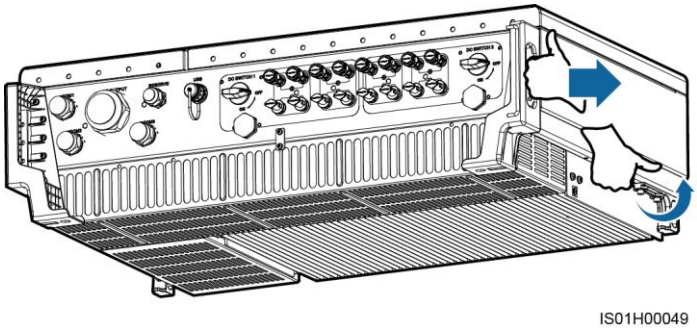
Step 2 If the installation position is high and you cannot mount the SUN2000 onto the mounting bracket, go to Step 3 and then Step 6.

Step 3 Ensure that two people lift the SUN2000 and turn it upright. Lift the SUN2000 by grasping the handle at the bottom of the SUN2000 with one hand and the handle at the top with the other.

CAUTION

To prevent device damage and personal injury, keep balance when lifting the SUN2000 because it is heavy.

Figure 4-15 Lifting a SUN2000

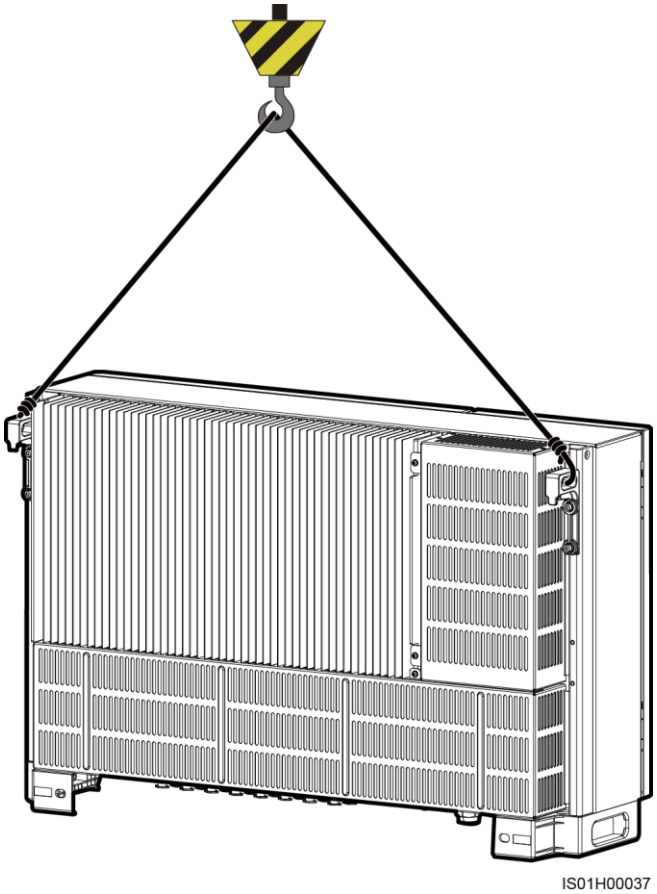


Step 4 Run a rope that is strong enough to bear the SUN2000 through the lifting eyes and hoist the SUN2000.

NOTICE

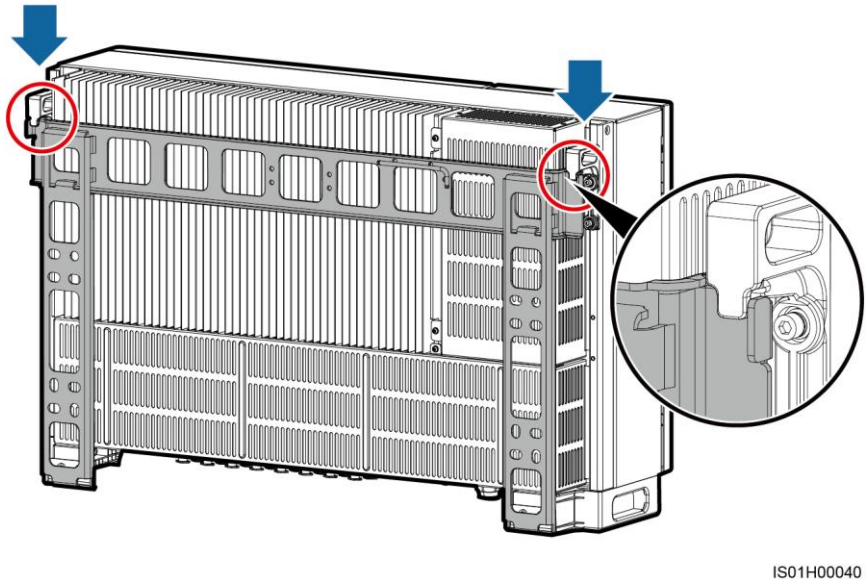
When hoisting the SUN2000, keep balance to protect the SUN2000 from colliding with the wall or other objects.

Figure 4-16 Hoisting a SUN2000



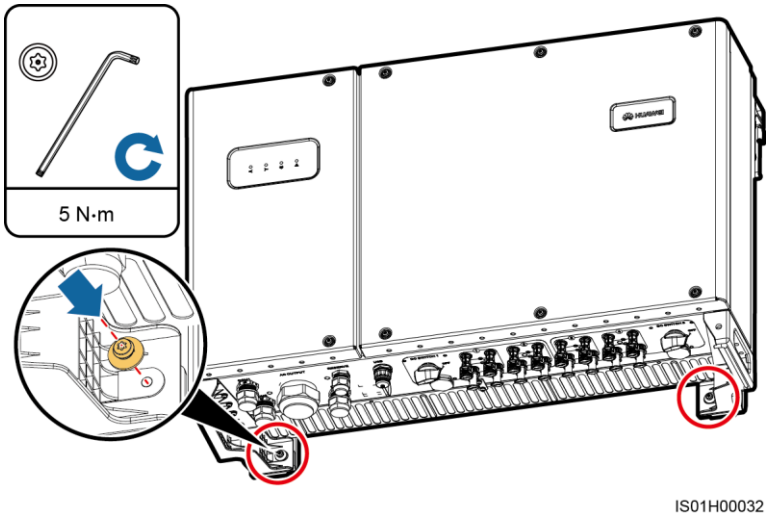
Step 5 Install the SUN2000 on the mounting bracket and level the SUN2000 chassis with the mounting bracket.

Figure 4-17 Mounting the SUN2000 onto a mounting bracket



Step 6 Tighten the two antitheft screws using a security torx wrench.

Figure 4-18 Tightening antitheft screws



----End

5 Electrical Connections

5.1 Precautions

DANGER

Before connecting cables, ensure that the two DC switches on the SUN2000 are OFF. Otherwise, the high voltage of the SUN2000 may result in electric shocks.

WARNING

- The equipment damage caused by incorrect cable connections is beyond the warranty scope.
- Only qualified technicians can perform operations about electrical connection.
- Before connecting cables, operators must take protective measures, such as wearing insulation shoes and protective gloves.

NOTE

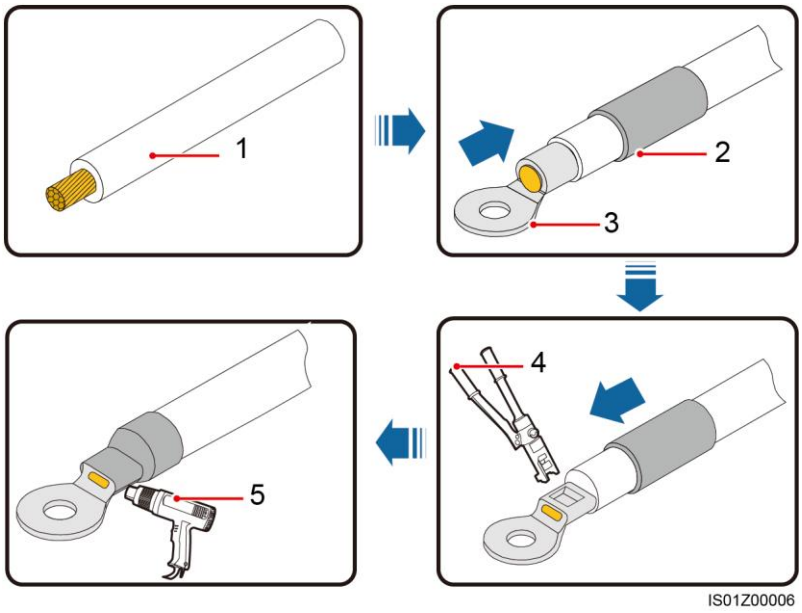
The cable colors shown in the electrical connection diagrams provided in this chapter are for reference only. Select cables in accordance with local cable specifications (green-and-yellow cables are only used for grounding).

5.2 Preparing an OT Terminal

NOTICE

- Pay attention to not scratch the core wire when stripping a cable.
- The cavity formed after the conductor crimp strip of the OT terminal is crimped must wrap the core wires completely. The core wires must contact the OT terminal closely.
- Wrap the wire crimping area with heat shrink tubing or PVC insulation tape. The following figure uses heat shrink tubing as an example.
- When using the heat gun, protect devices from being scorched.

Figure 5-1 Preparing an OT terminal



(1) Cable (2) Heat shrink tubing (3) OT terminal (4) Hydraulic pliers (5) Heat gun

5.3 Opening the Maintenance Compartment Door

Prerequisites

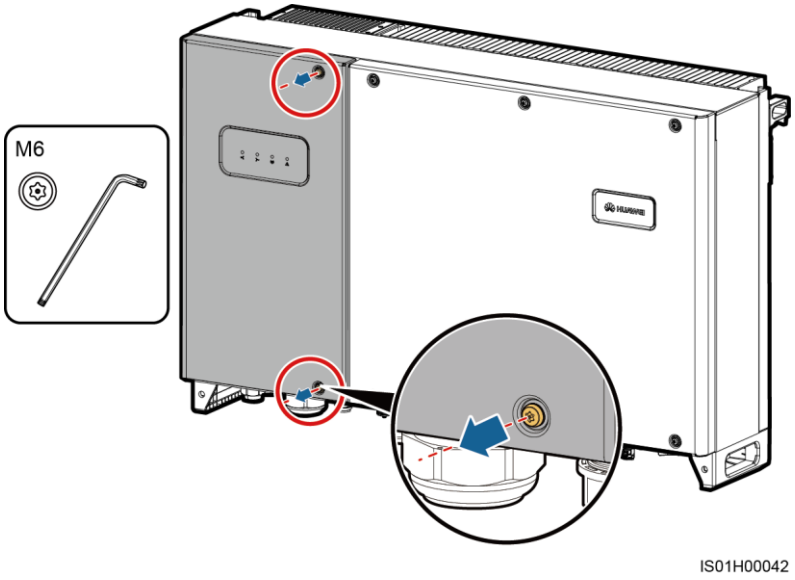
CAUTION

- Never open the host panel of the SUN2000.
- Before opening the maintenance compartment door, disconnect the AC and DC power supplies. For processes of disconnecting the power supplies, see 6.4 Powering Off the SUN2000. After powering off the SUN2000, wait at least 5 minutes and then perform operations on the SUN2000.
- If you need to open the maintenance compartment door on rainy or snowy days, take protective measures to prevent rain or snow entering the maintenance compartment. If it is impossible to take protective measures, do not open the maintenance compartment door in rainy or snowy days.
- Do not leave unused screws in the maintenance compartment.

Procedure

Step 1 Partially loosen the two screws on the maintenance compartment door.

Figure 5-2 Loosening screws



NOTE

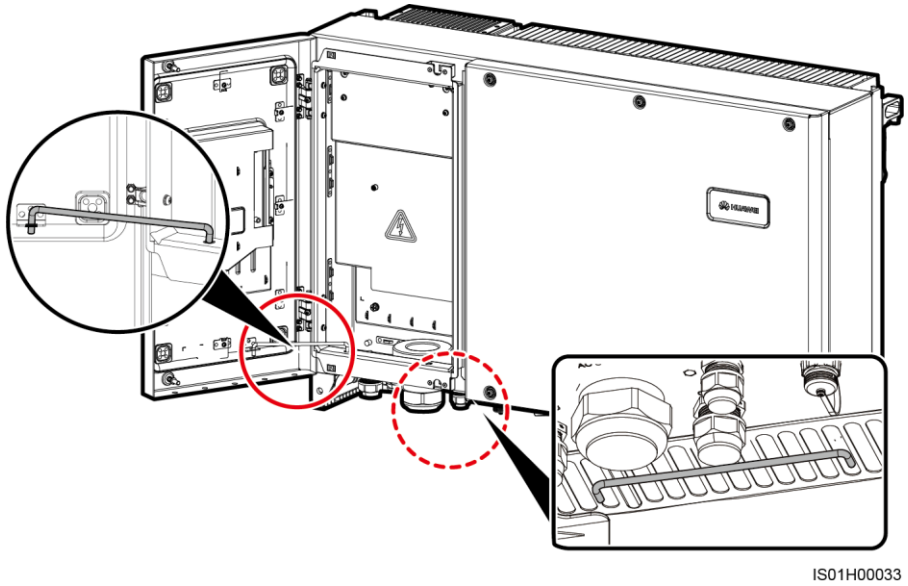
If the screws on the chassis door are lost, obtain spare screws from the fitting bag bound to the inductor cover at the bottom of the chassis.

Step 2 Open the maintenance compartment door and install a support bar.

NOTE

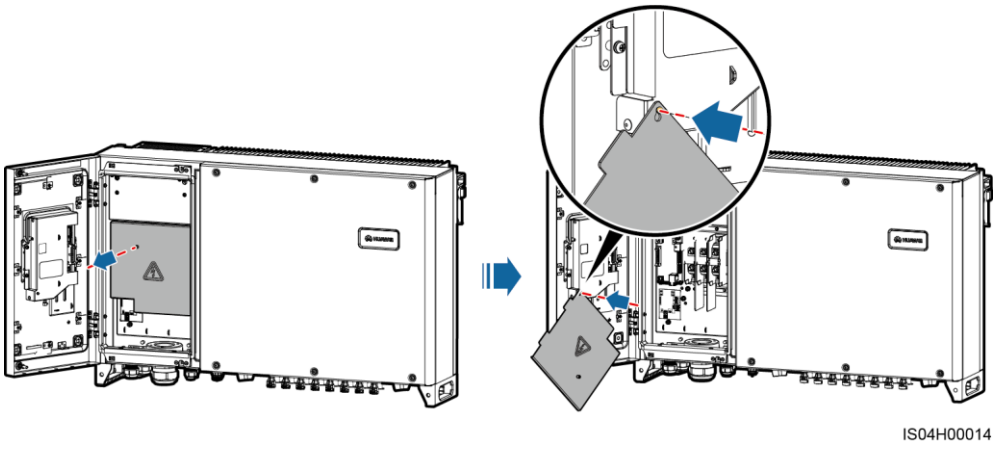
The support bar is bound to the inductor cover at the chassis base.

Figure 5-3 Installing a support bar



Step 3 Remove the cover and hang it on the hook of the chassis door.

Figure 5-4 Removing a cover



----End

5.4 Connecting the Ground Cable

Prerequisites

The ground cable and OT terminal are available.

- Recommended ground cable: an outdoor copper-core cable with a cross-sectional area of 16 mm^2 or more
- OT terminal: M6

Context

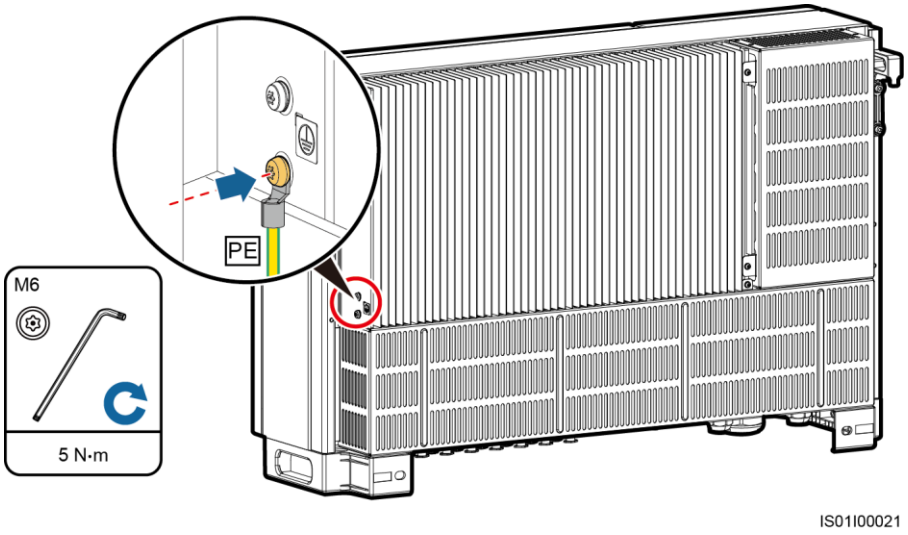
- Both the shell and maintenance compartment of the SUN2000 provide a ground point. Select either for connecting the ground cable. For details about how to connect a ground cable to the ground point in the maintenance compartment, see 5.5 Connecting AC Output Power Cables.
- There are two ground points on the chassis shell and you only need to use either of them.
- It is recommended that the ground cable be connected to a nearby ground point. For a system with multiple SUN2000s connected in parallel, connect the ground points of all SUN2000s to ensure equipotential connections to ground cables.

Procedure

Step 1 Prepare an OT terminal by following the instructions in 5.2 Preparing an OT Terminal.

Step 2 Secure the ground cable using the ground screw.

Figure 5-5 Connecting a ground cable



----End

5.5 Connecting AC Output Power Cables

Prerequisites

A three-phase AC switch must be installed on the AC side of the SUN2000 to ensure that the SUN2000 can be safely disconnected from the power grid.

WARNING

Do not connect loads between the SUN2000 and the AC switch.

The SUN2000 is integrated with a comprehensive residual current detection unit to distinguish fault current from residual current. Upon detecting that the residual current exceeds the threshold, the SUN2000 immediately disconnects from the power grid.

NOTE
If an AC switch that can detect residual current is installed outside the SUN2000, the residual current value that will trigger the switch trip should be greater than 600 mA.

Context

- If you connect a ground cable to the ground point on the chassis shell, you are advised to use a three-core (L1, L2, and L3) outdoor cable.
- If you connect a ground cable to the ground point in the maintenance compartment, you are advised to use a four-core (L1, L2, L3, and PE) outdoor cable.
- You need to prepare M8 OT terminals by yourself.

Table 5-1 Cable specifications

Cable Specifications		Copper-Core Cable	Copper-Clad Aluminum Cable or Aluminum Alloy Cable
Conductor cross-sectional area (mm^2)	Value range	16–70	25–70
	Recommended value	25	35
Cable outer diameter (mm)	Value range	37–44	
	Recommended value	40	

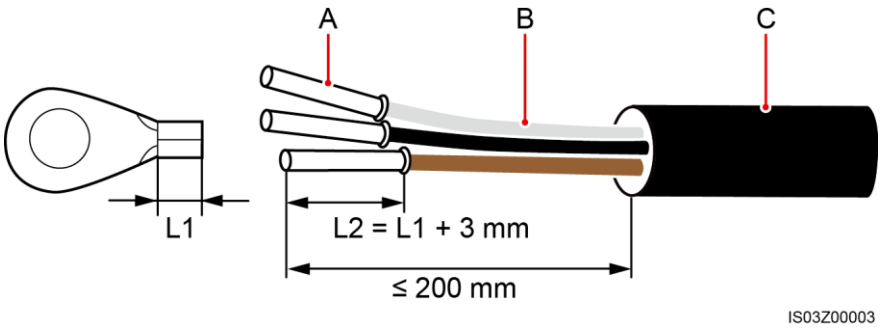
NOTE
If you connect a ground cable to the ground point in the maintenance compartment, prepare an M6 OT terminal by yourself.

Procedure

Step 1 Remove an appropriate length of the jacket and insulation layer from the AC output power cable using a wire stripper.

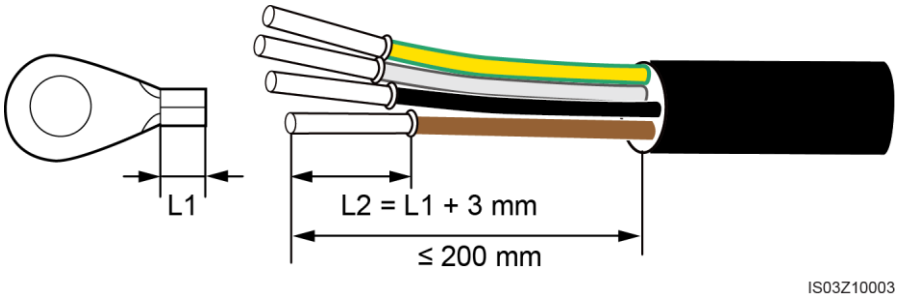
NOTICE
Ensure that the jacket is in the maintenance compartment.

Figure 5-6 Three-core cable



(A) Core wire (B) Insulation layer (C) Jacket

Figure 5-7 Four-core cable



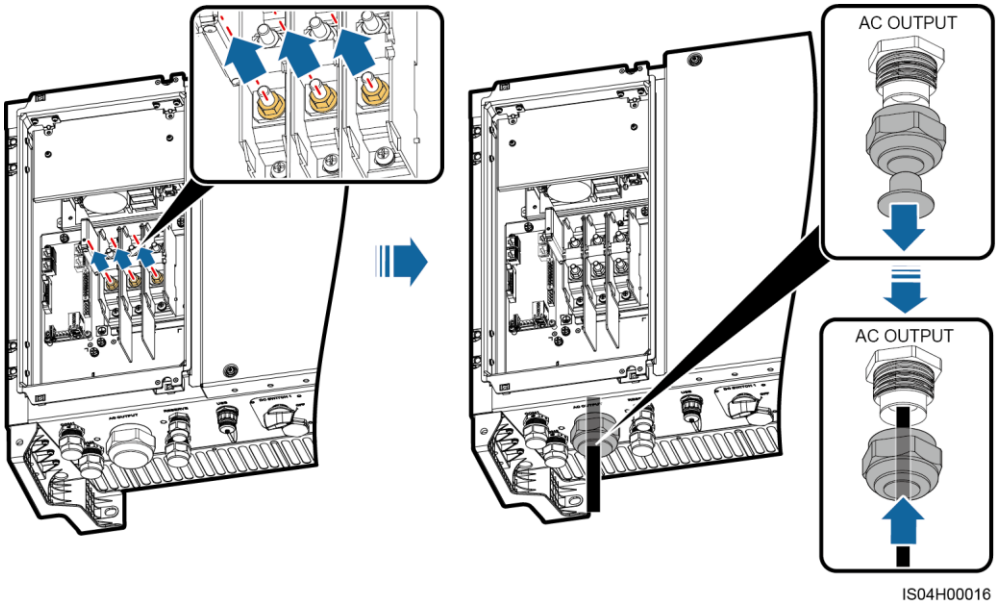
Step 2 Prepare an OT terminal by following the instructions in 5.2 Preparing an OT Terminal.

Step 3 Route the cable through the waterproof connector.

NOTE

For ease of connecting the AC output power cable, you are advised to remove the nut assembly from the AC terminal and set it aside, and then route the cable through the waterproof connector.

Figure 5-8 Routing cables



Step 4 Connect the AC output power cable.

Figure 5-9 Connecting an AC output power cable (three-core cable)

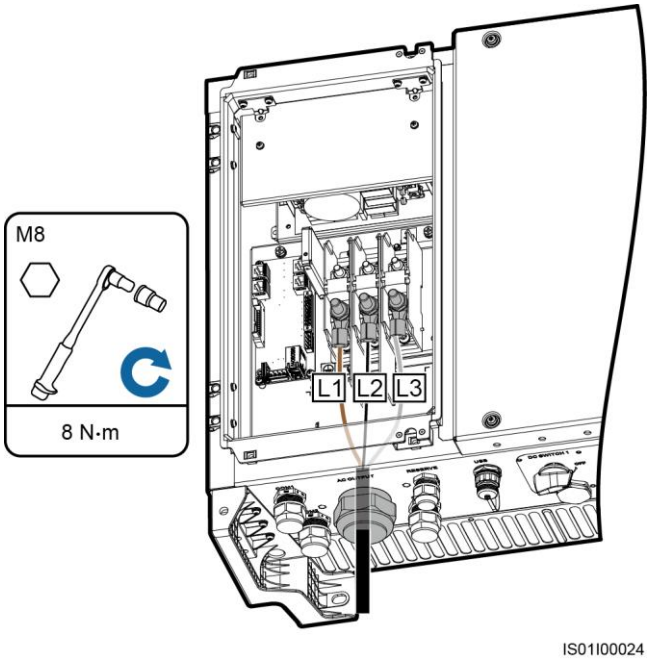
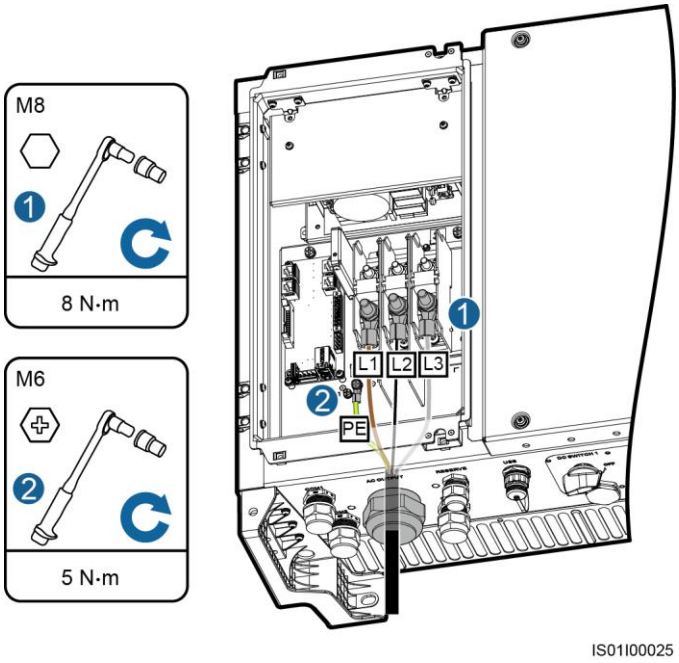


Figure 5-10 Connecting an AC output power cable (four-core cable)



NOTICE

Verify that the AC output power cable is connected securely. Otherwise, the SUN2000 may fail to operate or experience any fault that will cause damage to the terminal block. For example, the SUN2000 may generate heat during operating due to unreliable connection. The caused equipment damage is beyond the warranty scope.

NOTE

The cable colors shown in figures are for reference only. Select an appropriate cable according to the local standards.

----End

Follow-up Procedure

The caused equipment damage is beyond the warranty scope. Check that the cables are connected correctly and securely, and then seal the waterproof connectors with firestop putty.

5.6 Connecting DC Input Power Cables

Prerequisites

DANGER

- Before connecting DC input power cables, ensure that the DC voltage is within the safe range (lower than 60 V DC) and that the two DC switches on the SUN2000 are OFF. Otherwise, the high voltage may result in electric shocks.
- When the SUN2000 is grid-tied, it is not allowed to maintain DC input power cables, such as connecting or disconnecting a PV string or a PV module in a PV string. Otherwise, electric shocks or arcing (which may further cause fire) may occur.

WARNING

Ensure that the following conditions are met. Otherwise, the SUN2000 will be damaged, or even a fire disaster will be caused.

- The open-circuit voltage of each PV string is always lower than or equal to 1500 V DC.
- The positive and negative terminals of a PV string connect to the positive and negative DC input terminals of the SUN2000 respectively.

NOTICE

- Ensure that the PV string is well insulated to the ground.
- The PV strings connecting to the same MPPT circuit should be composed of the PV modules of the same model and quantity.
- During the installation of PV strings and SUN2000, the positive or negative terminals of PV strings may be short-circuited to the ground if power cables are not properly installed or routed. In this case, an AC or DC short circuit may occur and damage the SUN2000. The caused equipment damage is beyond the warranty scope.

Context

- DC terminal selection

  Figure 5-11 shows the DC terminals at the bottom of the SUN2000. Table 5-2 describes the requirements for DC terminal selection.

NOTE

The SUN2000 provides two DC switches, namely, DC SWITCH 1 and DC SWITCH 2. DC SWITCH 1 controls the first to the fourth routes of DC input terminals, while DC SWITCH 2 controls the fifth to the eighth routes of DC input terminals.

Figure 5-11 DC terminals

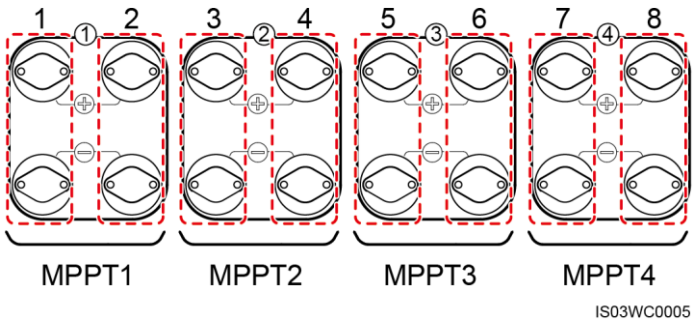


Table 5-2 DC terminal selection requirements

Number of Inputs	SUN2000
1	Connects to route 1.
2	Connects to routes 1 and 5.
3	Connects to routes 1, 3, and 5.
4	Connects to routes 1, 3, 5, and 7.
5	Connects to routes 1, 2, 3, 5, and 7.
6	Connects to routes 1, 2, 3, 5, 6, and 7.
7	Connects to routes 1, 2, 3, 4, 5, 6, and 7.
8	Connects to routes 1, 2, 3, 4, 5, 6, 7, and 8.

- DC input power cable specifications

  Table 5-3 lists the recommended DC input power cable specifications.

Table 5-3 Recommended DC input power cable specifications

Cable Type	Conductor Cross-Sectional Area (mm^2)		Cable Outer Diameter (mm)
	Range	Recommended Value	
PV cable that meets the 1500 V standard	4.0–6.0 (or 12–10 AWG)	4.0 (or 12 AWG)	4.5–7.8

NOTICE

Rigid cables, such as armored cables, are not recommended, because poor contact may be caused by the bending of the cables.

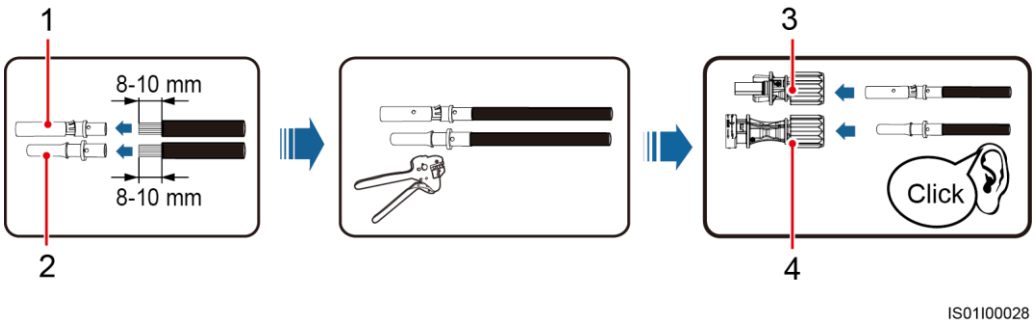
Procedure

Step 1 Prepare the positive and negative connectors, and tighten the locking nuts on the connectors.

CAUTION

Use the Amphenol UTX DC input terminals delivered with the SUN2000. If the terminals are lost or damaged, purchase the DC input terminals of the same model. Other models of DC input terminals may be incompatible with the SUN2000, which may cause serious consequences. The caused equipment damage is beyond the warranty scope.

Figure 5-12 Preparing positive and negative connectors



(1) Positive metal terminal (2) Negative metal terminal (3) Positive connector (4) Negative connector

NOTICE

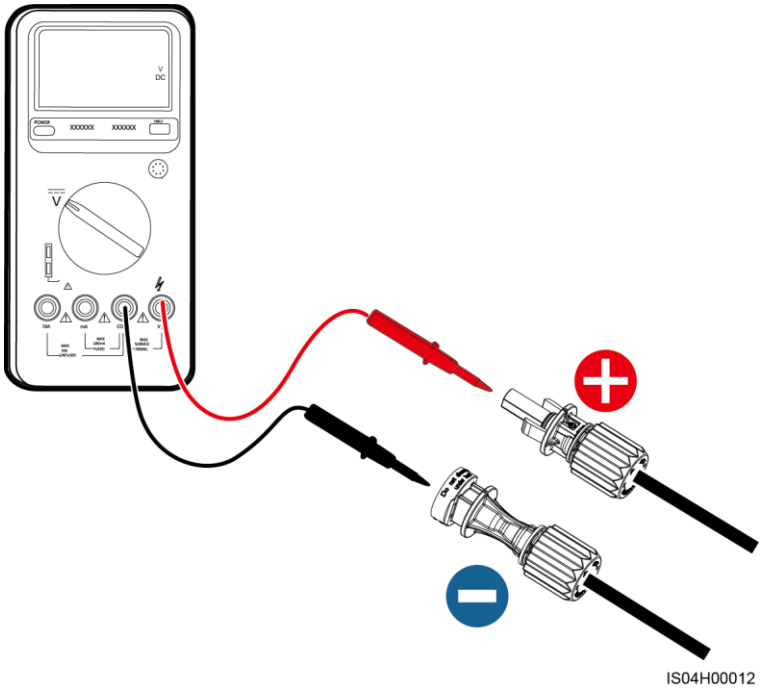
After the positive and negative metal terminals snap into place, pull the DC input power cables back to ensure that they are connected securely.

Step 2 Use a multimeter to measure the DC voltage between the positive polarity and negative polarity of the PV string.

NOTICE

The DC voltage measurement range of the multimeter must be at least 1500 V.

Figure 5-13 Measuring voltage



NOTICE

- If the voltage is a negative value, the PV string is reversely connected. Correct the polarity.
- If the voltage is greater than 1500 V, too many PV strings are configured. Remove some PV modules.

Step 3 Pull out the blue dustproof plugs from the ends of the DC input connectors.

WARNING

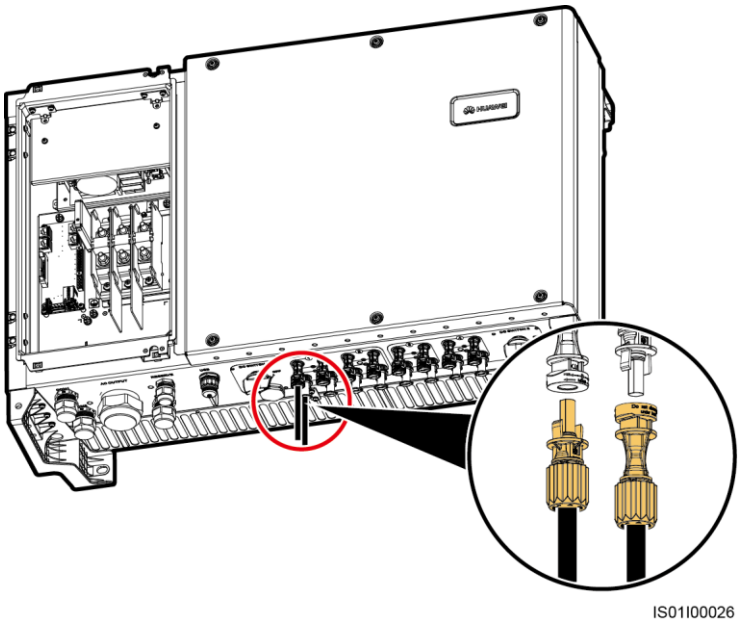
Before performing Step 4, ensure that the two DC switches are OFF.

Step 4 Insert the positive and negative connectors into the corresponding positive and negative DC input terminals of the SUN2000 until they snap into place.

NOTICE

1. After the positive and negative connectors snap into place, pull the DC input power cables back to ensure that they are connected securely.
2. Only after at least one PV string correctly connects to the MPPT1 circuit, can the SUN2000 enables the DC input detection function. Therefore, you are advised to connect DC input power cables to the MPPT1 circuit first.

Figure 5-14 Connecting DC input power cables



NOTICE

If the DC input power cable is reversely connected and the DC switch is ON, do not immediately turn off the DC switch or reconnect the positive and negative connectors. Otherwise, the device may be damaged. The caused equipment damage is beyond the warranty scope. Wait until the the solar irradiance declines at night and the PV string current reduces to below 0.5 A. Then, turn off the two DC switches, remove the positive and negative connectors, and rectify the connection of the DC input power cable.

----End

5.7 Connecting the Communications Cable

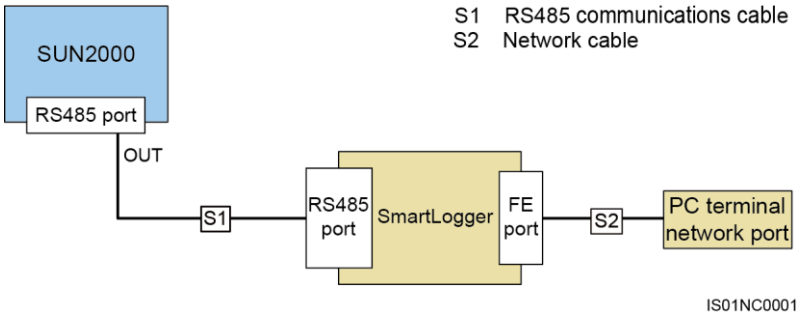
5.7.1 Communication Mode Description

RS485 Communication

The SUN2000 can connect to the SmartLogger over RS485 or to a PC through the SmartLogger to implement communication. You can use the SUN2000 APP, SmartLogger, embedded WebUI, or the network management software (such as the NetEco) on the PC to query information about the SUN2000, such as energy yield, alarms, and running status.

- Figure 5-15 shows the communication mode for a single SUN2000.

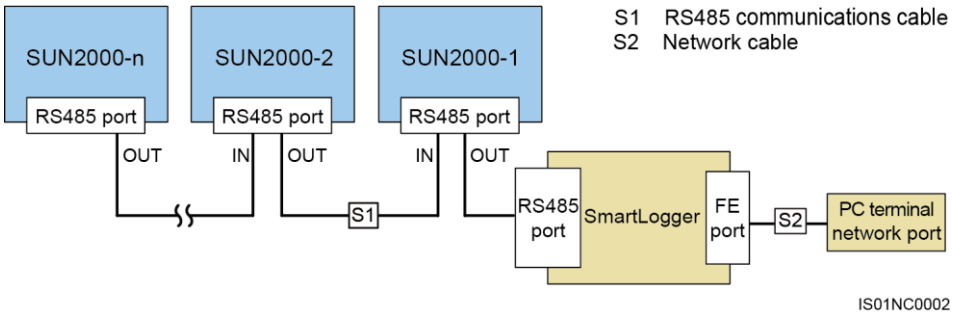
Figure 5-15 Communication mode for a single SUN2000



- Figure 5-16 shows the communication mode for multiple SUN2000s.

  If multiple SUN2000s are used, connect all the SUN2000s in daisy chain mode over an RS485 communications cable.

Figure 5-16 Communication mode for multiple SUN2000s



NOTE

- The RS485 communication distance between the SUN2000 at the end of the daisy chain and the SmartLogger cannot exceed 1000 meters.
- If multiple SUN2000s need to communicate with one another and are connected to a PC over the SmartLogger1000, a maximum of three daisy chains can be configured.
- If multiple SUN2000s need to communicate with one another and are connected to a PC over the SmartLogger2000, a maximum of six daisy chains can be configured.
- To ensure the system response speed, it is recommended that the number of devices on each daisy chain be less than 30.

PLC Communication

The PLC communication board loads communication signals onto power cables for transmission. For details about how to install the PLC, see the *PLC CCO01A User Manual* or *SmartLogger2000 User Manual*.

NOTE
The built-in PLC module in the SUN2000 does not need to be connected with cables.

Selecting a Communication Mode

The RS485 and PLC communication modes are mutually exclusive.

- If the PLC communication mode is selected, do not connect the RS485 communications cable. In addition, you need to set **PLC communication** to **Enable** on the SUN2000 APP.
- If the RS485 communication mode is selected, do not connect the PLC CCO module to the AC power cable. In addition, you are recommended to set **PLC communication** to **Disable** on the SUN2000 APP.

NOTE
PLC communication is set to **Enable** by default.

5.7.2 Connecting the RS485 Communications Cable

Description

An RS485 communications cable can be connected in two ways:

- Terminal block connection

  You are advised to use a DJYP2VP2-22 2x2x1 PC cable or a communications cable with a conductor cross-sectional area of 1 mm^2 and cable outer diameter of 14–18 mm.
- RJ45 network port connection

  You are advised to use a CAT 5E outdoor shielded network cable with an outer diameter less than 9 mm and internal resistance not greater than 1.5 ohms/10 m, with a shielded RJ45 connector.

NOTE
Select either connection mode during installation. Terminal block connection is preferred.

NOTICE
When laying out communications cables, separate them from power cables and avoid large signal interference sources to protect communication from being affected.

Terminal Block Pin Definitions

Figure 5-17 shows an RS485 terminal block.

Figure 5-17 Terminal block

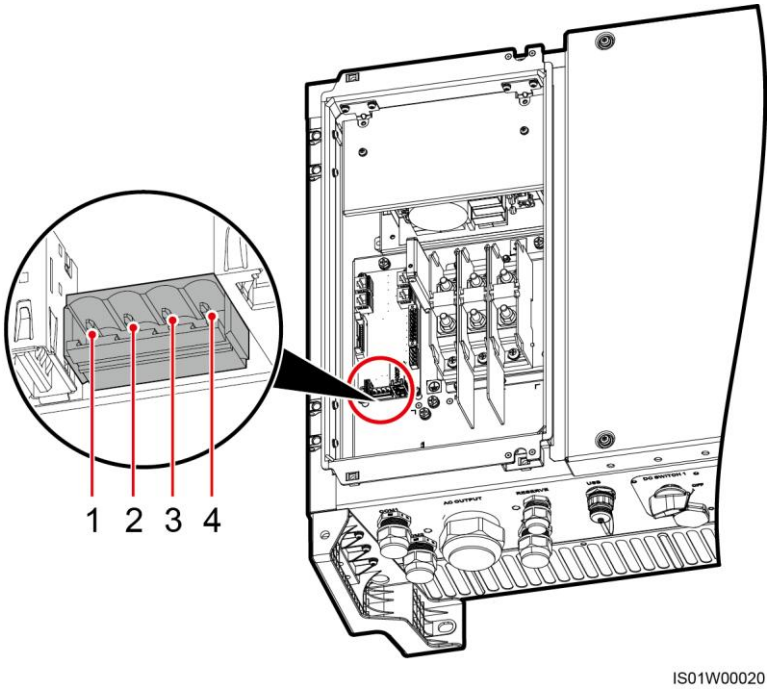


Table 5-4 describes pin definitions of the RS485 terminal block.

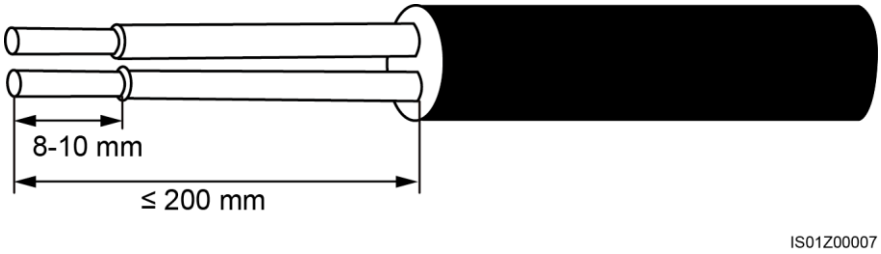
Table 5-4 Pin definitions of the RS485 terminal block

No.	Port Definition	Description
1	RS485A IN	RS485A, differential signal+
2	RS485A OUT	RS485A, differential signal+
3	RS485B IN	RS485B, differential signal–
4	RS485B OUT	RS485B, differential signal–

Connecting Cables to the Terminal Block

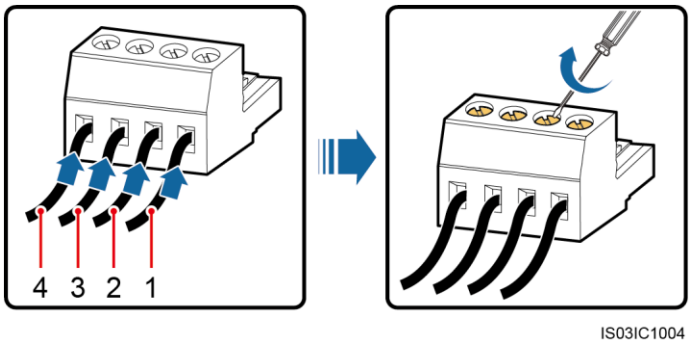
Step 1 Remove an appropriate length of the jacket and core wire insulation layer from the communications cable using a wire stripper.

Figure 5-18 Stripping an RS485 communications cable



Step 2 Remove the cable terminal base from the terminal block. Connect the communications cable to the terminal base.

Figure 5-19 Connecting cables to a terminal base

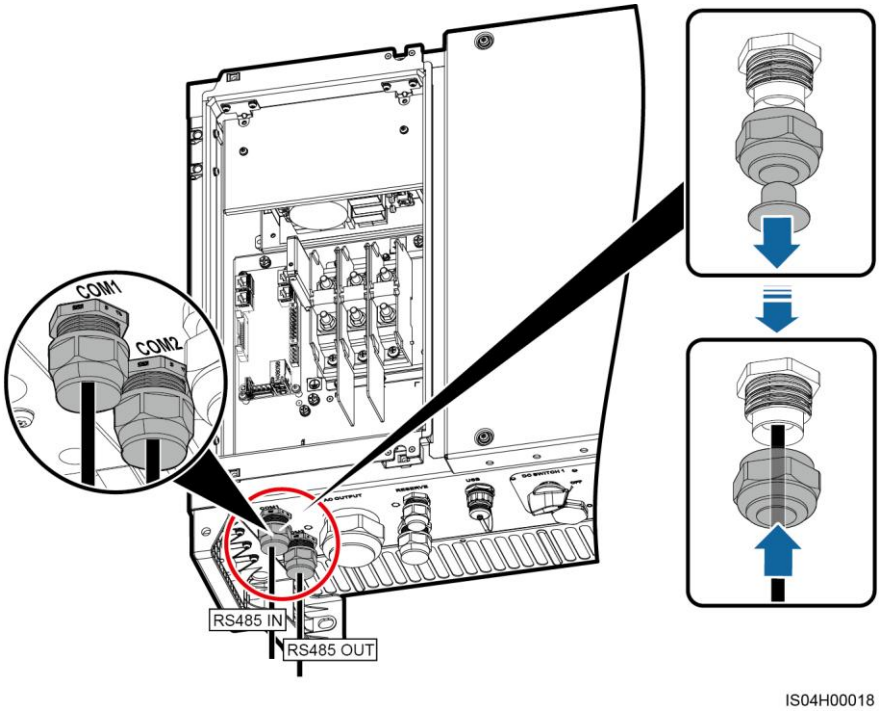


(1) RS485A IN (2) RS485A OUT

(3) RS485B IN (4) RS485B OUT

Step 3 Route the communications cable through the waterproof connector.

Figure 5-20 Routing cables

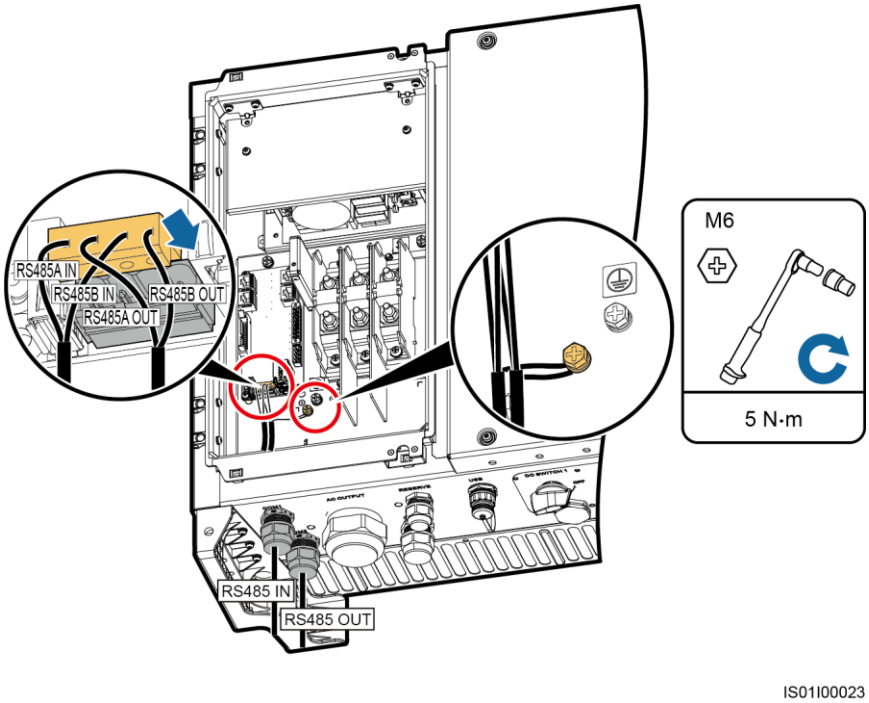


Step 4 Install the terminal base on the terminal block, and connect the shield layer to the ground point.

NOTE

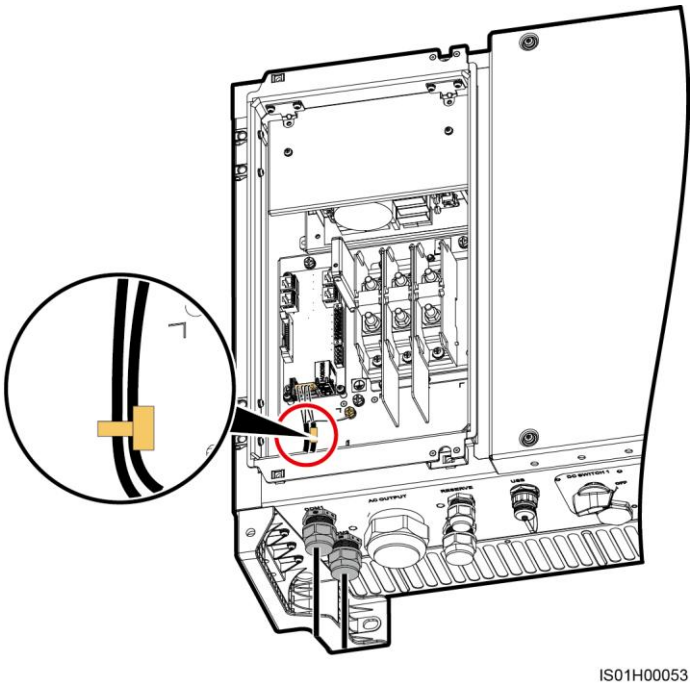
When connecting the shielded cable, crimp the OT terminal if required.

Figure 5-21 Connecting communications cables



Step 5 Bind communications cables after connecting them.

Figure 5-22 Binding communications cables



----End

RJ45 Connector Pin Definitions

Figure 5-23 shows an RJ45 connector.

Figure 5-23 RJ45 connector

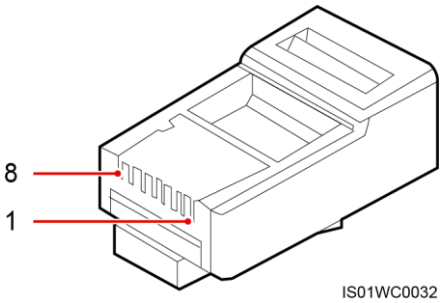


Table 5-5 lists the RJ45 connector pin definitions.

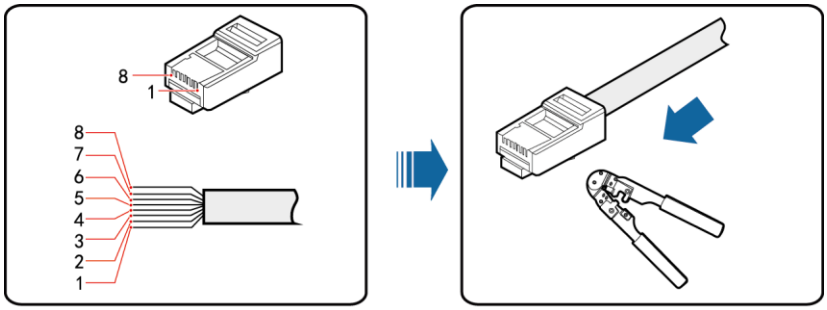
Table 5-5 RJ45 connector pin definitions

Pin	Color	Function
1	White-and-orange	RS485A, differential signal+
2	Orange	RS485B, differential signal–
3	White-and-green	N/A
4	Blue	RS485A, differential signal+
5	White-and-blue	RS485B, differential signal–
6	Green	N/A
7	White-and-brown	N/A
8	Brown	N/A

Connecting a Cable to the RJ45 Network Port

Step 1 Prepare an RJ45 connector.

Figure 5-24 Preparing an RJ45 connector

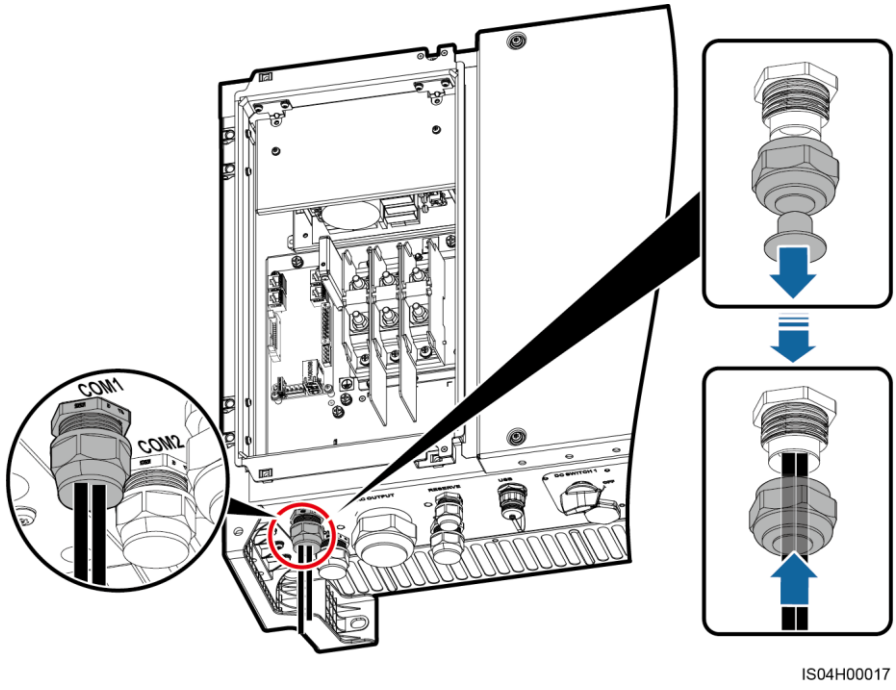


(1) White-and-orange (2) Orange (3) White-and-green (4) Blue

(5) White-and-blue (6) Green (7) White-and-brown (8) Brown

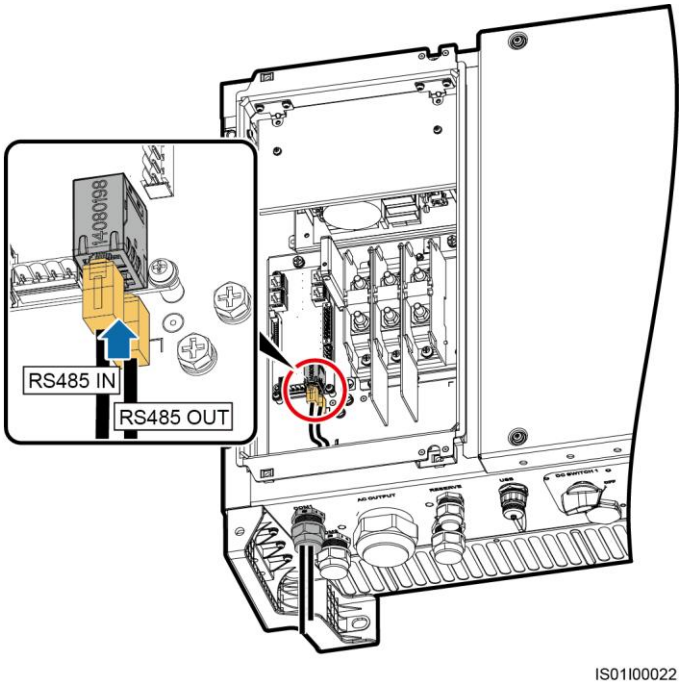
Step 2 Route the communications cable through the waterproof connector.

Figure 5-25 Routing cables



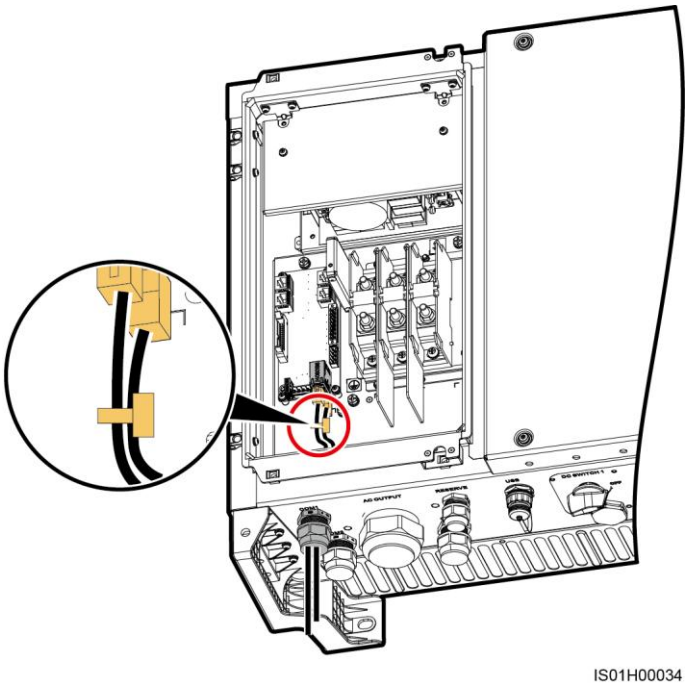
Step 3 Insert the RJ45 connector into the RJ45 network port in the SUN2000 maintenance compartment.

Figure 5-26 Connecting communications cables



Step 4 Bind communications cables after connecting them.

Figure 5-27 Binding communications cables



----End

Follow-up Procedure

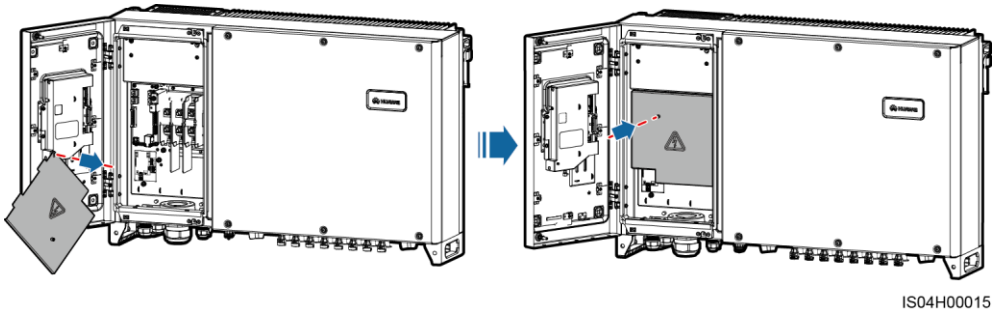
Check that the cables are connected correctly and securely, and then seal the waterproof connectors with firestop putty.

5.8 Closing the Maintenance Compartment Door

Procedure

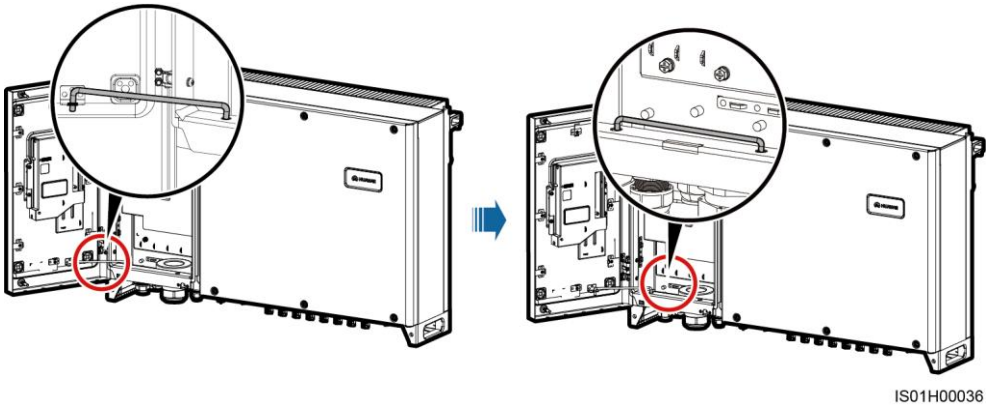
Step 1 Install the AC terminal cover.

Figure 5-28 Installing a cover



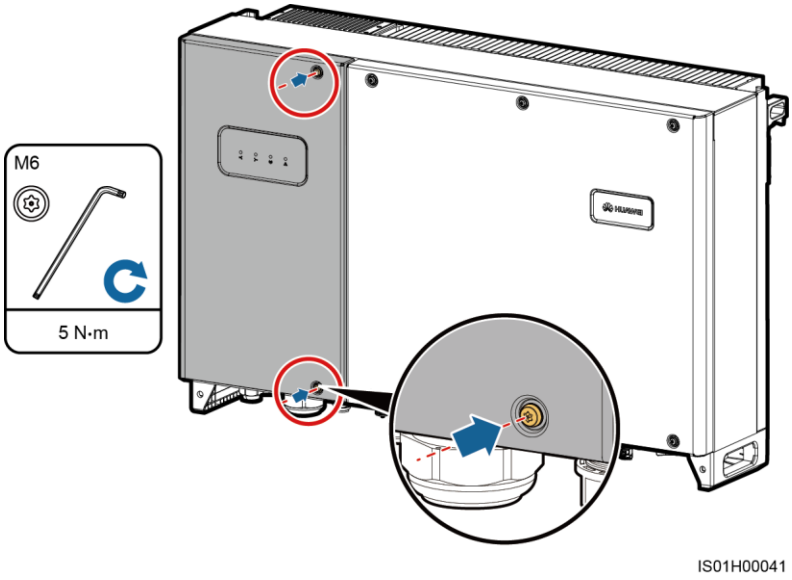
Step 2 Adjust the support bar.

Figure 5-29 Adjusting a support bar



Step 3 Close the maintenance compartment door and tighten the two screws on the door.

Figure 5-30 Tightening screws on the maintenance compartment door



----End

6 System Commissioning

6.1 Checking Before Power-On

1. The SUN2000 is installed correctly and securely.
2. Check that the DC switch and downstream AC output switch are OFF.
3. All ground cables are connected securely, without open circuits or short circuits.
4. All AC output power cables are connected correctly and securely, without open circuits or short circuits.
5. All DC input power cables are connected correctly and securely, without open circuits or short circuits.
6. The communications cable is connected correctly and securely.
7. All used waterproof connectors at the chassis bottom are applied with firestop putty.
8. The AC terminal cover is reinstalled.
9. The maintenance compartment door is closed and the door screws are tightened.
10. Idle DC input terminals are sealed.
11. Idle USB ports are plugged with waterproof plugs.
12. Idle waterproof connectors are plugged and the locking caps are tightened.

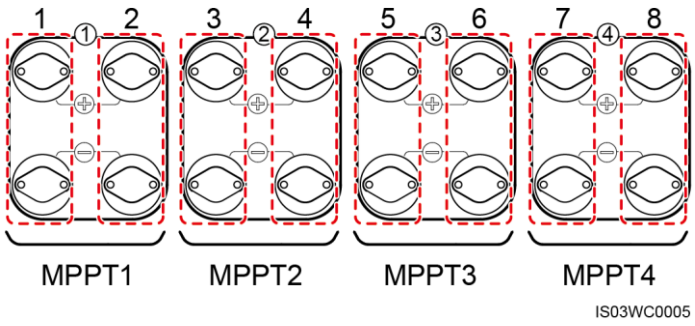
6.2 DC Input Detection

Function Description

The DC input power cable connection to the SUN2000 may be incorrect. After the DC input power cable connects to the SUN2000, the SUN2000 detects the DC input voltage of each route using the power generated by PV modules. If an abnormal voltage caused by incorrect cable connection is detected, the SUN2000 generates an alarm through the LED indicator and buzzer, reminding site personnel to check and rectify the fault, which prevents the SUN2000 from damage.

The SUN2000 provides four MPPT circuits with eight DC input terminals, as shown in Figure 6-1. After one PV string correctly connects to the MPPT1 circuit, the SUN2000 can start the DC input detection function. DC input detection can be performed automatically or manually.

Figure 6-1 DC terminals



NOTICE

- Only after at least one PV string correctly connects to the MPPT1 circuit, can the SUN2000 enables the DC input detection function. Therefore, you are advised to connect DC input power cables to the MPPT1 circuit first.
- The DC input detection function allows only independent access from each PV string to the inverter. That is, the PV strings cannot be connected in parallel and then to the inverter.

Table 6-1 describes the status of the LED indicators and buzzers.

Table 6-1 LED indicator and buzzer status description

PV Connection Indicator Status	Buzzer Status	Meaning
Blinking red	No sound	DC input detection is in progress.
Blinking green	No sound	The PV string cable is connected correctly.
Steady red	Buzzing	The PV string cable is connected incorrectly.

Automatic Detection

Following are the rules for starting automatic detection:

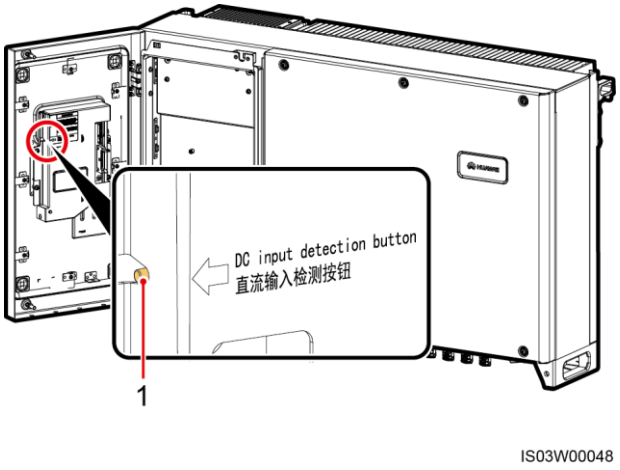
- Initial automatic detection is triggered 2 minutes after at least one PV string correctly connects to the MPPT1 circuit.
- Within three days after initial automatic detection is triggered, the SUN2000 performs automatic detection once every 10 minutes. From the fourth day, the SUN2000 performs automatic detection only upon automatic startup.
- The DC input detection function is valid only when the two DC switches on the SUN2000 are OFF.

Manual Detection

Perform manual detection by pressing the DC voltage detection button or using the SUN2000 app. Following are the start rules:

- Perform the triggering operation once to start one time of DC input detection. If DC input detection is ongoing, triggering operations will not take effect.

Figure 6-2 DC input detection button



(1) DC input detection button

- You can press the DC input detection button two consecutive times to forcibly silence the buzzer.
- The DC input detection function is valid only when the two DC switches on the SUN2000 are OFF.

6.3 Powering On the SUN2000

Prerequisites

NOTICE

- Before turning on the AC switch between the SUN2000 and the power grid, use a multimeter to check that the AC voltage is within the specified range.
- Before turning the DC switch on the SUN2000 to ON, ensure that the DC input power cable is connected correctly.

Procedure

Step 1 Turn on the AC switch between the SUN2000 and the power grid.

NOTICE

If you perform Step 2 before Step 1, the SUN2000 reports a fault about abnormal shutdown. The SUN2000 can start normally after the fault is automatically rectified. The default fault rectification time is 1 minute. You can modify the time over the NMS software installed on the PC that connects to the SUN2000.

Step 2 Turn the DC switch at the bottom of the SUN2000 to ON.

Step 3 (Optional) Measure the temperatures at the joints between DC terminals and connectors using a point-test thermometer.

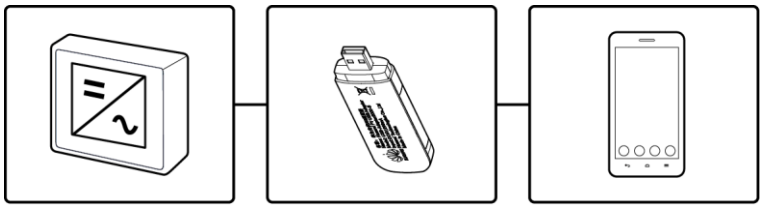
To ensure that the DC terminals are in good contact, check the temperatures at the joints between DC terminals and connectors after the SUN2000 has been running for a period of time. Ensure that the temperature rise does not exceed 40 ℃.

Step 4 Connect the SUN2000 to the mobile phone that runs SUN2000 app (app for short) through a Bluetooth module or USB data cable.

NOTICE

- Mobile phone operating system: Android 4.0 or later, iOS 7.0 or later. When the iOS is used, the app supports only Bluetooth connection.
- When you use a Bluetooth module to set up the connection, ensure that the mobile phone and SUN2000 are at most 10 meters away from each other. Otherwise, the communication quality between them will deteriorate.
- The screen snapshots in this document correspond to app V200R001C00SPC020.

Figure 6-3 Bluetooth module connection



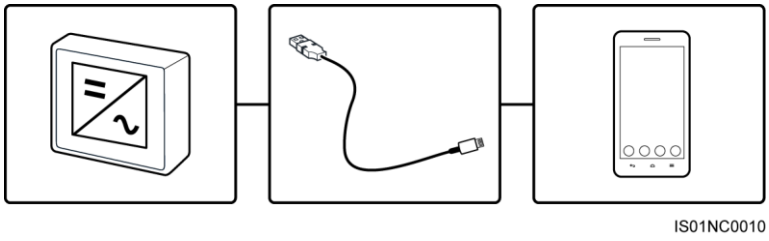
(A) SUN2000 (B) Bluetooth module (C) Mobile phone

NOTE

Purchase the Bluetooth module bundled with the SUN2000. A Bluetooth module purchased from any other source may not support communication between the SUN2000 and the app.

- The Android system supports the Bluetooth module USB-Adapter2000-B and BF4030.
- The iOS system supports the Bluetooth module USB-Adapter2000-B.

Figure 6-4 Data cable connection



(A) SUN2000 (B) USB data cable (C) Mobile phone

NOTE

Use the USB data cable delivered with the mobile phone.

- The port type of the USB data cable connected to the SUN2000 is USB 2.0.
- If the mobile phone provides a USB Type-C port, prepare a USB Type C to USB 2.0 adapter cable.

Figure 6-5 Login screen

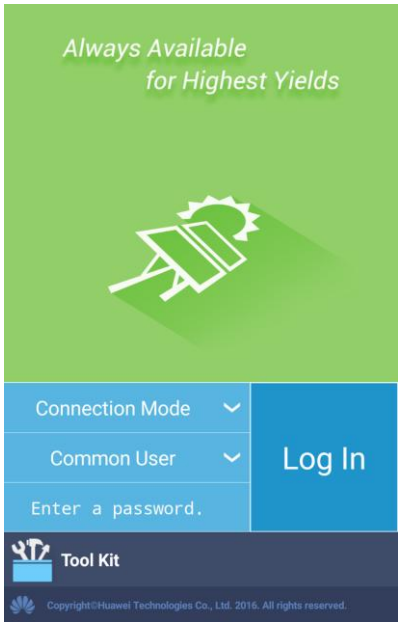


Figure 6-6 Selecting a connection mode

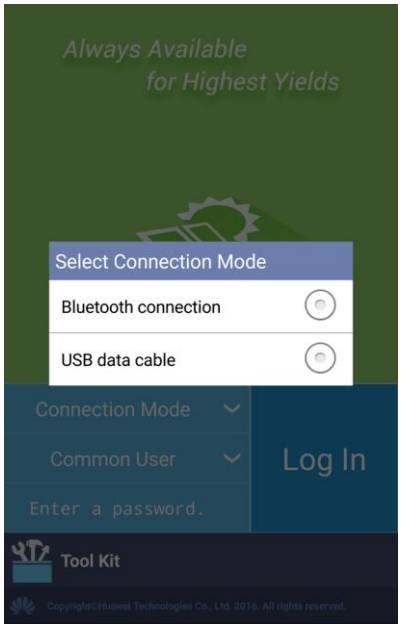


Figure 6-7 Bluetooth connection

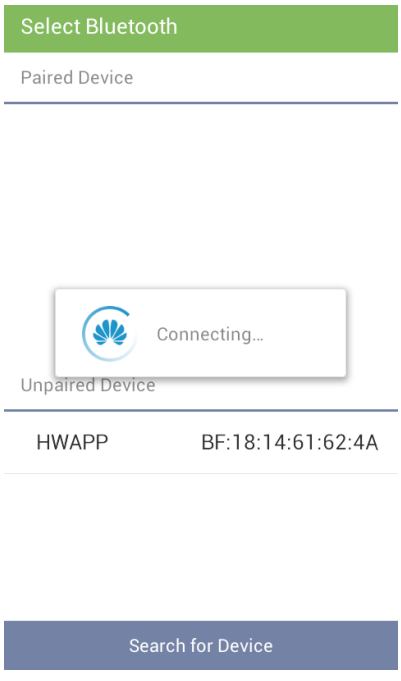
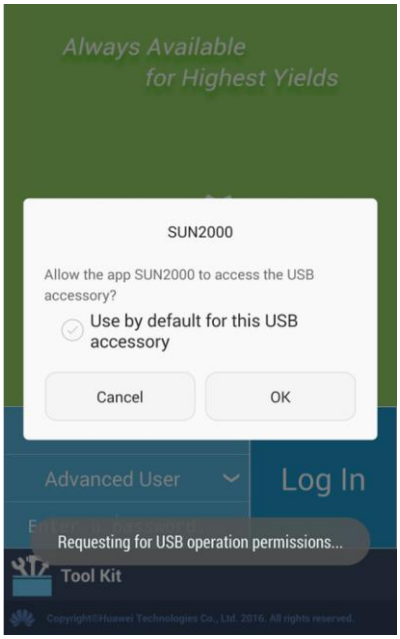


Figure 6-8 Data cable connection

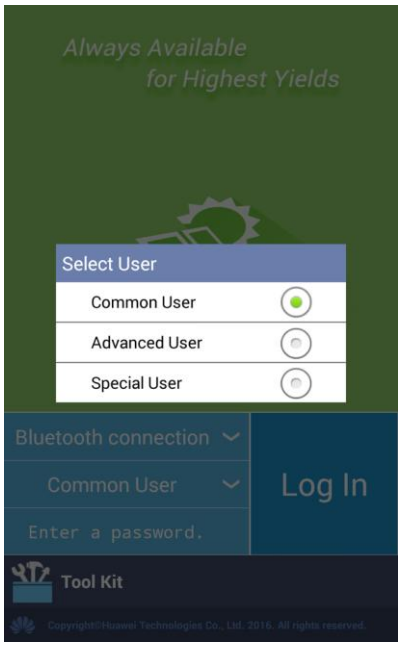


NOTE

After you select **Use by default for this USB accessory**, the message will not appear if you reconnect the app without disconnecting the USB data cable.

Step 5 Tap the user name area to switch between **Common User**, **Advanced User**, and **Special User**.

Figure 6-9 Switching between users



NOTE

- The login password is the same as that for the SUN2000 connected to the app and is used only when the SUN2000 connects to the app.
- The initial passwords for **Common User**, **Advanced User**, and **Special User** are all **00000a**. Use the initial password upon first login. To ensure account security, change the password immediately after login.
- During the login, if five consecutive invalid password entries are made (the interval between two consecutive entries is less than 2 minutes), the account will be locked for 10 minutes. The password should consist of six digits.

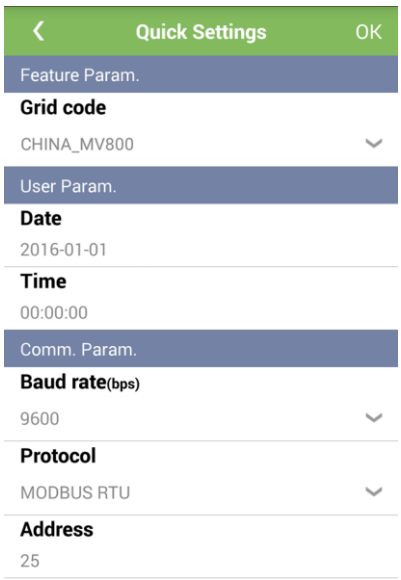
Step 6 Enter the password and tap **Login**.

Step 7 After the successful login, the **Quick Settings** screen or **Function Menu** screen is displayed.

NOTE

- If you log in to the app after the SUN2000 connects to the app for the first time or factory defaults are restored, the **Quick Settings** screen is displayed, on which you can set basic parameters. After the settings take effect, you can enter the main menu screen and modify the parameters on the **Settings** screen. By default, the SUN2000 can be grid-tied and you do not have to set parameters.
- You are advised to log in to the **Quick Settings** screen as an advanced user for parameter settings.

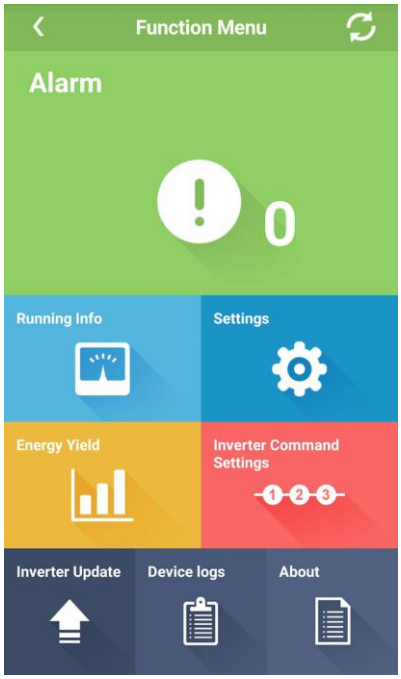
Figure 6-10 Quick Settings (advanced user)



NOTE

- Set the power grid code that applies to the country or region where the PV plant is located and the SUN2000 model.
- Set user parameters based on the current date and time.
- Set **Baud rate**, **Protocol**, and **Address** based on site requirements. **Baud rate** can be set to **4800**, **9600**, or **19200**. **Protocol** can be set to **MODBUS RTU**, and **Address** can be set to any value in the range of 1 to 247.
- When multiple SUN2000s communicate with the SmartLogger over RS485, the RS485 addresses for all the SUN2000s on each RS485 route must be within the address range set on the SmartLogger and cannot be duplicate. Otherwise, the communication will fail. In addition, the baud rates of all the SUN2000s on each RS485 route must be consistent with the SmartLogger baud rate.

Figure 6-11 Function Menu



----End

6.4 Powering Off the SUN2000

Context

WARNING

- If two SUN2000s share the same AC switch on the AC side, power off the two SUN2000s.
- After the SUN2000 powers off, the remaining electricity and heat may still cause electric shocks and body burns. Therefore, put on protective gloves and begin servicing the SUN2000 five minutes after the power-off.

Procedure

Step 1 Run a shutdown command on the SUN2000 APP, SmartLogger, or NMS.

For details, see the *SUN2000 APP User Manual*, *SmartLogger1000 User Manual*, *SmartLogger2000 User Manual*, or *iManager NetEco 1000S User Manual*.

Step 2 Turn off the AC switch between the SUN2000 and the power grid.

Step 3 Set the two DC switches to OFF.

----End

7 Man-Machine Interactions

7.1 Operations with a USB Flash Drive

USB flash drives of SanDisk, Netac, and Kingston are recommended. Other brands may be incompatible.

7.1.1 Exporting Configurations

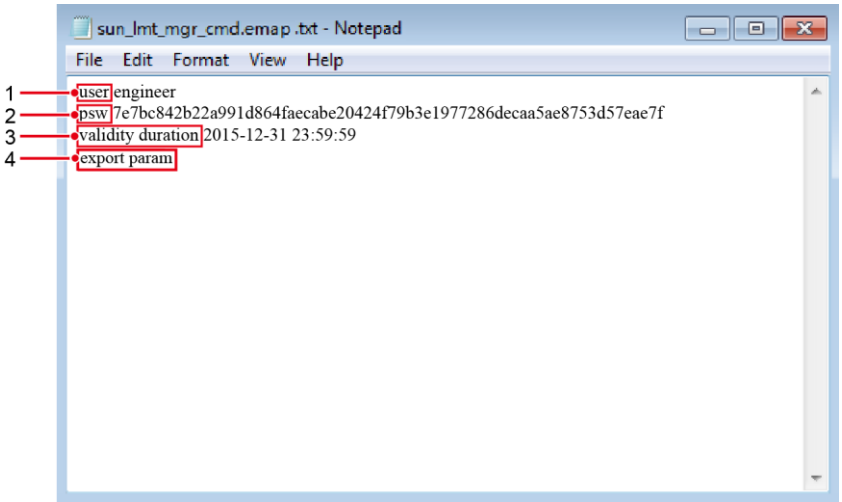
Procedure

Step 1 On the SUN2000 APP, tap **Inverter Command Settings** to generate a boot script file. For details, see the *SUN2000 APP User Manual*.

Step 2 Import the boot script file to a computer.

(Optional) The boot script file can be opened as a .txt file, as shown in Figure 7-1.

Figure 7-1 Boot script file



No.	Meaning	Remarks
1	User name	• Advanced user: engineer

No.	Meaning	Remarks
		• Special user: admin
2	Ciphertext	The ciphertext varies depending on the login password of the SUN2000 APP.
3	Script validity period	The script validity period varies depending on the script export time.
4	Command	Different command settings can produce different commands. • Configuration export command: **export param**. • Configuration import command: **import param**. • Data export command: **export log**. • Upgrade command: **upgrade**.

Step 3 Import the boot script file to the root directory of a USB flash drive.

Step 4 Connect the USB flash drive to the USB port. The system automatically identifies the USB flash drive and executes all commands specified in the boot script file. View the LED indicator to determine the operating status.

NOTICE

Verify that the ciphertext in the boot script file matches the login password of the SUN2000 APP. If they do not match and you insert the USB flash drive for five consecutive times, the user account will be locked for 10 minutes.

Table 7-1 LED indicator description

LED Indicator	Status	Meaning
	Green off	There is no operation with a USB flash drive.
	Blinking green at long intervals (on for 1s and then off for 1s)	There is an operation with a USB flash drive.
	Blinking green at short intervals (on for 0.125s and then off for 0.125s)	An operation with a USB flash drive has failed.
	Steady green	An operation with a USB flash drive is successful.

Step 5 Insert the USB flash drive into a computer and check the exported data.

NOTE

When the configuration export is complete, the boot script file and exported file are in the root directory of the USB flash drive.

----End

7.1.2 Importing Configurations

Prerequisites

You have exported configurations, and the exported files are complete.

Procedure

Step 1 On the SUN2000 APP, tap **Inverter Command Settings** to generate a boot script file. For details, see the *SUN2000 APP User Manual*.

Step 2 Import the boot script file to a computer.

Step 3 Replace the exported boot script file in the root directory of the USB flash drive with the imported one.

NOTICE

Replace the boot script file only and keep the exported files.

Step 4 Connect the USB flash drive to the USB port. The system automatically identifies the USB flash drive and executes all commands specified in the boot script file. View the LED indicator to determine the operating status.

NOTICE

Verify that the ciphertext in the boot script file matches the login password of the SUN2000 APP. If they do not match and you insert the USB flash drive for five consecutive times, the user account will be locked for 10 minutes.

Table 7-2 LED indicator description

LED Indicator	Status	Meaning
	Green off	There is no operation with a USB flash drive.
	Blinking green at long intervals (on for 1s and then off for 1s)	There is an operation with a USB flash drive.
	Blinking green at short intervals (on for 0.125s and then off for 0.125s)	An operation with a USB flash drive has failed.
	Steady green	An operation with a USB flash drive is successful.

----End

7.1.3 Exporting Data

Procedure

Step 1 On the SUN2000 APP, tap **Inverter Command Settings** to generate a boot script file. For details, see the *SUN2000 APP User Manual*.

Step 2 Import the boot script file to the root directory of a USB flash drive.

Step 3 Connect the USB flash drive to the USB port. The system automatically identifies the USB flash drive and executes all commands specified in the boot script file. View the LED indicator to determine the operating status.

NOTICE

Verify that the ciphertext in the boot script file matches the login password of the SUN2000 APP. If they do not match and you insert the USB flash drive for five consecutive times, the user account will be locked for 10 minutes.

Table 7-3 LED indicator description

LED Indicator	Status	Meaning
	Green off	There is no operation with a USB flash drive.
	Blinking green at long intervals (on for 1s and then off for 1s)	There is an operation with a USB flash drive.
	Blinking green at short intervals (on for 0.125s and then off for 0.125s)	An operation with a USB flash drive has failed.
	Steady green	An operation with a USB flash drive is successful.

Step 4 Insert the USB flash drive into a computer and check the exported data.

NOTE

After the data is exported, the boot script file and exported file are in the root directory of the USB flash drive.

----End

7.1.4 Upgrading

Procedure

Step 1 Log in to http://support.huawei.com/carrier/ and browse or search for SUN2000 on the **Product Support** tab page. Download the required upgrade package (for example, SUN2000HAV100R001C00SPC*XXX*) from the **Software** tab page.

Step 2 Decompress the upgrade package.

After obtaining the upgrade package **SUN2000HAV100R001C00SPCXXX_package.zip**, decompress the package and copy the extracted files to the root directory of the USB flash drive. Ensure that the extracted files include:

- config.txt
- sun_lmt_mgr_cmd.emap (This is a boot script file.)
- SUN2000.bin
- SUN2000_CPLD.bin
- SUN2000_FLT_Release.bin
- SUN2000_Master_Release.bin
- SUN2000_Slave_Release.bin
- vercfg.xml

NOTICE

- When the login password of the SUN2000 APP is the initial password (**00000a**), there is no need to perform Step 3–Step 5.
- When the login password of the SUN2000 APP is not the initial password, perform Step 3–Step 7.

Step 3 On the SUN2000 APP, tap **Inverter Command Settings** to generate a boot script file. For details, see the *SUN2000 APP User Manual*.

Step 4 Import the boot script file to a computer.

Step 5 Replace the boot script file in the upgrade package with the one generated by the SUN2000 APP.

Step 6 Copy the extracted files to the root directory of the USB flash drive.

Step 7 Connect the USB flash drive to the USB port. The system automatically identifies the USB flash drive and executes all commands specified in the boot script file. View the LED indicator to determine the operating status.

NOTICE

Verify that the ciphertext in the boot script file matches the login password of the SUN2000 APP. If they do not match and you insert the USB flash drive for five consecutive times, the user account will be locked for 10 minutes.

Table 7-4 LED indicator description

LED Indicator	Status	Meaning
	Green off	There is no operation with a USB flash drive.
	Blinking green at long intervals (on for 1s and then off for 1s)	There is an operation with a USB flash drive.
	Blinking green at short intervals (on for 0.125s and then off for 0.125s)	An operation with a USB flash drive has failed.
	Steady green	An operation with a USB flash drive is successful.

Step 8 (Optional) The system automatically restarts when the upgrade is completed. All LED indicators turn off during the restart. After the restart, the green indicator is blinking at long intervals (on for 1s and then off for 1s) for 1 minute until it becomes steady on, which indicates that the upgrade is successful.

NOTE

The SUN2000 can also be upgraded through the **Inverter Upgrade** in the SUN2000 APP. For details, see the *SUN2000 APP User Manual*.

----End

7.2 Operations with a SmartLogger

For operations with a SmartLogger, see the *SmartLogger1000 User Manual* or *SmartLogger2000 User Manual*.

7.3 Operations with the NMS

For operations with the NMS, see the *iManager NetEco 1000S User Manual*.

7.4 Operations with the SUN2000 APP

For operations with the SUN2000 APP, see the *SUN2000 APP User Manual*.

8 System Maintenance

8.1 Routine Maintenance

To ensure that the SUN2000 can operate properly for a long term, you are advised to perform routine maintenance on it as described in this chapter.

CAUTION

- Before cleaning the system, and maintaining the cable connections and grounding reliability, power off the system (see 6.4 Powering Off the SUN2000) and ensure that the two DC switches on the inverter are OFF.
- If you need to open the maintenance compartment door in rainy or snowy days, take protective measures to prevent rain and snow entering the maintenance compartment. If it is impossible to take protective measures, do not open the maintenance compartment door in rainy or snowy days.

Table 8-1 Maintenance list

Item	Check Method	Maintenance Interval
System cleanliness	Check periodically that the heat sinks are free from obstacles or dust.	Once six months to a year
System running status	• Check that the inverter is not damaged or deformed. • Check that the running sound of the inverter is normal. • When the inverter is running, check that all inverter parameters are correctly set.	Once six months
Cable connections	• Check that cables are securely connected. • Check that cables are intact, in particular, the parts touching the metallic surface are not scratched.	The first inspection is half a year after the initial commissioning. From then on, perform the inspection once six

Item	Check Method	Maintenance Interval
	• Check that the idle COM, USB, and AC OUTPUT ports are locked by waterproof caps.	months to a year.
Grounding reliability	Check that ground cables are securely connected.	The first inspection is half a year after the initial commissioning. From then on, perform the inspection once six months to a year.

8.2 Troubleshooting

Alarm severities are defined as follows:

- Major: The inverter enters the shutdown mode and disconnects from the power grid to stop generating electricity after a fault occurs.
- Minor: Some components are faulty but the inverter can still generate electricity.
- Warning: The inverter output power decreases due to external factors.

Table 8-2 Common alarms and troubleshooting measures

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
103	High DC Input Voltage	Major	• Cause ID = 1 The PV array is not properly configured. Excessive PV modules are connected in series to PV strings 1 and 2, and therefore the PV string open-circuit voltage exceeds the inverter maximum MPP voltage. • Cause ID = 2 The PV array is not properly configured. Excessive PV modules are connected in series to PV strings 3 and 4, and therefore the PV string open-circuit voltage exceeds the inverter maximum MPP voltage. • Cause ID = 3 The PV array is not properly configured.	• Cause ID = 1 Reduce the number of PV modules connected in series to PV strings 1 and 2 until the open-circuit voltage is less than or equal to the maximum inverter input voltage. After the PV array configuration is corrected, the inverter alarm disappears. • Cause ID = 2 Reduce the number of PV modules connected in series to PV strings 3 and 4 until the open-circuit voltage is less than or equal to the maximum inverter input voltage. After the PV array configuration is corrected, the inverter alarm disappears. • Cause ID = 3 Reduce the number of PV modules connected in series to PV strings 5 and 6 until the open-circuit voltage is less than

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
			Excessive PV modules are connected in series to PV strings 5 and 6, and therefore the PV string open-circuit voltage exceeds the inverter maximum MPP voltage. • Cause ID = 4 The PV array is not properly configured. Excessive PV modules are connected in series to PV strings 7 and 8, and therefore the PV string open-circuit voltage exceeds the inverter maximum MPP voltage.	or equal to the maximum inverter input voltage. After the PV array configuration is corrected, the inverter alarm disappears. • Cause ID = 4 Reduce the number of PV modules connected in series to PV strings 7 and 8 until the open-circuit voltage is less than or equal to the maximum inverter input voltage. After the PV array configuration is corrected, the inverter alarm disappears.
106–113	Abnormal String 1–8	Warning	Cause ID = 1 • The PV string is shielded from sunlight for a long time. • The PV string deteriorates or is damaged.	1. Check whether the PV string current is obviously lower than the currents of other PV strings. 2. If yes, check whether the PV string is shielded from sunlight. 3. If the PV string is clean and not shielded from sunlight, check whether any PV module is faulty.
120–127	String 1–8 Reversed	Cause ID = 1: Major Cause ID = 2: Warning	• Cause ID = 1 The PV string is reversely connected. • Cause ID = 2 Only a few PV modules are connected in series to the PV string, and therefore the end voltage is lower than that of other PV strings.	• Cause ID = 1 Check whether the PV string is reversely connected to the inverter. If yes, turn off the two DC switches after the PV string voltage drops within the safe voltage range (lower than 60 V DC), and then correct the PV string connection. • Cause ID = 2 Check whether the number of PV modules connected in series to the inverter is small. If yes, increase the number.
200	Abnormal DC Circuit	Major	Abnormal external conditions trigger the protection for the DC circuit inside the inverter. The possible causes are as follows: • Cause ID = 3 The inverter input is disconnected accidentally, or the PV string output	Cause ID = 3/10/11 1. The inverter detects its external working conditions in real time. After the fault is rectified, the inverter automatically recovers. 2. If the alarm persists, contact Huawei technical support. Cause ID = 12/15

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
			power changes sharply because the PV string is shielded from sunlight. • Cause ID = 10 The three phases of the power grid are seriously unbalanced, which triggers the protection for the internal control circuit of the inverter. • Cause ID = 11 The power grid voltage changes sharply and the inverter input power fails to discharge in a short time, which increases the internal voltage and triggers overvoltage protection. • Cause ID = 12/15 An unrecoverable fault occurs on a circuit inside the inverter.	Turn off the AC output switch and DC input switch. Then turn on the AC output switch and DC input switch after 5 minutes. If the fault persists, contact Huawei technical support.
202	Abnormal Invert Circuit	Major	Abnormal external conditions trigger the protection for the inverter circuit inside the inverter. The possible causes are as follows: • Cause ID = 13 The power grid voltage drops dramatically or the power grid is short-circuited, which damages the internal voltage detection circuit in the inverter. • Cause ID = 14 The power grid voltage drops dramatically or the power grid is short-circuited. As a result, the inverter transient output current exceeds the upper threshold and therefore the inverter protection is triggered. • Cause ID = 16 The DC current in the power grid exceeds the	Cause ID = 13/14/16 1. The inverter detects its external working conditions in real time. After the fault is rectified, the inverter automatically recovers. 2. If the alarm persists, contact Huawei technical support. Cause ID = 20 1. Check the inverter output cable for short-circuits. 2. If the alarm persists, contact Huawei technical support.

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
			upper threshold. • Cause ID = 20 The inverter output is short-circuited. As a result, the output current surges to a value above the upper limit, and the inverter protection is triggered.	
301	Abnormal Grid Voltage	Major	The power grid voltage is beyond the acceptable range. The possible causes are as follows: • Cause ID = 4 The power grid voltage is below the specified lower threshold. • Cause ID = 16 The power grid voltage exceeds the specified upper threshold. • Cause ID = 19 The power grid voltage has exceeded the specified upper threshold for 10 minutes. • Cause ID = 26 The power grid voltage exceeds the specified upper threshold. • Cause ID = 28 The three phases of the power grid differ greatly in voltage. • Cause ID = 29 1. The power grid experiences an outage. 2. The AC circuit is disconnected or AC switch is off. • Cause ID = 31 The impedance of the output phase wire A to the PE cable is low or short-circuited. • Cause ID = 32	Cause ID = 4 1. If the alarm occurs accidentally, the power grid may be abnormal temporarily. The inverter automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid voltage is within the acceptable range. If no, contact the local power operator. If yes, log in to the SUN2000 APP, SmartLogger, or the NetEco to modify the power grid overvoltage and undervoltage protection thresholds with the consent of the local power operator. 3. If the fault persists for a long time, check the connection between the AC switch and the output power cable. Cause ID = 16/19/26 1. Check whether the grid-tied voltage exceeds the upper threshold. If yes, contact the local power operator. 2. If you have confirmed that the grid-tied voltage exceeds the upper threshold and obtained the consent of the local power operator, modify the overvoltage and undervoltage protection thresholds. 3. Check whether the peak power grid voltage exceeds the upper threshold. Cause ID = 28 1. If the exception is caused by an external fault, the inverter

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
			The impedance of the output phase wire B to the PE cable is low or short-circuited. • Cause ID = 33 The impedance of the output phase wire C to the PE cable is low or short-circuited.	automatically recovers after the fault is rectified. 2. If the alarm persists and affects the energy yield of the power station, contact the local power operator. Cause ID = 29 1. Check the AC voltage. 2. Check that the AC power cable is connected and that the AC switch is ON. Cause ID = 31 Check the impedance of output phase wire A to the PE cable, locate the position with lower impedance, and resolve the issue. Cause ID = 32 Check the impedance of output phase wire B to the PE cable, locate the position with lower impedance, and resolve the issue. Cause ID = 33 Check the impedance of output phase wire C to the PE cable, locate the position with lower impedance, and resolve the issue.
305	Abnormal Grid Frequency	Major	• Cause ID = 2 The actual power grid frequency is higher than the standard requirement for the local power grid. • Cause ID = 4 The actual power grid frequency is lower than the standard requirement for the local power grid. • Cause ID = 5 The actual change rate of the power grid frequency does not meet the standard requirement for the local power grid.	Cause ID = 2/4 1. If the alarm occurs accidentally, the power grid may be abnormal temporarily. The inverter automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid frequency is within the acceptable range. If no, contact the local power operator. If yes, log in to the SUN2000 app, SmartLogger, or NMS to modify the power grid overfrequency and underfrequency protection thresholds with the consent of the local power operator. Cause ID = 5 1. If the alarm occurs accidentally, the power grid may be abnormal

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
				temporarily. The inverter automatically recovers after detecting that the power grid becomes normal. 2. If the alarm occurs frequently, check whether the power grid frequency is within the acceptable range. If no, contact the local power operator.
313	Low Insulation Resistance	Major	Cause ID = 1 • A short circuit occurs between the PV string and the PGND cable. • The PV string is installed in a moist environment for a long time.	1. Check the impedance between the PV string and the PGND cable. If a short circuit occurs, rectify the fault. 2. If you are sure that the impedance is less than the default value in a cloudy or rainy environment, log in to the SUN2000 app, SmartLogger, or NMS and set **Insulation resistance protection**.
318	Abnormal Residual Current	Major	Cause ID = 1 The insulation resistance against the PGND cable at the input side decreases when the inverter is running, which causes an excessively high residual current.	1. If the alarm occurs accidentally, the external circuit may be abnormal temporarily. The inverter automatically recovers after fault is rectified. 2. If the alarm occurs repeatedly or persists, check whether the impedance between the PV string and the ground is excessively low.
321	Cabinet Overtemperature	Major	Cause ID = 1 • The inverter is installed in a place with poor ventilation. • The ambient temperature exceeds the upper threshold. • The internal fan works abnormally.	1. Check the ventilation and ambient temperature of the inverter installation position. 2. If the ventilation is poor or the ambient temperature exceeds the upper threshold, improve the ventilation and heat dissipation. 3. If the ventilation and ambient temperature both meet requirements, contact Huawei technical support.
322	Abnormal SPI Communication	Major	Cause ID = 1 An unrecoverable fault occurs on a circuit inside the inverter.	Turn off the AC output switch and DC input switch. Then turn on the AC output switch and DC input switch after 5 minutes. If the fault persists, contact Huawei technical support.
326	Abnormal Grounding	Major	Cause ID = 1 • The neutral wire or PGND	1. Check that the neutral wire or PGND cable properly connects to

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
			cable does not connect to the inverter. • When you are grounding the PV string, you do not connect an isolation transformer to the inverter output.	the inverter. 2. If the PV string is grounded, check whether the inverter output needs to connect to an isolation transformer. If yes, connect the transformer to the inverter.
400	System Fault	Major	Cause ID = 1/3/21/23/27 An unrecoverable fault occurs on a circuit inside the inverter.	Turn off the AC output switch and DC input switch. Then turn on the AC output switch and DC input switch after 5 minutes. If the fault persists, contact Huawei technical support.
410	Abnormal Auxiliary Power	Major	Cause ID = 4 The sampling control board has an abnormal voltage, which may be caused by the following: • The internal power chip of the sampling control board is faulty. • The detection circuit becomes faulty.	1. When the alarm is generated, the inverter shuts down automatically. When the fault is rectified, the inverter starts automatically. 2. If the alarm persists, contact Huawei technical support.
413	Abnormal PV String Connection	Major	Cause ID = 1 The PV string does not properly connect to the MPPT1 circuit. Cause ID = 2 The PV string does not properly connect to the MPPT2 circuit. Cause ID = 3 The PV string does not properly connect to the MPPT3 circuit. Cause ID = 4 The PV string does not properly connect to the MPPT4 circuit.	Check the PV string for reverse connection and cross connection.
504	Software Version Unmatch	Minor	Cause ID = 1/2/3 During inverter software upgrade, the version of the software loaded is incorrect.	Check whether you have performed a software upgrade recently. If yes, upgrade the software to the correct version again.
505	Upgrade	Major	Cause ID = 1	Perform the upgrade again.

Alarm ID	Alarm Name	Alarm Severity	Possible Cause	Suggestion
	Failed		The upgrade does not end normally.	
61440	Flash Fault	Minor	Cause ID = 1 • The flash memory is insufficient. • The flash memory has bad sectors.	1. Replace the monitoring board. 2. If the monitoring board is built into the monitoring device, replace the monitoring device.

NOTE

If you cannot rectify faults with the measures listed in the preceding table, contact Huawei technical support.

9 Handling the Inverter

9.1 Removing the SUN2000

NOTICE

Before removing the SUN2000, disconnect both the AC and DC power supplies. For processes of disconnecting the power supplies, see 6.4 Powering Off the SUN2000. After powering off the SUN2000, wait at least 5 minutes before performing operations on it.

Perform the following operations to remove the SUN2000:

1. Disconnect all cables from the SUN2000, including RS485 communications cables, DC input power cables, AC output power cables, and PGND cables.
2. Remove the SUN2000 from the mounting bracket.
3. Remove the mounting bracket.

9.2 Packing the SUN2000

- If the original packing materials are available, put the SUN2000 inside them and then seal them by using adhesive tape.
- If the original packing materials are unavailable, put the SUN2000 inside a suitable hard carton and seal it properly.

9.3 Disposing of the SUN2000

If the SUN2000 service life expires, dispose of it according to the local disposal rules for electrical equipment waste.

10 Technical Specifications

Efficiency

Item	SUN2000-60KTL-HV-D1
Maximum efficiency	99.00%
Chinese efficiency	98.50%

Input

Item	SUN2000-60KTL-HV-D1
Maximum input power	67,300 W
Maximum input voltage	1500 V
Maximum input current (per MPPT)	22 A
Maximum short-circuit current (per MPPT)	30 A
Maximum inverter backfeed current to the PV array	0 A
Lowest operating/startup voltage	600 V/650 V
MPPT voltage range	600–1450 V
Full load MPPT voltage range	880–1275 V
Rated input voltage	1080 V
Number of inputs	8
Number of MPP trackers	4

Output

Item	SUN2000-60KTL-HV-D1
Rated output power	60,000 W
Maximum apparent power	66,000 VA
Maximum AC output power (cosφ = 1)	66,000 W
Rated output line voltage	800 V AC, 3W+PE
Rated output current	43.3 A
Rated output frequency	50 Hz/60 Hz
Maximum output current	48 A
Power factor	0.8 leading ... 0.8 lagging
Maximum total harmonic distortion (THD)	< 3%

Protection

Item	SUN2000-60KTL-HV-D1
Input DC switch	Supported
Anti-islanding protection	Supported
Output overcurrent protection	Supported
Input reverse polarity protection	Supported
PV string fault detection	Supported
DC surge protection	Type II
AC surge protection	Type II
Insulation resistance detection	Supported
Residual current device (RCD) detection	Supported

Display and Communication

Item	SUN2000-60KTL-HV-D1
Display	LED indicator, Bluetooth module+app, USB data cable+app
RS485	Supported
USB	Supported
PLC	Supported

Common Parameters

Item	SUN2000-60KTL-HV-D1
Dimensions (W x H x D)	930 mm x 600 mm x 270 mm
Weight	60 kg
Operating temperature	–25 ℃ to +60 ℃
Cooling mode	Natural convection
Altitude	4000m
Humidity	0%–100% RH
Input terminal	Amphenol UTX
Output terminal	Waterproof cable connector+OT terminal
Ingress protection rating	IP65
Self power consumption at night	2.5 W
Topology	No transformer
Noise (typical value)	≤ 40 dB

A Acronyms and Abbreviations

C	
CCO	central controller
L	
LED	light emitting diode
M	
MPP	maximum power point
MPPT	maximum power point tracking
P	
PID	potential induced degradation
PLC	power line communication
PV	photovoltaic
R	
RCD	residual current device
W	
WEEE	waste electrical and electronic equipment