

SUN600-(5KTL, 6KTL)-L0

User Manual

Issue 04
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Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: <https://e.huawei.com>

About This Document

Purpose

This document describes the Smart Solar Inverter-(5KTL, 6KTL)-L0 (inverter for short) in terms of its installation, electrical connection, commissioning, maintenance, and troubleshooting. Before installing and operating the inverter, ensure that you are familiar with the features, functions, and safety precautions provided in this document.





Intended Audience


This document is applicable to:

- Installers
- Users

Symbol Conventions

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

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	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.

Symbol	Description
 NOTE	Supplements the important information in the main text. 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 the changes made in earlier issues.

Issue 04 (2023-02-17)

- Updated [1 Safety Information](#).
- Updated [4.1 Checking Before Installation](#).
- Updated [5.1 Precautions](#).
- Updated [6 System Commissioning](#).
- Updated [8 System Maintenance](#).

Issue 03 (2022-02-25)

- Updated [2.1 Overview](#).
- Updated [10 Technical Parameters](#).

Issue 02 (2021-12-20)

- Updated [7.1.3 Creating a PV Plant and a User](#).
- Updated [7.2.1 Energy Control](#).
- Updated [10 Technical Parameters](#).

Issue 01 (2021-11-01)

This issue is the first official release.

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1 Safety Information

Statement

Before transporting, storing, installing, operating, using, and/or maintaining the equipment, read this document, strictly follow the instructions provided herein, and follow all the safety instructions on the equipment and in this document. In this document, "equipment" refers to the products, software, components, spare parts, and/or services related to this document; "the Company" refers to the manufacturer (producer), seller, and/or service provider of the equipment; "you" refers to the entity that transports, stores, installs, operates, uses, and/or maintains the equipment.

The **Danger, Warning, Caution, and Notice** statements described in this document do not cover all the safety precautions. You also need to comply with relevant international, national, or regional standards and industry practices. **The Company shall not be liable for any consequences that may arise due to violations of safety requirements or safety standards concerning the design, production, and usage of the equipment.**

The equipment should be used in an environment that meets the design specifications. Otherwise, the equipment may be faulty, malfunctioning, or damaged, which is not covered under the warranty. The Company shall not be liable for any property loss, personal injury, or even death caused thereby.

Comply with applicable laws, regulations, standards, and specifications during transportation, storage, installation, operation, use, and maintenance.

Do not perform reverse engineering, decompilation, disassembly, adaptation, implantation, or other derivative operations on the equipment software. Do not study the internal implementation logic of the equipment, obtain the source code of the equipment software, violate intellectual property rights, or disclose any of the performance test results of the equipment software.

The Company shall not be liable for any of the following circumstances or their consequences:

- The equipment is damaged due to force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions.
- The equipment is operated beyond the conditions specified in this document.

- The equipment is installed or used in environments that do not comply with international, national, or regional standards.
- You fail to follow the operation instructions and safety precautions on the product and in the document.
- You remove or modify the product or modify the software code without authorization.
- You or a third party authorized by you cause the equipment damage during transportation.
- The equipment is damaged due to storage conditions that do not meet the requirements specified in the product document.
- You fail to prepare materials and tools that comply with local laws, regulations, and related standards.
- The equipment is damaged due to your or a third party's negligence, intentional breach, gross negligence, or improper operations, or other reasons not related to the Company.

1.1 Personal Safety

 **DANGER**

Ensure that power is off during installation. Do not install or remove a cable with power on. Transient contact between the core of the cable and the conductor will generate electric arcs or sparks, which may cause a fire or personal injury.

 **DANGER**

Non-standard and improper operations on the energized equipment may cause fire, electric shocks, or explosion, resulting in property damage, personal injury, or even death.

 **DANGER**

Before operations, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces to prevent electric shocks.

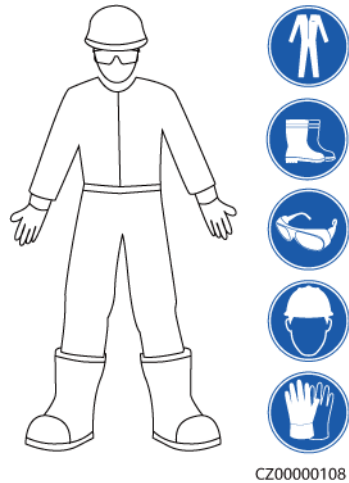
 **DANGER**

During operations, use dedicated insulated tools to prevent electric shocks or short circuits. The dielectric withstanding voltage level must comply with local laws, regulations, standards, and specifications.

WARNING

During operations, wear personal protective equipment such as protective clothing, insulated shoes, goggles, safety helmets, and insulated gloves.

Figure 1-1 Personal protective equipment



General Requirements

- Do not stop protective devices. Pay attention to the warnings, cautions, and related precautionary measures in this document and on the equipment.
- If there is a likelihood of personal injury or equipment damage during operations, immediately stop, report the case to the supervisor, and take feasible protective measures.
- Do not power on the equipment before it is installed or confirmed by professionals.
- Do not touch the power supply equipment directly or with conductors such as damp objects. Before touching any conductor surface or terminal, measure the voltage at the contact point to ensure that there is no risk of electric shock.
- Do not touch operating equipment because the enclosure is hot.
- Do not touch a running fan with your hands, components, screws, tools, or boards. Otherwise, personal injury or equipment damage may occur.
- In the case of a fire, immediately leave the building or the equipment area and activate the fire alarm or call emergency services. Do not enter the affected building or equipment area under any circumstances.

Personnel Requirements

- Only professionals and trained personnel are allowed to operate the equipment.
 - Professionals: personnel who are familiar with the working principles and structure of the equipment, trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation, operation, maintenance

- Trained personnel: personnel who are trained in technology and safety, have required experience, are aware of possible hazards on themselves in certain operations, and are able to take protective measures to minimize the hazards on themselves and other people
- Personnel who plan to install or maintain the equipment must receive adequate training, be able to correctly perform all operations, and understand all necessary safety precautions and local relevant standards.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment.
- Personnel who will perform special tasks such as electrical operations, working at heights, and operations of special equipment should possess the required local qualifications.
- Only authorized professionals are allowed to replace the equipment or components (including software).
- Only personnel who need to work on the equipment are allowed to access the equipment.

1.2 Electrical Safety

 **DANGER**

Before connecting cables, ensure that the equipment is intact. Otherwise, electric shocks or fire may occur.

 **DANGER**

Non-standard and improper operations may result in fire or electric shocks.

 **DANGER**

Prevent foreign matter from entering the equipment during operations. Otherwise, equipment damage, load power derating, power failure, or personal injury may occur.

 **WARNING**

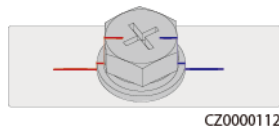
For the equipment that needs to be grounded, install the ground cable first when installing the equipment and remove the ground cable last when removing the equipment.

 **CAUTION**

Do not route cables behind the air intake and exhaust vents of the equipment.

General Requirements

- Follow the procedures described in the document for installation, operation, and maintenance. Do not reconstruct or alter the equipment, add components, or change the installation sequence without permission.
- Obtain approval from the national or local electric utility company before connecting the equipment to the grid.
- Observe the power plant safety regulations, such as the operation and work ticket mechanisms.
- Install temporary fences or warning ropes and hang "No Entry" signs around the operation area to keep unauthorized personnel away from the area.
- Before installing or removing power cables, turn off the switches of the equipment and its upstream and downstream switches.
- Before performing operations on the equipment, check that all tools meet the requirements and record the tools. After the operations are complete, collect all of the tools to prevent them from being left inside the equipment.
- Before installing power cables, check that cable labels are correct and cable terminals are insulated.
- When installing the equipment, use a torque tool of a proper measurement range to tighten the screws. When using a wrench to tighten the screws, ensure that the wrench does not tilt and the torque error does not exceed 10% of the specified value.
- Ensure that bolts are tightened with a torque tool and marked in red and blue after double-check. Installation personnel mark tightened bolts in blue. Quality inspection personnel confirm that the bolts are tightened and then mark them in red. (The marks should cross the edges of the bolts.)



- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.
- Before maintaining a downstream electrical device supply or power distribution device, turn off the output switch of its power supply equipment.
- During equipment maintenance, attach "Do not switch on" labels near the upstream and downstream switches or circuit breakers as well as warning signs to prevent accidental connection. The equipment can be powered on only after troubleshooting is complete.
- Do not open equipment panels.
- Check equipment connections periodically, ensuring that all screws are securely tightened.
- Only qualified professionals can replace a damaged cable.
- Do not scrawl, damage, or block any labels or nameplates on the equipment. Promptly replace labels that have worn out.

- Do not use solvents such as water, alcohol, or oil to clean electrical components inside or outside of the equipment.

Grounding

- Ensure that the grounding impedance of the equipment complies with local electrical standards.
- Ensure that the equipment is connected permanently to the protective ground. Before operating the equipment, check its electrical connection to ensure that it is reliably grounded.
- Do not work on the equipment in the absence of a properly installed ground conductor.
- Do not damage the ground conductor.

Cabling Requirements

- When selecting, installing, and routing cables, follow local safety regulations and rules.
- When routing power cables, ensure that there is no coiling or twisting. Do not join or weld power cables. If necessary, use a longer cable.
- Ensure that all cables are properly connected and insulated, and meet specifications.
- Ensure that the slots and holes for routing cables are free from sharp edges, and that the positions where cables are routed through pipes or cable holes are equipped with cushion materials to prevent the cables from being damaged by sharp edges or burrs.
- Ensure that cables of the same type are bound together neatly and straight and that the cable sheath is intact. When routing cables of different types, ensure that they are away from each other without entanglement and overlapping.
- Secure buried cables using cable supports and cable clips. Ensure that the cables in the backfill area are in close contact with the ground to prevent cable deformation or damage during backfilling.
- If the external conditions (such as the cable layout or ambient temperature) change, verify the cable usage in accordance with the IEC-60364-5-52 or local laws and regulations. For example, check that the current-carrying capacity meets requirements.
- When routing cables, reserve at least 30 mm clearance between the cables and heat-generating components or areas. This prevents deterioration or damage to the cable insulation layer.

1.3 Environment Requirements

 **DANGER**

Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.

 **DANGER**

Do not store any flammable or explosive materials in the equipment area.

 **DANGER**

Do not place the equipment near heat sources or fire sources, such as smoke, candles, heaters, or other heating devices. Overheat may damage the equipment or cause a fire.

 **WARNING**

Install the equipment in an area far away from liquids. Do not install it under areas prone to condensation, such as under water pipes and air exhaust vents, or areas prone to water leakage, such as air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that no liquid enters the equipment to prevent faults or short circuits.

 **WARNING**

To prevent damage or fire due to high temperature, ensure that the ventilation vents or heat dissipation systems are not obstructed or covered by other objects while the equipment is running.

General Requirements

- Ensure that the equipment is stored in a clean, dry, and well ventilated area with proper temperature and humidity and is protected from dust and condensation.
- Do not install or run the equipment beyond the technical specifications. Otherwise, its performance and safety will be compromised.
- Do not install, use, or operate outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, inserting connectors to or removing connectors from signal ports connected to outdoor facilities, working at heights, performing outdoor installation, and opening doors) in harsh weather conditions such as lightning, rain, snow, and level 6 or stronger wind.
- Do not install the equipment in an environment with dust, smoke, volatile or corrosive gases, infrared and other radiations, organic solvents, or salty air.
- Do not install the equipment in an environment with conductive metal or magnetic dust.
- Do not install the equipment in an area conducive for the growth of microorganisms such as fungus or mildew.
- Do not install the equipment in an area with strong vibration, noise, or electromagnetic interference.

- Ensure that the site complies with local laws, regulations, and related standards.
- Ensure that the ground in the installation environment is solid, free from spongy or soft soil, and not prone to subsidence. The site must not be located in a low-lying land or an area prone to water accumulation, and the horizontal level of the site must be above the highest water level of that area in history.
- Do not install the equipment in a position that may be submerged in water.
- If the equipment is installed in a place with abundant vegetation, in addition to routine weeding, harden the ground underneath the equipment using cement or gravel (recommended area: 3 m x 2.5 m).
- Do not install the equipment outdoors in salt-affected areas because it may be corroded. A salt-affected area refers to the region within 500 m of the coast or prone to sea breeze. Regions prone to sea breeze vary with weather conditions (such as typhoons and monsoons) or terrains (such as dams and hills).
- Before opening doors during the installation, operation, and maintenance of the equipment, clean up any water, ice, snow, or other foreign objects on the top of the equipment to prevent foreign objects from falling into the equipment.
- When installing the equipment, ensure that the installation surface is solid enough to bear the weight of the equipment.
- After installing the equipment, remove the packing materials such as cartons, foam, plastics, and cable ties from the equipment area.

1.4 Mechanical Safety

 **WARNING**

Ensure that all necessary tools are ready and inspected by a professional organization. Do not use tools that have signs of scratches or fail to pass the inspection or whose inspection validity period has expired. Ensure that the tools are secure and not overloaded.

 **WARNING**

Do not drill holes into the equipment. Doing so may affect the sealing performance and electromagnetic containment of the equipment and damage components or cables inside. Metal shavings from drilling may short-circuit boards inside the equipment.

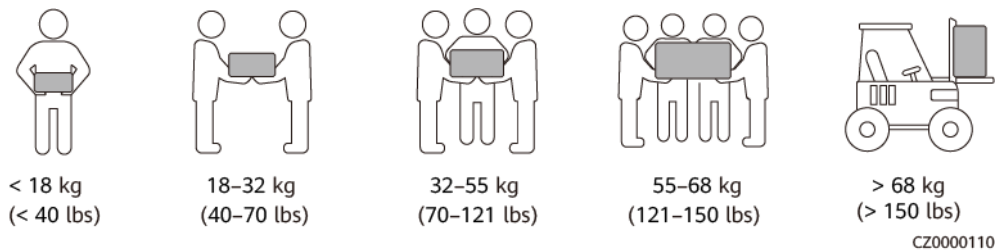
General Requirements

- Repaint any paint scratches caused during equipment transportation or installation in a timely manner. Equipment with scratches cannot be exposed for an extended period of time.

- Do not perform operations such as arc welding and cutting on the equipment without evaluation by the Company.
- Do not install other devices on the top of the equipment without evaluation by the Company.
- When performing operations over the top of the equipment, take measures to protect the equipment against damage.
- Use correct tools and operate them in the correct way.

Moving Heavy Objects

- Be cautious to prevent injury when moving heavy objects.



- If multiple persons need to move a heavy object together, determine the manpower and work division with consideration of height and other conditions to ensure that the weight is equally distributed.
- If two persons or more move a heavy object together, ensure that the object is lifted and landed simultaneously and moved at a uniform pace under the supervision of one person.
- Wear personal protective gears such as protective gloves and shoes when manually moving the equipment.
- To move an object by hand, approach to the object, squat down, and then lift the object gently and stably by the force of the legs instead of your back. Do not lift it suddenly or turn your body around.
- Do not quickly lift a heavy object above your waist. Place the object on a workbench that is half-waist high or any other appropriate place, adjust the positions of your palms, and then lift it.
- Move a heavy object stably with balanced force at an even and low speed. Put down the object stably and slowly to prevent any collision or drop from scratching the surface of the equipment or damaging the components and cables.
- When moving a heavy object, be aware of the workbench, slope, staircase, and slippery places. When moving a heavy object through a door, ensure that the door is wide enough to move the object and avoid bumping or injury.
- When transferring a heavy object, move your feet instead of turning your waist around. When lifting and transferring a heavy object, ensure that your feet point to the target direction of movement.
- When transporting the equipment using a pallet truck or forklift, ensure that the tynes are properly positioned so that the equipment does not topple. Before moving the equipment, secure it to the pallet truck or forklift using ropes. When moving the equipment, assign dedicated personnel to take care of it.
- Choose sea or roads in good conditions for transportation as transportation by railway or air is not supported. Avoid tilt or jolt during transportation.

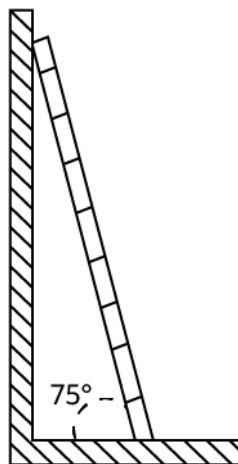
Using Ladders

- Use wooden or insulated ladders when you need to perform live-line working at heights.
- Platform ladders with protective rails are preferred. Single ladders are not recommended.
- Before using a ladder, check that it is intact and confirm its load bearing capacity. Do not overload it.
- Ensure that the ladder is securely positioned and held firm.



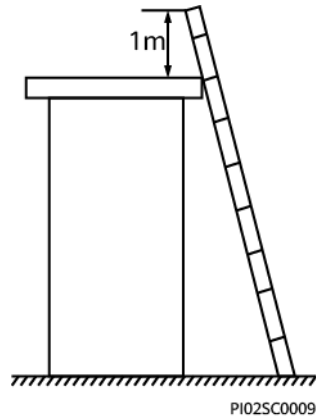
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- When climbing up the ladder, keep your body stable and your center of gravity between the side rails, and do not overreach to the sides.
- When a step ladder is used, ensure that the pull ropes are secured.
- If a single ladder is used, the recommended angle for the ladder against the floor is 75 degrees, as shown in the following figure. A square can be used to measure the angle.



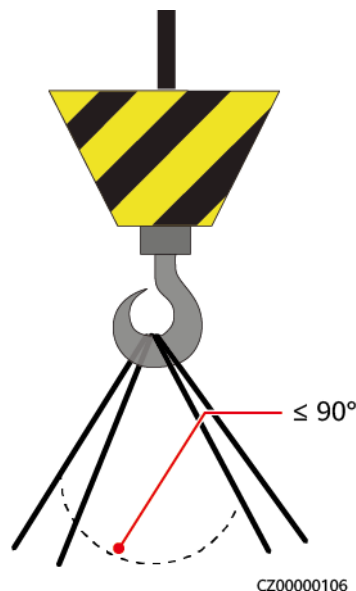
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- If a single ladder is used, ensure that the wider end of the ladder is at the bottom, and take protective measures to prevent the ladder from sliding.
- If a single ladder is used, do not climb higher than the fourth rung of the ladder from the top.
- If you use a single ladder to climb up to a platform, ensure that the ladder is at least 1 m higher than the platform.



Hoisting

- Only trained and qualified personnel are allowed to perform hoisting operations.
- Install temporary warning signs or fences to isolate the hoisting area.
- Ensure that the foundation where hoisting is performed on meets the load-bearing requirements.
- Before hoisting objects, ensure that hoisting tools are firmly secured onto a fixed object or wall that meets the load-bearing requirements.
- During hoisting, do not stand or walk under the crane or the hoisted objects.
- Do not drag steel ropes and hoisting tools or bump the hoisted objects against hard objects during hoisting.
- Ensure that the angle between two hoisting ropes is no more than 90 degrees, as shown in the following figure.



Drilling Holes

- Obtain consent from the customer and contractor before drilling holes.
- Wear protective equipment such as safety goggles and protective gloves when drilling holes.

- To avoid short circuits or other risks, do not drill holes into buried pipes or cables.
- When drilling holes, protect the equipment from shavings. After drilling, clean up any shavings.

2 Product Introduction

2.1 Overview

Function

The Smart Solar Inverter-(5KTL, 6KTL)-L0 is a single-phase grid-tied string inverter that converts the DC power generated by PV strings into AC power and feeds the electricity into the power grid.

Model

This document involves the following product models:

- Smart Solar Inverter-5KTL-L0
- Smart Solar Inverter-6KTL-L0

Figure 2-1 Model identifier (using Smart Solar Inverter-5KTL-L0 as an example)

Smart Solar Inverter-5KTL-L0

1 2 3 4

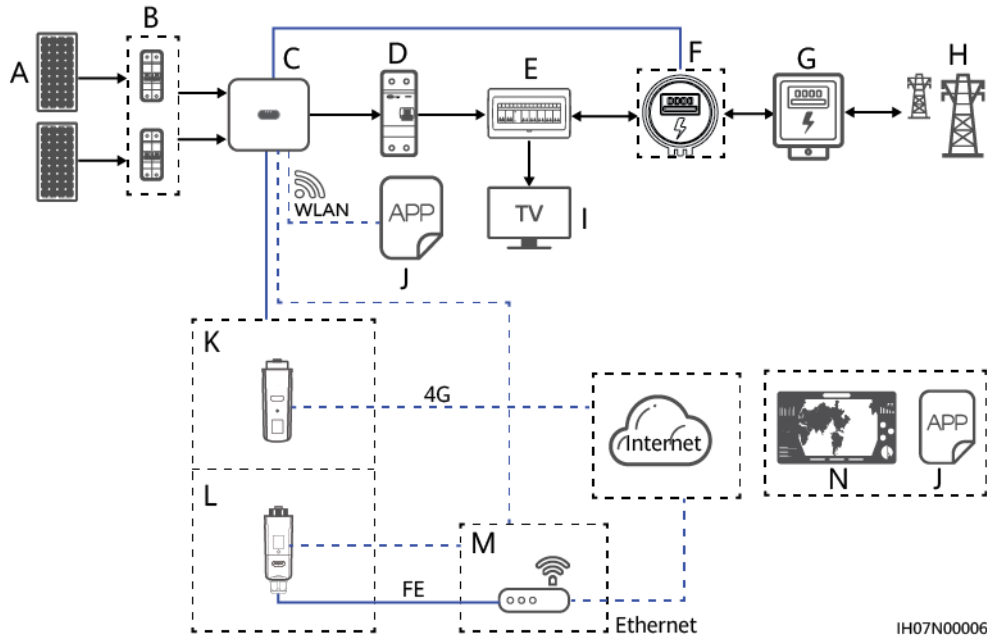
Table 2-1 Identifier description

No.	Meaning	Value
1	Product family name	Inverter: grid-tied solar inverter
2	Power level	<ul style="list-style-type: none">• 5K: The power level is 5 kW.• 6K: The power level is 6 kW.
3	Topology	TL: transformerless
4	Design code	L0: residential

Networking Application

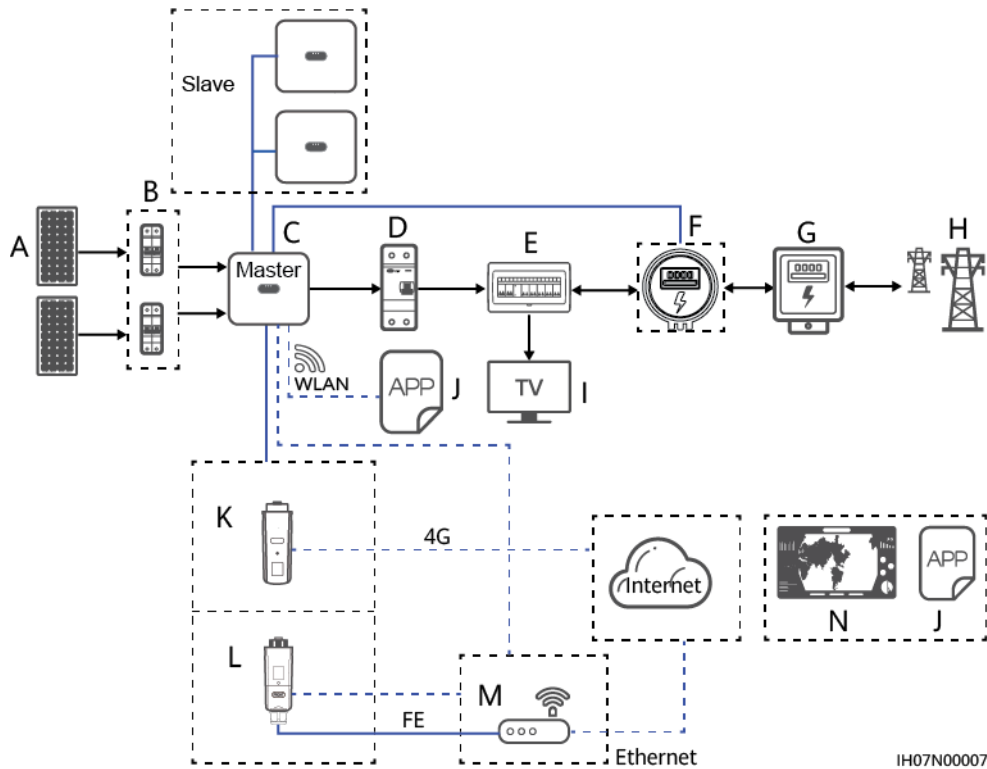
The inverter applies to residential rooftop grid-tied systems. The system consists of PV strings, grid-tied solar inverters, AC switches, and power distribution units (PDUs).

Figure 2-2 Single inverter scenario (dashed boxes indicate optional configuration)



IH07N00006

Figure 2-3 Inverter cascading scenario (dashed boxes indicate optional configuration)



IH07N00007

NOTE

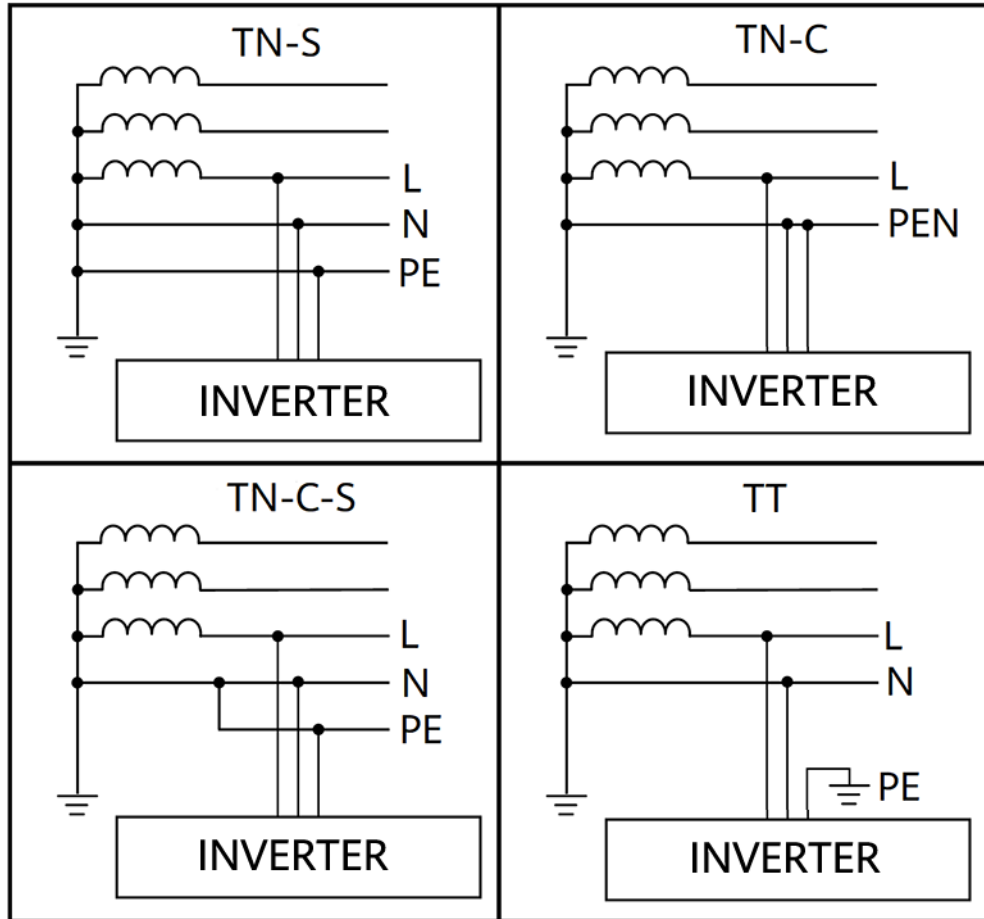
- ➔ indicates the power flow direction, — indicates the signal line, and indicates the wireless communication.
- In the inverter cascading scenario, the master and slave solar inverters are both Smart Solar Inverter-(5KTL, 6KTL)-L0, and a maximum of three inverters can be cascaded.
- In the inverter cascading scenario, only one smart power sensor (G in the figure) can be connected to the master inverter.
- In the inverter cascading scenario, the inverters connected to the power grid must meet the local power grid requirements.
- Smart PV Inverter-(5KTL, 6KTL)-L0 cannot connect to the SmartLogger, energy storage systems, or optimizers.
- Smart PV Inverter-(5KTL, 6KTL)-L0 does not support the off-grid mode.

(A) PV string	(B) DC switch	(C) Inverter
(D) AC switch	(E) Residential PDU	(F) Smart Power Sensor
(G) Residential power meter	(H) Power grid	(I) Household load
(J) FusionSolar app	(K) 4G Smart Dongle	(L) WLAN-FE Smart Dongle
(M) Router	(N) FusionSolar Smart PV Management System	

Supported Power Grid Types

The inverter supports the following power grid types: TN-S, TN-C, TN-C-S, and TT. In the TT power grid, the N-to-PE voltage must be less than 30 V.

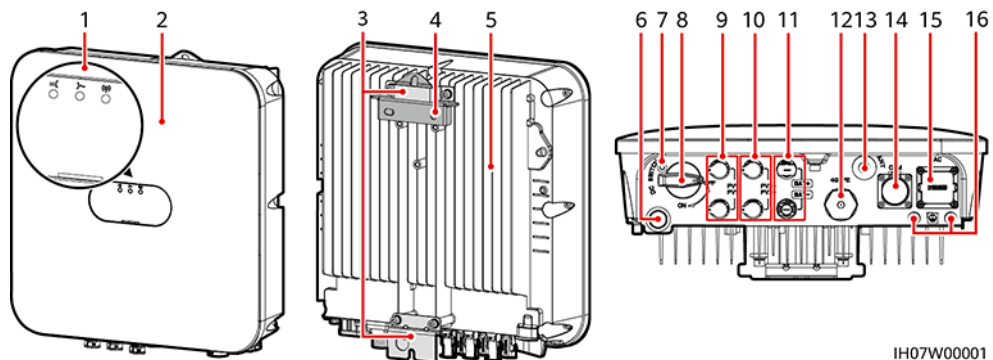
Figure 2-4 Power grid types



2.2 Component Description

Appearance

Figure 2-5 Appearance



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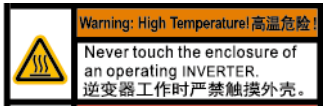
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|---|--|
| (1) LED indicators | (2) Front panel |
| (3) Hanging kit | (4) Mounting bracket |
| (5) Heat sink | (6) Ventilation valve |
| (7) DC switch locking screw hole ^a | (8) DC switch ^b (DC SWITCH) |
| (9) DC input terminals (PV1+/PV1-) | (10) DC input terminals (PV2+/PV2-) |
| (11) Reserved | (12) Smart Dongle port (4G/FE) |
| (13) Antenna port (ANT) | (14) Communications port (COM) |
| (15) AC output port (AC) | (16) Ground point |








 NOTE


- Note a: The DC switch locking screw is used to lock the DC switch to prevent accidental startup. It is delivered with the inverter.
- Note b: DC input terminals PV1 and PV2 are controlled by the DC switch.

2.3 Label Description

2.3.1 Enclosure Labels

Symbol	Name	Description
	Delay discharge	Residual voltage exists after the inverter is powered off. It takes 5 minutes for the inverter to discharge to the safe voltage.
	Burn warning	Do not touch a running inverter because it generates high temperatures on the shell.

Symbol	Name	Description
 <p>Danger: Electrical Hazard! 有电危险! Only certified professionals are allowed to install and operate the INVERTER. 仅有资质的专业人员才可进行逆变器的安装和操作。 High touch current, earth connection essential before connecting supply. 大接触电流! 接通电源前须先接地。</p>	Electric shock warning	<ul style="list-style-type: none"> High voltage exists after the inverter is powered on. Only qualified and trained electrical technicians are allowed to perform operations on the inverter. High touch current exists after the inverter is powered on. Before powering on the inverter, ensure that the inverter is properly grounded.
 <p>CAUTION Read instructions carefully before performing any operation on the INVERTER. 对逆变器进行任何操作前, 请仔细阅读说明书!</p>	Refer to documentation	Reminds operators to refer to the documents delivered with the inverter.
	Grounding label	Indicates the position for connecting the PE cable.
 <p>Do not disconnect under load! 禁止带负荷断开连接!</p>	Operation warning	Do not remove the DC input connector or AC output connector when the inverter is running.
 <p>WARNING High touch current, earth connection essential before connecting supply. 大接触电流! 接通电源前须先接地。</p>	Grounding warning	Ground the inverter before powering it on.
 <p>(1P)PN/ITEM:XXXXXXXX Y (32P)Model: XXXXXXXX (S)SN:XXXXXXXXXXXXX MADE IN CHINA</p>	Inverter serial number	Indicates the serial number.
 <p>MAC: xxxxxxxxxxxx</p>	Inverter MAC address	Indicates the MAC address.

Symbol	Name	Description
	Inverter Wi-Fi login QR code	Scan the QR code to connect to the Huawei inverter Wi-Fi network.

2.3.2 Product Nameplate

Figure 2-6 Nameplate (using Smart Solar Inverter-5KTL-L0 as an example)



(1) Trademark and product model

(2) Key technical parameters

(3) Certification marks

(4) Company name and country of origin

NOTE

The nameplate figure is for reference only.

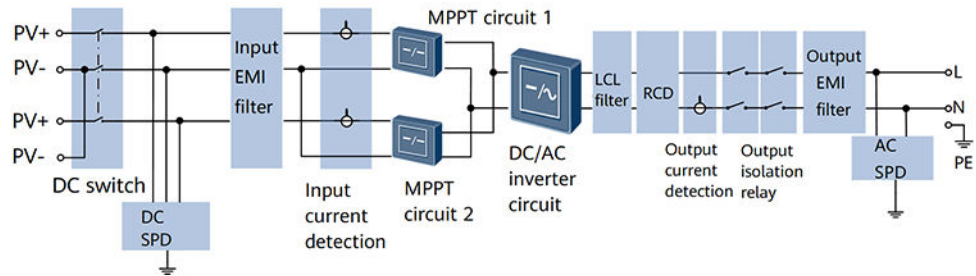
2.4 Working Principles

Schematic Diagram

The inverter receives inputs from up to two PV strings. Then the inputs are grouped into two MPPT routes inside the inverter to track the maximum power

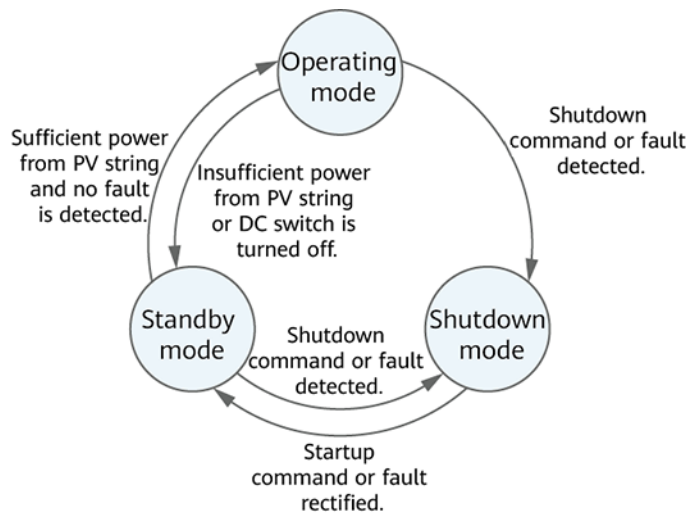
point of the PV strings. The DC power is then converted into single-phase AC power through an inverter circuit. Surge protection is supported on both the DC and AC sides.

Figure 2-7 Schematic diagram



Working Mode

Figure 2-8 Working modes



IS07500001

Table 2-2 Working mode description

Working mode	Description
Standby mode	<p>The inverter enters Standby mode when the external environment does not meet the requirements for starting the inverter. In Standby mode:</p> <ul style="list-style-type: none"> The inverter continuously detects its operation status. Once the operating conditions are met, the inverter enters Operating mode. If the inverter detects a shutdown command or a fault after startup, it enters Shutdown mode.

Working mode	Description
Operating mode	In Operating mode: <ul style="list-style-type: none">• The inverter converts DC power from PV strings into AC power and feeds the power to the power grid.• The inverter tracks the maximum power point to maximize the PV string output power.• If the inverter detects a shutdown command or a fault, it enters Shutdown mode.• If the inverter detects that the output power of PV strings does not meet the requirements for grid-tied power generation, it enters Standby mode.
Shutdown mode	<ul style="list-style-type: none">• In Standby or Operating mode, if the inverter detects a shutdown command or a fault, it enters Shutdown mode.• In Shutdown mode, if the inverter detects that the fault is rectified or the startup command is executed, the inverter enters Standby mode.

3 Inverter Storage

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

- Do not unpack the inverter.
- Keep the storage temperature at -40°C to $+70^{\circ}\text{C}$ and the humidity at 5%–95% RH.
- The product should be stored in a clean and dry place and be protected from dust and water vapor corrosion.
- A maximum of eight inverters can be stacked. To avoid personal injury or device damage, stack inverters with caution to prevent them from falling over.
- During the storage period, check the inverter periodically. (It is recommended that the check is performed every three months.) Replace the packing materials that are damaged by insects or rodents in a timely manner.
- If the inverter has been stored for more than two years, it must be checked and tested by professionals before being put into use.

4 System 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 requested, do not unpack the package and contact your supplier as soon as possible.

 **NOTE**

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

Package Contents

NOTICE

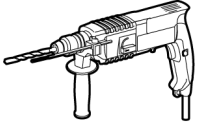
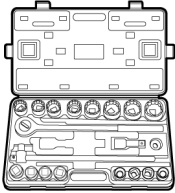
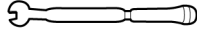
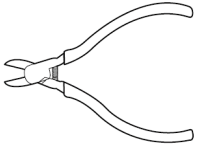
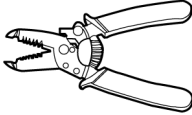
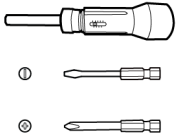

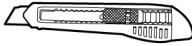

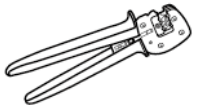
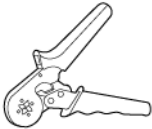




- After placing the equipment in the installation position, unpack it with care to prevent scratches. Keep the equipment stable during unpacking.

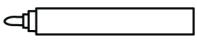
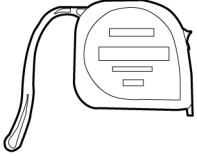

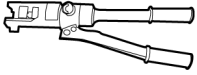
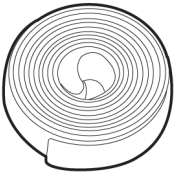
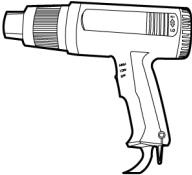





After unpacking the inverter, check that the contents are intact and complete. If any damage is found or any component is missing, contact your supplier.

 **NOTE**

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

4.2 Preparing Tools and Instruments

Type	Tools and Instruments		
Installation			
	Hammer drill (with a drill bit of 8 mm)	Torque socket wrench	Torque wrench
			
	Diagonal pliers	Wire strippers	Torque screwdriver
			
	Rubber mallet	Utility knife	Cable cutter
			
Crimping tool (model: PV-CZM-22100/19100)	Cord end terminal crimper	Disassembly and Assembly Tool (model: PV-MS-HZ open-end wrench)	
			
Cable tie	Vacuum cleaner	Multimeter (DC voltage measurement range ≥ 600 V DC)	

Type	Tools and Instruments		
	 Marker	 Steel measuring tape	 Level
	 Hydraulic pliers	 Heat-shrink tubing	 Heat gun
Personal protective equipment (PPE)	 Insulated gloves	 Protective gloves	 Dust mask
	 Safety boots	 Safety goggles	-

4.3 Determining the Installation Position

Basic Requirements

- The inverter is protected to IP65 and can be installed indoors or outdoors.
- Do not install the inverter in a place where personnel are easy to come into contact with its enclosure and heat sink, because these parts are extremely hot during operation.
- Do not install the inverter near flammable or explosive materials.
- Do not install the inverter at a place within children's reach.
- The inverter will be corroded in salt areas, and the salt corrosion may cause fire. Do not install the inverter outdoors in salt areas. A salt area refers to the region within 500 meters from the coast or prone to sea breeze. The regions

prone to sea breeze vary with weather conditions (such as typhoons and monsoons) or terrains (such as dams and hills).

Installation Environment Requirements

- The inverter must be installed in a well-ventilated environment to ensure good heat dissipation.
- When the inverter is installed under direct sunlight, the power may be derated due to the temperature rise.
- You are advised to install the inverter in a sheltered place or install an awning over it.

Mounting Structure Requirements

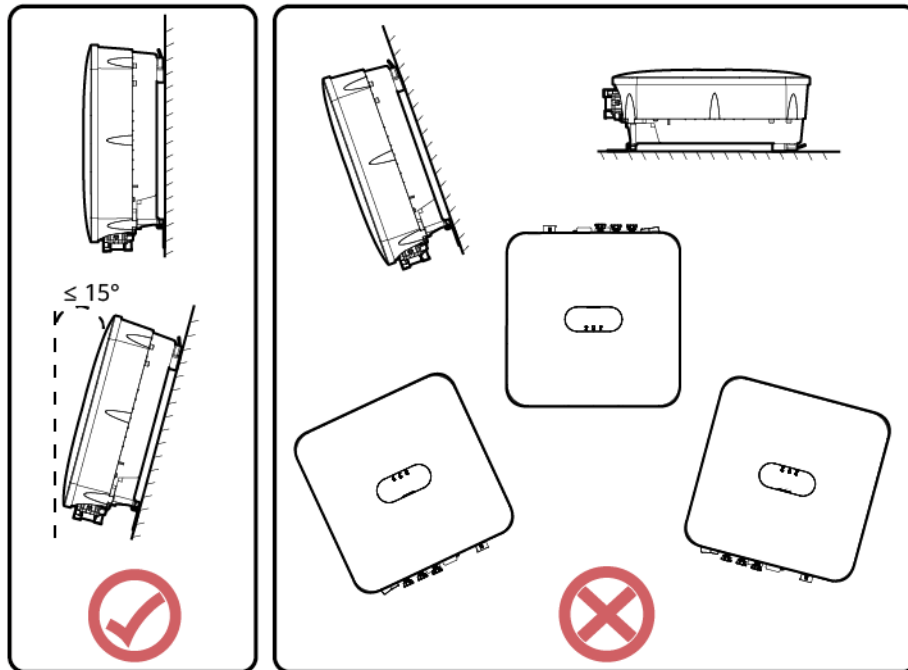
- The mounting structure where the inverter is installed must be fire resistant.
- Do not install the inverter on flammable building materials.
- Ensure that the installation surface is solid enough to bear the weight of the inverter.
- In residential areas, do not install the inverter on plaster board walls or walls made of similar materials with a weak sound insulation performance because the noise generated by the inverter may interfere with residents.

Installation Angle Requirements

The inverter can be wall-mounted or pole-mounted. The installation angle requirements are as follows:

- Install the inverter vertically or at a maximum back tilt of 15 degrees to facilitate heat dissipation.
- Do not install the inverter at forward tilted, excessive back tilted, side tilted, horizontal, or upside down positions.

Figure 4-1 Installation angle

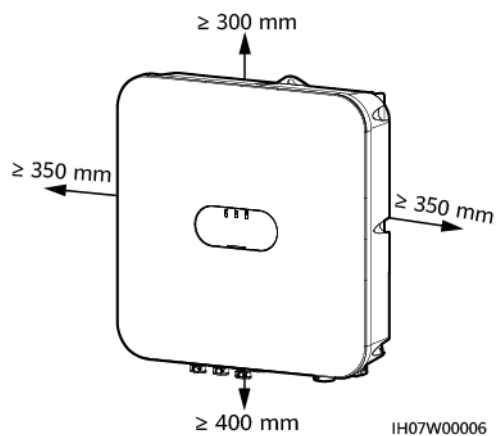


IH07H00004

Installation Space Requirements

- Reserve enough clearance around the inverter to ensure sufficient space for installation and heat dissipation.

Figure 4-2 Installation space



IH07W00006

- When installing multiple inverters, 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 4-3 Horizontal installation mode (recommended)

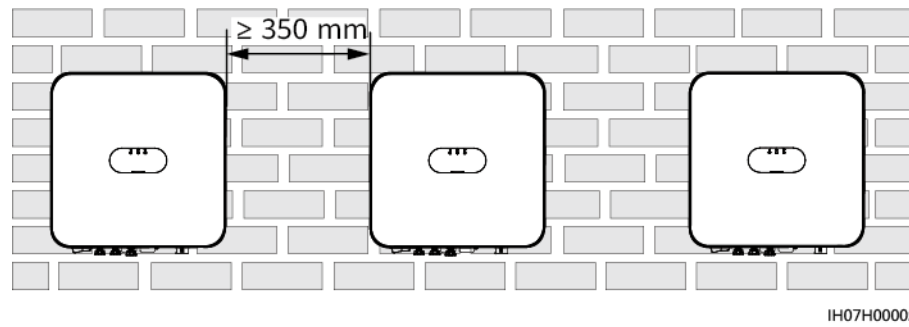


Figure 4-4 Triangle installation mode (recommended)

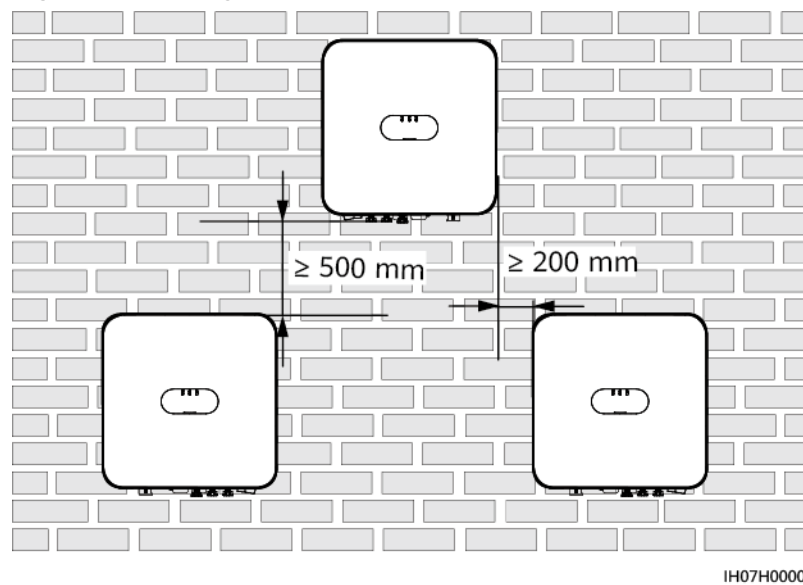
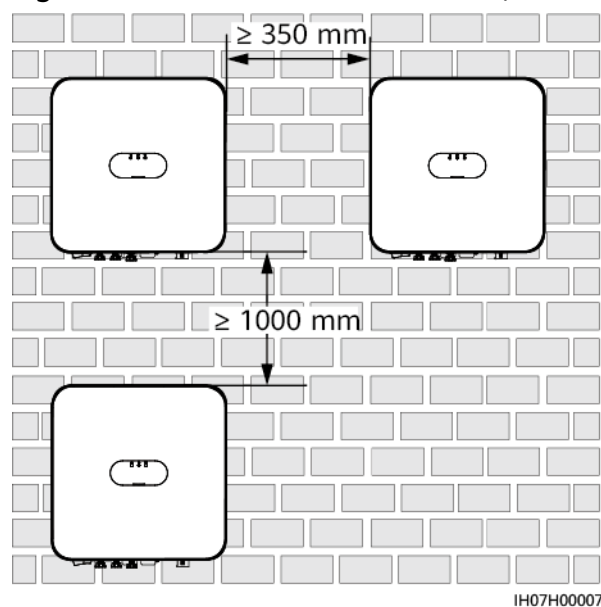


Figure 4-5 Stacked installation mode (not recommended)



 NOTE

The installation figures are for reference only and are irrelevant to the inverter cascading scenario.

4.4 Moving an Inverter

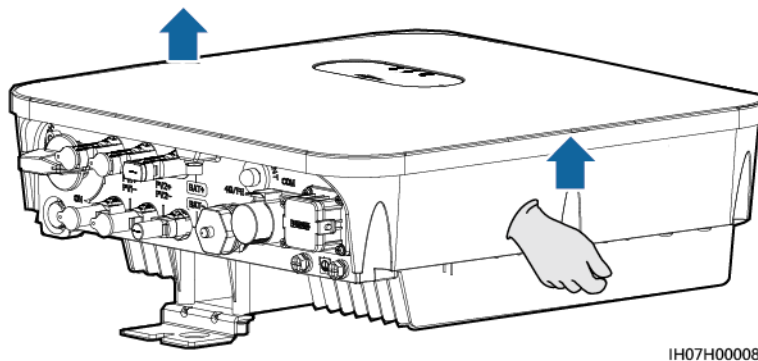
Procedure

- Step 1** Hold the handles on both sides of the inverter, lift the inverter from the packing case, and transport it to the installation position.

 CAUTION

- Move the inverter with care to prevent device damage and personal injury.
 - Do not use the wiring terminals and ports at the bottom to support any weight of the inverter.
 - When you need to temporarily place the inverter on the ground, use foam, paper, or other protection material to prevent damage to its enclosure.
-

Figure 4-6 Moving an inverter



IH07H00008

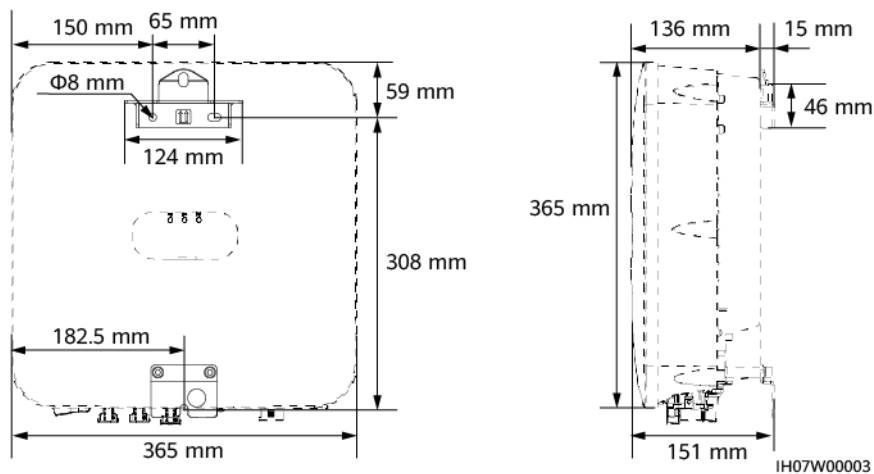
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4.5 Installing an Inverter

Installation Precautions

Figure 4-7 shows the dimensions of mounting holes for the inverter.

Figure 4-7 Mounting bracket dimensions



4.5.1 Wall-Mounted Installation

Procedure

- Step 1** Determine the positions for drilling holes using the marking-off template. Level the positions of mounting holes using a level, and mark the positions with a marker.
- Step 2** Secure the mounting bracket.

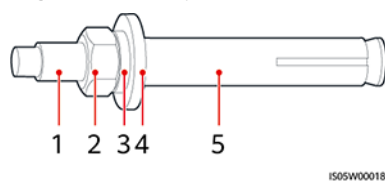
DANGER

When drilling holes, avoid the water pipes and power cables buried in the wall.

NOTE

- M6x60 expansion bolts are delivered with the inverter. If the length and amount of the bolts do not meet installation requirements, prepare M6 stainless steel expansion bolts by yourself.
- The expansion bolts delivered with the inverter are used for solid concrete walls. For other types of walls, prepare bolts by yourself and ensure that the wall meets the load bearing requirements of the inverter.

Figure 4-8 Expansion bolt composition

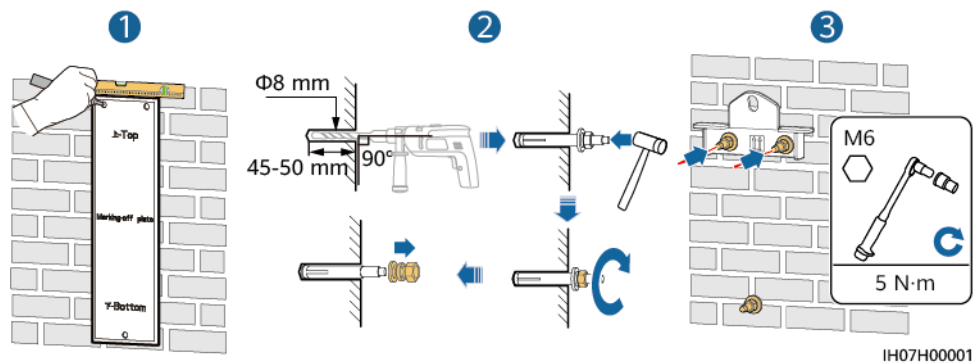


- | | | |
|-----------------|----------------------|-------------------|
| (1) Bolt | (2) Nut | (3) Spring washer |
| (4) Flat washer | (5) Expansion sleeve | |

NOTICE

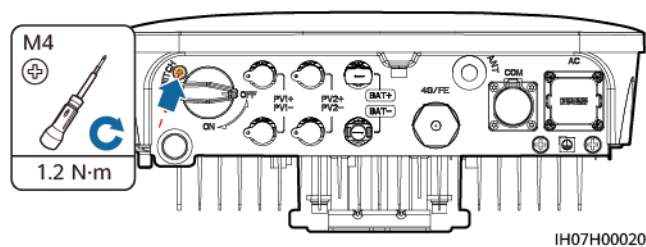
- To prevent dust inhalation or contact with eyes, wear safety goggles and an anti-dust mask when drilling holes.
- Wipe away any dust in or around the holes and measure the hole distances. If the holes are inaccurately positioned, drill holes again.
- Level the head of the expansion sleeve with the concrete wall after removing the nut, spring washer, and flat washer. Otherwise, the mounting bracket will not be securely installed on the wall.
- Loosen the nut, spring washer, and flat washer of the expansion bolt at the bottom.

Figure 4-9 Installing expansion bolts



Step 3 (Optional) Install the locking screw for the DC switch.

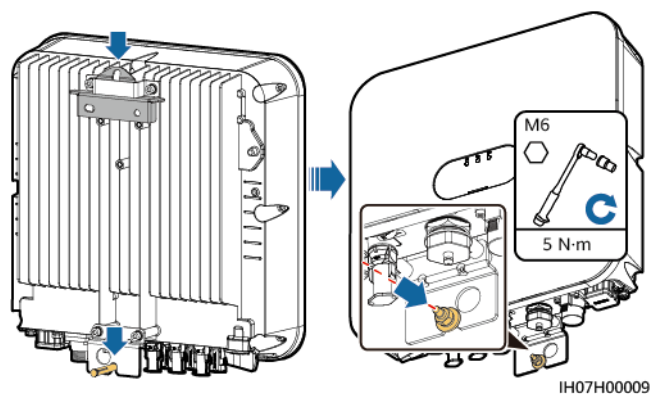
Figure 4-10 Installing a locking screw for the DC switch



Step 4 Install the inverter on the mounting bracket.

Step 5 Tighten the nuts.

Figure 4-11 Tightening nuts

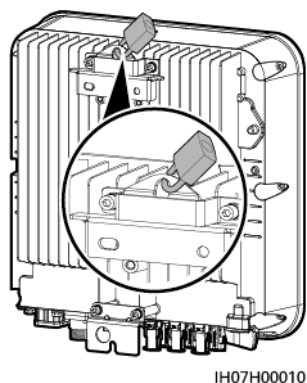


Step 6 (Optional) Install an anti-theft lock.

NOTICE

- Prepare an anti-theft lock suitable for the lock hole diameter ($\Phi 10$ mm).
 - An outdoor waterproof lock is recommended.
 - Keep the key to the anti-theft lock.
-

Figure 4-12 Installing an anti-theft lock



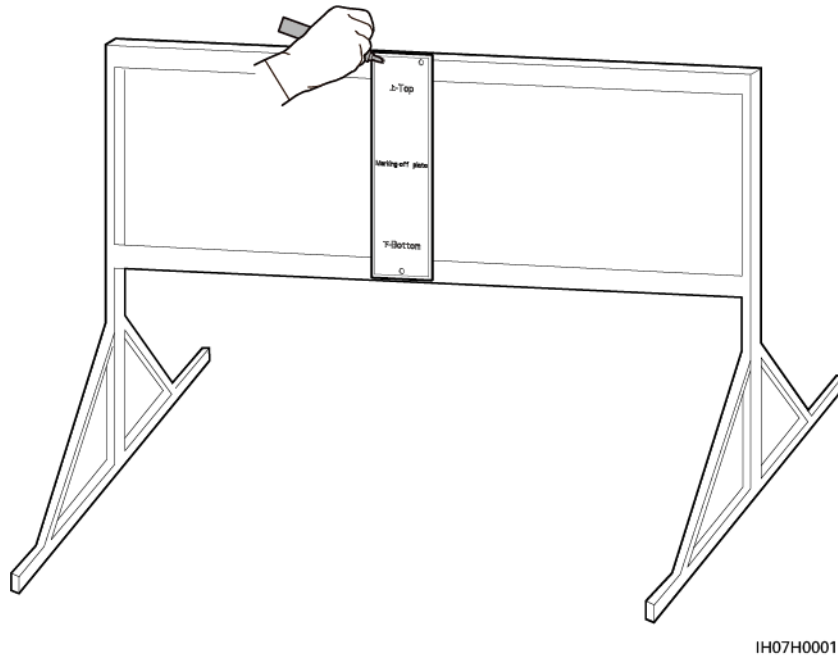
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4.5.2 Support-Mounted Installation

Procedure

Step 1 Determine the positions for drilling holes using the marking-off template, and then mark the positions with a marker.

Figure 4-13 Determining hole positions



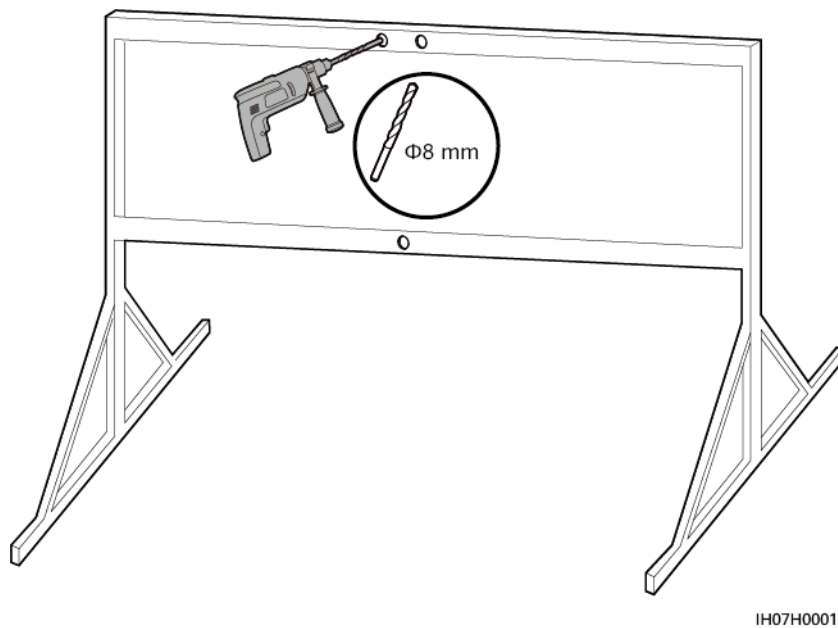
IH07H00011

Step 2 Drill holes using a hammer drill.

NOTE

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

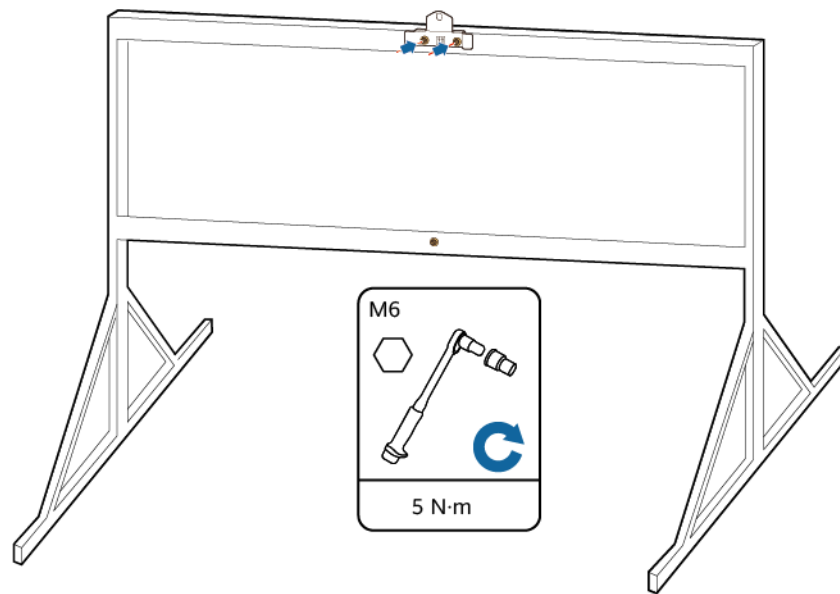
Figure 4-14 Drilling holes



IH07H00012

Step 3 Secure the mounting bracket.

Figure 4-15 Secure the mounting bracket



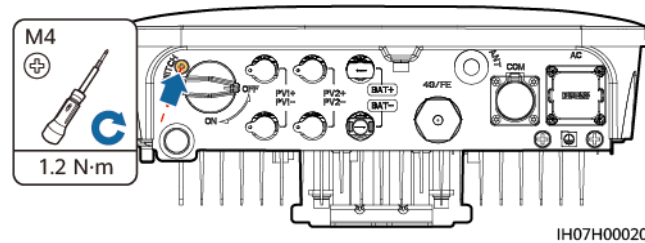
IH07H00013

NOTE

Prepare bolt assemblies based on the hole diameter of the mounting bracket.

Step 4 (Optional) Install the locking screw for the DC switch.

Figure 4-16 Installing a locking screw for the DC switch

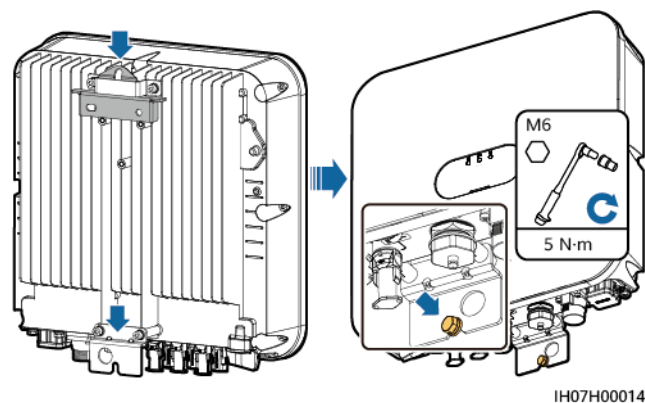


IH07H00020

Step 5 Install the inverter on the mounting bracket.

Step 6 Tighten the bolt assemblies.

Figure 4-17 Tightening bolt assemblies



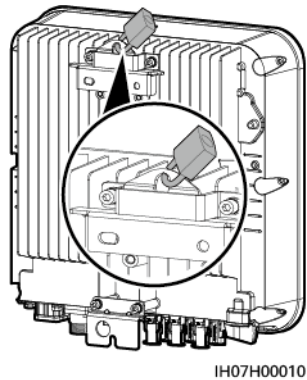
IH07H00014

Step 7 (Optional) Install an anti-theft lock.

NOTICE

- Prepare an anti-theft lock suitable for the lock hole diameter ($\Phi 10$ mm).
 - An outdoor waterproof lock is recommended.
 - Keep the key to the anti-theft lock.
-

Figure 4-18 Installing an anti-theft lock



----End

5 Electrical Connection

5.1 Precautions

 **DANGER**

When exposed to sunlight, the PV arrays supply DC voltage to the SUN2000. 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.

 **DANGER**

- The site must be equipped with qualified fire suppression facilities, such as fire sand and carbon dioxide fire extinguishers.
 - Wear insulated gloves and use insulated tools to prevent electric shocks or short circuits.
-

 **WARNING**

- The equipment damage caused by incorrect cable connections is beyond the warranty scope.
 - Only certified electrician can perform electrical terminations.
 - Wear proper PPE at all time when terminating cables.
 - To prevent poor cable connection due to overstress, it is recommended that the cables be bent and reserved, and then connected to the appropriate ports.
-

CAUTION

- Stay away from the equipment when preparing cables to prevent cable scraps from entering the equipment. Cable scraps may cause sparks and result in personal injury and equipment damage.
- When routing PV cables, the positive and negative PV string cables should be routed in different pipes to prevent cable damage and short circuits caused by improper operations during construction.

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 Cables

Figure 5-1 Inverter cable connections (dashed boxes indicate optional configuration)

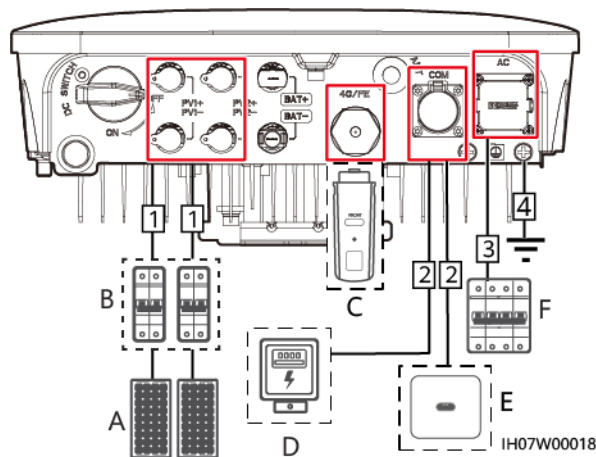


Table 5-1 Component description

No.	Component	Description	Source
A	PV string	The inverter supports the input from two PV strings.	Prepared by the customer
B	DC switch	Recommended: a DC circuit breaker with a rated voltage greater than or equal to 600 V DC and a rated current of 20 A	Prepared by the customer

No.	Component	Description	Source
C	Smart Dongle ^a	Supported models: <ul style="list-style-type: none"> WLAN-FE Smart Dongle: SDongleA-05 4G Smart Dongle: SDongleA-03 	Purchased from manufacturer
D	Smart Power Sensor ^b	The inverter can connect to the DDSU666-H and DTSU666-H smart power sensors.	Purchased from Manufacturer
		The following third-party meters are also supported: GAVAZZI-EM340-DIN AV2 3 X S1 X08, GAVAZZI-EM111-DIN AV8 1 X S1 X08, GAVAZZI-EM112-DIN AV0 1 X S1 X08, CCS-WNC-3Y-400-MB, CCS-WNC-3D-240-MB, and Chint DDSU666. The GAVAZZI three-phase meter has different power sampling methods. As a result, the power is incorrectly displayed on the NMS.	Prepared by the customer
E	Inverter	Select a proper model as required.	Purchased from manufacturer
F	AC switch	Recommended: a single-phase AC circuit breaker with a rated voltage greater than or equal to 250 V AC and a rated current of: <ul style="list-style-type: none"> 32 A (Smart Solar Inverter-5KTL-L0, and Smart Solar inverter-6KTL-L0) 	Prepared by the customer

Table 5-2 Cable description

No.	Cable	Type	Recommended Specifications	Source
1	DC input power cable	Common outdoor PV cable in the industry	<ul style="list-style-type: none"> Conductor cross-sectional area: 4–6 mm² Cable outer diameter: 5.5–9 mm 	Prepared by the customer
2	(Optional) Signal cable	Outdoor shielded twisted pair cable	<ul style="list-style-type: none"> Conductor cross-sectional area: <ul style="list-style-type: none"> – Combined crimping of cables on the port: 0.20–0.35 mm² – Crimping the cables on the port without combining them: 0.20–1 mm² Cable outer diameter: <ul style="list-style-type: none"> – 4-hole rubber plug: 4–8 mm – 2-hole rubber plug: 8–11 mm 	Prepared by the customer
3	AC output power cable ^a	<ul style="list-style-type: none"> Not using the PE equipotential point at the AC output port: two-core (L and N) outdoor copper cable Using the PE equipotential point at the AC output port: three-core (L, N, and PE) outdoor copper cable 	<ul style="list-style-type: none"> Conductor cross-sectional area: 4–6 mm² Cable outer diameter: 10–21 mm 	Prepared by the customer
4	PE cable	Single-core outdoor copper cable and M6 OT terminal	4–10 mm ²	Prepared by the customer
<p>Note a: The minimum cross-sectional area of the cable should be selected based on the rated value of the AC fuse.</p>				

 NOTE

- The minimum cable diameter must comply with local cable standards.
- The factors that affect cable selection include the rated current, cable type, routing mode, ambient temperature, and maximum expected line loss.

5.3 Connecting PE Cables

Precautions

 **DANGER**

- Ensure that the PE cable is securely connected. Otherwise, electric shocks may occur.
- Do not connect the neutral wire to the enclosure as a PE cable. Otherwise, electric shocks may occur.

 NOTE

- The PE point at the AC output port is used only as a PE equipotential point, and cannot substitute for the PE point on the enclosure.
- It is recommended that silica gel or paint be used around the ground terminal after the PE cable is connected.

Additional Information

The inverter provides the grounding detection function. This function is used to check whether the inverter is properly grounded before the inverter starts, or check whether the ground cable is disconnected when the inverter is running. This function is only available under limited conditions. To ensure the safe operation of the inverter, properly ground the inverter according to the connection requirements of the ground cable. For some power grid types, if the output side of the inverter is connected to an isolation transformer, ensure that the inverter is properly grounded and set **Grounding inspection** to **Disable** to enable the inverter to run properly. If you are not sure whether the inverter is connected to such a type of power grid, contact your dealer.

- According to IEC 62109, to ensure the safe operation of the inverter in the case of ground cable damage or disconnection, properly connect the ground cable of the inverter and ensure that it meets at least one of the following requirements before the grounding detection function becomes invalid:
 - If the PE terminal is not connected to the AC connector, use a single-core outdoor copper cable with a conductor cross-sectional area of at least 10 mm² as the PE cable on the chassis.
 - Use cables with the same diameter as the AC output power cable and ground the PE terminal on the AC connector and the ground screws on the chassis.
- In some countries and regions, the inverter must have additional ground cables. Use cables with the same diameter as the AC output power cable and

ground the PE terminal on the AC connector and the ground screws on the chassis.

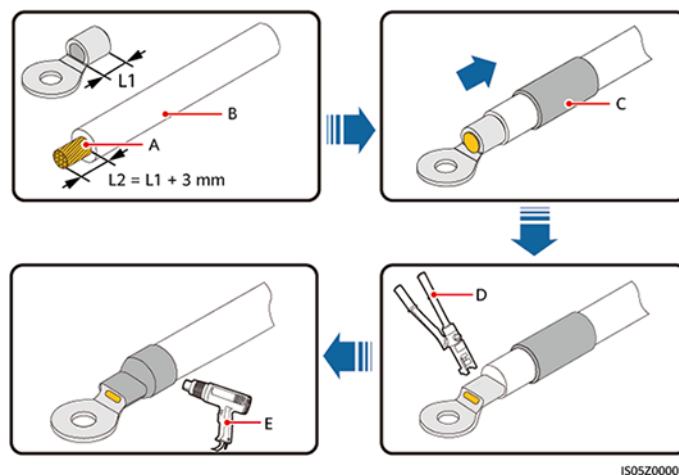
Procedure

Step 1 Crimp an OT terminal.

NOTICE

- Avoid scratching 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 insulation tape. The heat shrink tubing is used as an example.
- When using a heat gun, protect the equipment from being scorched.

Figure 5-2 Crimping an OT terminal



(A) Core wire

(B) Insulation layer

(C) Heat shrink tubing

(D) Hydraulic pliers

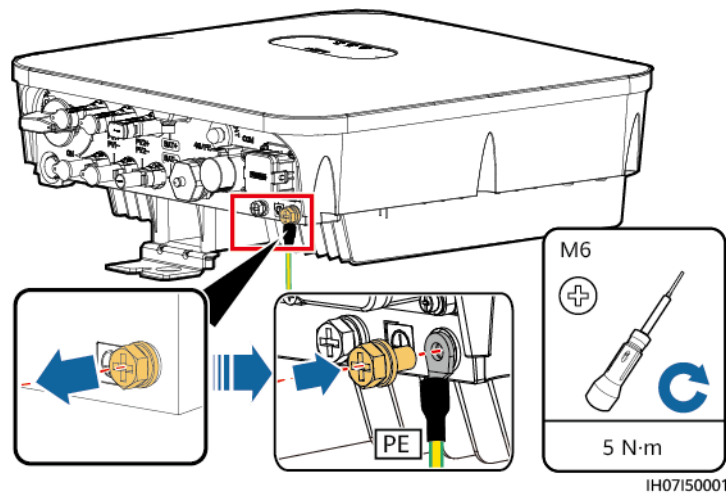
(E) Heat gun

Step 2 Connect the PE cable.

NOTICE

- Ensure that the PE cable is connected securely.
- You are advised to use the right ground point and reserve the other ground point for future use.

Figure 5-3 Connecting a PE cable



----End

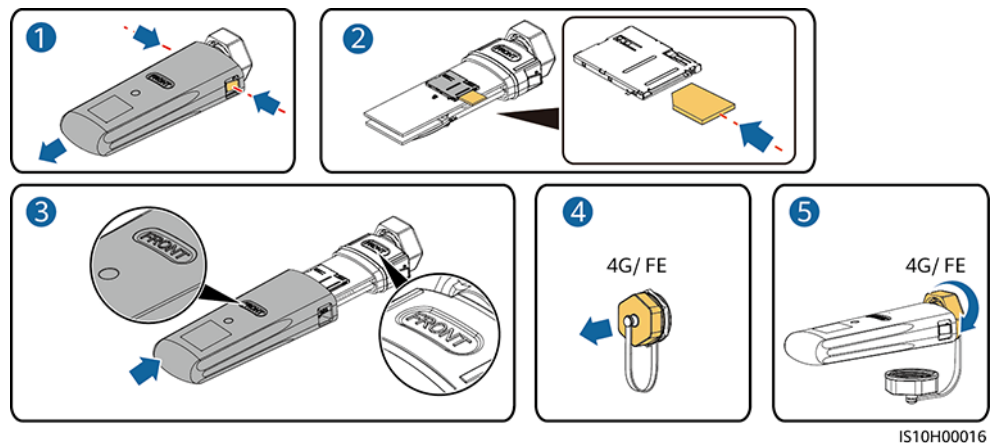
5.4 (Optional) Installing a Smart Dongle

Procedure

NOTE

- You are advised to install the Smart Dongle before installing the WLAN antenna.
- When installing the SIM card, determine its installation direction based on the silk screen and arrow on the card slot.
- Press the SIM card in place to lock it, indicating that the SIM card is correctly installed.
- When removing the SIM card, push it inwards to eject it.
- When reinstalling the cover of the Smart Dongle, ensure that the buckles spring back in place with a click sound.
- 4G Smart Dongle (4G Communication)

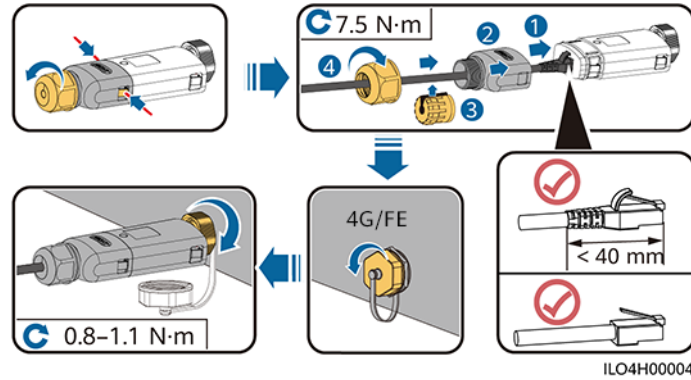
Figure 5-4 Installing a 4G Smart Dongle



- WLAN-FE Smart Dongle (FE Communication)

You are advised to use a CAT 5E outdoor shielded network cable (outer diameter < 9 mm; internal resistance ≤ 1.5 ohms/10 m) and shielded RJ45 connectors.

Figure 5-5 Installing a WLAN-FE Smart Dongle (FE communication)



5.5 Installing a WLAN Antenna

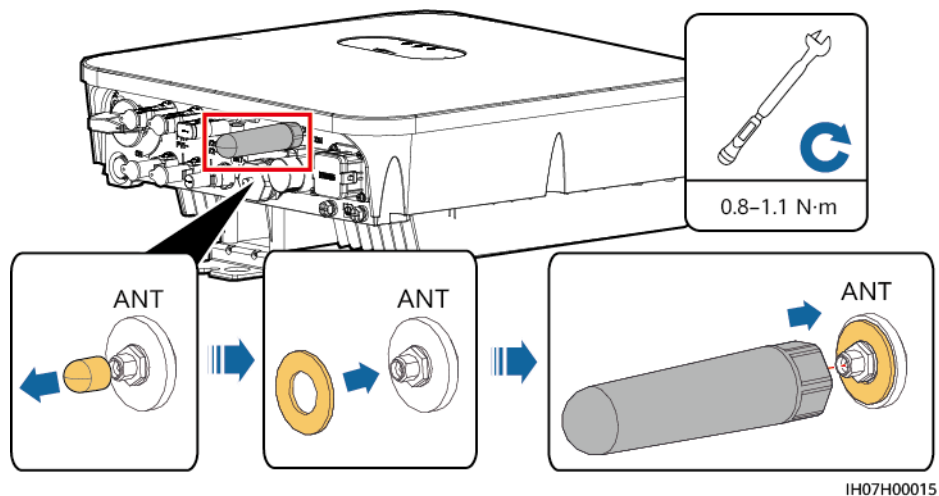
Procedure

- Step 1** Remove the watertight cap from the ANT port.
- Step 2** Install the washer to the ANT port on the chassis.
- Step 3** Install the WLAN antenna.

NOTICE

Ensure that the WLAN antenna is installed securely.

Figure 5-6 Installing a WLAN antenna



----End

5.6 Connecting an AC Output Power Cable

Precautions

An AC switch must be installed on the AC side of the inverter to ensure that the inverter can be safely disconnected from the power grid.

WARNING

- Do not connect loads between an inverter and an AC switch that directly connects to the inverter. Otherwise, the switch may trip by mistake.
- If an AC switch is used with specifications beyond local standards, regulations, or the Company's recommendations, the switch may fail to turn off in a timely manner in case of exceptions, causing serious faults.

CAUTION

Each inverter must be equipped with an AC output switch. Multiple inverters cannot connect to the same AC switch.

The inverter is integrated with a comprehensive residual current monitoring unit. Once detecting that the residual current exceeds the threshold, the inverter immediately disconnects itself from the power grid.

NOTICE

- If the external AC switch can perform earth leakage protection, the rated leakage action current should be greater than or equal to 100 mA.
- If multiple inverters connect to the general residual current device (RCD) through their respective external AC switches, the rated leakage action current of the general RCD should be greater than or equal to the number of inverters multiplied by 100 mA.
- A knife switch cannot be used as an AC switch.

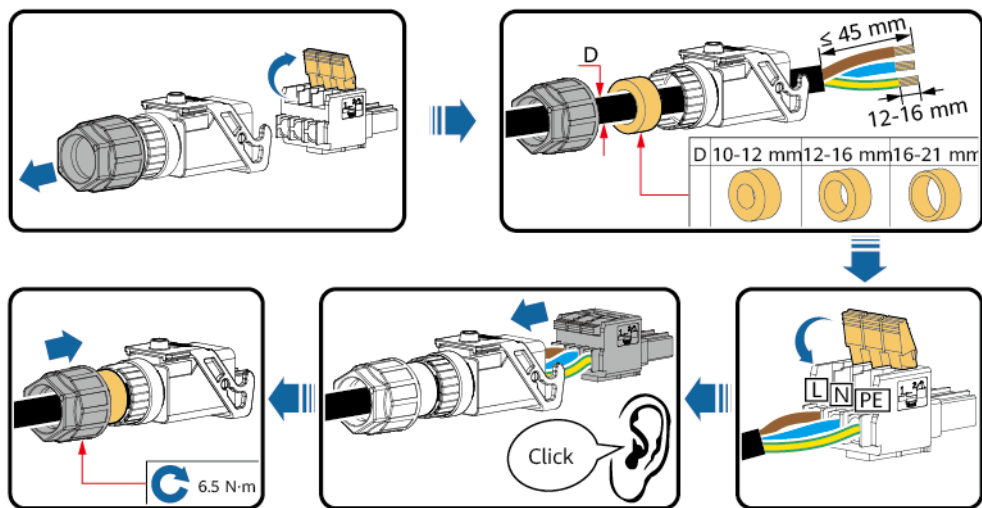
Procedure

- Step 1** Connect the AC output power cable to the AC connector.

NOTICE

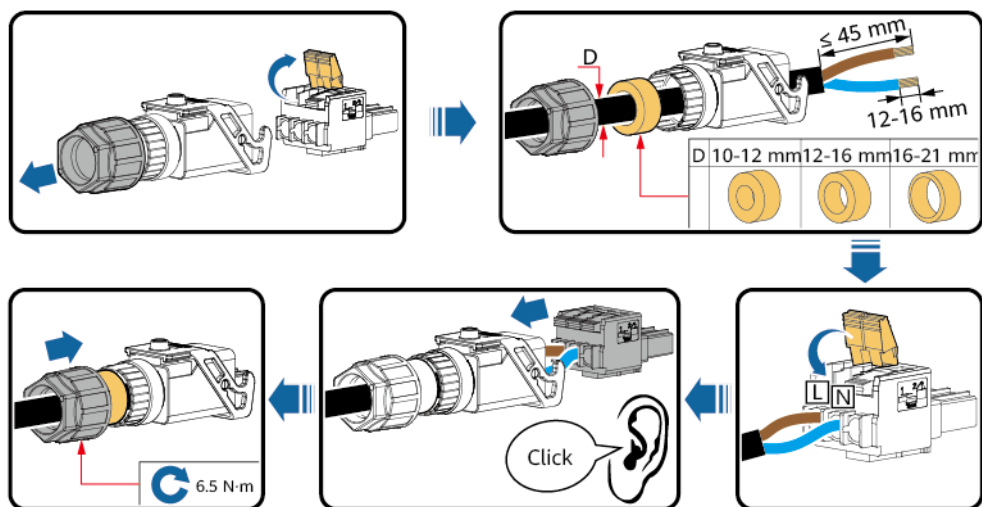
- The PE point at the AC output port is used only as a PE equipotential point, and cannot substitute for the PE point on the enclosure.
- Keep the AC output power cable and the PE cable close to each other.
- Keep the AC output power cable and the DC input power cable close to each other.
- Ensure that the cable jacket is inside the connector.
- Ensure that the exposed core is totally inserted into the cable hole.
- Ensure that AC output cable is secured. Failing to do so may cause inverter malfunction or damage to its AC connector.
- Ensure that the cable is not twisted.

Figure 5-7 Assembling an AC connector (three-core wire)



IH0120002

Figure 5-8 Assembling an AC connector (two-core wire)

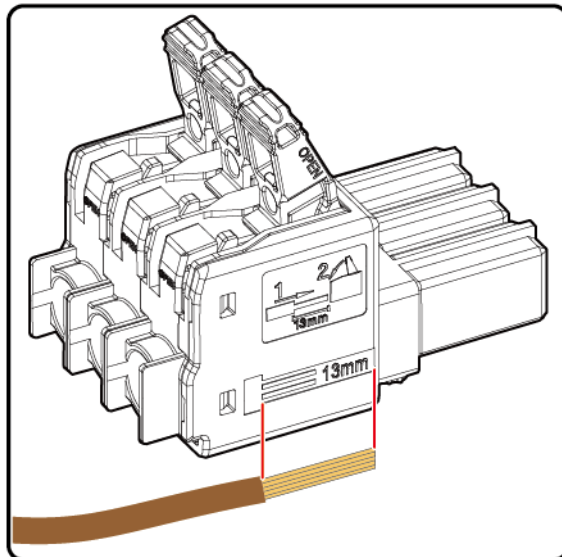


IH0120001

 NOTE

- The cable colors shown in the figures are for reference only. Select an appropriate cable according to the local standards.
- For the core installation method and the length for cable stripping, see the instructions on the side of the plug insert.

Figure 5-9 Length for cable stripping



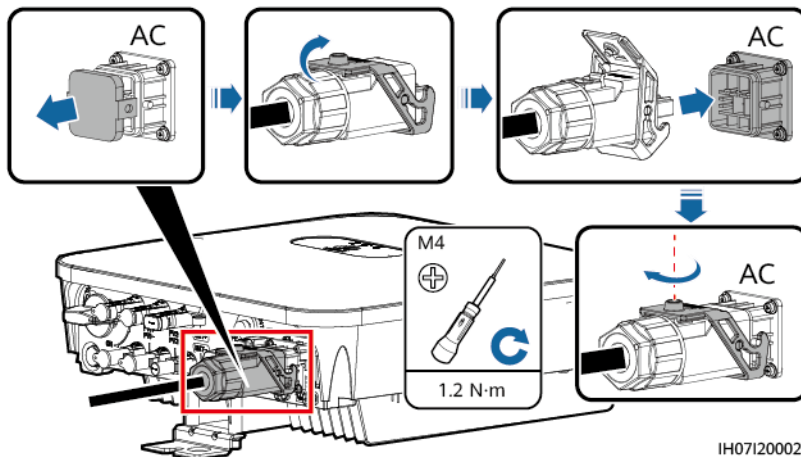
IS05W00036

Step 2 Connect the AC connector to the AC output port.

NOTICE

Ensure that the AC connector is connected securely.

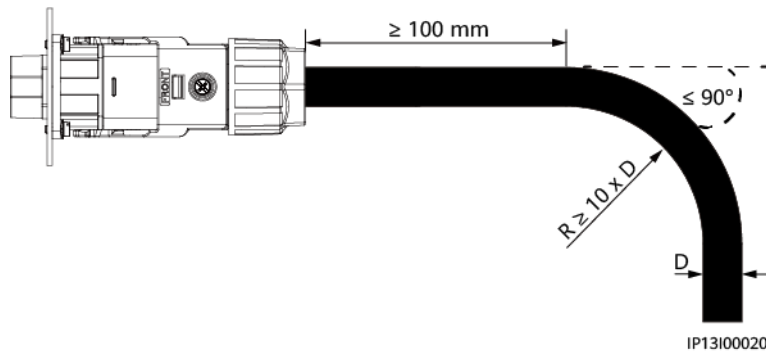
Figure 5-10 Securing an AC connector



IH07120002

Step 3 Check the route of the AC output power cable.

Figure 5-11 Cabling requirements



----End

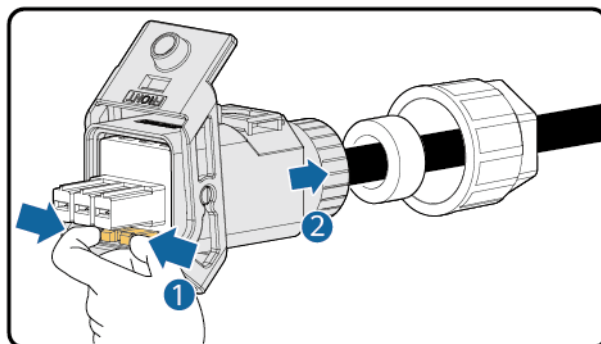
Follow-up Procedure

WARNING

Before removing the AC connector, ensure that the DC switch at the bottom of the inverter and all the switches connected to the inverter are OFF.

To remove the AC connector from the inverter, perform the operations in reverse order.

Figure 5-12 Removing a plug insert



IS05H00031

5.7 Connecting DC Input Power Cables

Precautions

⚠ DANGER

- Before connecting the DC input power cables, ensure that the DC voltage is within the safe range (lower than 60 V DC) and that the DC switch on the inverter is OFF. Failing to do so may result in electric shocks.
- When the inverter is running, it is not allowed to work on the DC input power cables, such as connecting or disconnecting a PV string or a PV module in a PV string. Failing to do so may cause electric shocks.
- If no PV string connects to a DC input terminal of the inverter, do not remove the watertight cap from the DC input terminals. Otherwise, the IP rating of the inverter will be affected.

⚠ WARNING

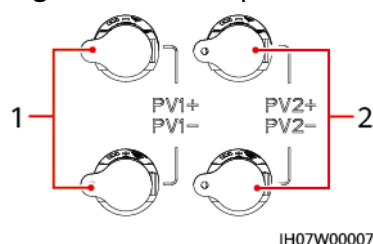
Ensure that the following conditions are met. Otherwise, the inverter may be damaged, or even a fire could happen.

- The DC input voltage of the inverter shall not exceed maximum input voltage under any circumstance.
- The polarities of electric connections are correct on the DC input side. The positive and negative terminals of a PV string connect to corresponding positive and negative DC input terminals of the inverter.
- If the DC input power cables are reversely connected, do not operate the DC switch as well as positive and negative connectors immediately. Wait until the night when solar irradiance declines and the PV string current drops to below 0.5 A. Then set the DC switch to the OFF position, remove the positive and negative connectors, and correct the polarities of the DC input power cables.

NOTICE

- Since the output of the PV string connected to the inverter cannot be grounded, ensure that the PV module output is well insulated to ground.
- During the installation of PV strings and the inverter, the positive or negative terminals of PV strings may be short-circuited to ground if the power cable is not properly installed or routed. In this case, an AC or DC short circuit may occur and damage the inverter. The caused device damage is not covered under any warranty or service agreement.

Figure 5-13 DC input terminals



(1) Terminals of DC input 1

(2) Terminals of DC input 2

Procedure

Step 1 Assemble a DC connector.

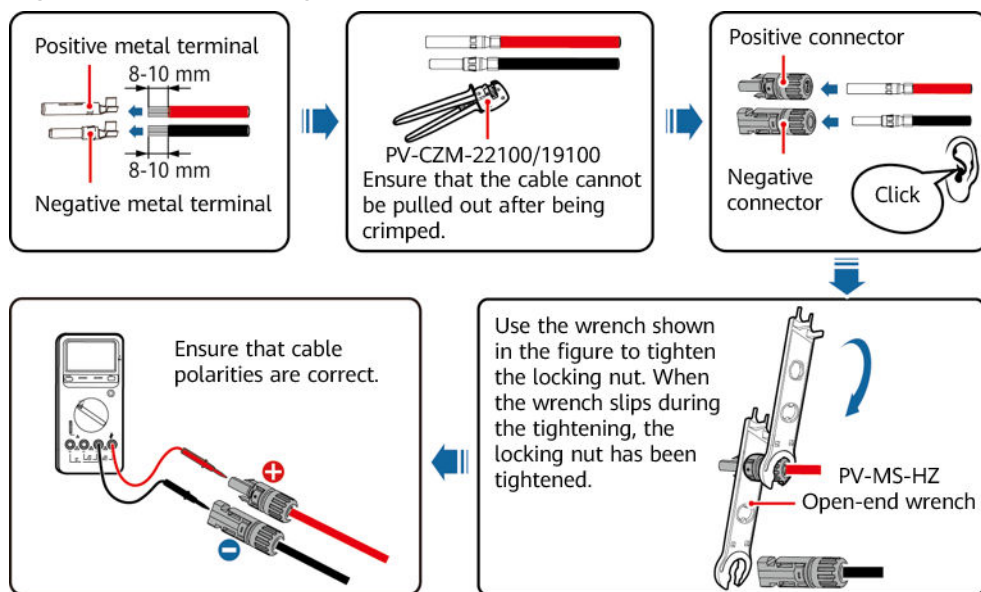
CAUTION

Use the Staubli MC4 positive and negative metal terminals and DC connectors delivered with the inverter. Using incompatible positive and negative metal terminals and DC connectors may result in serious consequences. The caused device damage is not covered under any warranty or service agreement.

NOTICE

- Keep the DC input PV+ cable and PV- cable close to each other.
- Cables with high rigidity, such as armored cables, are not recommended as DC input power cables, because poor contact may be caused by the bending of the cables.
- Before assembling DC connectors, label the cable polarities correctly to ensure correct cable connections.
- After crimping the positive and negative metal terminals, pull the DC input power cables back to ensure that they are connected securely.
- Insert the crimped metal terminals of the positive and negative power cables into the appropriate positive and negative connectors. Then pull back the DC input power cables to ensure that they are connected securely.

Figure 5-14 Assembling a DC connector



IH07130001

 NOTE

Use a multimeter to measure the voltage at the DC position. The multimeter must have a DC voltage range of at least 600 V. If the voltage is a negative value, the DC input polarity is incorrect and needs correction. If the voltage is greater than 600 V, too many PV modules are configured to the same string. Remove some PV modules.

 WARNING

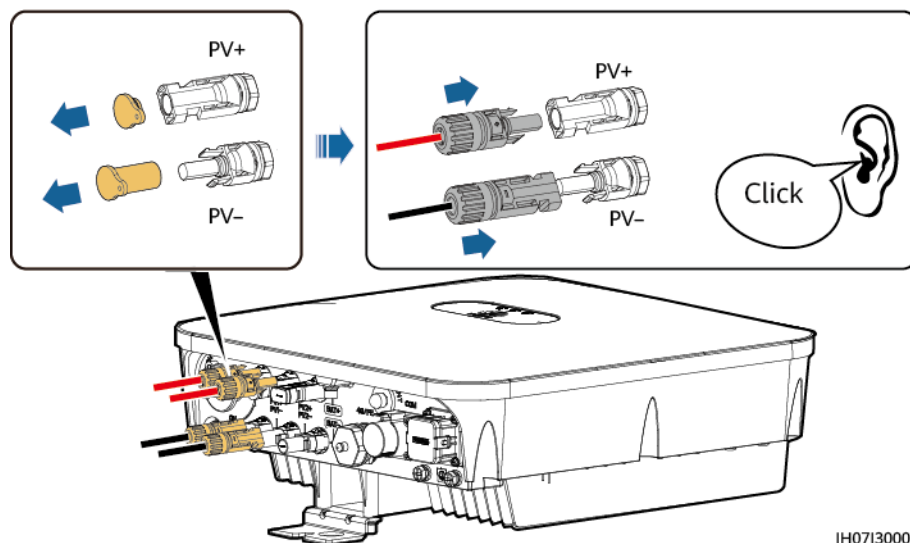
Before performing **Step 2**, ensure that the DC switch is set to OFF.

Step 2 Insert the positive and negative connectors into corresponding DC input terminals on the inverter.

NOTICE

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

Figure 5-15 Connecting DC input power cables



IH07130004

NOTICE

If the DC input power cable is reversely connected and the DC switch is set to ON, do not immediately turn off the DC switch or reconnect the positive and negative connectors. Otherwise, the device may be damaged. The caused device damage is not covered under any warranty or service agreement. Wait until the night when solar irradiance declines and the PV string current drops to below 0.5 A. Then set the DC switch to the OFF position, remove the positive and negative connectors, and correct the polarities of the DC input power cables.

----End

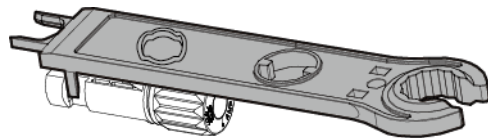
Follow-up Procedure

WARNING

Before removing the positive and negative connectors, ensure that the DC switch is OFF.

To remove the positive and negative connectors from the inverter, insert a disassembly tool into the notch and press the tool with an appropriate force.

Figure 5-16 Removing a DC connector



IH07H00019

5.8 (Optional) Connecting Signal Cables

Context

NOTICE

When laying out signal cables, separate them from power cables and keep them away from strong interference sources to prevent communication interruption.

Figure 5-17 Signal cable ports

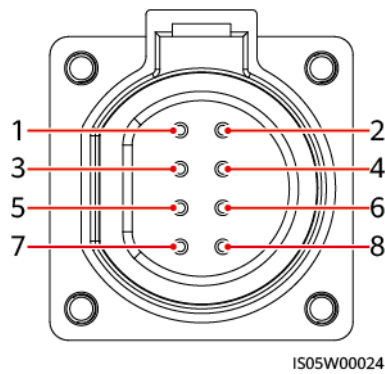


Table 5-3 COM port definition

No.	Label	Definition	Single Inverter Scenario	Inverter Cascading Scenario
1	485B1	RS485B, RS485 differential signal-	N/A	Used for connecting to the solar inverters.
2	485A1	RS485A, RS485 differential signal+		
3	485B2	RS485B, RS485 differential signal-	Connects to the RS485 signal port on the power collector.	Connects to the RS485 signal port on the power collector.
4	485A2	RS485A, RS485 differential signal+		
5	GND	GND of the DI1/DI2	Used for connecting to GND of the DI1/DI2.	
6	N/A	N/A	N/A	
7	DI1	Digital input signal 1+	Used for connecting to the DI1 positive signal. It can be used for connecting to the DRM0 scheduling signal port.	
8	DI2	Digital input signal 2+	Reserved port	

Communication Networking Mode

NOTE

The smart power sensor and Smart Dongle must be connected to the same inverter.

- Single inverter scenarios

Figure 5-18 Single inverter

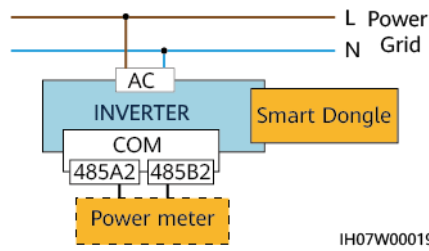
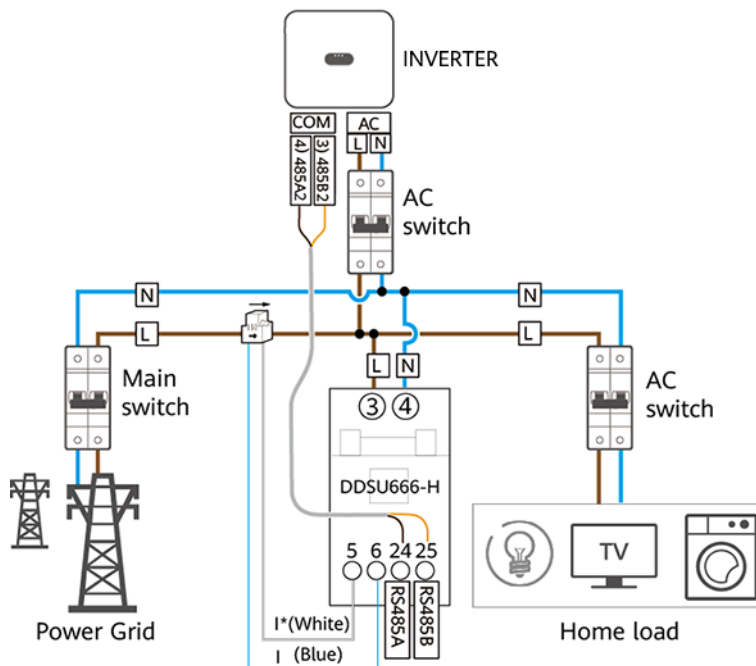


Figure 5-19 Connecting cables to the smart power sensor (single inverter)



- Inverter cascading scenarios
 - In-phase grid connection

Figure 5-20 In-phase grid connection

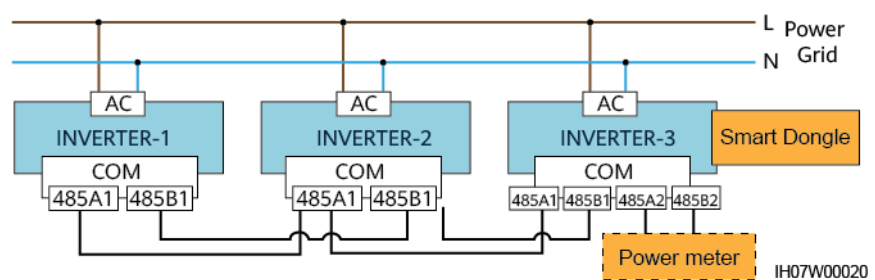
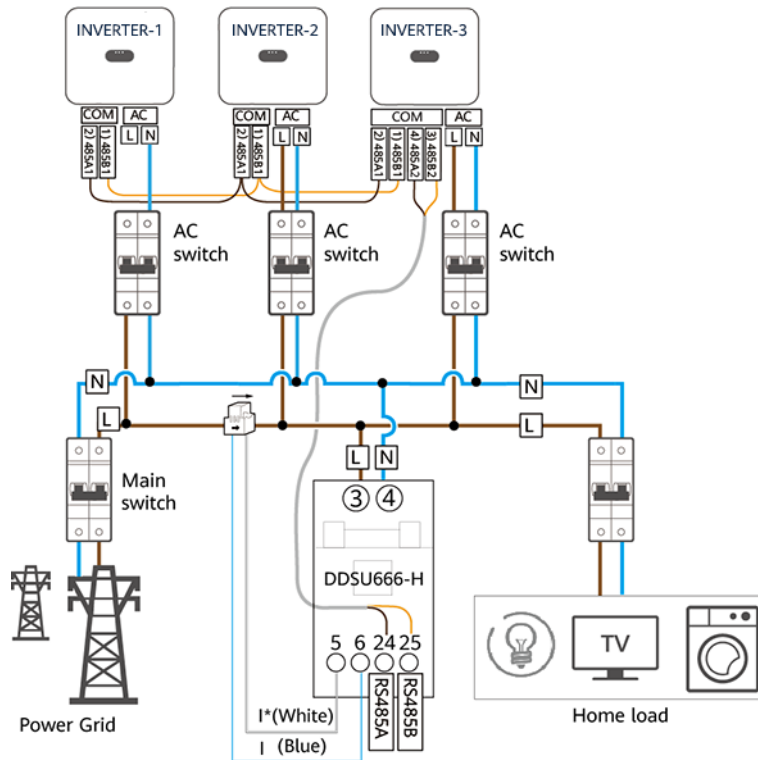


Figure 5-21 Connecting cables to the smart power sensor (in-phase grid connection)



- Balanced three-phase grid connection

Figure 5-22 Balanced three-phase grid connection

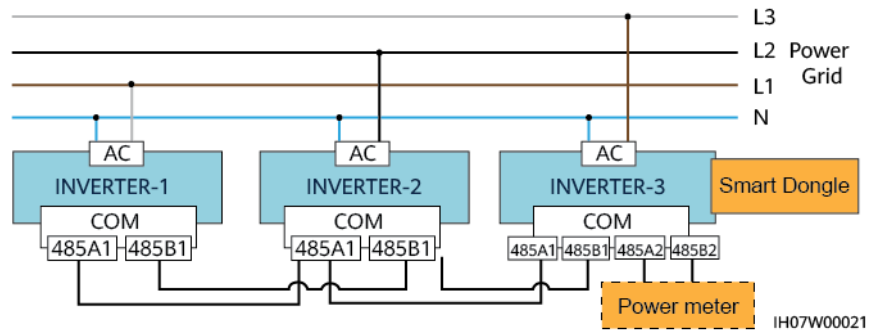
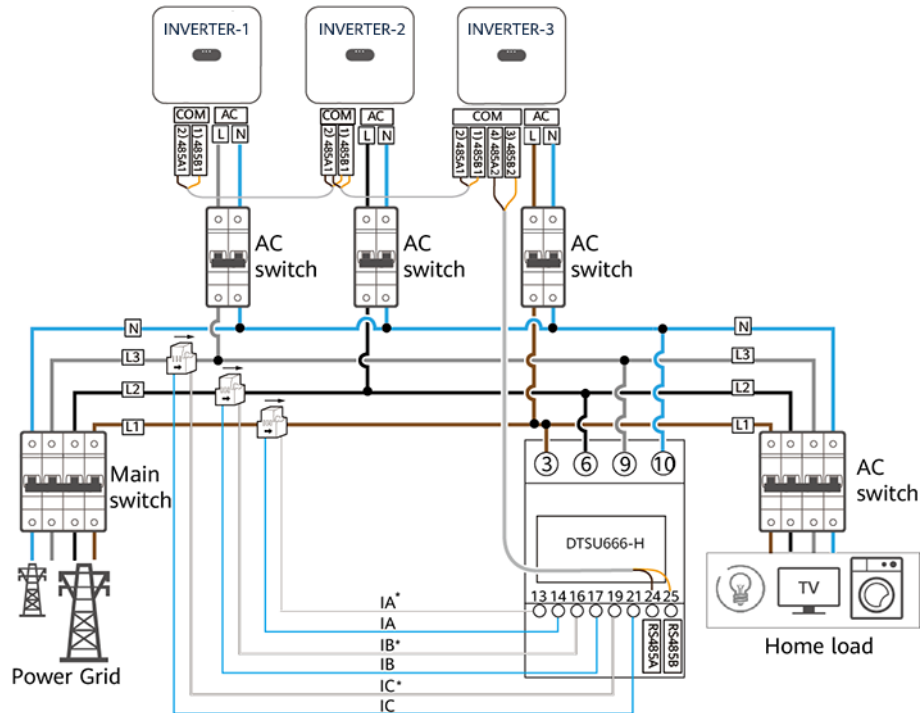


Figure 5-23 Connecting cables to the smart power sensor (balanced three-phase grid connection)



NOTE

- In cascading scenarios, the inverters are required to connect to the management system through a Smart Dongle.
- In the preceding networking, the inverters are cascaded and support the grid-tied point control function to achieve zero export.
- If the inverters requires the grid-tied point control function, they need to be connected to a smart power sensor.
- In the scenario of balanced three-phase grid connection, if the inverters requires the grid-tied point control function, they need to be connected to a three-phase smart power sensor to control the total three-phase power.

Procedure

Step 1 Connect signal cables to corresponding signal connectors.

NOTICE

- Ensure that the protection layer of the cable is in the connector. The surplus core should be cut off from the protection layer.
- Ensure that the exposed core is totally inserted into the cable hole.
- Ensure that the signal cables are connected securely.
- Ensure that the cables are not twisted.
- If multiple signal cables need to be connected to a single connector, ensure that the outer diameters of the signal cables are the same.

Figure 5-24 Crimping two signal cables

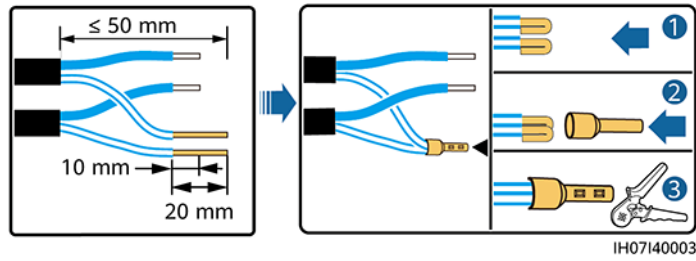
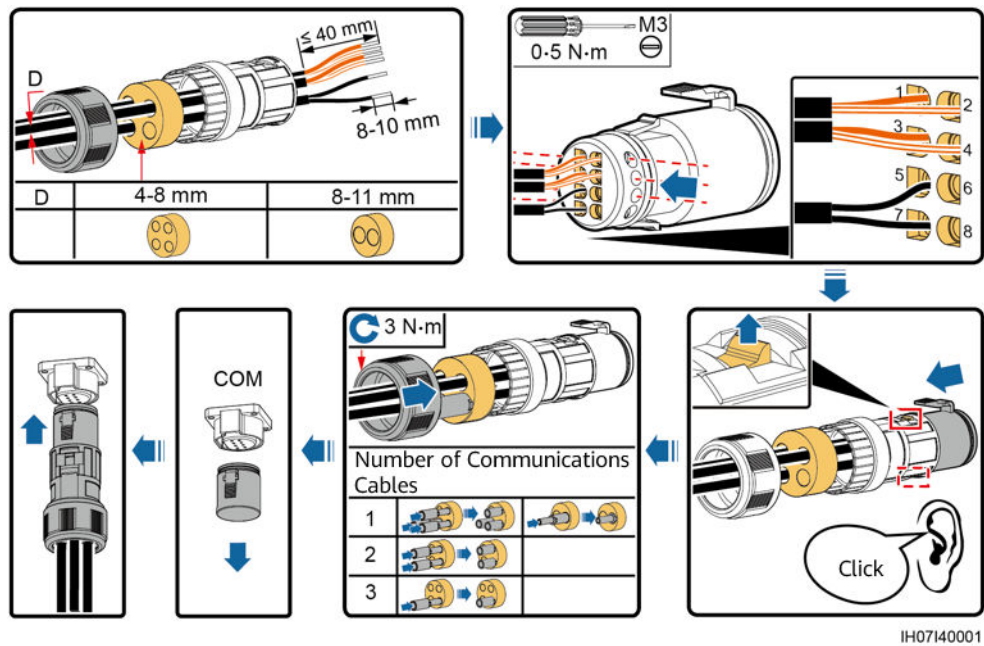


Figure 5-25 Assembling a signal connector (inverter cascading)

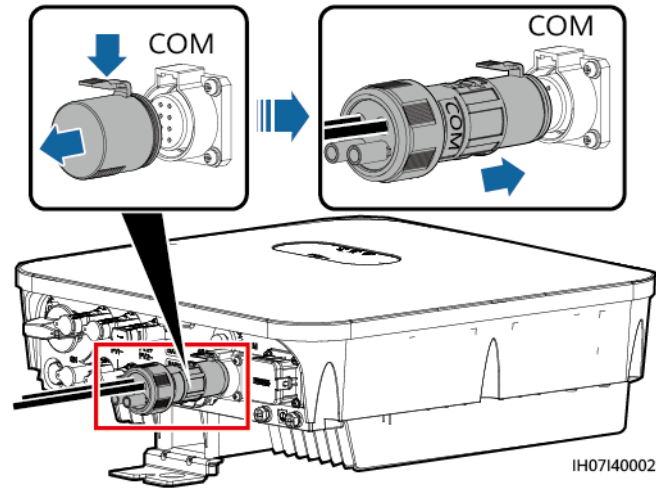


Step 2 Connect the signal connector to the corresponding port.

NOTICE

Ensure that the signal connector is connected securely.

Figure 5-26 Securing a signal connector



----End

6 System Commissioning

 DANGER

- Wear insulated gloves and use insulated tools to prevent electric shocks or short circuits.

6.1 Verification Before Power-On

Table 6-1 Check items and acceptance criteria

No.	Check Item	Acceptance Criteria
1	Inverter	The inverter is installed correctly and securely.
2	WLAN antenna	The WLAN antenna is installed correctly and securely.
3	Cables routing	Cables are routed properly as required by the customer.
4	Cable tie	Cable ties are evenly distributed and no burr exists.
5	Grounding	The PE cable is connected correctly, securely, and reliably.
6	Switch	The DC switch and all the switches connecting to the inverter are OFF.
7	Cable connection	The AC output power cable, DC input power cable, and signal cable are connected correctly, securely, and reliably.
8	Unused terminal and port	Unused terminals and ports are locked by watertight caps.

No.	Check Item	Acceptance Criteria
9	Installation environment	The installation space is proper, and the installation environment is clean and tidy.

6.2 System Power-On

Prerequisites

Before turning on the AC switch between the inverter and the power grid, use a multimeter to check that the AC voltage is within the allowed range.

NOTICE

Before the equipment is put into operation for the first time, ensure that the parameters are set correctly by professional personnel. Incorrect parameter settings may result in noncompliance with local grid connection requirements and affect the normal operations of the equipment.

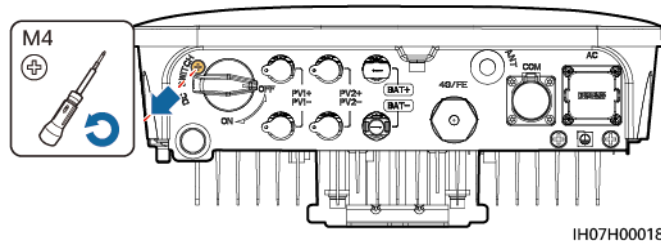
NOTICE

If the DC power supply is connected but the AC power supply is disconnected, the inverter will report a **Grid Loss** alarm. The inverter can start properly only after the power grid recovers.

Procedure

- Step 1** Turn on the AC switch between the inverter and the power grid.
- Step 2** (Optional) Remove the locking screw from the DC switch.

Figure 6-1 Removing the locking screw from a DC switch



- Step 3** Turn on the DC switch between the PV string and the inverter if there is any.
- Step 4** Turn on the DC switch at the bottom of the inverter.
- Step 5** Observe the LEDs to check the inverter operating status.

Table 6-2 LED indicators 1

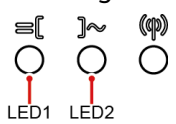
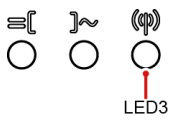
Category	Status		Description
Running indicator 	LED1	LED2	-
	Steady green	Steady green	The inverter is operating in grid-tied mode.
	Blinking green at long intervals (on for 1s and then off for 1s)	Off	The DC is on and the AC is off.
	Blinking green at long intervals (on for 1s and then off for 1s)	Blinking green at long intervals (on for 1s and then off for 1s)	Both the DC and AC are on, and the inverter is not exporting power to the power grid.
	Off	Blinking green at long intervals (on for 1s and then off for 1s)	The DC is off and the AC is on.
	Off	Off	Both the DC and AC are off.
	Blinking red at short intervals (on for 0.2s and then off for 0.2s)	-	There is a DC environmental alarm, such as an alarm indicating that High String Input Voltage, String Reverse Connection, or Low Insulation Resistance.
	-	Blinking red at short intervals (on for 0.2s and then off for 0.2s)	There is an AC environmental alarm, such as an alarm indicating Grid Undervoltage, Grid Overvoltage, Grid Overfrequency, or Grid Underfrequency.
	Steady red	Steady red	Fault.
Communication indicator 	LED3		-
	Blinking green at short intervals (on for 0.2s and then off for 0.2s)		Communication is in progress.
	Blinking green at long intervals (on for 1s and then off for 1s)		The mobile phone is connected to the inverter.
	Off		There is no communication.

Table 6-3 LED indicators 2

Category	Status			Description
Device replacement indication	LED1	LED2	LED3	-
	Steady red	Steady red	Steady red	The inverter hardware is faulty. The inverter needs to be replaced.

----End

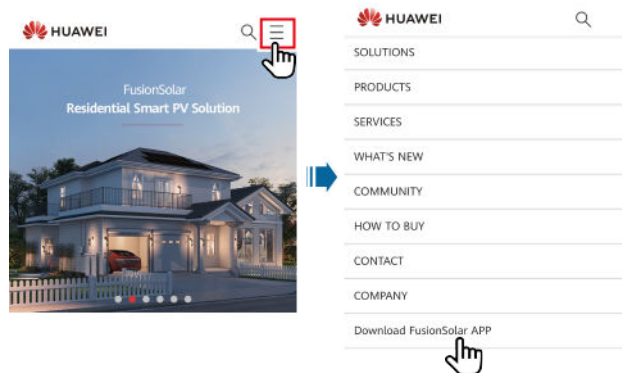
7 Man-Machine Interaction

7.1 App Commissioning

7.1.1 Downloading the FusionSolar App

- Method 1: Access <https://solar.huawei.com> using the mobile phone browser and download the latest installation package.

Figure 7-1 Download Mode



- Method 2: Search for FusionSolar on Huawei AppGallery and download the latest installation package.
- Method 3: Scan the following QR code and download the latest installation package.

Figure 7-2 QR code



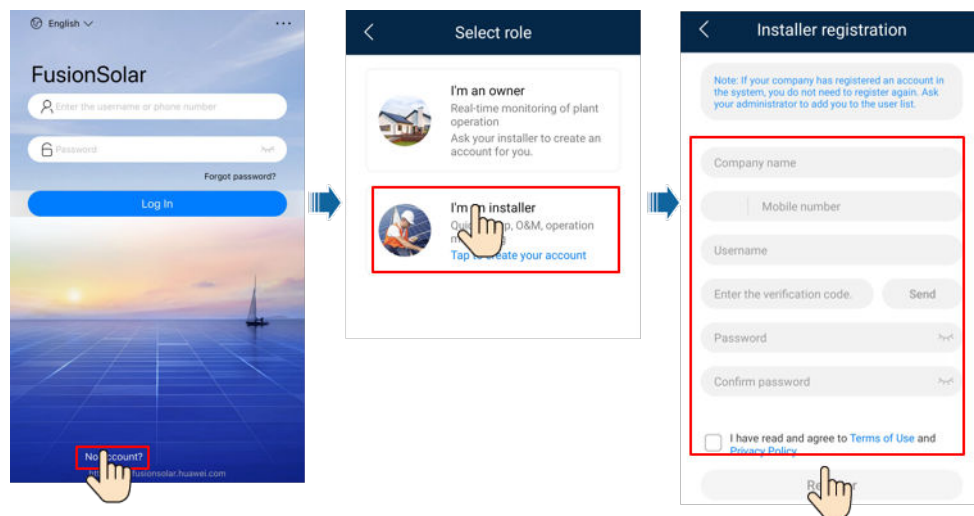
7.1.2 (Optional) Registering an Installer Account

NOTE

- If you have an installer account, skip this step.
- You can register an account only using a mobile phone only in China.
- The mobile number or email address used for registration is the user name for logging in to the FusionSolar app.

Create the first installer account and create a domain named after the company name.

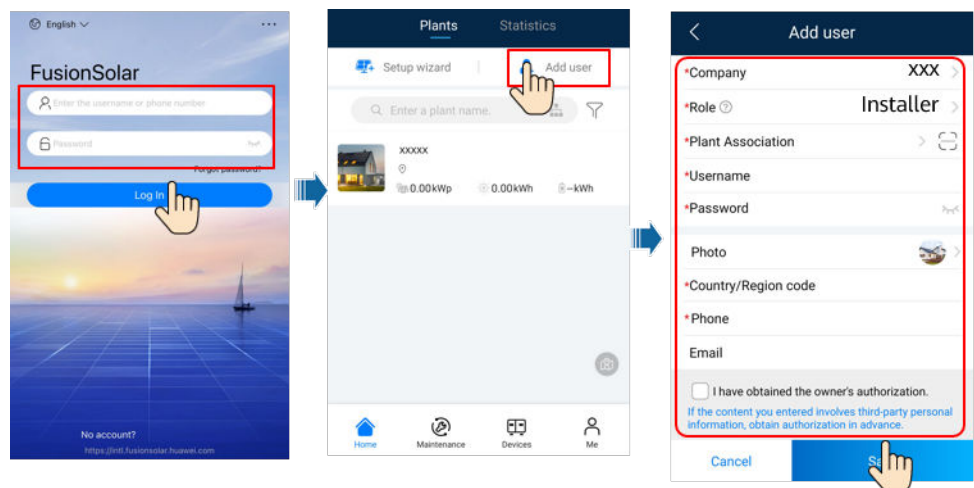
Figure 7-3 Creating the first installer account



NOTICE

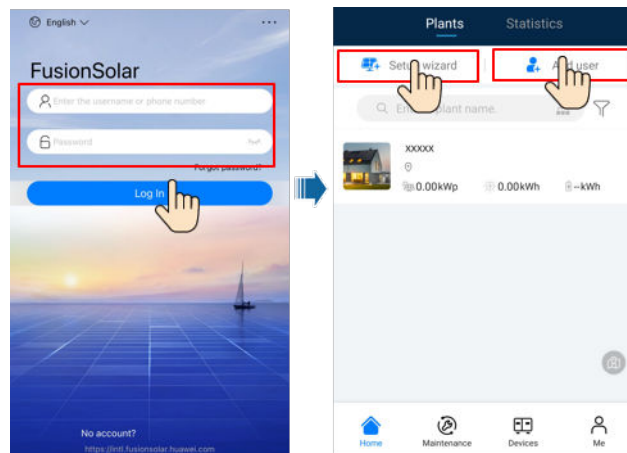
To create multiple installer accounts for a company, log in to the FusionSolar app and tap **New User** to create an installer account.

Figure 7-4 Creating multiple installer accounts for the same company



7.1.3 Creating a PV Plant and a User

Figure 7-5 Creating a PV plant and a user



NOTE

In the quick settings, the grid code is set to N/A by default (automatic startup is not supported). Set the grid code based on the area where the PV plant is located.

7.2 Parameters Settings

Go to the **Device Commissioning** screen and set inverter parameters. For details about entering the **Device Commissioning** screen, see [B Device Commissioning](#).

7.2.1 Energy Control

7.2.1.1 Grid-tied Point Control

Function

Limits or reduces the output power of the PV power system to ensure that the output power is within the power deviation limit.

Procedure

Step 1 On the home screen, choose **Power adjustment** > **Grid-tied point control**.

Figure 7-6 Grid-tied point control

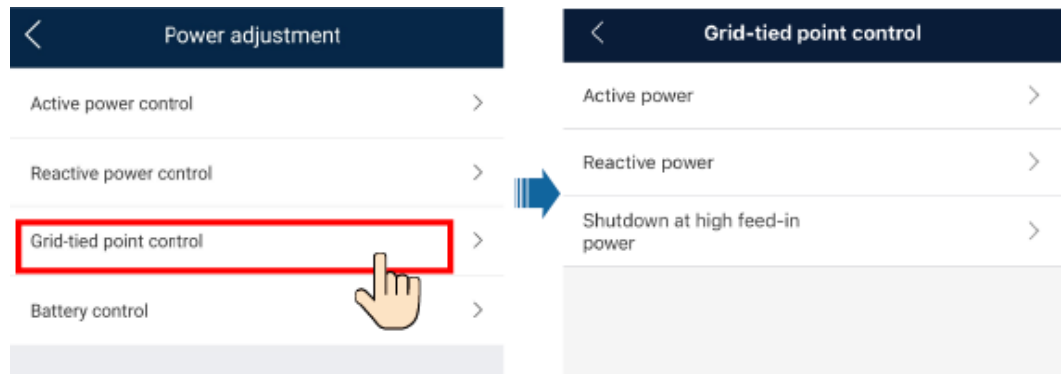


Table 7-1 Grid-tied point control

Parameter Name			Description
Active power	Unlimited	-	If this parameter is set to Unlimited , the output power of the inverter is not limited and the inverter can connect to the power grid at the rated power.
	Grid connection with zero power	Closed-loop controller	<ul style="list-style-type: none"> If multiple inverters are cascaded, set this parameter to SDongle. If there is only one inverter, set this parameter to Inverter.
		Limitation mode	Total power indicates export limitation of the total power at the grid-tied point.
		Power adjustment period	Specifies the shortest interval for a single anti-backfeeding adjustment.
		Power control hysteresis	Specifies the dead zone for adjusting the inverter output power. If the power fluctuation is within the power control hysteresis, the power is not adjusted.
		Active power output limit for fail-safe	Specifies the derating value of the inverter active power by percentage. If the Smart Dongle does not detect any meter data or the communication between the Smart Dongle and the inverter is disconnected, the Smart Dongle delivers the derating value of the inverter active power by percentage.

Parameter Name		Description
	Communication disconnection fail-safe	In the inverter anti-backfeeding scenario, if this parameter is set to Enable , the inverter will derate according to the active power derating percentage when the communication between the inverter and the Smart Dongle is disconnected for a period longer than Communication disconnection detection time .
	Communication disconnection detection time	Specifies the time for determining the communication disconnection between the inverter and the Dongle. This parameter is displayed when Communication disconnection fail-safe is set to Enable .
Grid connection with limited power (kW)	Closed-loop controller	<ul style="list-style-type: none"> • If multiple Smart Solar Inverters are cascaded, set this parameter to SDongle. • If there is only one Smart Solar Inverter, set this parameter to Inverter.
	Limitation mode	Total power indicates export limitation of the total power at the grid-tied point.
	Maximum grid feed-in power	Specifies the maximum active power transmitted from the grid-tied point to the power grid.
	Power adjustment period	Specifies the shortest interval for a single anti-backfeeding adjustment.
	Power control hysteresis	Specifies the dead zone for adjusting the inverter output power. If the power fluctuation is within the power control hysteresis, the power is not adjusted.
	Active power output limit for fail-safe	Specifies the derating value of the inverter active power by percentage. If the Smart Dongle does not detect any meter data or the communication between the Smart Dongle and the inverter is disconnected, the Smart Dongle delivers the derating value of the inverter active power by percentage.

Parameter Name		Description
	Communication disconnection fail-safe	In the inverter anti-backfeeding scenario, if this parameter is set to Enable , the inverter will derate according to the active power derating percentage when the communication between the inverter and the Smart Dongle is disconnected for a period longer than Communication disconnection detection time .
	Communication disconnection detection time	Specifies the time for determining the communication disconnection between the inverter and the Dongle. This parameter is displayed when Communication disconnection fail-safe is set to Enable .
Grid connection with limited power (%)	Closed-loop controller	<ul style="list-style-type: none"> • If multiple inverters are cascaded, set this parameter to SDongle. • If there is only one inverter, set this parameter to Inverter.
	Limitation mode	Total power indicates export limitation of the total power at the grid-tied point.
	PV plant capacity	Specifies the total maximum active power in the inverter cascading scenario.
	Maximum grid feed-in power	Specifies the percentage of the maximum active power of the grid-tied point to the PV plant capacity.
	Power adjustment period	Specifies the shortest interval for a single anti-backfeeding adjustment.
	Power control hysteresis	Specifies the dead zone for adjusting the inverter output power. If the power fluctuation is within the power control hysteresis, the power is not adjusted.

Parameter Name		Description
	Active power output limit for fail-safe	Specifies the derating value of the inverter active power by percentage. If the Smart Dongle does not detect any meter data or the communication between the Smart Dongle and the inverter is disconnected, the Smart Dongle delivers the derating value of the inverter active power by percentage.
	Communication disconnection fail-safe	In the inverter anti-backfeeding scenario, if this parameter is set to Enable , the inverter will derate according to the active power derating percentage when the communication between the inverter and the Smart Dongle is disconnected for a period longer than Communication disconnection detection time .
	Communication disconnection detection time	Specifies the time for determining the communication disconnection between the inverter and the Dongle. This parameter is displayed when Communication disconnection fail-safe is set to Enable .
Shutdown at high feed-in power ^a	Shutdown at high feed-in power	<ul style="list-style-type: none"> The default value is Disable. If this parameter is set to Enable, the inverter shuts down for protection when the grid-connection point power exceeds the threshold and remains in this condition for the specified time threshold.
	Upper feed-in power threshold for inverter shutdown	<ul style="list-style-type: none"> The default value is 0. This parameter specifies the power threshold of the grid-connection point for triggering inverter shutdown.

Parameter Name		Description
	High feed-in power duration threshold for triggering inverter shutdown	<p>The default value is 20. This parameter specifies the duration threshold of high feed-in power for triggering inverter shutdown.</p> <ul style="list-style-type: none"> • When High feed-in power duration threshold for triggering inverter shutdown is set to 5, Shutdown at high feed-in power takes precedence. • When High feed-in power duration threshold for triggering inverter shutdown is set to 20, Limited feed-in takes precedence (when Active power control is set to Limited feed-in).
<p>Note a: This parameter is supported only for the AS4777 grid code.</p>		

----End

7.2.1.2 Apparent Power Control on the Inverter Output Side

On the home screen, tap **Settings > Power adjustment** to set inverter parameters.

Figure 7-7 Apparent power control

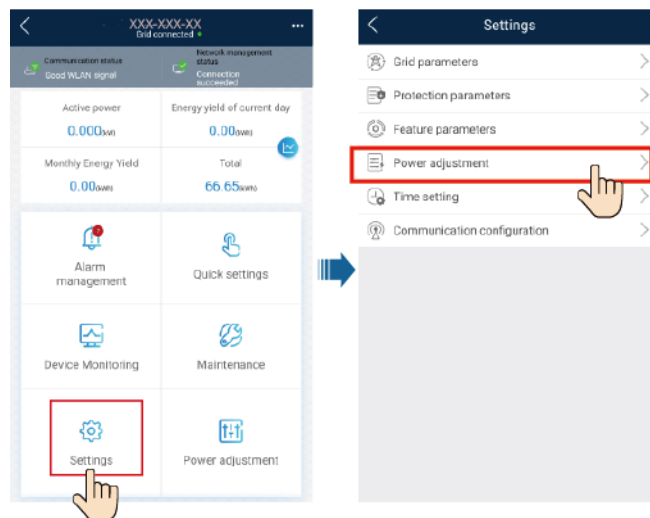


Table 7-2 Apparent power

Parameter	Description	Value Range
Maximum apparent power (kVA)	Specifies the output upper threshold for the maximum apparent power to adapt to the capacity requirements of standard and customized inverters.	[Maximum active power, S_{max}]
Maximum active power (kW)	Specifies the output upper threshold for the maximum active power to adapt to different market requirements.	[0.1, P_{max}]

 **NOTE**

The lower threshold for the maximum apparent power is the maximum active power. To lower the maximum apparent power, lower the maximum active power first.

7.2.2 AFCI

Function

If PV modules or cables are not properly connected or damaged, electric arcs may occur, which may cause fire. Inverters provide unique arc detection in compliance with UL 1699B-2018 to ensure the safety of users' lives and property.

This function is disabled by default, to enable this function, log in to the FusionSolar app, enter the **Device Commissioning** screen, choose **Settings > Feature parameters**, and enable **AFCI**.

Clearing Alarms

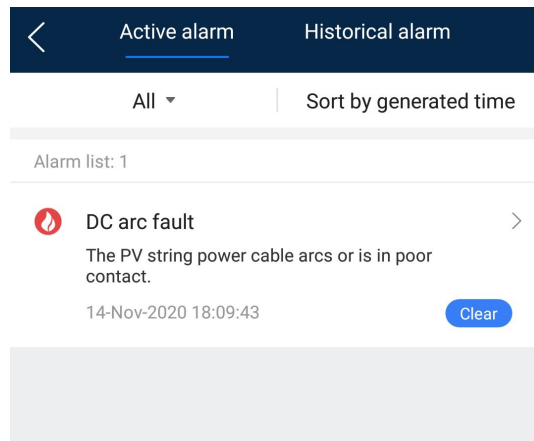
The AFCI function involves the **DC arc fault** alarm.

The Inverter has the AFCI alarm automatic clearance mechanism. If an alarm is triggered for less than five times within 24 hours, the Inverter automatically clears the alarm. If the alarm is triggered for five times or more within 24 hours, the Inverter locks for protection. You need to manually clear the alarm on the Inverter so that it can work properly.

You can manually clear the alarm as follows:

- Method 1:** FusionSolar App
 Log in to the FusionSolar app and choose **My > Device Commissioning**. On the **Device Commissioning** screen, connect and log in to the Inverter that generates the AFCI alarm, tap **Alarm management**, and tap **Clear** on the right of the **DC arc fault** alarm to clear the alarm.

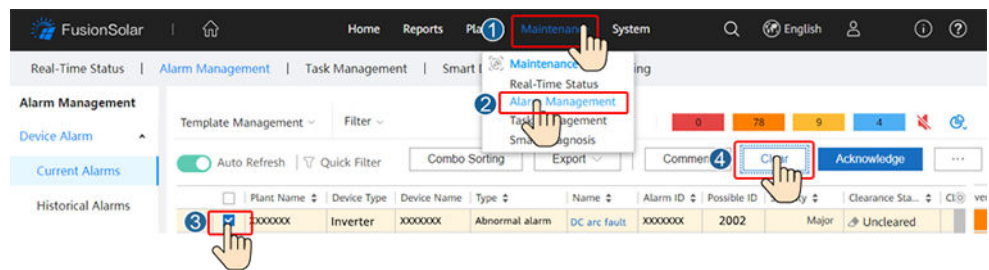
Figure 7-8 Alarm management



- **Method 2:** FusionSolar Smart PV Management System

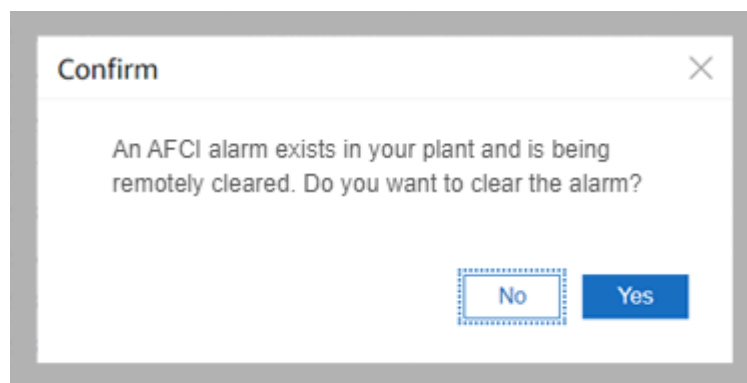
Log in to the FusionSolar Smart PV Management System using a non-owner account, choose **Management > Alarm Management**, select the **DC arc fault** alarm, and click **Clear** to clear the alarm.

Figure 7-9 Clearing alarms



Switch to the owner account with PV plant management rights. On the home page, click the PV plant name to go to the PV plant page, and click **OK** as prompted to clear the alarm.

Figure 7-10 Owner confirmation



7.2.3 IPS Check (for Italy CEI0-21 Grid Code Only)

Function

The Italy CEI0-21 grid code requires an IPS check for the Inverter. During the self-check, the Inverter checks the protection threshold and protection time of the maximum voltage over 10 min (59.S1), maximum overvoltage (59.S2), minimum undervoltage (27.S1), minimum undervoltage (27.S2), maximum overfrequency (81.S1), maximum overfrequency (81.S2), minimum underfrequency (81.S), and minimum underfrequency (81.S2).

Procedure

- Step 1** On the home screen, choose **Maintenance > IPS test** to access the IPS test screen.
- Step 2** Tap **Start** to start an IPS test. The Inverter detects maximum voltage over 10 min (59.S1), maximum overvoltage (59.S2), minimum undervoltage (27.S1), minimum undervoltage (27.S2), maximum overfrequency (81.S1), maximum overfrequency (81.S2), and minimum underfrequency (81.S1), and minimum underfrequency (81.S2).

Figure 7-11 IPS test

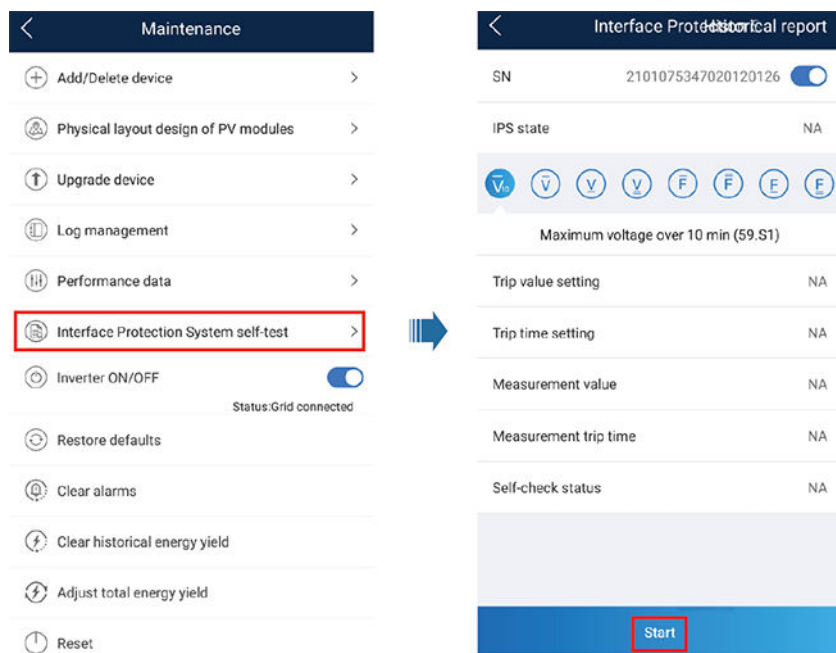


Table 7-3 IPS test type

IPS Test Type	Description
Maximum voltage over 10 min (59.S1)	The default maximum voltage over 10 min protection threshold is 253 V (1.10 Vn), and the default protection time threshold is 3s.

IPS Test Type	Description
Maximum overvoltage (59.S2)	The default overvoltage protection threshold is 264.5 V (1.15 Vn), and the default protection time threshold is 0.2s.
Minimum undervoltage (27.S1)	The default undervoltage protection threshold is 195.5 V (0.85 Vn), and the default protection time threshold is 1.5s.
Minimum undervoltage (27.S2)	The default undervoltage protection threshold is 34.5 V (0.15 Vn), and the default protection time threshold is 0.2s.
Maximum overfrequency (81.S1)	The default overfrequency protection threshold is 50.2 Hz, and the default protection time threshold is 0.1s.
Maximum overfrequency (81.S2)	The default overfrequency protection threshold is 51.5 Hz, and the default protection time threshold is 0.1s.
Minimum underfrequency (81.S1)	The default underfrequency protection threshold is 49.8 Hz, and the default protection time threshold is 0.1s.
Minimum underfrequency (81.S2)	The default underfrequency protection threshold is 47.5 Hz, and the default protection time threshold is 0.1s.

Step 3 After the IPS test is complete, **IPS State** is displayed as **IPS state success**. Tap **Historical report** in the upper right corner of the screen to view the IPS check report.

----End

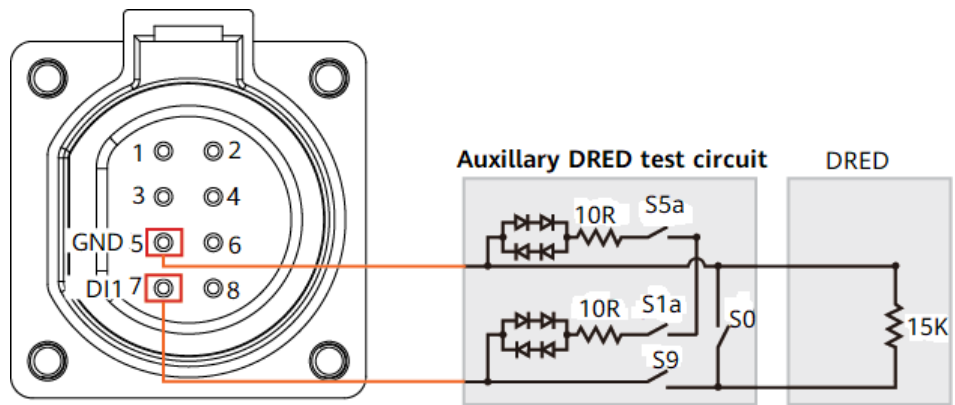
7.2.4 DRM (Australia AS4777)

Function

According to Australia AS 4777.2-2015, solar inverters need to support the function of demand response mode (DRM), and DRM0 is a mandatory requirement.

This function is disabled by default.

Figure 7-12 Wiring diagram for the DRM function



NOTE

The demand response enabling device (DRED) is a power grid dispatch device.

Table 7-4 DRM requirements

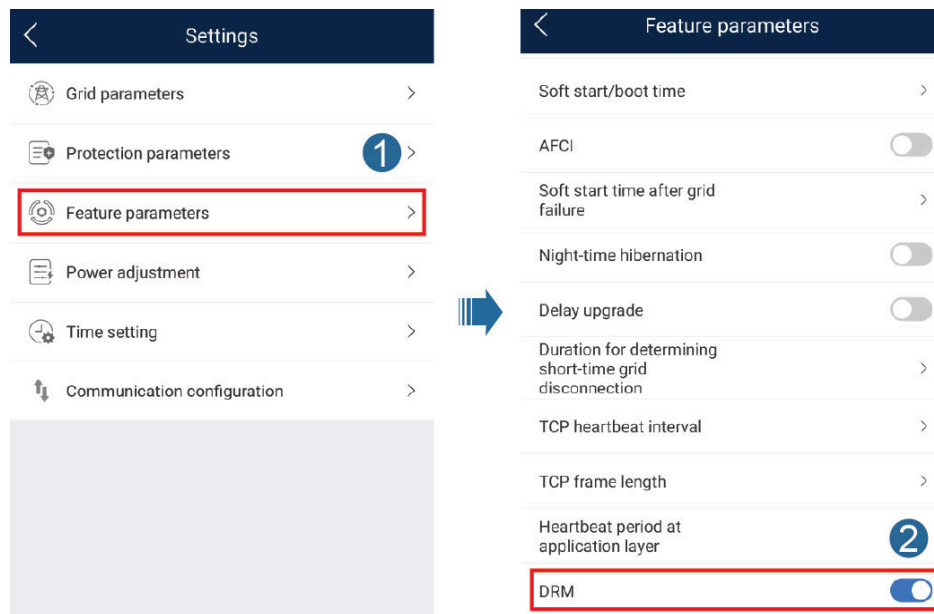
Mode	Port on the inverter	Requirements
DRM0	DI1 and GND of the COM port	<ul style="list-style-type: none"> When switches S0 and S9 are switched on, the solar inverter should be turned off. When switch S0 is switched off, and switch S9 is switched on, the solar inverter should be grid-tied.

Procedure

Step 1 On the home page, choose **Settings > Feature parameters**.

Step 2 Set **DRM** to .

Figure 7-13 DRM



----End

8 System Maintenance

 **DANGER**

- Wear insulated gloves and use insulated tools to prevent electric shocks or short circuits.
-

 **WARNING**

- Before performing maintenance, power off the equipment, follow the instructions on the delayed discharge label, and wait for a period of time as specified to ensure that the equipment is not energized.
-

8.1 System Power-Off

Precautions

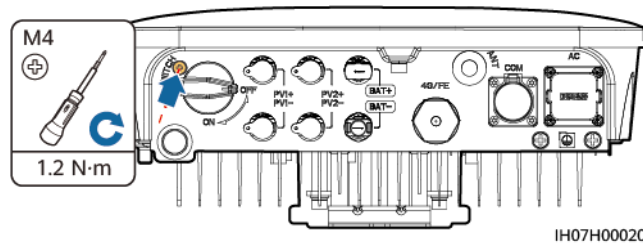
 **WARNING**

After the inverter powers off, the remaining electricity and heat may still cause electric shocks and body burns. Therefore, put on insulated gloves and begin operating the inverter five minutes after the power-off.

Procedure

- Step 1** Send a shutdown command on the app.
- Step 2** Turn off the AC switch between the inverter and the power grid.
- Step 3** Turn off the DC switch at the bottom of the inverter.
- Step 4** (Optional) Install the locking screw for the DC switch.

Figure 8-1 Installing a locking screw for the DC switch



Step 5 Turn off the DC switch between the inverter and PV strings.

----End

8.2 Routine Maintenance

To ensure that the inverter 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 inverter, connecting cables, and maintaining the grounding reliability, power off the inverter (see [8.1 System Power-Off](#) for details).

Table 8-1 Maintenance checklist

Check Item	Check Method	Maintenance Interval
System cleanliness	Check periodically that the heat sinks are free from obstacles and dust.	Once every 6 to 12 months
System running status	<ul style="list-style-type: none"> Check that the inverter is not damaged or deformed. Check that the inverter operates with no abnormal sound. Check that all inverter parameters are correctly set during operation. 	Once every six months
Electrical connection	<ul style="list-style-type: none"> Check that cables are secured. Check that cables are intact, and that in particular, the parts touching the metallic surface are not scratched. Check that unused DC input terminals, COM ports, ANT ports, and Smart Dongle waterproof covers are locked. 	The first inspection is 6 months after the initial commissioning. From then on, the interval can be 6 to 12 months.

Check Item	Check Method	Maintenance Interval
Grounding reliability	Check that ground cables are securely connected.	The first inspection is 6 months after the initial commissioning. From then on, the interval can be 6 to 12 months.

8.3 Troubleshooting

Alarm severities are defined as follows:

- Major: The inverter enters the shutdown mode or functions abnormally after a fault occurs.
- Minor: Some components are faulty but the inverter can still connect to the power grid and generate power.
- Warning: The inverter functions normally, but its output power decreases due to external factors.

Table 8-2 Common alarms and troubleshooting measures

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2001	High String Input Voltage	Major	The PV array is not properly configured. Excessive PV modules are connected in series to the PV string, and therefore the open-circuit voltage exceeds the maximum inverter operating voltage. Cause ID = 1, 2 <ul style="list-style-type: none"> • 1: The PV1 input voltage is high. • 2: The PV2 input voltage is high. 	Check the serial connection configuration of the PV string and ensure that the PV string open-circuit voltage is not greater than the maximum operating voltage of the inverter. After the PV array configuration is corrected, the alarm disappears.
2002	DC Arc Fault	Major	The PV string power cables arc or are in poor contact. Cause ID 1 = PV1 and PV2 Cause ID 2 = PV3 and PV4	Check whether the string cables arc or are in poor contact.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2003	DC Arc Fault	Major	The PV string power cables arc or are in poor contact. <ul style="list-style-type: none">• Cause ID 1 = PV1• Cause ID 2 = PV2	Check whether the string cables arc or are in poor contact.
2011	String Reversed	Major	The PV string is reversely connected. Cause ID = 1, 2 <ul style="list-style-type: none">• 1: PV1 is reversely connected.• 2: PV2 is reversely connected.	Check whether the PV string is reversely connected to the inverter. If yes, wait until the PV string current decreases below 0.5 A, set DC switch to OFF, and adjust the PV string polarity.
2021	AFCI Check Failure	Major	The AFCI check fails. Cause ID = 1, 2 <ul style="list-style-type: none">• 1: The AFCI check circuit is abnormal.• 2: The AFCI circuit is faulty.	Turn off the AC output switch and DC input switch, and then turn them on after 5 minutes. If the fault persists, contact your dealer.
2032	Grid Failure	Major	Cause ID = 1 <ul style="list-style-type: none">• The power grid experiences an outage.• The AC circuit is disconnected or the AC circuit breaker is OFF.	<ol style="list-style-type: none">1. Check the AC voltage.2. Check whether the AC circuit is disconnected or the AC circuit breaker is OFF.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2033	Grid Undervoltage	Major	<p>Cause ID = 1</p> <p>The grid voltage is below the lower threshold or the low voltage duration has lasted for more than the value specified by low voltage ride-through (LVRT).</p>	<ol style="list-style-type: none">1. If the alarm occurs occasionally, 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 allowed range. If no, contact the local power operator. If yes, modify the grid undervoltage protection threshold through the mobile app, or network management system (NMS) 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.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2034	Grid Overvoltage	Major	Cause ID = 1 The grid voltage exceeds the higher threshold or the high voltage has lasted for more than the value specified by high voltage ride-through (HVRT).	<ol style="list-style-type: none">1. If the alarm occurs occasionally, 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 allowed range. If no, contact the local power operator. If yes, modify the grid overvoltage protection threshold through the mobile app, or NMS with the consent of the local power operator.3. Check whether the peak voltage of the power grid is too high. If the fault persists and cannot be rectified for a long time, contact the power operator.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2036	Grid Overfrequency	Major	Cause ID = 1 Power grid exception: The actual power grid frequency is higher than the standard requirement for the local power grid.	<ol style="list-style-type: none"> 1. If the alarm occurs occasionally, 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 allowed range. If no, contact the local power operator. If yes, modify the grid overfrequency protection threshold through the mobile app, or NMS with the consent of the local power operator.
2037	Grid Underfrequency	Major	Cause ID = 1 Power grid exception: The actual power grid frequency is lower than the standard requirement for the local power grid.	<ol style="list-style-type: none"> 1. If the alarm occurs occasionally, 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 allowed range. If no, contact the local power operator. If yes, modify the grid underfrequency protection threshold through the mobile app, or NMS with the consent of the local power operator.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2038	Unstable Grid Frequency	Major	<p>Cause ID = 1</p> <p>Power grid exception: The actual grid frequency change rate does not comply with the local power grid standard.</p>	<ol style="list-style-type: none"> 1. If the alarm occurs occasionally, 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 allowed range. If no, contact the local power operator.
2039	Output Overcurrent	Major	<p>Cause ID = 1</p> <p>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.</p>	<ol style="list-style-type: none"> 1. The inverter detects its external working conditions in real time. After the fault is rectified, the inverter automatically recovers. 2. If the alarm occurs frequently and affects the energy yield of the power plant, check whether the output is short-circuited. If the fault persists, contact your dealer.
2040	Output DC Component Overhigh	Major	<p>Cause ID = 1</p> <p>The DC component of the inverter output current exceeds the specified upper threshold.</p>	<ol style="list-style-type: none"> 1. The inverter detects its external working conditions in real time. After the fault is rectified, the inverter automatically recovers. 2. If the alarm occurs frequently, contact your dealer.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2051	Abnormal Residual Current	Major	<p>Cause ID = 1</p> <p>The insulation impedance of the input side to PE decreases when the inverter is operating.</p>	<ol style="list-style-type: none"> 1. If the alarm occurs occasionally, the external circuit may be abnormal temporarily. The inverter automatically recovers after the fault is rectified. 2. If the alarm occurs frequently or persists, check whether the impedance between the PV string and the ground is too low.
2062	Low Insulation Resistance	Major	<p>Cause ID = 1</p> <ul style="list-style-type: none"> • A short circuit occurs between the PV array and the ground. • The ambient air of the PV array is damp and the insulation between the PV array and the ground is poor. 	<ol style="list-style-type: none"> 1. Check the output impedance of the PV array to ground. If there is a short circuit or lack of insulation, rectify it. 2. Check that the PE cable of the inverter is correctly connected. 3. If the impedance is lower than the specified protection threshold in rainy and cloudy days, set Insulation resistance protection using the mobile app, or NMS. Current insulation resistance: x MΩ, possible short circuit position: x%. The short circuit position is valid for a single PV string. If there are multiple PV strings, check the PV strings one by one. For details, see E Locating Insulation Resistance Faults.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2063	Overtemperature	Minor	Cause ID = 1 <ul style="list-style-type: none"> • The inverter is installed in a place with poor ventilation. • The ambient temperature is higher than the upper threshold. • The inverter is not working properly. 	<ul style="list-style-type: none"> • Check the ventilation and ambient temperature of the inverter installation position. • If the ventilation is poor or the ambient temperature exceeds the upper threshold, improve the ventilation and heat dissipation. • If the ventilation and ambient temperature both meet requirements, contact your dealer.

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2064	Device Fault	Major	<p>An unrecoverable fault has occurred on a circuit inside the inverter.</p> <p>Cause ID = 1-12</p> <ul style="list-style-type: none">• 1: The Boost input is short-circuited.• 2: The Boost input experiences overcurrent.• 3: The control circuit is faulty.• 4: The inverter circuit is abnormal.• 5: The residual current sensor is faulty.• 6: The temperature detection fails.• 7: EEPROM read/write fails.• 8: The auxiliary power supply is abnormal.• 9: The grid-tied relay is abnormal.• 10: The DC bus experiences overvoltage.• 11: The DC bus experiences undervoltage.• 12: The DC bus experiences voltage imbalance.	<p>Turn off the AC output switch and DC input switch, and then turn them on after 5 minutes. If the fault persists, contact your dealer.</p>

Alarm ID	Alarm Name	Alarm Severity	Possible Causes	Troubleshooting
2065	Upgrade Failed or Version Mismatch	Minor	<p>The upgrade does not complete normally.</p> <p>Cause ID = 1-4, 7</p> <ul style="list-style-type: none"> ● 1: The software and hardware of the main controller do not match. ● 2: The main and auxiliary controller software versions do not match. ● 3: The monitoring and power controller software versions do not match. ● 4: The upgrade fails. 	<ol style="list-style-type: none"> 1. Perform an upgrade again. 2. If the upgrade fails for multiple times, contact your dealer.
61440	Monitoring Unit Faulty	Minor	<p>Cause ID = 1</p> <ul style="list-style-type: none"> ● The flash memory is insufficient. ● The flash memory has bad sectors. 	<p>Turn off the AC output switch and DC input switch, and then turn them on after 5 minutes. If the fault persists, replace the monitoring board or contact your dealer.</p>
2067	Faulty Power Collector	Major	<p>Cause ID = 1</p> <p>The smart power sensor is disconnected.</p>	<ol style="list-style-type: none"> 1. Check that the configured power meter model is the same as the actual model. 2. Check that the communications parameters for the smart power sensors are the same as the inverter RS485 configurations. 3. Check whether the smart power sensor is powered on and whether the RS485 communications cable is connected.
2070	Active Islanding	Major	<p>Cause ID = 1</p> <p>When the power grid experiences an AC power outage, the inverter detects islanding proactively.</p>	<p>Check that the grid connection voltage of the inverter is normal.</p>

 **NOTE**

Contact your dealer if all failure analysis procedures listed above are completed and the fault still exists.

9 Inverter Disposal

9.1 Removing an Inverter

Procedure

- Step 1** Power off the inverter. For details, see [8.1 System Power-Off](#).
 - Step 2** Disconnect all cables from the inverter, including signal cables, DC input power cables, AC output power cables, and PE cables.
 - Step 3** Remove the WLAN antenna or the Smart Dongle from the inverter.
 - Step 4** Remove the inverter from the mounting bracket.
 - Step 5** Remove the mounting bracket.
- End

9.2 Packing an Inverter

- If the original packaging is available, put the inverter inside it and then seal it using adhesive tape.
- If the original packaging is unavailable, put the inverter inside a suitable hard carton and seal it properly.

9.3 Disposing an Inverter

If the inverter service life expires, dispose the inverter according to the local disposal rules for electrical equipment and electronic component waste.

10 Technical Parameters

10.1 Inverter Technical Specifications

Efficiency

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Maximum efficiency	98.4%	98.4%
European weighted efficiency	97.8%	97.8%

Input

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Maximum input voltage ^a	600 V	
Maximum input current (per MPPT)	12.5 A	
Maximum short-circuit current (per MPPT)	18 A	
Operating voltage range	80–600 V	
Startup voltage	100 V	
MPPT voltage range	90–560 V	
Rated input voltage	360 V	
Power supply	2	
Number of MPPTs	2	
Note a: The maximum input voltage includes the PV input voltage.		

Output

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Rated output power	5000 W ^a	6000 W
Maximum apparent power	5500 VA ^c	6000 VA
Rated output voltage	220 V/230 V /240 V	220 V /230 V /240 V
Adapted power grid frequency	50 Hz/60 Hz	
Maximum output current	25 A	27.3 A
Rated output current	22.7 A /21.7 A /20.8 A	27.3 A /26.1 A /25.0 A
Rated apparent power	5 kVA	6 kVA
Inrush current	25 A	27.3 A
Max output fault current	75.3 A	90.37 A
Max output overcurrent protection	30 A	32.76 A
Power factor	0.8 leading and 0.8 lagging	
Maximum total harmonic distortion (rated power)	≤ 3%	
<p>Note a: The rated output power is 5000 W for the AS4777 grid code.</p> <p>Note b: The maximum apparent power is 4600 VA for the VDE-AR-N 4105 grid code, and 5000 VA for the AS4777 grid code.</p> <p>Note c: The maximum apparent power is 5000 VA for the AS4777 grid code.</p>		

Protection

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Anti-islanding protection	Supported	
DC reverse polarity protection	Supported	
Insulation resistance detection	Supported	
Residual current monitoring unit (RCMU)	Supported	
AC short-circuit protection	Supported	

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
AC overcurrent protection	Supported	
Overtemperature protection	Supported	
DC surge protection	Supported	
AC surge protection	Supported	
AC overvoltage protection	Supported	
Arc fault protection	Supported	
Active anti-islanding method	AFD	
Protection class	I	
Overvoltage category	II (DC)/ III (AC)	
PV and AC port	DVCC	
Communication port	DVCA	

Communications

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Display	LED indicators; WLAN+App	
WLAN	Supported	
RS485	Supported	
Maximum RS485 communication distance	1000 m	
Communications expansion module	WLAN-FE (optional)/4G (optional)	

Common Parameters

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Topology	Non-Isolation	
IP rating	IP65	
Cooling mode	Natural cooling	
Dimensions (H x W x D)	365 mm x 365 mm x 156 mm (including the mounting bracket)	
Weight	12 kg	

Technical Specifications	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
Operating temperature	-25°C to +60°C (derated when the temperature is higher than +45°C)	-25°C to +60°C (derated when the temperature is higher than +40°C)
Humidity	0-100% RH	
Operating altitude	0-4000 m (derated above 2000 m)	

A Grid Code

 NOTE

The grid codes are subject to change. The listed codes are for reference only.

Table A-1 Grid Code

National/ Regional Grid Code	Description	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
VDE-AR-N-4105	Germany LV power grid	-	-
UTE C 15-712-1(A)	France mainland power grid	Supported	Supported
UTE C 15-712-1(B)	France island power grid	Supported	Supported
UTE C 15-712-1(C)	France island power grid	Supported	Supported
CEI0-21	Italy power grid	Supported	Supported
RD1699/661	Spain LV power grid	Supported	Supported
C10/11	Belgium power grid	Supported	-
IEC61727	IEC 61727 LV (50 Hz)	Supported	Supported
IEC61727-60Hz	IEC 61727 LV (60 Hz)	Supported	Supported
TAI-PEA	Thailand grid-tied standard power grid	Supported	-
TAI-MEA	Thailand grid-tied standard power grid	Supported	-
EN50549-LV	Ireland power grid	Supported	Supported
EN50549-SE	Sweden LV	Supported	Supported

National/ Regional Grid Code	Description	Smart Solar Inverter-5KTL-L0	Smart Solar Inverter-6KTL-L0
ABNT NBR 16149	Brazil power grid	Supported	Supported
Fuel-Engine-Grid	Diesel generator hybrid power grid	Supported	Supported
Fuel-Engine-Grid-60Hz	Diesel generator hybrid power grid	Supported	Supported
Austria	Austrian power grid	-	-
G98	UK G98 power grid	-	-
G99-TYPEA-LV	UK G99_TypeA_LV power grid	Supported	Supported
NRS-097-2-1	South Africa Power Grid		
SWITZERLAND-NA/ EEA:2020-LV230	Switzerland	Supported	Supported
SINGAPORE	Singapore LV power grid	Supported	Supported
HONGKONG	Hong Kong LV power grid	Supported	Supported
DUBAI	DUBAI LV power grid	Supported	Supported
Island-Grid	Island-Grid	Supported	Supported
DANMARK-EN50549- DK1-LV230	Denmark	Supported	Supported
DANMARK-EN50549- DK2-LV230	Denmark	Supported	Supported
AUSTRALIA- AS4777_A-LV230	Australia power grid	Supported	Supported
AUSTRALIA- AS4777_B-LV230	Australia power grid	Supported	Supported
AUSTRALIA- AS4777_C-LV230	Australia power grid	Supported	Supported
AUSTRALIA- AS4777_NZ-LV230	Australia power grid	Supported	Supported

B Device Commissioning

Step 1 Access **Device Commissioning** screen.

Figure B-1 Method 1: before login (not connected to the Internet)

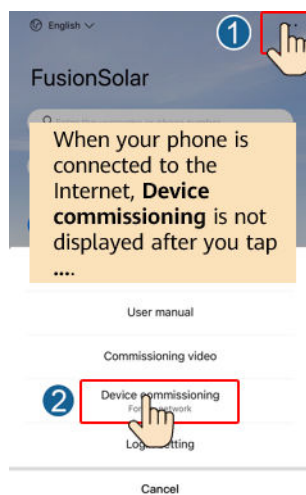
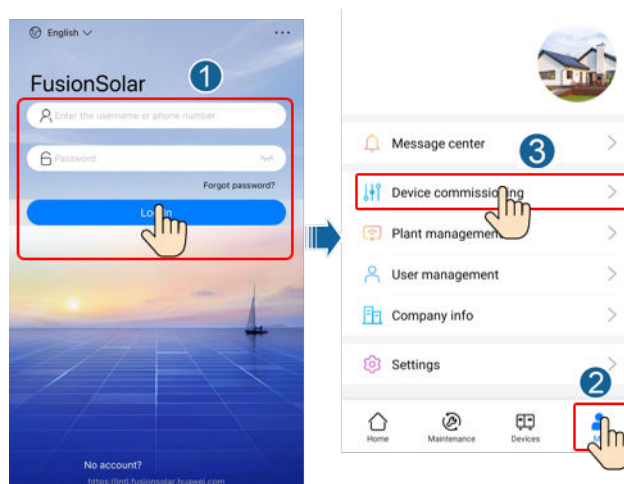


Figure B-2 Method 2: after login (connected to the Internet)



Step 2 Connect to the solar inverter WLAN and log in to the device commissioning screen as the **installer** user.

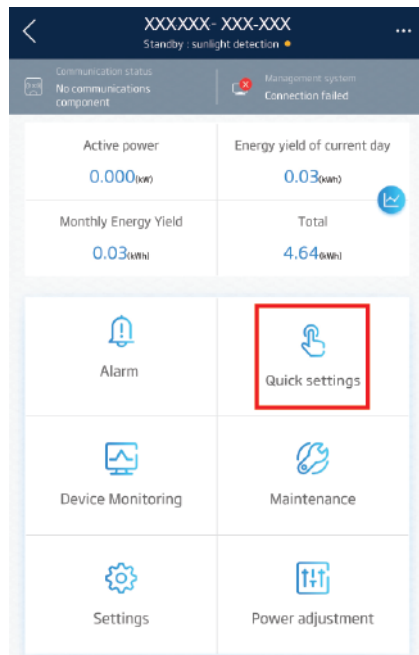
NOTICE

- If the mobile phone is directly connected to the inverter, the visible distance between the inverter and the mobile phone must be less than 3 m when a built-in antenna is used and less than 50 m when an external antenna is used to ensure the communication quality between the app and the inverter. The distances are for reference only and may vary with mobile phones and shielding conditions.
- When connecting the inverter to the WLAN over a router, ensure that the mobile phone and inverter are in the WLAN coverage of the router and the inverter is connected to the router.
- The router supports WLAN (IEEE 802.11 b/g/n, 2.4 GHz) and the WLAN signal reaches the inverter.
- The WPA, WPA2, or WPA/WPA2 encryption mode is recommended for routers. Enterprise-level encryption is not supported (for example, public hotspots requiring authentication such as airport WLAN). WEP and WPA TKIP are not recommended because these two encryption modes have serious security defects. If the access fails in WEP mode, log in to the router and change the encryption mode of the router to WPA2 or WPA/WPA2.

 **NOTE**

- Obtain the initial password for connecting to the solar inverter WLAN from the label on the side of the solar inverter.
- Set the password at the first login. To ensure account security, change the password periodically and keep the new password in mind. Not changing the initial password may cause password disclosure. A password left unchanged for a long period of time may be stolen or cracked. If a password is lost, devices cannot be accessed. In these cases, the user is liable for any loss caused to the PV plant.
- When you access the **Device Commissioning** screen of the inverter for the first time, you need to manually set the login password because the inverter does not have an initial login password.

Figure B-3 Quick settings



----End

C Resetting Password





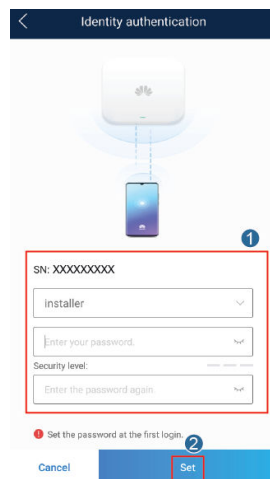
- Step 1** Ensure that the inverter connects to the AC and DC power supplies at the same time. Indicators  and  are steady green or blink at long intervals for more than 3 minutes.
- Step 2** Perform the following operations within 3 minutes:
1. Turn off the AC switch and set the DC switch at the bottom of the inverter to OFF. Wait until all the LED indicators on the inverter panel turn off.
 2. Turn on the AC switch and set the DC switch to ON. Ensure that the indicator  is blinking green at long intervals.
 3. Turn off the AC switch and set the DC switch to OFF. Wait until all LED indicators on the inverter panel are off.
 4. Turn on the AC switch and set the DC switch to ON. Wait until all indicators on the solar inverter panel blink and turn off 30 seconds later.
- Step 3** Reset the password within 10 minutes. (If no operation is performed within 10 minutes, all inverter parameters remain unchanged.)
1. Wait until the indicator  blinks green at long intervals.
 2. Obtain the initial WLAN hotspot name (SSID) and initial password (PSW) from the label on the side of the inverter and connect to the app.
 3. On the login screen, set a new login password and log in to the app.

Figure C-1 Setting the password

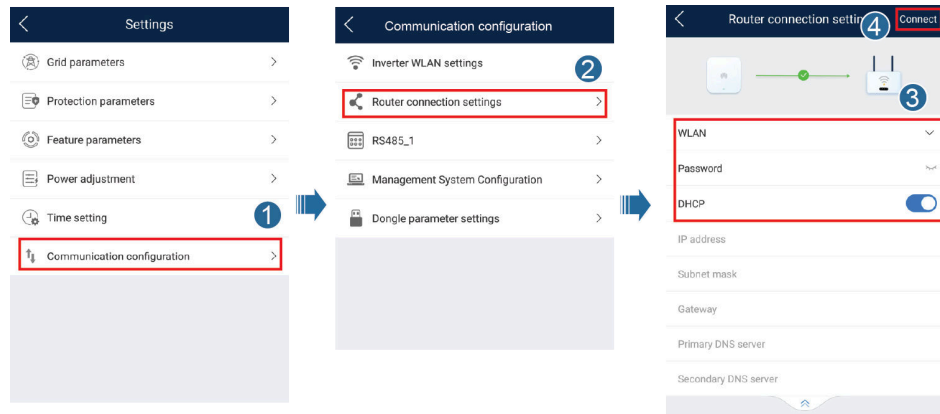


Step 4 Set router and management system parameters to implement remote management.

- Setting router parameters

Log in to the FusionSolar app, choose **Device Commissioning** > **Settings** > **Communication configuration** > **Router connection settings**, and set router parameters.

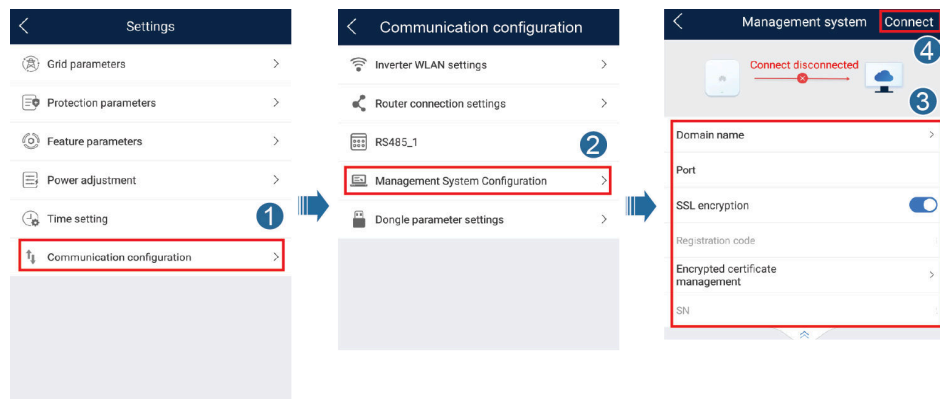
Figure C-2 Setting router parameters



- Setting management system parameters

Log in to the FusionSolar app, choose **Device Commissioning** > **Settings** > **Communication configuration** > **Management System Configuration**, and set management system parameters.

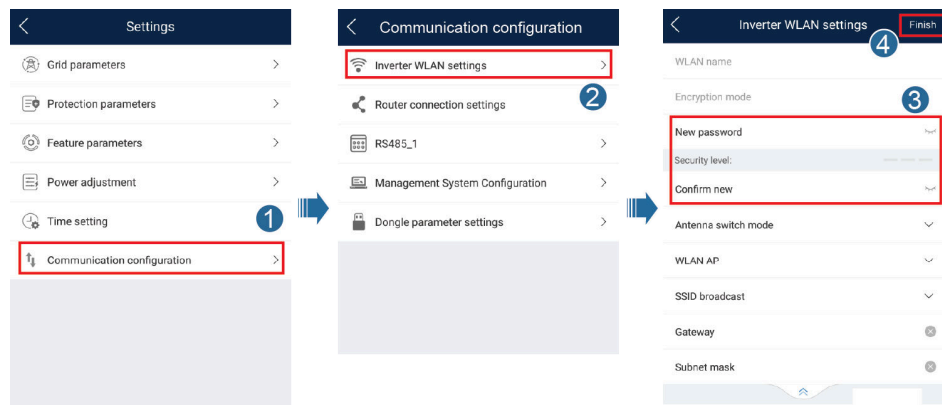
Figure C-3 Setting management system parameters



- (Optional) Resetting the WLAN password

Log in to the FusionSolar app, choose **Device Commissioning** > **Settings** > **Communication configuration** > **Inverter WLAN settings**, and reset the WLAN password.

Figure C-4 Resetting the WLAN password



----End

D Rapid Shutdown

Perform the following step to trigger rapid shutdown:

- Method 1: Turn off the AC switch between the solar inverter and the power grid.
- Method 2: Turn off the DC switch at the bottom of the inverter. (If an extra DC switch is connected to the input side of the inverter, turning off this DC switch will not trigger rapid shutdown.)

E Locating Insulation Resistance Faults

If the ground resistance of a PV string connected to a solar inverter is too low, the solar inverter generates a **Low Insulation Resistance** alarm.

The possible causes are as follows:

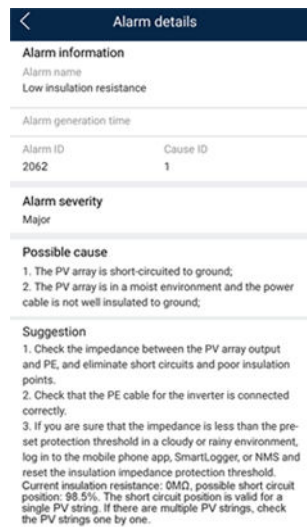
- A short circuit occurs between the PV array and the ground.
- The ambient air of the PV array is damp and the insulation between the PV array and the ground is poor.

To locate the fault, connect each PV string to a solar inverter, power on and check the solar inverter, and locate the fault based on the alarm information reported by the FusionSolar app. Perform the following steps to locate an insulation resistance fault.

NOTICE

If two or more ground insulation faults occur in a single PV string, the following method cannot locate the fault. You need to check the PV modules one by one.

- Step 1** The AC power supply is connected, and set the DC switch at the bottom of the solar inverter to OFF.
- Step 2** Connect each PV string to the solar inverter and set the DC switch to ON. If the solar inverter status is **Shutdown: Command**, choose **Device Commissioning > Maintenance > Inverter ON/OFF** on the app and send a startup command.
- Step 3** Log in to the FusionSolar app and choose **My > Device Commissioning**. On the **Device Commissioning** screen, connect and log in to the solar inverter, and access the **Alarm management** screen. Check whether the **Low Insulation Resistance** alarm is reported.
 - If the **Low Insulation Resistance** alarm is not reported one minute after the DC is supplied, choose **Device Commissioning > Maintenance > Inverter ON/OFF** on the app and send a shutdown command. Set the DC switch to OFF and go to **Step 2** to connect another PV string to the solar inverter for a check.
 - If a **Low Insulation Resistance** alarm is still reported one minute after the DC is supplied, check the percentage for possible short-circuit positions on the **Alarm details** page and go to **Step 4**.

Figure E-1 Alarm details**NOTE**

- The positive and negative terminals of a PV string are connected to the PV+ and PV- terminals of the solar inverter. The PV- terminal represents a possibility of 0% for the short-circuit position and the PV+ terminal represents a possibility of 100% for the short-circuit position. Other percentages indicate that the fault occurs on a PV module or cable in the PV string.
- Possible fault position = Total number of PV modules in a PV string x Percentage of possible short-circuit positions. For example, if a PV string consists of 14 PV modules and the percentage of the possible short-circuit position is 34%, the possible fault position is 4.76 (14 x 34%), indicating that the fault is located near PV module 4, including the previous and the next PV modules and the cables of PV module 4. The solar inverter has a detection precision of ±1 PV module.

Step 4 Set the DC switch to OFF and check whether the connector or DC cable between the possible faulty PV modules are damaged.

- If yes, replace the damaged connector or DC cable, set the DC switch to ON, and view the alarm information.
 - If the **Low Insulation Resistance** alarm is not reported one minute after the DC is supplied, the inspection on the PV string is complete. Choose **Device Commissioning > Maintenance > Inverter ON/OFF** on the app and send a shutdown command. Set the DC switch to OFF. Go to **Step 2** to check other PV strings. Then go to **Step 8**.
 - If the **Low Insulation Resistance** alarm is still reported one minute after the DC is supplied, go to **Step 5**.
- If not, go to **Step 5**.

Step 5 Set the DC switch to OFF, disconnect the possible faulty PV modules from the PV string, and connect a DC extension cable with an MC4 connector to the adjacent PV modules. Set the DC switch to ON and view the alarm information.

- If the **Low Insulation Resistance** alarm is not reported one minute after the DC is supplied, the fault occurs on the disconnected PV module. Choose **Device Commissioning > Maintenance > Inverter ON/OFF** on the app and send a shutdown command. Go to **Step 7**.

- If the **Low Insulation Resistance** alarm is still reported one minute after the DC is supplied, the fault does not occur on the disconnected PV module. Go to **Step 6**.

Step 6 Set the DC switch to OFF, reconnect the removed PV module, and repeat **Step 5** to check the adjacent PV modules.

Step 7 Determine the position of the ground insulation fault.

1. Disconnect the possible faulty PV module from.
2. Set the DC switch to OFF. Replace the faulty component to rectify the insulation resistance fault. Go to **Step 2** to check other PV strings. Then go to **Step 8**.

Step 8 Set the DC switch to ON. If the solar inverter status is **Shutdown: Command**, choose **Device Commissioning > Maintenance > Inverter ON/OFF** on the app and send a startup command.

----End

F Acronyms and Abbreviations

A	
AC	alternating current
D	
DC	direct current
DCI	direct current identification
F	
FRT	fault ride through
H	
HVRT	high voltage ride-through
I	
ID	identifier
L	
LED	light emitting diode
LVRT	low voltage ride-through
M	
MAC	Media Access Control
MPPT	maximum power point tracking
P	
PE	protective earthing

PV	photovoltaic
R	
RCMU	residual current monitoring unit
RH	relative humidity
S	
SN	serial number