

installation and user manual

# ON GRID SOLAR PV INVERTER

RS 6.0 T - 10.0 T - 15.0 T

**"RS" series** *three-phase*



RIELLO ELETTRONICA  **riello** solar  
tech



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## INTRODUCTION

Thank you so much for choosing RS 6.0 T - 10.0 T - 15.0 T, the latest generation of grid-tied PV string inverters (hereinafter referred to as the “inverter”) designed and developed by Riello Solartech.

Our company is specialised in the development and production of photovoltaic inverters. The solar inverters in this series are high-quality products, carefully designed and constructed with the aim of ensuring high performance.

This equipment can be used by any person, provided they **READ THIS MANUAL CAREFULLY AND THOROUGHLY**.

This user manual introduces the inverter in terms of its installation, electrical connections, operation, commissioning, maintenance and troubleshooting.

**For information regarding use and to obtain maximum performance from your equipment, this manual should be stored carefully near the inverter and CONSULTED BEFORE OPERATION.**

**NOTE:** some images contained in this document are for information purposes only and may not faithfully reproduce the parts of the product represented.

### Application Model

Grid-tied PV string inverter

- **RS 6.0 T / 10.0 T / 15.0 T** PV three-phase inverter with double MPPT input

### Intended Recipients

This user manual is intended for photovoltaic (PV) inverter operating personnel and qualified electrical technicians.

**Note:**

*this user manual is subject to change without prior notice. The latest version of the user manual and additional information on the product are available on <http://www.riello-solartech.com>, and/or by consulting your dealer.*

### Symbol Conventions

The safety symbols used in this manual, which highlight potential safety risks and important safety information, are listed below:

Symbol	Description
 DANGER	Indicates an imminently hazardous situation which, if not correctly followed, will result in serious injury or death.
 WARNING	Indicates a potentially hazardous situation which, if not correctly followed, could result in serious injury or death.
 CAUTION	Indicates a potentially hazardous situation which, if not correctly followed, could result in moderate or minor injury.
 NOTICE	Indicates a potentially hazardous situation which, if not correctly followed, could result in equipment failure or property damage.
 NOTE	Calls attention to important information, best practices and tips: supplements the safety instructions to optimise your use of the PV inverter and reduce wastage of resources.
 Refer	Refer to documentation (Remind operators to refer to the documentation shipped with the inverter).

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## SAFETY PRECAUTIONS

Before using the product, please read these safety precautions in the User Manual carefully.

### Personnel Safety

- The PV inverter must be installed, electrically connected, operated and maintained by a specially trained technician.
- The qualified technician must be familiar with the safety regulations concerning the electrical system, the working process of the PV power generation system and the standards of the local power grid.
- The technician must read through this User Manual carefully and master it before any operation.

### PV Inverter Protection

 NOTICE	Upon receiving the PV inverter, please check whether it was damaged during transport. If it was, please contact your dealer immediately.
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- Do not tamper with any warning signs on the inverter's enclosure, because these signs contain important information on safe operation.
- Do not remove or damage the nameplate on the inverter's enclosure, because it contains important product information.

### Installation Safety

 NOTICE	Please read the User Manual carefully before installing the PV inverter; warranty or liability will be voided if damage is caused by installation faults.
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- Ensure that there are no electrical connections around the PV inverter ports prior to installation.
- Adequate ventilation must be provided in the inverter's installation location. Mount the inverter in the vertical direction and ensure that no object is placed on the heat sink, as this may affect the cooling efficiency (for details, refer to the Installation chapter).

### Electrical Connections

 DANGER	Before installing the inverter, check all electrical ports to ensure that there are no damages or short-circuits. Otherwise, personal injury and/or fire will occur.
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- Input terminals of the PV inverter apply only to input terminals of the PV string; do not connect any other DC source to the input terminals.
- Before connecting PV modules, ensure that their voltage is within the safe range; when exposed to any sunlight, PV modules can generate high voltage.
- All electrical connections must meet the electrical standards of the relevant country or region.
- Cables used for electrical connections must be properly secured, well-insulated and made to the appropriate specification.

### Operation and Commissioning

 DANGER	While the inverter operates, high voltage can lead to an electrical shock hazard and even cause personal injury. Therefore, operate the PV inverter strictly according to the safety precautions in this User Manual.
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- Unless permission has been obtained from the power company of the country/region, the grid-tied PV inverter cannot start generating power.
- Follow the procedures for commissioning described in the User Manual when commissioning the PV inverter.
- When the PV inverter is operating, do not touch the surface of any other parts except for the DC switch; its constituent parts will be extremely hot and can cause burns.

### Maintenance

 DANGER	Power OFF all electrical terminals before performing inverter maintenance; strictly comply with the safety precautions stated in this document when operating the inverter.
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- For personal safety, maintenance personnel must wear appropriate personal protective equipment (such as insulation gloves and protective shoes) for inverter maintenance operations.
- Place temporary warning signs or erect fences to prevent unauthorised access to the maintenance site.
- Strictly follow the maintenance procedures specified in the User Manual.
- Check the relevant safety and performance of the inverter; rectify any faults which may compromise the safe operation of the inverter before restarting it.

### Additional Information

 NOTICE	To avoid any other unforeseeable risk, contact Riello immediately if any safety issue emerges during operation.
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## **PROTECTING THE ENVIRONMENT**

Our company has devoted extensive resources to the analysis of environmental aspects in the development of our products. All our products pursue the objectives set out in the environmental management system policy, developed by our company in accordance with current legislation.

This product does not contain hazardous materials such as CFCs, HCFCs or asbestos.

Product packaging is made from RECYCLED MATERIALS. The disposal of individual components must be performed in accordance with current legislation in the country where the product is used. Refer to the following table for material identification:

<b>DESCRIPTION</b>	<b>MATERIAL</b>	
Packaging box	Corrugated cardboard (PAP)	
Protective bag	High-density polyethylene (HDPE)	
Foam	Low-density polyethylene (LDPE)	

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## **LIMITED GUARANTEE**

The equipment you have purchased has been constructed according to the most modern techniques and was rigorously tested before leaving the factory.

During the guarantee period, the manufacturer shall repair or replace parts that prove defective, provided that such defects have not been caused by incompetence or negligence of the buyer, fortuitous events or force majeure (lightning, fire, flood, etc.), incorrect or inadequate installation other than as stated in the manual, unsuitable transport or delivery, opening of the unit by unqualified personnel or breaking of the closure seal, modification, testing or unauthorised repair, use or application beyond the limits defined by the manual, or application beyond those defined by safety standards (VDE, UL, etc.).

It is the responsibility of the person applying for technical assistance from Customer Service to provide detailed information about the detected failure or malfunction.

The repair and/or replacement of parts or the device shall be implemented at the discretion of the supplier.

Any repair under guarantee will be performed by the manufacturer or an authorised service centre. Equipment must arrive at the risk and expense of the customer in its original packaging so as not to cause further damage.

If repairs must be performed directly at the customer's premises, the customer shall be charged for expenses and hours of travel, while the costs for labour and parts shall be borne by the manufacturer. This guarantee does not in any case cover the replacement of equipment or compensation for any direct or indirect costs or claims for damage caused by device malfunction.

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# CONTENTS

<b>PRESENTATION</b>	<b>5</b>
Product presentation	5
<b>INSTALLATION</b>	<b>9</b>
Preliminary checks	9
Electrical installation	17
<b>USE</b>	<b>26</b>
System Operation	26
User Interface	28
Maintenance	31
Troubleshooting	32
Storage	34
Disposing of the product	34
<b>APPENDIX</b>	<b>35</b>
Technical Specifications	35

# PRESENTATION

## PRODUCT PRESENTATION

This chapter introduces the inverter and describes its functional model, network application, appearance, dimensions and working process, etc.

### Functional Model

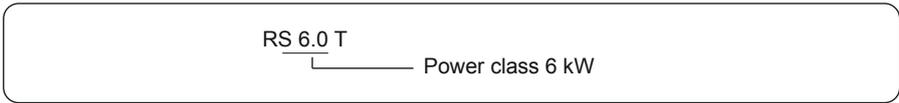
#### Function

This series consists of a three-phase grid-tied PV string inverter (transformerless) which converts the DC power generated by PV strings into AC power and feeds the power into the power grid.

 WARNING	The inverter is transformerless. Add an isolation transformer before grounding the positive/negative terminal of the PV modules (such as a thin-film module) for operation.
 WARNING	Do not connect PV modules in parallel to several PV inverters for operation.

### Model Description

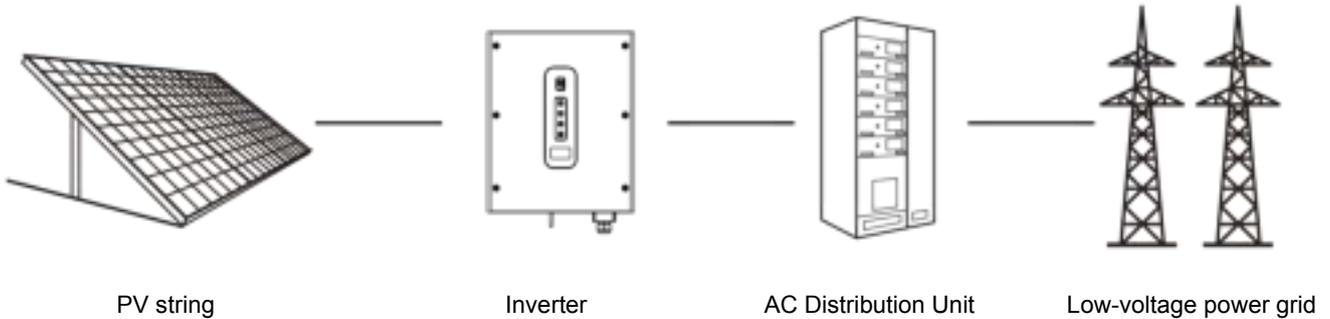
The number in the model name indicates the power class of the inverter, for example, model RS 6.0 T is a 6kW inverter.



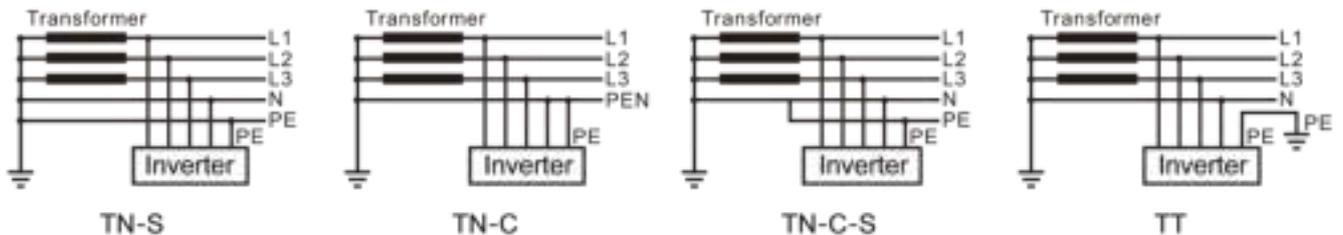
### Network Application

#### Grid-tied PV Power Systems

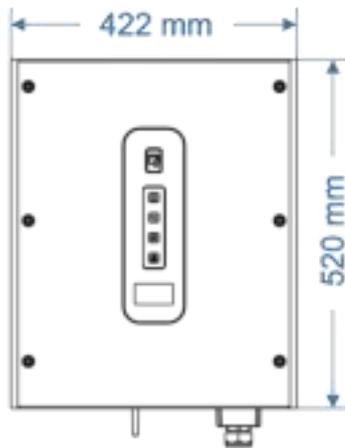
The series include grid-tied PV power systems for industrial/commercial rooftops, light complementary power generation systems, and large ground-based power stations. Typically, a grid-tied PV power system consists of PV modules, grid-tied inverters, AC distribution units and a low-voltage power grid, as shown in the figure below:



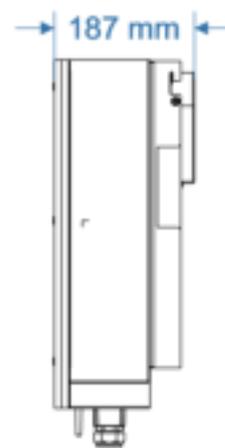
These series inverters support TN-S, TN-C, TN-C-S, and TT power grids as shown in the figure below:



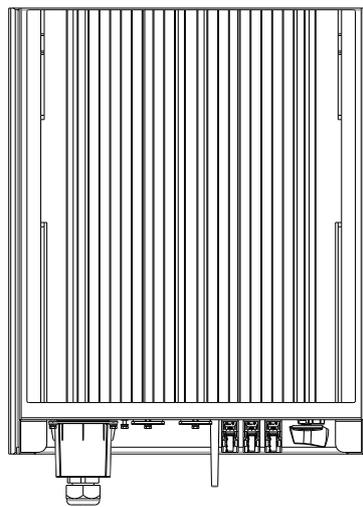
## Outline and Dimensions



Front view

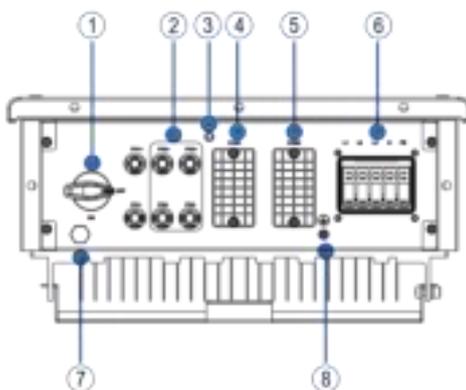


Side view



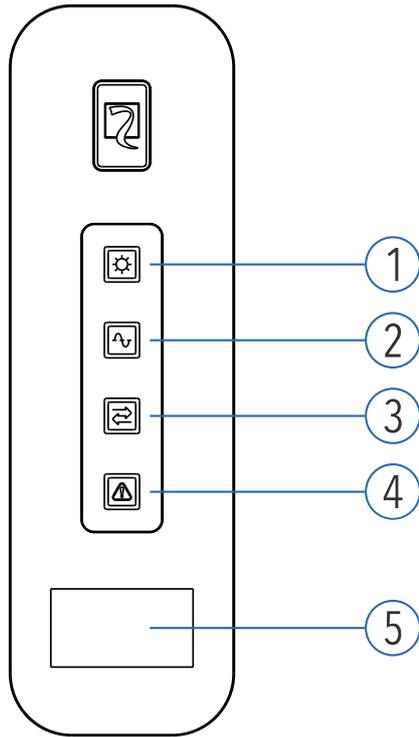
Bottom view

## Connections Area



- (1) DC isolation breaker
- (2) PV string connectors
- (3) Wi-Fi antenna connector
- (4) Communications interface 1 (COM1)
- (5) Communications interface 2 (COM2)
- (6) AC output connection
- (7) Vent valve
- (8) External protection ground connector

## Indicator Panel View LED and LCD Area



- (1) PV indicator
- (2) Grid indicator
- (3) COM indicator
- (4) Warning indicator
- (5) LCD

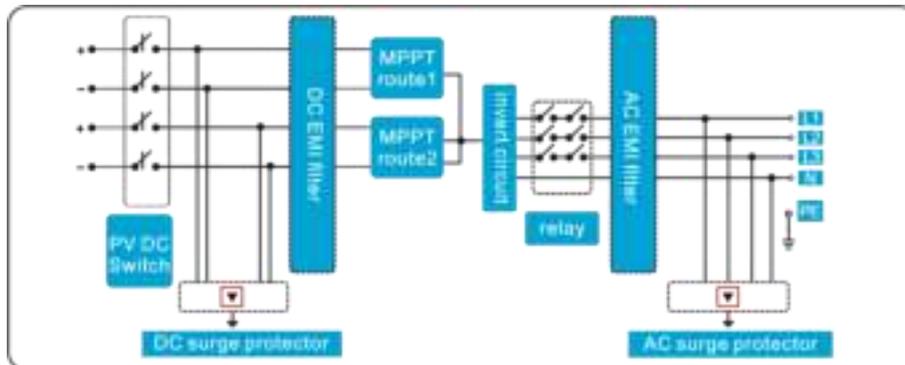
## Working Process

### Basic principle description

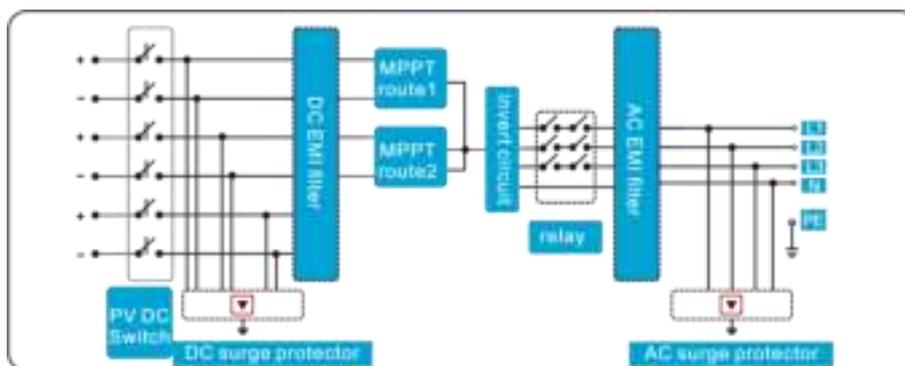
RS 6.0 T / 10.0 T receive inputs from 2 strings of PV panels. RS 15.0 T receive inputs from 3 strings of PV panels, with the 2nd and 3rd routes terminals merging into one independent MPPT. Then, the inputs are grouped into two independent MPPT routes inside the inverter to track the maximum power point of the PV panels. The MPPT power is then converted into DC bus and the DC power is converted to AC power through an inverter circuit. Lastly, the AC power is fed into the power grid. Surge protection and EMI filter are supported on both the DC and AC sides to reduce electromagnetic interference.

### Circuit Diagrams

The diagram below shows the circuit blocks of the RS 6.0 T / 10.0 T PV inverters:



The diagram below shows the circuit blocks of the RS 15.0 T PV inverters:



## Operating Modes

The following three operating modes of the inverter are described below: stand-by, operating, and shutdown. The table below shows the conditions for the inverter to switch between operating modes.

Mode	Description
Stand-by	The PV inverter enters the stand-by mode when: <ul style="list-style-type: none"> <li>The input voltage of the PV string can enable the auxiliary power supply to run but cannot meet the inverter operation requirements.</li> <li>The input voltage of the PV string can meet the inverter start-up requirements but cannot meet its minimum power requirements.</li> </ul>
Operating	When the PV inverter is grid-tied and generates electricity, it tracks the maximum power point to maximise the PV string output. It converts DC power from PV strings into AC power and feeds the power into the power grid. The PV inverter will enter the shutdown mode if a fault is detected or a shutdown command is given.
Shutdown	The PV inverter switches from stand-by or operating mode to shutdown mode if a fault is detected or a shutdown command is given. The inverter switches from shutdown mode to stand-by mode if a start-up command is given or when it detects that a fault has been rectified.

# INSTALLATION

## PRELIMINARY CHECKS

 DANGER	Do not install the inverter on flammable building materials or in an area where flammable or explosive materials are stored.
 CAUTION	Do not install the inverter in a place where personnel are likely to come into contact with its enclosure and heat sinks, to avoid electrical shock or burns.

### Checking the packaging contents

- Upon receiving the inverter, check that the packaging materials are intact.
- After unpacking, check that the deliverables are complete, intact and consistent with your order list.
- Examine the PV inverter and its fittings for any damage such as scraps and cracks.

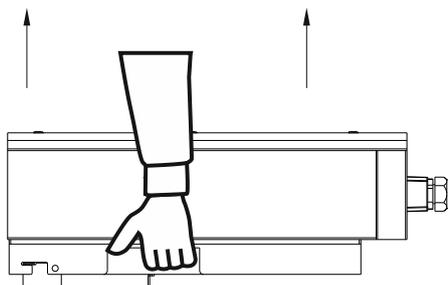


ITEM	DESCRIPTION
A	PV Inverter
B	Rear panel
C	Manuals
D	AC waterproof cover
E	COM2 waterproof cover
F	Signal terminals (4pin+6pin)
G	DC terminal connector group
H	Insulated end sleeve terminals
I	Screws
J	Expansion plugs kit (reserved for tightening the rear panel)
K	Wi-Fi antenna
L	Removal tool for DC connectors

 NOTICE	If any of the damage mentioned above is found, contact the dealer immediately.
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## Moving the inverter

After checking the outer packaging, move the PV inverter to the designated installation position horizontally. Grip the handles on both sides of the inverter, as shown in the figure below.



 CAUTION	<p>The inverter is relatively heavy! To prevent device damage and personal injury, arrange two people to move the inverter and handle with care.</p>
 CAUTION	<p>Do not place the PV inverter with its wiring terminals in contact with the floor, because the power ports and signal ports at the bottom of the device are not designed to bear the weight of the inverter. When placing the inverter on the floor horizontally, place foam or paper under it to protect its enclosure.</p>

## Identifying the PV Inverter

### Nameplate

After removing the PV inverter from its packaging box, identify it by reading its nameplate affixed to the side of the inverter. The nameplate contains important product information: model, communication/technical specifications and compliance symbols.

	<p><b>Risk of electric shock</b> The device contains high voltages, both alternating and direct current, and high leakage currents may be generated during operation. To avoid the risk of electric shock during maintenance or installation, make sure that all DC and AC connection terminals are disconnected. First connect the grounding wire to ground and disconnect it last during maintenance. Check for the proper phases and neutral connection. If the unit is used without following the specifications of the manufacturer, the protection provided by the equipment may be impaired. Disconnect the inverter from the grid and from the photovoltaic generator before cleaning the photovoltaic modules: an unexpected capacitive current from the surface of the modules may surprise operators, causing them to fall off the roof.</p>
  10 mins	<p><b>Handling the photovoltaic inverter</b> The photovoltaic inverter must only be handled by qualified service personnel. When the photovoltaic generator is exposed to sufficiently intense light, it generates DC voltage, and when connected to the device, it charges the bulk capacitor. After having disconnected the photovoltaic inverter from the grid and the photovoltaic generator, an electric charge may remain in the bulk capacitor. Please wait at least 10 minutes after disconnecting the device from the grid before handling it.</p>
	<p><b>Exclusively for the grid</b> The PV inverter is designed for the sole purpose of converting energy from PV modules and injecting it into the grid. This inverter is not designed to be powered by sources of primary energy other than PV modules or to be connected to different loads other than the public grid.</p>
	<p><b>Hot surfaces</b> Although it has been designed in accordance with international safety standards, the photovoltaic inverter may become hot during operation.</p>

	<p><b>Disposal</b> If the inverter service life has expired, dispose of the device in accordance with local rules for disposal of electrical equipment waste. Do not dispose of PV inverter with household waste.</p>
	<p><b>TÜV Certification</b> The PV inverter is compliant with the TÜV requirements.</p>

## Installation Requirements

These apply to wall-mounted installation, as described below in detail.

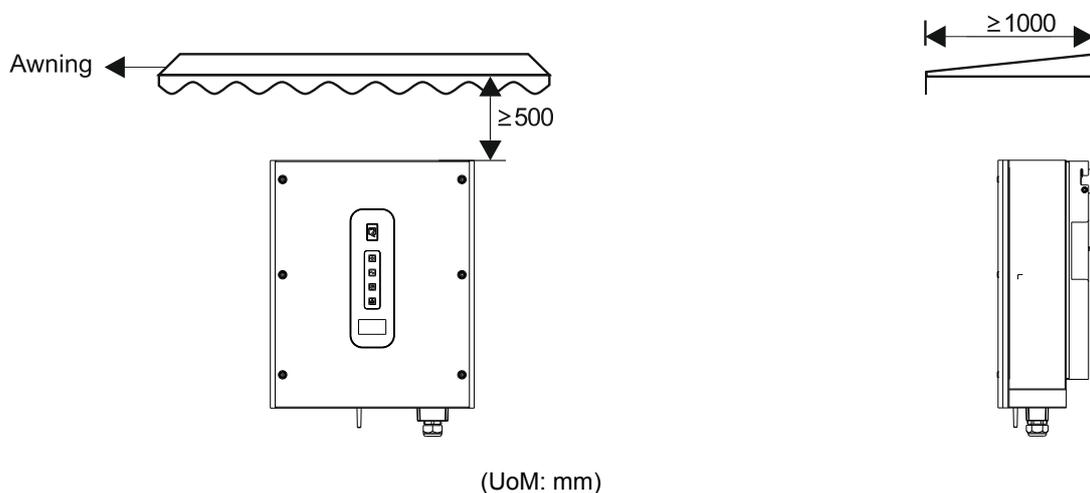
### Determining the Installation Position

#### Basic Requirements

- The inverter is protected to IP65 and can be installed indoors or outdoors.
- The installation method and position must be appropriate for the weight and dimensions of the inverter.
- Do not install the inverter in a place where personnel are likely to come into contact with its enclosure and heat sinks, because these parts are extremely hot during operation.
- Do not install the inverter in an area where flammable or explosive materials are stored.

#### Installation Environment Requirements

- The ambient temperature must be below 50°C, which ensures the inverter's optimal operation and extends its service life.
- The inverter must be installed in a well-ventilated environment to ensure good heat dissipation.
- The inverter must not be directly exposed to sunlight, rain and snow to avoid shortening its service life. It is recommended that the inverter be installed in a sheltered place. If no shelter is available, build an awning, as shown in the figure below.

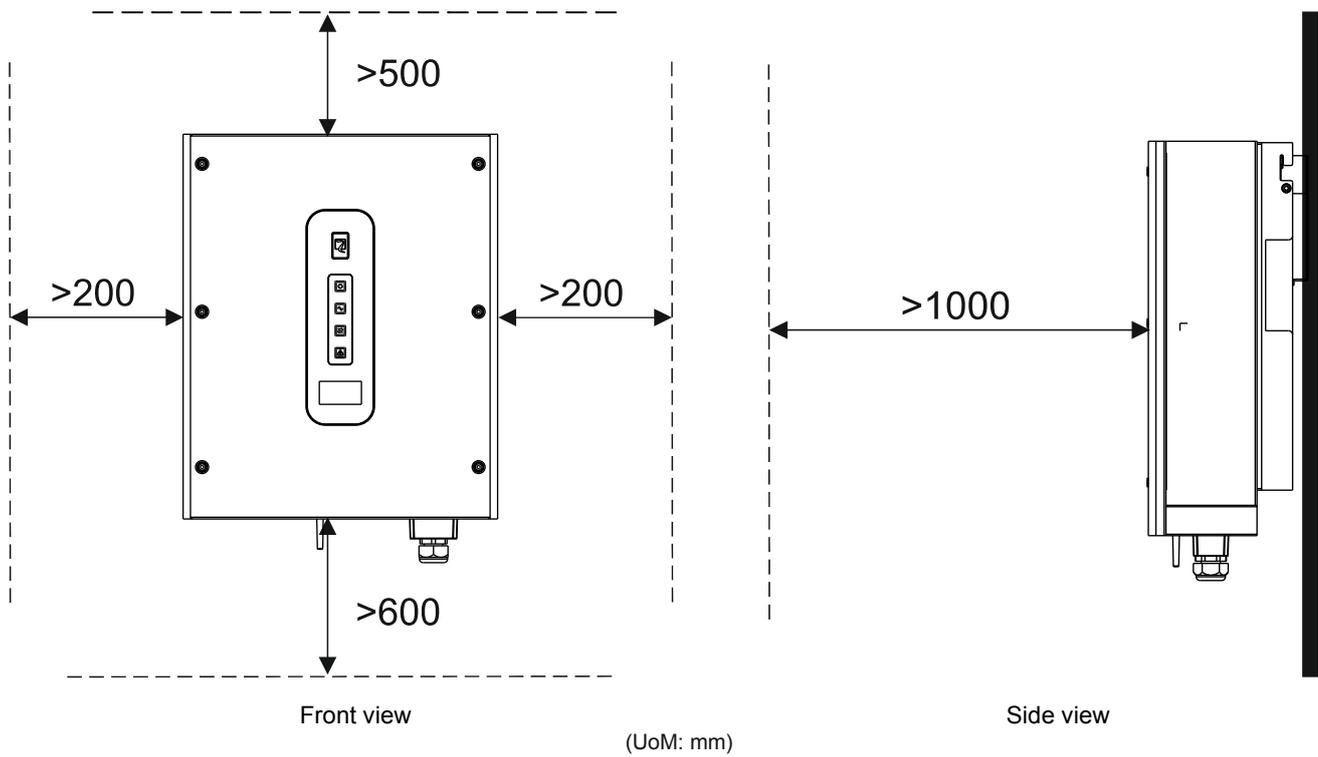


#### Carrier Requirements

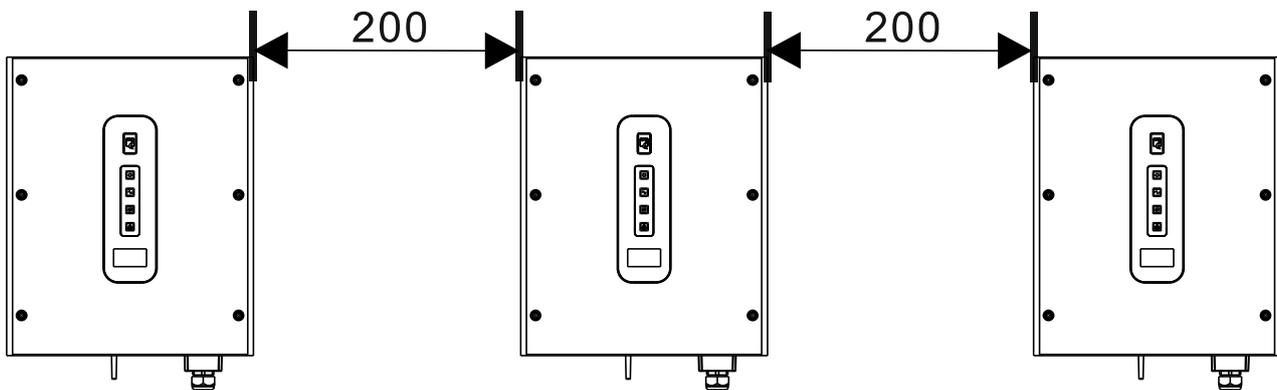
- The carrier where the inverter is installed must be fireproof. Do not install the inverter on flammable building materials.
- The wall must be solid enough to bear the weight of the inverter.
- Do not install the inverter on a wall made of gypsum boards or similar materials.

### Installation Space Requirements

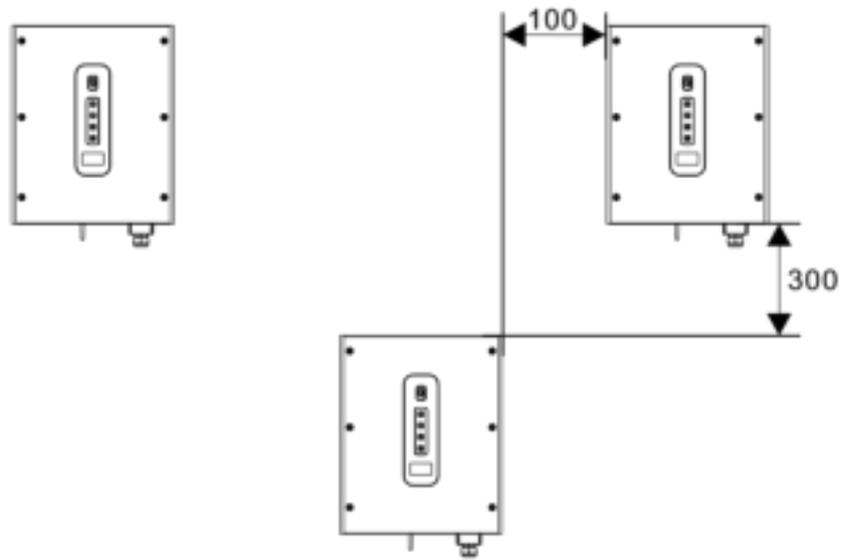
- It is recommended that the inverter be installed at eye level to facilitate operation and maintenance.
- Reserve enough clearance around the inverter to ensure sufficient space for installation and heat dissipation, as shown in the figure below.



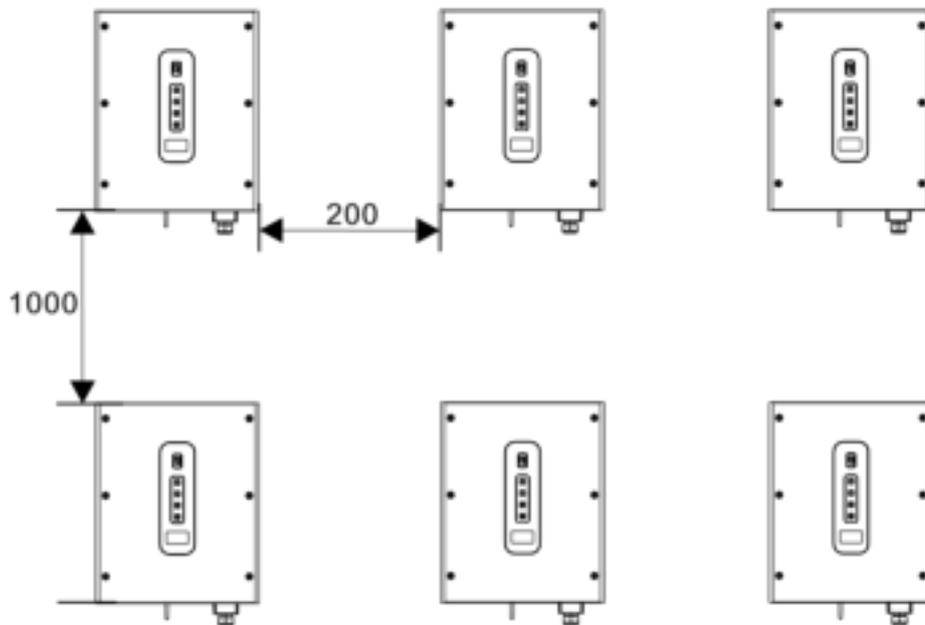
When installing multiple inverters, install them along the same line if sufficient space is available, or in a triangle pattern or stacked if there is insufficient space. The installation modes ensure sufficient space for installation and heat dissipation (see following figures for more details).



Installation along the same line (UoM: mm)



Installation in triangle pattern (UoM: mm)



Installation in stacked mode (UoM: mm)



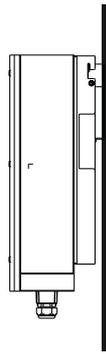
NOTICE

The clearance between multiple inverters must be increased to ensure proper heat dissipation when they are installed in a hot area.

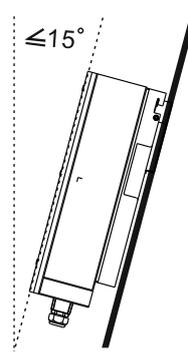
## Installation Mode Requirements

Install the inverter upright or with a maximum backward tilt angle of 15 degrees to facilitate heat dissipation. Below are some correct/wrong installation modes.

  
The correct installation mode



Upright



Backward tilt

  
The wrong installation mode



Upside-down



Horizontal



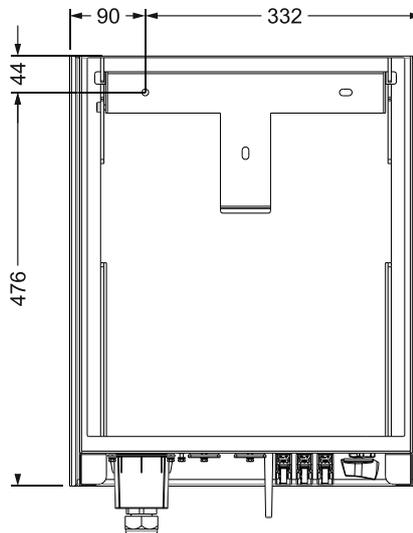
Incorrect installation will lead to failure of the inverter operation.

## Installing the Rear Panel

Before installing the inverter, secure the provided rear panel to a wall.

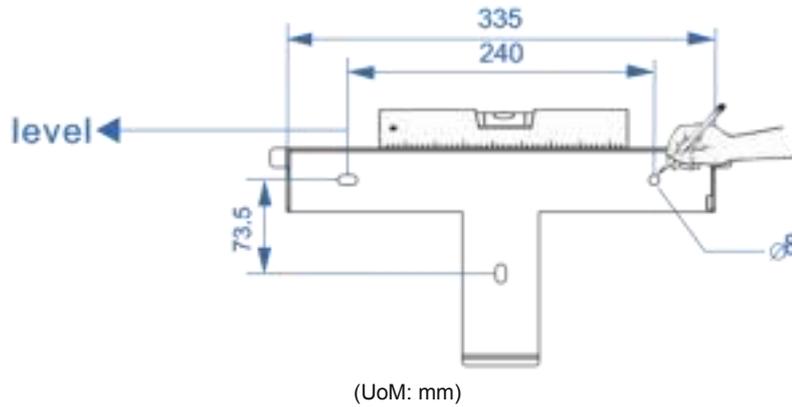
**Step 1** Remove the rear panel from the packaging box.

**Step 2** Determine the positions for drilling holes using the rear panel.



(UoM: mm)

**Step 3** Level the hole positions using a level and mark the hole positions using a marker.

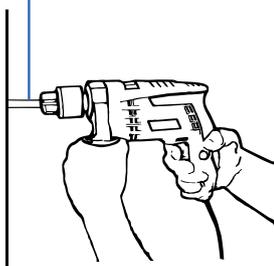


**Step 4** Drill holes using a hammer drill and install expansion bolts, as shown in the figure below.

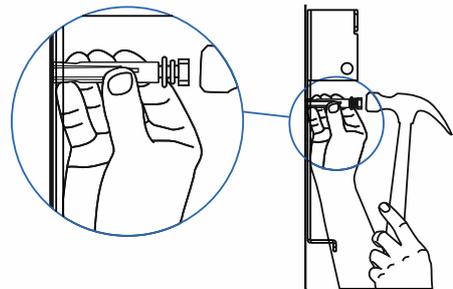
 <b>DANGER</b>	Before drilling the hole in the wall, ensure that no electrical wiring and/or water piping inside the wall will be damaged.
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- Drill a hole in a marked position to a depth of 60-65 mm using a hammer drill with a  $\Phi 10$  mm bit.
- Partially tighten an expansion bolt, insert it vertically into the hole and knock it completely into the hole using a rubber mallet.

$\Phi 10$ , Depth of the hole: 60-65mm

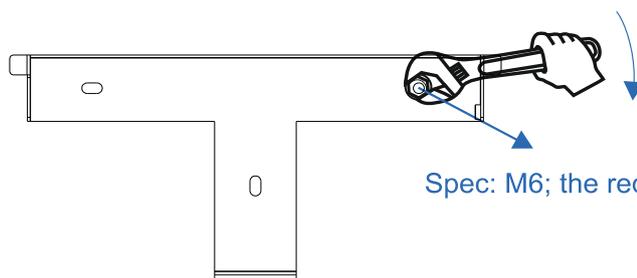


Drill the holes



Install the expansion plugs

**Step 5** Align the rear panel with the holes, insert the expansion bolts into the holes through the rear panel and tighten them to a torque of 3 Nm using a torque wrench.



Spec: M6; the required torque is 3 N·m

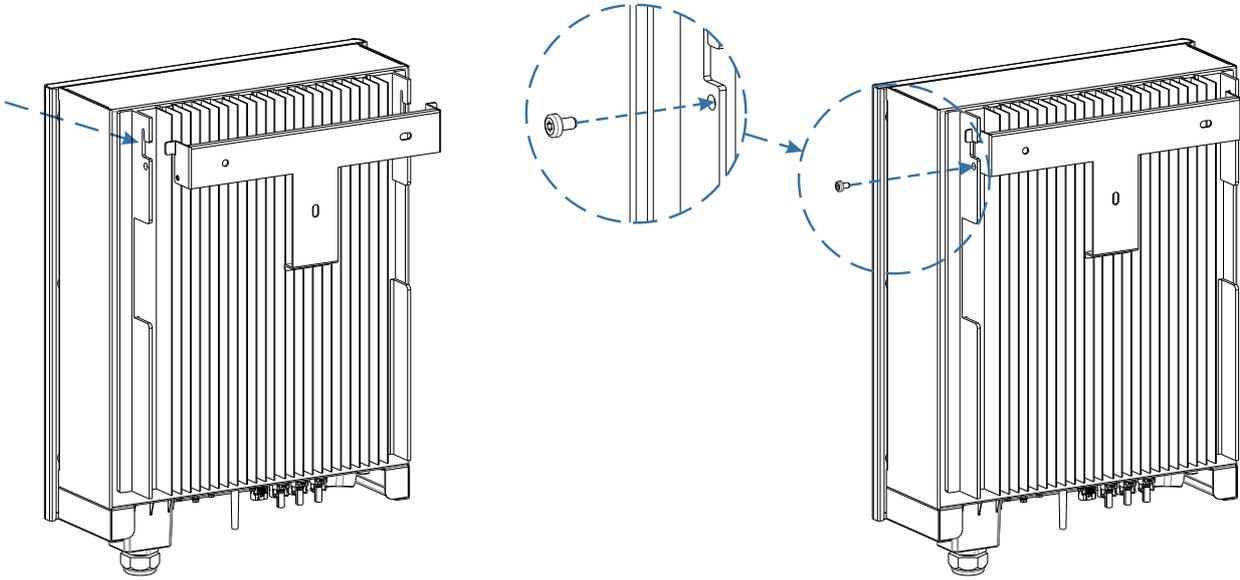
## Installing the Inverter

Follow the procedures described below:

**Step 1** The installer must hold the handle at both sides of the inverter and then lift the inverter and place it standing.

**Step 2** Mount the inverter on the rear panel and keep the two parts aligned with each another.

**Step 3** Tighten the M6 hexagon screw at the right side of the inverter to a torque of 3 Nm.



Mount on the rear panel

Tighten the screw at the right side

# ELECTRICAL INSTALLATION

## Preliminary operations

- It is advisable to install a circuit breaker on the AC side (see “Recommended circuit breaker” in the technical specifications table).
- Turn the DC switch to off.
- Open the AC switch downstream of the inverter.

 DANGER	Before performing any electrical connections, ensure that both the DC and AC switches are OFF. Otherwise, fatal injury can occur due to the high voltage generated by the AC and DC cables.
 CAUTION	Grounding of the PV strings must obey the following prerequisites:
<p>If an isolation transformer must be installed on the AC side of each inverter, ensure that the neutral wire of the isolation transformer is disconnected from the PGND cable.</p> <p>One isolation transformer must be connected to one PV inverter: do not install a single isolation transformer for multiple inverters; otherwise, circulating current generated by the inverters will lead to operation failure.</p>	

## Connecting Protection Ground (PGND) Cables

### Preparation

The ground cable and OT terminals have to be prepared.

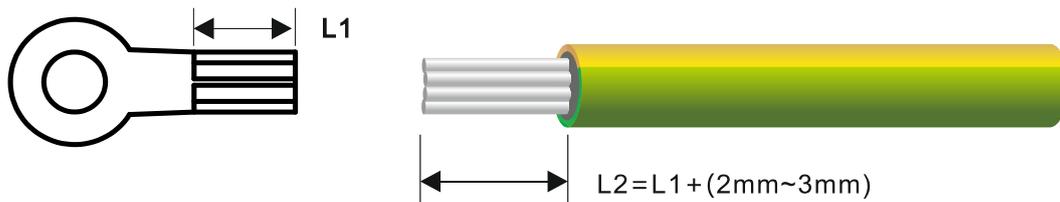
Ground cable: outdoor copper-core cables with 6mm<sup>2</sup> cross-sectional area or more are recommended.

OT terminal: OT terminal for M4 screw, 6mm<sup>2</sup> cable.

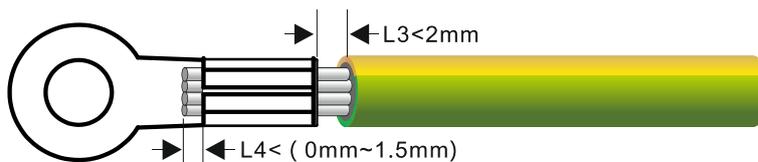
 NOTE	Proper grounding for the inverter helps to counter the impact of surge voltage and improve EMI performance. Connect the PGND cable before connecting the AC and DC power cables and the communication cables.
 NOTE	It is recommended that the ground cable be connected to a nearby ground position. For a system with multiple inverters connected in parallel, connect the ground points of all inverters to ensure equipotential connections.

## Wiring Procedures

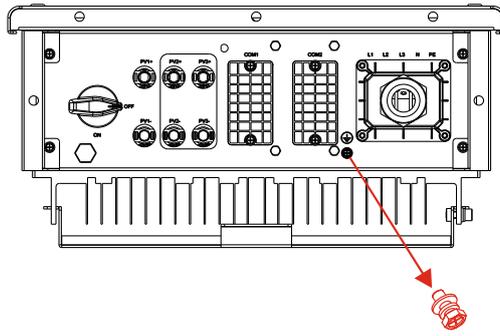
**Step 1** Remove an appropriate length of the insulation layer from the PGND cable using a wire stripper; this length must be longer than that of the OT terminal’s crimping end by 2 mm–3 mm.



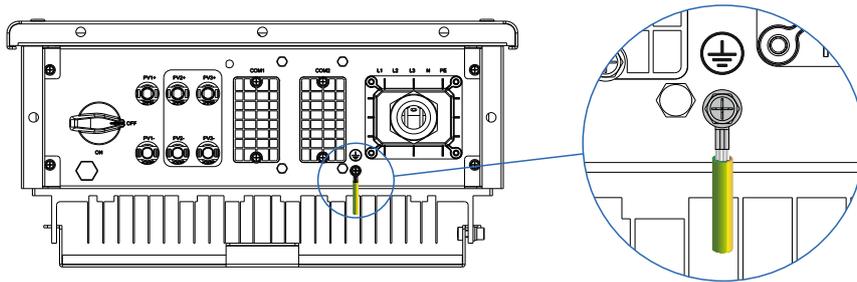
**Step 2** Insert the exposed core wires into the crimping areas of the OT terminal and crimp them using hydraulic pliers.



**Step 3** Remove the ground screws from the ground point.



**Step 4** Secure the PGND cable (done with steps 1 and 2) using the ground screw and tighten the screw to a torque of 1.2 Nm using a socket wrench.



**Connecting the AC Output Cables**

**Preparation**

The AC power cable and AC terminals have to be prepared.

AC power cable: outdoor multi-strand copper-core cables are recommended. The following table describes the specifications.

Inverter model	Cable type	Cross-sectional area (mm <sup>2</sup> )		Cable outer diameter (mm)
		Range	Recommended value	Range
RS 6.0 T	Multi-core outdoor cable	4–6	4	11–18
RS 10.0 T RS 15.0 T	Multi-core outdoor cable		6	

The AC power cable connected to the AC terminals must have a maximum length as reported in the following table:

Cross-section Area	Model		
	RS 6.0 T	RS 10.0 T	RS 15.0 T
4mm <sup>2</sup>	53m	30m	20m
6mm <sup>2</sup>	80m	47m	30m

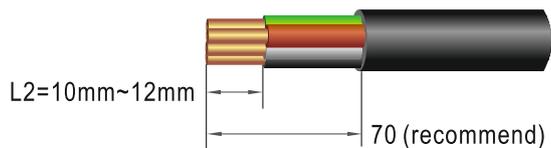
If a leak-protective switch is needed, please install a model B switch with at least 300mA current leakage.

Neutral wire sharing is forbidden for multi leak-protective switches in system, otherwise tripping operation will occur.

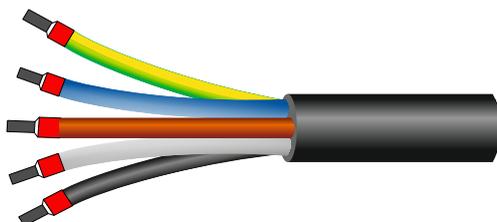
<b>WARNING</b>	An independent three-phase circuit breaker must be installed on the AC side of each inverter to ensure that the inverter can be safely disconnected from the power grid. Do not install one circuit breaker for multiple inverters.
<b>WARNING</b>	Do not connect loads between the AC output terminals of the inverter and circuit breaker.

## Procedure for Connecting AC Cables

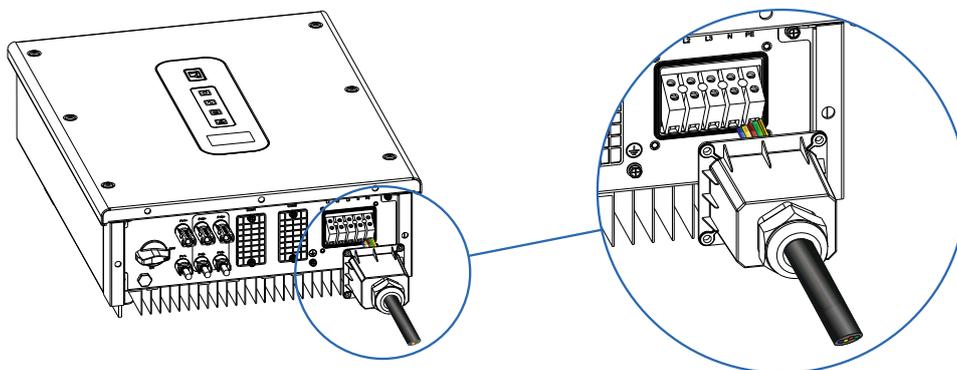
**Step 1** Remove an appropriate length of the jacket and insulation layer from the AC output cable using a wire stripper, as shown in figure below.



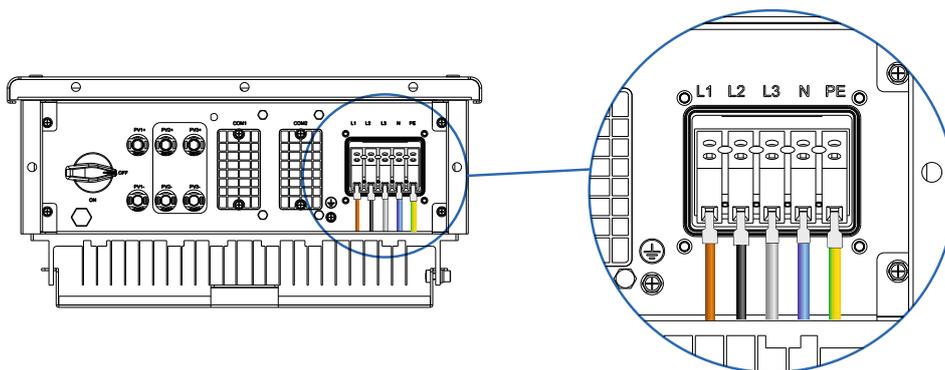
**Step 2** Insert the exposed core wires into the crimp area of the supplied insulated end sleeve terminals, crimp them using specific tools.



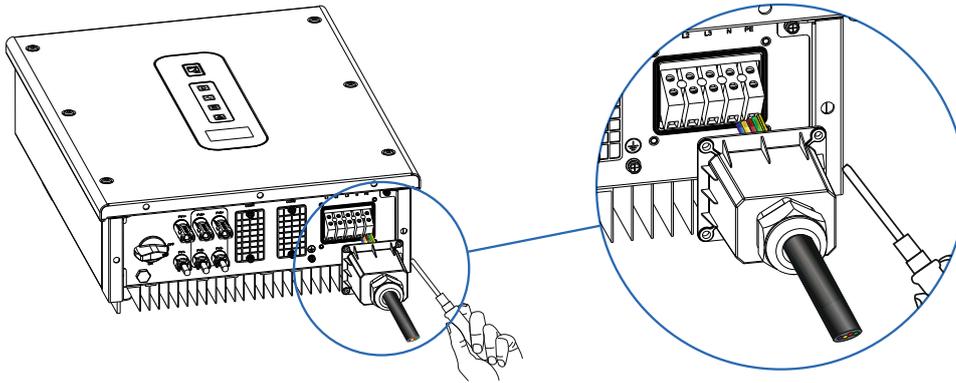
**Step 3** Insert the prepared AC output cables through AC waterproof cover with reserved wire length for electrical connecting.



**Step 4** Rout AC output cables to L1, L2, L3, N, and E on the AC terminal block respectively, and tighten them using screwdriver to a torque of 1.5Nm.



**Step 5** Fasten the AC waterproof cover by four hexagon screws supplied; tighten the screws to a torque of 0.8Nm.



**Step 6** Use a torque wrench to tighten cable gland with 5Nm.

### Connecting the PV Strings

	<b>DANGER</b>	The PV strings connection must comply with the following prerequisites; otherwise, an electric shock may occur.
PV modules generate electrical energy when exposed to sunlight and can create an electric shock hazard. Therefore, when connecting the PV modules, shield them with opaque cloth.		
Before connecting the DC input power cables, ensure that the voltage on the DC side is within the safe range and that the DC SWITCH on the inverter is OFF. Otherwise, high voltage may result in electric shock.		
When the inverter is grid-tied, it is not allowed to maintain DC input power cables, such as those used to connect or disconnect a string or a module in a string. Only after the inverter enters in shutdown mode can maintenance on the DC input power cables be performed.		

	<b>WARNING</b>	Grounding of the PV strings must comply with the following prerequisites; otherwise, a fire can break out.
PV modules connected in series in each PV string must have the same specifications.		
The maximum open-circuit voltage of each PV string must be always lower than or equal to its permitted range.		
The maximum short-circuit current of each PV string must be always lower than or equal to its permitted range.		
The positive and negative terminals of PV modules must be connected to the positive and negative DC input terminals of the inverter, respectively.		
During the installation of PV strings and the inverter, the positive or negative terminals of PV strings cannot be connected with a short-circuit.		

### Preparation

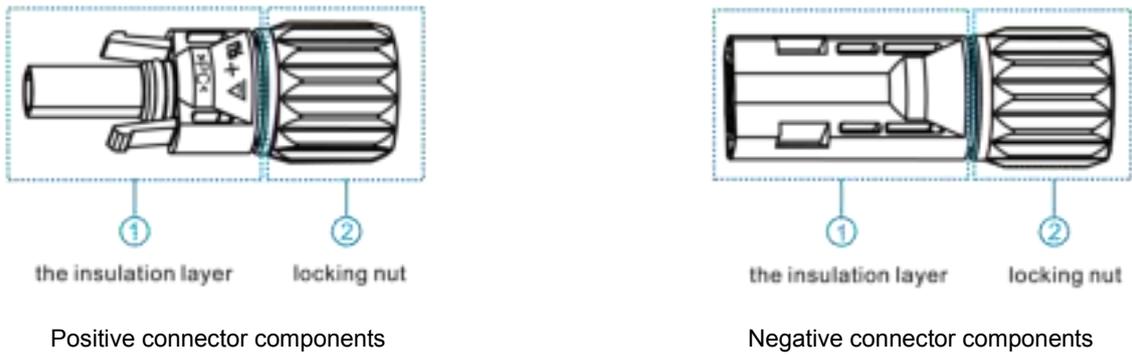
Route connection for the installation of PV strings and the inverter:

PV Strings	Inverter Input connection	Inverter model
1	Connected to any route	RS 6.0 T RS 10.0 T RS 15.0 T
2	Connected to routes 1 and 2	
3	Connected to routes 1, 2 and 3	RS 15.0 T

PV strings DC input cable and connectors have to be prepared; the following table lists the recommended outdoor copper-core DC input cable specifications.

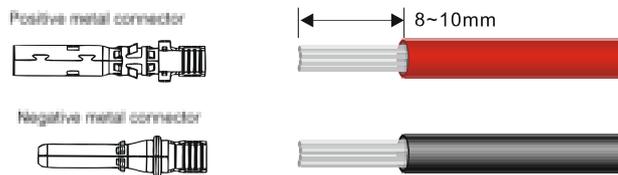
Inverter model	Cable type	Cross-sectional area (mm <sup>2</sup> )		Cable outer diameter (mm)
		Range	Recommended value	Range
RS 6.0 T RS 10.0 T RS 15.0 T	Common PV cables in the industry (model: PV1-F)	2.5–4	4	4–5

Connectors for PV strings: positive and negative DC input connectors are used, as shown below.

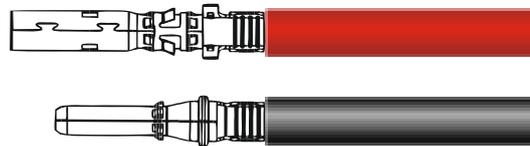


**Procedures for connecting the PV strings**

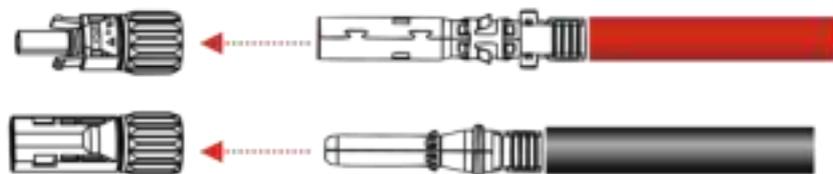
**Step 1** Remove an appropriate length of the insulation layer from the positive and negative power cables using a wire stripper, as shown in the figure below.



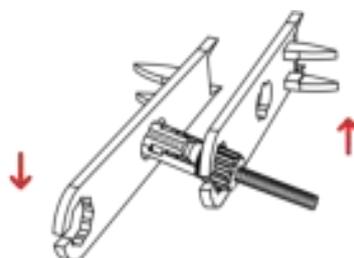
**Step 2** Insert the exposed areas of the positive and negative power cables into the metal terminals of the positive and negative connectors respectively and crimp them using a crimping tool, as shown below.



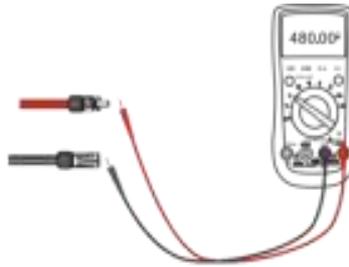
**Step 3** Insert the crimped positive and negative power cables into the corresponding positive and negative connectors until a “click” is heard, as shown below.



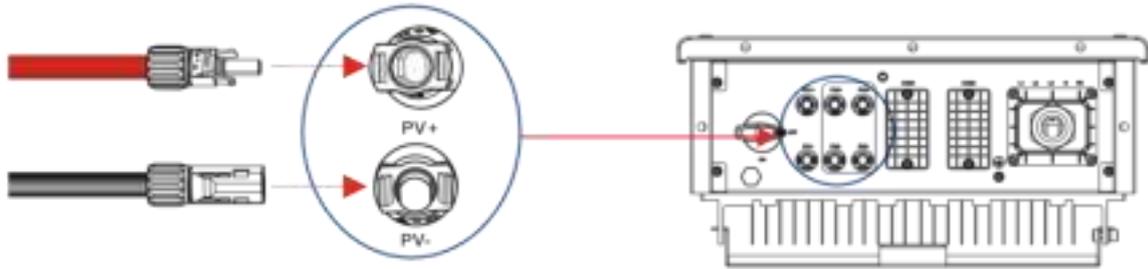
**Step 4** Tighten the locking nuts on the positive and negative connectors using a spanner.



**Step 5** Measure the voltage of every string route using a multimeter. Ensure that the poles of the DC input power cables match up.



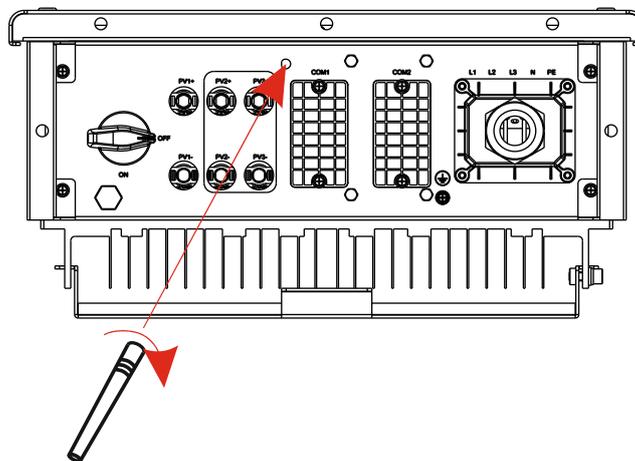
**Step 6** Insert the positive and negative connectors into their corresponding terminals of the inverter until a “click” is heard, as shown in the figure below.



**Step 7** After connecting the PV strings, ensure that all connectors are in position by checking for resistance when a slight pull is applied.

### Connecting the Wi-Fi Antenna

Fasten the Wi-Fi antenna (included in the box) to the inverter, screwing it onto the relative connector.

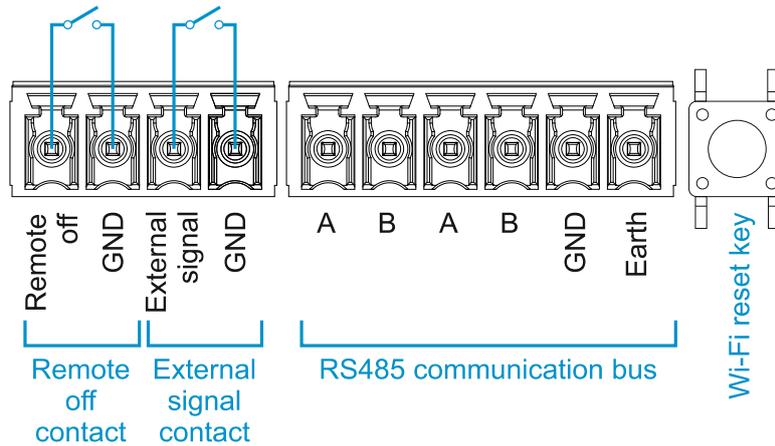


### Communication Port 1 (COM1)

The COM1 port consist of a DB9 connector and allows to connect any optional accessories. For more information about the available accessories please, visit the <https://riello-solartech.it> website.

## Communication Port 2 (COM2)

The COM2 port includes the following features:



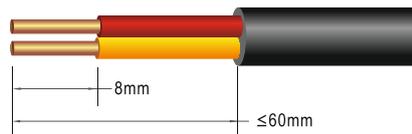
### Remote off contact and External signal contact

The Remote off and External signal contacts must be connected and used if required by the local regulation.

### Connecting Remote off and External signal cables

If the local regulation requires the Remote off and External signals please, follow the instructions below.

**Step 1** Remove an appropriate length of the insulation layer from the cable using a wire stripper, as shown in the figure below.



**Step 2** Remove the four screws at the inverter bottom to remove the COM2 cover plate.

**Step 3** Take the COM2 waterproof cover out of the accessory kit and remove the locking caps of the cable glands on the waterproof cover. Route the cables through the cable glands and reserve enough wire length for wiring to the inverter.

**Step 4** Take the 4pin terminal connector out of the accessory kit. Connect the Remote off signal cable to the first pair of terminals of the 4pin connector. Connect the External signal cable to the second pair of terminals of the 4pin connector.



**Step 5** Connect the 4pin signal terminal to its female terminal in the COM2 slot of the inverter and fasten the COM2 waterproof cover using the screws removed before. Tighten the waterproof cover screws to a torque of 0.8Nm as well as the locking caps.

## RS485 communication bus cables connection

The RS485 communication bus allow to connect the inverter in two modes:

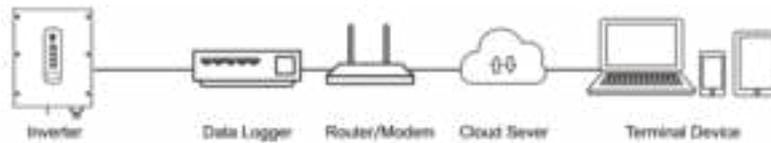
- Mode 1

To connect the inverter to a digital power meter in order to monitor the energy produced, consumed and sold during the day, when the sunlight is available.

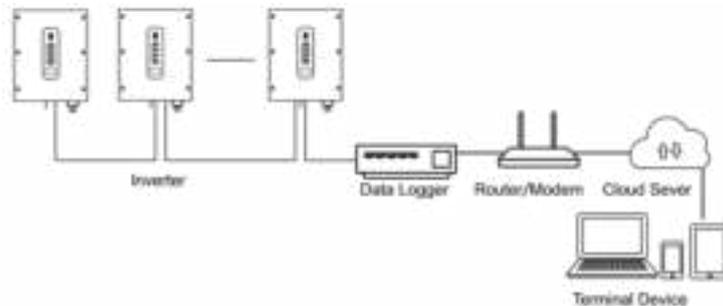
- Mode 2

To connect the inverter (or several inverters) to a datalogger in order to monitor the energy produced and inverter diagnostic. By connecting a digital power meter to the datalogger, it is possible to monitor also the energy consumed and sold during all day, even if the sunlight is not available. For more information please, refer to the <https://riello-solartech.it/> website.

RS485 communication mode for single inverter:



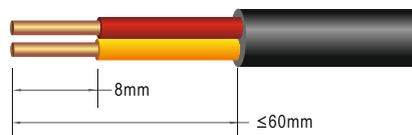
RS485 communication mode for multiple inverters:



 NOTE	<ol style="list-style-type: none"><li>1) If multiple inverters are connected, it is necessary to re-set Modbus address of each inverter manually by the <i>RS Connect</i> APP. For more details, refer to the APP user manual.</li><li>2) Turn RS485 Resistance to ON of the inverters at the end of the chain, by using the dedicated switch in the Settings page of the RS Connect APP.</li><li>3) Ensure that the appropriate length of communications cable between every two inverters is less than 200m and communication cable must be separated from other power cables to avoid communication interference.</li></ol>
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## Connecting RS485 Communication Cables

**Step 1** Remove an appropriate length of the insulation layer from the cable using a wire stripper, as shown in Figure 5.19.



**Step 2** Remove the four screws at the inverter bottom to remove the COM 2 cover plate.

**Step 3** Take the COM2 waterproof cover out of the accessory kit and remove the locking caps of the cable glands on the waterproof cover. Route the RS485 cables through the cable glands and reserve sufficient wire length for wiring to the inverter.

**Step 4** Take the 6pin Signal terminal out of the accessory kit. Connect the RS485 differential positive and negative signal cable (from datalogger or preceding inverter) to the first pair of A-B terminals of the 6pin connector respectively. If needed, connect the other RS485 differential positive and negative signal cable to the second pair of A-B terminals of the 6pin connector respectively, then connect the cable to the first pair of A-B terminals respectively, of the 6pin connector of the next inverter.



**Step 5** Connect the 6pin Signal terminal to its female terminal of the inverter's COM2 and fasten the COM2 waterproof cover using the screws removed before. Tighten the waterproof cover screws to a torque of 0.8Nm as well as the locking caps.

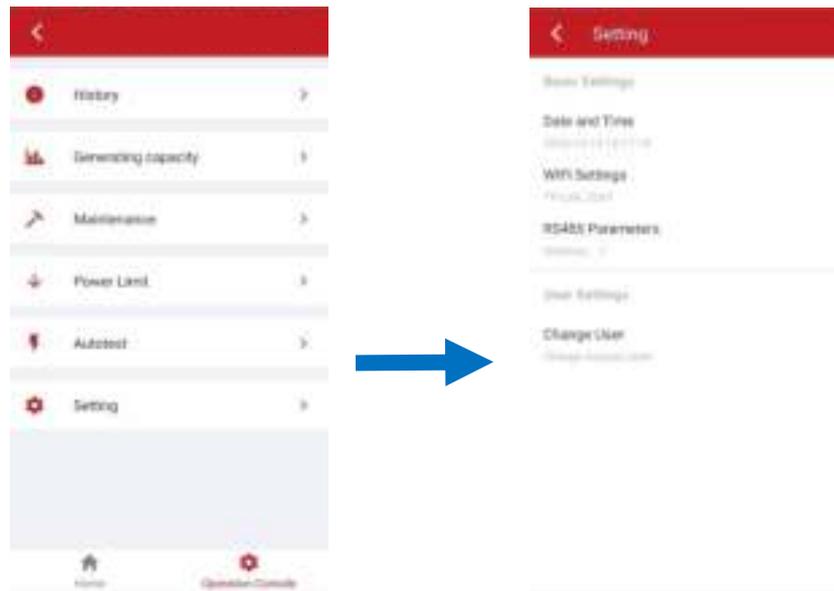
 NOTE	To prevent corrosion, apply silica gel or fireproof mud to the terminal or interface after connecting external PGND cables, AC cables, RS485 port.
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### Setting RS485 Communications Address

If the RS485 Modbus address configuration of the inverter is needed, it can be performed via the *RS connect* APP. Follow the steps below to configure the Modbus address.

**Step 1** Download the *RS Connect* APP from the APP store and connect to the inverter with the APP.

**Step 2** Select the “Operation Console” page, then select the “Setting” page, as shown in the figures below.



**Step 3** Check the Modbus address in RS485 Parameters, the default address is 1, click to configure the address and save it. The inverters at same RS485 bus must be set a unique address.

### Wi-Fi reset key

This key allows to reset the password of the Wi-Fi connection generated by the inverter to the factory default.

### Installation Verification

Once the inverted has been installed, check the following items:

- No other objects must be placed on the PV inverter.
- All screws, especially those used for electrical connections, must be tightened.
- The PV inverter must be installed correctly and securely.
- The ground, AC, DC and communications cables must be connected tightly/correctly and securely.
- Check that there is no open circuit or short-circuits at the AC and DC terminals using a multimeter.
- Connectors at AC terminals and RS485 ports must be tightened.
- Waterproof covers at the AC terminals, at the COM1 and COM2 must be installed and tightened.
- Idle terminals must be sealed.
- All safety warning symbols on the inverter must be intact and complete.

## SYSTEM OPERATION

### Powering the Inverter On

**Step 1:** Switch on the AC circuit breaker.

**Step 2:** Turn on the DC switch on the inverter.

**Step 3:** Observe the statuses of the LED indicator lights and the LCD display on the inverter by referring to the table in the user interface chapter.

 NOTE	When the LED status lights show that the inverter has entered the grid connection mode, it means that the inverter is operating properly. For any queries during the PV inverter's operation, contact your dealer.
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### Powering the Inverter Off

**Step 1:** Give a shutdown command on the inverter app (RS Connect).

**Step 2:** Switch off the circuit breaker at the AC terminal.

**Step 3:** Turn off the DC switch on the inverter.

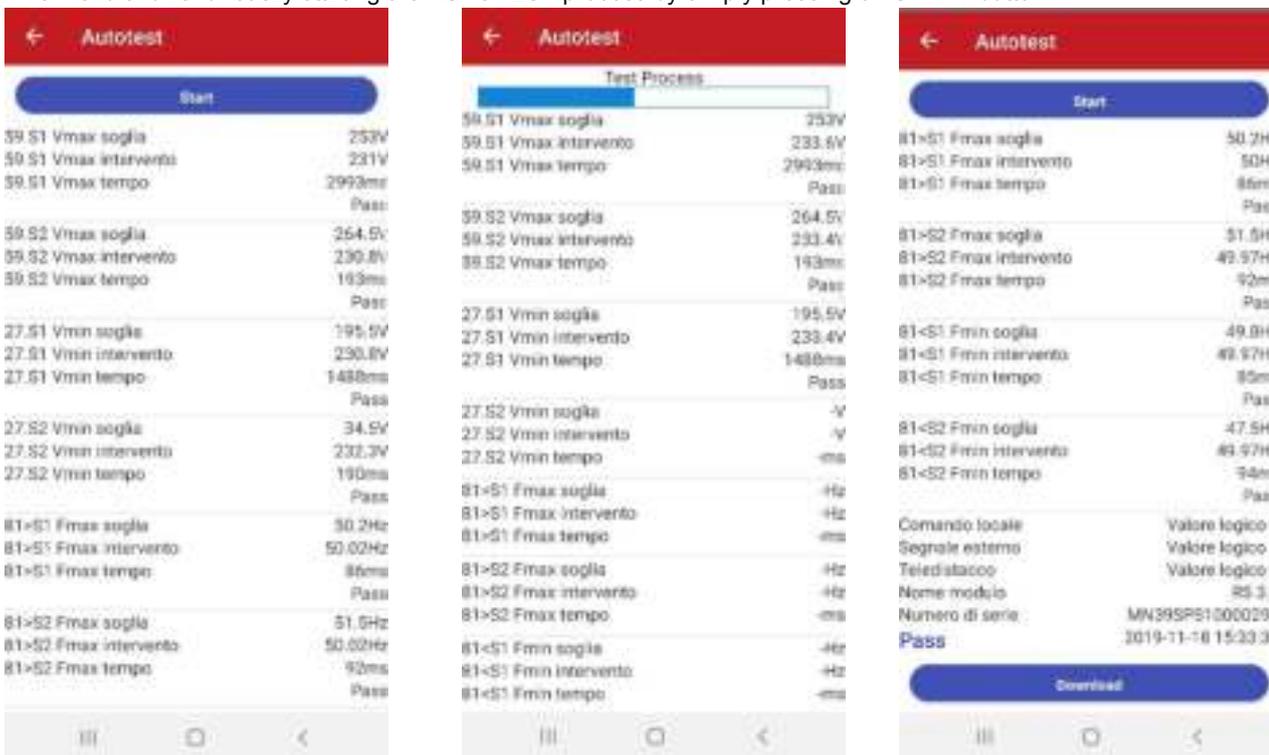
 WARNING	After the inverter switches off, the remaining electricity and heat may still cause electrical shock and burns. Wait ten minutes after the power-off before servicing the inverter.
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### Autotest

The inverter is equipped with AUTOTEST function for the internal Interface Protection (IP). The AUTOTEST process can be activated via the dedicated menu of the *RS Connect* APP.

If the local regulation requires to perform the AUTOTEST, please connect to the inverter via the *RS Connect* APP, select the "Operation Console" page, then access the "Autotest" menu.

This menu allows for easily starting the AUTOTEST process by simply pressing on START button.

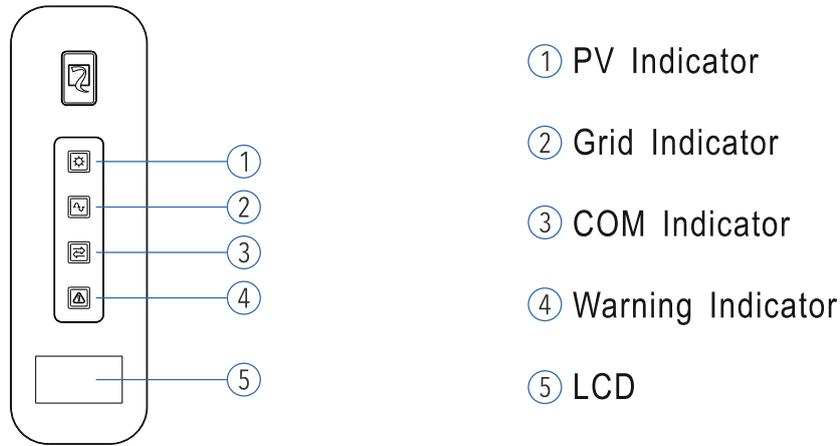


After that Autotest is executed is possible download the result pressing the relative button in the bottom of the page. For Android devices, a file called Autotest(*date*).csv will be saved in the root of the mobile phone. For Apple devices it is possible to share the report via e-mail.



# USER INTERFACE

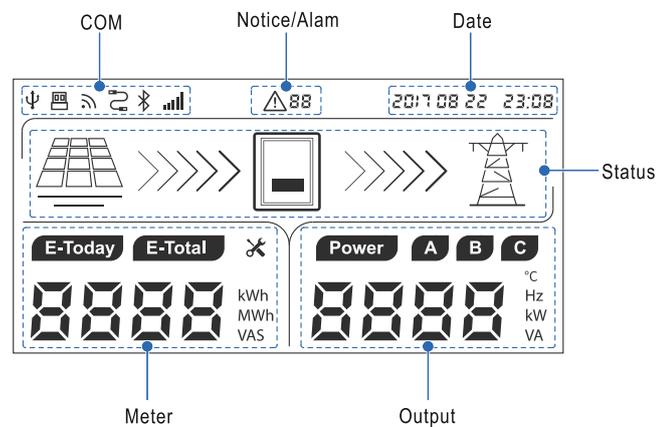
The indicator panel of the inverter is composed of LED indicators and a LCD. The LED indicators include the PV, Grid, COM and Warning indicators.



## LED status

LED indicator	Status	Description
PV Indicator	on	Voltage of PV strings meet the conditions for feed-in operation.
	blink	Voltage of PV strings does not meet the conditions for feed-in operation.
Grid Indicator	blink	Power grid abnormal. The conditions for feed-in operation are not yet met.
	on	Feed-in operation.
COM Indicator	blink	Communication data transmission is underway.
	off	No external communication is connected or no communication data
Warning Indicator	on/blink	Refer LED status in warning table
	off	No warning

## LCD Screen



### 1) COM

When the inverter is transferring data via Wi-Fi, the icon will be ON, if there is no data transmission, the icon will be off after 10s.

When the inverter is transferring data via RS485, the icon will be ON, if there is no data transmission, the icon will be off after 10s.

## 2) Notice/Alarm

When a warning is present on the inverter, the icon  will be ON with the specific warning code: the first bit of the code could be A (A) / B (b) / C (C), it stands for warning type, and the second bit is warning code, please refer to warning code in “LED/LCD Status and Warning Code Table”.

## 3) Date

When Wi-Fi / RS485 communications is normal and time zone is set correctly, the built-in clock of inverter will be synchronized with server's time.

## 4) Status

Icon  stands for PV strings; when inverter is in standby status, MPPT voltage of the PV string will be displayed in Meter zone.

Icon  stands for grid; when power grid is connected and voltage and frequency are in normal range, the icon is ON, if the voltage and frequency are not ok, the icon blinks; if the power grid is no connected, the icon will be OFF.

Icon  stands for energy flow; if the inverter is in normal status, the icon will be on; if the inverter is not feeding the AC output, the icon will be off.

## 5) Meter

Normal status: in this section, the display shows the “Today” and “Total” energy produced, MPPT voltage and current in sequence.	
Standby status: in this section, the display shows the countdown before inverter start-up.	
Any status: in this section, after setting parameter via APP, the screen shows the parameter value (without a comma) for 5 seconds.	

## 6) Output

Normal status: in this section, the display shows the instantaneous output “Power”, the grid voltage and current for all the three phases and the frequency in sequence.	
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## View Inverter status

The inverter operation status can be monitored by observing LED indicator status and LCD display. For more details, refer to the table in the following chapter.

## View and Set Inverter running data

The inverter operation data can be monitored by mobile phone APP. For more details, refer to the “RS Connect APP” chapter.

## LED/LCD Status and Warning Code Table

	LCD Display	PV Indicator	Grid Indicator	COM Indicator	Warning Indicator
Normal status (with Wi-Fi Internet connection OK)					
Starting up (inverter tries to connect to grid)	Countdown for grid connection		★F		
Wi-Fi connection Router OK – Internet OK					
Wi-Fi connection Router OK – Internet Fail				★S	
Wi-Fi connection Router Fail – Internet Fail					
Wi-Fi/RS485 communication during data transmission				★F	
PV normal					
PV absent					
Grid normal (inverter connected to grid)					
Grid normal (not connected to grid) Except start-up phase			★VS		
Grid absent	R2				

Grid over-voltage	A0	☉	★S	☉	○
Grid under-voltage	A1				
Grid over-frequency	A3				
Grid under-frequency	A4				
Grid unbalanced	A6	★S	☉	☉	○
PV over-voltage	B0				
PV under-voltage	B4	☉	☉	☉	★S
PV strings abnormal	B3				
Inverter over-temperature	C5				
Fan lock	C8				
Abnormal insulation resistance	B1	☉	☉	☉	●
Abnormal leakage current	B2				
Strings reverse	B7				
Control power low	C0				
Output DC over-current	C2				
Inverter relay abnormal	C3				
Abnormal leakage current HCT	C6				
System fault	C7				
BUS voltage imbalance	C9				
BUS over-voltage	CA				
Internal communication fault	CB				
Software incompatibility	CC				
EEPROM error	CD				
Sampling inconsistency	CE				
Invert circuit abnormal	CF				
Boost circuit abnormal	CG				
Datalogger lost	CH	☉	☉	☉	☉
Digital meter lost	CJ	☉	☉	☉	☉
Firmware updating in progress	OFF	●	●	●	●

**Symbol legend:**

●	light on
○	light off
☉	keep original status
★VS	light blinks very slow (every 5 s)
★S	light blinks slow (every 2 s)
★F	light blinks fast (every 0.5 s)

## MAINTENANCE



**WARNING**

Before commissioning or performing maintenance on the inverter and its peripheral distribution unit, switch off all the charged terminals of the inverter and wait at least 10 minutes after the inverter is powered off.

### Routine Maintenance

Check item	Check content	Maintain content	Maintenance interval
Inverter output status	Statistically maintain the electrical yield status and remotely monitor its abnormal status.	N/A	Weekly
PV inverter cleaning	Periodically check that the heat sink is free from dust and clogging.	Clean the heatsink periodically.	Yearly
PV inverter running status	Check that the inverter is not damaged or deformed. Check for normal sound emissions during inverter operation. Check and ensure that all inverter communications are running well.	If there is any abnormal situation, contact the customer service centre.	Monthly
PV inverter electrical connections	Check that the AC, DC and communication cables are securely connected; check that the PGND cables are securely connected; check that the cables are intact and have no signs of ageing.	If there is any abnormal situation, replace the cable or re-connect it.	Half-yearly

## TROUBLESHOOTING

When the inverter has an anomaly, its basic common warning and fault handling methods are shown in the following table.

Alarm code	Alarm name	Alarm explanation	
A0	Grid AC over-voltage	The grid voltage exceeds the allowed range.	<p>1. If the alarm occurs occasionally, it means that the grid is operating abnormally; the inverter can automatically restore its normal operating status after the grid returns normal.</p> <p>2. If the alarm occurs repeatedly and it can automatically recover, contact the local power company to obtain permission to modify the inverter grid protection parameters with the app.</p> <p>3. If the alarm occurs repeatedly for a long time, check whether:</p> <ol style="list-style-type: none"> <li>1) The output breaker is closed</li> <li>2) The output terminal is OK</li> <li>3) The output cable conforms to the instructions of the User Manual</li> </ol>
A1	Grid AC under-voltage	The grid voltage exceeds the allowed range.	
A2	Grid AC absent	The grid voltage is absent.	
A3	Grid AC over frequency	The grid frequency exceeds the allowed range.	
A4	Grid AC under-frequency	The grid frequency exceeds the allowed range.	
B0	PV DC over-voltage	The PV module input voltage is higher than the allowed range.	Please measure the PV input voltage with a multimeter and compare it with the "Max input voltage" shown on the inverter label. If the PV input voltage is higher than the "Max input voltage", reduce the quantity of PV modules.
B1	PV insulation abnormal	The insulation resistance against the ground is low before inverter start-up.	<p>1. If the alarm occurs occasionally, it may be caused by an external circuit; the inverter can automatically recover its normal operating status once the fault is solved.</p> <p>2. If the alarm occurs repeatedly or lasts a long time, take the following steps:</p> <ol style="list-style-type: none"> <li>1) Check if the output cable is stable.</li> <li>2) Plug the PV strings one by one to find the abnormal PV string. Check if the insulation resistance against the ground of the PV strings is too low, or if the cable is broken or connected incorrectly.</li> </ol>
B2	Abnormal leakage current	The insulation resistance against the ground at the input side decreases during inverter operation.	<p>1. If the alarm occurs occasionally, it may be caused by an external circuit; the inverter can automatically recover its normal operating status once the fault is solved.</p> <p>2. If the alarm occurs repeatedly or lasts a long time, take the following steps:</p> <ol style="list-style-type: none"> <li>1) Check if the output cable is stable.</li> <li>2) Plug the PV strings one by one to find the abnormal PV string. Check if the insulation resistance against the ground of the PV strings is too low, or if the cable is broken or connected incorrectly.</li> </ol>
C0	Control power low	Inverter internal power source abnormal	<p>1. If the alarm occurs occasionally, the inverter can automatically recover its normal operating status and no action is needed.</p> <p>2. If the alarm occurs repeatedly or lasts a long time, contact the customer service centre.</p>
B3	PV strings abnormal	The PV strings have been shielded for a long time or are deteriorating.	<p>1. Check whether the PV string is shielded.</p> <p>2. If the PV string is clean and not shielded, check if the PV modules are ageing or deteriorated, or if the cable/terminal is abnormal.</p>
B4	PV DC under-voltage	The PV module input voltage is below the inverter's default protection value.	<p>1. If the alarm occurs during weak sunlight conditions (in the morning or at dawn, during rain, etc.), this is normal and no action is needed.</p> <p>2. If not, check if there is a PV module connection short-circuit.</p>
B5	Weak PV radiation	The PV module power is less than the minimum inverter operating power.	This is due to weak sunlight. No action is needed.
C2	Output DC over-current	The DC component current in the grid exceeds the allowed range.	<p>1. If the alarm occurs occasionally, this is due to temporary abnormal grid voltage and the inverter can automatically recover its normal operating status, so no action is needed.</p> <p>2. If the alarm occurs repeatedly or lasts a long time, contact the customer service centre.</p>

C3	Inverter relay abnormal	The output relay cannot be closed.	1. If the alarm occurs occasionally, this is due to temporary abnormal grid voltage and the inverter can automatically recover its normal operating status, so no action is needed. 2. If the alarm occurs repeatedly or lasts a long time, check if the output neutral and live lines are inversely connected. If not, please contact the customer service centre.
C5	Inverter over-temperature	Inverter internal temperature high.	1. If the alarm occurs occasionally, the inverter can automatically recover its normal operating status and no action is needed. 2. If the alarm occurs repeatedly or lasts a long time, check if the installation site is exposed to direct sunlight, that it is well-ventilated and if the ambient temperature is too high. If not, contact the customer service centre.
C6	Abnormal leakage current HCT	Residual current test failed during inverter start-up.	1. If the alarm occurs occasionally, it may be caused by an abnormal external circuit; the inverter can automatically recover its normal operating status once the fault is solved. 2. If the alarm occurs repeatedly or lasts a long time, check if the insulation resistance against the ground of the PV strings is too low, or if the cable is broken or connected incorrectly.
B7	PV string reverse	The cables of the PV strings are connected reversely.	Check whether the cables of the PV strings are correctly connected. If they are connected reversely, reconnect the cables.
C7	System type error	Internal warning	Please contact the customer service centre.
C8	Fan lock	Fan abnormal	1. If the alarm occurs occasionally, restart the inverter. 2. If the alarm occurs repeatedly or lasts a long time, check if the fan is clogged. If not, please contact the customer service centre.
C9	BUS voltage imbalance	Internal warning	1. If the alarm occurs occasionally, the inverter can automatically recover its normal operating status and no action is needed. 2. If the alarm occurs repeatedly or lasts a long time, contact the customer service centre.
CA	BUS over-voltage	Internal warning	
Cb	Internal communication error	Internal warning	Please contact the customer service centre.
CC	Software incompatibility	Internal warning	Please contact the customer service centre.
Cd	EEPROM error	Internal warning	Please contact the customer service centre.
CE	Consistent warning	Internal warning	Please contact the customer service centre.
CF	Inverter abnormal	Internal warning	1. If the alarm occurs occasionally, the inverter can automatically recover its normal operating status and no action is needed. 2. If the alarm occurs repeatedly or lasts a long time, contact the customer service centre.
CG	BOOST abnormal	Internal warning	1. If the alarm occurs occasionally, the inverter can automatically recover its normal operating status and no action is needed. 2. If the alarm occurs repeatedly or lasts a long time, contact the customer service centre.
CH	Datalogger lost	Communication lost with datalogger	Check the correct RS485 bus connection and Modbus settings.
CJ	Digital meter lost	Communication lost with digital meter	Check the correct RS485 bus connection and Modbus settings.

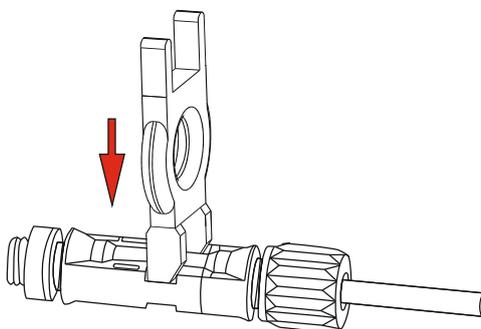
 NOTE	If you cannot clear the preceding alarm according to the recommended measures, contact your dealer promptly.
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## Removing the Inverter

Perform the following procedures to remove the inverter:

**Step 1:** Turn off the inverter (see dedicated chapter).

**Step 2:** Disconnect all cables from the inverter, including any communication cables, DC input and AC output power cables, and PGND cables, as shown in the following figure.



 <b>WARNING</b>	Before removing the DC input connector, double-check that the DC input switch is turned to OFF to avoid inverter damage and personal injury.
 <b>NOTE</b>	When removing the DC input connectors, insert the removal spanner into the bayonet, press the spanner down and take out the connector carefully.

**Step 3:** Unscrew the fixing screws that fasten the inverter to the rear panel.

**Step 4:** Remove the inverter from the rear panel.

**Step 5:** Remove the rear panel.

## STORAGE

This chapter describes the storage requirements for the inverter.

The following storage instructions apply if the PV inverter will not be deployed immediately:

- Do not unpack the inverter (add desiccant in the original box if the PV inverter is unpacked).
- Store the PV inverter within a temperature range of  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  and with relative humidity between 0 and 100% (no condensing).
- The PV inverter should be stored in a clean and dry place, protected from dust and water vapour corrosion.
- A maximum of six layers of inverters can be stacked.
- Do not position the inverter tilting frontwards, tilting excessively backwards, tilting sideways, or upside-down.
- Conduct periodic inspections during storage.
- Replace the packaging materials immediately if any rodent bites are found.
- Ensure that qualified personnel inspect and test the inverter before use if it has been stored for a long time.

## DISPOSING OF THE PRODUCT

The PV inverter contain electronic internal material that (in case of dismiss / disposal) are considered TOXIC and HAZARDOUS WASTE, such as electronic circuit boards and electric components. Treat these materials according to the laws applicable referring to qualified service personnel. Their proper disposal contributes to respect the environment and human health.

# APPENDIX

## TECHNICAL SPECIFICATIONS

Model	RS 6.0 T	RS 10.0 T	RS 15.0 T
<b>Efficiency</b>			
Max efficiency	97.9%	98%	98%
European efficiency	97.3%	97.4%	97.5%
<b>Input (PV)</b>			
Max input voltage	1000 V		
Rated input voltage	620 V		
Max input current	22A (11A/11A)		33A (11A/22A)
Max short-circuit current	30A (15A/15A)		45A (15A/30A)
Start input voltage / Min operating voltage	200V / 160V		
MPPT operating voltage range	160V – 950V		
MPPT operating voltage range (full-load)	300V – 800V	470V – 800V	
Max number of PV strings	2 (1/1)		3 (1/2)
No. of MPPTs	2		
<b>Output (grid)</b>			
Rated AC active power	6000W	10000W	15000W
Max AC apparent power	6600VA	11000VA	16500VA
Max AC active power (PF=1)	6600W	11000W	16500W
Max AC output current	3*10A	3*16A	3*23A
Rated AC voltage	400V, 3W+N+PE		
AC voltage range*	277V – 520V (adjustable)		
Rated grid frequency	50Hz / 60Hz		
Grid frequency range**	45Hz – 55Hz / 55Hz – 65Hz		
THDI	<3% (rated power)		
DC current injection	<0.5% I <sub>n</sub>		
Power factor	> 0.99 rated power (adjustable 0.8 leading - 0.8 lagging)		
Recommended circuit breaker	16A Z or B curve	20A Z or B curve	25A Z or B curve
<b>Protection</b>			
DC switch	Yes		
Anti-islanding protection	Yes		
AC over-current protection	Yes		
AC short-circuit protection	Yes		
DC reverse connection	Yes		
Surge arrester	AC Type III		
Insulation detection	Yes		
Leakage current protection	Yes		
<b>General</b>			
Topology	Transformerless		
IP Rating	IP65		
Night self-consumption	< 1 W		
Cooling	Natural cooling		
Operating temperature range	-25°C to 60°C		
Relative humidity range	0–100%		
Max operating altitude	4,000m (> 2,000m derating)		
Noise	< 30 dB (measured at 1 m)		
Dimensions (W*H*D)	422x520x187 mm		
Weight	21.5kg	23.5kg	

<b>HMI &amp; COM</b>	
Display	Wireless & APP + LED, LCD
Communication	Wi-Fi (integrated), RS485 (integrated)
<b>Certification</b>	
Safety	IEC62109-1, IEC62109-2
EMC	EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4
Grid code	CEI 0-16, CEI 0-21, RD1699
<b>Warranty</b>	5 Years / 10 Years (optional)

**Notes:**

\* The grid power voltage range can be set according to national voltage standards.

\*\* The power grid frequency range can be set according to national grid standards.



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