

installation and user manual

ON GRID SOLAR PV INVERTER

RS 1.5 - 2.0 - 3.0
RS 4.0 - 5.0 - 6.0

serie "RS"



RIELLO ELETTRONICA  **riello** solar
tech

INTRODUCTION

Thank you so much for choosing RS 1.5-6.0, 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 1.5/2.0/3.0** PV inverter with single MPPT input
- **RS 4.0/5.0/6.0** PV 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 (specific please in kind prevail) 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).

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 Chapter 4 - Installation).

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 the latter.

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:

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

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.

© No part of this manual may be reproduced without prior permission from the manufacturer.
For the purpose of improvement, the manufacturer reserves the right to change the product described at any time and without notice.

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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 single-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

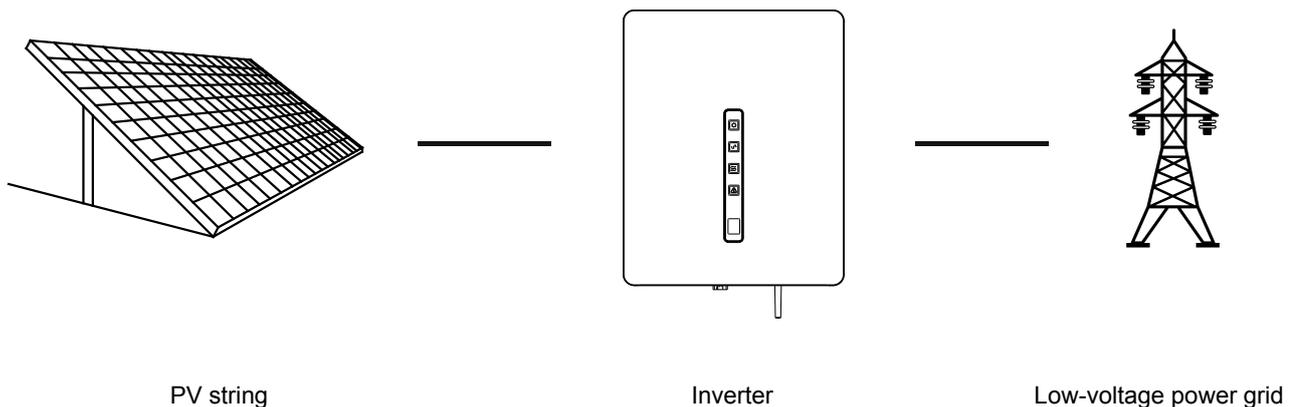
The number in the model name indicates the power class of the inverter, for example, model RS 3.0 is a 3 kW inverter.

RS 3.0
Power class 3 kW

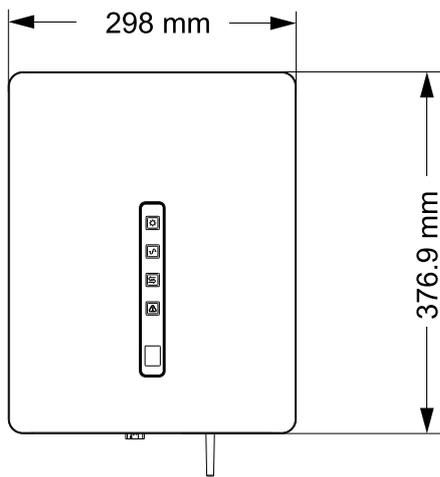
Network Application

Grid-tied PV Power Systems

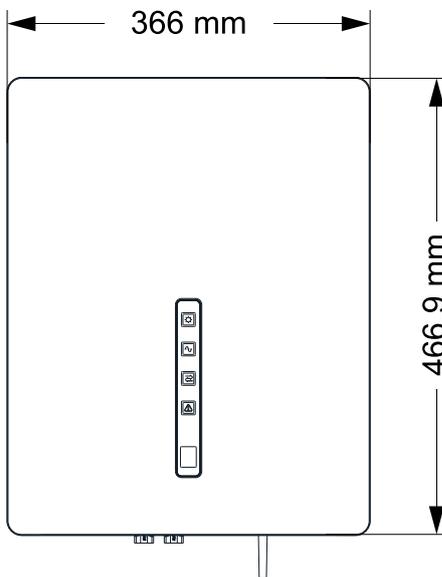
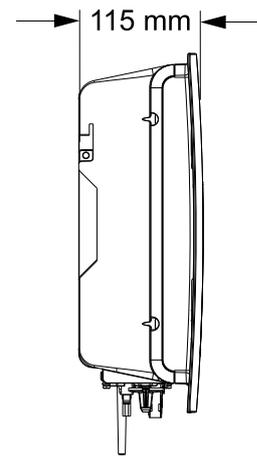
The series included grid-tied PV power systems for outdoor power stations. Typically, a grid-tied PV power system consists of PV modules, grid-tied inverters, AC distribution units and a low-voltage power grid, as shown in the figure below.



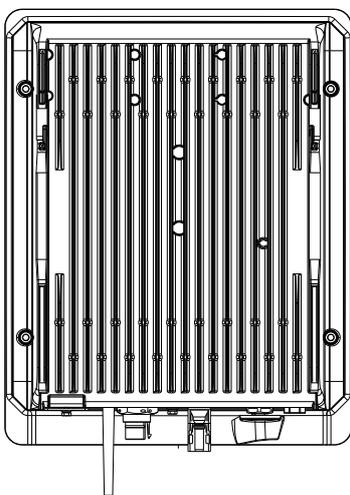
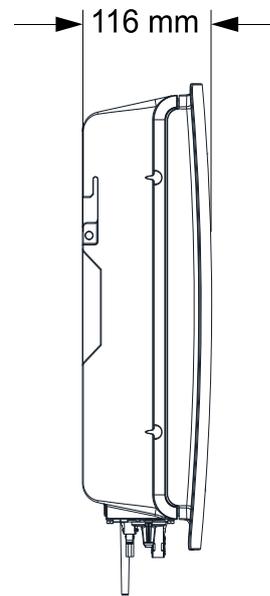
Outline and Dimensions



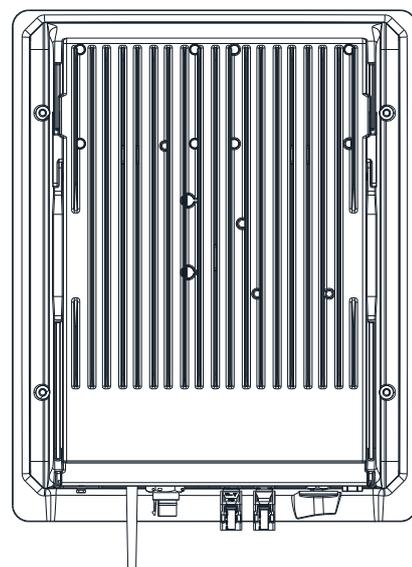
RS 1.5-2.0 3.0 PV inverter with single MPPT input (UoM: mm)



RS 4.0/5.0/6.0 PV inverter with double MPPT input (UoM: mm)

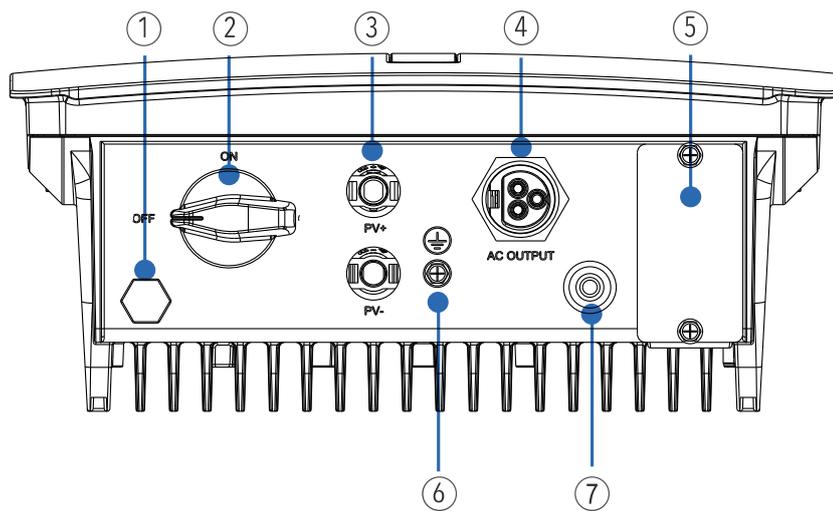


Bottom view RS 1.5/2.0/3.0



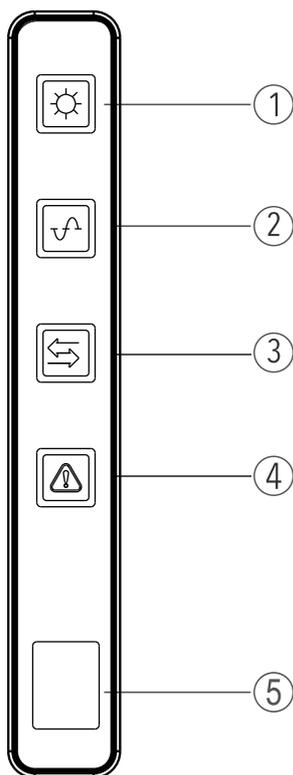
Bottom view RS 4.0/5.0/6.0

Connections Area



- (1) Vent valve
- (2) DC isolation breaker
- (3) PV string terminal
- (4) AC output connector
- (5) Communications interface
- (6) External protection ground interface

Indicator Panel View LED and LCD Area



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

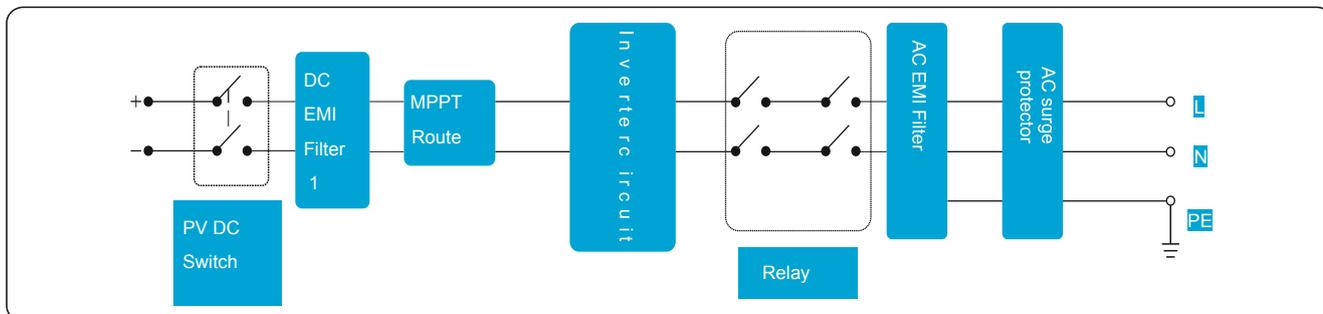
Working Process

Basic principle description

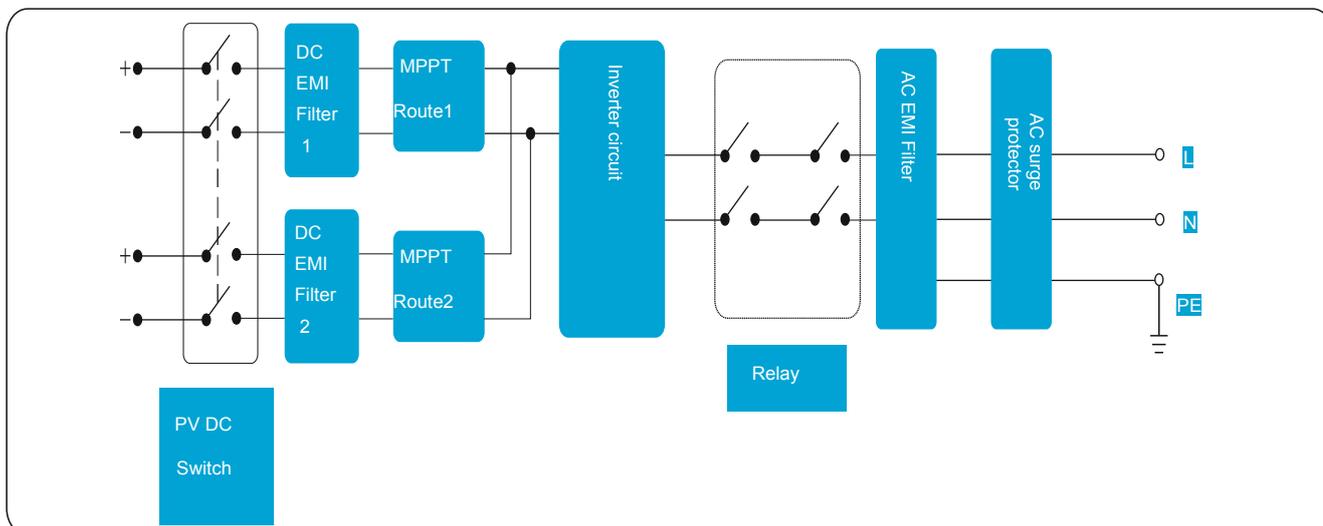
The RS 1.5/2.0/3.0 PV inverters with single MPPT input receives inputs from only one string of PV panels. The RS 4.0/5.0/6.0 PV inverters with double MPPT input receive inputs from two strings of PV panels. Then the inputs are grouped into one or two independent MPPT routes inside the inverter to track 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. An EMI filter is used on both the DC and AC sides to reduce electromagnetic inference; surge protection is supported on the AC side.

Circuit Diagrams

The diagram below shows the circuit blocks of the 1.5 kW-3 kW PV inverters with single MPPT input:



The diagram below shows the circuit blocks of the 4kW-6 kW inverters with double MPPT input:



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"> The input voltage of the PV string can enable the auxiliary power supply to run but cannot meet the inverter operation requirements. The input voltage of the PV string can meet the inverter start-up requirements but cannot meet its minimum power requirements.
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.

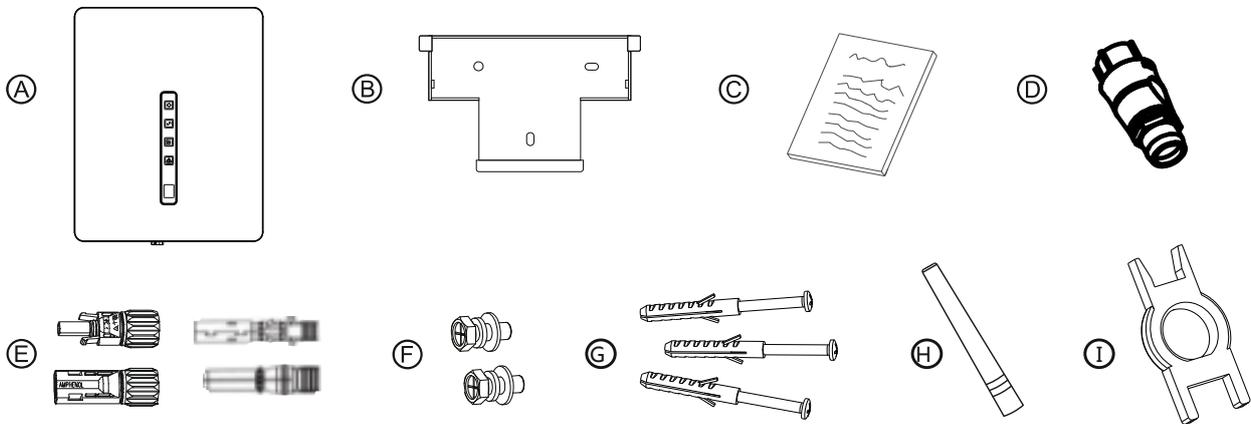
INSTALLATION

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.

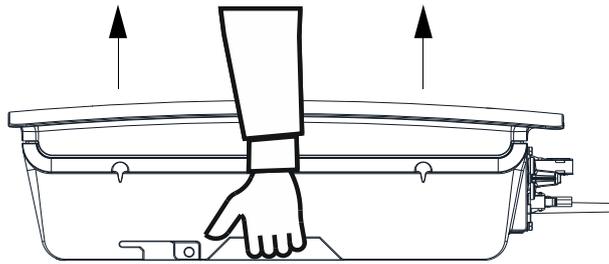


ITEM	DESCRIPTION
A	PV Inverter
B	Rear panel
C	Manuals
D	AC output connector
E	DC terminal connector group
F	Screws
G	Expansion plugs kit (for tightening the rear panel)
H	Wi-Fi antenna
I	Removal tool for DC connectors

 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.

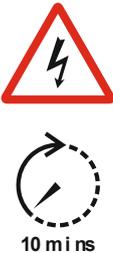


 CAUTION	<p>Do not place the PV inverter with its wiring terminals in contact with the floor, because the power ports and signal ports at the bottom of the device are not designed to bear the weight of the inverter. When placing the inverter on the floor horizontally, place foam or paper under it to protect its enclosure.</p>
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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>Risk of electric shock 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 phase 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>
	<p>Handling the photovoltaic inverter 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>Exclusively for the grid 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>Hot surfaces Although it has been designed in accordance with international safety standards, the photovoltaic inverter may become hot during operation.</p>
	<p>Disposal 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>

Installation Requirements

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

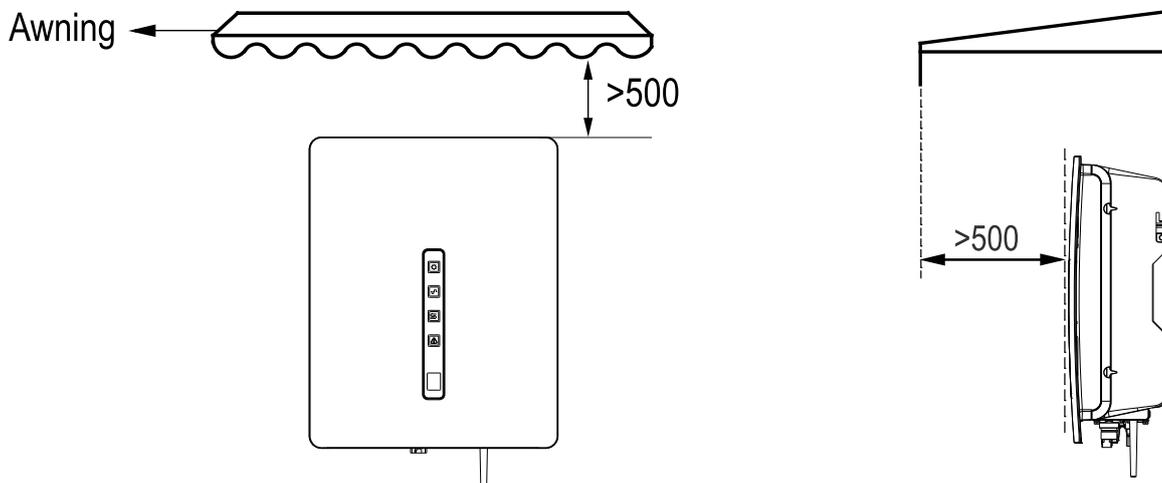
Determining the Installation Position

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.

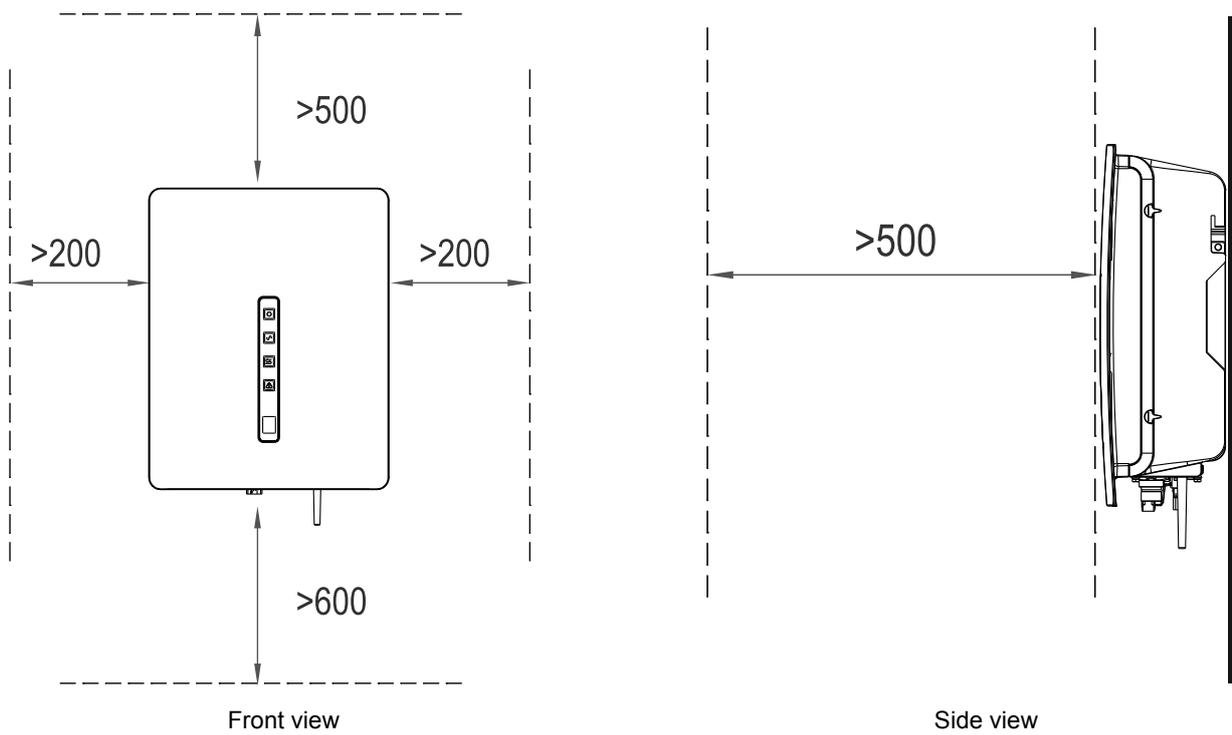


Carrier Requirements

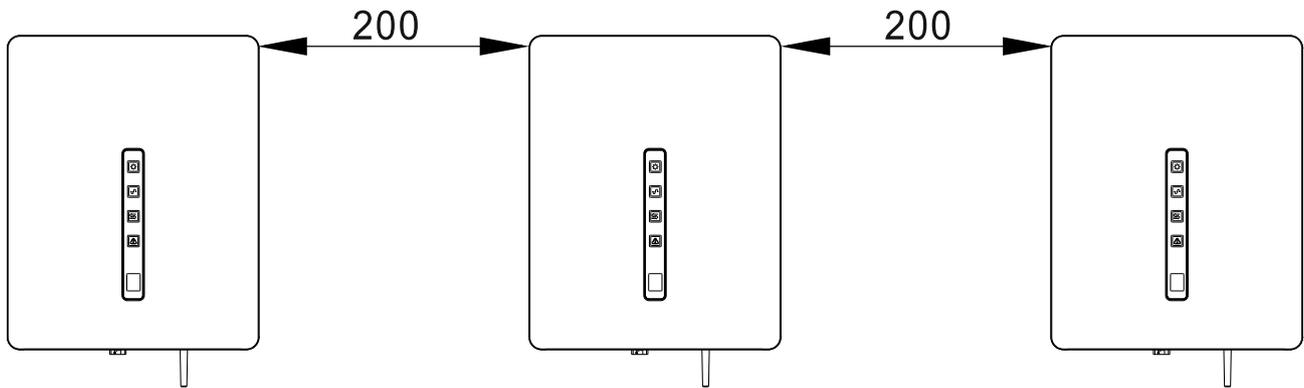
- The carrier where the inverter is installed must be fireproof. Do not install the inverter on flammable building materials.
- The wall must be solid enough to bear the weight of the inverter.
- Do not install the inverter on a wall made of gypsum boards or similar materials.

Installation Space Requirements

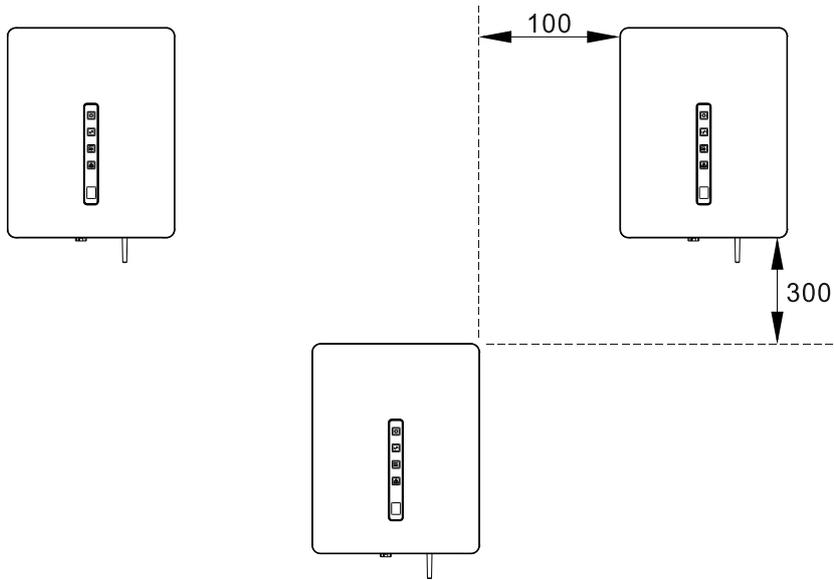
- It is recommended that the inverter be installed at eye level to facilitate operation and maintenance.
- Reserve enough clearance around the inverter to ensure sufficient space for installation and heat dissipation, as shown in the figure below.



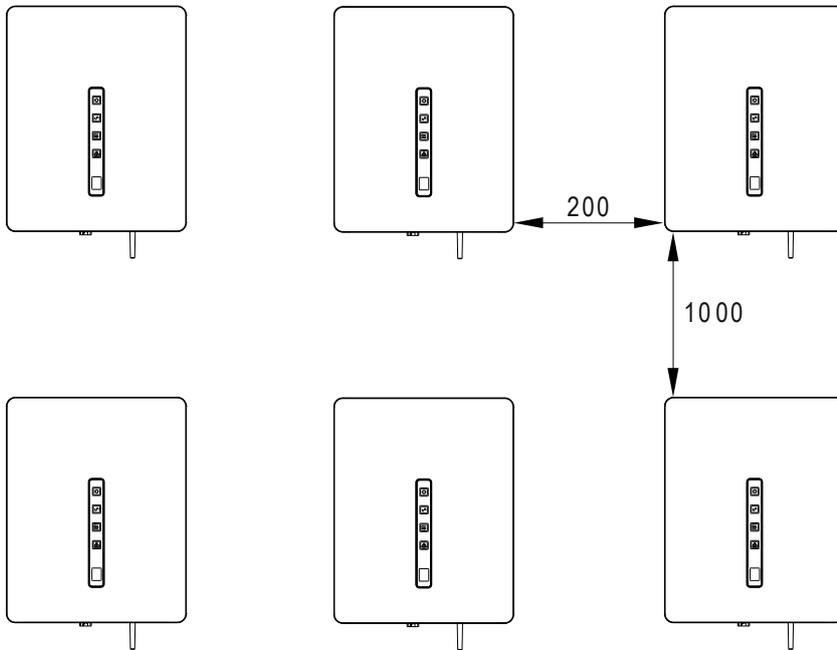
When installing multiple inverters, install them along the same line if sufficient space is available, or in a triangle pattern or stacked if there is insufficient space. The installation modes ensure sufficient space for installation and heat dissipation (see following figures for more details).



Installation along the same line (UoM: mm)



Installation in triangle pattern (UoM: mm)



Installation in stacked mode (UoM: mm)



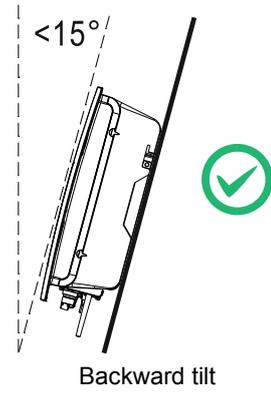
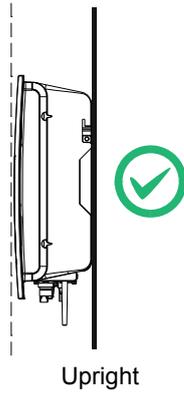
NOTICE

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

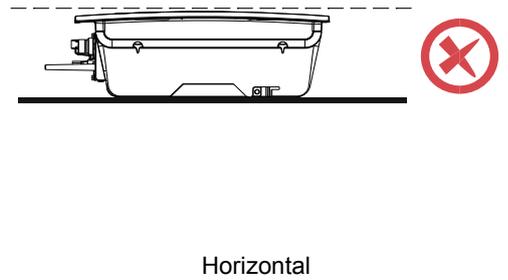
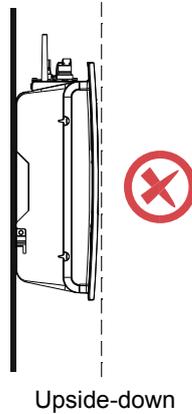
Installation Mode Requirements

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




The wrong installation mode



NOTICE

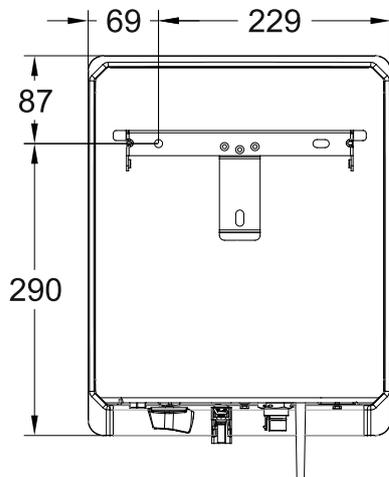
Incorrect installation will lead to failure of the inverter operation.

Installing a Rear Panel

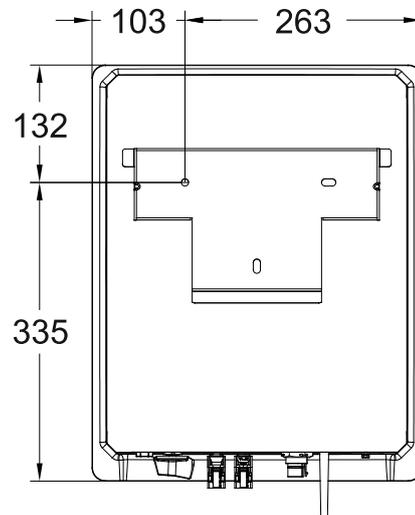
Before installing the inverter, secure the shipped rear panel to a wall.

Step 1 Remove the rear panel from the packaging box.

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

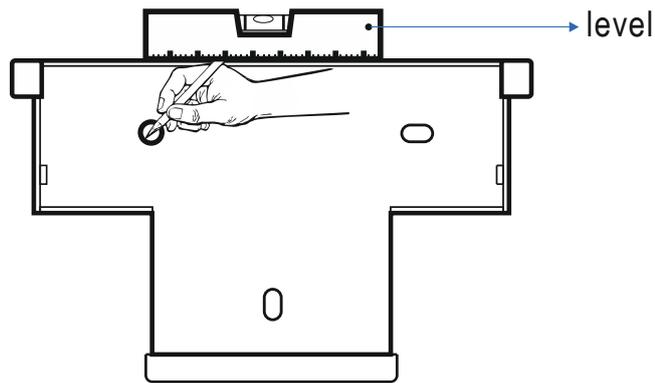


RS 1.5/2.0/3.0 PV inverter with single MPPT input



RS 4.0/5.0/6.0 PV inverter with double MPPT input

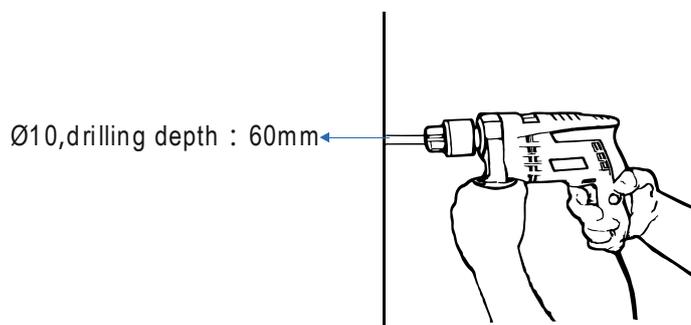
Step 3 Level the hole positions using a level and mark the hole positions using a marker.



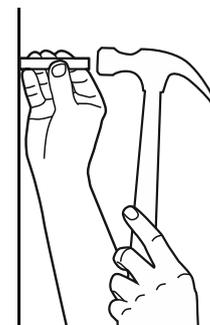
Step 4 Drill holes using a hammer drill and install expansion bolts, as shown in the figure below.

 DANGER	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 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.

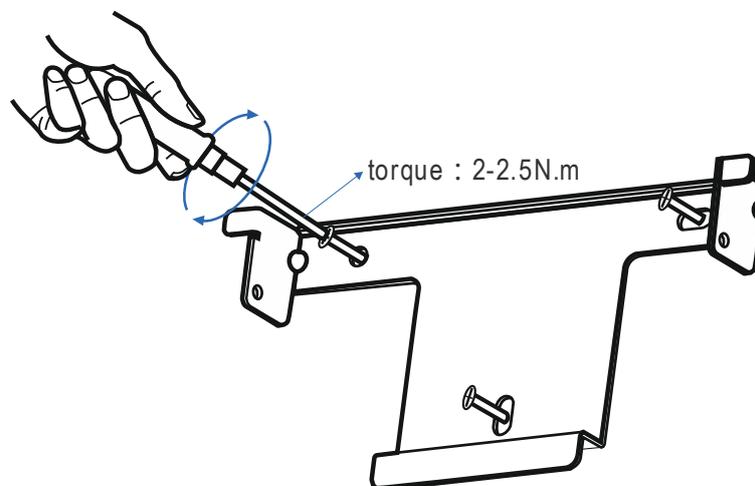


Punch holes



Install 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 2-2.5 Nm using a torque wrench.



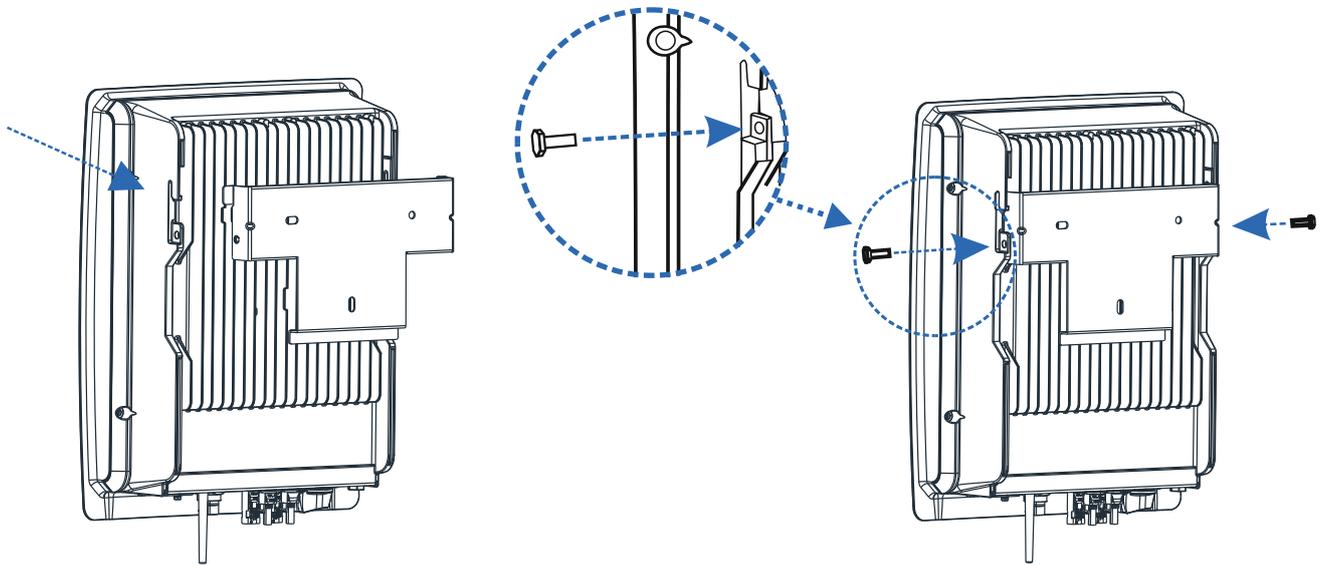
Installing the Inverter

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 one another.

Step 3 Tighten the two hexagon screws at both sides of the inverter to a torque of 1.2 Nm and 3 Nm respectively. Screw specs for 1K-3.6K and 3K-6K are M4 and M6 respectively.



Mount on the rear panel

Tighten the screws at both sides

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 goes with 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.

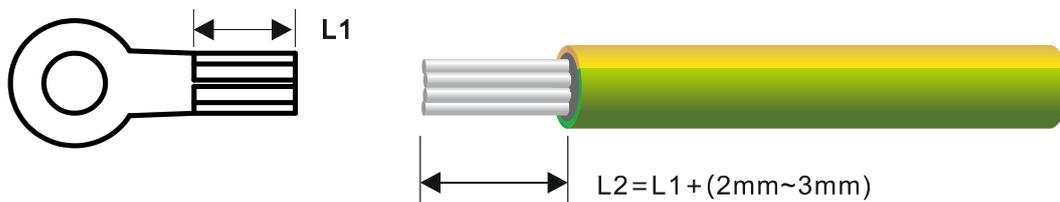
Ground cable: outdoor copper-core cables with 4 mm² cross-sectional area or more are recommended.

OT terminal: OT6~4 M4

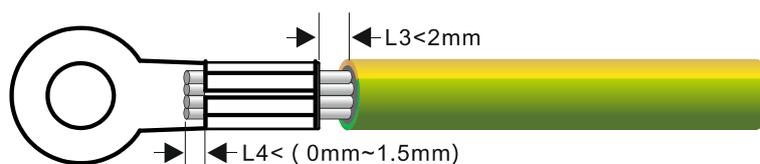
 NOTE	Proper grounding for the inverter helps to counter the impact of surge voltage and improve EMI performance. Connect the PGND cable before connecting the AC and DC power cables and the communication cables.
 NOTE	It is recommended that the ground cable be connected to a nearby ground position. For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

Wiring Procedures

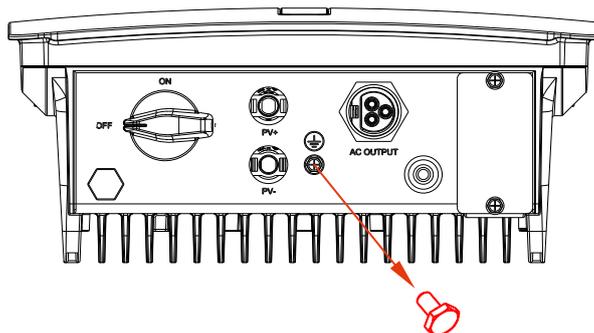
Step 1 Remove an appropriate length of the insulation layer from the PGND cable using a wire stripper; this length must be longer than that of the OT terminal's crimping end by 2 mm–3 mm.



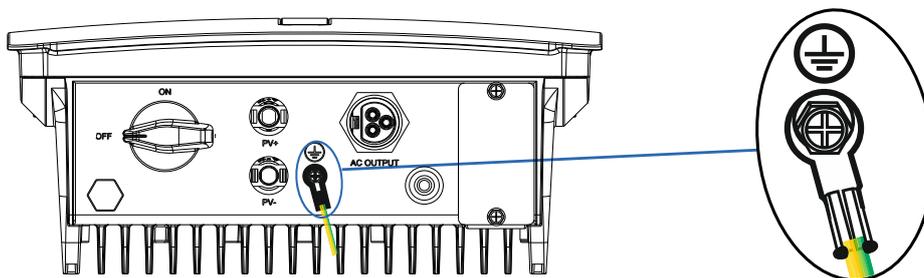
Step 2 Insert the exposed core wires into the crimping areas of the OT terminal and crimp them using hydraulic pliers.



Step 3 Remove the ground screws from the ground points.



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 been prepared.

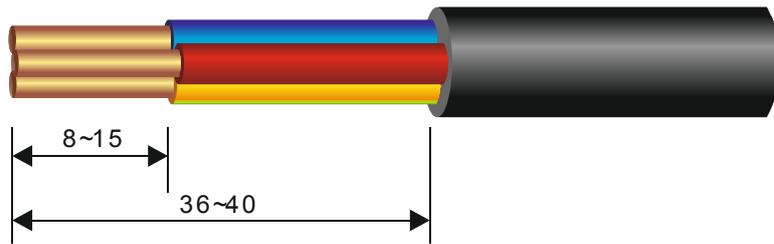
AC power cable: outdoor copper-core cables are recommended. The following table describes the specifications.

Inverter model	Cable type	Cross-sectional area (mm ²)		Cable outer diameter (mm)	
		Range	Recommended value	Range	Recommended value
1K–3.6K	outdoor cable	4–6	4	10–14	14
3K–6K	outdoor cable		6		

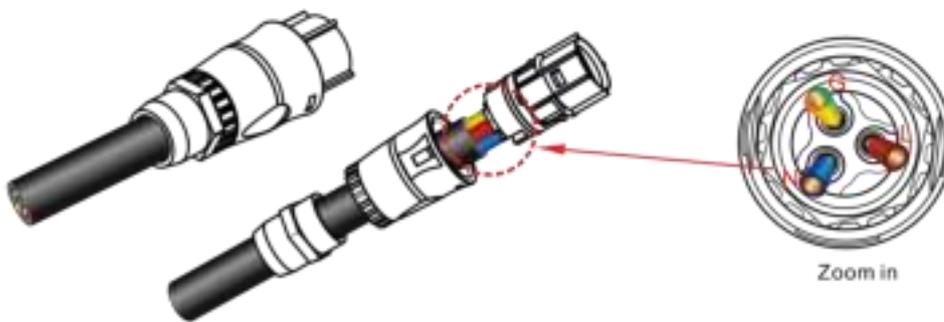
 WARNING	An independent circuit breaker must be installed on the AC side of each inverter to ensure that the inverter can be safely disconnected from the power grid.
 WARNING	Do not connect loads between the AC output terminals of the inverter and circuit breaker.

Procedure for Connecting AC Cables

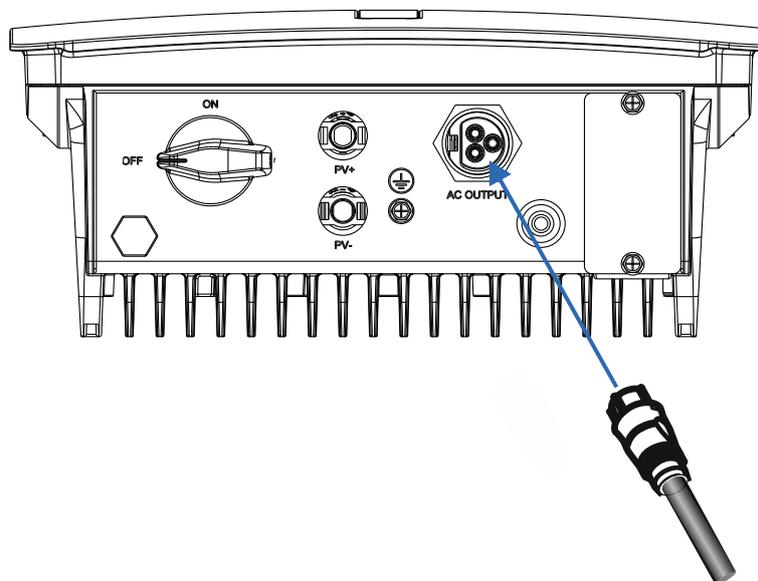
Step 1 Remove an appropriate length of the jacket and insulation layer from the AC output cable using a wire stripper, as shown in figure below.



Step 2 Insert the exposed core wires through the nut of the AC terminal sleeve in the middle, with the L terminal for the line wire, the N terminal for the neutral wire and the G terminal for the earth wire, then tighten the screw. The required torque is 0.8 Nm. After fastening the cables, tighten the nut and sleeve in the middle, as shown in figure below.



Step 3 After the AC wiring, route the AC connector into the AC terminal of the inverter and double-check it.



Connecting the PV Strings

 DANGER	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.	

 WARNING	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

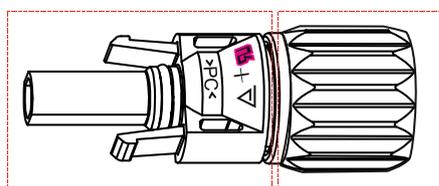
Route connection for the installation of PV strings and the inverter:

Inverter model	Number of input route
RS 1.5/2.0/3.0	1
RS 4.0/5.0/6.0	2

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

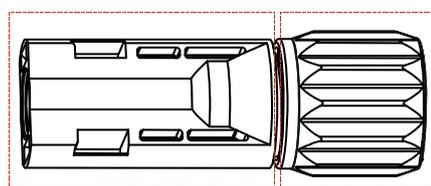
Inverter model	Cable type	Cross-sectional area (mm ²)		Cable outer diameter (mm)	
		Range	Recommended value	Range	Recommended value
RS 1.5/2.0/3.0	Common PV cables in the industry (model: PV1-F)	4–6	4	5–8	5
RS 4.0/5.0/6.0		4–6	6	5–8	8

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



1 the insulation layer 2 locking nut

Positive connector components



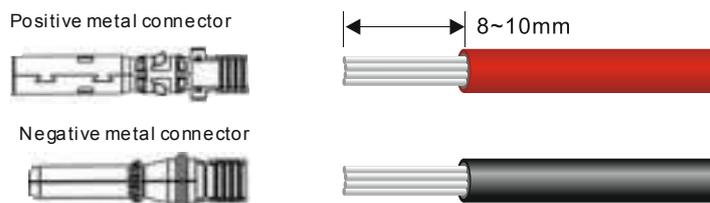
1 the insulation layer 2 locking nut

Negative connector components

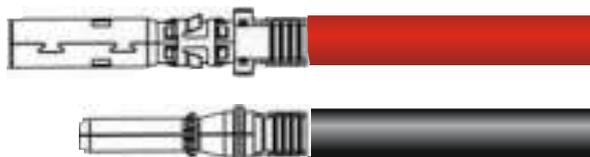
 NOTE	Positive and negative metal connectors are packaged with positive and negative connectors, respectively, when shipped. After unpacking the device, keep the positive and negative connectors separate to avoid confusion.
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Procedures for connecting the PV strings

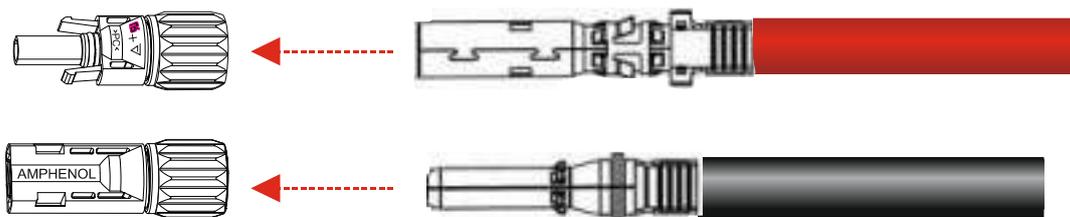
Step 1 Remove an appropriate length of the insulation layer from the positive and negative power cables using a wire stripper, as shown in the figure below.



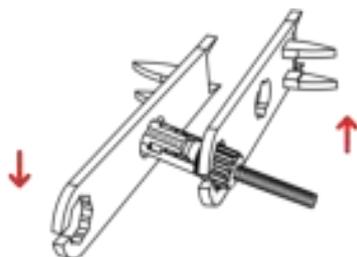
Step 2 Insert the exposed areas of the positive and negative power cables into the metal terminals of the positive and negative connectors respectively and crimp them using a crimping tool, as shown below.



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.



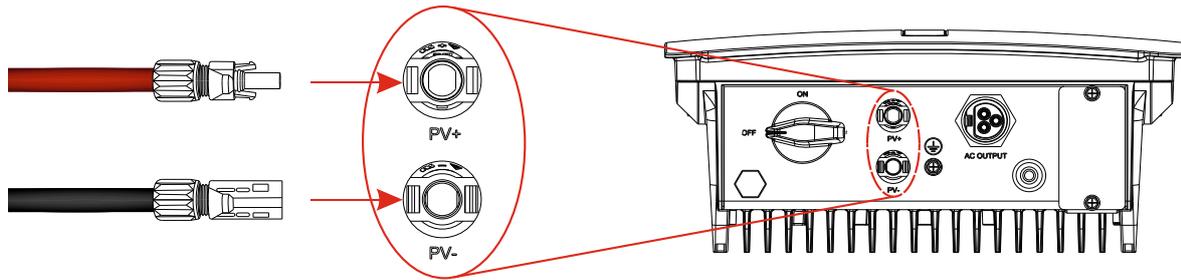
Step 4 Tighten the locking nuts on the positive and negative connectors using a spanner.



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



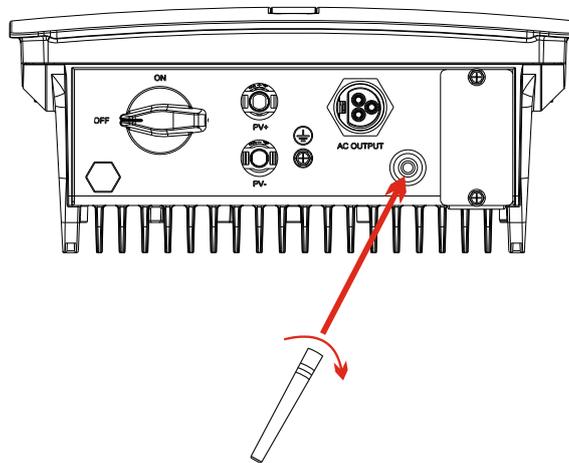
Step 6 Insert the positive and negative connectors into their corresponding terminals of the inverter until a “click” is heard, as shown in the figure below.



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.



Contacts and RS485 Module (optional)

A module is available including the RS485 standard, besides contacts and power limiter functions. This module must be installed to the inverter communication interface. For more details refer to www.riello-solartech.com.

Installation Verification

Once the inverter 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 tight.
- 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.
- Waterproof connectors at AC terminals and RS485 ports must be tightly plugged with waterproof plugs.
- Covers at the AC terminals must be tight.
- 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 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.

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.

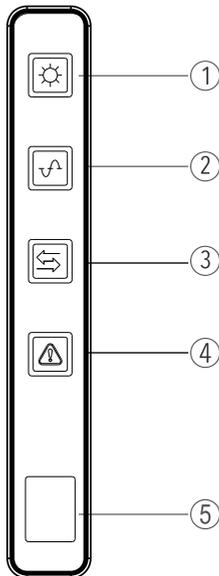


WARNING

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.

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.



- (1) **PV indicator:** this LED indicates the status of the DC voltage panels. When lit, DC voltage is present within the normal range.
- (2) **Grid indicator:** this LED indicates the AC voltage status. When lit, it means that AC is present and inverter is connected to the grid.
- (3) **COM indicator:** this LED indicated the communication status. See next table for details.
- (4) **Warning indicator:** this LED indicates that an alarm is present on the inverter. See next table for details.
- (5) **LCD:** normally, the LCD indicates the instantaneous power generated. If an alarm occurs, the LCD will display the relative alarm code. See next table for details.

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)	Instantaneous power generated	●	●	●	○
Starting up (inverter tries to connect to grid)	0.0 kW	●	★F	◎	○
Wi-Fi connection Router OK – Internet Fail	◎	◎	◎	●	◎
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	A2	◎	○	◎	○
Grid over-voltage	A0	◎	★S	◎	○
Grid under-voltage	A1				
Grid over-frequency	A3				
Grid under-frequency	A4				
Grid type unknown	A6				
PV over-voltage	B0	★S	◎	◎	○
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				
Consistent warning	CE				
Invert circuit abnormal	CF				
Boost circuit abnormal	CG				

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 performing maintenance on and commissioning 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.
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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 exception, its basic common warning and exception 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"> 1) The output breaker is closed 2) The output terminal is OK 3) The output cable conforms to the instructions of the User Manual
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"> 1) Check if the output cable is stable. 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.
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"> 1) Check if the output cable is stable. 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.
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.

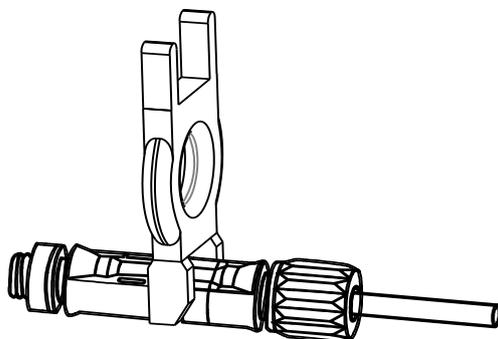
 NOTE	If you cannot clear the preceding alarm according to the recommended measures, contact your dealer promptly.
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Removing the Inverter

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.



 WARNING	Before removing the DC input connector, double-check that the DC input switch is turned to OFF to avoid inverter damage and personal injury.
 NOTE	When removing the DC input connectors, insert the removal spanner onto 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°C to $+70^{\circ}\text{C}$ and with the relative humidity of 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.
- 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.

DISPOSAL OF THE INVERTER

The PV inverter and its packing case are made from environment-friendly material. If its service life has expired, do NOT dispose of the inverter with household waste; dispose of it in accordance with local rules for the disposal of electrical equipment waste.

CONFIGURATION & MONITORING

INTRODUCTION

The PV inverters of this series are equipped with an integrated dual-channel Wi-Fi connection. Using a dedicated “RS Connect” app, it is possible to make a local connection to the system using the inverter as an access point (channel 1) and perform pre-configuration activities, such as the autotest and performance and analysis parameters instantaneous and periodic production measurements. The second Wi-Fi channel allows the connection with the own home router for sending information to the Riello Solartech cloud that will be visualised on the “RS Monitoring” supervision web portal.

For installation and configuration settings, use the dedicated RS Connect app.
For inverter energy production monitoring, use the RS Connect app or register with the Riello RS Monitoring cloud portal on www.riello-rsmonitoring.com.

“RS CONNECT” APP



RS Connect

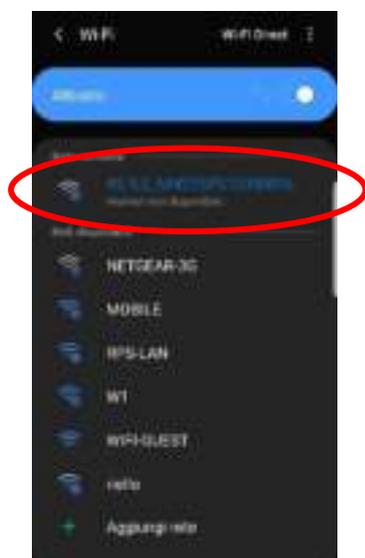


The RS Connect app is compatible with Android and iOS systems. It can be downloaded for free from Google Play and App Store. With its simple and user-friendly graphic interface, the app can be used to configure the system, manage the autotest and analyse the operating conditions of the system.

In addition, the monitoring and cloud login can be accessed directly from the homepage.

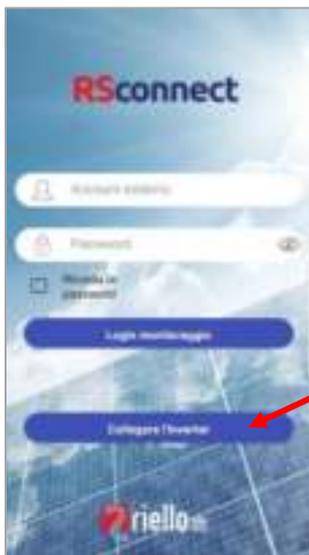
Preliminary configuration

1. Download the **RS Connect APP**.
2. Access to Wi-Fi settings of your smartphone and connect to the inverter Wi-Fi (The SSID of the inverter Wi-Fi is made up of the inverter model name RS x.x + serial number S/N of the inverter). Default password is: 12345678
NOTE: the inverter must be turned on (stand-by or operating).



Example of inverter Wi-Fi among the list of available Wi-Fi connections.

3. Start the RS Connect app and select "Connect Inverter"

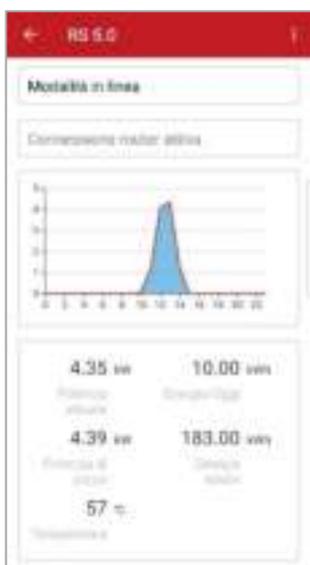


4. The following screen will appear; select the inverter from the list.
NOTE: for some devices, it is necessary to enable the position function.



Select the inverter by clicking on the serial number.

5. At this point, the MAIN screen will appear.



Starting from Main page, it is possible to view the grid connection status, the connection to Wi-Fi router status, the graph of instantaneous power production, current, power, peak power, daily energy, total energy and ambient temperature values.

In addition, the DC parameters (voltage and current at the inverter input) and the inverter output AC parameters (voltage and current, power factor, frequency, active power and reactive power) are displayed.

6. From the Main page the following menus can be accessed:
 History / Production / Maintenance / Settings / Autotest/ Power Limiter

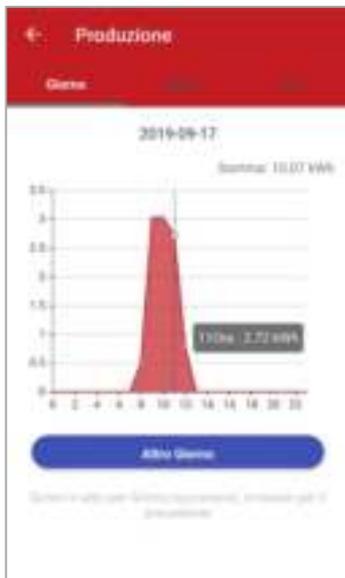


History

This page shows the list of last 128 events and alarms that have occurred.

Production

This page shows the daily / monthly / yearly energy production graphs.



Maintenance

This menu is reserved for technical service personnel. Not available for standard users.

Settings

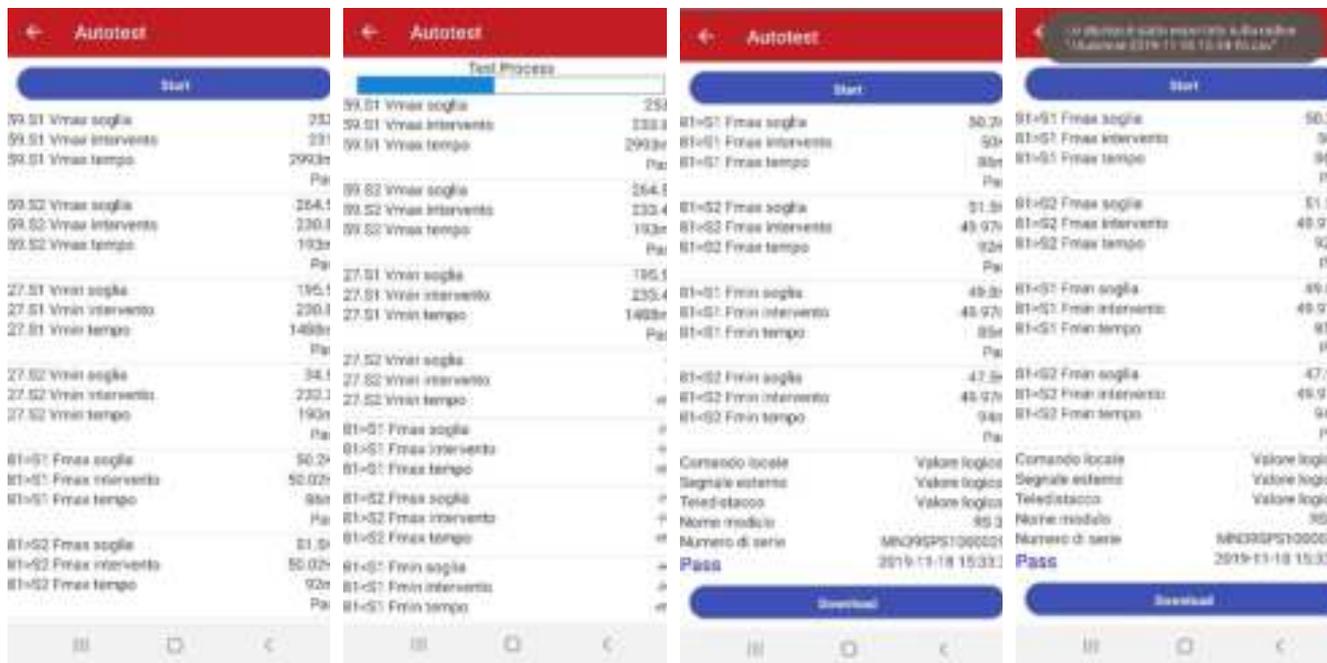
This menu is used to set:
 Date and time
 Wi-Fi connection with own router
 RS484 connection configuration

Advanced settings are reserved for technical service personnel. Not available for standard users.



Autotest

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*. A file called Autotest(date).csv will be saved in the root of the mobile phone.

*NOTE: this function, at the moment, is available only for Android devices

Power Limiter

This menu can be used to enable the power limiter function. Refer to the power limiter optional kit for further details and setting instructions.

Cloud Connection via App

To use this feature, you must first create an account and register your own solar plant on the Riello Solartech cloud portal at www.riello-rsmonitoring.com.

Start the RS Connect app and login with the account name and password (the same ones used to register with the Riello Solartech cloud portal).



If the inverter is correctly connected to the cloud through your own router, after the login you can view an enhanced monitoring system in this area including:

Day / month / year and configurable time-period graphs relative to the power, energy and many other parameters.
Electrical parameters relative to the instantaneous or historical data of each inverter; plant production.

“RS MONITORING” CLOUD PORTAL



RS Monitoring is the name of the portal for Riello Solartech inverters.

It is a professional monitoring system that strictly controls every type of PV system and the environment in which it is located. Useful for small, necessary for medium and large plants, RS Monitoring communicates data and information to users in real time. RS Monitoring allows real-time supervision of the performance of the systems that send data to the Cloud via the Wi-Fi connection integrated in the inverter.

The processing of this data, in addition to weather and environmental data, allows for keeping the systems totally under control.

By registering at the web portal www.riello-rsmonitoring.com.it it is possible to monitor the production and consumption trends of one or more photovoltaic systems by logging in with a single account. Furthermore, it is possible to activate the reception of fault alarm messages and those related to production. The types of messages are mail alerts.

The user can choose to modify the references of the e-mail addresses to which messages and other alarms will be delivered.

The platform provides for the management of an ordered and summary dashboard of all the PV fields monitored for each user with relative indications on the status and production of the plant.

It is possible to access detailed information on a single inverter in a selected system: status, power, energy and many other parameters on a daily, monthly, annual basis; status code and inverter error. It is possible to compare inverter performances and create reports.

Refer to the www.riello-solartech.com website for further details and registrations instructions.

The RS Monitoring system allows real-time displays and diagnostics of all the information relating to the photovoltaic systems, in terms of power, energy and the status of the inverters. With this system, all users can monitor, view and analyse the highly-detailed results of all their photovoltaic plants (through previously configuring the system itself; see the paragraph “Configuration panel – Settings”).

The system is equipped with an ALERT Service, which is detailed and configurable, so that users can be informed at all times via email about any errors or malfunctions of the plant. These alarms can be notified on the portal through the alarm icon.

Users can access the RS Monitoring Portal via the URL riello-rsmonitoring.com, by entering their Username and Password. If the user is not yet registered, they will obviously need to do so, by clicking on the “Sign Up!” link at the bottom of the page to access the RS Monitoring - Account Registration Page.

After entering the portal, users can access the display of their plants or the RS Monitoring Configuration Panel, by clicking the button in the top right-hand corner (user icon) and then “Settings”.

Through appropriate management, starting from the RS Monitoring system, it is possible to make requests from external APPs (the RS Connect APP) to obtain data that is available on the Portal.

The RS Monitoring system can be used in Italian and English.

Access to the RS Monitoring portal

To access the RS Monitoring portal after initial registration, a user will need to connect to the URL **riello-rsmonitoring.com**, and log in by entering their Username and Password (see Figure 1).

If the user is not yet registered, they will need to do so by clicking on the “Sign Up!” link at the bottom of the page.



Figure 1: Login page

After registration, the user will receive a confirmation email containing their Username and Password for access to the RS Monitoring portal. From this moment onwards, the user can use a configuration menu to create or acquire one of their systems and configure it according to its features. The user can display a summary Dashboard for each plant and view other sections to monitor its operation in real time and download relevant data.

- **User registration**

All users must register on the portal, either independently or by asking their Supervisor (e.g. their own installer) to perform the procedure on their behalf.

Registration is performed via a specific registration panel on the portal. Via the URL **riello-rsmonitoring.com**, users must click on the “Sign Up!” link at the bottom of the page to gain access to the account registration page.

Figure 2 shows the user account registration page.



Figure 2: Registration page

Any user can create an account via the registration page, by simply filling in the registration form and choosing the language they wish to use on the portal (this can also be changed subsequently).

All users must register by entering the following information:

- a. Username (Account User Name, represented by their email address)
- b. Password (Account User Password)
- c. Full Name (e.g. Name and Surname)
- d. Default language
- e. Authorisation for data processing (Privacy)

After registration, the user will receive a confirmation email containing their Username and Password for access to the RS Monitoring portal.

- **List of Plants**

After logging in to the RS Monitoring portal, a user will access the list of plants, if they have more than one plant. Otherwise the user will have direct access to their dashboard.

Initially, the list of plants will be empty and, therefore, it will be necessary to create a plant, by accessing the configuration page via the settings menu and clicking on the user icon in the top right-hand corner.

The list of plants page can be reached from all pages on the site, by clicking on the user icon which provides access to the plant list menu.

When the plants have been configured, summary information will be provided for each field displayed regarding daily production and the alarm status of the field. By clicking on the name of a plant, a user can access the relevant dashboard. In addition, a rapid search for a particular plant will always be available via a special filter and the chosen language can also be changed.

Figure 3: List of fields



- **Configuration panel - Settings**

The RS Monitoring configuration panel can be reached from all pages on the site by clicking on the user icon and then the settings menu. It features three sections: Account Settings, Add Plant, Amend Plant.

Account Settings

In the Account Settings section, one can amend the user information that was defined during registration, connect a logo with the user and, if required, change the account password.

User Information

In User Information, one can change the (obligatory) name of the user that is displayed on all pages of the site next to the user icon, the Tax ID Code/VAT No., Street, Post Code, Town/City, Country and telephone number associated with them. In addition, one can also change the default language used on the portal.

Change Logo

In this section, the user can upload an image that will become the user logo and will be displayed on the dashboards of all their plants. This image is univocal for each individual user and can only be displayed by that person.

Change Password

A user can use this section at any time to change their password used to access the RSmonitoring portal.

Add Plant

In the Add Plant section, a user can create their own plant or acquire one created by another user (e.g. their installer).

Create Plant

The Create Plant screen allows a user to initialise their field. The user must:

- Indicate the name to be associated with the field, the nominal power and the incentive tariff (on the inverter dashboard, this value will be essential in order to calculate earnings);
- Enter the location (address/street/...), and by clicking on Obtain Position, the system will obtain the latitude, longitude and time zone of the plant (essential for generating the times of the packages received by the inverters associated with the field).

After the field creation has been completed, if the procedure has been successful, a message will be displayed confirming this and then the field which has just been created will be associated with the account.

At this point, an “empty” plant will now exist to which one or more inverters will need to be associated.

Acquire Plant

If another user (e.g. an installer) has created and configured the plant, it can be acquired directly via the Acquire Plant section.

To use the Acquire Plant function, the user must enter one of the S/N serial numbers present on it and click on “search”. Once it has been established that the relevant S/N actually exists on that plant, the user can acquire it.

Modify Plant

On the Modify Plant screen, the user can display the list of fields created by and associated with them, and by clicking on one of them, they can amend some of the information that was entered when the field was created (via the Modify Plant, Mail Activation, Plant Image sections) and add/remove inverters in the Inverter List section.

Modify Plant

In this section, the user can change the name of the plant, the nominal power and the incentive tariff that was entered when the plant was created;

If the user is not the creator of the plant, they will only be able to change the incentive tariff, allowing them to amend the calculation regarding the plant earnings, to be displayed only through their account.

Mail Activation

Every user can decide independently and for each plant to enable/disable the email function for alarm emails to be sent to their account.

Plant Image

With the Plant Image function, all users can upload an image for each field, to be displayed in the individual dashboard through their own profile.

Inverter List

Only the creator of the plant can add and/or remove inverters.

When the plant is created, it will be empty and an inverter will need to be added to it, by entering the S/N in the appropriate field and clicking on the “+” key. The inverter will be added to the plant if and only, if:

- a) The S/N of the inverter meets the reliability requirements for the serial numbers defined by RPS and that the inverter with that S/N has already been in communication with the server.
- b) The S/N of the inverter is not already associated with any plant.

Once the inverters have been added to the plant, there will be a list of inverters and next to each inverter there will be a “-” sign which can be used to remove the inverter from the list.

- **Dashboard**

With the Smart **Dashboard**, customers and maintenance staff of a particular photovoltaic plant will have access in real time, and at all times, to information relating to the nominal power on the DC and AC sides; the daily, weekly, monthly, yearly and total energy, and also the status of the devices (when necessary, there will be a notice next to each alarm icon).



Figure 4: Dashboard

The first box in the dashboard will show information about the user and the field, with the date of installation, the dimensions and location of the field, the current time at the plant location, the logo and image (default items or those entered by the user during configuration) and information relating to earnings (calculated on the basis of the incentive tariff defined by the user for the plant), the number of trees planted and CO2 savings.

The second box will contain information on the energy relating to the entire plant and a button for the choice of chart to be displayed in the third box (field or individual inverter level). This chart will display the instantaneous DC and AC power values on an inverter level (for each individual inverter) and on a field level (i.e. the sum of all the inverters that make up the field).

Based on the inverter associated with the plant, this chart will adapt to its characteristics. It will be possible to notice the differences between inverters with single, double or treble MPPT.

The dashboard colours will allow the user to follow the flow of energy produced, in a highly intuitive manner, and if there is any anomaly on the DC or AC side.

The time of the last update relating to the plant or the selected device will be shown below the chart.

At the top of the page, there will be a menu allowing you to access the dashboard itself and also the Data, Alarm Log and Reports pages. The same menu will also allow the user to change the language of the portal for the current session.

- **Data**

The Data section allows the user to display all the information regarding their plant on a field or single inverter level.



Figure 5: Data Section

Plant data

This page allows the user to display the information on a plant level, showing in real time the power or energy of the plant (calculated as the sum of the powers/energies of the inverters associated with it) for the current day; and by using the appropriate datapickers, the user can view the same information for different days/weeks/months/years.

Single Inverter

To view the information for an individual inverter, the user will need to use that section. By using the appropriate datapickers and selecting the inverter of the plant in question, one can display the AC Data (power, voltage, current, frequency), the Inverter Data (temperature), MPPT Data (MPPT power, MPPT voltage, MPPT current), DC Data Strings (DC power, DC voltage, DC current) and Periodic Data (weekly energy, monthly energy, annual energy, total energy).

Inverter Comparison

In this section, one can compare 2 curve graphs. One can choose the same inverter or 2 different inverters, the same date or 2 different dates and the same measurement or 2 different measurements. If the selected measurement is the same, the 2 graphs will overlap in a single graph; conversely, 2 separate graphs will be displayed side-by-side.

History

The History log section will provide the customer with information regarding the exact moment when an IN or OUT alarm is triggered for the inverters of the plant; by selecting a specific time period, one can view the information on the screen (by clicking on Load Log) or download an excel file which contains this data (by clicking on Download Events Log).

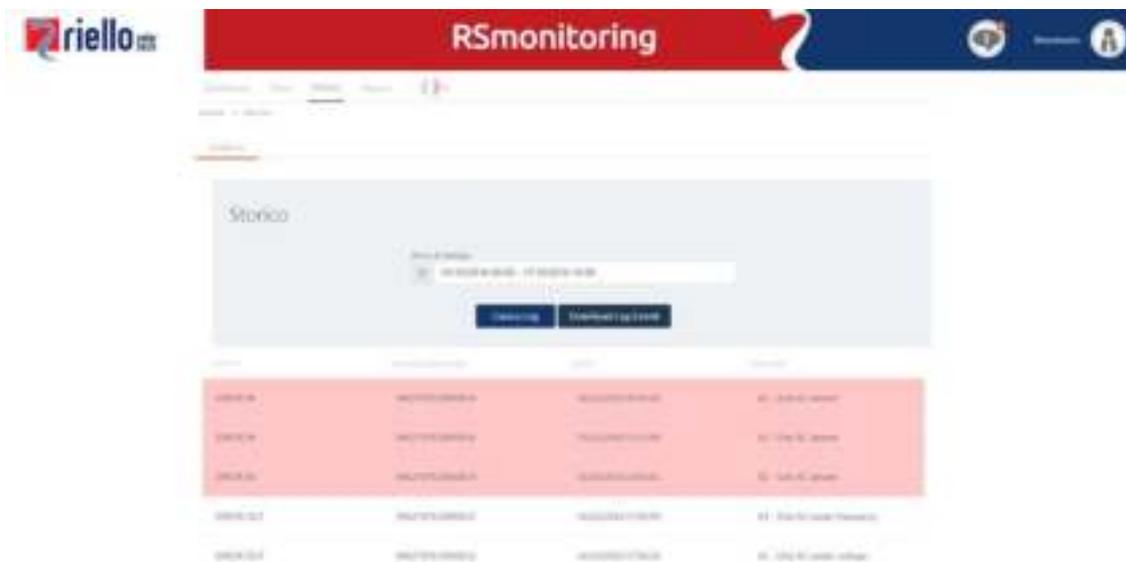


Figure 6: Alarm Log Section

Reports

The Reports section will provide the customer with information on the measurements of the inverters of the plant; by selecting a specific time period, one can view on the screen the power measurements of the inverters (by clicking on Load Log) or download an Excel file which contains all the measurement data, associated with all the inverters of the plant, in that time period (by clicking on Download Events Log).

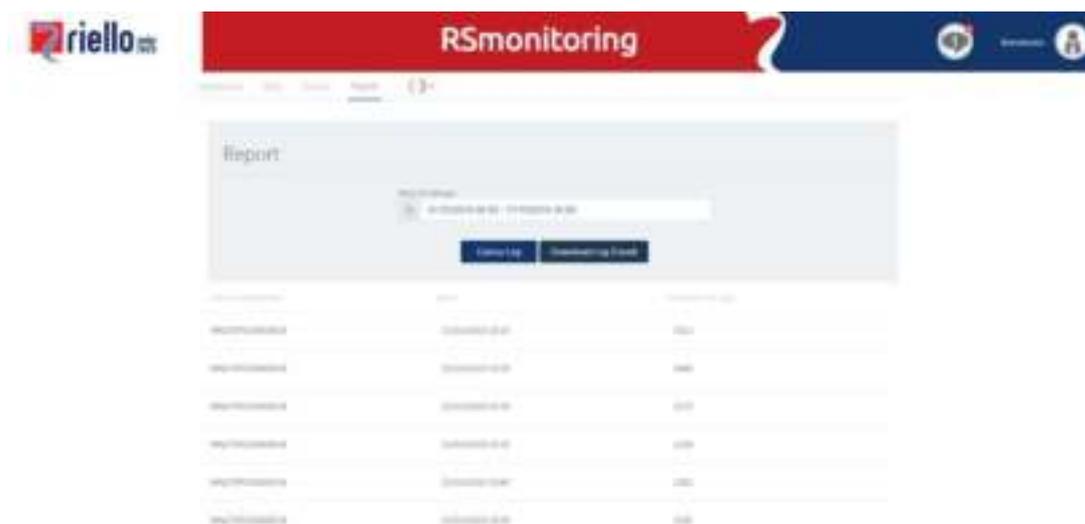


Figure 7: Reports Section

Service Alert and Management of Alarms

The RS Monitoring system is equipped with an **ALERT Service**, which is detailed and configurable, so that users can be informed at all times via email about any errors or malfunctions of the plant.

The management of alarms is divided into the following groups:

GROUP 1 - Absence of communication: This error is generated when packages are not sent by an inverter for more than 8 hours. After this time, an alarm email is sent to the customer and the error is notified on the portal. This control is performed 24 hours a day.

GROUP 2 – Energy production zero: This error is generated when the packages from the inverter under examination show a power value of zero for more than 8 consecutive hours. After this time, an alarm email is sent to the customer and the error is notified on the portal. This control is only performed during daytime hours (dawn till dusk)

GROUP 3 – Alarms generated by the inverters: These errors, sent by the inverters are managed according to specifications agreed with RPS (see Table 1).

TIPO ALLARME	CONTROLLO ALLARME	VISUALIZZAZIONE SU PORTALE	PERIODO MAIL	ABILITAZIONE VISUALIZZAZIONE/MAIL
A0-Sovratensione AC	02401:GIORNO	IMMEDIATA	8 ORE	X
A1-Sottotensione AC	02401:GIORNO	IMMEDIATA	8 ORE	X
A2-Allarme Rete AC	02401:GIORNO	IMMEDIATA	8 ORE	✓
A3-Frequenza rete AC troppo alta	02401:GIORNO	IMMEDIATA	8 ORE	X
A4-Frequenza rete AC troppo bassa	02401:GIORNO	IMMEDIATA	8 ORE	X
B0-FV Sovratensione DC	02401:GIORNO	IMMEDIATA	8 ORE	X
B1-FV errore isolamento	02401:GIORNO	IMMEDIATA	8 ORE	X
B2-Eccessiva corrente dispersione	02401:GIORNO	IMMEDIATA	8 ORE	X
A5-Tensione AC più alta del BUS	02401:GIORNO	IMMEDIATA	8 ORE	X
C0-Basse potenze	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
B3-Stringa FV anomala	02401:GIORNO	IMMEDIATA	8 ORE	✓
B4-Sottotensione DC	02401:GIORNO	IMMEDIATA	8 ORE	X
B5-Interramento debite	02401:GIORNO	IMMEDIATA	8 ORE	X
A6-Tipo di rete non identificato	02401:GIORNO	IMMEDIATA	8 ORE	X
B6-Ritorno arco elettrico	02401:GIORNO	IMMEDIATA	8 ORE	X
B6-Corrente di dispersione >300mA	02401:GIORNO	IMMEDIATA	8 ORE	X
C2-Componente continua corrente DC eccessiva	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C3-Allarme rete uscita	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C4-Servizi comp continui con uscita gasata	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C5-Sovratemperatura inverter	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C6-Corrente di dispersione anomala	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
B7-Inversione polarità stringa FV	02401:GIORNO	IMMEDIATA	8 ORE	X
C7-Errore di sistema	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C8-Basso ventilatore	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C9-Feruzione BUS sbilanciata	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
E4-Sovratensione BUS	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C8-Errore comunicazione interna	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C1-Incompatibilità software	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C2-Errore EEPROM	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C3-Anomalia permanente	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C7-Anomalia inverter	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓
C0-Allarme Router	24 ORE SU 24	IMMEDIATA	IMMEDIATA	✓

Table 1: Management of Group 3 alarms

APPENDIX

TECHNICAL SPECIFICATIONS

Model	RS 1.5	RS 2.0	RS 3.0	RS 4.0	RS 5.0	RS 6.0
Efficiency						
Max efficiency	97.6%	97.6%	97.5%	97.4%	97.4%	97.4%
European efficiency	96.1%	96.6%	96.8%	96.8%	96.9%	97.1%
Input (PV)						
Max input voltage	600 V					
Rated input voltage	360 V					
Max input current	12.5 A			22 A (2x11 A)		
Max short-circuit current	15 A			30 A (2x15 A)		
Start input voltage / Min operating voltage	90 V / 70 V					
MPPT operating voltage range	90 V–580 V					
MPPT operating voltage range (full-load)	130 V–520 V	170 V–520 V	240 V–520 V	190V-520V	240 V–520 V	300 V–520 V
Max number of PV strings	1			2 (1/1)		
No. of MPPTs	1			2		
Output (grid)						
Rated AC active power	1,500 W	2,000 W	3,000 W	4000 W	5,000 W	6,000 W
Max AC apparent power	1,650 VA	2,200 VA	3,300 VA	4400 VA	5,500 VA	6,600 VA
Max AC active power (PF=1)	1,650 W	2,200 W	3,300 W	4400 W	5,500 W	6,600 W
Max AC output current	7.2 A	9.5 A	14.3 A	19.1A	23.8 A	28.6 A
Rated AC voltage	220 V / 230 V, L+N+PE					
AC voltage range*	160 V–300 V					
Rated grid frequency	50 Hz / 60 Hz					
Grid frequency range**	45 Hz–55 Hz / 55 Hz–65 Hz					
THDI	<3% (rated power)					
DC current injection	<0.5% In					
Power factor	> 0.99 rated power (adjustable 0.8 leading - 0.8 lagging)					
Recommended circuit breaker	10A Z or B curve	16A Z or B curve	20A Z or B curve	25A Z or B curve	32A Z or B curve	32A Z or B curve
Protection						
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					
General						
Topology	Transformerless					
IP Rating	IP65					
Night self-consumption	< 5 W					
Cooling	Natural cooling					
Operating temperature range	-25°C to 60°C					
Relative humidity range	0–100%					
Max operating altitude	4,000 m (> 2,000 m derating)					
Noise	< 30 dB (measured at 1 m)					
Dimensions (W*H*D)	298x377x130 mm			367x467x135 mm		
Weight	9.3 kg			12.9 kg		

HMI & COM	
Display	Wireless & app + LED, LCD
Communication	Wi-Fi (integrated), RS485 (optional)
Certification	
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 0-21, RD1699
Warranty	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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