
R1

Mini Series

User Manual

R1 - 1K1 - SS

R1 - 1K6 - SS

R1 - 2K2 - SS

R1 - 2K7 - SS

R1 - 3K3 - SS

R1 - 3K7 - SS

RENAC

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1. Introduction










1.1 Introduction

This manual describes solar inverters : R1-1K1-SS/R1-1K6-SS/R1-2K2-SS/R1-2K7-SS/R1-3K3-SS/R1-3K7-SS. These inverters are transformerless based inverter.

Please read the safety instructions in this manual first. Throughout the manual it is assumed that the reader is familiar with AC and DC installations and knows the rules and regulations for electrical equipment and for connecting it to the utility AC grid. It is especially important to be familiar with the general safety rules for working with electrical equipment.


1.2 Applied designations

Throughout the manual important information is shown at different levels depending on the character of the information, as shown here:

	Safety information important for human safety. Violation of warnings may result in injury to persons or death.
	Danger of high voltage and electric shock!
	Signals danger due to electrical shock and indicates the time (5 minutes) to allow after the inverter has been turned off and disconnected to ensure safety in any installation operation.
	Danger of hot surface!
	Product should not be disposed as normal household waste.
	CE Mark.
	ROHS Mark.
	Information important for the protection of property. Violation of this type of information may cause damage and loss of property.
	Useful additional information or "Tips and Tricks" on specific subjects.

1.3 Important safety information

Read this before installing, operating or maintaining the inverter.



Before installation:

Check for damage to inverter and packaging. If you are in doubt, please contact your supplier before installing the inverter. Check the voltages of the solar modules and make sure they are within the limits of the inverter specifications before connecting them to the inverter.

Installation:

Only trained and authorized personnel familiar with local electrical codes may install the inverter. For optimum safety, please follow the steps described in this manual. Keep in mind that the inverter has two voltage carrying sides, the PV input and the AC grid.

Disconnecting the inverter:

Always disconnect the AC line first! Afterwards disconnect the PV lines. Note that the inverter can still be charged with very high voltages at hazardous levels even when it is disconnected from grid and solar modules. Wait at least 5 min. before proceeding, after having disconnected from grid and PV panels.

Operating the inverter:

Before connecting the AC grid to the inverter, make sure that the installation cover is mounted again. The inverter must not be open during operation.


Maintenance and modification:

Only authorized personnel are allowed to repair or modify the inverter. To ensure optimum safety for user and environment, only the original spare parts available from your supplier should be used.

Functional safety parameters:

Unauthorized changes of functional safety parameters may cause injury or accidents to people or inverter. Additionally it will lead to the cancelling of all inverter operating approval certificates.

1.4 System sizing



When dimensioning a photovoltaic system, it must be ensured that the open circuit voltage of the PV string never exceeds the maximum permissible input voltage, R1-1K1-SS/R1-1K6-SS/R1-2K2-SS series inverters the maximum input voltage is 500V DC, R1-2K7-SS/R1-3K3-SS/R1-3K7-SS series inverters the maximum input voltage is 550V DC. Higher voltages may result in permanent damage to the inverter.

The selection of PV string output should be based on the optimum utilization of the invested capital compared to the expected annual energy yield from the system. This optimization depends on local weather conditions and should be considered in each individual case.

The inverter incorporates an input power limiting device, which automatically keeps the power at levels that are safe for the inverter. The limitation depends mainly on internal and ambient temperatures. The limitation is calculated continuously and always allows the maximum possible amount of energy to be produced.

Please use the tool supplied by Renac Power when dimensioning a photovoltaic system.

2. Technical description of inverter

2.1 Mechanical design

Figure 2-1 shows the outline dimensions of R1-1K1-SS/R1-1K6-SS/R1-2K2-SS/R1-2K7-SS/R1-3K3-SS/R1-3K7-SS:

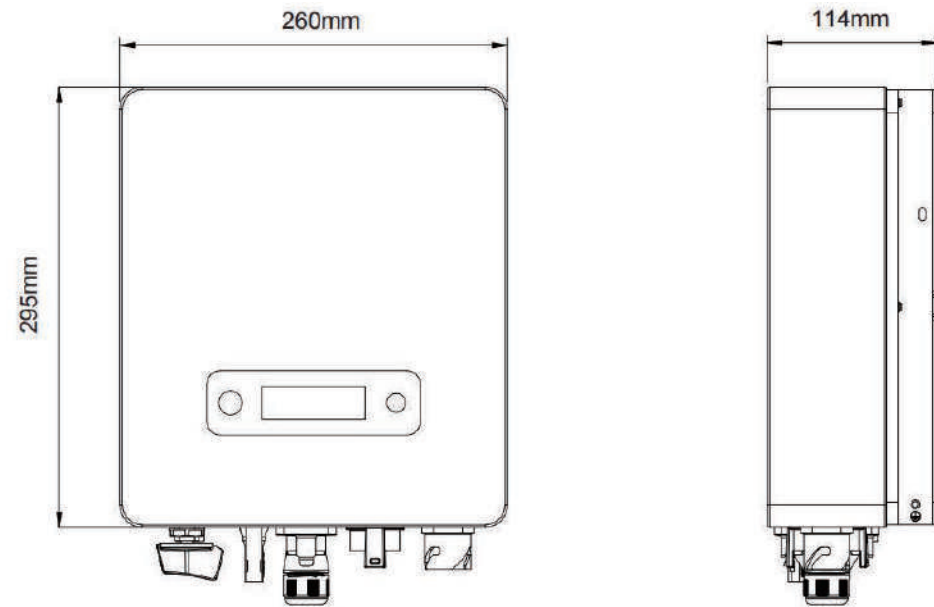


Figure 2-1 Outline dimensions

Figure 2-2 shows the electrical terminals of R1-1K1-SS/R1-1K6-SS/R1-2K2-SS/R1-2K7-SS/R1-3K3-SS/R1-3K7-SS:

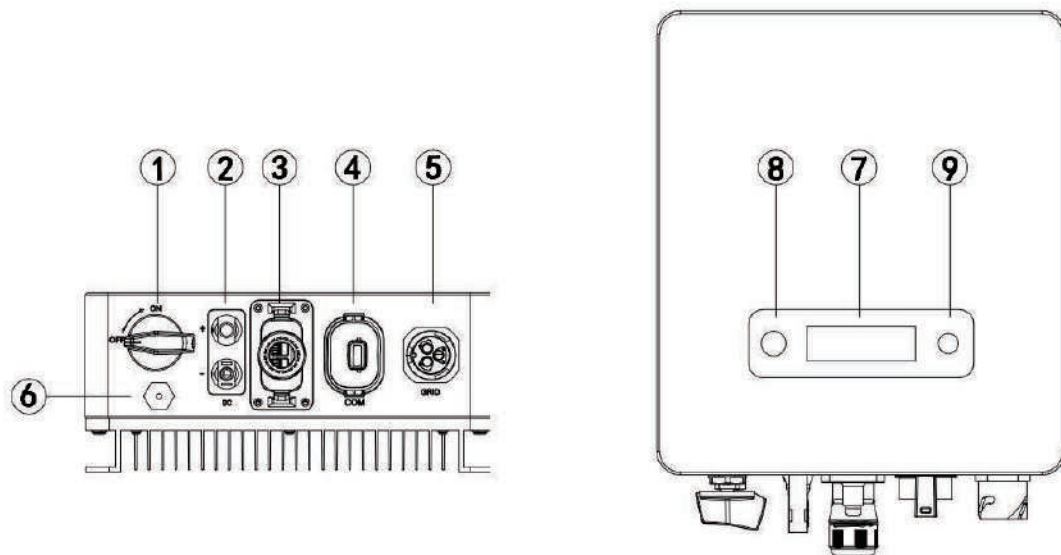


Figure 2-2 Electrical Terminals

1	DC Switch	2	DC (PV Terminal)
3	I/O Port	4	Communication port
5	AC terminal	6	Vent valve
7	LCD	8	LED(Run/Fault)
9	Key		



For safety reasons, the use of a DC switch is recommended. Between the PV modules and the power modules may be mandatory in some countries.

2.2 Electrical system design

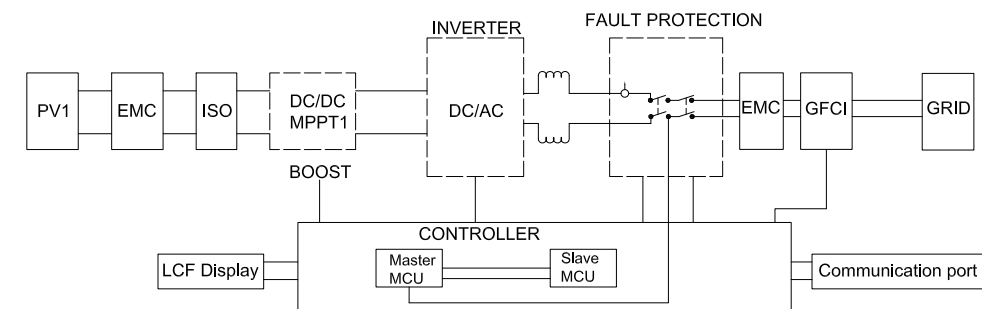


Figure 2-3 wiring diagram of the inverter system

Please refer to chapter 3 for the detail connecting and install methods.

2.3 Technical data

Model	R1-1K1-SS	R1-1K6-SS	R1-2K2-SS	R1-2K7-SS	R1-3K3-SS	R1-3K7-SS
DC Input Data						
Max. Recommended PV Power	1400W	2400W	2800W	3500W	4200W	4800W
Max.DC Input Voltage	500V	500V	500V	550V	550V	550V
MPPT voltage Range	50-500V			50-550V		
Rated Input Voltage	360V					
Start-up Voltage	70V					
No. of MPP Trackers	1					
No. of Input Strings per Tracker	1					
Max. DC Input Current	13.5A	13.5A	13.5A	13.5A	16A	13.5A
Isc	17A	17A	17A	17A	20A	17A
DC Switch	Optional					

AC Output Data						
Rated AC Power	1100W	1600W	2200W	2700W	3300W	3680W
Max.output power	1100VA	1600VA	2200VA	2700VA	3300VA	3680VA
Max. AC Current	4.8A	7.2A	9.6A	12A	14.4A	16A
Rated AC Voltage/Range	220V/230V; 160-290V					
Grid frequency/ range	50Hz/60Hz ; ±5Hz					
Adjustable Power Factor[cos φ]	0.8leading ~0.8lagging					
Output THDi(@Rated Output)	≤2%					
Efficiency						
Max.Efficiency	97.00%	97.10%	97.10%	97.30%	97.30%	97.30%
Euro Efficiency	96.50%	96.60%	96.60%	96.80%	96.80%	96.80%
MPPT Efficiency	99.90%	99.90%	99.90%	99.90%	99.90%	99.90%
Protection						
DC Insulation Monitoring	Integrated					
Input Reverse Polarity Protection	Integrated					
Anti-island Protection	Integrated					
Residual Current Monitoring	Integrated					
Over-heat Protection	Integrated					
AC Overcurrent Protection	Integrated					
AC Short-circuit Protection	Integrated					
AC Overvoltage Protection	Integrated					
DC Surge Protection	Integrated(Type III)					
AC Surge Protection	Integrated(Type III)					
General Data						
Size(Width*Height*Depth)	295x260x115mm					335*260*120mm
Weight	6.8KG	6.8KG	6.8KG	6.8KG	6.8KG	7.5KG
User Interface	LCD					
Communication	RS485 or WIFI or GPRS					
Ambient Temperature Range*	-25 C ~ 60 C					
Relative Humidity*	0-100%					
Operating Altitude*	≤4000m					
Standby Self Consumption	< 0.2W					
Topology	Transformerless					
Cooling	Natural Convection					
Protection Grades	IP65					
Noise	<30dB					
Warranty	5 /7/10 years					
Certifications & Standards						
Grid Regulation	VDE 0126-1-1, G98, EN50549, C10/11 PEA, MEA, AS4777 ,CEI0-21,IEC61727,IEC62116,IEC60068,IEC61683					
Safety Regulation	IEC 62109-1, IEC 62109-2					
EMC	EN 61000-3-2,EN 61000-3-3, EN61000-6-1, EN61000-6-3, IEC61000-4-16,IEC61000-4-18,IEC61000-4-29					

2.4 Grid codes

No.	National/Regional Grid Code	Description
9	C10/11	Belgium power Grid.
10	G59	UK power Grid.
11	China	China power Grid, meet Grid standards "CN-NBT".
12	VDE0126-FR	France power Grid, meet Grid standards "VDE 0126".
13	EN50549-PL	Poland power Grid.
14	BDEW-DE	Germany power Grid, meet Grid standards "BDEW-MV".
15	VDE0126-DE	Germany power Grid, meet Grid standards "VDE 0126".
16	CEI0-16	Italy power Grid, meet Grid standards "CEI 0-16".
17	G83	UK power Grid.
18	Greece Island	Greece Island power Grid.
19	EN50549-CZ	Czech Republic power Grid, meet Grid standards "EN50438Y2007-CZ".
20	IEC61727	India power Grid.
21	Korea	Korea power Grid.
22	EN50549-SW	Sweden power Grid.
23	China-W	China power Grid, Grid voltage range: 160-290V Grid frequency range: 47-53HZ.
24	China-H	China power Grid, meet standards "CQC".
25	IEC61727-IN	India power Grid, meet Grid standards "IEC61727".
26	Brazil	Brazil power Grid, meet Grid standards "NBT 16150".
27	IEC61727-SL	Sri Lanka power Grid, meet Grid standards "IEC61727".
28	Mexico	Mexico power Grid, meet Grid standards "IEC61727 60HZ".
29	NZ4777	New Zealand power Grid, meet Grid standards "NZ4777".
30	Philippines	Philippines power Grid, meet Grid standards "IEC61727 60HZ spec".
31	IEC61727-SL-W	Sri Lanka power Grid, Grid voltage range: 160-290V, Grid frequency range: 47-53HZ.
32	PEA	Thailand power Grid.
33	PEA-W	Thailand power Grid, Grid voltage range: 160-290V, Grid frequency range: 47-53HZ.
34	IEC61627-VN	Vietnam power Grid.
35	IEC61627-VN-W	Vietnam power Grid, Grid voltage range: 160-290V, Grid frequency range: 47-53HZ.
36	MEA	Thailand power Grid.
37	MEA-W	Thailand power Grid, Grid voltage range: 160-290V, Grid frequency range: 47-53HZ.
38	Tunisia	Tunisia power Grid.
39	Tunisia-W	Tunisia power Grid, Grid voltage range: 160-290V, Grid frequency range: 47-53HZ.

3. Installation and startup

	<p>Warning!</p> <p>Before installation and maintenance, AC and DC side doesn't carry electricity, but if DC side is just disconnected, capacitance still contains electricity, so please wait for at least 5 minutes to ensure the capacitors completely release the energy and inverter is not electrified.</p>
	<p>Note!</p> <p>Inverters must be installed by qualified person.</p>

3.1 Package information

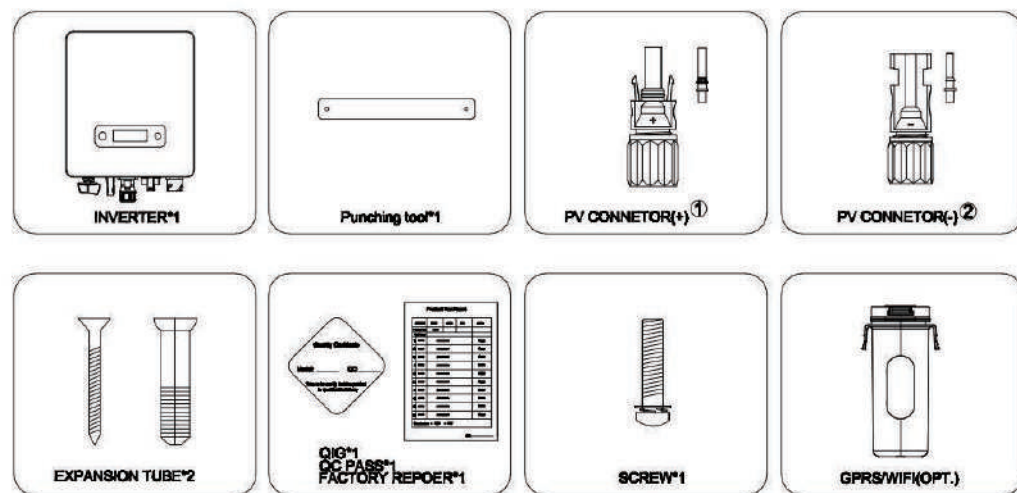


Figure 3-1 package information

3.2 Installation environment

- 1) In order to achieve optimal performance, the ambient temperature should be kept lower than 45 °C.
- 2) For the convenience of checking the LCD display and possible maintenance activities, please install the inverter at eye level.
- 3) Inverters should NOT be installed near inflammable or explosive items. Any strong electro-magnetic equipment should be kept away from installation site.
- 4) Product label and warning symbol shall be clear to read after installation.
- 5) Please do not install inverter under direct sunlight, rain and snow.

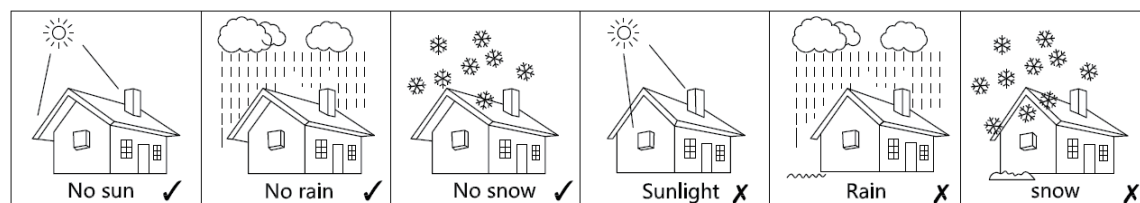


Figure 3-2 installation environment

3.3 Installation position

- | | |
|--|---|
| | <ol style="list-style-type: none"> 1) The installation method and mounting location must be suitable for the inverter's weight and dimensions. 2) Mount on a solid surface. 3) Select a well-ventilated place sheltered from direct sun radiation. |
|--|---|

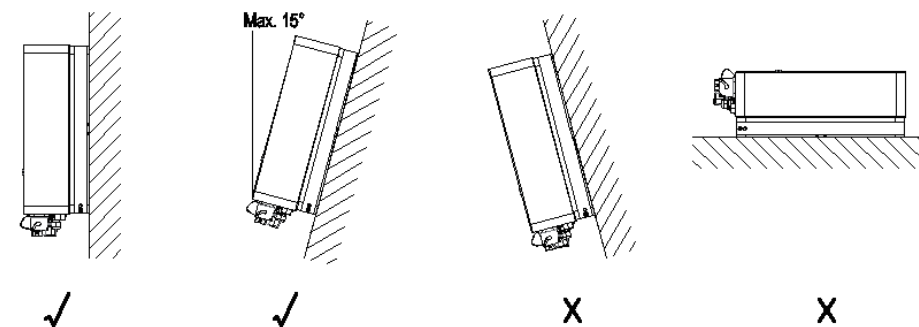


Figure 3-3 installation position

In consideration of heat dissipation and convenient dismantlement, the minimum clearances around the inverter should be no less than the following value

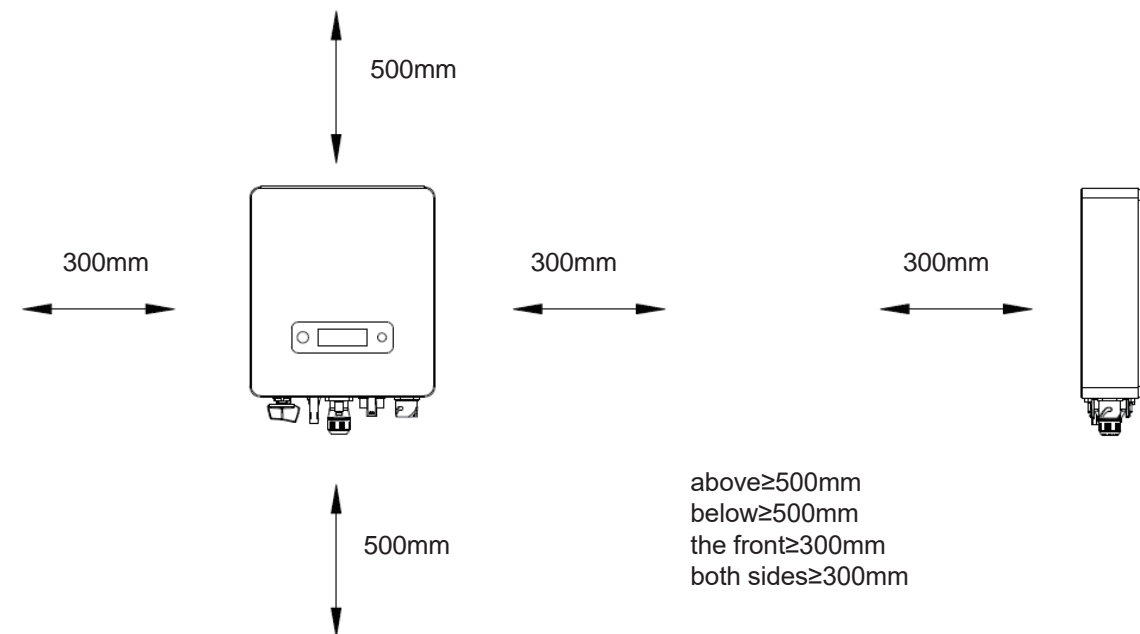


Figure 3-4 Distance required of Inverters

3.4 Mounting procedure

Step1: Drill 2 Fix Ø11 holes in the wall according to the dimensions.

Step2: Fix the wall mounting bracket on the wall with two expansion bolts in accessory bag.

Step3: Place the inverter on the wall-mounted bracket and install the fix screw.

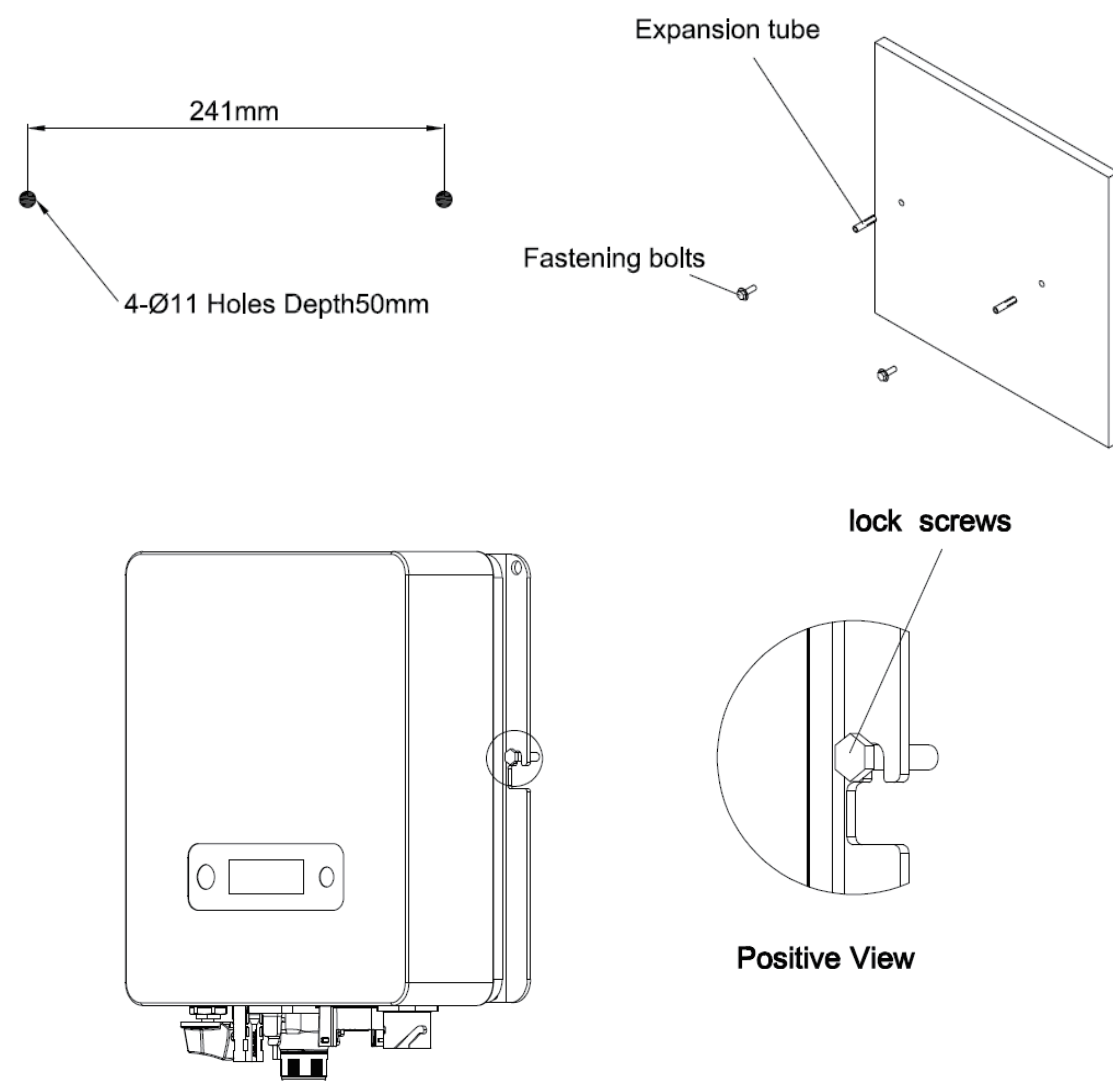


Figure 3-5 mounting the inverter

3.5 Electrical connection

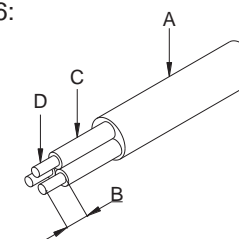
3.5.1. Connection to the grid (AC output)



- 1) Add breaker or fuse to AC side, the specification should be more than 1.25 times of rated AC output current.
- 2) The PE line of inverter should be connected to the earth, make sure the impedance of neutral wire and earth wire less than 10 ohm.
- 3) Disconnect the breaker or fuse between the inverter and the utility.
- 4) The integrated leakage current detection device of the inverter can detect external leakage current in real time. When the detected leakage current exceeds the limit value, inverter will quickly disconnect with the grid. If the leakage current protection device is installed externally, the action current should be 300mA or higher.

Connect the inverter to the grid as follows:

- 1) Strip off L/N/PE cables as figure 3-6:



No.	Description	Remark
A	Protective layer	Diameter ranges : 9-16mm
B	Length of stripped off	12mm
C	Insulate layer	50mm
D	Cross section of ac cables	4-6mm ²

Figure 3-6 Strip off PE/N/L cables

- 2) Tighten the nut clockwise & Tighten L/N/PE cable screws to the terminals according to markings.



Fix (Torque: 2~2.5 N.m) the connector of AC cable to the corresponding terminals

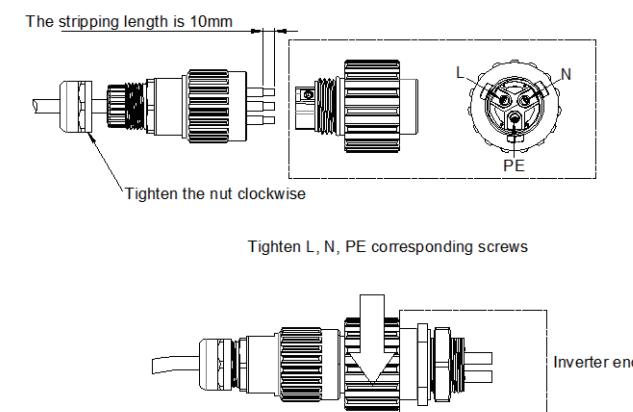


Figure 3-7 Connect the inverter to the Grid

- 3) Plug Grid side connector into AC connector of inverter end, rotate and tighten clockwise.

3.5.2. Connection to PV string (DC input)



- 1) Before connecting PV string, make sure DC switch is turned off
- 2) Make sure PV string polarity confirms with DC connector, otherwise, it will cause damage to inverter
- 3) Make sure the maximum open circuit voltage (Voc) of each PV string does not exceed the inverter input voltage Vmax under any condition
- 4) Do not connect positive or negative pole of PV string to earth wire. Otherwise, it will cause damage to inverter

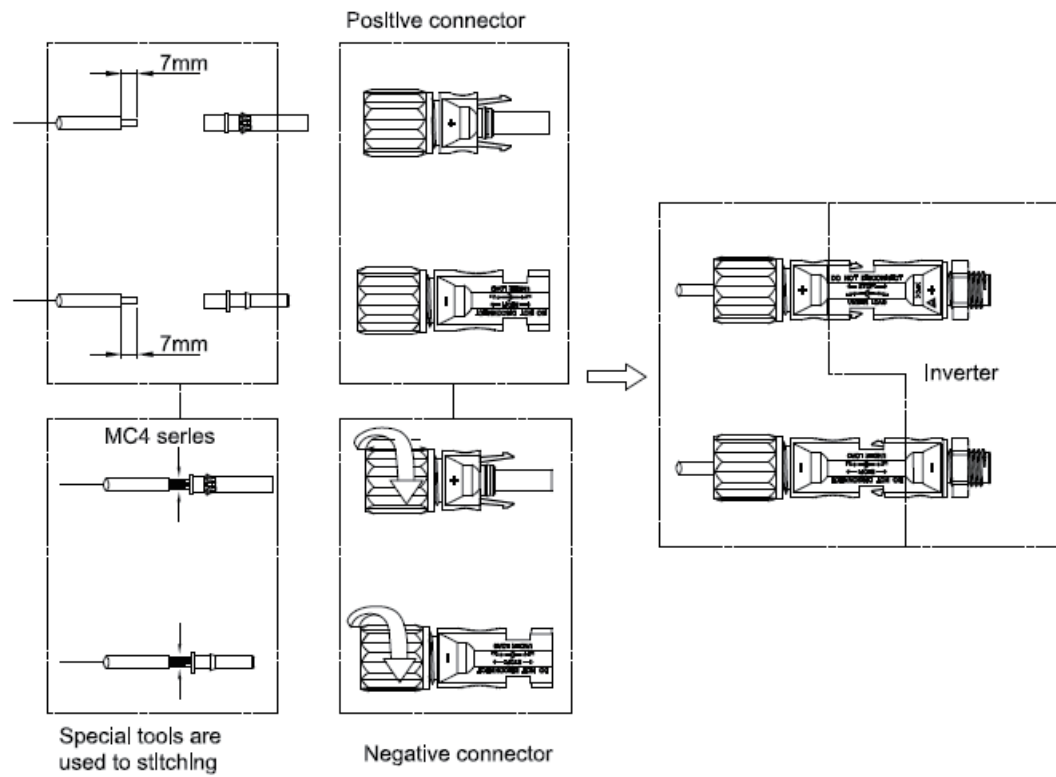


Figure 3-8 Connect the PV string

3.5.3. Communication

Overview of communication ports:

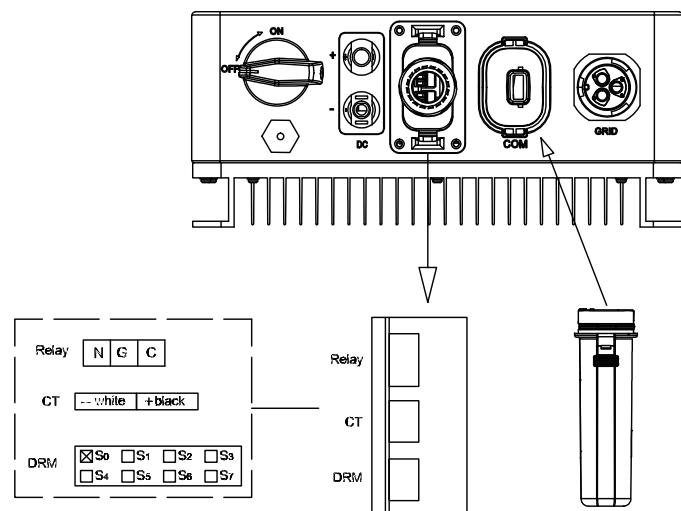


Figure 3-9

3.5.3.1 WIFI/GPRS Communication (optional)

Connect the WIFI/GPRS module produced by Renac to the COM port of inverter. After successful connection, information such as power generation and running state of the inverter can be viewed via the App on the phone. The details please refer to the module user manual.

The block diagram of the WIFI/GPRS communication system is as follows:

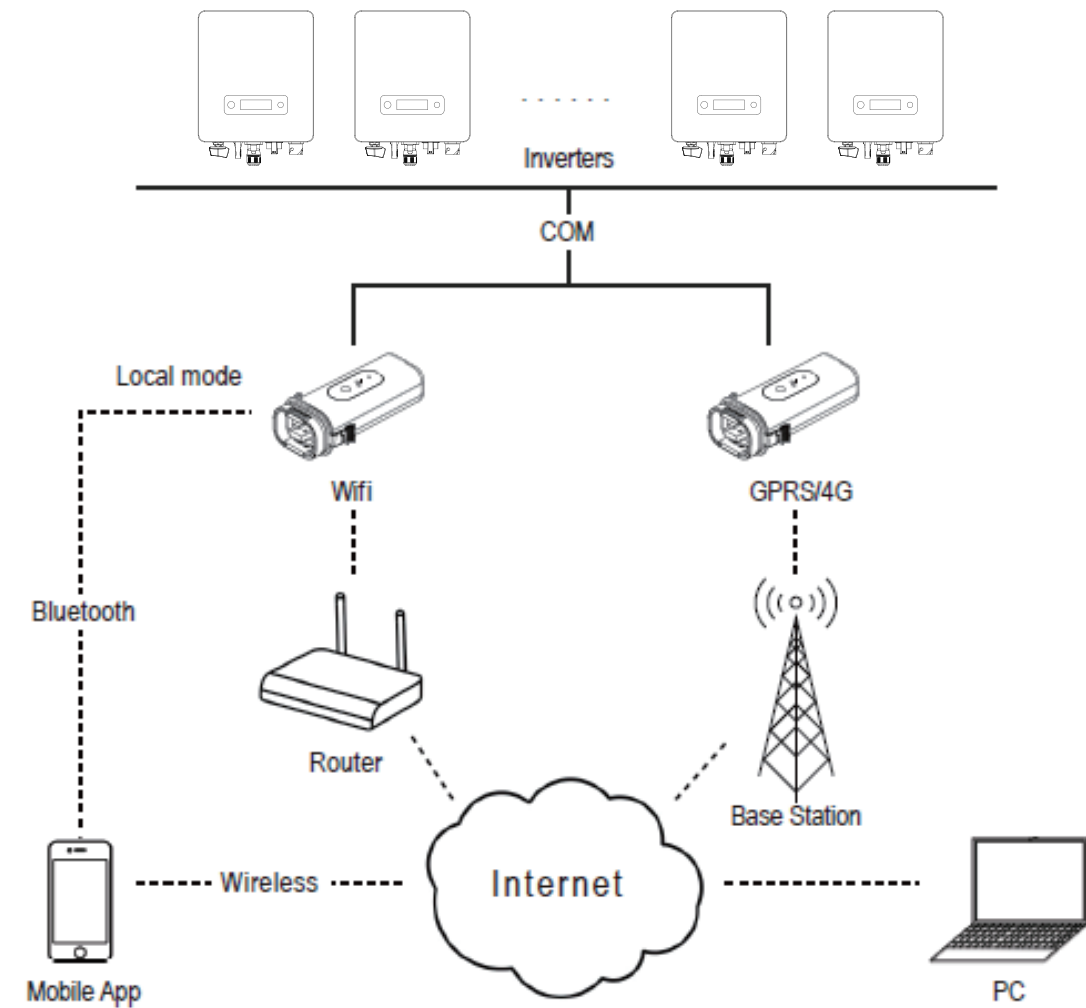


Figure 3-10

3.5.3.2 CT Connection (Optional)

The inverter is equipped with the feed-in power limit function, and the communication port on inverter is "CT" (figure 3-9), below is the method of connecting the CT in system.

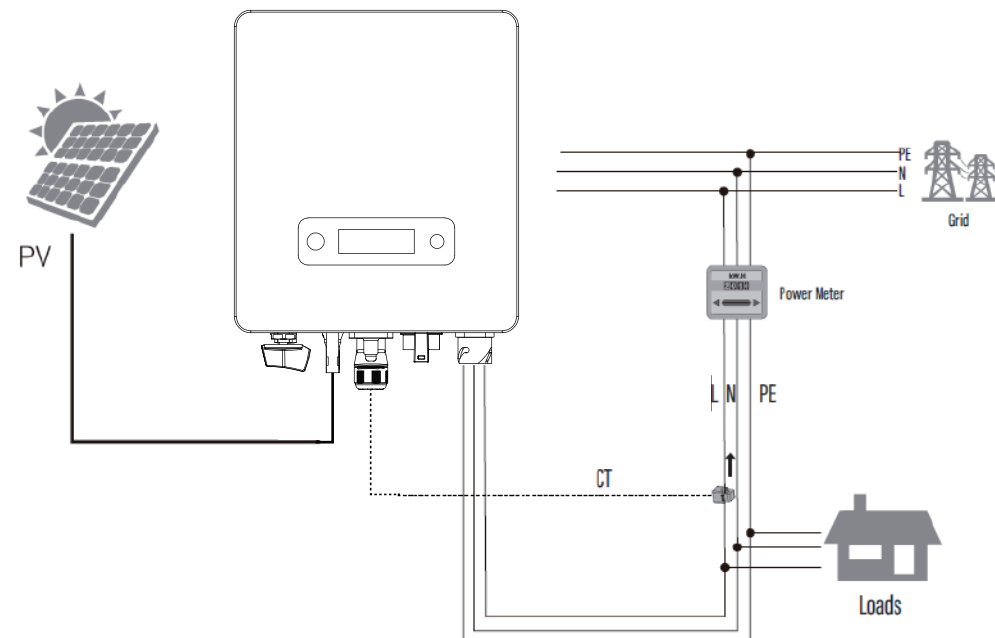


Figure 3-11

3.5.3.3 DRM connection

The inverter supports the demand response modes as specified in the standard AS/NZS 4777. The inverter has integrated a terminal for connecting to a DRED. The details please refer to figure 3-9, and for CEI standard, DRM S0 is the DI port .

3.5.3.4 Relay connection

The relay can be set to fault alarm output, and user can configure it to be a normal open contact (COM&NO) or a normal close contact (COM&NC).The relay is initially at the NC terminal, and it will trip to another contact when a fault occurs.

Use LED indicators or other equipment to indicate whether the inverter is in the faulty state. The following figures show the typical applications of normal open contact and normal close contact:

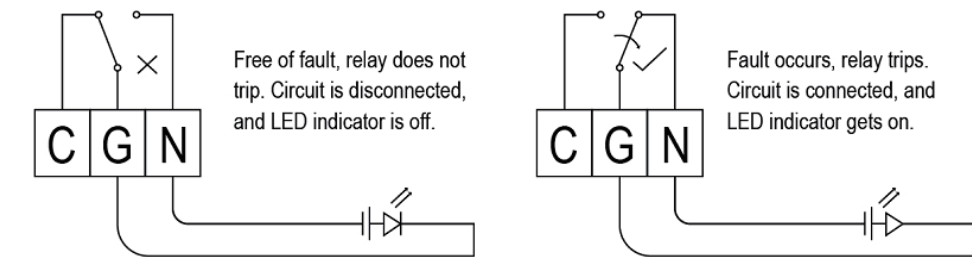


Figure 3-12 Normal open contact

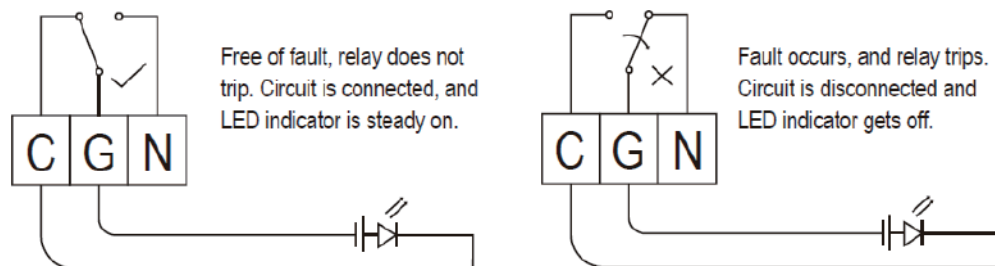


Figure 3-13 Normal close contact

3.6 Starting the inverter

Before turning on the inverter, please confirm:

- 1) Three AC wires (PE/L/N) cable correctly connected to the inverter AC side through AC circuit breaker;
- 2) The DC cable connected correctly to the inverter DC side through DC circuit breaker, please be attention to the cable connected to the two string correctly and it's polarity;
- 3) The unused terminals are covered.

Starting the inverter:

- 1) Close the DC and AC circuit breaker;
- 2) If the solar panels provide enough energy, the power module will work and the LCD panel will be lit;
- 3) In case you are starting the inverter for the first time, the inverter needs to be commissioned. Commissioning is described on page 17, chapter 4.3.
- 4) Then the inverter will turn into self-check mode and the LCD panel will display the remaining time of connect simultaneously.
- 5) After the inverter turn into normal mode, it feeds electrical energy into grid, and LCD panel will display the generated electrical energy.

As long as the inverter works, it will automatically track the maximum power point to absorb the maximum energy from solar. When night comes, the irradiance is not strong enough to provide energy, the inverter will power off automatically. When the next day comes, the input voltage reaches the start value, it will start again automatically.

4. User interface

4.1 Led and key

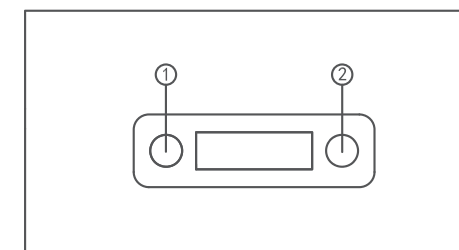
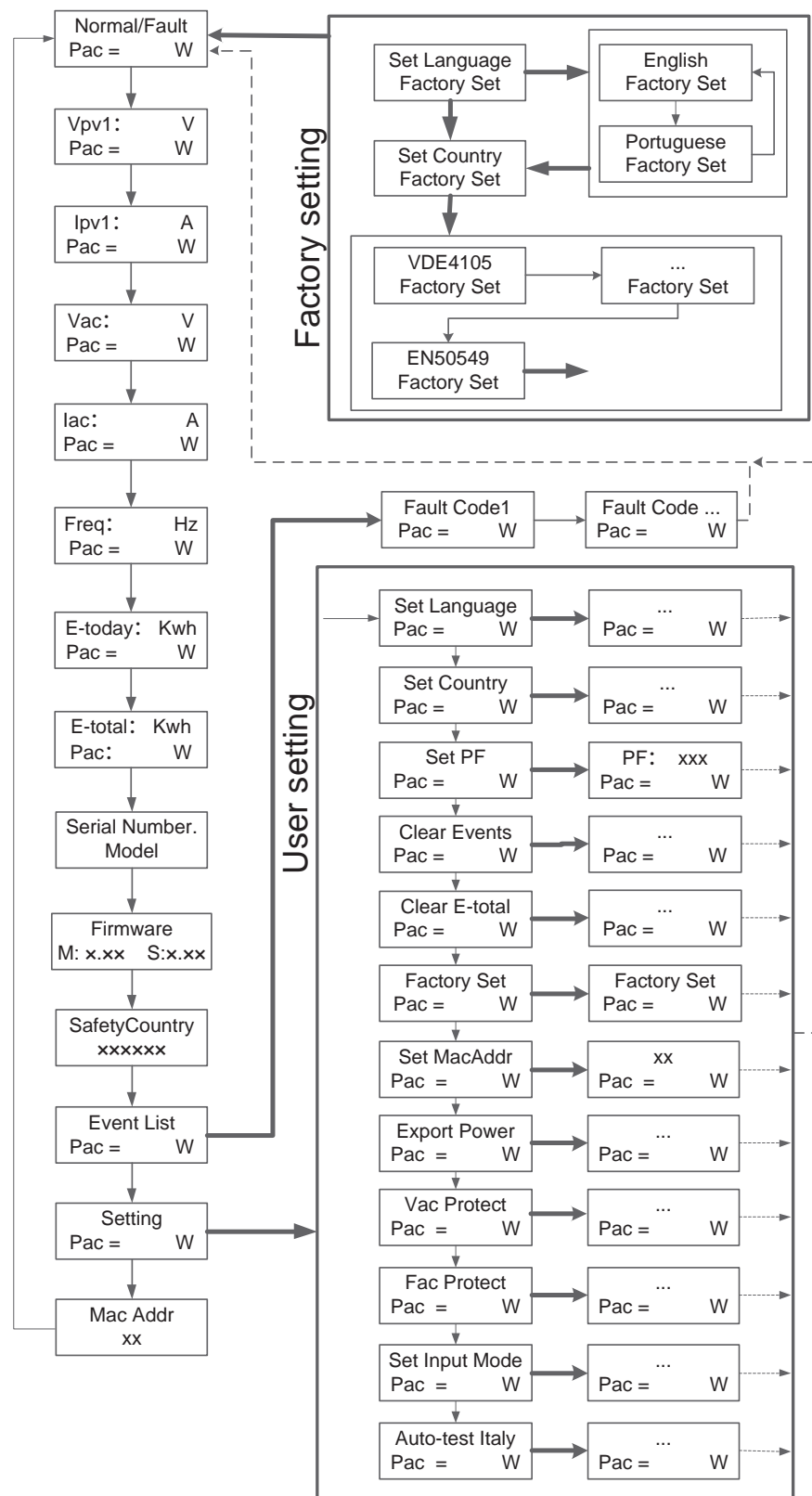


Figure 4-1 LED display

No.	Object	Description
1	Run (Green LED)	On = Normal operation
		Flashing = Waiting, checking or starting up
1	Fault (Red LED)	On = Failure
		Flashing = Temporary failure
2	Pushbutton	Pressing < 1 s: Next
		Pressing > 2 s: Enter

4.2 LCD display

Menu structure:



→ Press the button less than 1 second

→ Long Press the button

-----> Return

4.3 Factory setting

- 1) Press pushbutton long in order to enter the "Factory setting" menu.
- 2) Press pushbutton long to enter the "language setting" menu.
- 3) Press pushbutton less than 1 sec. to the langue menu you want and Press pushbutton long to select.
- 4) Press pushbutton less than 1 sec. to the country menu you want and Press pushbutton long to select.

4.4 Setting language

- 1) Press pushbutton less than 1 sec. several times until you reach the "Setting" menu.
- 2) Press pushbutton long in order to enter the "setting" menu.
- 3) Press pushbutton less than 1 sec. several times until you reach the "language setting" menu.
- 4) Press pushbutton less than 1 sec. to the langue menu you want and Press pushbutton long to select.

4.5 Setting modbus address

- 1) Press pushbutton less than 1 sec. several times until you reach the "Setting" menu.
- 2) Press pushbutton long in order to enter the "setting" menu.
- 3) Press pushbutton less than 1 sec. several times until you reach the "module add" menu.
- 4) Press pushbutton less than 1 sec. to the modbus address number you want and Press pushbutton long to set.

4.6 Setting export power (CT)

- 1) Press pushbutton less than 1 sec. several times until you reach the "Setting" menu.
- 2) Press pushbutton long in order to enter the "setting" menu.
- 3) Press pushbutton less than 1 sec. several times until you reach the "Export power" menu.
- 4) Press pushbutton long to enter onto "Export power".
- 5) Set "Export power" as "1", press pushbutton long to save the value.

4.7 Self-Test in accordance with CEI 0-21 (Applies to Italy only)

The self-test is only required for inverters, which are commissioned in Italy. The Italian standard requires that all inverters feeding into the utility grid are equipped with a self-test function in accordance with CEI 0-21. During the self-test, the inverter will consecutively check the protection reaction times and values for overvoltage, under voltage, over frequency and underfrequency.

Self-test function is available at any time. It also allows end user get test reports shown on LCD display.

There are two ways to execute the self-test:

Auto-Test from screen:

- 1) Press pushbutton less than 1 sec. several times until you reach the "Setting" menu.

- 2) Press pushbutton long in order to enter the "setting" menu.
- 3) Press pushbutton less than 1 sec. several times until you reach the "AutoTest - Italy" menu (You need to set the inverter country to CEI 0-21 before testing).

SafetyCountry CEI 0-21	Auto Test-Italy Pac = 3000W
----------------------------------	---------------------------------------

- 4) Press pushbutton long to execute the auto -test.
- 5) The inverter will automatically run the test until the screen shows "Test end", if the test passes, it will show "test ok", if the test is failed, it will show "test failed".

59.S1Testing 253.0V/243.9V	59.S1 Test ok 223.3V/1993ms
59.S2Testing 264.5V/232.6V	59.S2 Test ok 223.8V/187ms
27.S1Testing 195.5V/213.0V	27.S1 Test ok 223.5V/1485ms
27.S2Testing 34.5V/38.8V	27.S2 Test ok 230.2V/186ms
81 > .S1Testing 50.20Hz/49.88Hz	81 > .S1 Test ok 49.98Hz/95ms
81 < .S1Testing 49.80Hz/49.88Hz	81 < .S1 Test ok 50.03Hz/88ms
81 > .S2Testing 51.50Hz/51.39Hz	81 > .S2 Test ok 50.04Hz/93ms
81 < .S2Testing 47.50Hz/48.01Hz	81 < .S2 Test ok 50.01Hz/91ms

Auto-Test from Solar Admin:

- 1) Download and install "Solar Admin" on laptop.
- 2) Connect inverter to laptop via RS485 port.
- 3) When the inverter and "solar admin" are successfully connected. Click "Sys.setting" - "Other" "AUTOTEST" enter into "Auto - Test" interface.
- 4) Click "Execute" to start the test.
- 5) The inverter will automatically run the test until the screen shows "Test end".
- 6) Click "Read" to read the test value, and click "Export" to export the test report.
- 7) After click "Read" button, interface will show the test results, if the test passes, it will show "PASS", if the test is failed, it will show "FAIL".

5. Warranty

The standard warranty period for the inverter is 60 months from the date of installation and no more than 66 months (5.5 years) from the date of shipment from factory.

5.1 Warranty claim procedure

Please report defective device with a brief error description and SN code to our service mail or service hotline for registration.

Alternatively, please contact your specific dealer or installer if your unit is defective or faulty.

To claim the warranty under the warranty terms of factory, you need to supply us with the following information and documentation regarding the faulty unit:

- 1) Product Model No (e.g. R1-3K3-SS) and the serial Number (e.g. 8003321190511006).
- 2) Copy of the invoice and warranty certificate for the inverter.
- 3) Error message on LCD screen and additional information regarding the fault/error.
- 4) Detailed information about the entire system (modules, circuits, etc.).
- 5) Documentation of previous claim/exchanges (if applicable).

In the case of an exchange, the remainder of the warranty entitlement will be transferred to the replacement device. In this event, you will not receive a new certificate, as this replacement will be noted by factory.

5.2 Service after warranty expiration

For products which are out of warranty, factory charges an on-site service fee, parts, labor cost and logistic fee to end-user which can be any/all of:

- 1) On-site attendance fee: Cost of travel and time for the technician in attending on-site;

- 2) Parts: Cost of replacement parts (including any shipping/admin fee that may apply);
- 3) Labor: Labor time fee charged for the technician, who is repairing, maintaining, and installing (hardware or software) and debugging the faulty product;
- 4) Logistic fee: Cost of delivery, tariff and other derived expense when defective products are sent from user to factory or/and repaired products are sent from factory to user.

Appendix A: FAQ (Frequently asked questions)

Sometimes, the PV system does not work normally; we recommend the following solutions for average troubleshooting. This can help the technician to understand the problem and take a proper action.

Fault	LCD display	Possible actions
Clearable Fault	Isolation Fault1	<ol style="list-style-type: none"> 1. Check whether the inverter is earthed and test impedance between PV (+) & (-) and the impedance must exceed 3MΩ; 2. Check whether the AC-side has contacts with earth.
	Grid Faults: 10min OVR Fault OVR Fault UVR Fault OFR Fault UFR	<ol style="list-style-type: none"> 1. Wait for 5 minutes, if the grid returns to normal, PV inverter automatically restarts. 2. Make sure grid voltage and frequency meet the local specifications.
	No utility	<ol style="list-style-type: none"> 1. Grid is not connected. 2. Check grid connection cables. 3. Check grid usability. 4. If grid is ok and the problem exists still, maybe the fuse in the inverter is open, please call service.
	Low Temp Over Temp	<ol style="list-style-type: none"> 1. The internal temperature of inverter is higher or lower than specified normal value. 2. Find a way to reduce or increase the ambient temperature. 3. if the problem remains, please call local service.
	PV10VFault	<ol style="list-style-type: none"> 1. Check the open PV DC voltage, and see if it is greater than or too close to 550VDC 2. If PV DC voltage is less than 550VDC, and the problem still occurs, please call local service.
Permanent Fault	Consistent Faults: Consist VGrid Consist Freq Consist GFCI Consist DCI	<ol style="list-style-type: none"> 1. Disconnect all PV (+) or PV (-) from solar panels 2. Wait for a few seconds. 3. After the LCD switches off, reconnect and check again. 4. If the problem remains, please call local service.
	RelayFail	
	EEPROM R/W Fail	
	Sci Comm lose	
	Spi Comm lose	
	BushFault	
	GFCIDeviceFault	
	IGridDevice	
	PLLFault	
	AutoTestFail	
	PV Config fault	
	Fan error	
	DCI out range	
	OCPV1	
	OCIGrid	

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