

# RADIUS String inverters

RADIUS



.... Installation & operation manual

Models : iUNO-INV(1)-XKX-1M-BTXXXXXX



Rishabh Manufacturing Unit  
Rishabh Instruments Ltd.  
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NASHIK, NASIK, MAHARASHTRA, India - 422007

## Information about this manual

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Please read the safety instructions carefully before using the product. Keep the manual in a safe place and make sure it is available to engineering and installation personnel throughout the product's service life.

Rishabh Instruments Ltd has the right to modify products, data and dimensions without notice.

The data can only be used for the product description and they can not be understood as legally stated properties.

Thank you for choosing this Radius product.

Please send any information that could help us improve this manual to the following address:

[inverters@rishabh.co.in](mailto:inverters@rishabh.co.in)

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1.	How to use this manual .....	<b>5</b>
1.1	Validity .....	5
1.2	Target Group .....	5
1.3	SW version .....	5
1.4	Documentation and declaration of conformity .....	5
2.	Safety Precautions .....	<b>6</b>
2.1	Symbols used in the manual .....	6
2.2	Symbols used on outside labels .....	6
2.3	General warnings and safety information .....	7
2.4	Intended or permitted purpose .....	8
2.5	Improper or prohibited use .....	8
3.	Description of the RADIUS iUNO inverter .....	<b>9</b>
3.1	Introduction .....	9
3.2	Appearance/Overview .....	9
3.3	Block diagram of Inverter .....	10
3.4	Device identification .....	11
3.4.1	Data plate .....	11
3.4.2	Model identification(Type) .....	11
4.	Transportation – Handling - Storage .....	<b>12</b>
4.1	Handling packed equipment .....	12
4.2	Packaging and unpacking .....	12
4.3	Storage .....	13
4.4	Disposal of the device .....	13
5.	Installation .....	<b>14</b>
5.1	Safety instructions .....	14
5.2	Selecting the Installation site .....	14
5.3	Mounting .....	15
5.3.1	Mounting the device on a wall .....	15
5.3.2	Mounting the inverter on the bracket .....	16
5.3.3	System Diagram with Inverter and Electrical connection .....	17
6.	Electrical Connection .....	<b>18</b>
6.1	Safety .....	18
6.2	Connecting to the grid (utility grid) and ground cable (PE) .....	18
6.3	Connecting to the PV panel (DC input) .....	21
6.4	DC side fuses .....	22
6.4.1	DC side fuses .....	22
6.4.2	String current monitoring .....	23
6.5	AC side fuses .....	23
6.6	Choice of leakage breaker on AC side .....	24
6.7	DC circuit breaker .....	24
6.8	Other connections .....	25
6.8.1	Signal Connector .....	25
6.8.2	WiFi Dongle function use .....	26
6.8.3	RS-485 functions use .....	27
7.	Display & Bluetooth App interface .....	<b>28</b>
7.1	Advanced Display .....	28
7.2	Android Application .....	29
7.3	Commissioning .....	34
7.4	App screens: operating statuses, stand by .....	37
7.4.1	Operating Statuses .....	37
7.4.2	Standby .....	37
8.	Description of parameters .....	<b>38</b>
8.1	Parameters description .....	38
8.1.1	Legend .....	38
9.	Communication .....	<b>54</b>
9.1	RS485 serial connection with MODBUS RTU protocol .....	54

10.	Troubleshooting .....	<b>55</b>
10.1	Error messages classification .....	55
10.2	Alarms and Warnings list .....	55
11.	Specifications .....	<b>58</b>
11.1	iUNO-INV(1)-XKX-1M-BTXXXXXX models .....	58
11.1.1	Efficiency curves .....	60
12.	Dimensions and weight .....	<b>61</b>
13.	Maintenance and cleaning .....	<b>62</b>
13.1	Product label .....	62
13.2	Cleaning operations .....	63
13.3	Routine maintenance procedures .....	63
14.	Warranty conditions .....	<b>64</b>
15.	Contact .....	<b>65</b>



## 1. How to use this manual

### 1.1 Validity

This manual describes the assembly, installation, commissioning and maintenance of the following RADIUS Industrial Inverters :

iUNO-INV(1)-0K85-1M-BTXXXXXX	iUNO-INV(1)-1K0-1M-BTXXXXXX	iUNO-INV(1)-1K5-1M-BTXXXXXX
iUNO-INV(1)-2K0-1M-BTXXXXXX	iUNO-INV(1)-2K5-1M-BTXXXXXX	iUNO-INV(1)-3K0-1M-BTXXXXXX
iUNO-INV(1)-3K3-1M-BTXXXXXX	iUNO-INV(1)-3K6-1M-BTXXXXXX	iUNO-INV(1)-3K8-1M-BTXXXXXX
iUNO-INV(1)-4K0-1M-BTXXXXXX	iUNO-INV(1)-4K2-1M-BTXXXXXX	iUNO-INV(1)-4K4-1M-BTXXXXXX
iUNO-INV(1)-4K6-1M-BTXXXXXX	iUNO-INV(1)-4K8-1M-BTXXXXXX	iUNO-INV(1)-5K0-1M-BTXXXXXX

### 1.2 Target Group

Qualified personnel means people who have received training and have proven skills and knowledge of the skills construction and operation of this device.

Qualified personnel are trained to deal with the danger and hazards involved in installing electric devices.

#### Additional information

Further information on specific topics contact.

### 1.3 Firmware version

This manual applies to FW version V1.0X.0X.0X

The sw uses FreeRTOS™ ([www.freertos.org](http://www.freertos.org)).

### 1.4 Documentation and declaration of conformity

This technical documentation describes the procedures that must be followed in order to ensure safety during the transportation, installation, use and maintenance of the electrical equipment to which the manual refers. Store this manual so that it can be referred to whenever necessary.

Manufacturer declares that the equipment is designed to conform the current law in the country of installation & that the declaration of conformity can be consulted or requested from Radius - solar service personnel.

Inverter is designed to conform the below mentioned applicable standards :

Grid code	EN 50549-PL	VDE 0126 2006	SAGC Cat B
	EN 50549-1/2019	VDE 0126 A1/2012	SAGC Cat C
	EN 50438/2014	RD 661/2007	NRS 097-2-1
	India	IEC 61727/2004	UTEC C15-712
	India-Kerala	CEI 016	UK G83
	CEI 021	SAGC Cat A1-A2	UK G59/3 LV sys
	VDE 4105	SAGC Cat A3	UK G59/3 HV sys
Photovoltaic (PV) systems. Characteristics of the utility interface.	IEC 61727: 2004		
Electromagnetic Compatibility (EMC)	EN 61000-6-2/-3		
Procedure for measuring efficiency.	IEC 61683		
Environmental testing	IEC 60068-2-1, 60068-2-2, 60068-2-14, 60068-2-30		
Anti islanding	IEC 62116: 2008		
Safety of power converters for use in photovoltaic power systems	IEC 62109-1, 62109-2		

#### Note!

Available certifications can be availed at Radius Solar Worldwide.

In case of any problem, you can email us at: [inverters@rishabh.co.in](mailto:inverters@rishabh.co.in)

## 2. Safety Precautions

### 2.1 Symbols used in the manual



Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.



Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.



Indicates that the presence of electrostatic discharge could damage the appliance. When handling the boards, always wear a grounded bracelet.



Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.



Indicates an essential or important procedure, condition, or statement.

### 2.2 Symbols used on outside labels

	Indicates that you must read the manual before doing any work.
	Indicates absence of the isolation transformer.
	Indicates risk of electrocution due to high voltage. All work on the inverter must be done ONLY by trained technicians.
Warning Multiple power supply	Indicates risk of electric shock. Machine equipped with multiple power supply(DC and AC). Before doing any work, check that both the DC and the AC power supply have been disconnected.
Warning Hot surface	Indicates risk of burning due to very hot surfaces. Before doing anywork, let the unit cool sufficiently ; wear personal protective equipment (for example, gloves).
10 minutes	Indicates risk of electric shock. Before doing any work, allow all stored energy to drain for at least 10 minutes.

## 2.3 General warnings and safety information

Please read these instructions carefully in order to ensure your personal safety and that of others and to prolong the service life of this product and of the plant connected to it.



Operators must be instructed or skilled persons. They must have read and fully understood the operating instructions contained in this manual and those relating to the machine before having access to equipment controls. Persons who are not skilled or instructed must not be allowed to use the equipment.

The term “specially trained and competent” operator refers to the person responsible for installing and transporting the electrical equipment.

According to standard CEI EN 60204-1:

A skilled person: is a person with technical knowledge or sufficient experience to be able to avoid the dangers which electricity may create.

An instructed person: is a person adequately advised or supervised by skilled persons to be able to avoid the dangers which electricity may create (e.g. maintenance operators).

### Safety Instructions



All maintenance operations carried out on live equipment can involve serious risks. These operations must be carried out by skilled persons who are fully aware of the risks and provided with all the appropriate personal protective equipment and suitable tools.

To remove all dangerous voltage from inside the panel, disconnect all the external power connections (AC side, DC side and auxiliary voltage) and make sure these cannot be reconnected inadvertently (put up a work in progress sign).

Energy stored in the equipment's DC link capacitors can be an electric shock hazard. Even after the unit is disconnected from the grid and photovoltaic panels, there may still be high voltages in the inverter. Do not remove the casing (terminal side) until at least 10 minutes after disconnecting all power sources.

Follow all the safety instructions in this manual.

Make sure all power supplies have been disconnected before touching any parts.

Do not modify circuits or software programs or make adjustments without the manufacturer's prior consent. Any such modifications could pose a risk for persons or equipment.

Failure to comply with the manufacturer's instructions when using the inverter could undermine safety.

The installer is responsible for choosing the most appropriate residual current-operated circuit breaker according to the characteristics of the PV plant.



### Danger of burn injuries due to hot enclosure parts!

- Some parts of the equipment may become very hot during operation. DO NOT touch the heat sink while the inverter is working.

### Grounding the PV generator

- Comply with local requirements for grounding the PV modules and the PV generator.
- We recommend connecting the generator frame and other electrically conductive surfaces in a manner which ensures continuous conduction and grounding these in order to achieve maximum protection of the system and personnel.

## 2.4 Intended or permitted purpose

This device is a single-line string inverter designed to:

convert direct current(DC) from a PVgenerator into alternating current(AC) suitable for connection to a Single phase public grid.

Limits of use:

- The inverter can be used only with PV modules that do not require grounding of one of the poles.
- For PV modules that require grounding of one of the poles,use the dedicated version of the product (-P/-N depending on the grounded pole) and an external transformer (as described in the specific addendum).
- Only a PV generator can be connected to the inverter in input (DONOT connect batteries or other power sources).
- The inverter can be connected to the grid only in qualified countries.
- The inverter can be used only by respecting all of the technical characteristics.

Use the equipment ONLY for its INTENDED OR PERMITTED PURPOSE. If you need any explanations, please contact Radius Solar Service.

## 2.5 Improper or prohibited use

NEVER:

- Install the equipment in potentially flammable/explosive environments or in environments with adverse or prohibited conditions (temperature and humidity).
- Use the equipment with defective or disabled safety devices.
- Use the equipment or parts of the equipment by connecting it to other machines or devices (unless specifically permitted).
- Modify work parameters not accessible to the operator and/or any parts of the equipment to change its performance or insulations.

### 3. Description/Overview of the RADIUS inverter

#### 3.1 Introduction

The Radius model inverter is a multi string inverter designed to convert direct current (DC) from a PV generator into alternating current( AC) suitable for connection to a Single phase public grid.

At the application level, the range of string inverters consists of main product line:

##### - iUNO models

This is very extensive and flexible, intended mainly for photovoltaic roof arrays with complex tracking and irradiation features. For more information and advice on the ideal configuration for your PV plant, please contact manufacturer's pre sales service.

The main product line offers the following power levels:

Rated Active Power	Models
850 W	iUNO-INV(1)-0K85-1M-BTXXXXXX
1.0 kW	iUNO-INV(1)-1K0-1M-BTXXXXXX
1.5 kW	iUNO-INV(1)-1K5-1M-BTXXXXXX
2.0 kW	iUNO-INV(1)-2K0-1M-BTXXXXXX
2.5 kW	iUNO-INV(1)-2K5-1M-BTXXXXXX
3.0 kW	iUNO-INV(1)-3K0-1M-BTXXXXXX
3.3 kW	iUNO-INV(1)-3K3-1M-BTXXXXXX
3.6 kW	iUNO-INV(1)-3K6-1M-BTXXXXXX
3.8 kW	iUNO-INV(1)-3K8-1M-BTXXXXXX
4.0 kW	iUNO-INV(1)-4K0-1M-BTXXXXXX
4.2 kW	iUNO-INV(1)-4K2-1M-BTXXXXXX
4.4 kW	iUNO-INV(1)-4K4-1M-BTXXXXXX
4.6 kW	iUNO-INV(1)-4K6-1M-BTXXXXXX
4.8 kW	iUNO-INV(1)-4K8-1M-BTXXXXXX
5.0 kW	iUNO-INV(1)-5K0-1M-BTXXXXXX

The iUNO series of RADIUS inverter can have either 1 or 2MPPTs. Please connect to Radius Solar Sales team to understand the use cases of 1MPPT and 2MPPT models.

#### 3.2 Appearance Overview

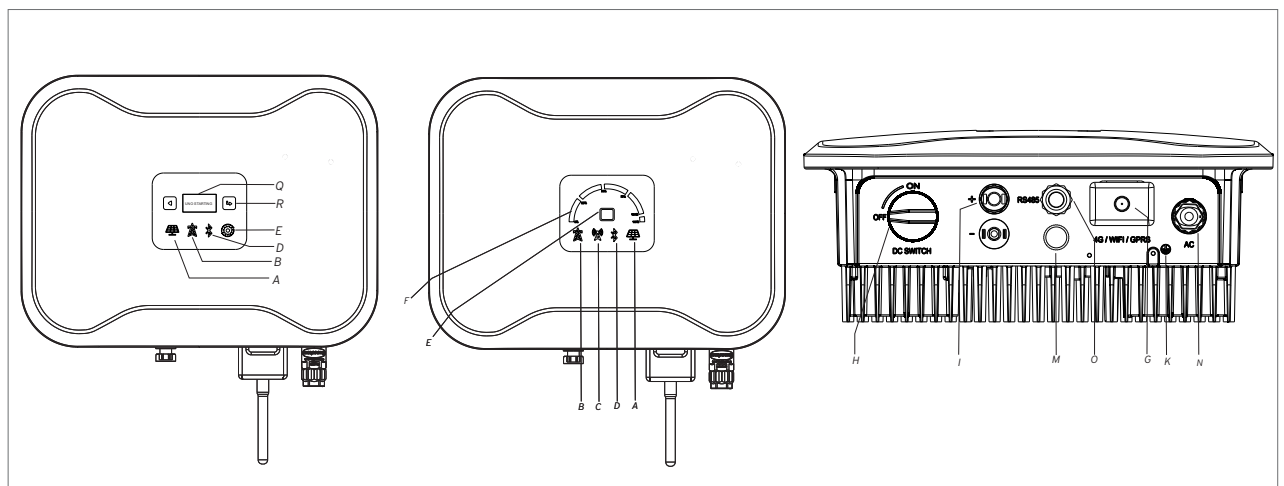


Figure 1 :Overview - UNO

The details of the appearance overview is as follows:

Designator	Description
A	PV status: Green: Indicates PV voltage is healthy
B	Grid Status: Green: Indicates Grid voltage is healthy
C	Remote Monitoring Status: Green: Indicates device is communicating
D	Bluetooth Connection Status: Green: Indicates bluetooth is connected

Designator	Description
E	Inverter status: Stable Green: Indicates Inverter is feeding power into the grid Flashing Yellow: Indicates Inverter is in a warning state Blue: Indicates Inverter is in a initializing state Red: Indicates Inverter is in an Alarm state
F	Bar graph: Filled Green: Indicates the power level being fed in to the grid
G	WiFi/GPRS/4G Connection port
H	DC Switch
I	DC Connection port for MPPT1
K	PE Terminal - Housing/ M4 Stud
M	Protective Vent
N	3 Pole (L,N,E) Circular AC connection Port
O	Communication(RS485)/Sensor port
Q	OLED Display
R	Touch Key

### 3.3 Block diagram of the inverter

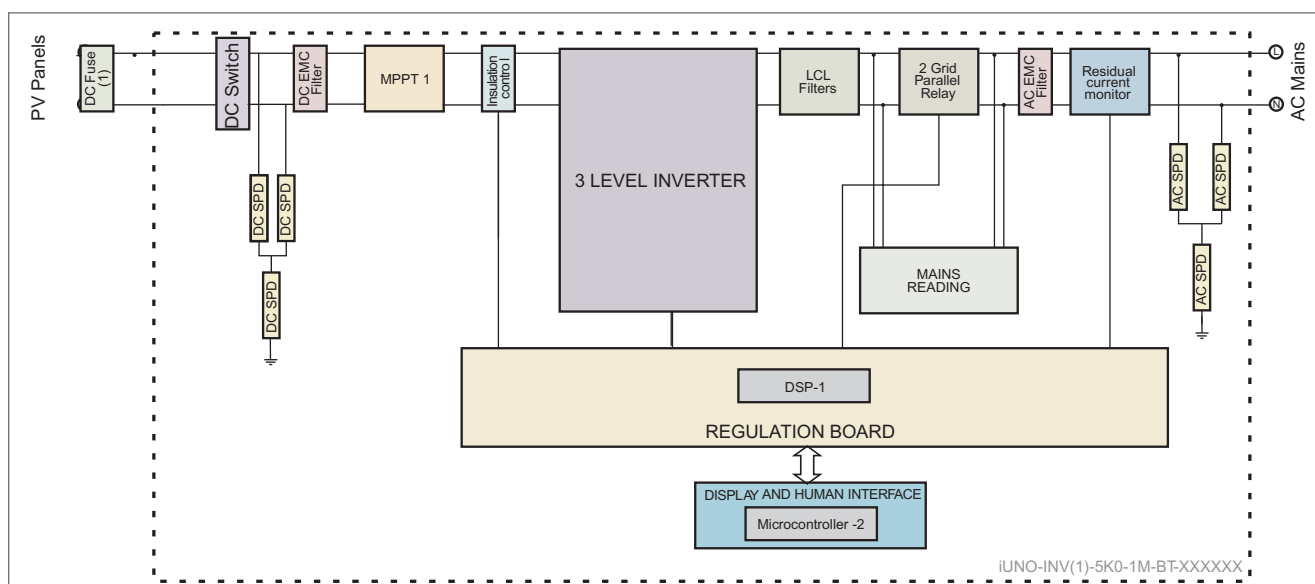


Figure 2 : Block diagrams - iUNO models


**Note!**

The unit is equipped with an circuit breaker conforming to the safety requirements specified in VDE0126-1-1.  
The block diagram are shown for 5.0kW model. See section 11 for the number of strings for each MPPT channel and the number of MPPT for each model.

### 3.4 Device identification

#### 3.4.1 Data plate

The data plate with details of the specific model is attached to the left side of the inverter.

 <b>Rishabh Instruments Pvt. Ltd.</b> F31 MIDC, SATPUR, NEAR CEAT TYRES, SATPUR, NASHIK, NASIK, MAHARASHTRA, India - 422007 Ph: +91 2532202019 Email: inverters@rishabh.co.in	
Model Name	iUNO-INV(1)-5KO-1M-BT-XXXXXX
Version	01.03.01.00
U DC max	550V
I DC max	1*20.0A
Isc max	1*25A
U DC range	60-510V
V AC nom	1/N/PE 230V/400V
f AC nom	50/60Hz
P AC nom	5000W/5500VA
Power factor	0.8 cap. - 0.8 ind.
I AC nom	21.7Arms
I AC max	23.8Arms
Protection Degree	IP 66
Protection Class	1
Ambient Temperature	-25°C..... +60°C
BRAND NAME : Rishabh RADIUS PART NUMBER : UNO-05K0M1TBXXXXXX SERIAL NUMBER: RI-250600000X	
CE	

#### 3.4.2 Model identification (Type)

iUNO-INV(1)	-XXkX	-MX	BT	D	X	X	X	XX	
									iUNO-INV(1)-XXXX-1M-BT-XXXXXX
									Reserved XX = Reserved
									Reserved X = Reserved
									DC Switch X = Not Available
									Remote Monitoring system S = DC Switch G = GSM Dongle W = Wifi Dongle
									Display X = New Graphical Display X = OLED Display
									Bluetooth BT=Bluetooth included
									MPPT number 1 = 1 MPPT 2 = 2MPPT
									Inverter power in kW 0.85k = 850W 1.0k = 1.0 kW 1.5k = 1.5 kW 2.0k = 2.0 kW 2.5k = 2.5 kW 3.0k = 3.0 kW 3.3k = 3.3kW 3.6k = 3.6 kW 3.8k = 3.8 kW 4.0k = 4.0 kW 4.2k = 4.2 kW 4.4k = 4.4 kW 4.6k = 4.6 kW 4.8k = 4.8 kW 5.0k = 5.0 kW
									PV inverter, iUNO series

## 4. Transportation – Handling - Storage



All transportation, handling and storage operations must only be performed by specially trained and competent operators.

### 4.1 Handling packed equipment

The equipment can easily be transported using a lift truck, or fork crane with adequate load capacity, Dimensions and weights are specified in chapter "12.Dimensions and weight" .

Correct methods of transportation, storage, installation and assembly, as well as appropriate use and maintenance, are essential for ensuring the proper and safe operation of this equipment.

Protect the equipment against shocks and vibrations during transportation.

Make sure it is also protected against water(rain),humidity and extreme temperatures.

### 4.2 Packaging and unpacking

The packaging consists of a 7 Ply corrugated box . The inverter is protected from external impact by placing foam protectors around the inverter. Corrugated box dimensions for 0.8-5kW iUNO-1MPPT model are : 400X320X195mm

**Note !** These materials must be disposed of in accordance with local regulations.

As soon as the equipment is delivered check that:

- there is no visible damage to packaging,
- the details in the delivery note correspond to the order.
- after opening the package, please check the contents of the box. It should contain the following:

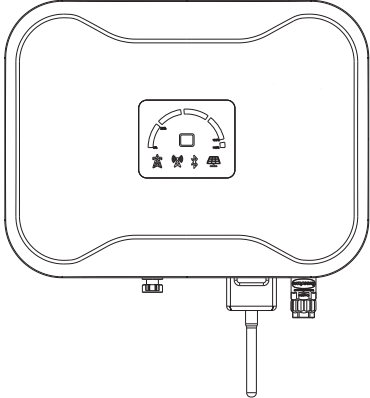
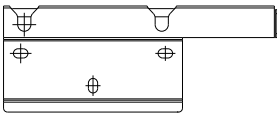
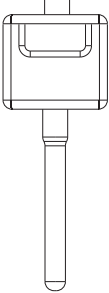

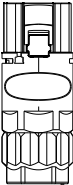
				 
REF.	Description			Q.ty
A	Radius Inverter			1
B	Mounting bracket			1
C	Wifi/GSM Dongle			1
D	Mc4 Connectors (Male & Female) - Cable End			1
E	AC 3Pole Connector - Cable End			1
F	Thumb screw for hanging the inverter on the bracket			2
G	Screws for Expansion Plug			3
H	Expansion Plug			3

Figure 3 : Packaging contents - 0.85- 5kW iUNO model



Open the packaging carefully and make sure that:

- no parts of the equipment have been damaged during transportation,
- the equipment is that actually ordered.

Please notify the local sales office if you notice any damage or if the equipment supplied is incomplete or not what was ordered.

Open the box and remove the accessories as well. Now proceed as described below.

Removal of the inverter from the box can be carried out as shown in the figure. Using hands on the given on right and left bracket and using bottom stand the inverter can be taken out of the box.

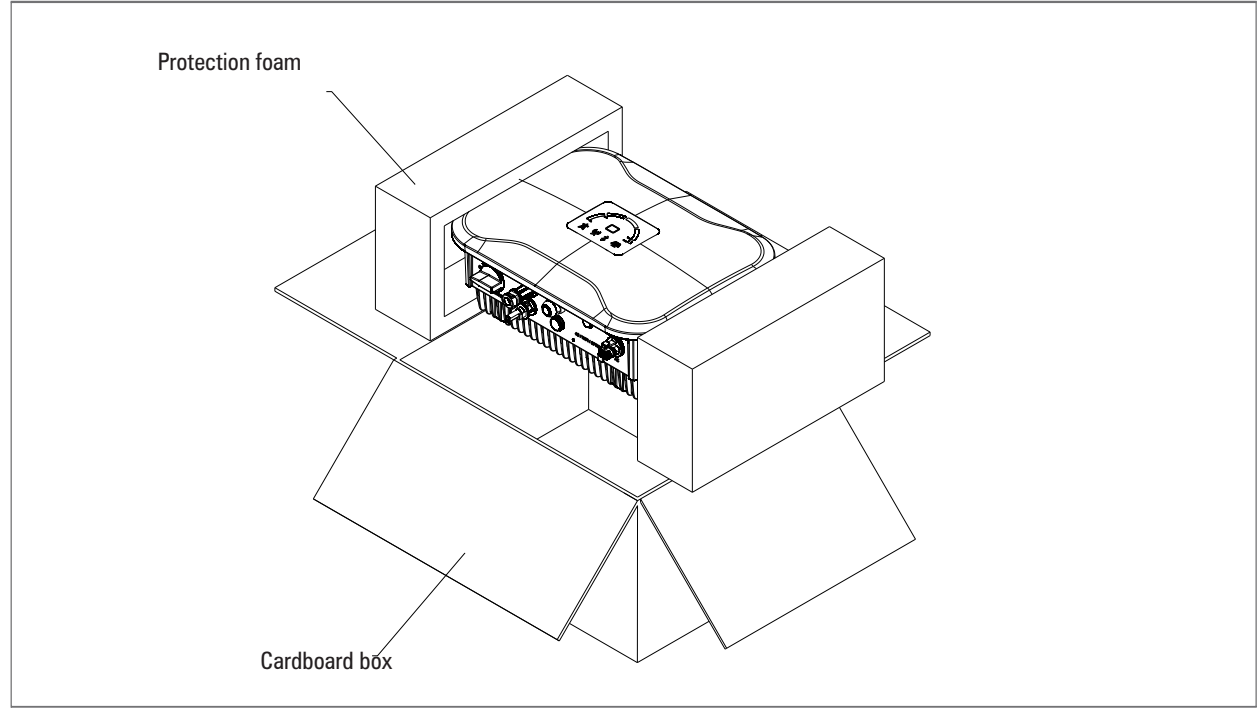


Figure 4 : Exploded view of Inverter Packing

4.3 Storage

This equipment must be stored in a dry place within the specified temperature range,see chapter “11. Specifications

<div><p>4</p></div>	<p>If the crate is stored correctly it can be stacked for a maximum of 12boxes. Do not stack other prod- -ucts materials on top of it.</p>
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Changes in temperature may lead to the formation of condensation inside the equipment. This is acceptable in certain conditions but not when the equipment is in use. Therefore it is always important to ensure that there is no condensa-  
-tion in the equipment before connecting it to the power supply!

4.4 Disposal of the device

This inverer can be disposed of as an electronics waste according to national regulation in force for the disposal of electronic components.

## 5. Installation

### 5.1 Safety instructions



- A) Do not remove the upper casing. The inverter contains no user-service able parts. All servicing must be performed by qualified service personnel. All wiring and electrical installation should be performed by qualified service personnel and must meet national requirements.
- B) Both AC and DC voltage sources are terminated inside the inverter. Please disconnect these circuits before servicing.
- C) When a photovoltaic panel is exposed to light, it generates a DC voltage. When connected to this equipment, a photovoltaic panel will charge the DC link capacitors.
- D) Energy stored in the equipment's DC link capacitors can be an electric shock hazard. Even after the unit is disconnected from the grid and photovoltaic panels, there may still be high voltages in the inverter. Do not remove the casing (terminal side) until at least 10 minutes after disconnecting all power sources.
- E) This unit is designed to feed power to the public power grid (utility) only. Do not connect this unit to an AC source or generator. Connecting the inverter to external devices could result in serious damage to your equipment.
- F) Although designed to meet all safety requirements, some parts and surfaces of the inverter are still hot during operation. To reduce the risk of injury, do not touch the heat sink at the back of the inverter or near by surfaces while the inverter is operating.

### 5.2 Selecting the Installation site



- Do not install the inverter on structures made of flammable or thermolabile materials.
- The mounting location and method must be suitable for the weight and dimensions of the inverter. Choose a wall or solid vertical surface that can support the inverter.
- DO NOT install the inverter in locations at risk of explosion or near easily inflammable materials.



- Never install the inverter in an environment with little or no air flow or in a dusty environment. This could under mine the efficiency of the inverter.
- Radius inverter are suitable for installations in outdoor and wet locations, however avoid installing the inverter in location under extreme wetness and avoid direct exposure to sunlight.
- Mount on a solid surface, the mounting location must be accessible at all times.
- Mount the inverter in a vertical position or with a maximum backward tilt of 15°. The connection area must point downwards. Never install the device with a sideways tilt. Do not install horizontally. (See figure below).

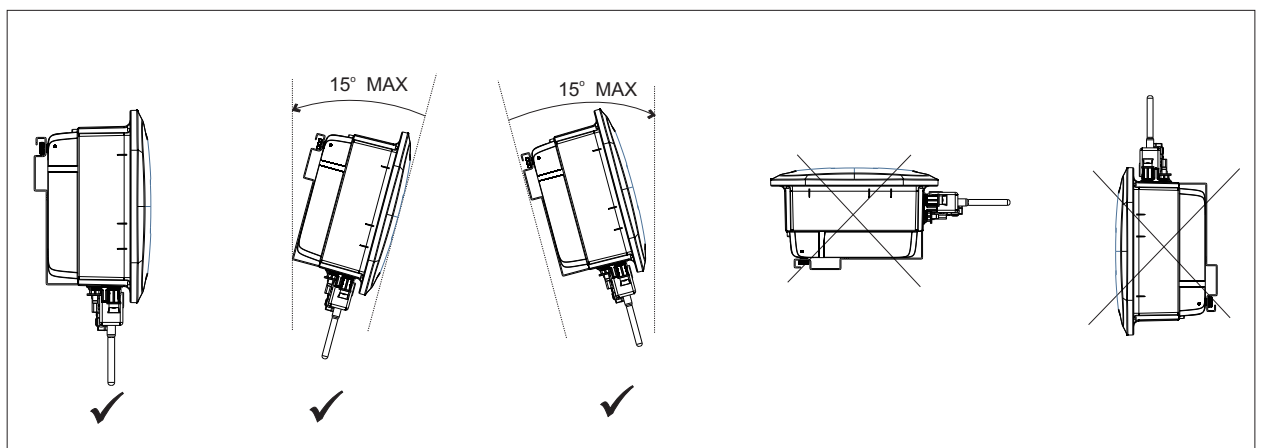


Figure 5 : Installation warning

- The ambient temperature should be -25 ..+50°C to ensure optimal operation. Refer to the temperature derating curves on pg. 54.
- Do not expose the inverter to direct sunlight to avoid any reduction in power due to excessive heating.
- Do not install the inverter in living areas, the noise caused by the machine could affect daily life.

- Be careful not to obstruct the slits or the equipment cooling systems.
- DO NOT place anything on the inverter while it is working.

### 5.3 Mounting

The inverters must be positioned so as to ensure free movement of ventilation air around them and facilitate wiring and maintenance operations.

- Maximum permissible inclination : 15° with respect to the vertical
- Minimum upper and lower distance : 400 mm and 620 mm
- Minimum distance between inverters : 500 mm

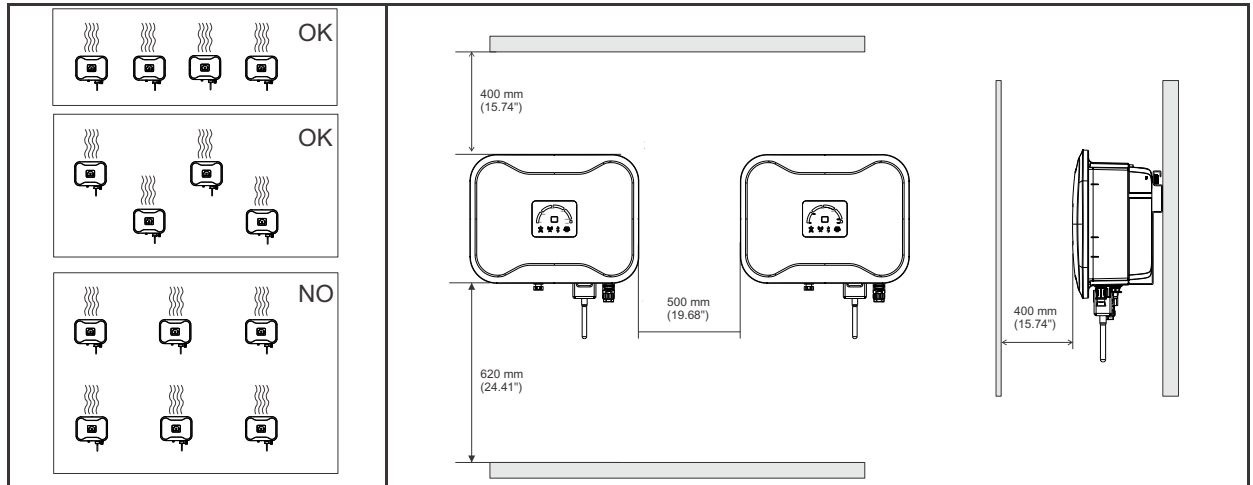


Figure 6 : Free movement of ventilation air and Minimum distances

#### 5.3.1 Mounting the device on a wall

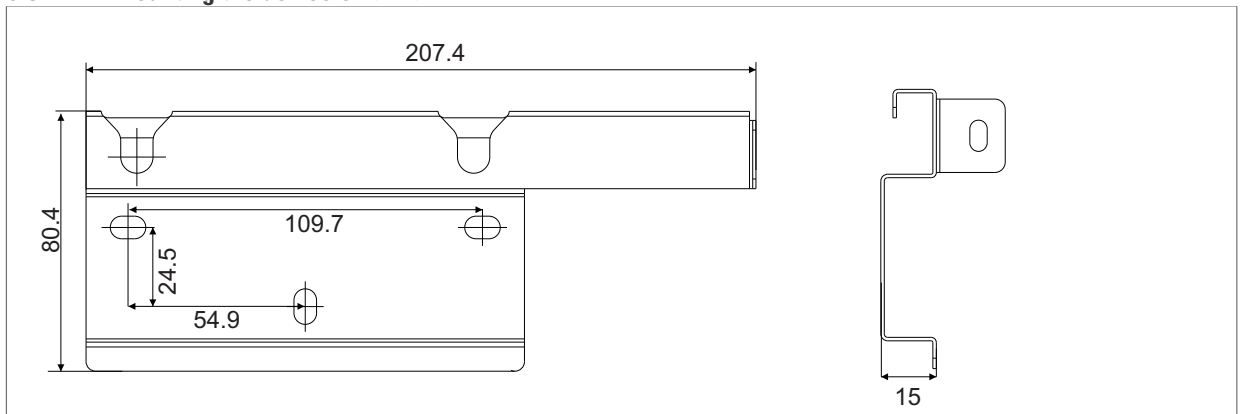


Figure 7 : Wall-mounting bracket dimensions - 0.85~5kW model

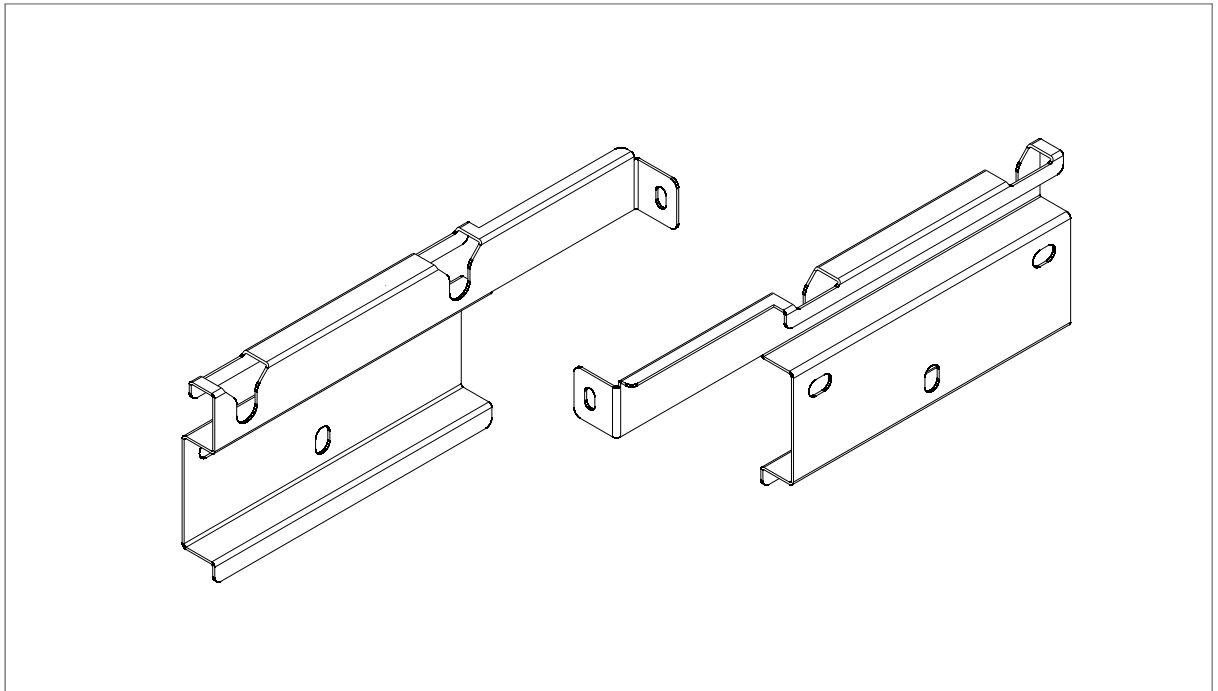


Figure 8 : Side View for Wall-mounting bracket (0.85-5kW) models

- (1) Use the mounting bracket as a template or use the cardboard template which is supplied with the inverter, ensure it is positioned horizontally. Drill 3 holes in the wall in correspondence with the holes on the bracket shown in the figure. Attach the bracket to the wall with 3, M5 screws (not supplied).



Caution

**The size of the holes depends on the wall material and the anchorage system used(e.g. expansion plugs).**

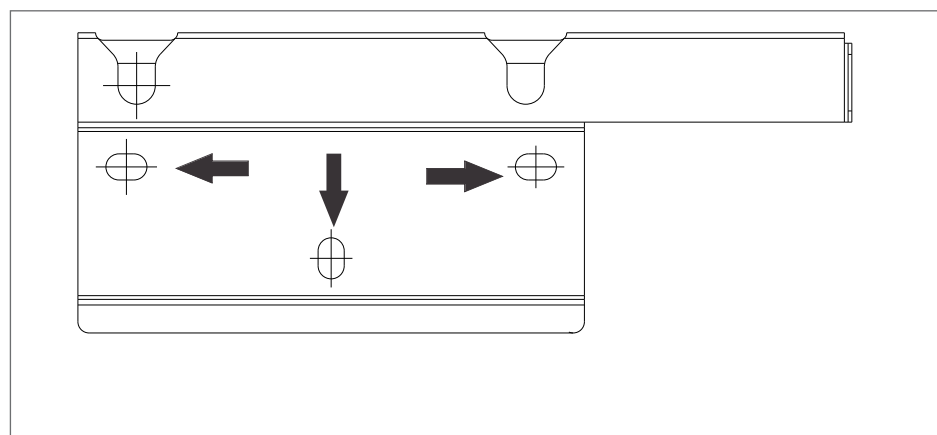


Figure 9 : Mounting bracket fixing

### 5.3.2 Mounting the inverter on the bracket

- (2) Lift the inverter and hang it on the mounting bracket at the top, then rest it on the wall.



Ensure that the installation of the inverter is stable by trying to lift it from the bottom. The inverter must remain securely in place.

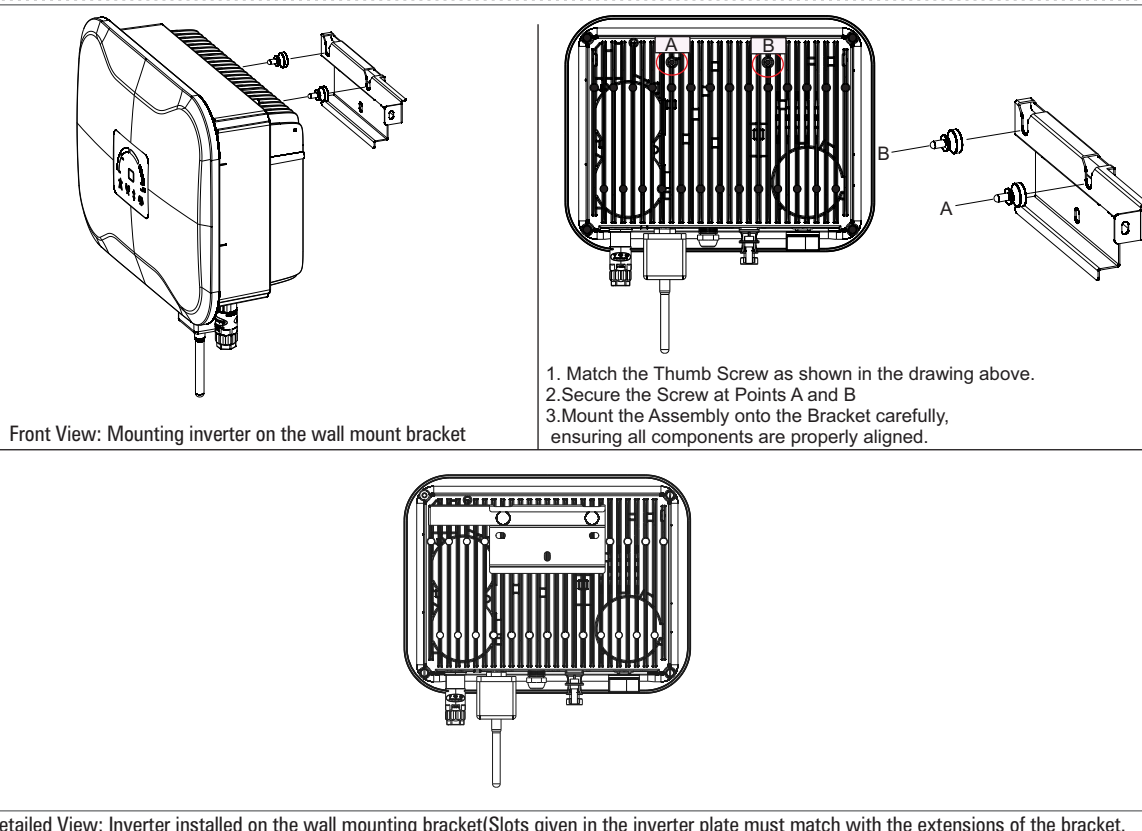


Figure 10 : Fixing the inverter on the bracket

### 5.3.3 System Diagram with Inverter and Electrical connection

- PV Panel: Supplies DC power to the inverter
- Inverter : Converts DC (Direct Current) power from the PV panel(s) to AC (Alternating Current) power. The inverter will always try to convert the maximum power from your PV panel(s).
- Utility : Referred to as the “grid” in this manual, this is the way your electricity company provides power to your place.

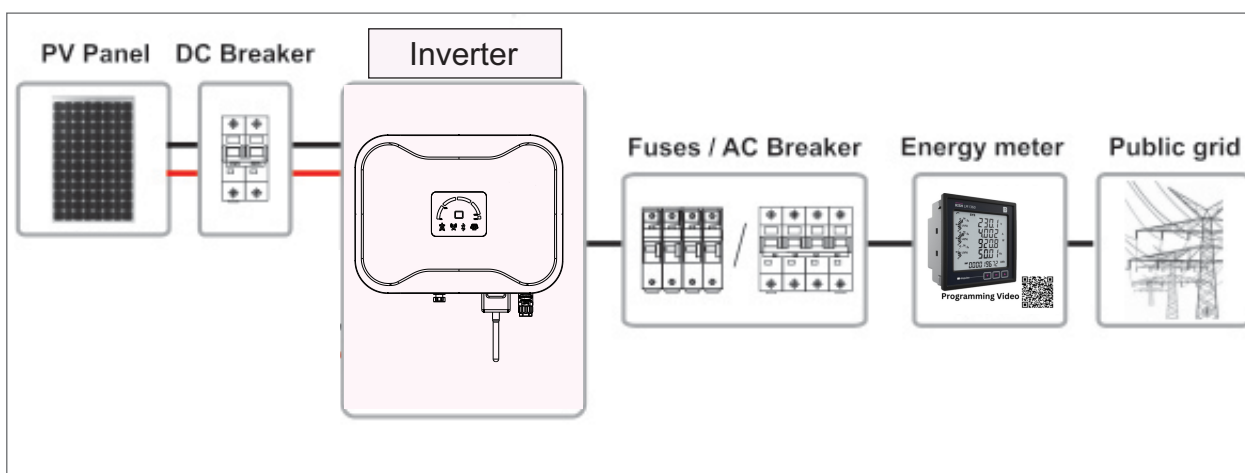


Figure 11 : Schematic diagram of the system

#### Note!

The system configuration depends on many factors (module type, production target, AC connection, installation site, current regulations, etc.) and must therefore be designed, built, and decided by a qualified technician.

## 6. Electrical Connection

### 6.1 Safety



Connect the ground connector to the terminal (PE) and Housing Earth terminal of the inverter.

The ground conductor must be the first to be connected

If replacing the inverter, the ground connector must be the last to be disconnected.

High voltages exist when the PV panel is exposed to the sun. To reduce the risk of electric shock, avoid touching live components and treat connection terminals carefully.

The DC cable must be disconnected before disconnecting the AC cable.

The inbuilt DC circuit breaker can operate under load.

Operation to be performed by specially trained personnel.

Risk of electric shock. If the PV field is illuminated, voltage is present on the DC side.

There is voltage on the input terminals even if the DC circuit breaker (see Figure 17 on page 25) is in position OFF.

### 6.2 Connecting to the grid (utility grid), ground cable (PE)

- Measure grid(utility) voltage and frequency (See “11. Specifications” on page 59).
- Open the circuit breaker and/or fuses between the inverter and the utility grid.
- Use insulated cables with minimum working temperature of 90°C.
- Follow color codes for wiring L1,L2, L3, N as per the local regulations, grounding cable should be yellow-green.
- The grounding cable should also be connected to the housing terminal. The size of the cable should be same as given below for PE cable.
- The set of 3 wires(L1, N, PE) to be connected to the inverter side connector should be passed through shield before passing it through the cable seal of the AC connector. Follow the AC connection steps as given in the following section.

Cable requirements for maximum length of 30 meters:

Model	Terminals	Recommended section		Maximum section		Cable OD
		(mm <sup>2</sup> )	AWG no.	(mm <sup>2</sup> )	N. AWG	
iUNO-INV(1)-0K85-1M....	L1-N-PE	2.5	14	4	12	16
iUNO-INV(1)-1K0-1M....	L1-N-PE	2.5	14	4	12	16
iUNO-INV(1)-1K5-1M....	L1-N-PE	2.5	14	4	12	16
iUNO-INV(1)-2K0-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-2K5-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-3K0-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-3K3-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-3K6-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-4K0-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-4K2-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-4K6-1M....	L1-N-PE	4	12	4	12	16
iUNO-INV(1)-5K0-1M....	L1-N-PE	4	12	4	12	16

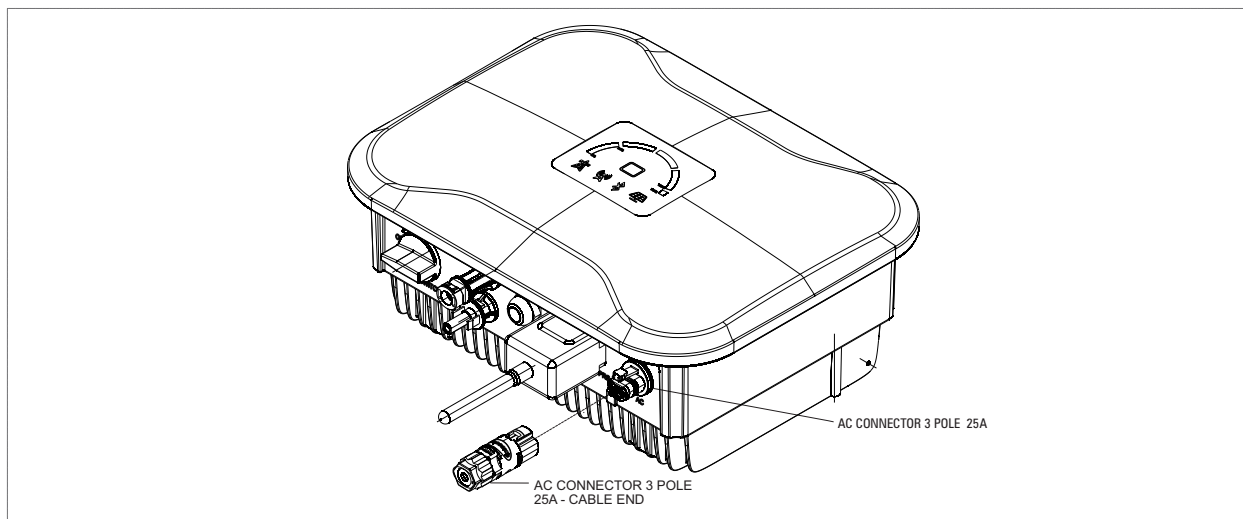
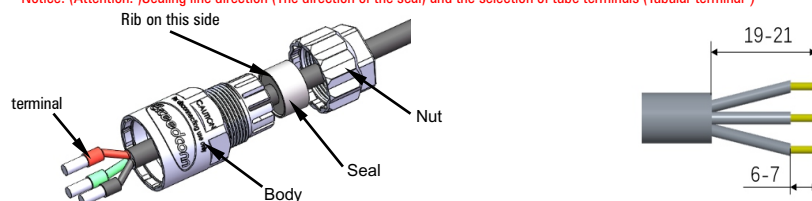


Figure 12 : AC connection ( 5kW model)

### Line-to-Line Connector Installation (installation of cable end connector)

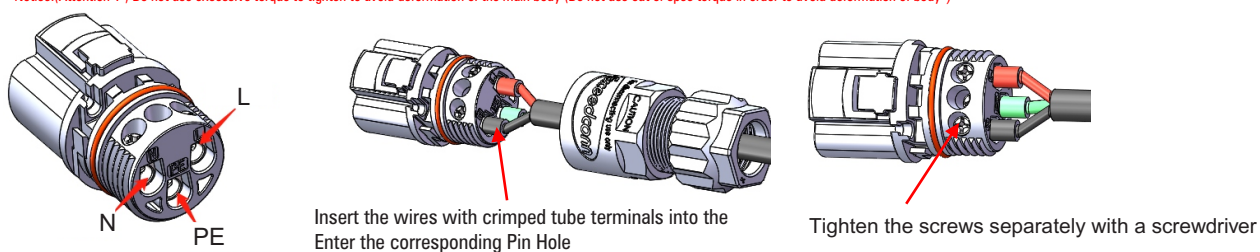
a : Parts mounted on cables.

Notice: (Attention: ) Sealing line direction (The direction of the seal) and the selection of tube terminals (Tubular terminal )

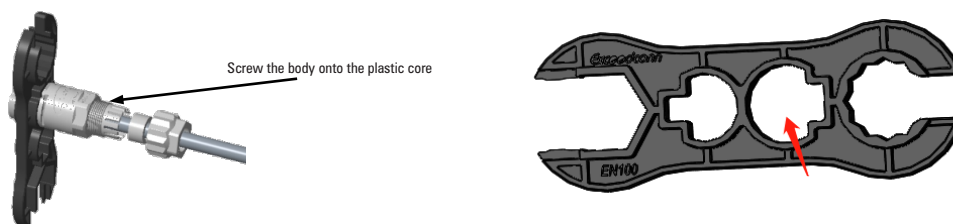


b、crimp the wires as shown in the figure and tighten the screws to the required torque. 0.5~0.7 N·m.

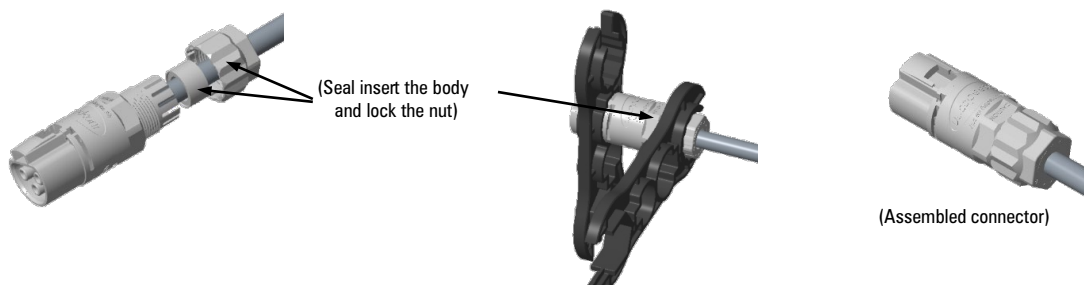
Notice: (Attention : ) Do not use excessive torque to tighten to avoid deformation of the main body (Do not use out of spec torque in order to avoid deformation of body )



c、Use a special wrench to screw the plastic core into the main body, and the tightening torque should not exceed 0.8 N·m.



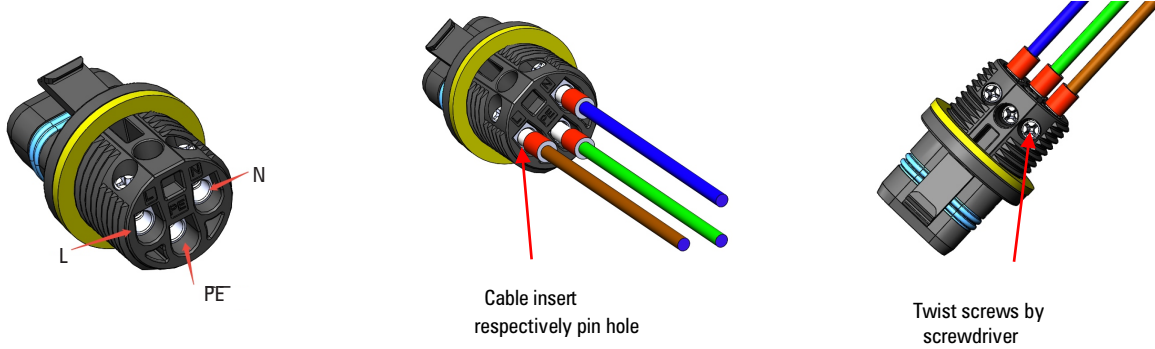
d、Place the sealing body into the main body slot, and then tighten the wire lock nut to the main body, with a torque not exceeding 1.5 N·m.



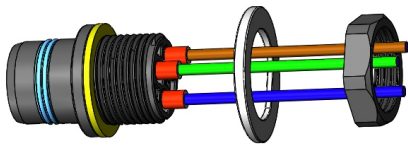
### Wire-to-Board Connector Installation

(Installation of wire-to-panel type connectors)

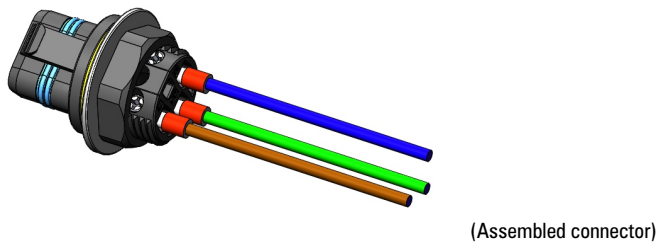
- A. According to picture below to tighten wires screw twisting torque 0.5~0.7 Nm.



- B. Pass the cables and connectors through the panel openings



- C. Lock the nut with a torque of  $1.2 \pm 0.2 \text{ N.M}$





### 6.3 Connecting to the PV panel (DC input)



Caution

- Before connecting the PV panels to the DC terminals, please make sure the polarity is correct. Incorrect polarity connection could permanently damage the unit.
- Before connecting the PV panels to the DC terminals, check that the maximum PV string current is below the maximum current allowed by the model (see chapter 11). On models with fuses (-F), check that the current is below the size of the installed string fuse.
- Check that poles pertaining to different mppt are not connected under the same MPPT.
- Make the DC side connections without voltage by isolating the PV field circuit.
- In case of non-insulated installations, the string inverter must be used only with PV generators that comply with insulation class II in conformity with application class A of IEC 61730.



Warning!

Under all conditions, always make sure the maximum open circuit voltage(Voc) of each PV string is less than 500Vdc. Avoid paralleling of the MPPT i.e different MPPTs on the inverter input should not be energized on the same PV input.

#### Cable requirements

Terminals	Section (mm <sup>2</sup> )	AWG no.	Note
+, -	2.5 ... 6	13 ... 10	<ul style="list-style-type: none"> <li>The section depends on the string current.</li> <li>Mc4 connectors for DC connections</li> </ul>

1. Crimp the positive and negative wires from the panels appropriately, following the steps given on the page 22
2. Connect the positive and negative terminals from the PV panel to the positive(+) terminals and negative(-) terminals on the Inverter.

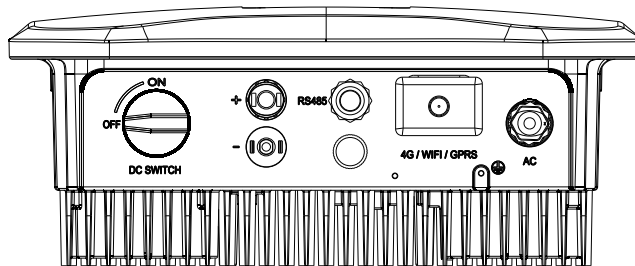
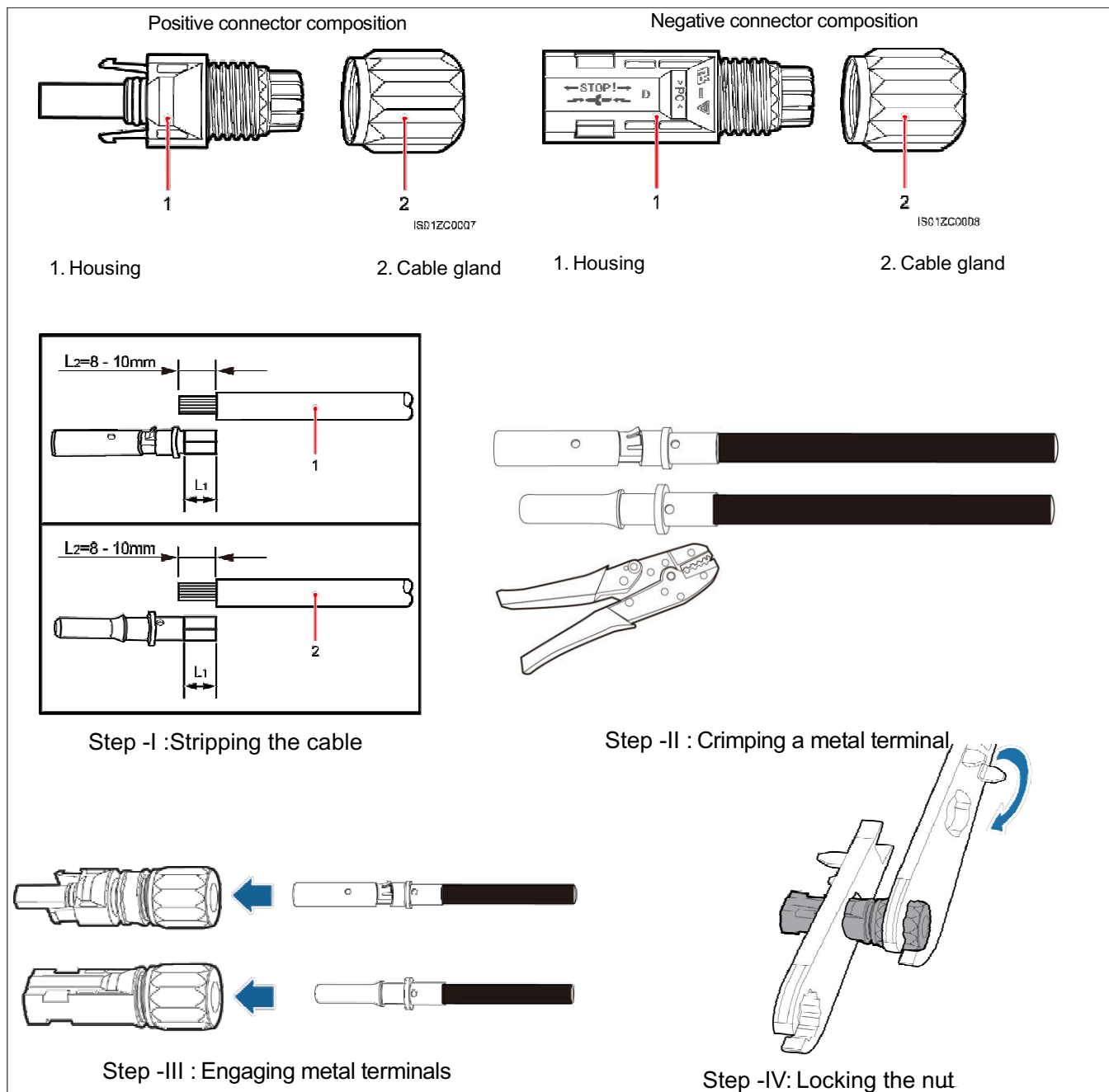


Figure 13 : Connecting to the PV panel 1MPPT model

(Refer to the tables and diagrams below for recommended connections to the photovoltaic field for Ok85 ~ 5kW.)

Terminals			Description
S1	+	-	String 1 current input MPPT1

Follow the steps given in the below figure to connect the PV strings to the Mc4 connectors



## 6.4 DC side fuses and string current monitoring

### 6.4.1 DC side fuses (Inline Fuses -F models)

The DC side fuses are very useful because in case of a malfunction or short-circuit of a string module or cable they trip and eliminate the defective string. This prevents the currents from all of the other strings in parallel from contributing to the short-circuit.

This reduces risks of fire or damage to the PV array.



**Operation to be performed by specially trained personnel.**

#### **ELECTROCUTION RISK!**

**Even with the inverter switched off circuit breaker(\*) in position 0, there could still be dangerous voltage from the photovoltaic field.**



**The string cable terminals are live! Cut voltage from the DC side (open the up-line isolator (if present) or shade the PV panels or disconnect the last PV panel of each string) and from the AC side.**

The string fuses may have to be replaced in case of:

- 1) change off use rating based on type of PV panel used
- 2) damaged fuse.

To replace the fuses it is necessary to:

- 1) disconnect voltage from the AC and DC side
- 2) disconnect all cables from the DC terminals
- 3) identify and replace the blown fuse inside the inline connector(see table below), then replace the panels and connections.

(\*) 30A is the standard fuse size installed in the factory. Other fuse sizes (type gpV / 650Vcc) can be installed according to the instructions of the PV module manufacturer. These fuses can be ordered on request.

#### **6.4.2 String current monitoring**

This function is pre included in all the models.

By current sensors in series with each string, the current in each string is monitored (see section "Input data" on page 39) and any anomalies or faults are signalled.

#### **6.5 AC side fuses/AC side Circuit breaker**

These fuses/breaker are not supplied with the equipment but are available on request.

In compliance with IEC 62109, the AC output must be protected with fuses or a circuit breaker.

The following is a table of recommended fuses/breaker rating:

Model	Fuses/breaker
iUNO-INV(1)-0K85-1M....	gR /25A/300V
iUNO-INV(1)-1K0-1M....	gR /25A/300V
iUNO-INV(1)-1K5-1M....	gR /25A/300V
iUNO-INV(1)-2K0-1M....	gR /25A/300V
iUNO-INV(1)-2K5-1M....	gR /25A/300V
iUNO-INV(1)-3K0-1M....	gR /25A/300V
iUNO-INV(1)-3K3-1M....	gR /25A/300V
iUNO-INV(1)-3K6-1M....	gR /25A/300V
iUNO-INV(1)-4K0-1M....	gR /35A/300V
iUNO-INV(1)-4K2-1M....	gR /35A/300V
iUNO-INV(1)-4K6-1M....	gR /35A/300V
iUNO-INV(1)-5K0-1M....	gR /35A/300V

## 6.6 Choice of leakage breaker on AC side

The string inverters are equipped with a protection against ground faults in conformity to German safety standard VDE0126-1-1. Specifically, they are equipped with a redundancy reading of leakage current to ground applicable to all current components (both DC and AC).

Leakage current to ground is measured simultaneously and independently by two different processors. The protection trips if one (or both) of them detects a fault, with consequent disconnection from the grid and stop of the generation process.

There is an absolute limit of 300 mA (0.85~5kW) of total AC+DC leakage current with tripping of the protection within 300msec.

There are also three other trip limits to protect against fault currents caused by accidental contact with leaking live parts; these limits are 30mA with trip in 0.3sec, 60mA with trip in 0.15sec, and 150mA in 0.04 sec.

The integrated device protects the system only against ground faults occurring up-line of the inverter (toward the DC side). Any leaks in the section on the AC side between the grid and the inverter are not detected and require an external protection.

Therefore, a type A leakage breaker have to be installed to protect the AC line.

When multiple leakage protection switches are installed in the system, it is forbidden to share the neutral line, otherwise the leakage protection function may be triggered by mistake and cause the switch to trip.

It is advisable to use a breaker with trip current of at least 300 mA to avoid false faults due primarily to capacitive leakage of the PV modules.

## 6.7 DC circuit breaker

The DC circuit breaker galvanically disconnects the DC source on the AC side.

Breaking is done simultaneously on the positive and negative poles of all MPPT present.



**Warning: the DC circuit breaker DOES NOT switch off the AC side.**

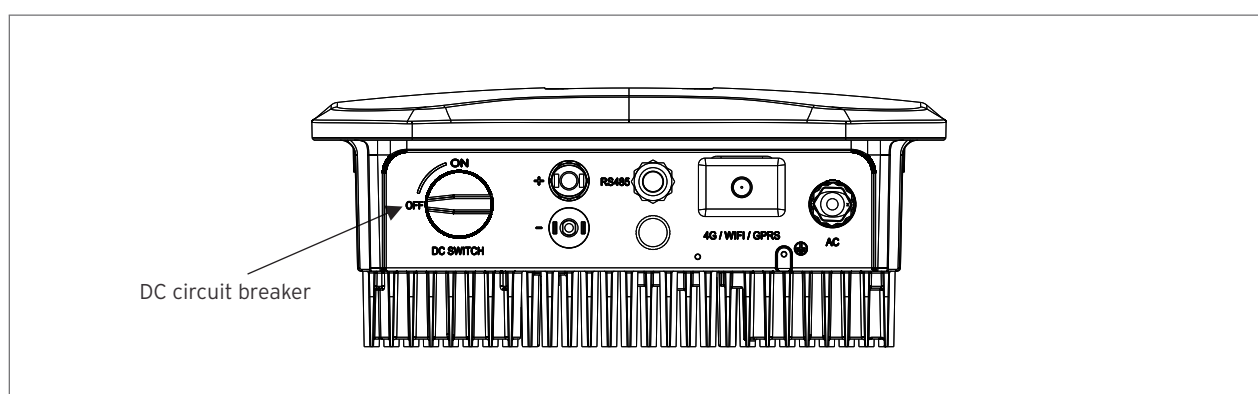


Figure 17 : DC circuit breaker

Position 0 = Open (OFF), switches off the inverter completely.

Position 1 = Closed (ON)

Model	Circuit breaker type and characteristics
iUNO-INV(1)-0K85-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-1K0-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-1K5-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-2K0-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-2K5-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-3K0-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-3K3-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-3K6-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-4K0-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-4K2-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-4K6-1M....	600V 25A(for each MPPT)
iUNO-INV(1)-5K0-1M....	600V 25A(for each MPPT)

## 6.8 Other connections

The inverter features many other connections which includes communication port, Type RS-485 and connection port for WiFi/GSM /4G dongle.

### 6.8.1 RS-485 Connection

The inverter has a 4 pin signal connector. The pin configuration of the signal connector is as shown below.

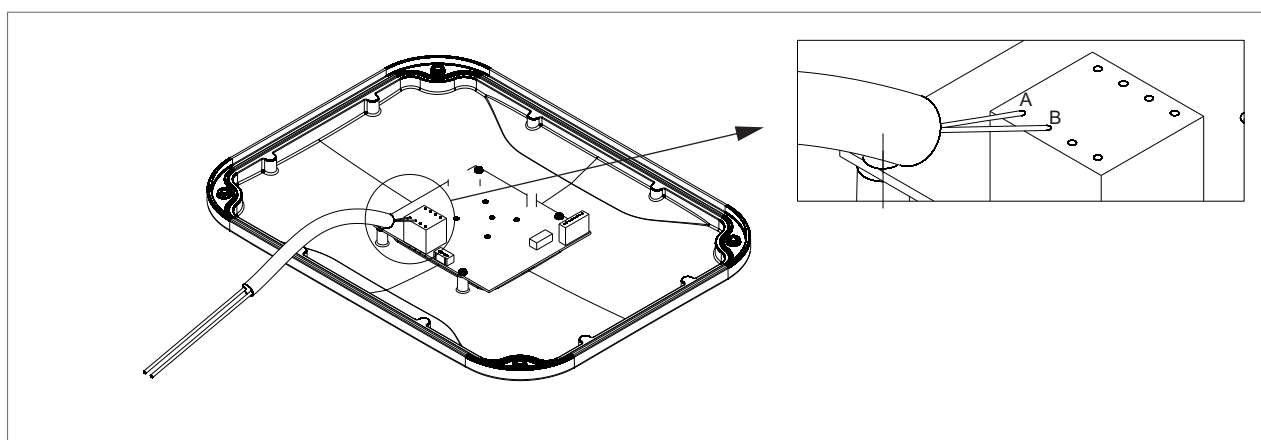
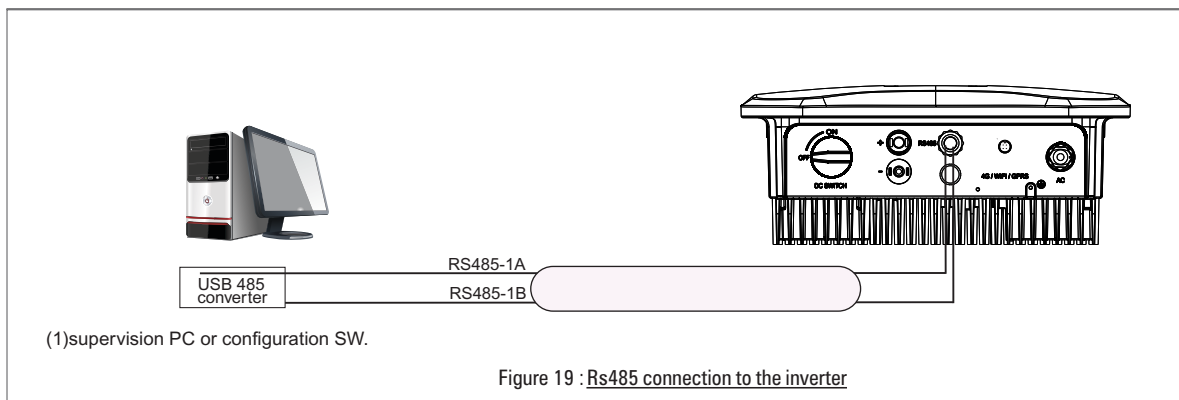


Figure 18 : Signal Connector

To install the cable end connector, follow the installation procedure as given below.

- Cut the two wires to the required length.
- Strip approximately 6-7 mm of insulation from the end of each wire using a wire stripper.
- Ensure that the copper strands are not damaged or frayed.
- Refer to the connection table and drawing above to identify the correct terminal positions and wire assignments. Match each wire to the corresponding terminal as per the instructions provided.

2	4	6	8	→ CN2
1	3	5	7	
1	2	RS485_A2		
3	4	RS485_B2		
6		AI_1+		
8		AI_1-		
5		AI_0+		
7		AI_0-		



**Pass Wires A and B Through the Gland:**Carefully insert Wire A and Wire B (0.25 sq.mm) through the cable gland provided on the enclosure or bracket.

**Connect the Wires to the Modbus Connector:**Refer to the wiring table and drawing to connect Wire A and Wire B to the appropriate terminals on the Modbus connector.Ensure proper polarity and terminal assignment(e.g.A+ and B-). Perform a visual and pull-test check to confirm a secure connection. After wiring, securely close the top cover of the inverter .

**Power On the Inverter:**Switch ON the inverter to proceed with the forward operation or next process step.

## 6.8.2 WiFi Dongle functions use



Operation to be performed by specially trained personnel.

In order to monitor the inverter data remotely, the users can connect the WiFi dongle to the RMU port of the inverter. To connect the WiFi dongle to the cloud, follow the instructions given along with the dongle.

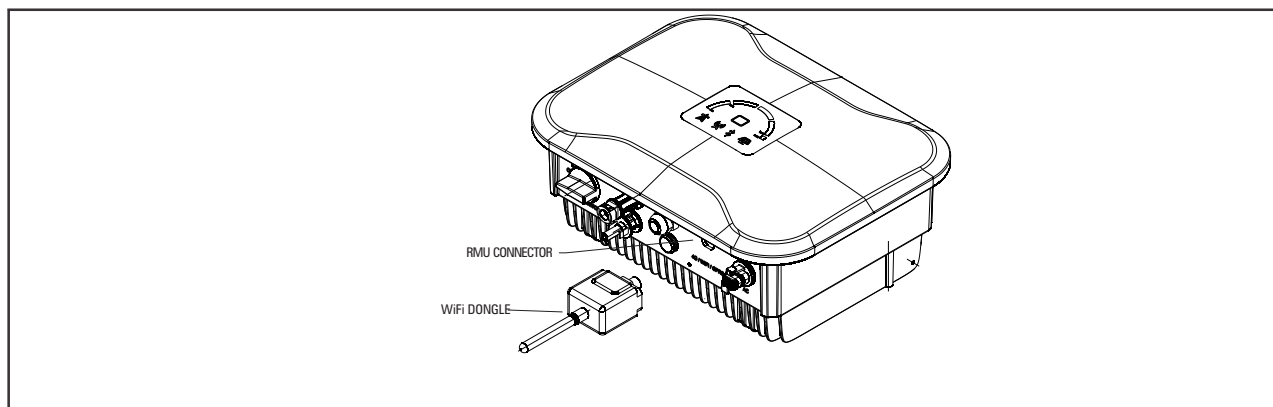


Figure 20 : RMU Port

### 6.8.3 RS-485 function use



**Warning!**

Operation to be performed by specially trained personnel.

**Note!**

Refer 6.8.1 for modbus connection and information

You can use the RS-485 of the inverter for the following features:

#### 1) PRODUCTION LOGS DOWNLOAD USING A RADIUS CONNECT SOFTWARE

Production and operation data can be downloaded and analyzed using Radius Connect Software.  
Please refer to the software user manual of Radius Connect Software.

**Note!**

Production and operation data are saved in CSV format and can be visualized via laptop/PC.

#### 2) ALARM LOGS DOWNLOAD ON A RS-485 MEMORY

Alarm logs can be downloaded and analyzed using Radius Connect Software.  
Please refer to the software user manual of Radius Connect Software.

**Note!**

Alarm history is saved in CSV format and can be visualized on a PC/laptop.

## 7. Display and Bluetooth App Interface

### 7.1 Advanced Display

The inverter features one of the simplest yet new and intuitive display for the users. There are two variants of the user interface available for the users to choose from. The details of both the displays are as given below:

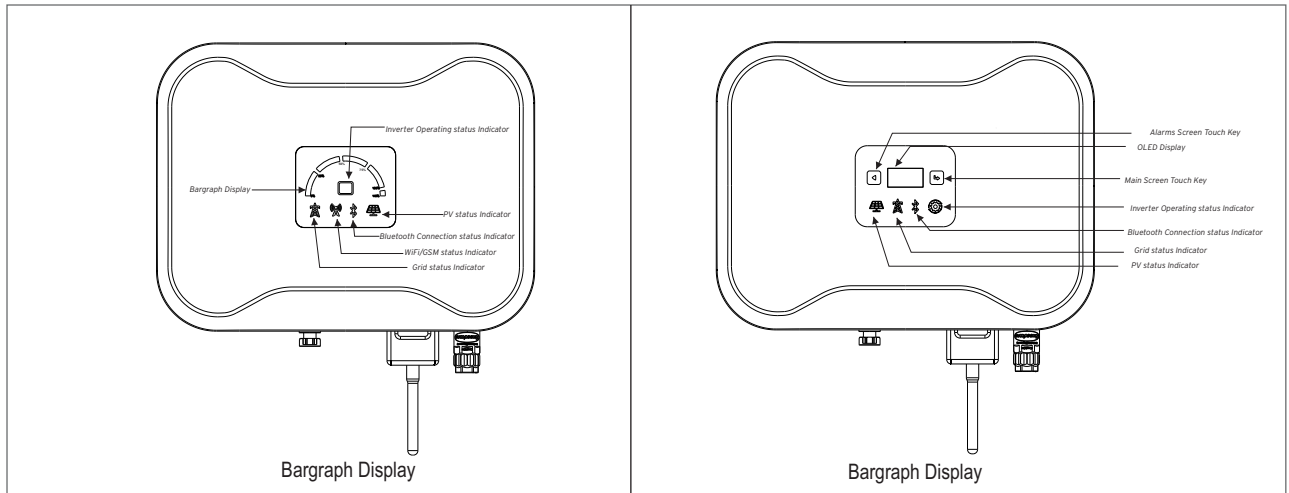


Figure 22 : Inverter Display

#### OLED Display & Touch Keys

The 2.5inch OLED display is used to show the critical parameters like output power, grid voltages, input voltages, input current, output current, Eday, Etotol and alarms etc. Touch key can be used to scroll through the alarms and main screen parameters. A long press on alarm touch key can be used to clear the alarms instantaneously. Similarly a long press on other touch key will hold the present screen on the display.

#### PV status Indicator

OFF: Indicates the MPPT voltage is not healthy. Ensure each MPPT voltage meets the minimum and maximum voltage limits.

GREEN: Indicates the MPPT voltage is healthy.

#### Grid status Indicator

OFF: Indicates the Grid voltage is not healthy. Ensure each phase voltage is as per the Grid connection codes.

GREEN: Indicates the Grid voltage is healthy.

#### Remote monitoring status Indicator

OFF: Indicates the remote connection cannot be established. Ensure the dongle is properly inserted in to the port.

GREEN: Indicates the communication between the dongle and the inverter is healthy.

#### Bluetooth status indicator

OFF: Indicates the bluetooth is available for connection. Use Radius Neo App to establish connection with the inverter.

STABLE GREEN: Indicates the bluetooth is connected and communicating.

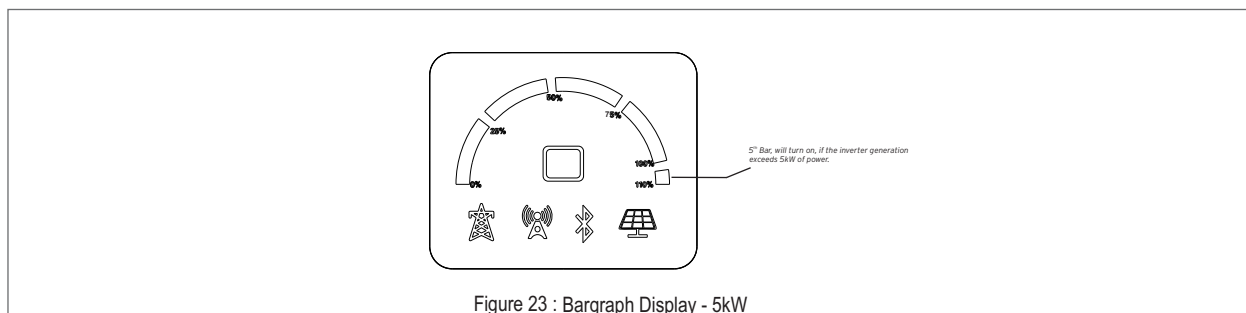
#### Note!

In case of a loss of communication with the connected bluetooth device, inverter automatically disconnects after 10 min and frees up the link for the connection with the other devices.

#### Inverter Bargraph display

Inverter has five bars to indicate the various power level ranging form 0% through 110% of the rated power. First four bar represent 25% increments , corresponding to 0% through 100% of the rated power level. If the power exceeds 100% the fifth will illuminate overload (up to 110%)





### Inverter operating status indicator

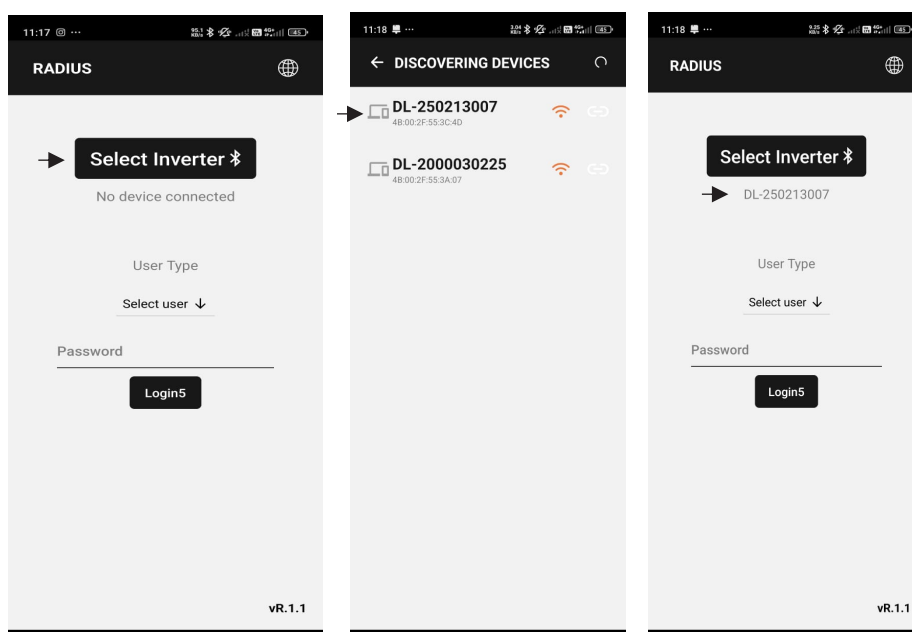
This is a multi-color indicator. Inverter uses various colors to indicate the different operating states of the inverter.

Reference	Colour	Function
Initialization procedure	Blue stable	the inverter is performing initialization procedures, calculating the isolation resistance, or waiting for the start command (if not started previously).
DC-Grid Connection phase	Blue flashing	The inverter has powered the DC circuit and is executing the ramp for connection to the grid.
Grid Connected	Green flashing	The inverter has connected to the grid (the AC Switch has closed).
Generation	Green stable	The inverter is generating (MPPT function is active) and is healthy.
Power Limitation	Cyan stable	Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.
Fault	Red stable	The inverter is in a fault condition.
Warning	Yellow flashing	A warning is present.

## 7.2 Android/iOS Application

In order to record, monitor or analyze the realtime time as well as historical data, there is an easy to use android application available. The app "Radius Neo" can be downloaded from the Android playstore. Follow the general installation procedure and allow all the permissions required at the time of installation. The app connects to the inverter over the bluetooth. Follow the below procedure to connect to the inverter and to analyze various parameter and the performance of the inverter.

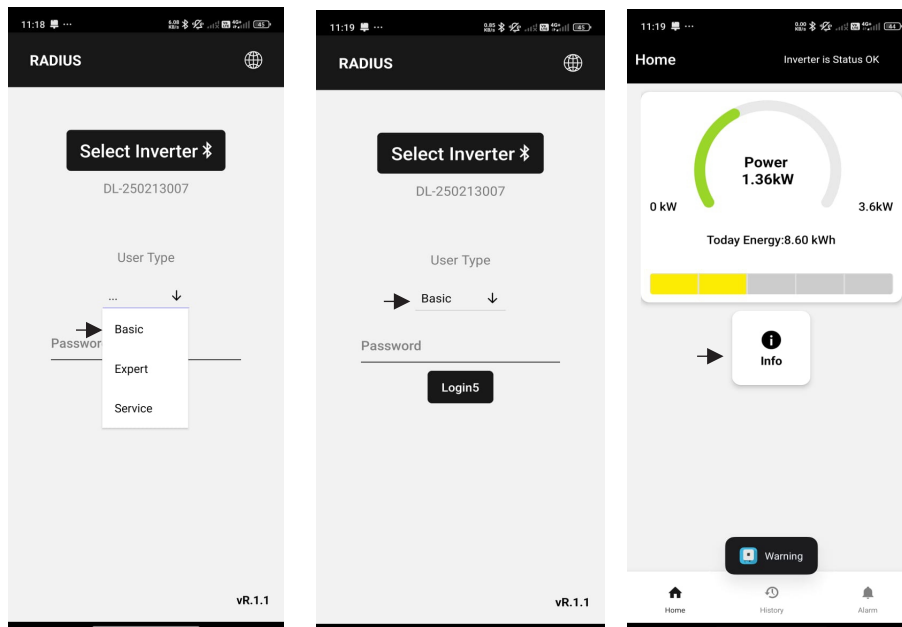
Once the installation is completed, follow the onscreen instructions to connect to the desired inverter, to visualize the various inverter parameters.



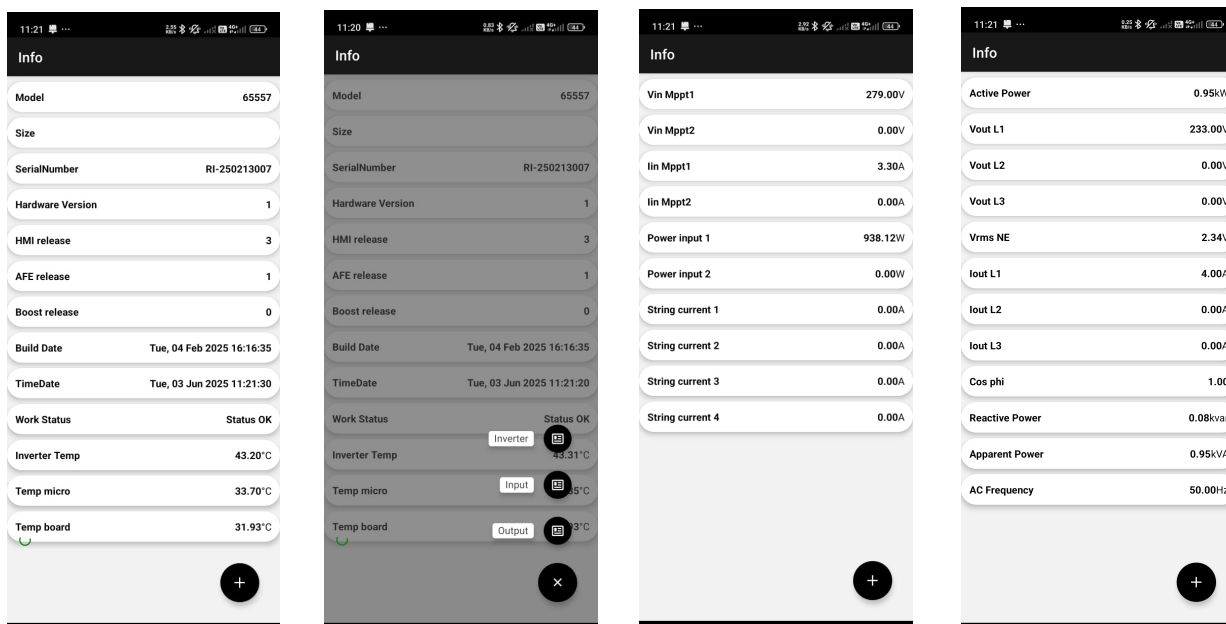
**Note!**

In order to visualize the data of the inverter using bluetooth, it is essential that the inverter is turned on. Also note that the inverter can only connect to one mobile device at one time.

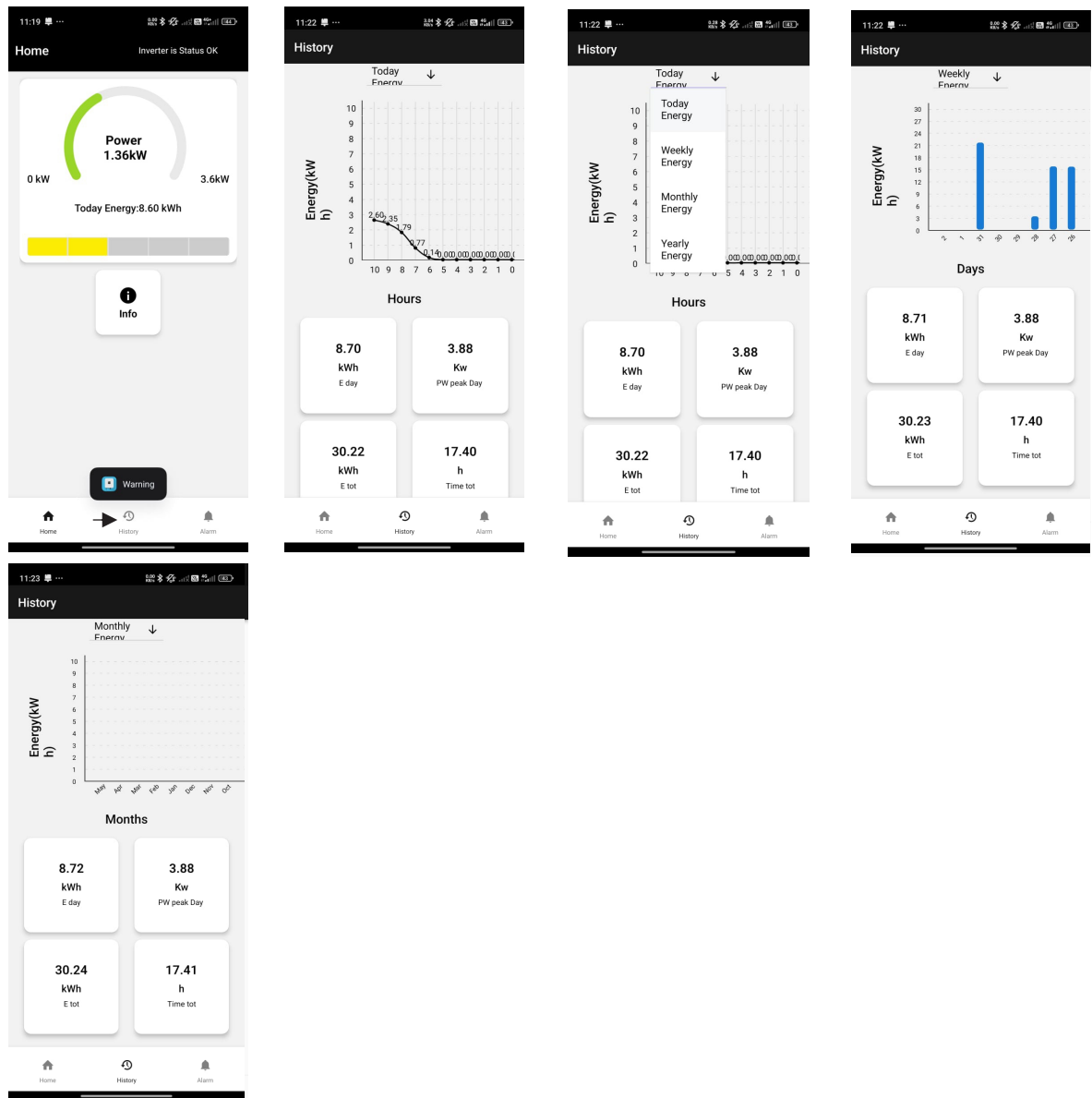
The application features 3 access modes/user types namely basic, expert and Service. The basic user can login without password.



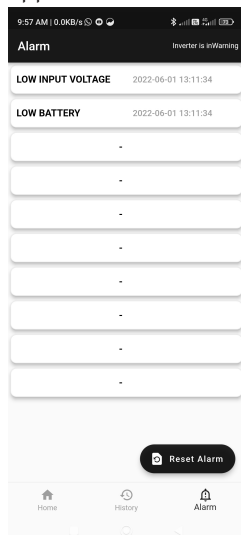
The basic parameters like input data, Output Data and Inverter info can be visualized inside the "info" menu.



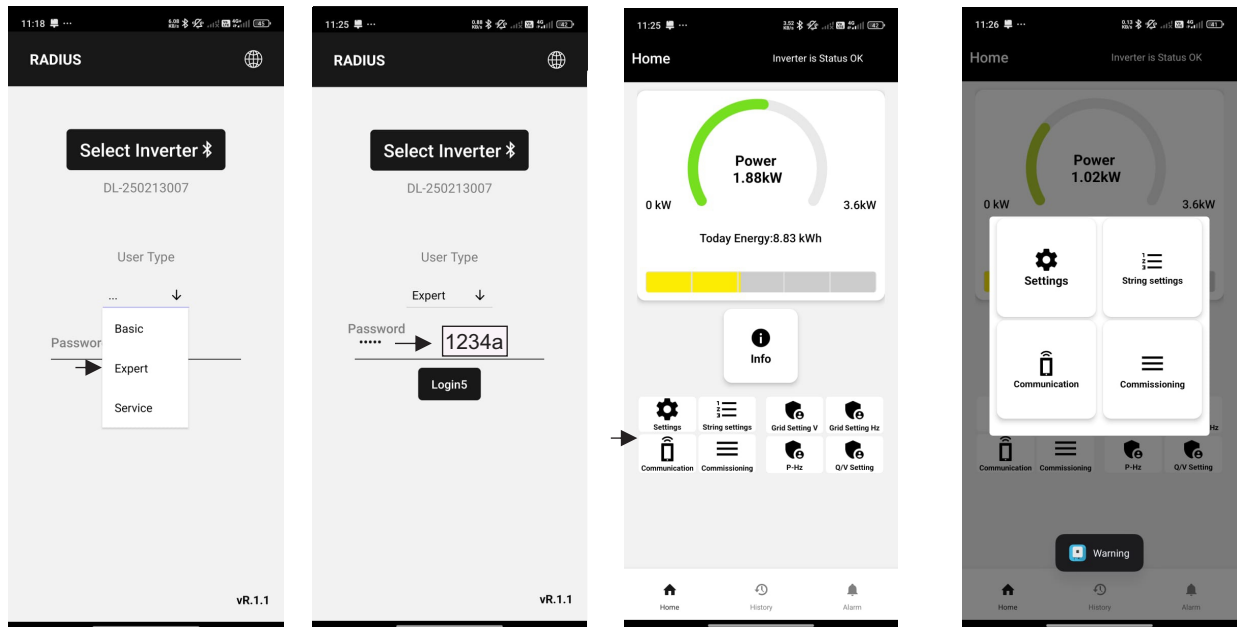
The historical production data of the inverter i.e Total Energy, Today Energy & Peak power etc can be visualized in the History Tab located at the bottom of the application.



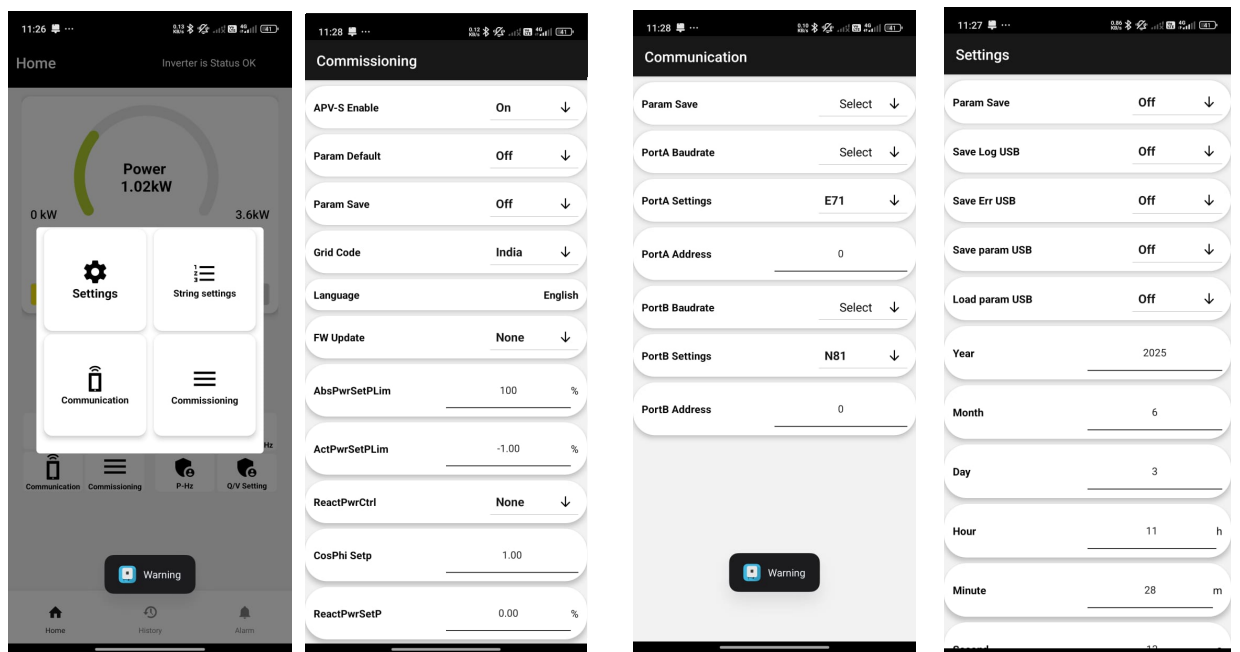
The Alarm and Warning data of the inverter can be visualized in the Alarm Tab located at the bottom of the application. The alarm indication is also indicated at the Title Bar in all the screens of the Application.



To login in to expert login use the password “1234a”. The expert menu provides access to various parameters of the inverter.



The parameters related inverter commissioning are grouped inside the menu “Commissioning”. The parameters related to communication settings are grouped under the menu” Communication”. The parameters related to other settings are grouped under the menu “Settings”.



The parameters related to the Grid voltage & Grid Frequency settings are available under the menu “Grid Setting Voltage”& “Grid Setting Hz”. The parameters related to the P-Hz (LFSM) settings are available under the menu “P-Hz” setting.

Grid Settings V

Delay for connect

1

s

ReConnect time

1

s

Thrsd U <

80

%

Time U <

400

ms

Thrsd U >

120

%

Time U >

200

ms

Thrsd U >

120

%

Time U >

200

ms

Thrsd U <

50

%

Time U <

20

ms

Grid Setting Hz

Fmin for connect

47.50

Hz

Fmax for connect

50.20

Hz

Thrsd f <

47.25

Hz

Thrsd f >

52.70

Hz

Time f <

100

ms

Time f >

100

ms

Thrsd f <

47.00

Hz

Time f <

500

ms

Thrsd f >

52.00

Hz

Time f >

500

ms

P-Hz

bPHZType

CEI 021

↓

LFSMo-aPHzType

Activated

↓

LFSMo-f1

50.30

Hz

LFSMo-fstop

50.00

Hz

LFSMo-Slope

83.33

%/Hz

LFSMo-Tstop

300

s

LFSMu-f1

49.80

Hz

LFSMu-Slope

40.00

%/Hz

LFSMu-Tstop

0

s

LFSMo-IntDelay

0

s

The parameters related to the settings for string failure detection are available under the menu “String Setting”.

String Settings

StringAvgTime

30

s

StringThresh

50.00

%

StringMin

3.00

A

String Config 1

Included

↓

String Config 2

Included

↓

String Config 3

Included

↓

String Config 4

Included

↓

StrWarning Enable

Disable

↓

For the detailed description of all the parameters refer to the section “8 . Description of Parameters”.

## 7.3 Commissioning



**Warning!**

Operation to be performed by specially trained personnel.

### First power on after performing parameter default

After you have carefully executed the electrical connection of the inverter, at first power, connect the inverter using mobile application as given in the section 7.3. If the commissioning of the inverter is pending then the app will show notification on the commissioning tab.



**Warning!**

The process of commissioning of inverter can only be performed using expert login in the mobile application.

If the notification on the commissioning tab is available, the guided procedure inside the commissioning tab lets you set:

- The country's grid standard (MANDATORY)
- The language for display menus (MANDATORY)
- Selection of used string (MANDATORY)
- Then date and time (MANDATORY)



There are different grid parameters (dictated by the national/local grid code and/or by the distributor) depending on the country of installation.

The following table shows the grid standards selectable.

Sr.No.	Grid Standard	Mains Voltage
0.	None	-
1.	EN 50549-PL	230V L-N-PE
2.	EN 50549-1/2019	230V L-N-PE
3.	EN 50438/2014	230V L-N-PE
4.	India	230V L-N-PE
5.	India-Kerala	230V L-N-PE
6.	CEI 021	230V L-N-PE
7.	VDE 4105	230V L-N-PE
8.	VDE 0126 2006	230V L-N-PE
9.	VDE 0126 A1/2012	230V L-N-PE
10.	RD 661/2007/India 1PH	230V L-N-PE
11.	IEC 61727/2004	230V L-N-PE
12.	CEI 016	230V L-N-PE
13.	Pakistan	230V L-N-PE

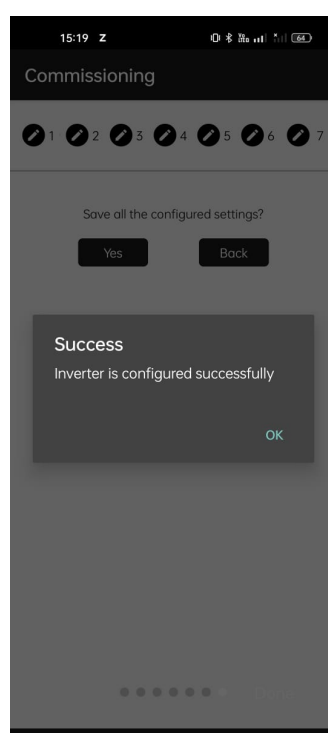
Before selecting, check that the grid code is correct for the grid to which the inverter will be connecting. If you are not sure, check the technical specification of the system/grid or contact your local utility.

**Note!** Select EN50549-PL to configure the inverter as per the requirements of PTPIREE in Poland.

The grid standard is saved automatically and will not be requested when the inverter is switched on again.

If the wrong grid code has been selected, see chapter “7. DESCRIPTION OF MENUS.”

After you have confirmed the grid code, you will see the following screen



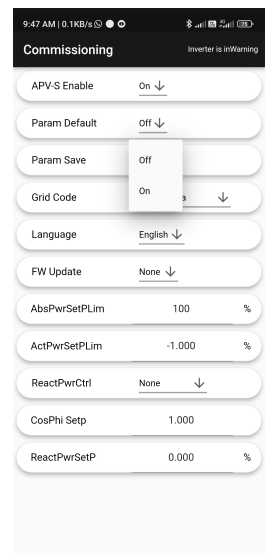
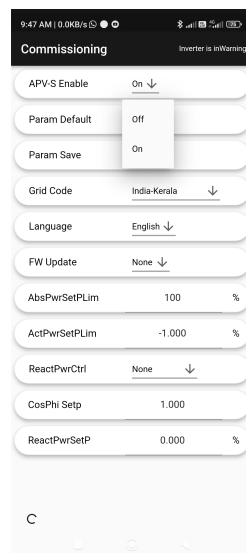
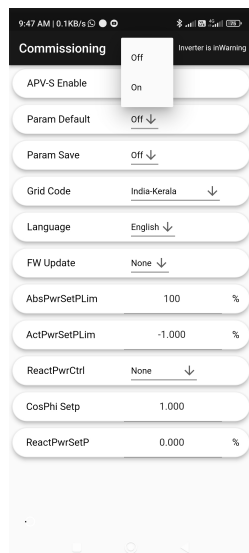
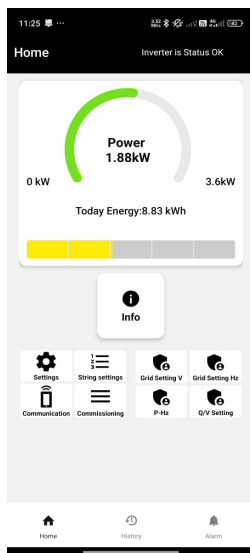
The starting procedure is now ended, and the home page of the inverter will appear. The inverter starts the grid connection procedure.



**Correct setting of the TIME and DATE is necessary for saving the production log and alarm data in the inverter's integrated memory.**

Incase if the grid code is wrongly selected or is not as per the requirements of the local authority, then the grid code can be changed using parameter default function. To set all the parameters to factory default settings, follow the below given instructions.

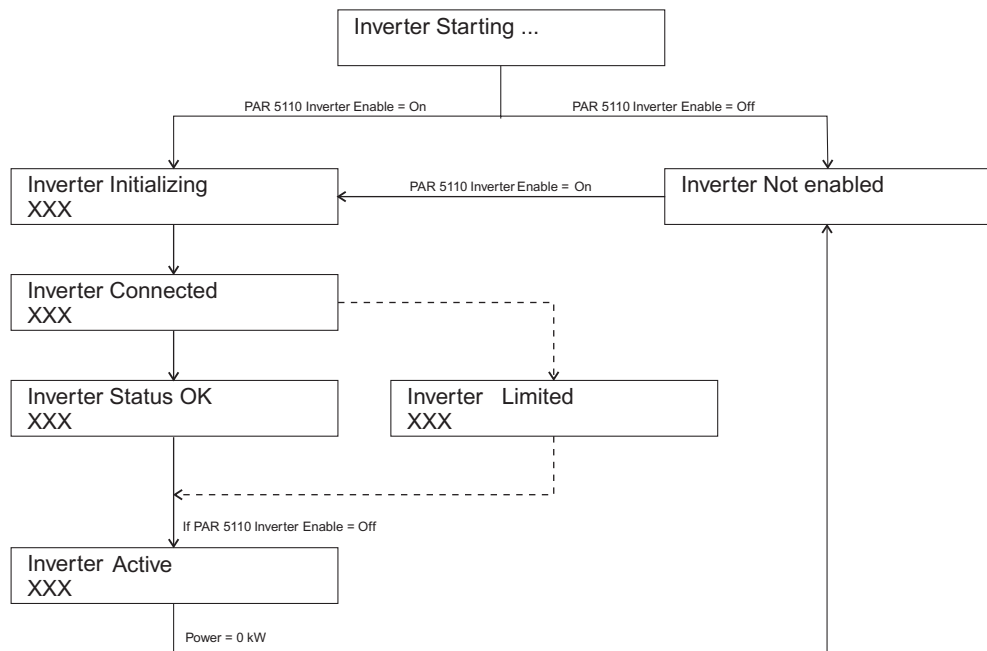
1. Login into the Application using Expert Mode.
2. Open "Commissioning-tab". Set the Inverter Enable to "Off".
3. Set Parameter Default to "ON". Wait until the Param default state changes back to "OFF".
4. Set Param Save to "ON". Wait until the Param Save status changes back to "OFF".
5. Turn OFF the inverter. Wait until inverter is completely switched OFF.
6. Now switch on the inverter again.
7. Follow the instructions given in the section 7.3 Commissioning to select the proper grid code.





## 7.4 App screens: Operating statuses, stand by

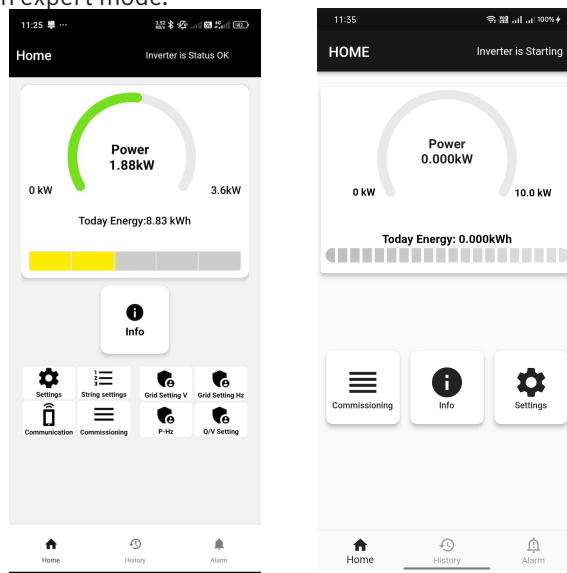
### 7.4.1 Operating statuses (advanced level)



<b>Starting</b>	Displayed for a few seconds after power-on.
<b>Initializing</b>	Initialization procedures and connection to DC circuit.
<b>Connected</b>	Inverter connects to AC grid and prepares for generation.
<b>Status OK</b>	Inverter is generating.
<b>Limited</b>	Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.
<b>Active</b>	0 power is generated: inverter is disabled (PAR5110 = Off) or is in test mode.
<b>XXX</b>	Sequential display of "Stand-by" data (see below).

### 7.4.2 Stand-by

The following screens are shown in sequence in the absence of alarms or warnings during normal operation of the inverter in expert mode.



## 8. Description of parameters

### 8.1 Parameters description

#### 8.1.1 Legend

PAR	Description	UM	Def	Min	Max	Access
Parameter identifier	Parameter description	Unit of measure	Default value	Minimum value	Maximum value	Accessibility : E=Expert R=Read W= Write

## Info

The Info menu displays the values of measured quantities, operating parameters, and information to identify the inverter and the configuration.

### Note!

The values on the display may diverge from real values and cannot be used to calculate an official invoice. The quantities read by the inverter are needed to check its operation and to control the current to be injected in the grid. The inverter does not have a meter approved for legal metrology.

## Input data

PAR	Description	UM	Def	Min	Max	Access				
650	<b>VinMppt1</b>	V	R							
	Display of DC voltage at input to MPPT channel no.									
656	<b>IinMppt1</b>	A	R							
	Display of DC current at input to MPPT channel no.									
140	<b>Power input 1</b>	W	R							
	Display of power at input to MPPT channel no.									
	(*)Enable monitoring to display string current. Unavailable strings have value 0.									
150	<b>String current 1</b>	A	R							
	Display of current at input of string “n”.									
172	<b>String status</b>									
	Display of strings status:									
0	String not configured or out the threshold setting (*)									
1	String OK									
	(*) occurs only if the string current is beyond the set limit (PAR 597) for the set time (PAR 596) compared to the average current of the strings.									
	Example: display 0000/0001									
	<table><tr><td>0</td></tr><tr><td>String 1= ERROR</td></tr></table>		0	String 1= ERROR	<table><tr><td>1</td></tr><tr><td>String 1= OK</td></tr></table>		1	String 1= OK		
0										
String 1= ERROR										
1										
String 1= OK										

PAR	Description	UM	Def	Min	Max	Access				
176	String active					ER				
Display of active strings: each bit corresponds to a string present. Together with PAR 172, indicates the strings present, the ones that are monitored, and in error.										
0	String not active									
1	String active									
Example: display 0000/0001										
<table><tr><td>0</td></tr><tr><td>String 1 = Not active</td></tr></table>		0	String 1 = Not active	<table><tr><td>1</td></tr><tr><td>String 1 = active</td></tr></table>					1	String 1 = active
0										
String 1 = Not active										
1										
String 1 = active										

370	String Status 1					ER
Based on the models, only the parameters shown on the table are displayed.						
Display of strings status:						
Not Available	string not present.					
Not included	string present but not configured					
Active	string functioning.					
Error	string current beyond limit ("String error" warning is generated). For more information See Alarms and Warnings list" on page 56.					

## Output data

PAR	Description	UM	Def	Min	Max	Access
<b>112</b>	<b>Vout L1</b>	V	R			
	Display of AC output voltage of drive (Phase Voltage U/V/W).					
<b>118</b>	<b>Iout L1</b>	A	R			
	Display AC output current of drive ( Phase Voltage U/V/W).					
<b>126</b>	<b>Active Power</b>	kW	R			
	display( Power ).					
<b>124</b>	<b>Cos phi</b>		R			
	The power factor value (cos) is displayed.					
<b>128</b>	<b>Reactive Power</b>	kW	R			
	The value of the reactive power generated into the mains is displayed.					
<b>180</b>	<b>Apparent Power</b>	kW	R			
	Display of value of apparent power generated on the grid.					
<b>130</b>	<b>AC Frequency</b>	Hz	R			
	The drive output frequency is displayed.					

## Inverter info

PAR	Description	UM	Def	Min	Max	Access																										
478	<b>Name</b> Display of inverterfamily: UNO					R																										
480	<b>Model</b> Display the inverter model i.e.: iUNO-INV(1)-5KO-1M-BT-XXXXXX					R																										
482	<b>Size</b> Display of inverter size (forexample: 05kWAE1MPPT)					ER																										
490	<b>Software Version</b> Display of FW version (Main inverter version and release of internal SW components). I.e.:					R																										
	<table><tr><td>V 01</td><td>00</td><td>00</td><td>00</td></tr><tr><td>Main version</td><td>Release HMI</td><td>Release AFE</td><td>Release Boost</td></tr></table>	V 01	00	00	00	Main version	Release HMI	Release AFE	Release Boost			<table><tr><td>T00</td></tr><tr><td>Type</td></tr></table>	T00	Type																		
V 01	00	00	00																													
Main version	Release HMI	Release AFE	Release Boost																													
T00																																
Type																																
498	<b>Build date</b> Display of date of FW version.					ER																										
511	<b>Work status</b> Display of inverter work status.					R																										
	<table><tr><td>0</td><td>Starting</td><td>Displayed for a few seconds after power-on.</td></tr><tr><td>1</td><td>Initializing</td><td>Initialization procedures and connection to DC circuit.</td></tr><tr><td>2</td><td>Not Enabled</td><td>Inverter not enabled to generate power</td></tr><tr><td>3</td><td>Connected</td><td>Inverter connects to AC grid and prepares for generation.</td></tr><tr><td>4</td><td>Status OK</td><td>Inverter is generating.</td></tr><tr><td>5</td><td>Limited</td><td>Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.</td></tr><tr><td>6</td><td>Warning</td><td>Inverter in warning status</td></tr><tr><td>7</td><td>Alarm</td><td>Inverter in alarm status</td></tr><tr><td>8</td><td>Active</td><td>0 power is generated: inverter is disabled (PAR 5110 = Off) or is in test mode.</td></tr></table>	0	Starting	Displayed for a few seconds after power-on.	1	Initializing	Initialization procedures and connection to DC circuit.	2	Not Enabled	Inverter not enabled to generate power	3	Connected	Inverter connects to AC grid and prepares for generation.	4	Status OK	Inverter is generating.	5	Limited	Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.	6	Warning	Inverter in warning status	7	Alarm	Inverter in alarm status	8	Active	0 power is generated: inverter is disabled (PAR 5110 = Off) or is in test mode.				
0	Starting	Displayed for a few seconds after power-on.																														
1	Initializing	Initialization procedures and connection to DC circuit.																														
2	Not Enabled	Inverter not enabled to generate power																														
3	Connected	Inverter connects to AC grid and prepares for generation.																														
4	Status OK	Inverter is generating.																														
5	Limited	Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.																														
6	Warning	Inverter in warning status																														
7	Alarm	Inverter in alarm status																														
8	Active	0 power is generated: inverter is disabled (PAR 5110 = Off) or is in test mode.																														
174	<b>Inverter state</b> Status bit code.					ER																										

PAR	Description	UM	Def	Min	Max	Access
146	<b>Inverter Temp</b>	°C	R			
	Display of heatsink temperature read by sensor.					
240	<b>Temp micro</b>	°C				ER
	Display of HMI micro temperature.					
242	<b>Temp board</b>	°C				ER
	Display of temperature in HMI card.					
500	<b>Boot rel</b>					ER
	Display of boot SW release.					
501	<b>Boot ver</b>					ER
	Display of boot SW version.					
520	<b>Serial Number</b>					R
	Display of inverter serial number.					
530	<b>Time Date</b>					R
	Display of current date and time of inverter. Format dd/MM/YY hh:mm:ss.					
4840	<b>Warning 1</b>					ER
	Bit code of status of alarms specified on table.1 bit for each alarm. For more information, see chapter 10 .					

Bit	Code	Description
0	1	AFE Comm
1	2	Boost Comm
2	3	AFE Boot
3	4	Boost Boot
4	5	EEPROM error
5	6	String error
6	7	Log error
7	8	HMI Boot
8	9	Low Battery
9	10	File error
10	11	USB error
11	12	LoadDefault error
12	13	Slave Comm
13	14	Watchdog Error

**4841 Alarm B1** ER

Bit code of status of alarms specified on table.1 bit for each alarm.  
For more information, see chapter 10.

Bit	Code	Description
0	17	Input OV DC Bus
1	18	Input OC 1
2	19	Com err
3	20	Input OC 2
4	21	Insulation err
5	22	Missed config 1
6	23	Leakage curr B
7	24	Micro OT B
8	25	Internal err 1
9	26	Ground kit err
10	27	Klixon err 1
11	28	Redundancy err 1
12	29	Internal err 2
13	30	Internal err 3

**4842 Alarm B2** ER

Bit code of status of alarms specified on table;1 bit for each alarm.  
No alarm provided in this section.

Bit	Code	Description
15	48	Slave alarm

**4843 Alarm A1** ER

Bit code of status of alarms specified on table.1 bit for each alarm.  
For more information, see chapter 10.

Bit	Code	Description
0	49	DC Link UV A
1	50	DC LINK OV A
2	51	DC Link Unbalance
3	52	Output OC 1
4	53	Output OC 2
5	54	Grid UV
6	55	Grid OV
7	56	Grid UF
8	57	Grid OF
9	58	Redundancy err 2
10	59	Sink OT B
11	60	Grid fail
12	61	Sink OT A
13	62	Sink UT A
14	63	DC Current Inj
15	64	LeakageCurrent A

**4844 Alarm A2** ER

Bit code of status of alarms specified on table.1 bit for each alarm.  
For more information, see chapter 10.

Bit	Code	Description
0	65	Power Relay err
1	66	Micro OT A
2	67	Klixon err 2
3	68	Missed config 2

4	69	AC Voltage Unbalanced
5	70	AC Current Unbalanced
6	71	Internal err 5
7	72	Internal err 6
8	73	A Overload

#### 4845 Warning 2 ER

Bit code of status of alarms specified on table.1 bit for each alarm.  
For more information, see chapter 10.

Bit	Code	Description
0	81	OverVoltageVin
1	82	Module OT
2	83	Heatsink OT
3	84	Varistor not OK

## History

### Total

PAR	Description	UM	Def	Min	Max	Access
134	<b>E tot</b>	MWh	R			
	Displays total energy generated since first firing.					
138	<b>Time tot</b>	h	R			
	Displays total generating / enabling time.					
184	<b>LifeTime</b>	h	R			
	Displays total operating / non operating time.					

### Today

PAR	Description	UM	Def	Min	Max	Access
132	<b>E day</b>	kWh	R			
	Displays total daily energy.					
136	<b>PW peak Day</b>	kW	R			
	Displays daily energy peak value.					
2200	<b>Energy hh:mmh</b>	kWh	R			
2202	<b>Energy hh:mmh</b>	kWh	R			
2204	<b>Energy hh:mmh</b>	kWh	R			
2206	<b>Energy hh:mmh</b>	kWh	R			
2208	<b>Energy hh:mmh</b>	kWh	R			
2210	<b>Energy hh:mmh</b>	kWh	R			
2212	<b>Energy hh:mmh</b>	kWh	R			

2214	Energy hh:mmh	kWh	R
2216	Energy hh:mmh	kWh	R
2218	Energy hh:mmh	kWh	R
2220	Energy hh:mmh	kWh	R
2222	Energy hh:mmh	kWh	R
2224	Energy hh:mmh	kWh	R
2226	Energy hh:mmh	kWh	R
2228	Energy hh:mmh	kWh	R
2230	Energy hh:mmh	kWh	R

Displays value of energy generated in previous 16 hours.

i.e.:if the time is 11:30,PAR 2200 shows "10:00h", PAR 2202 shows "09:00h",etc.

Energy 10:00h  
\*0.000kWh

2122	Energy MM/YYYY	MWh	R
------	----------------	-----	---

Displays value of energy generated in previous 12 months.

i.e.: if today is 06 Sep 2022, PAR 2100 shows "09/2022", PAR 2102 "09/2022", etc.

## Last 10 years

PAR	Description	UM	Def	Min	Max	Access
2018	<b>E 1Yr</b>	MWh	R			
	Displays total energy generated in last 12 months.					
2020	<b>Time 1Yr</b>	h	R			
	Displays operating time in last 12 months.					
2022	<b>CO2 1Yr</b>	kg	R			
	Displays calculation of kg of CO <sub>2</sub> saved in last 12months (compared to generation of electricity with fossil fuels).					
2150	Energy YYYY	MWh	R			
2152	Energy YYYY	MWh	R			
2154	Energy YYYY	MWh	R			
2156	Energy YYYY	MWh	R			
2158	Energy YYYY	MWh	R			
2160	Energy YYYY	MWh	R			
2162	Energy YYYY	MWh	R			
2164	Energy YYYY	MWh	R			
2166	Energy YYYY	MWh	R			
2168	Energy YYYY	MWh	R			

Displays total energy generated in last 10 years.

i.e.: if today is 30 Sep 2024,PAR 2150 shows "2021", PAR 2152 "2024", etc.



PAR	Description	UM	Def	Min	Max	Access
301	<b>Log Time</b>		300s			ERW
	Setting of interval for saving production history.					
	Total memorization time, variable according to selected recording cycle.					
	Circular memory: the oldest data are automatically overwritten.					

Recording cycles	Memorization time
0 sec	no history
60 sec	55 gg
120 sec	abt 3.5 months
300 sec	abt 9 months
600 sec	1.5 years
900 sec	2.2 years
1200 sec	3 years

## Time

### **Note!**

Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

**Run PAR 550 Param Save to save the value of currently used parameters.**

PAR	Description	UM	Def	Min	Max	Access
70	<b>Set DateTime</b>					ERW
	Setting internal clock. Format: dd/MM/YY hh:mm.					

## Alarms

**Note:** For more information on alarms and warnings, see chapter 10.

### Active alarms

The list of active alarms and warnings is saved on this menu, with indication of the time the alarm tripped.  
Alarms are shown starting from the most recent (no.1) to the oldest (no.10).

**Note:** The alarms reset command deletes only alarms and warnings whose cause has been eliminated or is no longer active.

## Settings

### System

**Note:** Any change to the value of parameters has an immediate effect on inverter operations, but is not automatically saved in permanent memory. All unsaved changes will be lost when power to the drive is switched off.  
Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
550	Param Save		Off	Off	On	ERW
	Any change to the value of parameters has an immediate effect on inverter operations, but is not automatically saved in permanent memory. All unsaved changes will be lost when power to the drive is switched off. PAR 550 Param Save is used to save the value of currently used parameters in the permanent memory. This parameter is also visible in Easy mode if a valid password has been entered (factory or personal).					
590	Password		-	-	-	RW
	Changing the password for advanced parameterization.					
	<b>Make a note of the new password: when it is changed and saved, the default password is no longer valid. Only the new password can be used.</b>					
554	Access Mode		Easy	Easy	Expert	RW
	Easy Expert Set the parameter to Expert to access advanced parameterization. To access the parameter, enter password 1234a (factory default). The password can be changed with PAR 590 Password					



**Attention**



**Attention**

After the Default param command is run, you have to repeat the Commissioning procedure when the inverter is switched on again.

This parameter can be changed only with the inverter disabled (PAR 510 Inverter Enable= Off) and when the inverter is not generating (PAR 511 Work status= 2, Not enabled).

PAR	Description	UM	Def	Min	Max	Access
72	<b>Year</b> Setting year. Format:YY ( example : 2014 = 14).	YY				ERW
74	<b>Month</b> Setting month. Format : MM (example:June=06).	MM				ERW
76	<b>Day</b> Setting day. Format : GG (example:05).	GG				ERW
78	<b>Hour</b> Setting hour. Format: 24H (example: 10PM = 22).	DD				ERW
80	<b>Minute</b> Setting minutes. Format : mm (example : 9'=09).	m				ERW
82	<b>Second</b> Setting seconds. Format : ss (example : 6''=06).	s				ERW
83	<b>TimeZone</b> Time zone set relative to Universal Coordinated Time UTC).		0	-12	+12	ERW
84	<b>DayLightSaving</b> Automatic setting of Daylight Saving Time. With 84 "Daylightsaving" = On (default), the time automatically switches from solar to day light saving time (last Sunday in March and October) (check applicability in country of installation).		On	Off	On	ERW

## Commissioning

**Note!** Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

**Run PAR 550 Param Save to save the value of currently used parameters.**

PAR	Description	UM	Def	Min	Max	Access
5110	<b>Inverter Enable</b>		Off	Off	On	ERW

Starts and stops inverter regeneration by remote control through serial communication.

On Automatically set to ON during first firing.

Off The inverter must be set to Off to make changes to PAR 5111, 580 and 587.

580	<b>Param Default</b>		Off	Off	On	ERW
-----	----------------------	--	-----	-----	----	-----

Transfers the standard factory - set values to the inverter memory ("Def" column on the parameters table).

5111	<b>Grid code</b>		None	-	-	ERW
------	------------------	--	------	---	---	-----

Setting of Gridcode. Requested and set at first firing.

0	None	10	RD 661/2007/India 1PH
1	EN 50549-PL	11	IEC 61727/2004
2	EN 50549-1/2019	12	CEI 016
3	EN 50438/2014	13	Pakistan
4	India		
5	India-Kerala		
6	CEI 021		
7	VDE 4105		
8	VDE 0126 2006		
9	VDE 0126 A1/2012		

**Note!** This parameter can be changed only with the inverter disabled (PAR 5110 Inverter Enable = Off) and when the inverter is not generating (PAR 511 **Work status** = 2, Not enabled).

595	<b>Language</b>		None			ERW
-----	-----------------	--	------	--	--	-----

Setting the display language

None (English)

English

Polish

5120	<b>AbsPwrSetPLim</b>	%	100	0	100	ERW
------	----------------------	---	-----	---	-----	-----

Setting percentage of active power setpoint related to absolute power according to standard.

0 = 0% of absolute active power

100 = 100% of absolute active power

5114	<b>ReactPwrSetP</b>	%	0	-100%	+100%	ERW
------	---------------------	---	---	-------	-------	-----

Defines the reactive power that the inverter will generate at the connection point in "Fixed-Q" mode (PAR 5118 set to 1).

It is expressed as a percentage of rated active power P<sub>n</sub>. The permitted range of values is:

-100.0 .... +100.0.

PAR	Description	UM	Def	Min	Max	Access
0.0	equals no reactive power delivery/draw					
-10.0	equals reactive power of $0.1 \cdot P_n$ drawn from the grid. The current produced by the inverter will be phased in advance compared to voltage, with convection of the generator (inductive behavior).					
30.0	equals reactive power delivery of $0.3 \cdot P_n$ to the grid. The current produced by the inverter will be phased in delay compared to voltage, with convection of the generator (capacitive behavior).					

<b>5116</b>	<b>CosPhi Setp</b>		1.0	-0.9	+0.9	ERW
Defines the cosphi that the inverter controls at the connection point in "Fixed cos-phi "mode(PAR 5118 set to 2).						
1.0	equals no reactive power delivery/draw					
-0.9	equals production of current phased in advance compared to voltage, with convection of the generator (inductive behavior).					
0.9	equals production of current phased in delay compared to voltage, with convection of the generator (capacitive behavior).					

<b>5118</b>	<b>ReactPwrCtrl</b>		-	-	-	ERW
-------------	---------------------	--	---	---	---	-----

Setting of reactive power control mode.

0	None
1	Fixed Q
2	Fixed cos-phi
3	Q(U)
4	Cos-phi(P)

## String Settings

<b>380</b>	<b>String config 1</b>		Included			ER
Setting string monitoring. Only the parameters of strings actually present in the inverter are shown. See the table on the "Input Data" menu.						
<b>Not Included</b>		<b>string not configured for monitoring.</b>				
<b>Included</b>		<b>configured for monitoring.</b>				
<b>596</b>	<b>StringAvgTime</b>	s	300	5	1800	ERW
Setting string currents monitoring time.						
<b>597</b>	<b>StringThresh</b>	mA	3000	0	30000	ERW
String currents monitoring limit.						
<b>594</b>	<b>CO2factor</b>		531	1	1000	ERW
Conversion factor for calculating Kg CO <sub>2</sub> .						

## Communication

### **Note!**

Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

**Run PAR 550 Param Save to save the value of currently used parameters.**

PAR	Description	UM	Def	Min	Max	Access
201	<b>PortA Baudrate</b> Select baudrate (inbps) of first port. 1200bps 2400bps 4800bps 9600bps 19200bps 38400bps 57600bps 115200bps	bps	38400	1200	115200	ERW
202	<b>PortA Settings</b> Configure data packet of first port. N81 E81 O81 N71 E71 O71 N82 E82 O82 N72 E72 O72		N81			ERW
203	<b>PortA Address</b> Modbus address.		1	1	63	ERW
204	<b>PortB Baudrate</b> Baudrate (inbps) of second port. 1200bps 2400bps 4800bps 9600bps 19200bps 38400bps 57600bps 115200bps	bps	9600	1200	115200	ERW

PAR	Description	UM	Def	Min	Max	Access
205	<b>PortB Settings</b> Configure data packet of second port. N81 E81 O81 N71 E71 O71		N81			ERW
206	<b>PortB Address</b> Modbus address.		2	1	83	ERW

## Grid Settings - Voltage

### Note!

Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

**Run PAR 550 Param Save to save the value of currently used parameters.**

PAR	Description	UM	Def	Min	Max	Access
20604	<b>Vmin for Connect</b> Minimum voltage for connection to the Grid. This is set in %of VACnominal.	%				ERW
20606	<b>Vmax for Connect</b> Maximum voltage for connection to the Grid. This is set in %of VACnominal.	%				ERW
20610	<b>Delay for Connect</b> Minimum time delay for Grid connection.	s				ERW
20612	<b>Reconnect time</b> Minimum time for Grid Reconnection.	s				ERW
20852	<b>Thrsd U&lt;</b> Grid undervoltage threshold - slow limit. This is to be set in % of VACnominal	%				ERW
20854	<b>Time U&lt;</b> Time limit for grid undervoltage threshold-slow limit. This is to be set in ms.	ms				ERW
20860	<b>Thrsd U&gt;&gt;</b> Grid overvoltage threshold - Fast limit. This is to be set in % of VACnominal	%				ERW
20862	<b>Time U&gt;&gt;</b> Time limit for grid undervoltage threshold-Fast limit. This is to be set in ms.	ms				ERW
20874	<b>Thrsd U&gt;</b> Grid overvoltage threshold - Slow limit. This is to be set in % of VACnominal	%				ERW

PAR	Description	UM	Def	Min	Max	Access
20876	<b>Time U&gt;</b> Time limit for grid undervoltage threshold-Slow limit. This is to be set in ms.	ms				ERW
20878	<b>Thrsd U&lt;&lt;</b> Grid overvoltage threshold - Fast limit. This is to be set in % of VACnominal	%				ERW
20880	<b>Time U&lt;&lt;</b> Time limit for grid undervoltage threshold-Fast limit. This is to be set in ms.	ms				ERW

## Grid Settings - Frequency

**Note!** Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.  
**Run PAR 550 Param Save to save the value of currently used parameters.**

PAR	Description	UM	Def	Min	Max	Access
20600	<b>Fmin for Connect</b> Minimum voltage for connection to the Grid. This is set in %of VACnominal.	Hz				ERW
20602	<b>Fmax for Connect</b> Maximum voltage for connection to the Grid. This is set in %of VACnominal.	Hz				ERW
20864	<b>Thrsd f&lt;</b> Grid undervoltage threshold - slow limit. This is to be set in % of VACnominal	%				ERW
20868	<b>Time f&lt;</b> Time limit for grid undervoltage threshold-slow limit. This is to be set in ms.	ms				ERW
20886	<b>Thrsd f&gt;&gt;</b> Grid overvoltage threshold - Fast limit. This is to be set in % of VACnominal	%				ERW
20888	<b>Time f&gt;&gt;</b> Time limit for grid undervoltage threshold-Fast limit. This is to be set in ms.	ms				ERW
20866	<b>Thrsd f&gt;</b> Grid overvoltage threshold - Slow limit. This is to be set in % of VACnominal	%				ERW
20870	<b>Time f&gt;</b> Time limit for grid undervoltage threshold-slow limit. This is to be set in ms.	ms				ERW
20882	<b>Thrsd f&lt;&lt;</b> Grid overvoltage threshold - Fast limit. This is to be set in % of VACnominal	%				ERW
20884	<b>Time f&lt;&lt;</b> Time limit for grid undervoltage threshold-Fast limit. This is to be set in ms.	ms				ERW



## LFSM(P-Hz) Settings

### Note!

Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

**Run PAR 550 Param Save to save the value of currently used parameters.**

PAR	Description	UM	Def	Min	Max	Access
<b>11206</b>	<b>bPHZType</b> Configure PHz Type. CEI 021 CEI-016 EN50549-1-PL EN50549-1-2019					ERW
<b>20280</b>	<b>LFSMo-aPHzType</b> Activates or deactivated the LFSMo function.					ERW
<b>20286</b>	<b>LFSMo-ThrsdFreq(f1)</b> F1 frequency threshold for LFSMo.	Hz				ERW
<b>20288</b>	<b>LFSMo-DeactThrsd(fstop)</b> Fstop frequency threshold for LFSMo.	Hz				ERW
<b>20290</b>	<b>LFSMo-Slope(Droop)</b> Slope or Droop parameter for LFSMo function. Slope of 40%/Hz indicates 5% droop.	%/Hz				ERW
<b>20292</b>	<b>LFSMo-DeactTime(tstop)</b> Deactivation time for LFSMo.	s				ERW
<b>20294</b>	<b>LFSMo-IntentionalDelay</b> Intentional delay for LFSMo.	s				ERW
<b>22286</b>	<b>LFSMu-ThrsdFreq(f1)</b> F1 frequency threshold for LFSMu.	Hz				ERW
<b>22288</b>	<b>LFSMu-DeactThrsd(fstop)</b> fstop deactivation threshold for LFSMu.	Hz				ERW
<b>22290</b>	<b>LFSMu Slope(Droop)</b> Slope or Droop parameter for LFSMu function. Slope of 40%/Hz indicates 5% droop.	%/Hz				ERW
<b>22292</b>	<b>LFSMu-DeactTime(tstop)</b> Deactivation time for LFSMu.	s				ERW
<b>22296</b>	<b>LFSMu-IntentionalDelay</b> Intentional delay for LFSMu.	s				ERW

## 9. Communication

### 9.1 RS485 serial connection with MODBUS RTU protocol

Communication is performed via RS485 serial connection with MODBUS RTU protocol.

To configure communication between the inverter and the monitoring/software system, you have to respect numerous elements in order to ensure correct functioning.

You can connect and communicate with a maximum of 50 nodes. DO NOT exceed 10 meters for the communication line (for longer lengths please contact Solar Service).

In case of communication between a single inverter and a PC (with supervision SW or inverter configuration SW installed), you need to use a USB-RS485 converter cable (we recommend our cable code 8S8F60 length 1.8 meters or code 8S8F61 length 5 meters (laboratory tested); other "passive" converters may not work).

Example of connection: with one inverter see Figure 24.



We recommend running the serial connection cable in a tray separated from power cables.

In case of systems with high interference, we recommend shielding the cables with a metal pipe (grounded at a single point).

In case of communication between multiple inverters and a PC or between one or more inverters and the datalogger.

- for the connection, use a cable consisting of two symmetrical twisted pairs, spiraled with a single shield, typical impedance  $Z_0=120\text{ ohm}$  (minimum  $2 \times 2 \times 0.22\text{ mm}^2$  or min.  $2 \times 2\text{ AWG24}$ ),
- the cable shield must be continuous for the entire chain and must be grounded at a single point.

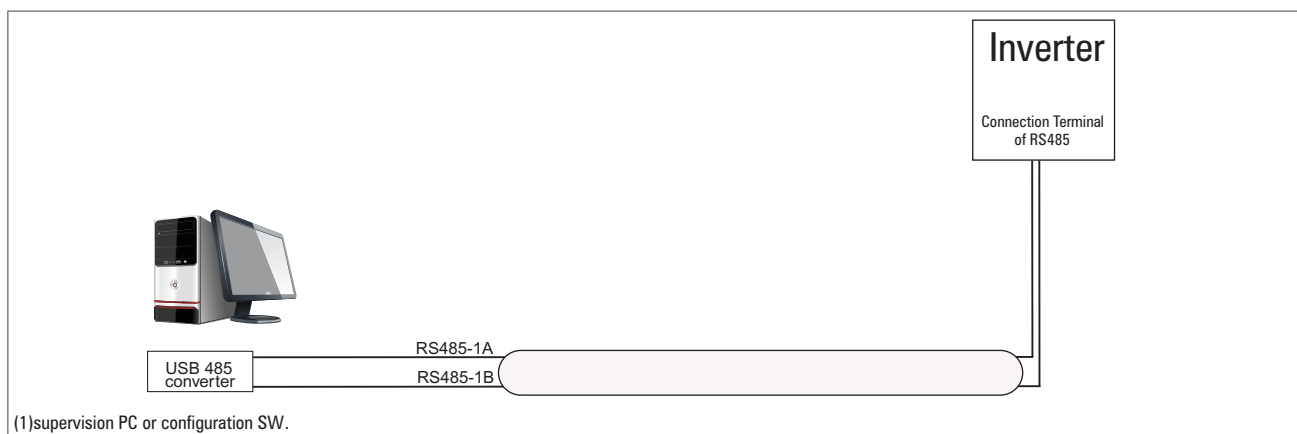


Figure 24 : RS-485 connection to the inverter

#### Note!

The first and last element of the modbus chain must have the termination resistor inserted.

## 10. Troubleshooting

### 10.1 Error messages classification

The inverter PVSA is able to report alarms / warnings on the display if the input voltage is higher than the  $V_{START}$ .

It is possible to distinguish the type of error in “alarm” or “warning” as described in the following table:

<b>Alarms</b>	Red led on Green led off	These alarms stop the inverter
<b>Warnings</b> Code from 1 to 16	Red led off Green led blinking	The inverter continues to operate and generate but it reports this warning by detecting an abnormality at inverter level. The inverter can stop if these warnings are combined with other alarms.
<b>Warnings</b> Code from 81 to 84	Red led off Green led blinking	The inverter continues to operate and generate but it reports this warning by detecting an abnormality at system / plant level or the need to perform maintenance

### 10.2 Alarms and Warnings list

Cod. (1)	Displayed message	Type	Description	Cause	Solution
1	AFE Comm	Warning	AFE Communication error	No communication with AFE micro	Do an alarm reset. *
2	Boost Comm	Warning	Boost Communication error	No communication with Boost micro	Do an alarm reset. *
3	AFE Boot	Warning	AFE in Boot State	AFE did not load software. Occurs if update is interrupted	Do an alarm reset. *
4	Boost Boot	Warning	Boost in Boot State	Boost did not load software. Occurs if update is interrupted	Do an alarm reset. *
5	EEPROM error	Warning	Parameter Save/Load error	HMI lost saved parameters	Re-parameterize inverter. *
6	String error	Warning	String Current Test error	One or more monitored strings have values beyond limit	Check set limits and that strings are correctly connected.. * / **
7	Log error	Warning	Log error	Cannot read or write production or alarms log	Check that log was correctly copied to USB drive. If not, copy it again. If you are not copying the log to a USB drive, contact Radius Solar Service **
8	HMI Boot	Warning	HMI in Boot State	HMI did not load software	Contact Radius Solar Service
9	Low Battery	Warning	Low Battery	Replace clock battery	Check that battery is correctly inserted. If it is, it means that it is drained. Replace it by following the instructions in the manual. */**
10	File error	Warning	File error	USB read/write error	Check that USB is inserted correctly and that process was successful. If not, reinsert USB and/or repeat process. *
11	USB error	Warning	USB error	USB hardware error	Do an alarm reset. *
12	LoadDefault error	Warning	Load default error	Cannot load default parameters	Check inverter parameterization. */**
13	Slave Comm	Warning	PVSA Slave comm error	Slave Communication error	Check that slave inverters are connected and on
14	WatchDog Error	Warning	WatchDog Error	Internal Error detected by HMI	Do an alarm reset. *
15	Low InputVoltage	Warning	Low Input Voltage	Input voltage too low	Do an alarm reset. *
16	Grid Not OK	Warning	Grid voltage is not suitable for grid connection.	Grid voltage not proper.	Check that available grid voltage conforms to requirement of selected relevant Grid Standard. */**
17	Input OV DC Bus	Alarm	Over Voltage on DC bus detected from Boost	Input voltage too high .	Check that configuration of strings conforms to characteristics of inverter specified in manual. */**
18	Input OC SW 1	Alarm	Over Current Boost SW	Maximum input current exceeded	Check that inputs from PV panels are correct. */**
19	Internal com err	Alarm	Wrong internal communication	Communication problems among internal devices	Switch inverter OFF and then back ON. *
20	Input IGBT Desat	Alarm	Overcurrent Boost 2	Maximum input current exceeded	Check that inputs from PV panels are correct. */**

Cod. (1)	Displayed message	Type	Description	Cause	Solution
21	Insulation err	Alarm	Insulation Resistance Error	PV field insulation below limits	Check insulation of PV field. *
22	Missed config 1	Alarm	Wrong Configuration / Size	Initialization error	Do an alarm reset. *
23	Leakage curr B	Alarm	Leakage current Error detected from Boost	Leakage current detected on AC side	Check insulation of PV field. *
24	Micro OT B	Alarm	Boost micro over temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Radius Solar Service
25	Internal err 1	Alarm	Internal error 1	Internal error in inverter	Switch inverter OFF and then back ON. *
26	Ground kit err	Alarm	Ground Kit Error	Loss of PV generator isolation and leakage to ground	Check isolation to ground and replace fuse after eliminating cause of error.. *
27	Klixon err 1	Alarm	Klixon error	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Radius Solar Service
28	Redundancy err 1	Alarm	Redundancy Error	Conflict between measurements of leakage current	If problem persists, contact Radius Solar Service
29	Boost Trap	Alarm	Boost Trap	Internal error in inverter	Switch inverter OFF and then back ON. *
30	AFE Reset	Alarm	AFE Reset	Internal error in inverter	Switch inverter OFF and then back ON. *
31	Overtemperature HW	Alarm	Overtemperature HW	Overtemperature in inverter	Check inverter ventilation is as per requirement.
32	Input Overcurrent HW	Alarm	Input Overcurrent HW	Maximum input current exceeded	Check input panels are correctly configured. If problem persists, then restart the inverter.
49	DC Link UV A	Alarm	DC bus undervoltage	Voltage on DC bus below limits	If problem persists, contact Radius Solar Service
50	DC LINK OV A	Alarm	DC bus overvoltage (Inverter)	Voltage on DC bus above limits	Do an alarm reset. *
51	DC Link Unbalance	Alarm	DC bus unbalanced	Voltage on DC bus above limits	Check that configuration of strings conforms to characteristics of inverter specified in manual. */**
52	Output OC 1	Alarm	Over Current SW Inverter	Maximum output current exceeded	Do an alarm reset. *
53	Output IGBT Desat	Alarm	Over Current IGBT inverter	Maximum output current exceeded	Do an alarm reset. *
54	Grid UV	Alarm	Grid Under Voltage	Grid voltage below minimum levels	Wait for return of grid conditions needed to start the inverter
55	Grid OV	Alarm	Grid Over Voltage	Grid voltage above maximum levels	Wait for return of grid conditions needed to start the inverter
56	Grid UF	Alarm	Grid Under Frequency	Grid frequency below minimum levels	Wait for return of grid conditions needed to start the inverter
57	Grid OF	Alarm	Grid Over Frequency	Grid frequency above maximum levels	Wait for return of grid conditions needed to start the inverter
58	Redundancy err 2	Alarm	Redundancy Error	Conflict between measurements of output voltage	Do an alarm reset. *
59	Sink OT B	Alarm	Input Side Module Over Temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Radius Solar Service
60	Grid fail	Alarm	Input Side Module Under Temperature	Grid Disconnection During Inverter generation	Wait for return of grid conditions needed to start the inverter
61	Sink OT A	Alarm	Output Side Module Over Temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Radius Solar Service
62	Sink UT A	Alarm	Output Side Module Under Temperature	Temperature below allowed limits	Wait for temperature to return to working range. If problem persists, contact Radius Solar Service
63	DC Current Inj	Alarm	DC Injected Over Limit	DC current injected in grid has exceeded limit	Do an alarm reset. *
64	LeakageCurrent A	Alarm	Leakage Current Over Limit	Leakage current detected on AC side	Check insulation of PV field. *
65	Power Relay err	Alarm	Grid Relay Fault	Relay check procedure failed	Do an alarm reset. *
66	Micro OT A	Alarm	Inverter Micro Over Temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Radius Solar Service

Cod. (1)	Displayed message	Type	Description	Cause	Solution
67	Kilxon Error 2	Alarm	Inverter overtemperature	Inverter overtemperature	Check inverter temperature and inverter ventilation
68	Wrong Size	Alarm	Wrong Size file	Wrong size file detected	Switch inverter OFF and then back ON. *
69	AC Voltage Unbalanced	Alarm	AC Voltage Unbalanced detected	Grid unbalanced	Check voltages and connection to grid
70	Internal Comm. Error	Alarm	Internal Error	Comm. problem in internal devices	Switch inverter OFF and then back ON. *
71	AFE trap	Alarm	Afe Trap	Internal error in inverter	Switch inverter OFF and then back ON. *
72	Boost Reset	Alarm	Boost Reset	Internal error in inverter	Switch inverter OFF and then back ON. *
73	A Overload	Alarm	Overload detected	Overload in output	Check grid voltages
74	AFE wrong firmware	Alarm	AFE Wrong Firmware	AFE wrong firmware	Download the correct firmware*
75	AC current unbalance	Alarm	Current unbalance detected	AC current unbalance detected	Check output current of the inverter.
76	N-E overvoltage	Alarm	N-E overvoltage	Earth to neutral voltage not correct	Check earth to neutral voltage*
77	Output OC HW2	Alarm	Output overcurrent HW	Output side overcurrent	Check output current of the inverter.
81	OverVoltageVin	Warning	Over Voltage Input Voltage	Input voltage is in over the warning level	Check the PV plant
82	Module OT	Warning	Over Temperature IGBT Boost Module (first level)	Inverter temperature over the warning level	Check the PV plant
83	Heatsink OT	Warning	Over Temperature Sink Module (first level)	Inverter temperature over the warning level	Check the PV plant
84	SPD not OK	Warning	At least one SPD failed	At least one SPD failed	Do an alarm reset. *

\*\* Do an alarm reset,

If problem persist contact Radius Solar Service

## 11. Specifications

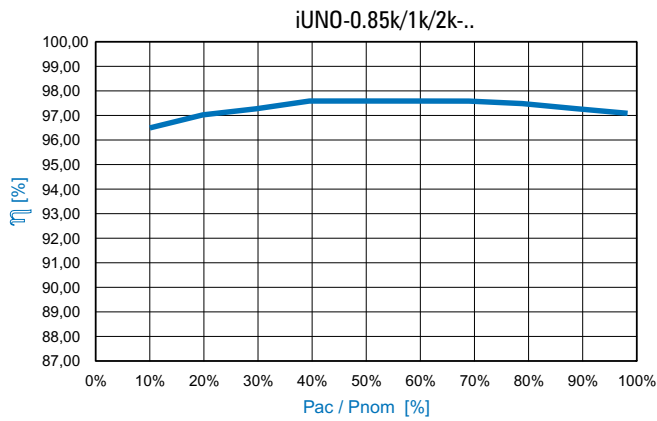
### 11.1 iUNO-INV(1)-XKX-1M-BT-XXXXXX models

RADIUS - iUNO		0.85kW-1M	1.0kW-1M	1.5kW-1M	2.0kW-1M	2.5kW-1M	3.0kW-1M	3.3kW-1M	3.6kW-1M	3.8kW-1M	4.0kW-1M	4.2kW-1M	4.4kW-1M	4.6kW-1M	4.8kW-1M	5.0kW-1M
INPUT DATA (DC SIDE)																
Input Data	Maximum DC voltage	V <sub>DC</sub> max	[V]	550												
	MPPT Operating Range		[V]	50V-490V												
	Start up voltage/Nominal(Rated Voltage)		[V]	50V/360V												
	Max. Recommended PV Power		[Wp]	1275	1500	2250	3000	3750	4500	4950	5400	5700	6000	6300	6600	6900
	MPPT number	No. MPPT		1	1	1	1	1	1	1	1	1	1	1	1	1
	Number of strings per MPPT	No.		1	1	1	1	1	1	1	1	1	1	1	1	1
	Maxm DC current per MPPT	I <sub>max</sub>		20	20	20	20	20	20	20	20	20	20	20	20	20
	Maxm Short Circuit Current	I <sub>sc</sub>	[A]	25	25	25	25	25	25	25	25	25	25	25	25	25
Output Data	Rated AC Power/Maxm AC Power	P <sub>NOM/MAX</sub> AC	[W/VA]	850/935	1000/1100	1500/1650	2000/2200	2500/2750	3000/3300	3300/3630	3600/3960	3800/4180	4000/4400	4200/4620	4400/4840	4600/5060
	AC rated current/Max current	I <sub>AC</sub> Nom/Imax	[A]	3.7/4.1	4.3/4.7	6.5/7.1	8.6/9.5	10.8/11.9	13/14.3	14.3/15.8	15.6/17.2	16.5/18.2	17.4/19.1	18.3/20.1	19.1/21.0	20.0/22.0
	AC voltage	V <sub>AC</sub>	[V]	{(220V <sub>LN</sub> )/(230V <sub>LN</sub> )/(240V <sub>LN</sub> )} {output voltage Range (184...277V <sub>LN</sub> )}												
	Rated AC frequency	f <sub>AC</sub>	[Hz]	50/60Hz (Output frequency range (45-55)/(55-65) Hz)												
	Grid connection			Line-Neutral-PE												
	Current THD	THDi	[%]	≤3 <sup>2)</sup>												
	Power factor (settable)	cosphi		+/- 0.8												
	Max inverter backfeed current to the array (AC or DC)		(A)	0												
	Max output fault current (AC. Peak and Duration)			Peak:45A <sub>pk</sub> ( t <sub>d</sub> :80us)												
Efficiency	Maximum efficiency <sup>2)</sup>		[%]	97.2	97.2	97.3	97.2	97.5	97.5	97.4	97.3	97.3	97.4	97.4	97.4	97.6
	European efficiency (η <sub>Euro</sub> )		[%]	97.1	97.1	97.2	97.0	97.3	97.3	97.3	97.2	97.1	97.2	97.2	97.3	97.4
Protections	Interface protections(grid monitor)			Integrated												
	Anti-islanding			Integrated (Where required by local regulations)												
	Insulation control			Integrated												
	Residual current monitoring			Integrated												
	Reverse DC polarity protection			Integrated												
	AC/DC overvoltage			Inbuilt AC SPD & DC SPD (SPD failure detection and indication through alarm)												
	DC injection control			Integrated												
	DC circuit breaker			Circuit breaker under load(optional)												
	DC fuses & string failure detection			20A/25A fuses on both poles of each string(optional)												
	Night Consumption(Standby loss)			<1W.												

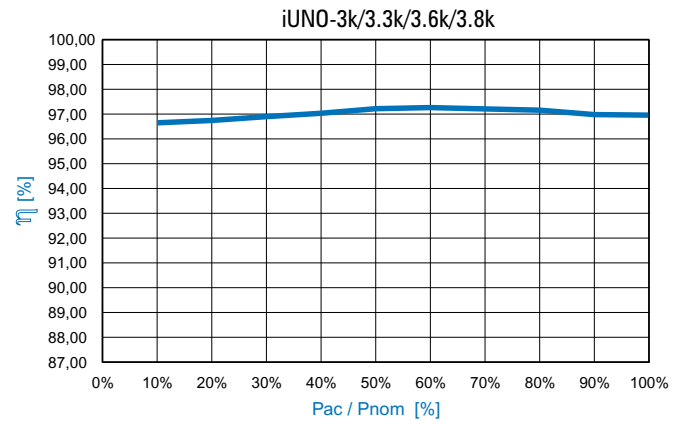
RADIUS - iUNO		0.85kW-1M	1.0kW-1M	1.5kW-1M	2.0kW-1M	2.5kW-1M	3.0kW-1M	3.3kW-1M	3.6kW-1M	3.8kW-1M	4.0kW-1M	4.2kW-1M	4.4kW-1M	4.6kW-1M	4.8kW-1M	5.0kW-1M
INTERFACES																
Interface	User Interface		LED indicators, Display, LCD/OLED Display(optional) and local monitoring via mobile App by Bluetooth connection & Solar connect software(Windows) (only for firmware updates and downloading of historical data)(optional)													
	Communications		RS485/WIFI/Ethernet/GPRS/4G/Bluetooth/ Cloud Server Communication													
	Inputs/Outputs		Analog Input, digital output / optional													
COOLING																
Cooling		Natural Convection														
ENVIRONMENT DATA																
Environment Data	Temperature Range		-25 °C.... +60 °C(No derating upto 50°C) <sup>3)</sup>													
	Noise Emission(Typical)		<35dB(A)													
	Vibration		1G													
	IP protection degree		IP 66													
	Environmental conditions		4K4H													
	Maximum permissible value for relative humidity, non condensing		0 %RH ~ 100 %RH													
	Pollution degree		EN 60721-3-4, free from direct solar radiation To avoid increase in the internal temperature of the inverter and cause a reduction of the output power (derating)													
Altitude		Up to 3000m														
Standards	Approvals		IEC 60068-2-1/2/14/30, IEC 61727, IEC 62109-1/2, IEC 62116,EN50530 IEC 61683, IEC 60529, IEC 61000-6-3/2, CE, VDE-0126, BIS Registered													

- 1) Tripping limits are set as per the local regulations & governing standards
- 2) The efficiency values are defined through measuring process with high precision instruments during nominal conditions.
- 3) Refer temperature vs power derating curve on page 61

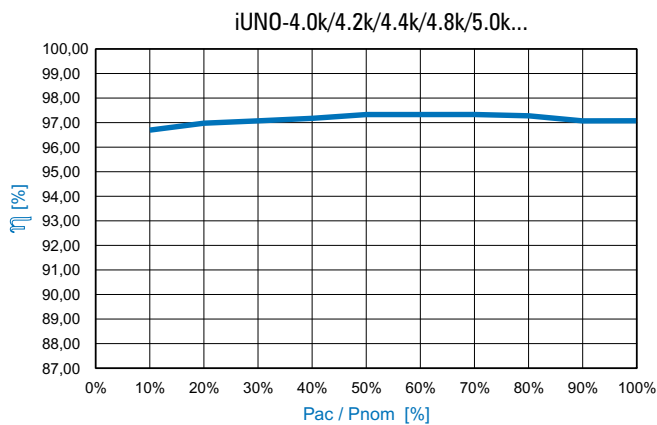
### 11.1.1 Efficiency curves



@360Vdc iUNO-0.85k/1k/2k...

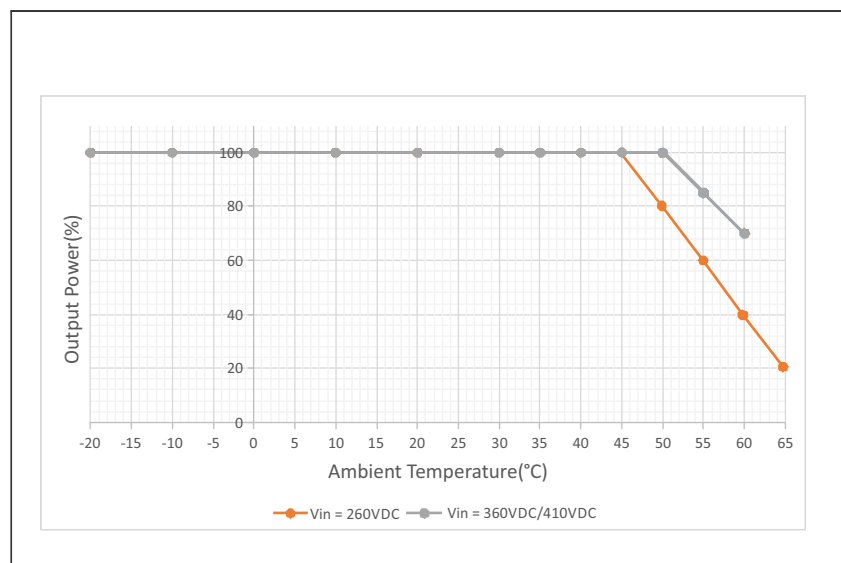


@360Vdc iUNO-3k/3.3k/3.6k/3.8k...



@360Vdc iUNO-4.0k/4.2k/4.4k/4.8k/5.0k...

### iUNO TEMPERATURE DERATING CURVE



#### Note!

The efficiency values are defined through measuring process with high precision instruments during nominal conditions. The inverters not working under nominal conditions can have different efficiency data.



12. Dimensions and weight

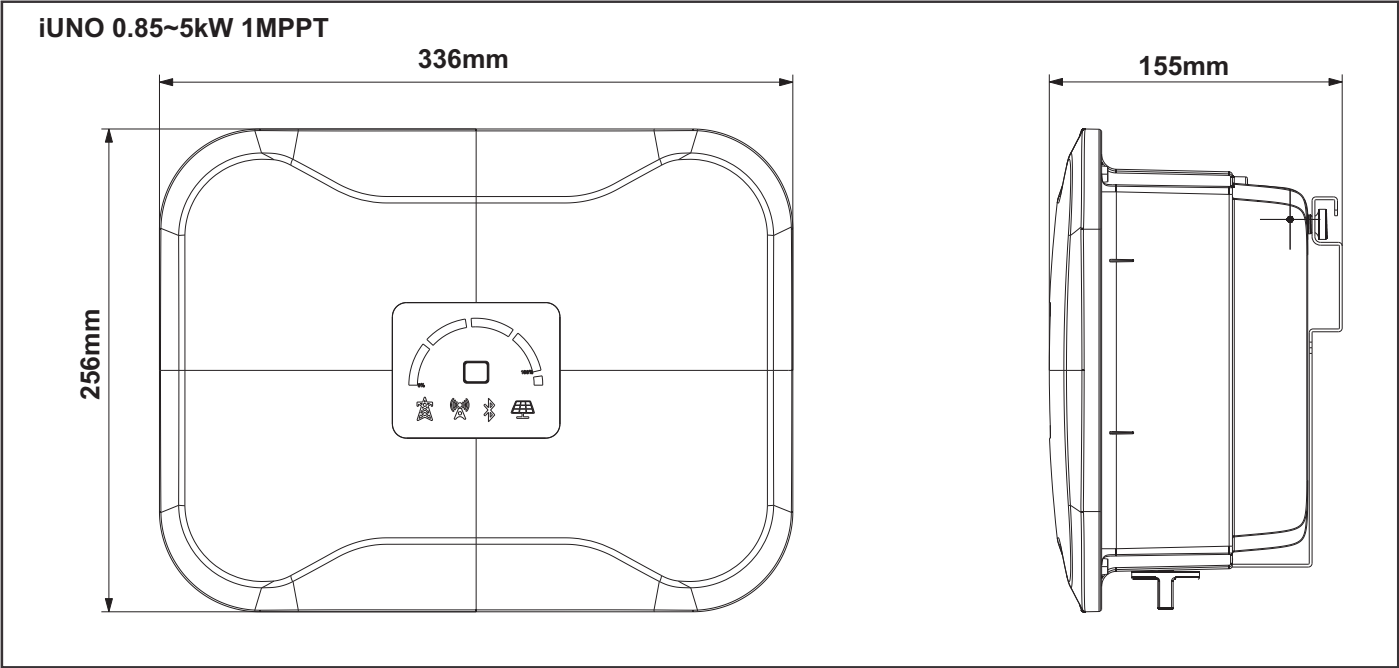


Figure 25: Dimensions - iUNO model

RADIUS - iUNO		0.85kW-1M	1.0kW-1M	1.5kW-1M	2.0kW-1M	2.5kW-1M	3.0kW-1M	3.3kW-1M	3.6kW-1M	3.8kW-1M	4.0kW-1M	4.2kW-1M	4.4kW-1M	4.6kW-1M	4.8kW-1M	5.0kW-1M
INTERFACES																
Dimensions: Width x Height x Depth	mm	336 x 256 x 155mm														
	[inches ]	[13.22 x 10.07 x 6.14]														
Weight	kg	6														
	[lbs]	17.63														

## 13. Maintenance and cleaning

---

The maintenance and cleaning operations described here are necessary to guarantee the minimum safety requirements of the PV inverter. It is strongly recommended to have maintenance and cleaning procedures performed by Radius personnel.



### **Warning!**

Operation to be performed by specially trained personnel.

Before carrying out any maintenance or cleaning operations, remove all dangerous voltage from inside the panel.

To remove all dangerous voltage from inside the panel, disconnect all the external power connections (AC side and DC side) and take steps to prevent voltage from being accidentally re-applied. Put up appropriate signs to indicate work in progress and to prohibit all maneuvers.

Wait 10 minutes before starting any work (to allow the capacitors to discharge).

Follow all the safety instructions in this manual.

Make sure all power supplies have been disconnected before touching any parts.

Maintenance personnel must be qualified and provided with adequate protective equipment.

Qualified personnel must have the followings skills:

- Knowledge of how an inverter works and is operated;
- Training in how to deal with the dangers and risks associated with controlling and servicing electrical devices and plants;
- Training in the maintenance of electrical devices and plants;
- Knowledge of all applicable standards and directives;
- Knowledge of and adherence to these instructions, including all safety precautions.

Protective equipment used must meet the requirements of directive 89/686/EC. Protective equipment must also include any additional protections required under applicable legislation or otherwise prescribed.

Never remove any interlocks, guards or protective devices on the equipment or use these incorrectly.

Do not remove or conceal warning signs affixed to machinery.

Do not modify circuits or software programs or make adjustments without the manufacturer's prior consent. Any such modifications could pose a risk for persons or equipment.

### 13.1 Product label

The product label identifies the inverter.

#### Environmental conditions during maintenance

The penetration of humidity and dust can damage the inverter.

Maintenance must only be carried out in humidity- and dust-free conditions.

#### Keeping technical documentation

This manual must always be available for use by persons responsible for operating and servicing the equipment.

Keep this documentation next to the inverter.

## 13.2 Cleaning operations

It is important to avoid any build-up of dust on the outside of the inverter. DO NOT use corrosive products or material that generates electrostatic charges for this purpose.

Check the cleanliness of the internal components of the inverter panel every 12 months. Remove any dust with a low-pressure jet of water or soft cloth.

Cleaning must be performed on inverters installed in particularly dusty environments.

## 13.3 Routine maintenance procedures

- Periodic checks

Action	Frequency
Check that all labels and danger signs are completely legible	12 months
Check that the cables coming from outside the inverter are in perfect condition	12 months
Visually check for any damage to the inverter casing	12 months
Check that the ambient conditions of the inverter installation still comply with the ambient data shown on chapter 11.	12 months
Check integrity of cable clamps	12 months

## 14. Warranty conditions

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The warranty is valid from the date of delivery of the RADIUS products.

The standard manufacturer's warranty, included in the price of the product, is valid starting from the date of delivery.

Before the end of that period you may purchase the extended warranty.

For more information on warranty terms and conditions, contact RADIUS solar sales.

## 15. Contact

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