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INSTRUCTION MANUAL FOR THE INSTALLER

UNO-2.0-I / UNO-2.5-I

TRANSLATION OF THE ORIGINAL INSTRUCTIONS

This manual must be considered as an integral part of the equipment, and must be available at all times to everyone who interacts with the equipment.
The manual must always accompany the equipment, even when it is transferred to another user.

Operators are under an obligation to read this manual and strictly follow the instructions given in it, because ***Power-One*** cannot be held responsible for damage caused to people or property, or for damage to the equipment, if the conditions described below are not complied with.

The customer is under an obligation to keep the industrial secret, and therefore the following documentation and its annexes non may not be tampered with or modified, reproduced or transferred to third parties, without the authorization of ***Power-One***.

000049CG - UNO-2.0-2.5-I-OUTD-Installer EN Rev C (M000003CG)

—1 - Introduction and general information

Conditions of warranty and supply

Warranty conditions **are described in an appropriate certificate supplied with the equipment**. Moreover, the warranty conditions are understood to be valid if the Client observes what is described in this manual; any conditions deviating from those described below must be explicitly agreed upon in the purchase order.

Power-one declares that the tool complies with legal provisions in force in the European Economic Community and releases statements of compliance.

Exclusions from the supply

Power-one declines any responsibility in case standards for correct installation are not adhered to and it is not liable for systems upstream or downstream of the equipment supplied by it.
It is absolutely prohibited to make modifications to the equipment.
The Customer is entirely responsible for any modifications made to the system.

It is not possible to provide the multitudes of installations and environments in which the tool will be installed; for this it is necessary to checked for: adequate spaces, adapted to accept the tool; air noise produced as a function of the environment; any conditions of flammability.

Power-one cannot be held responsible for lack of production even if it results from break-downs of the tool, or the data communication system.

Power-one CANNOT be held responsible for defects or malfunctions as a result of: improper use of the tool; alterations due to transportation or special environmental conditions; lack of or improper maintenance; tampering or poor repairs; use or installation done by non-qualified people.

Power-one CANNOT be held responsible for disposal of: displays, cables, batteries, accumulators etc. It is necessary that the Client provides, according to standards in force in the country of installation, disposal of such substances that are potentially harmful to the environment.

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01, bracket
02, inverter
03, locking screw
04, front cover
05, main board
06, service cable glands
07, DC disconnect switch
08, AC cable gland
09, AC output screw terminal block
10, DC input connectors
11, anticondensation valve
12, display
13, keypad
14, LED panel
15, heat sink

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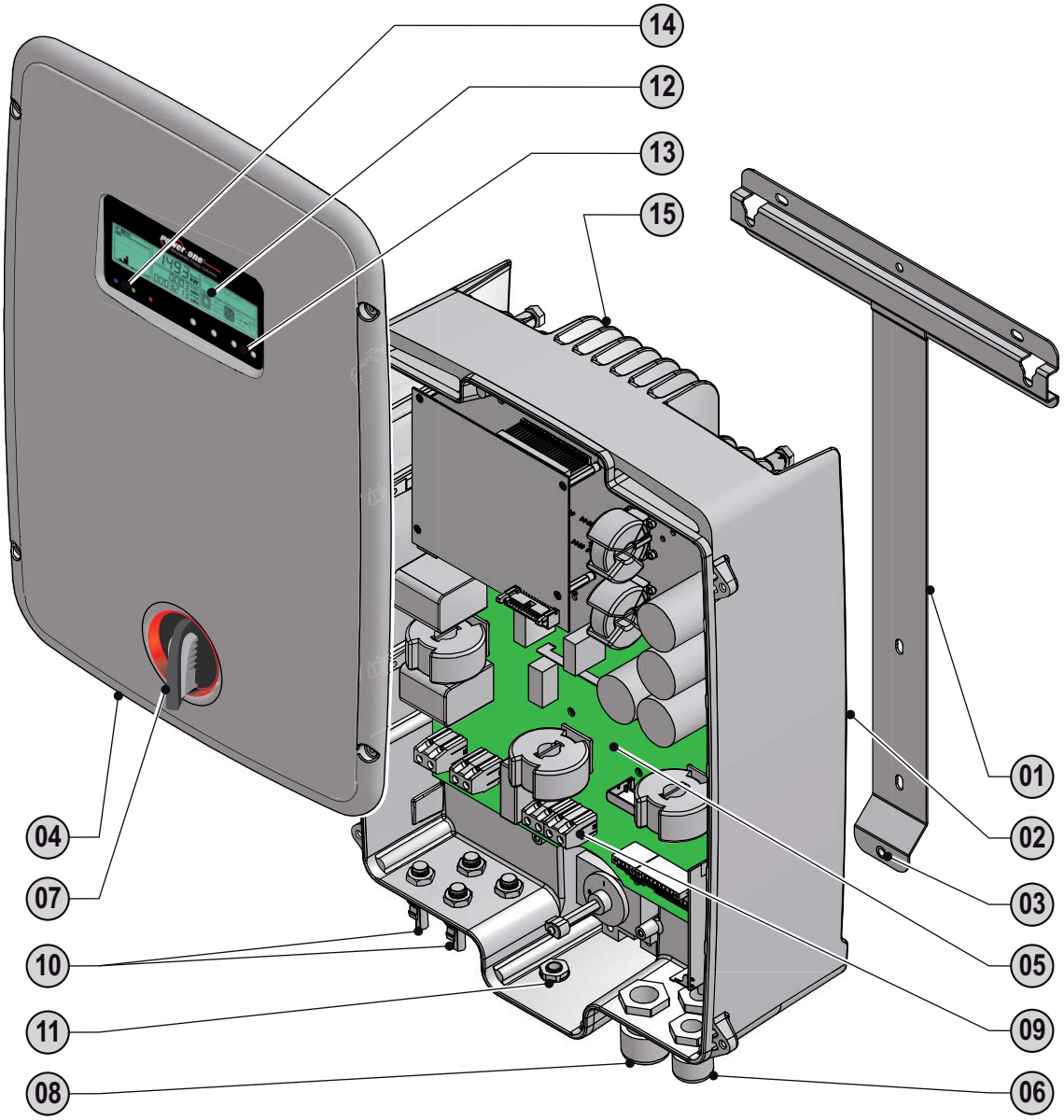
Graphical representation of references



The document and who it is for

Purpose and structure of the document

This operating and maintenance manual is a valid guide that will enable you to work safely and carrying out operations necessary for keeping the equipment in good working order.

The document was originally written in ITALIAN; therefore, in the event of inconsistencies or doubts please ask the manufacturer for the original document.

List of annexes

In addition to this operating and maintenance manual, (if applicable or on request) the following attached documentation is supplied:
- EC declaration of conformity
- quick installation guide
- service manual for the installer
- warranty

WARNING: Part of the information given in this document is taken from the original documents of the suppliers. This document contains only the information considered necessary for the use and routing maintenance of the equipment.

Staff characteristics

The customer must make sure that the operator has the necessary skill and training to do his/her job. Staff in charge of using and maintaining the equipment must be skilled, aware and mature for the described tasks and must have the reliability to correctly interpret what is described in the manual.

The employment of a person who is NOT qualified, is drunk, or on narcotics, has a prosthetic mitral valves or a pacemaker is strictly forbidden.

The customer is civilly liable for the qualification and mental or physical conditional of the professional figures who interact with the equipment. They must always use the personal protective equipment provided for by the laws of the country of destination and whatever is provided by their employer.

Reference regulations

The reference standards complied with in the design and manufacture of the equipment are described below.

- **2006/95/EC** Low-voltage directive (ex 73/23/EEC).

- **2004/108/EC** Electromagnetic Compatibility Directive, Italian Legislative Decree D.Lgs. 6/11/2007 no. 194 (ex 89/336/EEC).

- **D.Lgs. no. 81 of 9/4/2008** Implementation of the Consolidation Act on safety (ex D.Lgs. 626/94 of 18/9/1994), directives for improvement of occupational health and safety.

- **UNI EN ISO 14121-1: 2007** Safety of machinery - Principles for risk assessment.

- **IEC EN 62109-1: 2011** Safety of power converters for use in photovoltaic power systems. Part 1: General requirements.

- **IEC EN 62109-2: 2011** Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters

- **UNI EN 12198-2: 2009** Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery.

- **UNI 9513:1989** Vibration and shock. Vocabulary. - Defines terms relating to vibration and shock.

- **IEC 70-1 (EN 60529 June 1997)** Degrees of protection provided by enclosures (IP code).

- **UNI 10893: 2000** Technical product documentation – instructions for use. Organization and order of contents

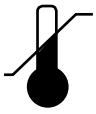
- **UNI ISO 10015: 2001** Guidelines for training.

- **ISO 7000 - DIN 30600** Graphic symbols and signs for function identification.

- **UNI 11394: 2001** Technical information – System for assessing the instructions for use of technical goods.

Symbols and signs

Table: Symbols

	In the manual and/or in some cases on the equipment, the danger or hazard zones are indicated with signs, plates, symbols or icons, like the CE marking.
	This points out that it is mandatory to consult the manual or original document, which must be available for future use and must not be damaged in any way.
	This points out operations or situations in which staff must be very careful, respectively: Generic hazard or hazardous voltage
	This points out a hazard due to the presence of heated areas or in any case areas that have hot parts (danger of burns).
	This points out that the examined area must not be entered or that the described operation must not be carried out.
	This points out that the equipment must not be worked on by anyone with a pacemaker, prosthetic mitral valve or prosthesis with electronic circuits.
	This points out that it is mandatory to carry out the described operations using the clothing and/or personal protective equipment provided by the employer.
	This indicates the degree of protection of the equipment according to IEC standard 70-1 (EN 60529 June 1997).
	Point of connection for grounding protection.
	This indicates the allowed temperature range
	This indicates the risk of electric shock. Time need to discharge stored energy: 5/10 minutes
	This indicates that the equipment must be disposed of in accordance with the regulations in force in the country of installation.
	Respectively direct current and alternating current
	Isolating transformer present or not present
	Positive pole and negative pole of the input voltage (DC)
	This indicates the centre of gravity of the equipment.

Field of use, general conditions

Power-One accepts no liability for damage of any kind that may arise from incorrect or careless operations.

The equipment must not be used for uses that do not fall within the intended field of use. The equipment MUST NOT be used by inexperienced staff, or by experienced staff to carry out operations on the equipment that are not in accordance with what is described in this manual and in the attached documents.

Intended or allowed use

This equipment is a multi-string inverter designed to:
transform a direct electric current (DC)
coming from a photovoltaic generator (PV)
into an alternating electric current (AC)
Suitable for being fed into the national grid.

Limits of the field of use

The operating current dispersed during normal operation must not exceed the limits specified in the technical specifications.
Only one photovoltaic generator can be connected to the input of the inverter (do not connect batteries or other sources of power supply)
The inverter can be connected to the electricity grid in qualified countries only.
The inverter can be used only if all the technical characteristics are observed.

Improper or disallowed use

THE FOLLOWING ARE STRICTLY FORBIDDEN:
• Installing the equipment in environments with particular flammability conditions or in adverse or disallowed environmental conditions (temperature and humidity)..
• Using the equipment with the safety devices not working or disabled.
• Using the equipment or parts of the equipment by connecting it to other machines or equipment, unless expressly provided for.

• Modifying the operating parameters that are not accessible to the operator and/or parts of the equipment to vary the performance or change its insulations.

• Cleaning with corrosive products that may corrode parts of the equipment or generate electrostatic charges.
• Using or installing the equipment or parts of it without having read and correctly interpreted the contents of the operating and maintenance manual.

• Warming or drying rags and clothes on parts at temperature. Besides being dangerous, this would compromise the ventilation and cooling of the components.

2 - Characteristics

General conditions

The description of the characteristics of the equipment allows its main components to be identified, to refine the technical terminology used in the manual.
The technical terminology and the quick information finding system are assisted by the following:
• Contents
• Numerical index of references
• Index.
The Characteristics chapter contains information about the models, the composition of the equipment, the characteristics and technical data, the overall dimensions and the identification of the equipment.

This manual should be read inchronological order as established by the manufacturer and the reader assumes responsibility for failure to do so. All the information is given considering each time that the information of the preceding chapters has been acknowledged.

In some cases, there may be a need to separately document the operation of the software or attach supplementary documentation to this manual for more qualified professional figures.

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Models and range of equipment

The specific models of multi-string inverter that this manual is about are divided into two groups according to the maximum output power (2 kW or 2.5 kW).
For inverters of equal output power the variant between the various models is the presence or lack thereof, of the DC disconnect switch **07**.

The choice of model of inverter must be made by a qualified technician who knows about the installation conditions, the devices that will be installed outside the inverter and possible integration with an existing system.

- **2.0 kW Single-phase MODELS**

UNO-2.0-I-OUTD: Standard version
UNO-2.0-I-OUTD-S: Version equipped with DC disconnect switch **07**

- **2.5 kW Single-phase MODELS**

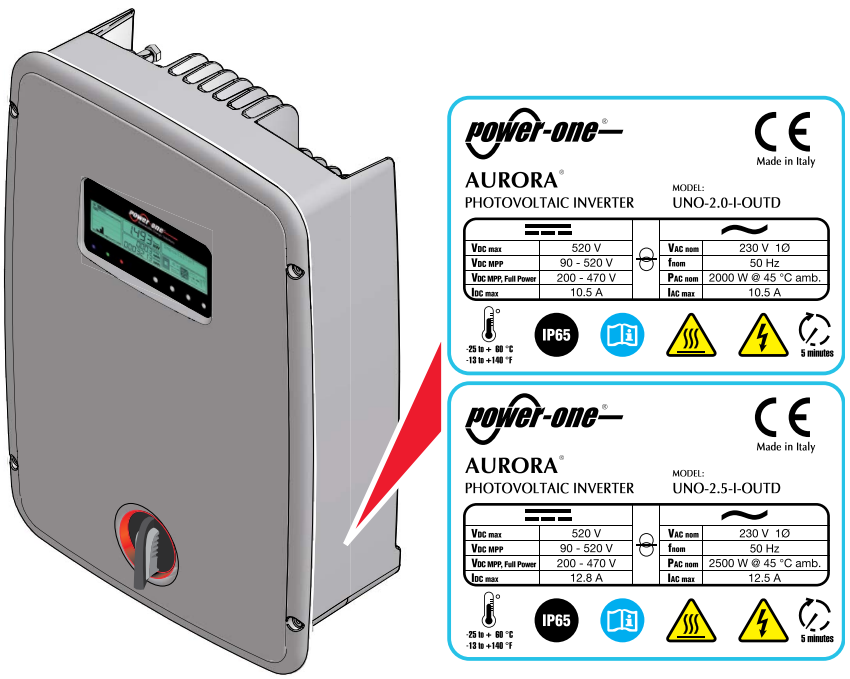
UNO-2.5-I-OUTD: Standard version
UNO-2.5-I-OUTD-S: Version equipped with DC disconnect switch **07**

Identification of the equipment and the manufacturer

The technical data shown in this manual do not in any case replace those shown on the plates attached to the equipment.

The plates attached to the equipment must NOT be removed, damaged, dirtied, hidden, etc.

N.B. The plates must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.); they must be cleaned regularly and kept visible at all times.



Characteristics and technical data

Table: Technical Data	UNO-2.0-I-OUTD	UNO-2.5-I-OUTD
Input		
Absolute Maximum DC Input Voltage (Vmax,abs)	520 V	
Start-up DC Input Voltage (Vstart)	200 V (adj. 120...350 V)	
Intervallo Operativo di Tensione DC in Ingresso (Vdcmin...Vdcmax)	0.7 x Vstart...520 V	
Rated DC Input Power (Pdcr)	2100 W	2600 W
Number of Independent MPPT	1	
Maximum DC Input Power for each MPPT (PMPPTmax)	"2300 W Linear Derating from MAX to Null [470V≤VMPPT≤520V]"	"2900 W Linear Derating from MAX to Null [470V≤VMPPT≤520V]"
MPPT Input DC Voltage Range (VMPPTmin,f ... VMPPTmax,f) at Pacr	200...470 V	200...470 V
Maximum DC Input Current (Idcmax) / for each MPPT (IMPPTmax)	12.5 A / 12.5 A	12.8 A / 12.8 A
Maximum Input Short Circuit Current for each MPPT	15.0 A	
Maximum Backfeed current (from AC to DC side)	Negligible	
Number of DC Inputs Pairs for each MPPT	2	
DC Connection Type	Tool Free PV Connector WM / MC4	
Input protection		
Reverse Polarity Protection	Yes, from limited current source	
Input Overvoltage Protection for each MPPT - Varistor	2	
Photovoltaic Array Isolation Control	According to local standard	
DC Switch Rating for each MPPT (-S Version)	16 A / 600 V	
Output		
AC Grid Connection Type	Single phase	
Rated AC Power (Pacr)	2000 W	2500 W
Maximum AC Output Power (Pacmax)	2200 W (4)	2750 W (5)
Rated AC Grid Voltage (Vac,r)	230 V	
AC Voltage Range	180...264 V (1)	
Maximum AC Output Current (Iac,max)	10.5 A	12.5 A
Maximum output fault current	<20Arms (60mS)	
Rated Output Frequency (fr)	50 Hz	
Output Frequency Range (fmin...fmax)	47...53 Hz (2)	
Nominal Power Factor (Cosphiac,r)	> 0.990	
Total Harmonic Distortion of Current	< 2%	
AC Connection Type	Screw terminal block	
Output protection		
Anti-Islanding Protection	According to local standard	
Maximum AC Overcurrent Protection	15.0 A	
Output Overvoltage Protection - Varistor	2 (L - N / L - PE)	
Operating performance		
Maximum Efficiency (ηmax)	96.3%	
Weighted Efficiency (EURO/CEC)	95.1% / -	95.4% / -

Power Input Treshold	24.0 W
Stand-by Consumption	< 8.0 W (3)
Communication	
Wired Local Monitoring	PVI-USB-RS232_485 (opt.), PVI-DESKTOP (opt.)
Remote Monitoring	PVI-AEC-EVO (opt.), AURORA-UNIVERSAL (opt.)
Wireless Local Monitoring	PVI-DESKTOP (opt.) with PVI-RADIOMODULE (opt.)
User Interface	Graphic display
Environmental	
Ambient Temperature Range	-25...+60°C (-13...+ 140°F) with derating above 45°C (113°F)
Storage Temperature	-40...80°C (-40...+176°F)
Relative Humidity	0...100 % condensing
Environmental pollution classification for external environment	3
Noise Emission	< 50 db(A) @ 1 m
Maximum Operating Altitude without Derating	2000 m / 6560 ft
Physical	
Environmental Protection Rating	IP 65
Cooling	Natural
Dimension (H x W x D)	518mm x 367mm x 161mm / 20.4" x 14.4" x 6.3"
Weight	< 17 kg / 37.4 lb
Mounting System	Wall bracket
Overvoltage Category in accordance with IEC 62109-1	II (DC input) III (AC output)
Safety	
Isolation Level	HF transformer
Safety Class	I
Safety and EMC Standard	EN 50178, AS/NZS3100, AS/NZS 60950, EN61000-6-1, EN61000-6-3, EN61000-3-11, EN61000-3-12
Grid Standard	Enel Guideline (CEI 0-21 + Attachment A70 Terna)(6), VDE 0126-1-1, VDE-AR-N 4105(7), G83/1, EN 50438, RD1663, AS 4777

1. The AC voltage range may vary depending on specific country grid standard
2. The Frequency range may vary depending on specific country grid standard
3. Night time consumption < 0.6W
4. Limited to 2000 W for Germany
5. Limited to 2500 W for Germany
6. Since their applicability dates, limited to plant power ≤ 3kW
7. Limited to plant power ≤ 3.68 kVA

Remark. Features not specifically listed in the present data sheet are not included in the product

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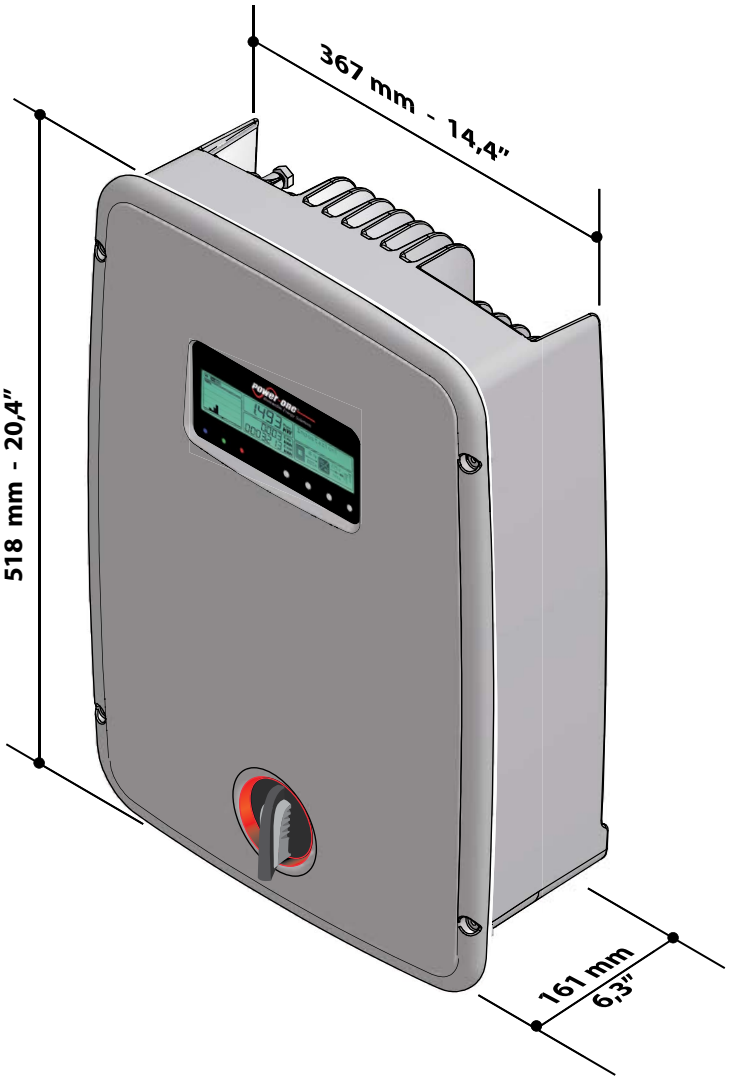
Tightening torques

To maintain the IP65 protection of the system and for optimal installation, the following tightening torques must be used:

Front cover **04** screws	**2,2 Nm**
AC cable gland **08** M25	**5,0 Nm**
Service cable glands **06** M20	**2,7 Nm**
AC output screw terminal block **09** 6 mm^2	**1,5 Nm**
Signals terminal boards	**0,25 Nm**
Quick fit connectors WM / MC4	**2.5 Nm**

Overall dimensions

The overall dimensions are expressed in mm and in inches



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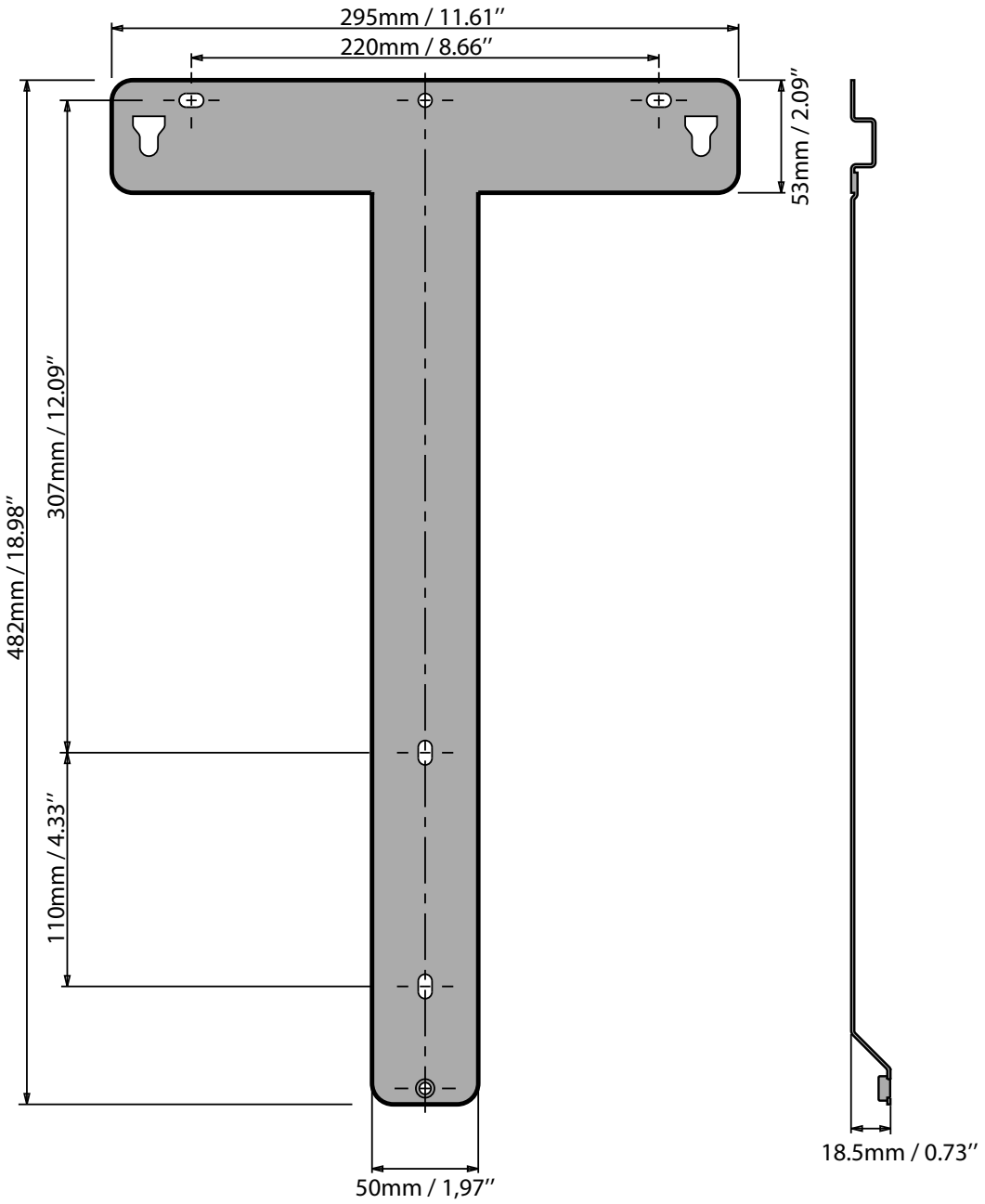
Bracket dimensions

The overall dimensions are expressed in mm and in inches

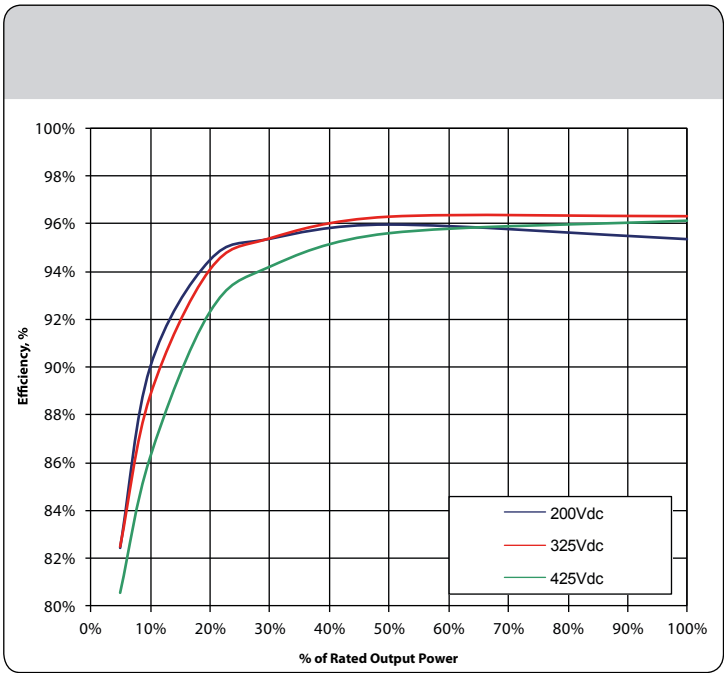


Efficiency curves

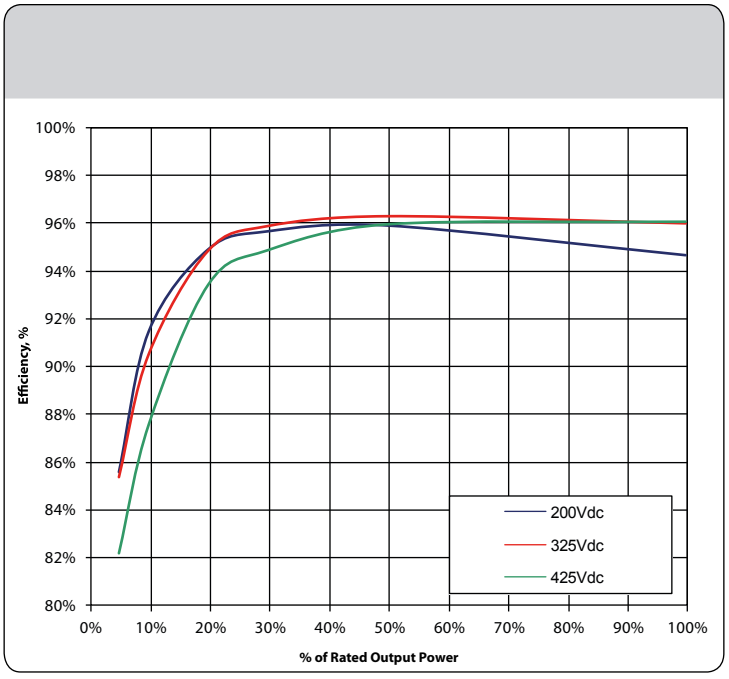
The equipment was designed in compliance with energy conservation standards, to avoid waste and unnecessary leakage.
The manufacturer has taken into due consideration the current energy saving standards in Italy.
Graphs of the efficiency curves of all the models of inverter described in this manual are shown below.

The efficiency curves are linked to technical parameters that are continually being developed and improved and should therefore be considered approximate.

UNO-2.0-I-OUTD
UNO-2.0-I-OUTD-S



UNO-2.5-I-OUTD
UNO-2.5-I-OUTD-S



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Power Derating

In order to allow inverter operation in safe thermal and electrical conditions, the unit automatically reduces the value of the power fed into the grid.
Power derating can take place due to adverse environmental conditions or due to unsuitable input voltage values.

The conditions for power reduction due to environmental conditions and input voltage can also occur at the same time, but the power reduction will always relate to the lower value measured.

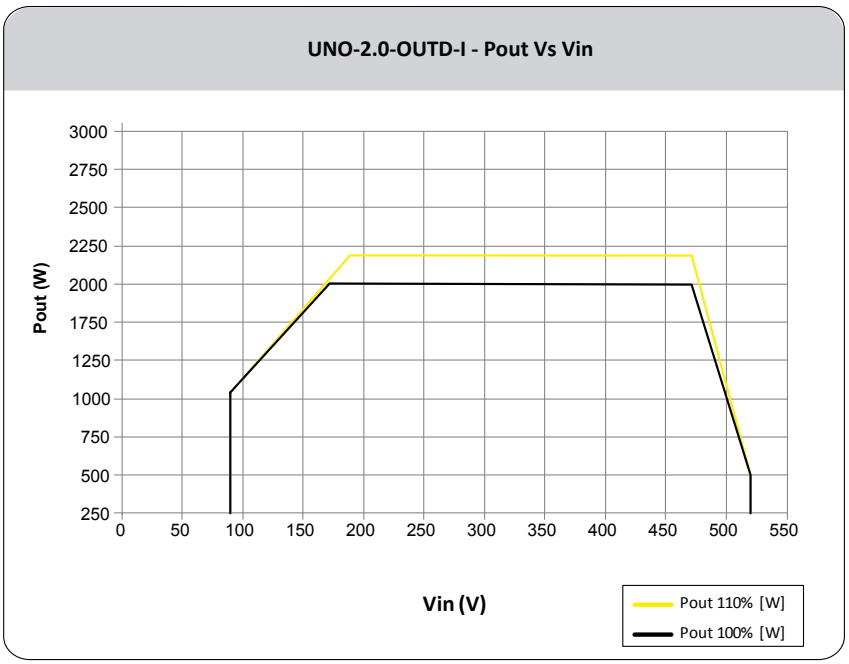
Power reduction due to environmental conditions

The power reduction value and the inverter temperature at which it occurs depend on the ambient temperature and on many operating parameters. Example: input voltage, grid voltage and power available from the photovoltaic field.
The inverter can therefore reduce the power during certain periods of the day and according to the value of these parameters.
In any case, the inverter guarantees the maximum output power even at high temperatures, provided the sun is not shining directly on it.

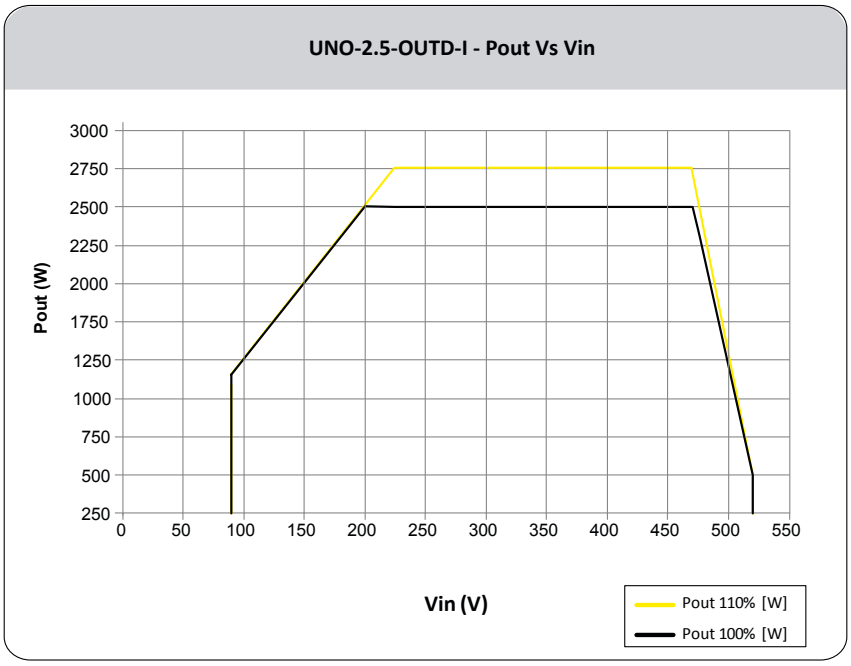
Power reduction due to the input voltage

The graphs show the automatic reduction of supplied power when input voltage values are too high or too low.

UNO-2.0-I-OUTD
UNO-2.0-I-OUTD-S



UNO-2.5-I-OUTD
UNO-2.5-I-OUTD-S



Characteristics of a photovoltaic generator

A PV generator consists of an assembly of photovoltaic panels that transform solar radiation into DC electrical energy and can be made up of:

Strings: X number of PV panels connected in series
Array: group of X strings connected in parallel

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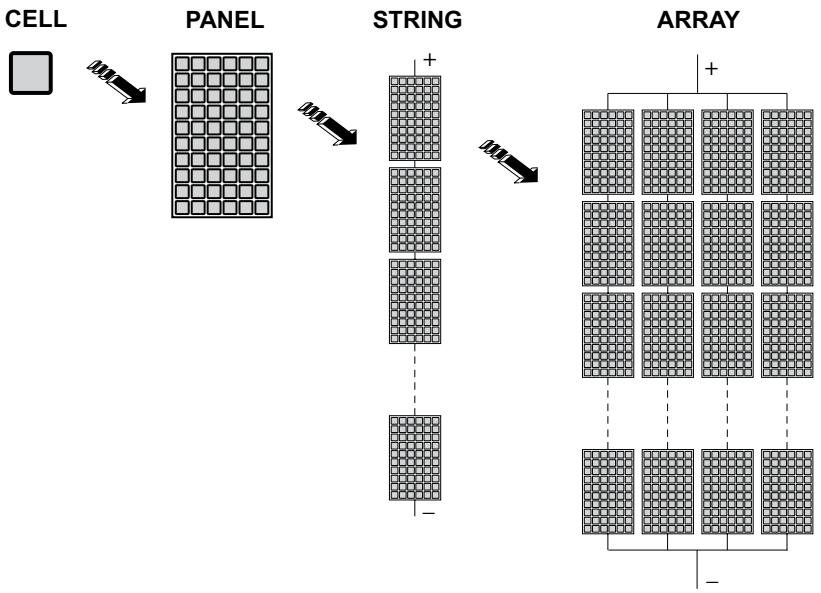
Strings and Arrays

In order to considerably reduce the cost of installing a photovoltaic system, mainly associated with the problem of wiring on the DC side of the inverter and subsequent distribution on the AC side, the string technology **has been developed**. A photovoltaic panel consists of many photovoltaic cells mounted on the same support.

• A **string** consists of a certain number of panels connected **in series**.
• An **array** consists of two or more strings connected **in parallel**.

Large photovoltaic systems can be made up of several arrays, connected to one or more inverters.

By maximizing the number of panels inserted into each string, it is possible to reduce the cost and complexity of the connection system of the photovoltaic system.



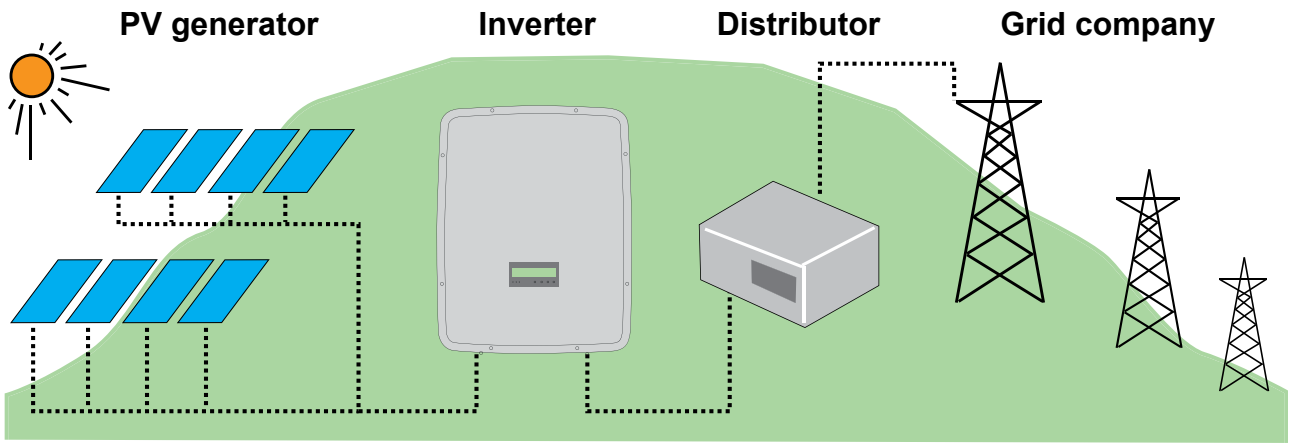
The current of each array must fall within the limits of the inverter.

To work, the inverter must be connected to the national electricity grid since its operation can be equated to a current generator that supplies power in parallel with the grid voltage. That is why inverters cannot support the grid voltage (islanding).

Description of the equipment

This equipment is a multi-string inverter that converts direct electric current from a photovoltaic generator into alternating electric current and feeds it into the national grid.
Photovoltaic panels transform energy from the sun into direct current (DC) electrical energy (through a photovoltaic field, also called photovoltaic (PV) generator; in order to use it it is necessary to transform the type of alternating current into “AC”. This conversion, known as DC to AC inversion, is made efficiently without using rotating parts and only through static electronic devices.
In order to allow inverter operation in safe thermal and electrical conditions, in the event of adverse environmental conditions or unsuitable input voltage values, the unit automatically reduces the value of the power fed into the grid.
This way the solar energy system compensates for the energy drawn from the utilities connected to the grid to which it is linked.
The solar energy system therefore powers all connected electrical devices, from lighting to household appliances, etc.
When the photovoltaic system is not supplying sufficient power, the power needed to ensure normal operation of the connected electrical devices is drawn from the national grid. If, on the other hand, excess power is produced, this is fed directly into the grid, so becoming available to other consumers.
In accordance with local and national regulations, the power produced can be sold to the grid or credited towards future consumption, so bringing about a saving of money.

Operating diagram



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Connection of several inverters together

If the photovoltaic system exceeds the capacity of a single inverter, it is possible to make a multiple connection of inverters to the system, with each one connected to a suitable section of the photovoltaic field, on the DC side, and connected to the grid on the AC side.
Each multi-string inverter will work independently of the others and will supply the grid with the maximum power available from its section of photovoltaic panels.

Notes on the sizing of the system

Decisions about how to structure a photovoltaic system depend on a certain number of factors and considerations to make, such as for example, the type of panels, the availability of space, the future location of the system, energy production goals over the long term, etc.

A configuration program that can help to correctly size the photovoltaic system is available on the web site of ***Power-One*** (www.power-one.com).

Functionality and components of the equipment

Data transmission and control
The inverter, or a network of several inverters, can also be monitored remotely through an advanced communications system based on an RS-485 serial interface. The range of optional Power-One devices that can be connected to this communication line allows one to monitor the device locally or remotely via internet access.
In addition, and again as an option, it is possible to use a monitoring system via radio by installing on the inverter itself the “PVI-Radiomodule” radio board in order to have a remote data visualization terminal with a wireless connection.

Radiomodule
The radiomodule board is an accessory that is used to add a radio communication line to the inverter. It can be used in parallel to the RS-485 line for the transmission of data to the monitoring system.

Configurable relay
The inverter has a configurable switching relay that can be used in various operating conditions set in the dedicated menu. A typical application example is the closing of the contact when an alarm occurs.

Remote switching on/off
This command can be used to disconnect/connect the inverter to the grid via an external (remote) command.
This function must be enabled in the relevant menu and if it is operating, the connection of the inverter on the grid, besides being dictated by the presence of normal parameters, also depends on the external switching on/off control.

Input poles grounding
The circuit type of the inverter “isolated by a high-frequency transformer” allows, through special wiring located inside the inverter, for the connection of one of the two input DC poles (positive or negative) to ground.
It is also possible to have both the input DC poles “floating” and as such not grounded.

Stand by Mode
This functionality allows the inverter to remain on and grid connected even with an input voltage of less than 70Vdc. It is particularly useful in conditions of low irradiation and with passing shadowed areas that would cause continuous connections and disconnections to the grid. Instead, with this functionality, the inverter starts to deliver power as soon as the input voltage exceeds the 80VDC without having to repeat the grid connection sequence.
The time in which the inverter remains in this state can be set by accessing the Settings menu and activating the time for Input Undervoltage Protection (TprotUV). If within the set time the conditions to export po-

wer to the grid do not reoccur (i.e. Vin>80VDC), the inverter disconnects from the grid and goes into SLEEP Mode.

Sleep Mode

This functionality turns off the inverter completely and the power absorption is reduced to a minimum (0.6W).
In this mode, the inverter allows display of the information available even in the absence of input voltage and therefore in the absence of sufficient irradiation of the photovoltaic panels. In fact, the display can be “awakened” by pressing any button on the display.
After 30 seconds of inactivity the display will once again switch off automatically.

Topographic diagram of the equipment

The diagram summarises the operation of the inverter.
The main blocks are the DC-DC input converter (called “booster”) and the DC-AC output inverter. Both, work at a high switch-over frequency, and so are small and relatively light.
This inverter is equipped with a high frequency transformer, in other words with galvanic isolation of the primary (DC side) from the secondary (AC side), while maintaining very high performance in terms of output and energy export. This type of circuit allows for the grounding of the inputs, both positive and negative, where required by the solar panel type used or by the rules of the country of installation.
The inverter is equipped with a single input converter with maximum power point tracking (MPPT) to which it is possible to connect two strings of photovoltaic panels
Thanks to the high efficiency and the large heat dissipation system, a maximum power operation is guaranteed in a wide range of the ambient temperature without the use of external cooling fans.
The inverter is controlled by two independent DSPs (Digital Signal Processors) and a central microprocessor.
The connection to the power grid is thus kept under control by two independent monitors, in full compliance with the electric field norms both for power supply to the systems as well as security.
The inverter is already equipped with all the protections necessary for safe operation and compliance with the norms.
The operating system performs the operation of communicating with the relevant components to carry out data analysis.
All this guarantees optimal operation of the entire unit and high efficiency in all insolation and load conditions, always in full compliance with the relevant directives, standards and provisions.

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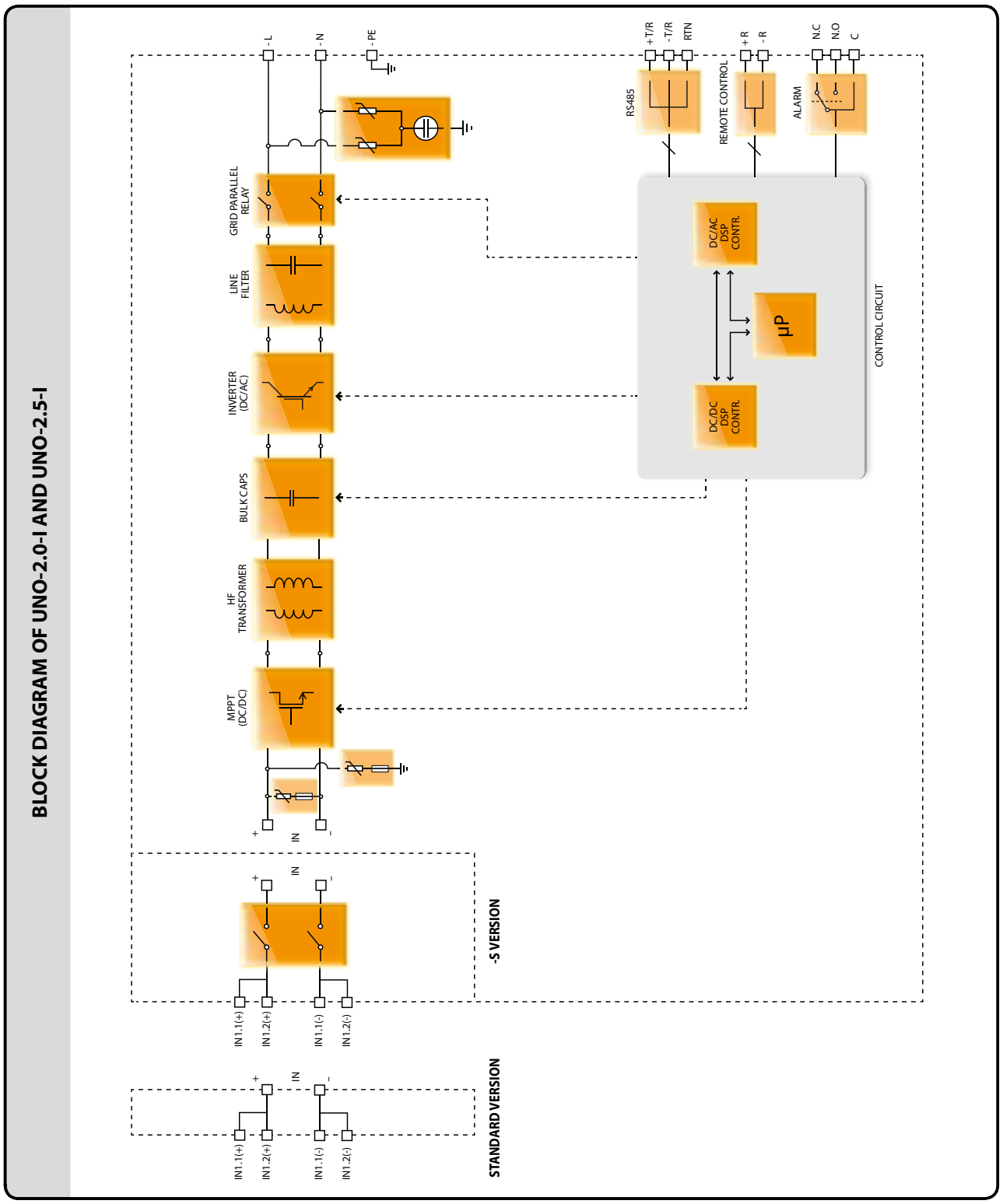
BLOCK DIAGRAM OF UNO-2.0-I AND UNO-2.5-I



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Protective devices

Anti-Islanding

In the event of a local grid outage by the electricity company, or when the equipment is switched off for maintenance operations, the inverter must be physically disconnected safely, to ensure protection of people working on the grid, all in accordance with the relevant national standards and laws. To prevent possible islanding, the inverter is equipped with an automatic protective disconnection system called “Anti-Islanding”.

Ground fault in the photovoltaic panels

An advanced ground fault protection circuit continuously monitors the ground connection and disconnects the inverter when a ground fault indicating this condition by means of the red GFI LED on the LED panel **14**. This functionality is active also in the event of grounded connection of one of the two input poles of the inverter.

Further protective devices

The inverter is equipped with additional protective devices to guarantee safe operation in any circumstance. These protective devices include:
- Continuous monitoring of the grid voltage to ensure the voltage and frequency values stay within operating limits;
- Control of internal temperatures to automatically limit the power if necessary to ensure the unit does not overheat (derating).

The numerous control devices produce a replete structure to guarantee totally safe operation.

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3 - Safety and accident prevention

Safety instructions and general information

The equipment has been manufactured in accordance with the strictest accident-prevention regulations and supplied with safety devices suitable for the protection of components and operators.

For obvious reasons, it is not possible to anticipate the great number of installations and environments in which the equipment will be installed; it is therefore necessary for the customer to appropriately inform the manufacturer about particular installation conditions.

Power-one accepts no liability for failure to comply with the instructions for correct installation are cannot be held responsible for the systems upstream or downstream of the equipment it has supplied.

It is essential to provide operators with correct information. They must therefore read and comply with the technical information given in the manual and in the attached documentation.

The instructions given in the manual do not replace the safety devices and technical data for installation and operation stuck on the product, and they certainly do not replace the safety regulations in force in the country of installation and common sense rules.
The manufacturer is willing to train staff, at its premises or on site, in accordance with conditions to be set out in the contract.

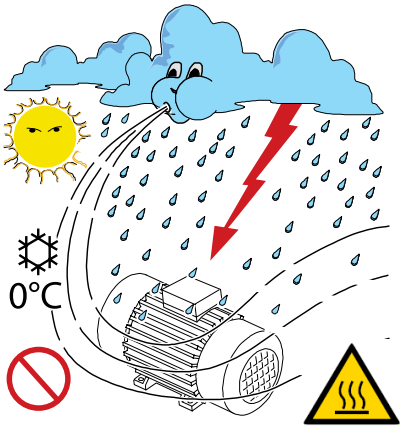
Do not use the equipment if you find any operating anomalies.

Avoid temporary repairs. All repairs should be carried out using only genuine spare parts, which must be installed in accordance with their intended use.

Liabilities arising from commercial components are delegated to the respective manufacturers.

Hazardous areas and operations

Environmental conditions and risks



The equipment can be installed outdoors, but only in environmental conditions that do not prevent its regular operation. Adverse environmental conditions, such as: sun, rain, snow, wind, too hot or too cold, altitudes, humidity, etc., can lead to a reduction in performance.

Power-One CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.

The same precautions should be adopted for dismantling the equipment.

The equipment is not equipped to operate in environments that have particular flammability or explosive conditions.

The customer and/or installer must appropriately train operators or anyone who may come near the equipment, and highlight, if necessary with notices or other means, the hazardous areas or operations at risk if required: ***magnetic fields, hazardous voltages, high temperatures, possibility of discharges, generic hazard, etc.***

Signs and plates

The plates attached to the equipment must absolutely NOT be removed, damaged, dirtied, hidden, etc.

The plates must be cleaned regularly and kept visible at all times, that is, they must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.)
The technical data shown in this manual do not in any case replace those shown on the plates attached to the equipment.

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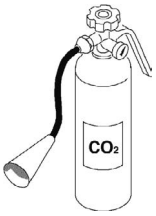
Thermal hazard

WARNING: removal of guards or covers is allowed only **10 minutes after the voltage has been removed**; ; this is to let components cool down and allow any electrostatic charges and parasitic voltages to be discharged.

When the equipment has just been switched, it may have hot parts, as a result of overheating of the surfaces at temperature (e.g.: transformers, accumulators, coils, etc.) so be careful where you touch.



In the event of fire, use CO_2 foam extinguishers and use auto extraction systems to fight fire in closed environments.

Clothing and protective devices for staff

Power-One has eliminated sharp edges and corners, but in some cases it is not possible to do anything, and we therefore advise wearing the clothing and personal protective devices provided by the employer.

Staff must not wear clothes or accessories that can start fires or generate electrostatic charges or, in gener, clothing that can impede personal safety.

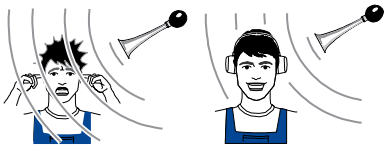
All operations on the equipment should be performed with suitably insulated clothes and instruments.
E.g.: Insulated gloves (class 0, category RC)

Maintenance operations must be carried out with the equipment disconnected from the grid and from the photovoltaic generator.

Staff must NOT go near the equipment with bare feet or wet hands.

The maintenance technician must in any case make sure no one else can switch on or operate the equipment during the maintenance operations, and must report any anomaly or damage due to wear or ageing so that the correct safety conditions can be restored.

The installer or maintenance technician must always pay attention to the work environment, so that it is well lit and has sufficient spaces to ensure they have an escape route.



In the installation, consider or make sure the ***noise emitted based on the environment*** is not such that it exceeds thresholds allowed by law (less than 80 dBA).

Residual Risks

Despite the warnings and safety systems, there are still some residual risks that cannot be eliminated.
These risks are listed in the following table with some suggestions for preventing them.

Table of residual risks

RISK ANALYSIS AND DESCRIPTION	SUGGESTED REMEDY
Noise pollution due to installation in unsuitable environments or where staff work permanently.	Reassess the environment or the place of installation.
Suitable local ventilation that does not cause overheating of the equipment and is sufficient not to create discomfort to people in the room.	Restore suitable ambient conditions and air the room.
External weather conditions, such as water seepage, low temperatures, high humidity, etc.	Maintain ambient conditions suitable for the system.
Overheating of surfaces at temperature (transformers, accumulators, coils, etc.) can cause burns. Also be careful not to block the cooling slits or systems of the equipment.	Use suitable protective equipment or wait for the parts to cool before switching on the equipment.
Inadequate cleaning: compromises cooling and does not allow the safety plates to be read.	Clean the equipment, plates and work environment adequately.
Accumulation of electrostatic energy can generate hazardous discharges.	Ensure the devices have discharged their energy before working on them.
Inadequate training of staff.	Ask for a supplementary course.
During installation, temporary fixing can involve risks of unhooking from the bracket **01**	Pay attention and prevent access to the installation area.
Accidental disconnection of the quick fit connectors with the equipment in operation, or wrong connections, can generate electric arcs.	Pay attention and prevent access to the installation area.

4 - Lifting and transport

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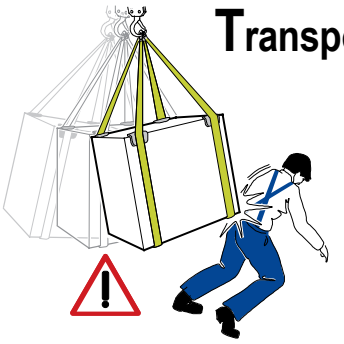
General conditions

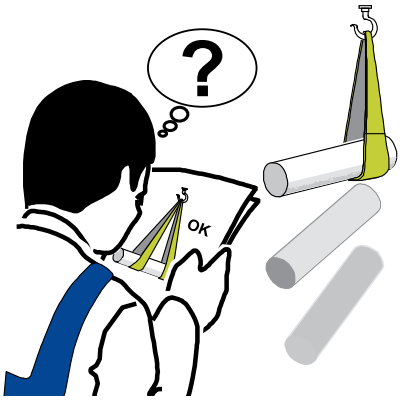
Some specifications are not applicable to small equipment or components.



Transport and handling

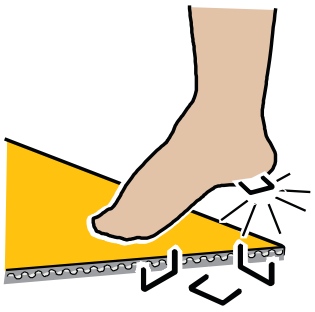
Transport of the equipment, especially by road, must be carried out with by suitable ways and means for protecting the components (in particular, the electronic components) from violent shocks, humidity, vibration, etc.
During handling, do not make any sudden or fast movements that can create dangerous swinging.

Lifting



Power-One usually stores and protects individual components by suitable means to make their transport and subsequent handling easier, but as a rule it is necessary to turn to the experience of specialized staff in change of loading and unloading the components.
Where indicated and/or where there is a provision, eyebolts or handles, which can be used as anchorage points, are inserted and/or can be inserted.
The ropes and means used for lifting must be suitable for bearing the weight of the equipment.
Do not lift several units or or parts of the equipment at the same time, unless otherwise indicated.

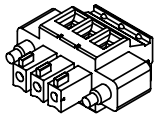
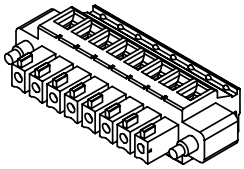
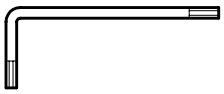
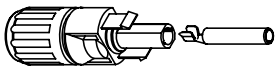
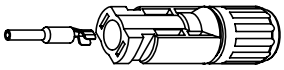
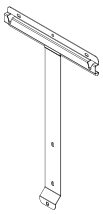
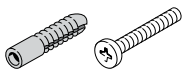
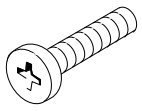
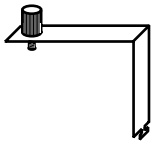
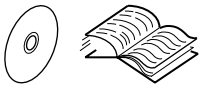
Unpacking and checking



We remind you that the packaging elements (cardboard, cellophane, staples, adhesive tape, straps, etc.) may cause cuts and/or injuries if not handled with care. They should be removed by suitable means and not left in the hands of irresponsible people (e.g., children).
The components of the packaging must be disposed on in accordance with the regulations in force in the country of installation.
When you open the package, check that the equipment is undamaged and make sure all the components are present.
If you find any defects or damage, stop unpacking and consult the carrier, and also promptly inform ***Power-One***.

List of supplied components

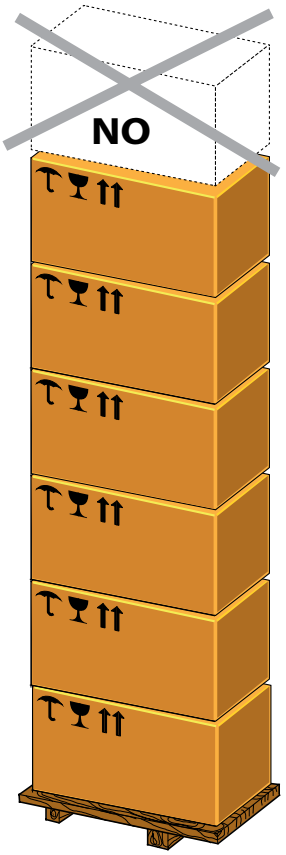
Table: Components supplied with the equipment

	Components available for all models	Quantity
	Connector for connecting the configurable relay	2
	Connector for the connection of the communication and control signals	2
	L-key, TORX TX20	1
	Two-hole gasket for M20 signal cable glands M20 and cover	2 + 2
	Female quick fit connectors	2
	Male quick fit connectors	2
	Bracket for wall mounting	1
	Bolts and screws for wall mounting	3
	Locking screw **03** for fastening of the inverter to the bracket	1
	Bracket and screws for lead sealing the AC connector	1
	User manual and CD-ROM	1

Equipment weight

Mass (weight in kg) UNO-2.0 / UNO-2.5: 17 kg
Lifting points: 2

If the package is stored correctly, it can withstand **a maximum load of 6 pieces of equipment.** DO NOT stack with equipment or products other than those indicated.



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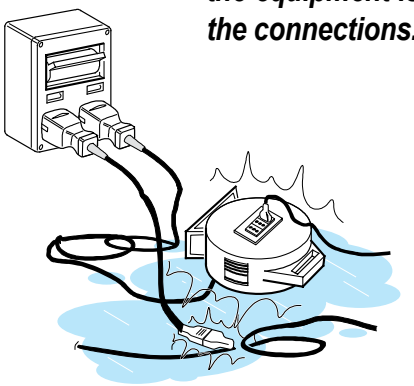
5 - Installation

General conditions

Installation of the equipment is carried out based on the system and the place in which the equipment is installed; therefore, its performance depends on the correctness of the connections.



Staff authorised to carry out the installation must be specialised and experienced in this job; they must also have received suitable training on equipment of this type.

The operation must be carried out by specialised staff; it is in any case advisable to comply with what is written in this manual and adhere to the diagrams and attached documentation.

The installation must be carried out with the equipment disconnected from the grid and from the photovoltaic generator.

The installation must be carried out with the equipment disconnected from the grid (power disconnect switch open) and with the photovoltaic panels shaded or isolated.

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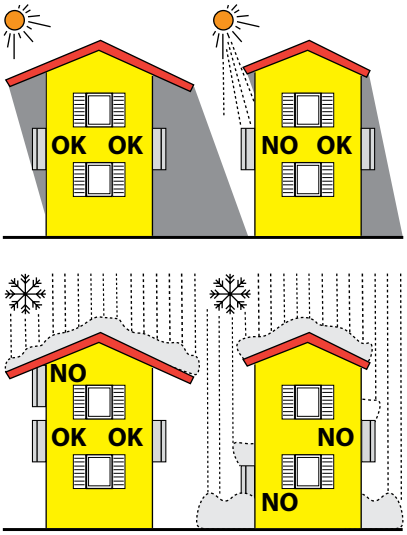
Environmental checks



• Consult the technical data to check the environmental parameters to be observed (degree of protection, temperature, humidity, altitude, etc.)
• Do not expose to direct sunlight to avoid unwanted power derating due to an increase in the internal temperature of the inverter.
• Do not install in small closed rooms where air cannot circulate freely.
• To avoid overheating, always make sure the flow of air around the inverter is not blocked.
• Do not install in places where gases or flammable substances may be present.
• Do not install in rooms where people live or where the prolonged presence of people or animals is expected, because of the noise that the inverter makes during operation.
• Avoid electromagnetic interference that can compromise the correct operation of electronic equipment, with consequent situations of danger.

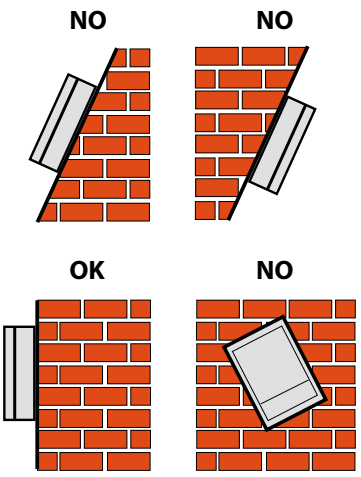
Installations above 2000 metres

On account of the rarefaction of the air (at high altitudes), particular conditions may occur that should be considered when choosing the place of installation:

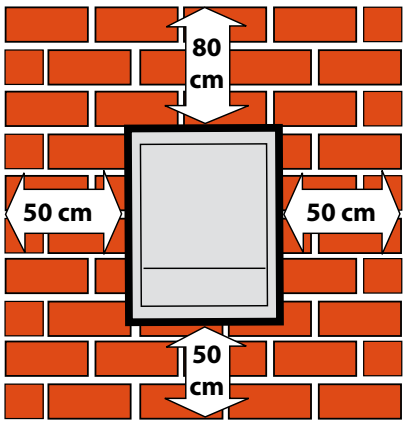
• Less efficient cooling and therefore a greater likelihood of the device going into derating because of high internal temperatures.
• Reduction in the dielectric resistance of the air that, in the presence of high operating voltages (DC input), can create electric arcs (discharges) that can reach the point of damaging the inverter.
As the altitude increases, the failure rate of some electronic components increases exponentially because of cosmic radiation.

All installations at altitudes of over 2000 metres must be assessed case by case considering the aforesaid criticalities.

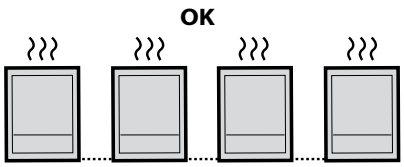
Installation position



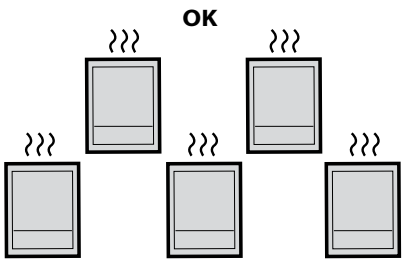
When choosing the place of installation, comply with the following conditions:
• Install on a wall or strong structure suitable for bearing the weight.
• Install in safe, easy to reach places.
• If possible, install at eye-level so that the display and status LEDs can be seen easily.
• Install vertically with a maximum inclination of +/- 5°. If this condition is not complied with, the inverter could go into temperature derating because of the worsening of heat dissipation.



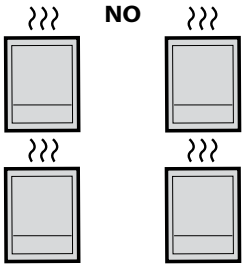
• To carry out maintenance of the hardware and software of the equipment, remove the covers on the front. Check that there are the correct safety distances for the installation that will allow the normal control and maintenance operations to be carried out.
• Comply with the indicated minimum distances.



• For a multiple installation, position the inverters side by side.



• If the space available does not allow this arrangement, position the inverters in a staggered arrangement as shown in the figure so that heat dissipation is not affected by other inverters.



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Wall/Pole mounting

During installation do not place the inverter 02 with the front cover 04 facing towards the ground.

• Position the bracket **01** perfectly level on the wall and use it as a drilling template.

• Drill the 3 holes required using a drill with 10mm bit. The holes must be about 70mm deep.
On bracket **01** there are 5 fastening holes, but only 3 are used depending on the type of installation: on a pole **holes A**, on a wall **holes B**.

• Fix the bracket to the wall with the 3 wall anchors, 10mm in diameter, supplied.

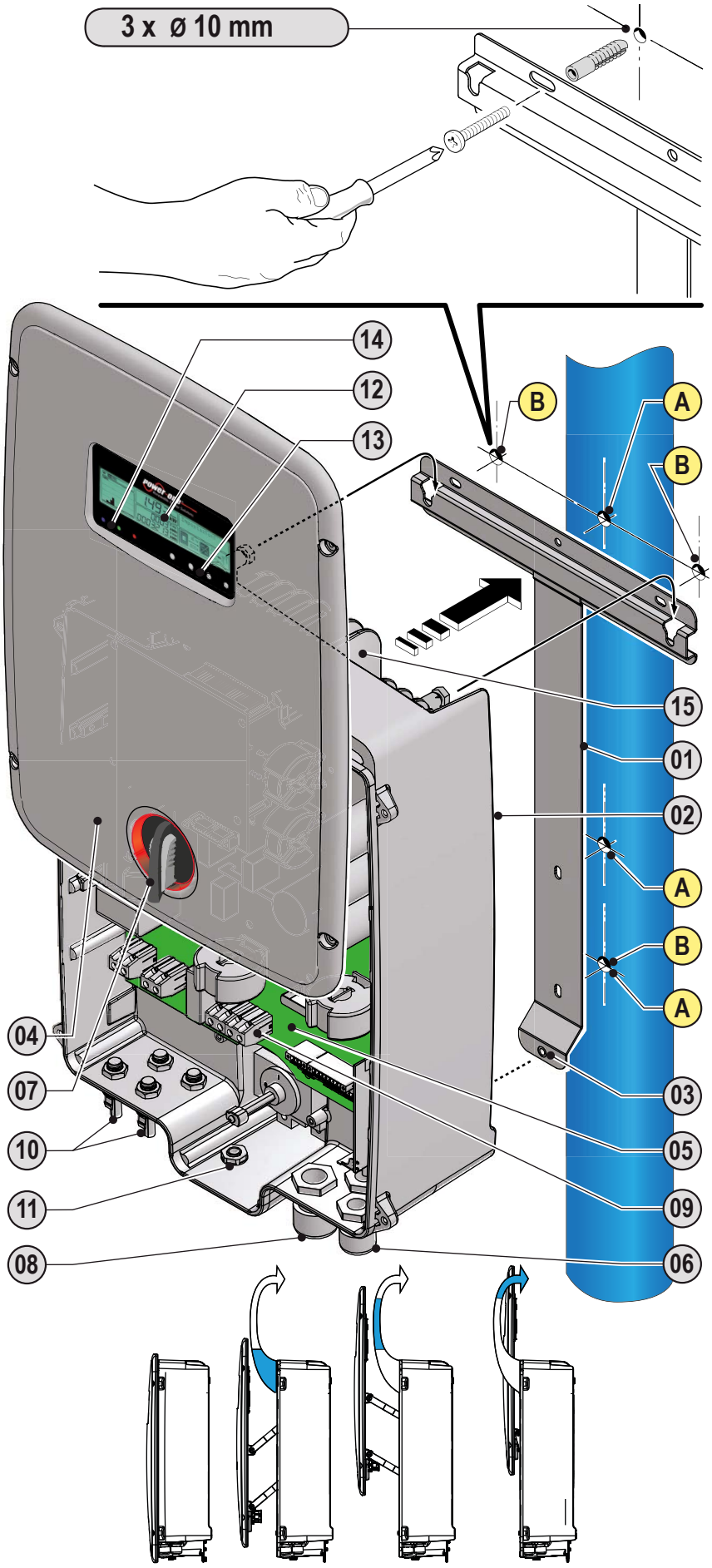
• Hook the inverter to the bracket by inserting the head of the rear screws in the slots as shown in the figure.

• Proceed to anchor the inverter to the bracket by tightening the locking screw **03** located on the lower side.

• Unscrew the 4 screws and open the front cover **04** upwards in order to make all the necessary connections. **The cover is equipped with fixed hinges and cannot be removed.**

• Once the connections have been made proceed to closing the cover by tightening the 4 screws on the front to the torque indicated in the specifications.

• Remove the protective film located on the front.



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Operations preparatory to PV generator connection

Checking the correct polarity of the strings

Using a voltmeter, check that the voltage of each string observes the correct polarity and falls within the input voltage limits accepted by the inverter (see technical data).

If the voltage without load of the string is near the maximum value accepted by the inverter, it must be borne in mind that with low ambient temperatures the string voltage tends to increase (in a different way according to the photovoltaic module used). In this case, it is necessary to carry out a check of the sizing of the system and/or a check on the connections of the modules of the system (e.g.: number of modules in series higher than the design number).

Checking of leakage to ground of the photovoltaic generator

Measure the voltage present between positive and negative pole of each string with respect to ground.
If a voltage is measured between an input pole and ground, it may be that there is a low insulation resistance of the photovoltaic generator and the installer will have to carry out a check to solve the problem.

Do not connect the strings if a leakage to ground has been found because the inverter might not connect to the grid.

Requirements of the PV generator

If the PV generator is made up of two or more strings it is necessary to remember that they must be formed by PV modules which have the same type and number of panels in series. In addition, they must have the same installation conditions (in terms of orientation in relation to the SOUTH and inclination in relation to the horizontal plane)
All input parameters that must be met for the correct operation of the inverter are shown in the specifications.

Choice of differential protection downstream of the inverter

Based on the current **CEI 64-8** Norms and Variant 4 (V4) of September 2006, which in Section 712: "Solar photovoltaic power systems (PV)" addresses photovoltaic applications, with particular reference to paragraph **712.413**: "Protection against indirect contact", the following may be noted:
712.413.1.1.1.2 When an electric system includes a PV power supply system without at least a simple separation between the AC side and the DC side, the differential device installed to provide protection against indirect contact by automatic disconnection of the power supply must be of the B type in accordance with **IEC 60755/A 2**.

When the PV inverter is not in terms of its construction such as to put continuous ground fault current (cc) into the electrical system, a differential switch of type B is not required according to IEC 60755/A 2.

Note: The first section of the article, in reference to the "simple separation between the AC side and the DC side", considers isolation transformers that operate at low frequency (grid frequency).

Aurora Power-One inverters with a high frequency transformer are equipped with an isolation transformer for each of the DC/DC converters which operates at high frequency (switch-over frequency of the converter). This transformer allows for high frequency galvanic isolation between the DC and AC side of the system. In addition to this the inverters include protection mechanisms so that they cannot input ground fault currents.

Power-One Italy S.p.A. declares that the Power-One Aurora high-frequency isolated inverters are in terms of their construction continuous ground fault currents and therefore, in accordance with Article 712.413.1.1.1.2 of Section 712 of CEI 64-8/7 Norms there is no requirement that the differential installed downstream of the inverter is type B in accordance with IEC 60755 / A 2.

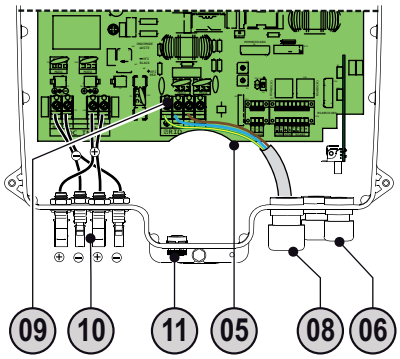
Power-One recommends the use of a switch with type A or AC differential magneto-thermal protection with IΔn=30mA sensitivity.

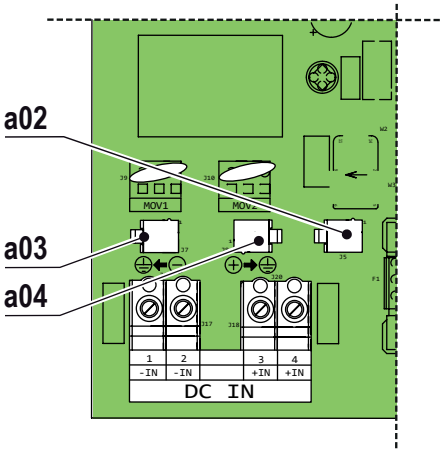
Inverter Components

For both of the inverter **02** models (2 kW or 2.5 kW) two different set-ups are available:

UNO-X.X-I-OUTD: Standard version
UNO-X.X-I-OUTD-S: Version equipped with DC disconnect switch **07**

Standard version





S Version

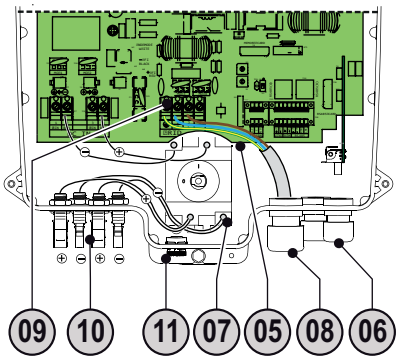
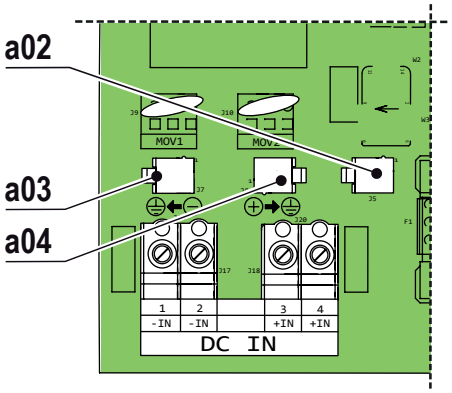


Table: electrical system components

Ref.	Description
05	main board
06	service cable glands
07	DC disconnect switch
08	AC cable gland
09	AC output terminal board
10	DC input connectors
11	anti-condensation valve
a02	Connector for floating ground of the inputs
a03	Connector for negative grounding of the inputs
a04	Connector for positive grounding of the inputs

Grounding configuration of the DC inputs



The grounding of the inputs **is negative configuration by default**.
For the correct operation, some photovoltaic panels require the connection of the potential of the positive terminal to the earth terminal, or to have both of the input poles floating in regards to ground potential.

In order to achieve this, it is possible to vary the default configuration, moving the connector installed in a03 (**negative grounding**) to a04 (**positive grounding**) or a02 (**floating configuration**).

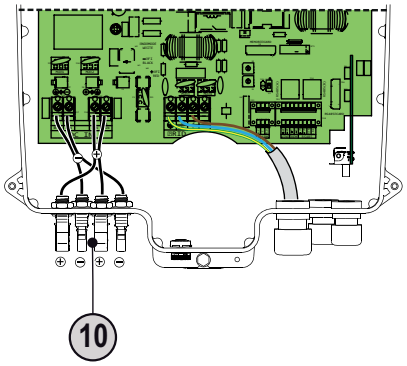
The configuration of the grounding of the inputs must be done before any connections or testing takes place.
Incorrect configuration may cause damage to the system and photovoltaic panels!

Input connection to the PV generator (DC side)

After undergoing preliminary checks and as such having verified that there are no problems in the photovoltaic system, you can connect the inverter to the inputs.

To prevent electrocution hazards, all the connect operations must be carried out the DC disconnect switch 07 or the external disconnect switch open and locked.

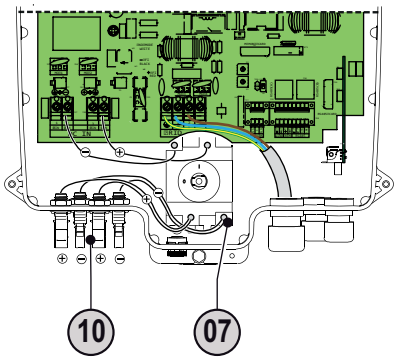
Standard version



For the string connections it is necessary to use the quick fit connectors (multicontact or weidmüller) located on the bottom of the mechanism. **The maximum numbers of input strings which can be connected is 2**.
Connect all the strings included in the design of the system and always check the tightness of the connectors.

If some of the string inputs should not be used you must proceed to verify the presence of covers on DC input connectors **10** and then install them should they be absent. This operation is necessary for the tightness of the inverter and to avoid damaging the free connector that could be used at a later date.

S Version



The two pairs of DC input connectors **10** are internally related to a single input channel, so there are no preferences on the connectors to be used in the case of installation of a single string.

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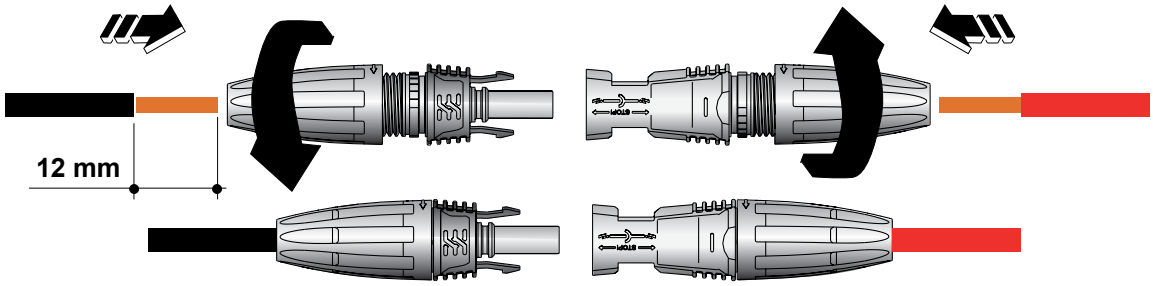
Procedure for installing quick fit connectors

On the inverter models that provide quick coupling connectors, these can be provided in two different types:

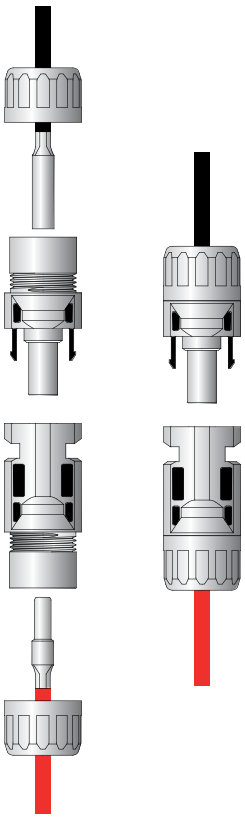
WEIDMULLER

The installation of Weidmuller connectors does not require special tools.

- Strip the end of the cable to which you are going to attach the connector (after making sure it conforms to the limits of the connector).
- Insert the cable in the connector until you hear a locking “click”.
- Fully tighten the knurled ring nut for optimum locking.



WARNING: To prevent damage to the equipment, pay particular attention to the polarities when wiring the cables.



MULTICONTACT (or equivalent)

The installation of Multicontact connectors requires crimping that must be carried out using a suitable tool.

- Strip the end of the cable to which you are going to attach the connector (after making sure it conforms to the limits of the connector).
- Attach the terminal to the conductor using the special crimping pliers.
- Insert the cable with terminal into the connector until you hear the click that indicates the terminal is locked inside the connector.
- Firmly tighten the cable gland to finish the operation.

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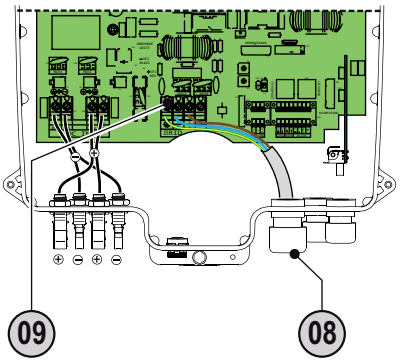
Grid output connection (AC side)

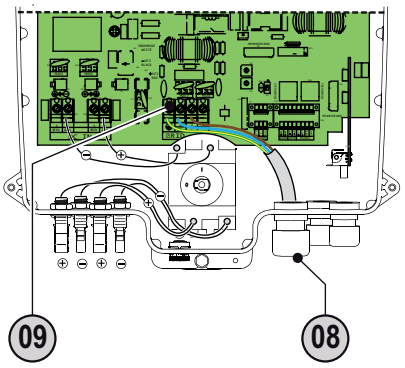
For the connection to the inverter grid you need 3 connections: ground, neutral and phase. **The ground connection to the inverter is obligatory**.
Plug the grid cable into the inverter using the specific AC cable gland **08** and connect the AC output screw terminal block **09**.

Use a properly sized tripolar cable and check the tightness of the AC cable gland 08 at the end of the installation.

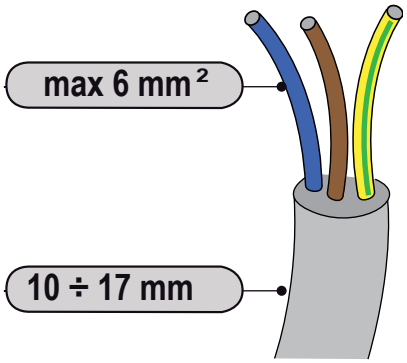
Standard version



S Version



Characteristics and sizing of the line cable



The cross-section of the AC line conductor must be sized in order to prevent unwanted disconnections of the inverter from the grid due to high impedance of the line that connects the inverter to the power supply point; In fact, if the impedance is too high, it causes an increase in the AC voltage that, on reaching the limit set by the country of installation, causes the inverter to switch off.

The table shows the maximum length of the line conductor based on the cross-section of this conductor:

Cross-section of the line conductor (mm²)	Maximum length of the line conductor (m)	
	UNO-2.0-I-OUTD	UNO-2.5-I-OUTD
2,5	15	12
4	25	20
6	38	30

The values are calculated considering an energy loss along the line (in rated power conditions) not exceeding 1%.

The temperature rating of the line cable must be at least 20° C above the maximum expected ambient temperature.

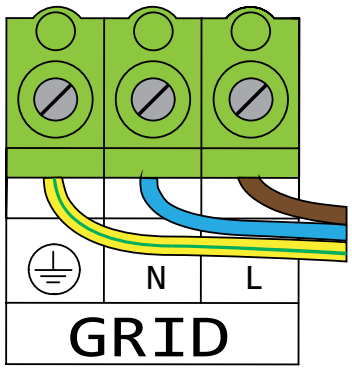
Load protection switch (AC disconnect switch)

To protect the AC connection line of the inverter, we recommend installing a device for protection against over current and leakage with the following characteristics:

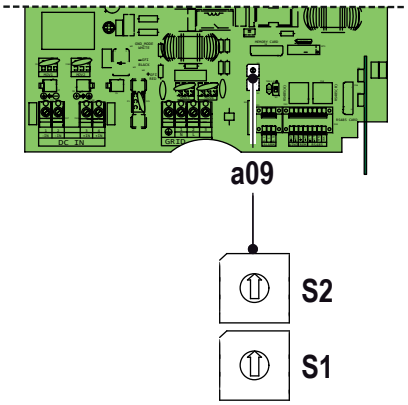
	UNO-2.0-I-OUTD	UNO-2.5-I-OUTD
Type	Automatic circuit breaker with differential thermal magnetic protection	
Voltage/Current rating	230Vac/16A	230Vac/16A
Magnetic protection characteristic	B/C	B/C
Type of differential protection	A/AC	A/AC
Differential sensitivity	30mA	30mA
Number of poles	2	2

Connection to the AC side terminal board

To prevent electrocution hazards, all the connection operations must be carried out with the disconnect switch downstream of the inverter (grid side) open and locked.



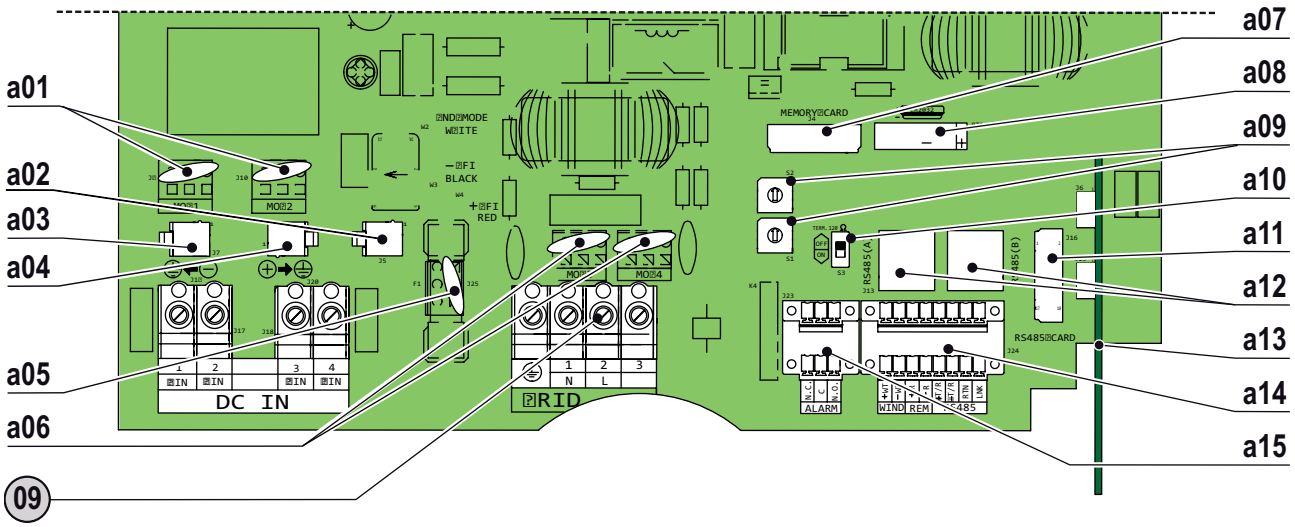
For all models you connect the AC output screw terminal block **09** by passing the cables through the AC cable gland **08**.
The maximum diameter accepted by the cable gland is from 10 to 17 mm2 while each terminal of the terminal board accepts a cable with cross-section which can vary from 0.6 up to 16 mm2.
Unscrew the AC cable gland **08**, remove the cover, insert the cable of suitable cross-section and connect the conductors (Ground, Neutral, and Phase) to the terminals on the AC output screw terminal block **09**.
Pay special attention and ensure you do not reverse the phase with the neutral!
Once the connection to the terminal board has been made, tighten the cable gland firmly and check the seal.



Before connecting the inverter to the distribution grid it is necessary to set the country standard by manipulating the two rotary switches a09 and following the instructions in the table displayed in the relevant section.v

NOTE: For installations carried out in Italy it is required to lead seal the AC connector. To this end a bracket must be fixed on top of the AC output screw terminal block 09 by tightening the screw on the appropriate turret is provided. The distributor grid during the phase of connecting to the grid will then provide for application of the lead sealing.

Main board



Ref. manual	Ref. inverter	Main board 05 Description
a01	J9 - J10	Input varistors
a02	J5	Connector for floating ground of the inputs
a03	J7	Connector for negative grounding of the inputs
a04	J8	Connector for positive grounding of the inputs
a05	F1 - J25	PTC
a06	J11 - J12	Output varistors
a07	J4	Inverter data memory card housing
a08	BT1	Battery housing
a09	S1 - S2	Rotary switches for setting the standard of the country and the language of the display
a10	S3	Switch for setting the termination resistance of the RS485 line
a11	J16	RS485 communication card housing
a12	J13 - J14	Connection of the RS485 line on RJ45 connector
a13	J6 - J15	Radiomodule card slot
a14	J24	Speed sensor connections, remote control, RS485
a15	J23	Connection to the multi-function relay
09	J21 - J22	AC output terminal board

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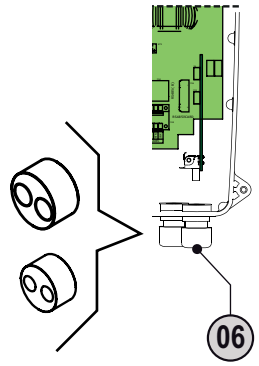
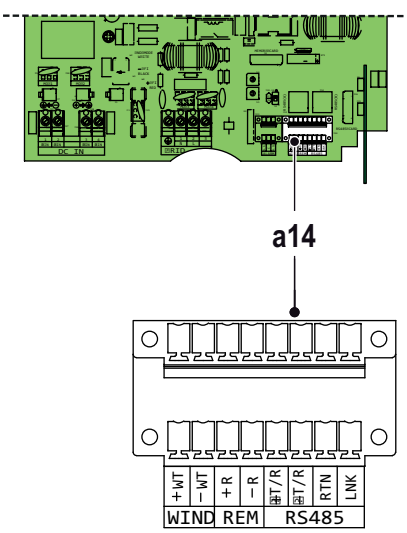
Connections of the signals to the main board



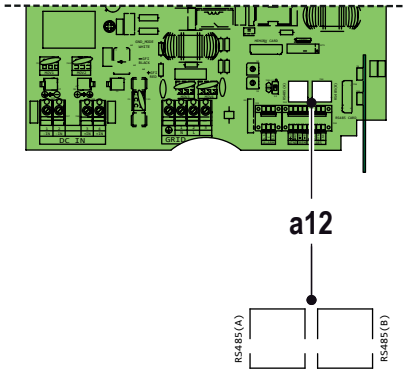
Each cable which must be connected to the connectors of the communication and control signals must pass through the two service cable glands **06** (shown in the picture).
The available cable glands are two M20s that can take a cable with a diameter of 7 mm to 13 mm. Two-hole gaskets are supplied for insertion in the cable gland, which allow two separate cables with cross-section of up to 5 mm to go through.
The signal cables are connected to the main board **05** inside the inverter by means of the terminal connectors supplied.

Serial Connection Communication (RS485)

On the inverter there is a RS485 communication line, dedicated to connecting the inverter to monitoring devices or to carrying out “daisy-chain” (“in-out”) connections of multiple inverters.
The RS485 connecting cables can use both the terminal connectors a14 as well as the RJ45 connectors to be connected to the dedicated port a12.



Connection of the conductors using the terminal connectors a14 (+T/R, -T/R, RTN and LNK).
The LNK connection must be used for connecting the shielding boot(s) of the cable(s).



Connection of conductors with RJ45 connectors a12
The RJ45 connectors (A) and (B) available for the RS485 communication, are equivalent to each other and can be used interchangeably for the arrival or for the output of the line in realising the daisy chain connection of the inverters.

The same is true for connections made using the terminal connectors a14.

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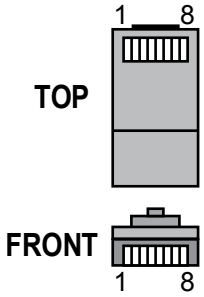
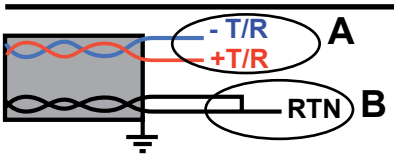
Table: crimping scheme connectors RJ45



Pin N°	Function
1	not used
2	not used
3	+T/R
4	not used
5	-T/R
6	not used
7	RTN
8	not used

Use a connector with metal body to provide cable shield continuity!

For long distance connections, the connection on terminal connector is preferable using a shielded twisted pair cable with characteristic impedance of Z0=120 Ohm like the one shown in the following table:

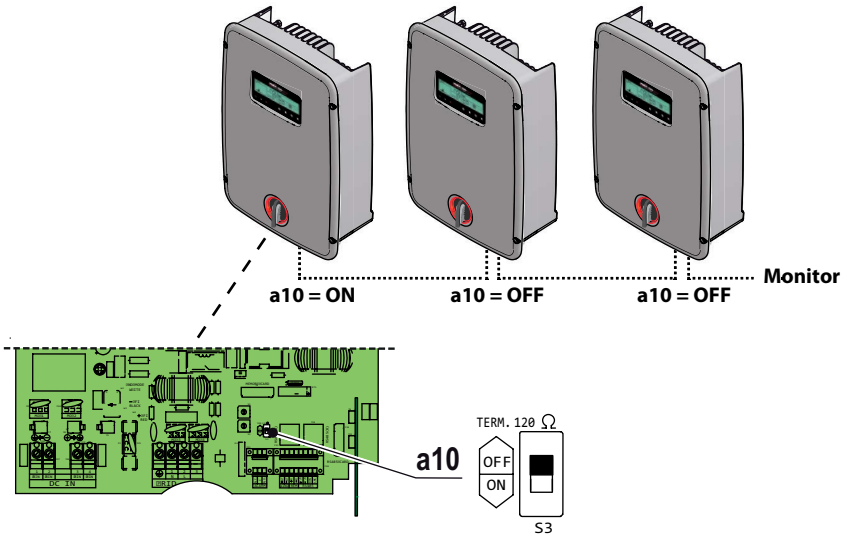


Signal	Symbol	Pair	Cable
Positive data	+T/R	A	1
Negative data	-T/R	A	2
Reference	RTN	B	1+2

Shield continuity must be provided along the communication line using the LNK terminal and must be grounded at a single point.

Procedure for connection to a monitoring system

Connect all the units of the RS485 chain in accordance with the “daisy-chain” arrangement (“in-out”) observing the correspondence between signals, and activate the termination resistance of the communication line in the last element of the chain by switching switch a10 (to ON position).



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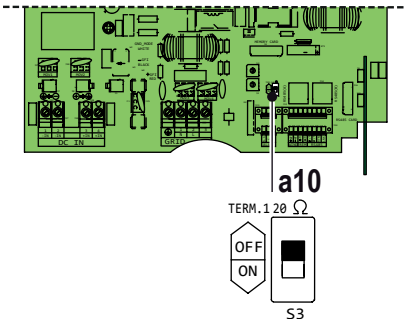
If a single inverter is connected to the monitoring system, activate the termination resistance of the communication line by switching switch a10 (to ON position).
Set a different RS485 address on each inverter of the chain. **No inverter should have "Auto" as its address**. An address can be chosen freely from out of 2 to 63.
The address on the inverter is set through the display and the push-button panel (see relevant chapter).

We recommend not exceeding a length of 1000m for the communication line.
No more than 62 inverters can be connected to the same RS485 line.



When using an RS-485 connection, if one or more inverters are added later to the system, you must remember to return to OFF position the switch of the termination resistance used (PC or PMU) of the inverter that was previously the last one of the system.
Each inverter is dispatched with two (2) as the predefined RS485 address and with switch for setting termination resistance a10 to OFF position.

Monitoring system via serial (RS485)

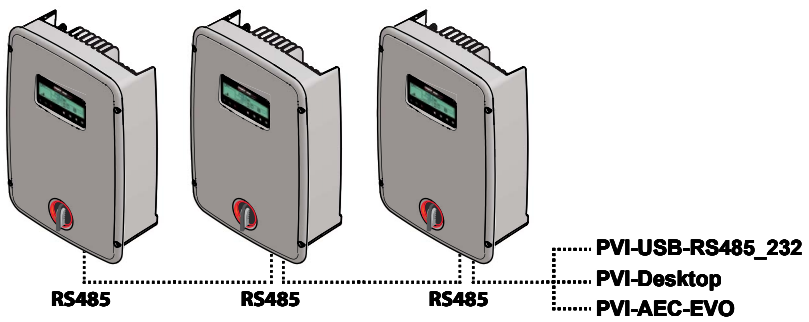
The RS485 line can be connected to various monitoring devices that can be in **local** or **remote** mode:

- **Local monitoring from PC** with **PVI-USB-RS485_232** adaptor and **Aurora Communicator** software
- **Local monitoring from remote display** with **PVI-DESKTOP** device
- **Remote monitoring** with **PVI-AEC-EVO** monitoring system and **Portal P1**

For local monitoring, ***Power-One*** recommends connecting its PVI-USB-RS485_232 adaptor between the first unit of the daisy-chain and the computer.

Equivalent devices found on the market can also be used for the same purpose, but, bearing in mind that they have never been specifically tested, Power-One cannot guarantee correct operation of the connection.

Please note that these devices may also require an external termination impedance, whereas this is **not necessary** with the Aurora PVI-USB-RS485_232.



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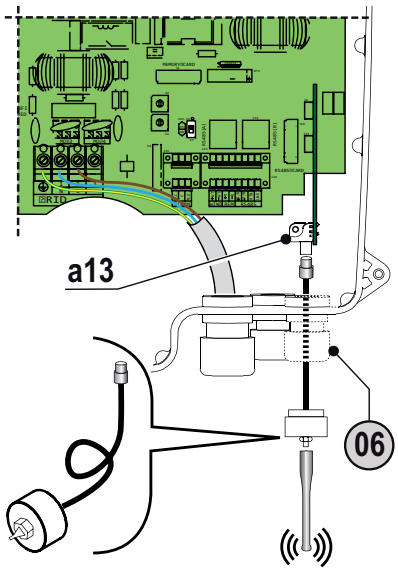
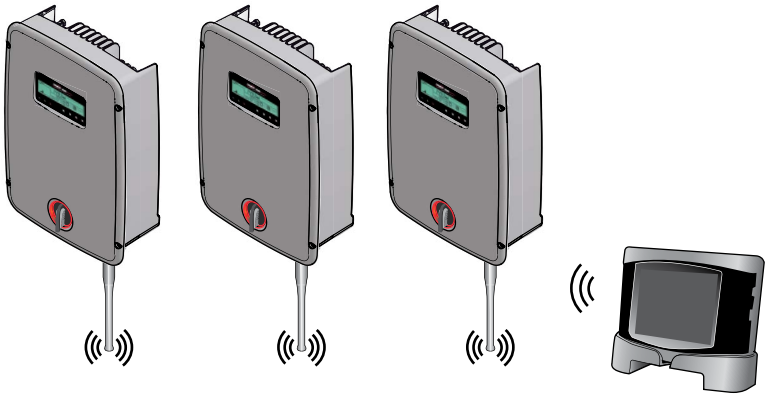
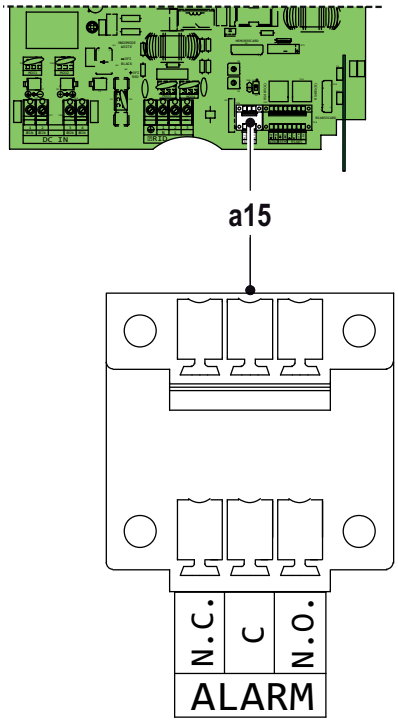
Monitoring System via Radiomodule



The radiomodule card is an accessory for the data transmission via radio waves to a monitoring device.
The radiomodule card is installed on the main board **05** vertically, by connecting the two a13 connectors and screwing the anchoring screws.
In turn wiring ending with an antenna installed outside the inverter is connected to the radiomodule:
The part of the inverter where the antenna will be installed will be in the place of one of the service cable glands **06** of M20 measurements.
The monitoring is carried out using the **PVI-DESKTOP** device.



Configurable relay connection



NC = Normally closed
C = Common contact
NO = Normally open

The inverter has a multi-function relay a09, whose switching can be configured. It can be connected with normally open contact (being connected between the NO terminal and the common contact C) and with normally closed contact (being connected between the NC terminal and the common contact C).
This contact can be used in four different operating configurations that can be set in the dedicated menu.

Operating modes

• **Production**: the relay switches whenever a connection to (and therefore a disconnection from) the grid occurs.
So if the NO (or NC) contact is chosen, the contact will stay open (or closed) until the inverter is connected to the grid; once the inverter connects to the grid and starts to export power, the relay switches state and therefore closes (or opens).
When the inverter disconnects from the grid, the relay contact returns to its position of rest, namely open (or closed).

• **Alarm**: the relay switches whenever there is an alarm on the inverter (Error). No switching occurs when there is a Warning.
So if the NO (or NC) contact is chosen, the contact will stay open (or closed) until the inverter reports an error; once the inverter reports an error, the relay switches state and therefore closes (or opens).

The contact remains switched from its rest condition until normal operation is restored.
• **Alarm** (configurable): the relay switches whenever there is an alarm (Error) or a Warning, which have been previously selected by the user through the dedicated menu.
If the NO (or NC) contact is chosen, the contact will stay open (or closed) until the inverter reports an error or a warning out of those selected from the menu; once the inverter displays an error or a warning out of those selected, the relay switches state and therefore closes (or opens) the contact. The relay remains switched from its rest condition until the alarm or warning has disappeared.

• **Crepuscular**: the relay usually switches when the voltage from the photovoltaic generator exceeds/falls below the threshold set for grid connection.
If the NO (or NC) contact is chosen, the contact will stay open (or closed) until the inverter has an input voltage higher than the one selected for grid connection. The contact remains switched from its rest condition for as long as the inverter is switched on (even if not connected to the grid). This mode is useful for disconnecting large output transformers that could have unnecessary consumption during the night.

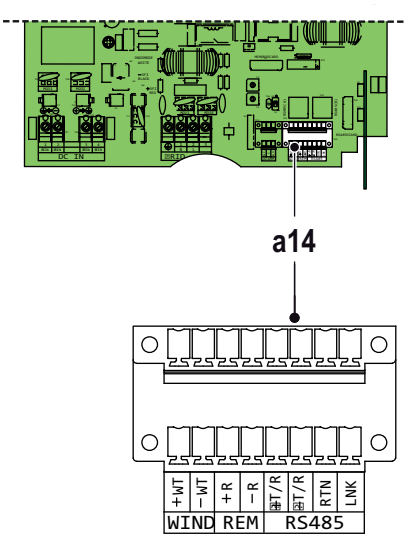
The device to be connected to the relay can be of different types (light, sound, etc) but must comply with the following requirements:

Alternating current
Maximum Voltage: 240 Vac Maximum Current: 1 A

Direct current
Maximum Voltage: 30 Vdc Maximum Current: 0.8 A

Cable requirements
External diameter: from 5 to 17 mm
Conductor cross-section: from 0.14 to 1.5 mm^2

Remote control connection



The connection and disconnection of the inverter to and from the grid can be controlled through an external control.
The function must be enabled in the relevant menu. If the remote control function is disabled, the switching on of the inverter is dictated by the presence of the normal parameters that allow the inverter to connect to the grid.
If the remote control function is operating, besides being dictated by the presence of the normal parameters that allow the inverter to connect to the grid, the switching on of the inverter also depends on the state of the +R terminal compared to the -R terminal present on the connector a14 of the main board **05**.
When the +R signal is brought to the same potential as the -R signal (i.e. by making a short circuit between the two terminals of the connector), this causes the inverter to disconnect from the grid.
The remote control OFF condition is shown on the display.
The connections of this control are made between the “+R” input and “-R”. Since this is a digital input, there are no requirements to be observed as regards cable cross-section (it only needs to comply with the sizing requirement for passing cables through the cable glands and the terminal connector).

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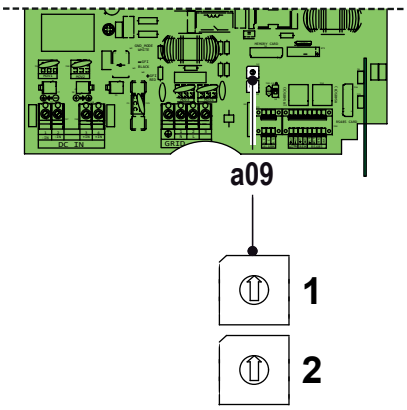
Standard grid setting of the country and language display

There are different grid parameters (dictated by the electricity distributor) according to the country in which the inverter is installed.

Setting the grid standard for the country of installation is a necessary operation before commissioning, and the installer must know the correct standard to be configured.



The inverter is configured using the rotary switches a09.
Before turning the rotary switches, make sure the inverter is switched off!
At the same time as the grid standard is set, **the language of the display menus** is also set.

Table: country standard and language

The table below shows which country grid standard and menu language are assigned to the various positions of the rotary switches a09

Switch 1	Switch 2	Country Grid Standard	Display menu language
0	0	NOT-ASSIGNED	ENGLISH
0	1	GERMANY – VDE 0126 @ 230V Single Phase	GERMAN
0	2	UL 1741 @ 208V Single Phase	ENGLISH
0	3	UL 1741 @ 240V Split Phase	ENGLISH
0	4	UL 1741 @ 277V Single Phase	ENGLISH
0	5	ENEL GUIDA @ 230V Single Phase	ITALIAN
0	6	SPAIN @ 230V	SPANISH
0	7	UK – G83 @ 230V	ENGLISH
0	9	IRELAND @ 230V	ENGLISH
0	A	AUSTRALIA @ 230V	ENGLISH
0	B	ISRAEL @ 230V	ENGLISH
0	D	FRANCE @ 230V	FRENCH
0	E	BELGIUM @ 230V	FRENCH
0	F	GREECE @ 230V	ENGLISH
1	0	PORTUGAL @ 230V	ENGLISH
1	1	CORSICA @ 230V	FRENCH
1	2	HUNGARY @ 230V	ENGLISH
1	3	CHINA @ 230V	ENGLISH
1	4	KOREA @ 220V	ENGLISH
1	5	TAIWAN @ 230V	ENGLISH
1	6	CHECA Republic @ 230V	ENGLISH
1	7	GERMANY – VDE AR-N-4105 @ 230V	GERMAN
1	8	ENEL CEI-021 @ 230V Single Phase	ITALIAN
8	8	Debug USA	-
F	F	Debug EU	-

The predefined setting is 0 / 0 and means no grid standard is selected and the display language is English (in this case, the “Set Country” message will appear on the display).

If a position of switches not assigned on the display 12 is selected, “Invalid Selection” appears.

Saving the country standard and language

The settings become fixed after 24 hours of operation of the inverter (it does not need to be connected to the grid, and only needs to be powered).
The time remaining before the settings become fixed can be seen in the dedicated menu, and a notice appears if the time has expired.

Once the settings are fixed, turning the rotary switches will produce no effect. In this condition, only the language can be changed through the dedicated menu.

At any time and for any reason, the ENGLISH language of the display menu can be set by simultaneously pressing the “ESC” and “ENTER” buttons for at least 3 seconds.

If it is necessary to change the standard of the country after the settings have been fixed (after 24 hours of operation) please contact Power-One’s technical support department with the part number and serial number of the inverter to hand.

6 - Instruments

General conditions

One of the first rules for preventing damage to the equipment and to the operator is to have a thorough knowledge of the INSTRUMENTS. We therefore advise you to read this manual carefully. If you are not sure about anything or there is discrepancy in information, please ask for more detailed information.

Do not use the equipment if:
- you do not have suitable qualifications to work on this equipment or similar products;
- you are unable to understand how it works;
- you are not sure what will happen when the buttons or switches are operated;
- you notice any operating anomalies;
- there are doubts or contradictions between your experience, the manual and/or other operators.

Power-One cannot be held responsible for damage to the equipment or the operator if it is the result of incompetence, insufficient qualifications or lack of training.

Display and keypad

Description of symbols and display fields

The operating parameters of the equipment are displayed through the display **12**: warnings, alarms, channels, voltages, etc.
During operation, the display behaves dynamically, which allows some information to be displayed cyclically (see relevant chapter).

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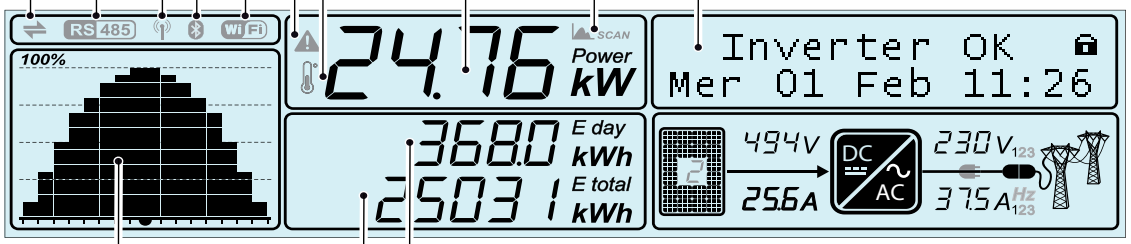
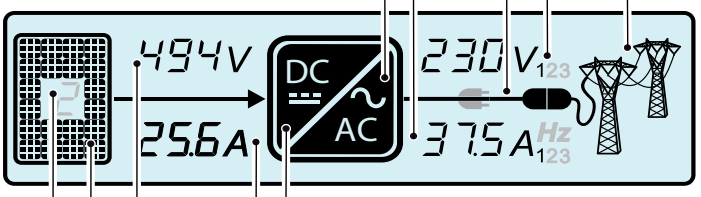
b1 - Indicates the transmission and reception of data through the RS485 line.
b2 - Indicates the presence of the RS485 communication line.
b3 - Reports the presence of a line of radio communication (Radiomodule card installed)
b4 - Indicates the presence and enablement of the bluetooth communication line (NOT available).
b5 - Indicates the presence and enablement of the WiFi communication line.(NOT available)
b6 - Reports a derating of active power for the input voltage out of range or power limitation imposed by the grid or display operator
b7 - Reports a derating of power due to high internal temperature
b8 - Instantaneous power generated for the grid
b9 - MPPT SCAN function activated
b10 - Lines of text for the cyclical display of inverter parameters, error codes and the menu navigation



b13 - Displays the energy produced over a day.
b12 - Displays the total energy produced since installation of the inverter.
b11 - Graph of the power fed into the grid (from 0 to 100%). The time scale is settable to 8/16/24 hours

b18 - Indicates the circuit part for conversion from DC to AC.
b20 - Output current from the highlighted phase. At the end of the display of the currents the grid frequency (Hz) is displayed.
b21 - Connection to the grid:
Inverter not connected
Inverter connected
b19 - Output voltage of the highlighted phase
b22 - Status of the grid voltage:
Icon not present: no grid voltage
Flashing icon: grid voltage present but outside the parameters set by the grid standard
Icon present: grid voltage present and within the parameters set by the grid standard



b17 - Indicates the DC/DC input circuit part (Booster)
b16 - Input current (DC)
b15 - Input voltage (DC)
b14 - Indicates that the PV generator voltage is higher than the Vstart of the inverter.
b24 - Indicates the channel which refers to the values of voltage and input current displayed. In the case of independent channels the display parameters is cyclic (channel 1 or 2)v

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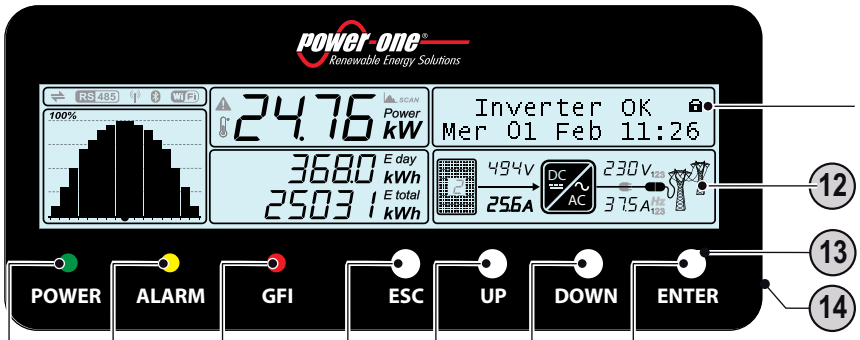
Description of the keypad

Through the combination of LED panel **14** buttons, under the display **12,** values can be set or data can be displayed by scrolling them.
Some LEDs are also shown on the keypad **13** for status conditions.



While pressing the ENTER key the cyclic display parameters can be:
- Locked
- Cyclic

This allows you to confirm the operation or to enter the set data item.

This allows you to read the data on the display by scrolling downwards, or to decrease the set value to correct it during data entry.

This allows you to read the data on the display by scrolling upwards, or to increase the set value to correct it during data entry.

This button allows you to exit a mode.

The “GFI” (ground fault) LED indicates that the inverter has detected a ground fault on the DC side of the photovoltaic generator. When this fault is detected, the inverter immediately disconnects from the grid and the relevant error warning appears on the LCD display.

Indicates that the inverter has detected an anomaly.
The type of problem is shown on the display.

Indicates that the inverter is working correctly.
This LED flashes while the grid is being checked when the unit is commissioned. If a valid grid voltage is measured, the LED stays on continuously, provided there is sufficient sunlight to activate the unit. If not, the LED continues to flash until there is sufficient sunlight for activation. During this phase, the LCD display shows the “Waiting for sun….” message. Indica che l’inverter funziona correttamente.

In their various possible multiple combinations, the LEDs can indicate conditions that are different from the original single one; see the various descriptions given in the manual.

In their various possible multiple combinations, the buttons allow you to obtain actions that are different from the original single one; see the various descriptions given in the manual.

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7 - Operation

General conditions

Before checking the operation of the equipment, it is necessary to have a thorough knowledge of the INSTRUMENTS chapter and the functions that have been enabled in the installation.
The equipment operates automatically without the aid of an operator; operating state is controlled through the instruments.

The interpretation or variation of some data is reserved exclusively for specialized and qualified staff.

The incoming voltage must not exceed the maximum values shown in the technical data in order to avoid damaging the equipment.
Consult the technical data for further details.

Even during operation, check that the environmental and logistic conditions are correct (see installation chapter).
Make sure that the said conditions have not changed over time and that the equipment is not exposed to adverse weather conditions and has not been isolated with foreign bodies.

Monitoring and data transmission

As a rule, the inverter operates automatically and does not require special checks. When there is not enough solar radiation to supply power for export to the grid, (e.g. during the night) it disconnects automatically. In this mode data consultation on the display **12** is possible (holding down any one key of the keypad **13**, the display is activated).
The operating cycle is automatically restored when there is sufficient solar radiation. At this point, the luminous LEDs on the LED panel **14** will indicate this state.

User interface mode

The inverter is able to provide information about its operation through the following instruments:
• Warning lights (luminous LEDs)
• LCD display for displaying operating data
• Data transmission on dedicated RS-485 serial line. The data can be collected by a PC (using the signal converter PVI-USB-RS485_232) or a data logger equipped with an RS-485 port (PVI-DESKTOP / PVI-AEC-EVO). Contact ***Power-One*** assistance for any doubts about the compatibility of the devices.

Types of data available

The inverter provides two types of data, which are usable through the relevant interface software and/or through the display **12**.

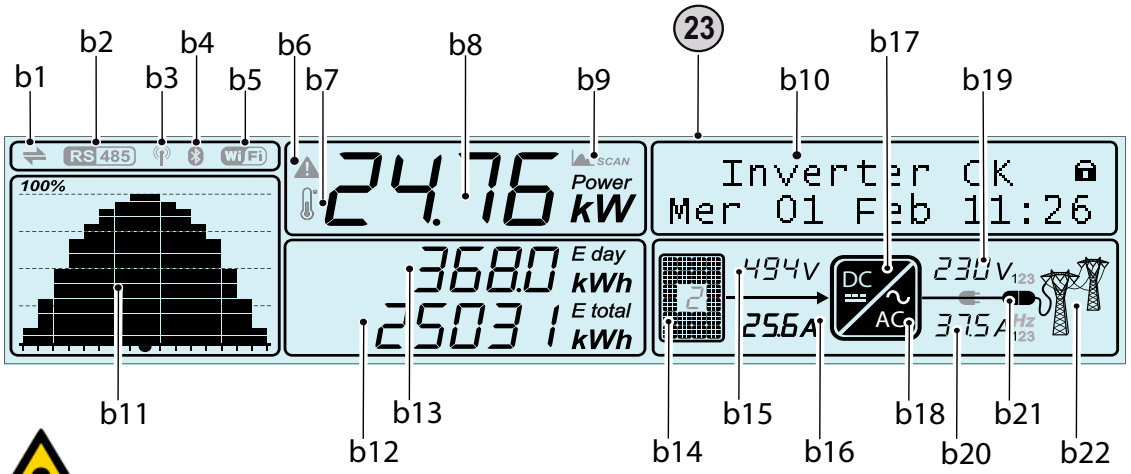
Real-time operating data
Real-time operating data can be transmitted on request through the communication lines and are not recorded in the inverter. For data transmission to a PC, the free software supplied with the inverter can be used (please check at www.power-one.com for more updated versions).

Internally stored data
The inverter internally stores a set of data that are necessary for processing statistical data and an error log with time marking.

Commissioning

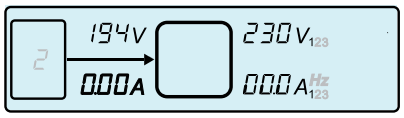
Do not place objects of any kind on the inverter during operation!

Do not touch the heatsink while the inverter is operating!
Some parts may be very hot and cause burns.

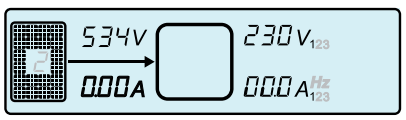


NOTE: Before proceeding with commissioning, make sure you have carried out all the checks and verifications indicated in the section on preliminary checks.

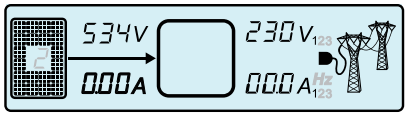
Vin < Vstart



Vin > Vstart



Vgrid OK

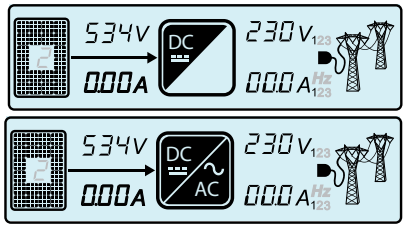


The inverter commissioning procedure is as follows:

• Put the DC disconnect switch **07** in ON position. If there are two separate external disconnect switches (one for DC and the other for AC), first close the AC disconnect switch and then the DC disconnect switch. There is no order of priority for opening the disconnect switches.

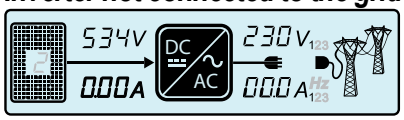
• When the inverter has power, the first check performed is the one relating to the input voltage:
- If the DC input voltage is lower than the Vstart voltage (voltage required to begin the inverter's grid connection) the b14 icon remains off and the "Waiting for the sun" message is displayed b10.
- If the DC input voltage is higher than the Vstart voltage the b14 icon is displayed and the inverter goes to the next stage of the controls.
In both cases the voltage levels and input current are displayed in the b15 and b16 fields.

• The inverter performs a control of grid parameters. The b22 icon, which represents the grid distribution, can have different statuses:
- Not present, if the mains voltage results as absent.
- flashing, if the mains voltage is present but outside the parameters dictated by the standard of the country of installation.
- Turns on, if the mains voltage is present and within the parameters dictated by the standard of the country of installation. In this condition, the inverter starts the sequence of grid connection.
This verification can take several minutes (from a minimum of 30 seconds up to several minutes), depending on grid conditions and settings relative to the standard of the country

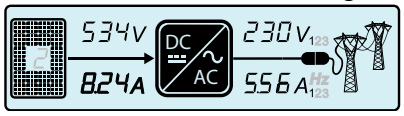


• At this point the b17 icon will flash, this indicates the start-up of the DC-DC circuit (booster) part. This icon will remain permanently switched on when the DC-DC will be operating at steady state (the flashing of the icon usually lasts a few seconds).
Immediately after this, the b18 icon, which indicates the AC-DC circuit (inverter) part, will also behave normally.

Inverter not connected to the grid

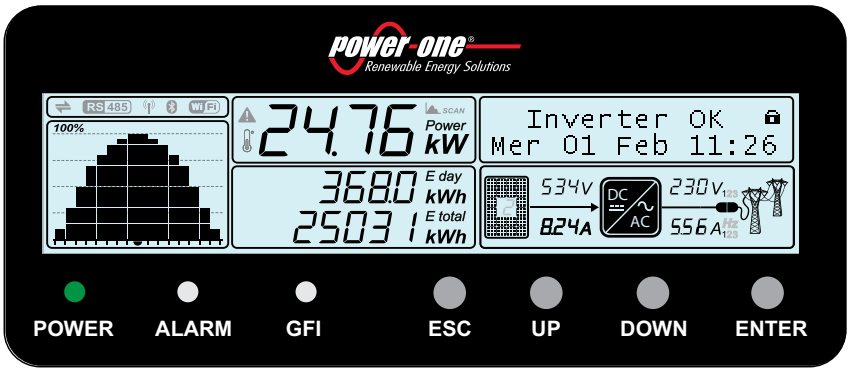


Inverter connected to the grid



• Immediately after this the grid connection will start. During this phase the icons will be displayed in sequence on the b21 board until the connection of the inverter. After the inverter is connected, the icons on the whole line b21 will come on steady.
If the inverter disconnects from the grid, the icons of the left side (cable and plug) of the line b21 will stay on.

• Once the connection sequence has been completed, the inverter starts to operate and indicates its correct operation by making a sound and by the green LED coming on steady on the LED panel **14**. This means there is sufficient solar radiation to feed power into the grid.

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• If the checking of the grid does not give a positive result, the unit will repeat the procedure until all the parameters that allow connection to the grid (grid voltage and frequency, insulation resistance) are within the range. During this procedure, the green LED flashes.

At the end of the first starting of the inverter, the wiring box must be configured using the dedicated Aurora Manager software. The software and relevant manual for carrying out this configuration are contained in the CD supplied with the inverter.

Display access and settings

After the commissioning of the inverter, it is possible/necessary to set the configuration of the inverter by accessing the “Account Settings” from the display. The following are the main adjustable parameters (see the section dedicated to the “**Menu descriptions**”)

• **Address RS485**: settings required in the case of system monitoring using the RS485 board

• **Vstart**: setting required in the case it is requested by the configuration during the system requirement phase (“Vstart” parameter)

• **MPPT scan**: allows you to carry out a search for the maximum power point with sensitivity and adjustable time intervals (“MPP” parameter).

• **Analogue inputs setting (where present)**: allows you to set the parameters of the analogue sensors connected as the input (“Analogue Inputs”).

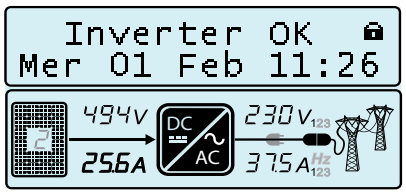
• **Input Strings (where present)**: setting necessary to carry out checks on the status of the fuses and on the current imbalance of the strings present in the input (“Fuse control” parameters).

• **Reactive power input setting (where present)**: setting necessary to manage the reactive power input into the grid in different ways (“Reactive Power parameter”)

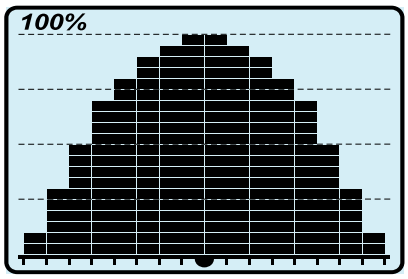
• **Limitation active power setting (where present)**: setting necessary to set a limit on active power output of the inverter (“Power reduction” parameter)

Dynamic behaviour of the display

• If the MPPT scan function is enabled, icon b9 will be shown on the display. See configuration in the MPPT settings menu section. This icon will flash during scanning.



• During operation, the following values are displayed in rotation:
- Voltage and current (b15 and b16) from the PV generator. According to the configuration or model of the inverter, the voltages and currents of one or both channels (or of the single strings) will be displayed. The input channel considered is indicated by the value entered on icon b14.
- Voltage and current (b19 and b20) on the various phases. According to the model of inverter, the voltages and currents of one (1) or three phases (1,2,3) will be displayed. The phase considered is shown on the right side of the voltage and current values.
At the end of the aforesaid display, the grid frequency will be indicated in field b20 and the line voltage will be indicated in field b19.
At the same time, the main readings made by the inverter will be displayed in rotation on the graphic display b10.



• Display of the power graph b11
The histogram includes 16 horizontal units and 20 vertical units.
The period of time is represented by the horizontal axis of the graph and can be set by the user to 8, 16 or 24 hours; therefore, each horizontal unit can represent 30, 60 or 120 minutes.
The vertical axis represents the maximum power derating (2.2kW for the UNO-2.0-I-OUTD and 2.75kW for the UNO-2.5-IOUTD) and therefore 100% corresponds to this outgoing exported power value.
Finally, bear in mind that the power value expressed by each column of the graph represents the average value of the power during the period relating to the horizontal unit.

LED behaviour

● = LED on
⊗ = LED flashing
⊗ = LED off
(x) = Any one of the conditions described above

The following table shows all the possible combinations of activation of the LEDs, situated on the LED panel **14** in relation to the operating state of the inverter.

Table: LED behaviour

Status of the LEDs	Operating state	Notes
green: ⊗ **yellow:** ⊗ **red:** ⊗	Night mode (auto switch-off of the inverter)	The inverter is in night time switch-off mode (input voltage 70% less than the start-up voltage set for both inputs).
green: ⊗ **yellow:** ⊗ **red:** ⊗	Inverter initialization (loading of settings and wait for grid check)	This is a transition state due to the checking of the operating conditions. During this phase, the input power is sufficient and the inverter checks the conditions necessary for connection to the grid (for example: value of the input voltage, value of the insulation resistance, etc.).
green: ● **yellow:** ⊗ **red:** ⊗	The inverter is connected and feeds power into the grid	The machine is operating normally. During this phase, the inverter automatically carries out a research and analysis of the maximum power point (MPP) available from the photovoltaic generator.
green: (x) **yellow:** (x) **red:** ●	Anomaly in the insulation system of the photovoltaic generator	The inverter indicates that too low an insulation resistance (R iso) has been detected (presence of a leakage to ground of the PV generator) and feeds the power extracted from the photovoltaic generator into the grid. The problem may be connected with an insulation fault in the PV modules or in the connections (DC side).
green: ⊗ **yellow:** ● **red:** ⊗	We have: Anomaly (warning: W warning codes) Error (error: E warning codes)	Whenever the control system of the inverter detects an anomaly (W) or fault (E) in the operation of the monitored system, the yellow LED comes on steady and a message indicating the type of problem found appears on the display **12**. The error can be inside or outside the inverter (see Alarm messages).
green: ⊗ **yellow:** ⊗ **red:** ⊗	Internal ventilation anomaly	Indicates an operating anomaly in the internal ventilation. This does not cause much of a problem to the inverter because the fan starts only at high temperatures combined with high output powers.
green: ⊗ **yellow:** ● **red:** ⊗	Disconnection from the grid	Indicates that the grid voltage for allowing the inverter to connect to the grid is not present. The inverter shows the No Vac message on the display.

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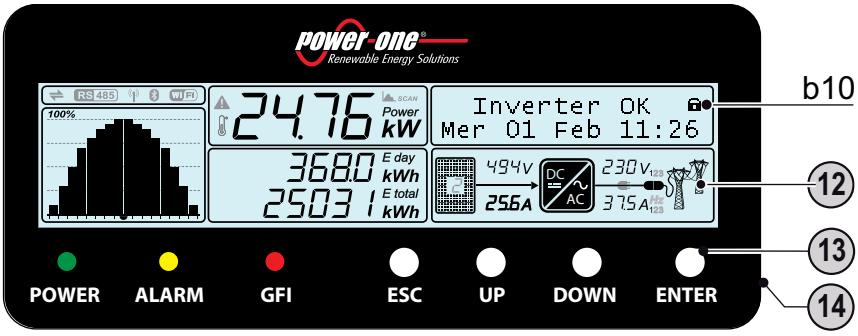
Specifications on the behaviour of the LEDs

Next to each state of the inverter, indicated through the steady or intermittent lighting of the relevant LED, a message that identifies the operation it is carrying out or the detected fault/anomaly is also shown on the display **12**, section b10, (see relevant chapter).



In the event of malfunctioning, it is extremely dangerous to try to eliminate the fault personally. The instructions given below must be strictly followed; if you do not have the experience and necessary qualification to work safely, please contact a specialized technician.

Insulation fault LED

What to do after an insulation fault warning

When the red LED comes on, first try to reset the warning through the multi-function button ESC on the LED panel **14**.

If the inverter duly reconnects to the grid, the fault was due to temporary phenomena.

We advise having the system inspected by the installer or a specialized technician if this malfunctioning occurs frequently.

If the inverter does not reconnect to the grid, make it safe by isolating it (by means of the disconnect switches) on the both the DC side and the AC side, and then contact the installer or an authorized service centre to have the photovoltaic generator fault repaired.

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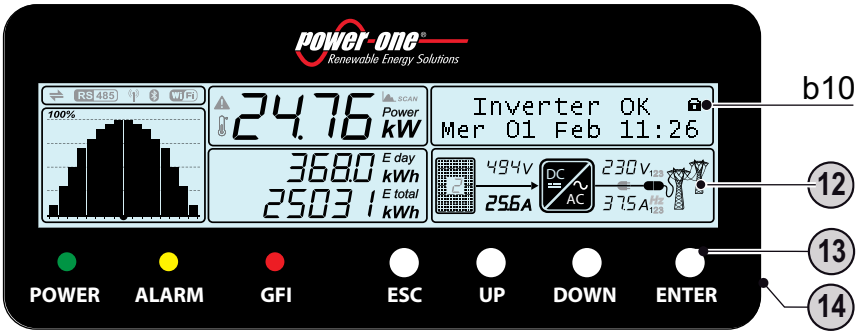
Description of the menus

The display **12** has a section b10 (graphic display) for moving through the menu using the buttons of the LED panel **14**.
Section b10 consists of 2 lines with 16 characters per line and can be used to:

- display the operating state of the inverter and the statistical data;
- display the service messages for the operator;
- display the alarm and fault messages for the operator;
- changing the settings of the inverter.



Using the panel buttons

- The UP and DOWN buttons of the LED panel **14** are used to move around a menu or to increase/decrease the settable values.

- The ESC button allows access to the three main sub-menus, STATISTICS, SETTINGS and INFORMATION.
This allows you to return to the previous sub-menu while moving through the menus.

- The ENTER button allows access to the required sub-menu while moving though the menus and allows the main menu scroll mode to be changed (icons b23 are activated):
CYCLIC: Cyclic display of the main parameters of the inverter.
LOCKED: Display locked on the screen you want to monitor continuously.

Statistics menu

Selecting STATISTICS from the three main sub-menus gives access to:

• **Total**
This section of the menu allows you to display the Total statistics:
Time: Total operating time
E-tot: Total energy produced
Val. : Total production value, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved compared to fossil fuels

• **Partial**
This section of the menu allows you to display the partial statistics:
Time: Partial operating time
E-par: Partial energy produced
PPeak: Peak power value
Val. : Partial production value, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Partial amount of CO_2 saved

* To reset all the counters of this sub-menu, press the ENTER button for more than 3 seconds. At the end of this time, you will hear a sound repeated 3 times.

• **Today**
This section of the menu allows you to display the daily statistics:
E-day: Daily energy produced
Ppeak: daily peak power value
Val. : Daily production value, calculated with the currency and conversion coefficient
set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved daily

• **Last 7 days**
This section of the menu allows you to display the statistics for the last 7 days:
E-7d: Energy produced over the last 7 days
Val. : Value of production for the last 7 days, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved over the last 7 days

• **Last month**
This section of the menu allows you to display the statistics for the last month:
E-mon: Energy produced during the current month
Val. : Value of production for the last month, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved during the current month

• **Last 30 days**
This section of the menu allows you to display the statistics for the last 30 days:
E-30d: Energy produced over the last 30 days
Val. : Value of production for the last 30 days, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved over the last 30 days

• **Last 365 days**
This section of the menu allows you to display the statistics for the last 365 days:
E-365: Energy produced over the last 365 days
Val. : Value of production for the last 365 days, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved over the last 365 days

• **User period**
This section of the menu allows the statistics for a period selected by the user to be displayed:
Once the start and end dates for the period have been set, the following data are available:
E: Energy produced during the selected period
Val. : Value of production for the selected period, calculated with the currency and conversion coefficient set in the relevant section of the SETTINGS menu
CO_2: Amount of CO_2 saved during the selected period

Settings menu

When SETTINGS is selected from the three main sub-menus, the first screen for the password is displayed in the display.
The default password is "0000".
This can be changed using the display buttons, always following the same procedure:
• Use ENTER to scroll the digits (from left to right)
• Use ESC to return to the previous digit (from right to left)
• Press ESC several times to return to the previous menus
• Use DOWN to progressively scroll the numerical scale downwards (from 9 to 0)
• Use UP to progressively scroll the numerical scale upwards (from 0 to 9)
After entering the password, press ENTER to access the information gathered in this section:

• Address
This section of the menu allows you to set the address for the serial communication of single inverters connected to the RS485 line.
The addresses that can be assigned are 2 to 63. Use the UP and DOWN buttons to scroll the numerical scale.
At present, the 'AUTO' selection cannot be used

• Setting of Display
This section of the menu allows you to set the characteristics of the display:
1. Light: setting of the mode and adjustment of the brightness of the display
Mode:
On: Light always on
Off: Light always off
AUTO: Automatic light control. The light comes on whenever a button is pressed and stays on for 30 sec, after which it gradually goes out.
Intensity: adjustment of display brightness (scale from 1 to 9)
2. Contrast: adjustment of display contrast (scale from 1 to 9)
3. Buzzer: button sound setting
On: the sound of the buttons is activated
Off: the sound of the buttons is deactivated
4. Power Graph: Allows you to set the time scale of the power graph (8/16/24h)

• Service
This section of the menu is reserved for installers. To access this, it is necessary to have a dedicated password that will be provided by the Power-One Service.

Once get password (2nd level) is possible to perform the following settings inwardly of menu

Parameter	Parameter description	Setting range
Set U>>	Grid Over-voltage (OV) threshold (extended range)	Unom … Unom x 1.3
Set U<<	Grid Under-voltage (UV) threshold (extended range)	10V … Unom
Set F>>	Grid Over-Frequency (OF) threshold (extended range)	Fnom … Fnom + 5Hz
Set F<<	Grid Under-Frequency (UF) threshold (extended range)	Fnom - 5Hz … Fnom
Set U>	Grid Over-voltage (OV) threshold (strict range)	Unom … Unom x 1.3
Set U> (10Min)	Grid Over-voltage (OV) threshold (measure of the average value of the mains voltage)	Unom … Unom x 1.3
Set U<	Grid Under-voltage (UV) threshold (strict range)	10V … Unom
Set F>	Grid Over-Frequency (OF) threshold (strict range)	Fnom … Fnom + 5Hz
Set F<	Grid Under-Frequency (UF) threshold (strict range)	Fnom - 5Hz … Fnom
Set Uconn>	Max voltage admissible during grid pre-connection phase	Unom … Unom x 1.3
Set Uconn<	Min voltage admissible during grid pre-connection phase	10V … Unom
Set Fconn>	Max frequency admissible during grid pre-connection phase	Fnom … Fnom + 5Hz
Set Fconn<	Min frequency admissible during grid pre-connection phase	Fnom - 5Hz … Fnom
Set Time U>>	Intervention time of Over Voltage (U>>) protection	0 … 327670mS
Set Time U<<	Intervention time of Under Voltage (U<<) protection	0 … 327670mS
Set Time F>>	Intervention time of Over Frequency (F>>) protection	0 … 327670mS
Set Time F<<	Intervention time of Under Frequency (F<<) protection	0 … 327670mS
Set Time U>	Intervention time of Over Voltage (U>) protection	0 … 327670mS

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Set Time U<	Intervention time of Under Voltage (U<) protection	0 … 327670mS
Set Time F>	Intervention time of Over Frequency (F>) protection	0 … 327670mS
Set Time F<	Intervention time of Under Frequency (F<) protection	0 … 327670mS
Set time conn 1	Time lag, of grid parameters control, before connection	0 … 65535mS
Set time conn 2	Time lag, of grid parameters control, before connection after grid fault	0 …65535mS
Disable U>>	U>> protection threshold disabling	Enable/Disable
Disable U<<	U<< protection threshold disabling	Enable/Disable
Disable F>>	F>> protection threshold disabling	Enable/Disable
Disable F<<	F<< protection threshold disabling	Enable/Disable
Disable U>	U> protection threshold disabling	Enable/Disable
Disable U> (10Min)	U> (10Min) protection threshold disabling	
Disable U<	U< protection threshold disabling	Enable/Disable
Disable F>	F> protection threshold disabling	Enable/Disable
Disable F<	F< protection threshold disabling	Enable/Disable
U> (10Min) Der.	Enabling of power derating due to high average grid voltage value	Enable/Disable
Slow Ramp	Enabling gradual power immission into the grid after connection	Enable/Disable
OF Derating	Selection of power derating mode due to high value of grid frequency	0 : Derating disable 1 : Derating BDEW 2 : Derating VDE-AR-N 3 : Derating CEI
Reset Country S.	Allow to unlock the selection of the grid standard via rotary switches	
Accept boards	Allow to associate a new inverter board (when replacing)	

Due to the variation of the above mentioned parameters it is possible that the disconnection from the grid does not take place if the values exceed those mentioned in the standards of the country of installation. If these parameters exceed the standard values, install an interface protection, external to the inverter, which is compliant with the requirements of the country of installation.

• New PW
This section of the menu allows you to change the password for accessing the settings menu (default 0000).

We ADVISE you to be very careful in memorizing the new password.
If the Password is misplaced, it will not be possible to access the inverter, since there is no Reset function for security reasons.

• Currency
This section of the menu allows you to set the name of the currency and the value given to 1 kWh of energy produced. The correct setting of these parameters allows you to display the actual earning/saving given by the system. **Name:** the chosen value is set (default is Euro)
Val/KWh: indicates the cost/incentive of 1 KWh expressed in the chosen currency (default is 0.50).

• Date/Time
Allows you to set the current date and time (daylight saving time not included)

• Language
Allows you to set the required menu language

• Vstart
This section of the menu allows you to set the Vstart voltage (separately for both channels if they are configured in independent mode or available), to adapt it to the requirements of the system.

We advise changing the activation voltage only if really necessary and to set it to the correct value: the photovoltaic generator sizing instrument available on the Internet site of Power-One indicates whether it is necessary to change the Vstart and the value to set.

• Alarm
This section of the menu allows you to set the switching of a relay contact (available as a normally open contact – N.O. – and also as a normally closed contact – N.C.). This contact can be used, for example, to: activate a siren or a visual alarm, control the disconnect device of an

external transformer, or control an external device. Maximum ratings of the alarm contact: 240Vac/1A and 30Vdc/0.8A
The switching of the relay can be set in 4 different modes:
PRODUCTION: the relay switches when the inverter connects to the grid.
ALARM: the relay switches when there is an alarm (code E).
ALARM (conf.): the relay switches if there are alarms (code E) or warnings (code W) chosen by the user from a list (the list may also show choices that are not envisaged for the specific model).
CREPUSCULAR: the relay switches only when it exceeds the input voltage set for connection to the grid.

• Remote Control

This section of the menu allows you to enable/disable the connection/disconnection of the inverter to/from the grid through the relevant control signal (+R/-R).
Disable: the connection/disconnection of the inverter to/from the grid is dictated by the input (voltage from the photovoltaic generator) and output (grid voltage) parameters of the inverter.
Enable: the connection/disconnection of the inverter to/from the grid is dictated by the state of the +R signal compared to the -R signal as well as by the input (voltage from the photovoltaic generator) and output (grid voltage) parameters of the inverter.

• UV prot. T

This section of the menu allows you to set the time for which the inverter stays connected to the grid after the input voltage has dropped below the Under Voltage limit (set at 70% of Vstart). Power-One sets the time at 60 sec. The user can set it at from 1 to 3600 sec.
Example: with the UV Prot.time set at 60 seconds, if the Vin drops below 70% of Vstart at 9:00, the inverter stays connected to the grid (taking power from it) until 9:01.

• MPPT

This section of the menu allows you to set the parameters of the maximum power point search (MPPT) function. This function is useful when there are shadowed areas on the PV generator that can create several maximum power points in the work curve.
MPPT amplitude: the amplitude of the interference introduced in DC is chosen through the setting of this parameter to establish the optimal working point. There are 3 settings to choose from (LOW, MEDIUM, HIGH). The default setting is MEDIUM.
Multi-max scan: through the setting of this parameter, you can enable/disable the scan, decide the frequency with which the scan is carried out and override it manually.
Enable/Disable: Enables/Disables the scan for identifying the maximum power point of the system.

Scan Interval: this allows you to set the interval of time between scans. It must be borne in mind that, the shorter the interval between scans, the greater will be the loss of production due to the fact that, during the scan, energy is transferred to the grid but not at the maximum power point. Each scan takes 2 seconds.
Manual Scan: Allows you to start (asynchronously to the periodicity set through the Scan Interval) the manual scanning of the photovoltaic generator for peak point tracking.

• Alarm Msg
This section of the menu allows you to enter a customized message that is displayed on the display immediately after the specific error message has been displayed.
Enable/Disable: Enables/Disables the display of customized messages
Writing of Msg: you can write your customized message that can be written on two lines of 16 characters each. To write the message, use the UP/DOWN arrows to choose the character you wish to enter and press ENTER to confirm.

Information menu

• Product ID
Allows you to display the product identification code.

• Serial No.
Allows you to display the serial number of the equipment.

• Firmware
Allows you to display the revision of the firmware installed in the equipment.

• Country selector
Allows you to display information regarding the grid standard set with the rotary selectors.
- Current value: Displays the set grid standard.
- New value: If the position of the rotary switches is changed (a new grid standard is therefore selected) during operation, the new standard selected will be displayed but will be made effective only after the equipment has been switched off and then on again and only if the time remaining for carrying out this operation has not expired (24h of operation).
- Set new: Allows you to confirm/set the new grid standard set in the "New value" section of the previous menu. When this function is used, there will be no correspondence between the standard selected on the display and the position of the rotary selectors.
- Time remaining: Displays the time remaining in which it is still possible to set a new grid standard. When the time expires, "Locked" will be displayed, which indicates it is not possible to change the grid standard again.

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8 - Maintenance

General conditions

Checking and maintenance operations must be carried out by specialized staff assigned to carry out this work.

Maintenance operations must be carried out with the equipment disconnected from the grid, unless otherwise indicated.

For cleaning, DO NOT use rags made of filamentary material or corrosive products that may corrode parts of the equipment or generate electrostatic charges.
Avoid temporary repairs. All repairs should be carried out using only genuine spare parts.
The maintenance technician is under an obligation to promptly report any anomalies.

DO NOT allow the equipment to be used if problems of any kind are found, and restore the normal conditions correctly or otherwise make sure that this is done.

Always use the personal protective equipment provided by the employer and comply with the safety conditions of the Accident prevention chapter.

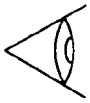
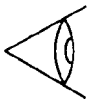
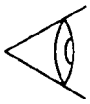
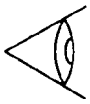
Power-One accepts no liability if the checking and maintenance cycles indicated in this manual and in the attached documentation are not complied with correctly, and also when maintenance is entrusted to unqualified staff.

To maintain the correct working performance, have the systems checked by your installer after **about 5 years** of activity.

Routine maintenance

For routine maintenance operations is recommended to be carried out by the installer or qualified staff.

Table: routine maintenance

	Perform **annually or as necessary** cleaning of the equipment; verify, in particular, the cleaning of the heat sink **15**, in order to avoid obstructions that could compromise the air flow. Use compressed air, a vacuum cleaner or special cleaners, if possible
	Clean the photovoltaic panels **every year**, at the change of season or as necessary. The performance of the system depends very much on the condition of the photovoltaic panels. To clean, follow the specifications of the PV panel supplier.
	**Every year** or in the event of malfunctioning, check that the environmental conditions have not changed drastically (exposure to weather conditions); also check that the inverter or PV panels have not been shaded or isolated by foreign bodies.
	**Once a year** or in the event of malfunctioning, check the tightness of the cable glands **06** or **08** the fixing of the connectors and the fixing of the front cover **04**. Any infiltration can generate problems of humidity and consequent short circuit.
	Carry out tests **every year** or in the case of anomalies, particularly after violent weather events, input varistors a01 and output varistors a06 installed on the main board **05**. Before restarting the inverter the cause of the failure must be resolved.
	**Once a year** or in the event of malfunctioning, check the backup battery and replace it if necessary. The battery normally lasts 10 years, but many conditions can reduce efficiency. The battery is found in the slot a20 of the main board **05**.

Special maintenance

Special maintenance operations should be performed in presence of warning (Wxxx) or error (Exxx) messages coming from the inverter. To understand and solve the problem follow the table reported in the following paragraph related to Alarm Messages that the inverter could generate.
Special maintenance operations can be carried out only by the installer or qualified staff.

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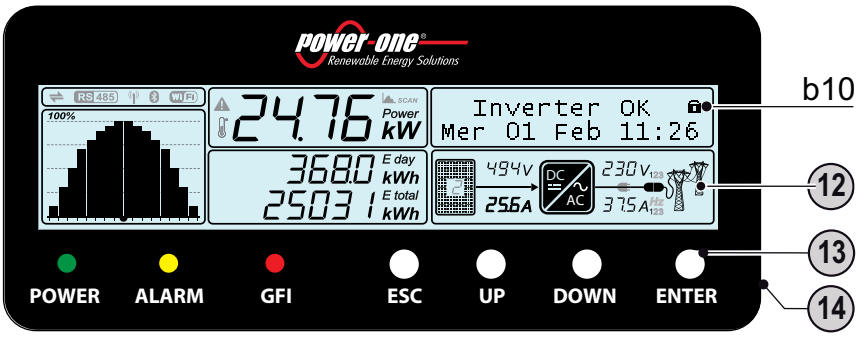
Alarm Messages

The equipment is able to indicate errors/warnings on the display only if the input voltage is higher than the Vdcmin voltage (POWER LED flashing or on; see operation chapter).
The messages and their codes are indicated on the highlighted part b10 of the display **12**.



The following table contains the entire Error/warning list of string inverters. Some Error/Warning codes could be not used depending of installed inverter model

Display Message	Display Codes	Alarm	Cause	Solution
Ground Fault	Red LED	Ground Fault	The alarm is generated when a ground leakage current is detected in the DC section of the system. The alarm is accompanied by the lighting up of the red LED on the front of the inverter.	If possible, measure the insulation resistance using a megohmmeter positioned between the photovoltaic field (positive terminal short-circuited to the negative pole) and ground. If the measured value is less than 1 megaohm, the photovoltaic generator must be checked by a technician/ installer to identify and eliminate the problem. If the measured value is greater than 1 megaohm and the error warning continues to be present, contact the ***Power-one Service***.
Degauss error	---	Degaussing state fail		
Input OC	E001	Input Overcurrent	The alarm appears when the inverter input current exceeds the set overcurrent threshold.	You must check whether the composition of the PV generator allows an input current that exceeds the maximum threshold allowed by the inverter and that the configuration of the (independent or parallel) inputs is carried out correctly. If the configuration of the PV generator and the setting of the input channels are suitable, contact the***Power-one Service***
Input OV	E002	Input Overvoltage	This alarm is indicated when the inverter input voltage (coming from the PV generator) exceeds the operating threshold. The alarm is triggered before reaching the absolute threshold beyond which the inverter will be damaged. When the inverter input voltage exceeds the Over Voltage threshold, the inverter will not start because of the generation of the alarm.	Measure the input voltage in the inverter with a voltmeter. If it is higher than the maximum voltage of the operating interval, the alarm is real and you must check the configuration of the PV generator. If it is lower than the maximum voltage of the operating interval, the alarm is caused by an internal malfunctioning and you must contact the ***Power-one Service***
No Parameters	E003	Internal Parameters Error	The main microcontroller is unable to correctly initialize the two DSPs (booster stage and inverter stage). This is usually due to communication problems on the internal bus of the inverter.	This is an error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service.***

Bulk OV	E004	Bulk Overvoltage	Error inside the inverter. The alarm is raised when the voltage at the ends of the bulk capacitors exceeds the Over Voltage threshold.	The alarm can be caused by causes external to the inverter: an excessive inverter input voltage can be detected as a bulk overvoltage condition. In this case, it is advisable to check the inverter input voltage and, if this value is near the input OV threshold, re-examine the configuration of the photovoltaic generator. The alarm can be caused by causes internal to the inverter, and in this case, you must contact the ***Power-one Service***.
Comm.Error	E005	Internal cation Error	The alarm occurs when there are communication problems between the control devices inside the inverter.	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Output OC	E006	Output Overcurrent	The alarm appears when the inverter output current exceeds the output overcurrent threshold of the inverter.	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service.***
IGBT Sat	E007	IGBT Saturation	The alarm appears when one of the active devices of the inverter is in saturation state.	Once the error appears, the inverter attempts to resume normal operation. If the error occurs sporadically, it may be caused by a sharp transition of the grid voltage or the input voltage but is not attributable to inverter malfunctioning. If the error is associated with an internal fault, it will continue to appear, and you must therefore contact the ***Power-one Service***.
Internal error	E009	Internal Error	Error inside the inverter	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Bulk Low	E010	Low Bulk Voltage	The alarm can be caused by causes external to the inverter: a low inverter input voltage (just above the activation voltage) that is not accompanied by sufficient availability of power from the photovoltaic generator (typical condition of periods of insufficient irradiation).	If the error warning appears sporadically, it can be attributed to causes external to the inverter (insufficient irradiation, and therefore little power available from the PV generator) . If the problem appears systematically even in conditions of high solar radiation and with input voltage significantly higher than the activation voltage, contact the ***Power-one Service***.
Ramp Fail	E011	Bulk ramp timeout	Error inside the inverter regarding the time for starting steady state operation of the DC-DC circuit part (Booster).	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
DcDc Fail	E012	Booster module error revealed by Inverter	Error inside the inverter regarding the operation of the DC-DC circuit part (Booster).	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Wrong Mode	E013	Wrong Input Mode (parallel instead of independent)	The alarm is generated only when the inverter is configured with parallel inputs. In this particular configuration, the inverter carries out the input voltage check of each of the two channels, and the alarm is raised if the two voltages differ by more than 20Vdc.	Make sure the setting of the "IN MODE" switch has been intentionally positioned on "PAR" and that the jumpers have been inserted between the two input channels. If the configuration of the inverter is correct, check that the input strings have the usual number of panels in series, of the usual make and with the same inclination/ orientation. If both the configuration of the inverter and the characteristics of the PV generator comply with the specifications, contact the ***Power-one Service***.
Over Temp.	E014	Over-temperature	External temperature above 60°C. This parameter also depends on the power that the inverter must supply since the measurement of the temperatures is carried out internally and is affected by the heat dissipated by the components of the inverter.	Wait for the temperatures to which the inverter is exposed to return within operating range and for the inverter to cool down If the problem persists (once the ambient temperature has returned within the range), contact the Power-one Service. You must remember to wait for the time necessary to allow the inverter to cool down.
Bulk Cap Fail	E015	Bulk Capacitor Fail	Error inside the inverter regarding a problem in the bulk capacitors.	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Inverter Fail	E016	Inverter module error revealed by Booster	The alarm is generated when a problem is detected in the inverter circuit part (DC/AC).	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.

Start Timeout	E017	Inverter module start-up timeout	Error inside the inverter regarding the time for starting steady state operation of the DC-AC circuit part (Inverter).	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Ground Fault	E018	Leakage current fail	The alarm is generated when, during normal operation of the inverter, a ground leakage current is detected in the DC section of the system. The alarm is accompanied by the lighting up of the red LED on the front of the inverter. The inverter may even also generate the E018 alarm message for AC leakage currents associated with the capacitive nature of the photovoltaic generator compared to ground.	If possible, measure the insulation resistance using a megohmmeter positioned between the photovoltaic field (positive terminal short-circuited to the negative pole) and ground. If the measured value is less than 1 megaohm, the PV generator must be checked by a technician/installer to identify and eliminate the problem. If the measured value is greater than 1 megaohm and the error warning continues to be present, contact the ***Power-one Service***.
Self Test Error 3	E019	Leakage current sensor self-test fail	Before connecting to the grid, the inverter carries out an autotest that regards the leakage current sensor. The test is carried out by “forcing” a current of known value in the leakage current sensor: the microprocessor compares the read value with the known value. The error is generated if the comparison between the read value and the known value during the test is not within the allowed tolerance.	This is an error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the Power-one Service. By its nature, the alarm appears only before connection to the grid.
Self Test Error 1	E020	Booster relay self-test fail	Before connecting to the grid, the inverter carries out some internal tests. One of these tests regards the correct operation of the booster relay. The test is carried out by “forcing” the switching of the relay and checking its functionality. The error is generated if a problem is found with the operation of the relay.	This is an error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the Power-one Service. By its nature, the alarm appears only before connection to the grid.
Self Test Error 2	E021	Inverter relay self-test fail	Before connecting to the grid, the inverter carries out a test that regards the operation of the inverter relay. The test is carried out by “forcing” the switching of the relay and checking its functionality. The error is generated if a problem is found with the operation of the relay.	This is an error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the Power-one Service. By its nature, the alarm appears only before connection to the grid.
Self Test Error 4	E022	Relay self-test timeout	Time taken to execute the autotest carried out on the relays of the DC_AC circuit part (inverter) is too long. This may indicate a problem associated with the aforesaid relays.	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
DC inj error	E023	Dc-Injection out of range	The error is generated if the direct component of the current supplied to the grid exceeds the threshold of 0.5% of the rated operating current. In any case, the inverter does not stop because of the E023 error, but tries to connect to the grid again. Sporadic repetition of the error is a sign of large grid distortions or sudden changes in irradiation, whereas systematic repetition of the error warning will be a sign of an inverter fault.	If the grid voltage is strongly distorted, report this anomaly to the grid company for the resolution of the problem If there is an inverter fault, contact the ***Power-one Service***.

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Internal error	E024	Internal Error	Error inside the inverter	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Riso Low	E025 (not shown on the display)	Low insulation resistance	Before connecting to the grid, the inverter measures the insulation resistance of the PV generator compared to ground. If the insulation resistance measured by the inverter is less than 1 Mohm, the inverter does not connect to the grid and shows the “Riso Low” error. The causes may be: - Damaged PV panel(s). - Junction box(es) of the panels not properly sealed, so allowing water and/or damp seepage; - Problems in the connections between panels (not perfectly connected); - Poor quality cable junctions; - Presence of unsuitable (trigger voltage lower than the characteristics of the PV generator strings) or damaged overvoltage surge arresters outside the inverter in the DC section. - Presence of damp inside the field panel, if there is one.	If possible, measure the insulation resistance using a megohmmeter positioned between the photovoltaic field (positive terminal short-circuited to the negative pole) and ground (as described in the relevant section: "checking the ground insulation of the PV generator"). If the measured value is less than 1 megaohm, the photovoltaic generator must be checked by a technician/installer to identify and eliminate the problem If the measured value is greater than 1 megaohm and the error warning continues to be present, contact the Power-one Service. **(Damp increases leakage and can therefore be the cause of a reduction in insulation resistance).**
Vref Error	E026	Bad internal reference voltage	Wrong measurement of the reference voltage inside the equipment	Internal error that cannot be checked externally. If the problem persists (even after switching the inverter off and then on again), contact the ***Power-one Service***.
Error Meas V	E027	VGrid Measures Fault	Error in the internal measurement of the grid voltage (imposed by regulations) to have a measurement redundancy (2 measurements on the same parameter carried out by two different circuits).	This is an error inside the inverter that cannot be checked externally. If the problem is persistent (even after switching the inverter off and then on again), contact the ***Power-one Service***.
Error Meas F	E028	FGrid Measures Fault	Error in the internal measurement of the grid frequency (imposed by regulations) to have a measurement redundancy (2 measurements on the same parameter carried out by two different circuits).	This is an error inside the inverter that cannot be checked externally. If the problem is persistent (even after switching the inverter off and then on again), contact the Power-one Service.
Error Meas Z	E029	ZGrid Measures Fault	Error in the internal measurement of the insulation resistance of the PV generator compared to ground (imposed by regulations) to have a measurement redundancy (2 measurements on the same parameter carried out by two different circuits).	Error inside the inverter that cannot be checked externally. The error occurs if the internal measurement is carried out before connection to the grid) If the problem is persistent (even after switching the inverter off and then on again), contact the ***Power-one Service***.
Error Meas Ileak	E030	ILeak Measures Fault	Error in the internal measurement (carried out when the inverter is connected to the grid) of the leakage current of the DC side (PV generator) compared to ground (imposed by regulations) to have a measurement redundancy (2 measurements on the same parameter carried out by two different circuits).	This is an error inside the inverter that cannot be checked externally. If the problem is persistent (even after switching the inverter off and then on again), contact the Power-one Service.

Error Read V	E031	Wrong V Measure	Measurement of the internal voltage at the ends of the output relay out of range. There is too great a difference in voltage between the input and the output of the output relay.	This is an error inside the inverter that cannot be checked externally. If the problem appears repeatedly, you must contact the Power-one Service.
Error Read I	E032	Wrong I Measure	Measurement of the output voltage unbalance (carried out between the three phases) out of range (only in three-phase models).	This is an error inside the inverter that cannot be checked externally. If the problem appears repeatedly, you must contact the Power-one Service.
UTH	E033	Under Temperature	Temperature outside the inverter below -25°C	Wait for the temperatures to which the inverter is exposed to return within operating range. If the problem persists, contact the ***Power-one Service***. You must remember to wait for the time necessary to allow the inverter to warm up.
Interlock fail	E034	IGBT not ready	Error inside the inverter	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***.
Remote Off	E035 (not shown on the display)	Waiting remote ON	The inverter has been switched off remotely (remote OFF) and remains in waiting state for the signal that will switch it on again (remote ON).	Switch on the inverter remotely. If the unit does not switch on, disable the remote on/off function and switch the equipment off completely and then switch it on again. If the problem persists (after re-enabling the Remote ON/ OFF function from the display), contact the ***Power-one Service***.
Vout Avg error	E036	Average Vout out of range	The average grid voltage value (every 10 minutes) does not fall within the allowed ranges. The grid voltage at the point connected to the inverter is too high. This may be caused by a grid impedance that is too high. Towards the end of the timeout, the inverter limits the power to check whether the grid voltage stabilizes within the normal parameters. If this does not happen, the inverter disconnects from the grid.	Check the grid voltage at the inverter connection point. If the grid voltage diverges from the range because of grid conditions, ask the grid company to adjust the grid voltage. If the grid company authorizes a change to the inverter parameters, arrange the new limits with the ***Power-one Service***.
Riso Low	E037	Low insulation resistance (amorphous mode only)	This error can appear only if the “Amorphous” mode is enabled. This function is enabled only in inverters equipped with grounding kit and is used to monitor the voltage at the ends of the grounding resistor. The error appears when the voltage at the ends of the resistor connected between ground and pole of the photovoltaic generator exceeds 30V for more than 30 minutes or 120V for more than one second.	Check for the presence and correct contacting of the two terminals of the grounding resistor installed inside the inverter. If possible, measure the insulation resistance using a megohmmeter positioned between the PV field (positive terminal short-circuited to the negative pole) and ground (as described in the operation chapter). If the measured value is less than 1 megaohm, the photovoltaic generator must be checked by a technician/ installer to identify and eliminate the problem. If the measured value is greater than 1 megaohm and the error warning continues to be present, contact the ***Power-one Service***.
Mid Bulk OV	E038	Mid bulk OV	Error inside the inverter	Error inside the inverter that cannot be checked externally. If the problem persists (after switching the inverter off and then on again), contact the ***Power-one Service***
Sun Low	W001	(Low input voltage during switch-on on of the inverter)	Insufficient irradiation. Wrong configuration of the PV generator or a configuration “at the limit” as regards the minimum input voltage of the inverter.	Check the inverter input voltage. If it does not exceed the Vstart, check that there is sufficient irradiation and that the composition of the system is correct. If it exceeds the Vstart, contact the ***Power-one Service***.

Input UV	W002	(Low input voltage during switch-off)	Insufficient irradiation Wrong configuration of the photovoltaic generator or a configuration “at the limit” as regards the minimum input voltage of the inverter.	Check the inverter input voltage. If it does not exceed the Vstart, check that there is sufficient irradiation and that the composition of the system is correct. If it exceeds the Vstart, contact the ***Power-one Service***.
Grid Fail	W003	Grid Fail (grid voltage parameters outside the limits)	This error warning appears when, during normal operation of the inverter, the grid parameters fall outside the limits set by the grid company. No grid voltage (after the warning, the inverter goes on "No Vac") Unstable grid voltage (downwards and upwards) Unstable grid frequency	Check the grid voltage on the inverter. If absent, check for the absence of grid voltage on the supply. If the voltage tends to rise (when the inverter is connected), it means there are high line or grid impedances. Check the grid voltage on the supply as well; if it is high, it means there is a high grid impedance. In this case, ask the grid company to adjust the grid voltage. If the grid company authorizes a change to the inverter parameters, arrange the new limits with the ***Power-one Service***. If the voltage at the supply point is much lower than that measured on the inverter, the line must be adjusted (inverter-counter). If the grid voltage and frequency fall within the limits (even when the inverter is connected to the grid), contact the ***Power-one Service***.
Table fail	W009	Empty Wind Table		**(wind models only)**
Fan Fail	W010 (not shown on the display)	Fan Fail	This error appears when there is malfunctioning of the fan(s) inside the inverter. In this condition, the yellow LED on the front panel flashes.	Error inside the inverter that cannot be resolved with external operations. If the alarm is persistently repeated, contact the ***Power-one Service***. **(Alarm not shown on the display; there is only a flashing yellow LED)**
Bulk UV	W011	Bulk Under-voltage	Reading of the internal voltage on the bulk capacitors carried out when the inverter is connected to the grid.	Check the inverter input voltage. If it does not exceed the Vstart, check that there is sufficient irradiation and that the composition of the system is correct. If it exceeds the Vstart, contact the ***Power-one Service***.
Battery low	W012	Low internal clock battery voltage	Internal battery for maintenance of the date/time settings is discharged or damaged.	Replace the battery with the inverter completely switched off (disconnect AC side and DC side) and be sure to observe the correct polarity.
Clk fail	W013	Internal clock fail	The alarm appears when the time shown on the display differs by more than 1 minute from the internal time of the microprocessors and indicates clock circuit malfunctioning.	This is an error inside the inverter that cannot be resolved with external operations. If the alarm is persistently repeated, contact the ***Power-one Service***.
Jbox fail	W017	Fuse-control board fail (DC string fail)	Fuse(s) on the fuse boards is/are damaged.	Using a multimeter, check the condition of the fuses (situated on the fuse boards). Replace any open fuses and check that the input current on the string(s) does not exceed the rating of the fuses (if string parallels have been made outside the inverter). If there are no damaged string fuses and the inverter continues to display the alarm message, check whether the settings to be made through the Aurora Manager software are correct (presence or absence of one or more input strings).
SPD DC protection open	W018	SPD DC protection open	Overvoltage surge arresters situated on the DC side are damaged.	Look at the inspection window present on each surge arrester (DC side). If it is red, the surge arrester is damaged and the cartridge must be replaced. If the alarm status continues to be present even though all the surge arresters have a green inspection window, contact the ***Power-one Service***.
SPD AC protection open	W019	SPD AC protection open	Overvoltage surge arresters situated on the AC side are damaged.	Look at the inspection window present on each surge arrester (AC side). If it is red, the surge arrester is damaged and the cartridge must be replaced. If the alarm status continues to be present even though all the surge arresters have a green inspection window, contact the ***Power-one Service***.

Verification of ground leakage

If the inverter has reported a ground fault, there may be a ground leakage from the PV generator (DC side).

To check this, measure the voltage between the positive pole and ground and between the negative pole (of the PV generator) and ground using a voltmeter whose input accepts a voltage of at least 1000 Volts.

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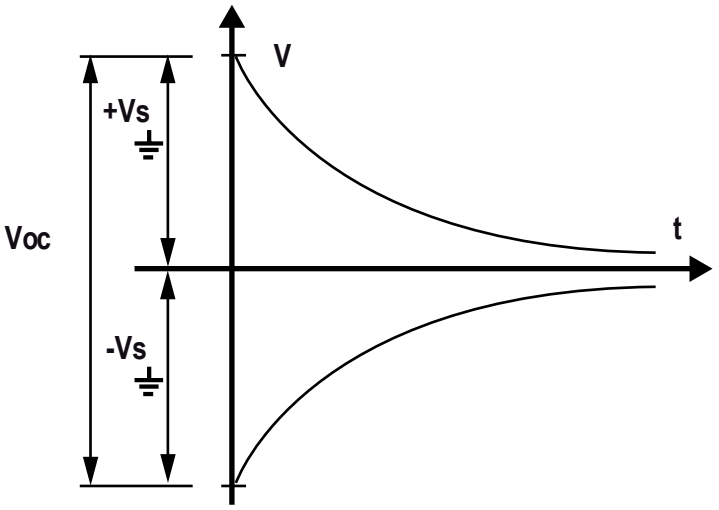
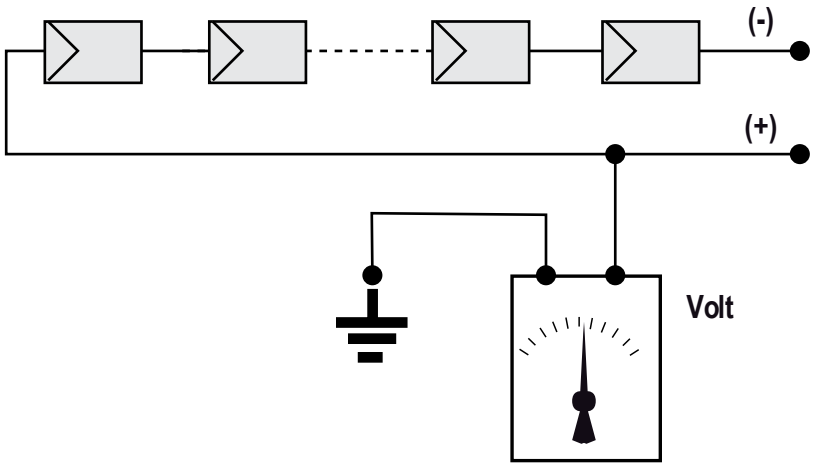
Behaviour of a system without leakage

Due to the capacitive effect of the PV generator, during the first moments that the voltmeter is connected between one of the two poles and ground, it will measure a voltage of about Voc/2, which will tend to stabilize around 0V if there is no ground leakage, as shown in the graph below:

The internal resistance of the voltmeter tends to zero the voltage present on the PV generator due to the capacitive effect.



How to make the measurement:



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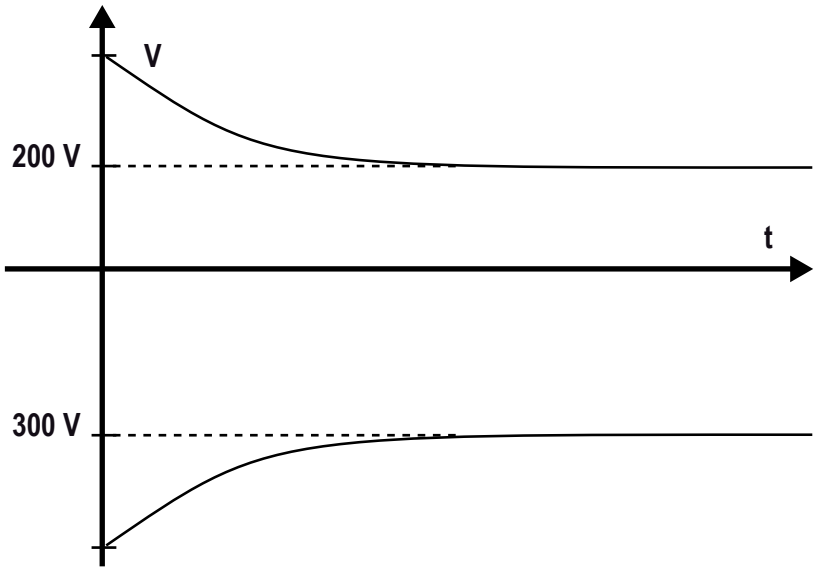
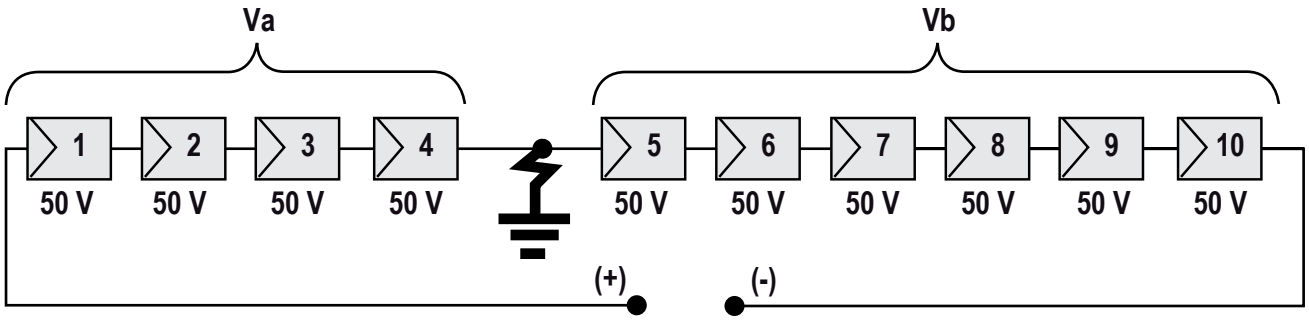
Behaviour of a system with leakage

If the voltage measured between one of the two poles and ground does not tend to 0V and stabilizes on a value, there is a ground leakage from the PV generator.

Example: When the measurement is made between positive pole and ground, a voltage of 200V is measured.



This means that if the system is made up of 10 modules in series and each one supplies 50V, the leakage can be located between the 4th and 5th PV module.



Va = voltage measured between + pole and ⏚ = 200V
Vb = voltage measured between - pole and ⏚ = 300V
In all the measurements with ⏚, the ground of the inverter is indicated.

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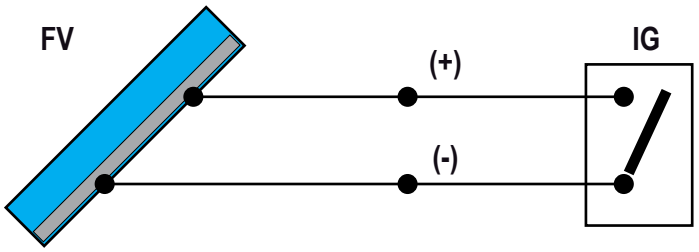
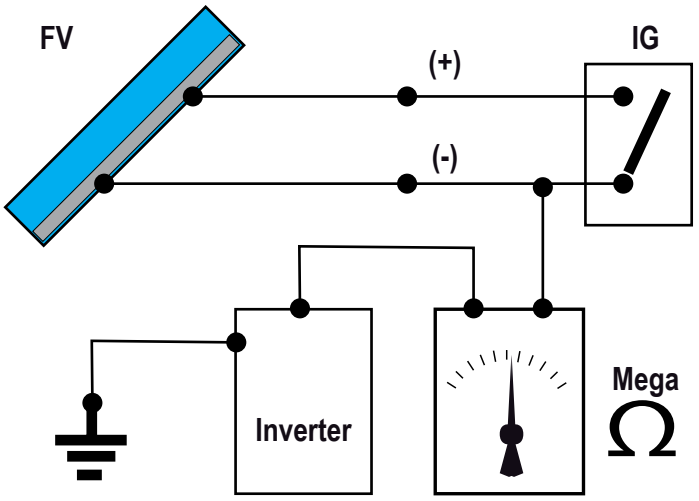
Measuring the insulation resistance of photovoltaic generator

To measure the insulation resistance of the PV generator compared to ground (⏚), the two poles of the PV generator must be short-circuited (using a suitably sized selector).



Once the short-circuit has been made, measure the insulation resistance (Riso) using a megohmmeter positioned between the two shorted poles and ground (of the inverter).



-TL MODELS (transformerless). If the measured insulation resistance (Riso) is less than 1Mohm the inverter does not connect to the grid due to a low insulation of photovoltaic generator respect to ground.

-I MODELS (with high frequency transformer). If the measured insulation resistance (Riso in case of input poles floating respect to ground or QF=1 if the one of input poles is grounded) is less than 0.2Mohm the inverter does not connect to the grid due to a low insulation of photovoltaic generator respect to ground.

The insulation resistance is affected by the environmental conditions the PV generator is in (E.g.: photovoltaic module wet from dump or rain) , and therefore the measurement must be made immediately after the anomaly

Storage and dismantling

Storage of the equipment or prolonged stop

If the equipment is not used immediately or is stored for long periods, check that it is correctly packed and contact ***Power-One*** for storage instructions.
The equipment must be stored in well-ventilated indoor areas that do not have characteristics that might damage the components of the equipment.

Restarting after a long or prolonged stop requires a check and, in some cases, the removal of oxidation and dust that will also have settled inside the equipment if not suitably protected.

Dismantling, decommissioning and disposal

Power-One CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.

If the equipment is dismantled, in order to dispose of the products that it is composed of, you must adhere to the regulations in force in the country of destination and in any case avoid causing any kind of pollution.

Dispose of the various types of materials that the parts of the equipment consist of in dumps that are suitable for the purpose.

Table: disposal of components

COMPONENT	MATERIAL OF CONSTRUCTION
Frame, brackets, supports	Arc-welded steel FE37
Casing or covers	ABS, plastic
Paint and	RAL .....
Gaskets and seals	Rubber / Teflon / Viton
Electrical cables	Copper / Rubber
Polyethylene / Nylon	Conduits
Back-up battery	Nickel / Lead/ Lithium