

ABB solar inverters

Product manual

UNO-2.0/2.5-I-OUTD (2.0 to 2.5 kW)





IMPORTANT SAFETY INSTRUCTIONS

This manual contains important safety instructions that must be followed during installation and maintenance of the equipment.



Operators are required to read this manual and scrupulously follow the indications reported in it, since ABB cannot be held responsible for damages caused to people and/or things, or the equipment, if the warranty conditions are not observed.

Product Manual

UNO-2.0/2.5 string inverters

1 - Introduction and general information



2 - Characteristics



3 - Safety and accident prevention



4 - Lifting and transport



5 - Installation



6 - Instruments



7 - Operation



8 - Maintenance



Warranty and Supply Conditions

The warranty conditions are considered to be valid if the customer adheres to the indications in this manual; any conditions deviating from those described herein must be expressly agreed in the purchase order.

The equipment complies with the pertinent legislation currently in force in the country of installation and it has issued the corresponding declaration of conformity.

Not included in the supply

ABB accepts no liability for failure to comply with the instructions for correct installation and will not be held responsible for systems upstream or downstream the equipment it has supplied. It is absolutely forbidden to modify the equipment. Any modification, manipulation, or alteration not expressly agreed with the manufacturer, concerning either hardware or software, shall result in the immediate cancellation of the warranty.

The Customer is fully liable for any modifications made to the system.



Given the countless array of system configurations and installation environments possible, it is essential to check the following: sufficient space suitable for housing the equipment; airborne noise produced depending on the environment; potential flammability hazards.

ABB will NOT be held liable for defects or malfunctions arising from: improper use of the equipment; deterioration resulting from transportation or particular environmental conditions; performing maintenance incorrectly or not at all; tampering or unsafe repairs; use or installation by unqualified persons.

ABB will NOT be held responsible for the disposal of: displays, cables, batteries, accumulators etc. The Customer shall therefore arrange for the disposal of substances potentially harmful to the environment in accordance with the legislation in force in the country of installation.

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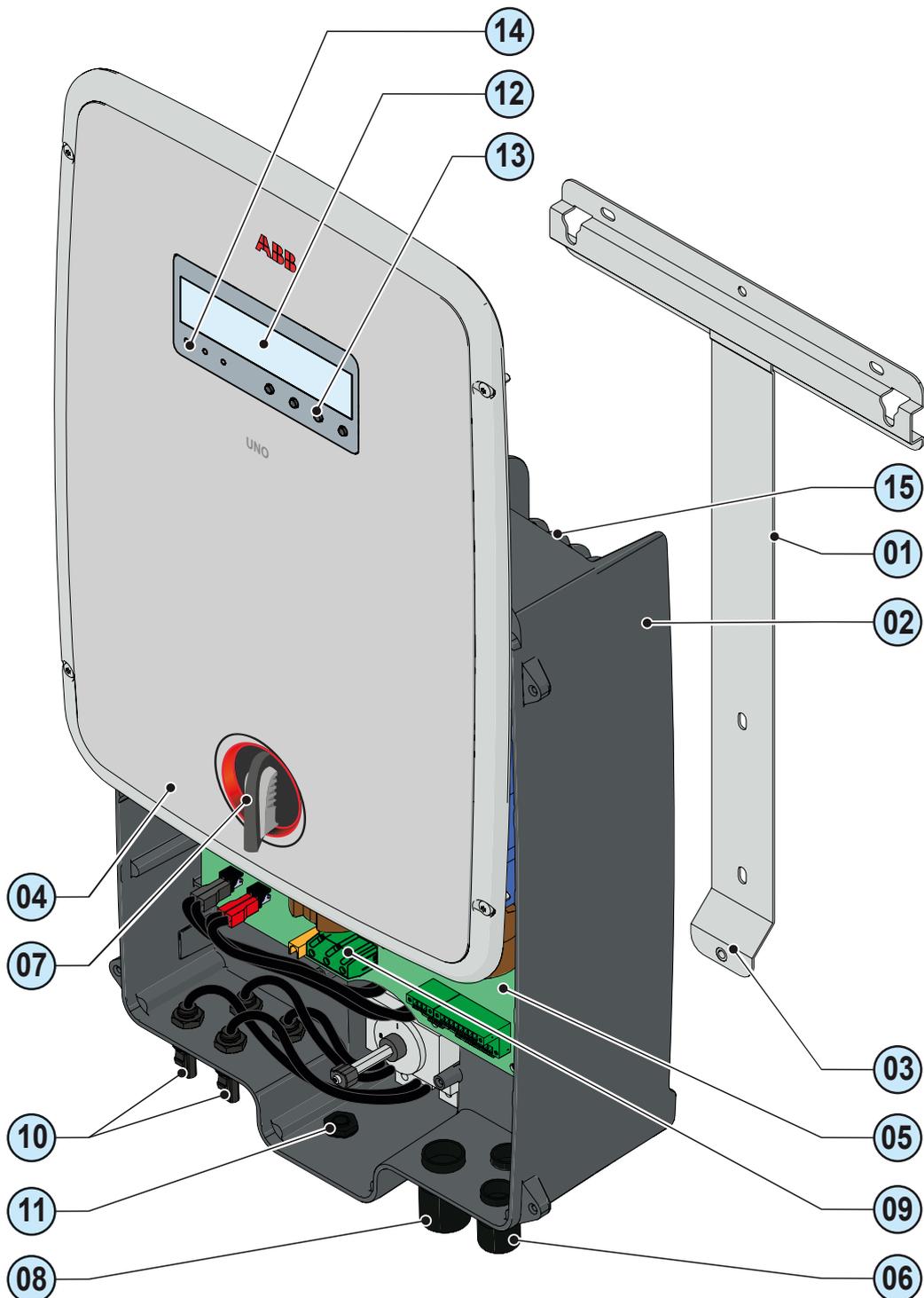


Reference number index

- | | | |
|------------------|-----------------------------------|---------------------------|
| ①, bracket | ⑥, service cable glands | ⑪, anticondensation valve |
| ②, inverter | ⑦, DC disconnect switch | ⑫, display |
| ③, locking screw | ⑧, AC cable gland | ⑬, keypad |
| ④, front cover | ⑨, AC output screw terminal block | ⑭, LED panel |
| ⑤, main board | ⑩, DC input connectors | ⑮, heat sink |



Graphical representation of references



The document and who it is for

Purpose and structure of the document

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



If the equipment is used in a manner not specified in the installer manual, the protection provided by the equipment may be impaired.



The language in which the document was originally written is 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 enclosed documentation is supplied:

- EC declaration of conformity
- quick installation guide
- 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 routine 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. Personnel in charge of using and maintaining the equipment must be expert, aware and skilled for the described tasks and must reliably demonstrate their capacity to correctly interpret what is described in the manual.



For safety reasons, only a qualified electrician who has received training and/or demonstrated skills and knowledge on the structure and operation of the unit may install the inverter.



The installation must be performed by qualified installers and/or licensed electricians in accordance with the existing regulations in the country of installation.



The employment of a person who is NOT qualified, is drunk, or on narcotics, is strictly forbidden.



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

Symbols ad signs

In the manual and/or in some cases on the equipment, the danger or hazard zones are indicated with signs, labels, symbols or icons.

Table: Symbols

i		<p>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.</p>
		<p>Generic hazard - Important safety information. This points out operations or situations in which staff must be very careful.</p>
		<p>Hazardous voltage - This points out operations or situations in which staff must be very careful due to hazardous voltage.</p>
		<p>Hot parts - This points out a hazard due to the presence of heated areas or in any case areas that have hot parts (danger of burns).</p>
		<p>This points out that the examined area must not be entered or that the described operation must not be carried out.</p>
		<p>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.</p>
		<p>This indicates the degree of protection of the equipment according to IEC standard 70-1 (EN 60529 June 1997).</p>
		<p>Point of connection for grounding protection.</p>
		<p>This indicates the allowed temperature range</p>
		<p>This indicates the risk of electric shock. Time need to discharge stored energy: 5/10 minutes</p>
		<p>Respectively direct current and alternating current</p>
		<p>Isolating transformer present or not present</p>
		<p>Positive pole and negative pole of the input voltage (DC)</p>
		<p>This indicates the centre of gravity of the equipment.</p>

Field of use, general conditions

ABB shall not be liable for any damages whatsoever that may result from incorrect or careless operations.



*You may not use the equipment for a use that does not conform to that provided for in the field of use. The equipment **MUST NOT** be used by inexperienced staff, or even experienced staff if carrying out operations on the equipment that fail to comply with the indications in this manual and enclosed documentation.*



Intended or allowed use

This equipment is a inverter designed for:
transforming a continuous electrical current (DC)
supplied by a photovoltaic generator (FV)
in an alternating electrical current (AC)
suitable for feeding into the public distribution grid.

Limits in field of use

The operating current dispersed during normal operation must not exceed the limits specified in the technical specifications.

Only a photovoltaic generator can be connected in the input of the inverter (do not connect batteries or other sources of power supply).

The inverter can be connected to the electricity grid only in countries for which it has been certified/approved.

The inverter may only be used in compliance with all its technical characteristics.

Improper or prohibited use



IT IS STRICTLY FORBIDDEN TO:

- Install the equipment in environments subject to particular conditions of flammability or in adverse or disallowed environmental conditions, (temperature and humidity).
- Use the equipment with safety devices which are faulty or disabled.
- Use the equipment or parts of the equipment by linking it to other machines or equipment, unless expressly provided for.
- Modify operating parameters that are not accessible to the operator and/or parts of the equipment to vary its performance or change its isolation.
- Clean with corrosive products that could eat into parts of the equipment or generate electrostatic charges.
- Use or install the appliance or parts of it without having read and understood the contents of the user and maintenance manual.
- Heat or dry rags and clothing on the parts in temperature. In addition to being hazardous, doing so would compromise component ventilation and cooling.



General conditions

A description of the characteristics of the equipment is given so as to identify its main components and specify the technical terminology used in the manual.

Technical terminology and the fast retrieval system for information, are supported by:

- Contents
- Reference number index

The Characteristics chapter contains information about the models, details of the equipment, characteristics and technical data, overall dimensions and identification of the equipment itself.



The customer/Installer takes full responsibility if, when reading this manual, the chronological order of its presentation established by the manufacturer is not observed. All information is provided considering occasional inclusion of that provided in previous chapters.



In certain cases, there may be a need to separately document software functionality or attach supplementary documentation to this manual intended for more qualified professionals.

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 



The choice of the inverter model 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.



• UNO-2.0-I-OUTD MODELS

UNO-2.0-I-OUTD:

- Number of input channels: 1
- DC disconnect switch : No
- Input connectors: quick fit connectors (2 pairs)

UNO-2.0-I-OUTD-S:

- Number of input channels: 1
- DC disconnect switch : Yes
- Input connectors: quick fit connectors (2 pairs)

• UNO-2.5-I-OUTD MODELS

UNO-2.5-I-OUTD:

- Number of input channels: 1
- DC disconnect switch : No
- Input connectors: quick fit connectors (2 pairs)

UNO-2.5-I-OUTD-S:

- Number of input channels: 1
- DC disconnect switch : Yes
- Input connectors: quick fit connectors (2 pairs)

Identification of the equipment and the manufacturer

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



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

The approval label contains the following information:

1. Manufacturer
2. Model
3. Rating data
4. Certification marks



1

ABB

www.abb.com/solar
SOLAR INVERTER

4

DIN V VDE 0126-1-1
PROTECTIVE CLASS: I

CE
Made in Italy

2

MODEL:
INO-2.0-I-OUTD-S

V_{dc} max	520 V
V_{dc} MPP	90 - 520 V
V_{dc}, Full Power	200 - 470 V
I_{dc} max	12.5 A
I_{sc} max	15 A

V_{acr}	230 V 1Ø
f_r	50 Hz
P_{acr} (cos φ = 1)	2000 W @ 50°C amb.
I_{ac} max	10.5 A

-25 to +60 °C
-13 to +140 °F

IP65

1

ABB

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SOLAR INVERTER

4

DIN V VDE 0126-1-1
PROTECTIVE CLASS: I

CE
Made in Italy

2

MODEL:
INO-2.5-I-OUTD-S

V_{dc} max	520 V
V_{dc} MPP	90 - 520 V
V_{dc}, Full Power	200 - 470 V
I_{dc} max	12.8 A
I_{sc} max	15 A

V_{acr}	230 V 1Ø
f_r	50 Hz
P_{acr} (cos φ = 1)	2500 W @ 45°C amb.
I_{ac} max	12.5 A

-25 to +60 °C
-13 to +140 °F

IP65

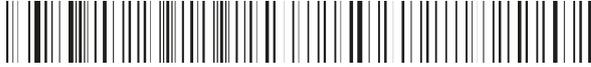
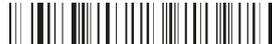
N.B. The labels must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.); they must be cleaned regularly and kept visible at all times.

- 14 -

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Besides the label with the specifications, an additional inverter identification label is also provided.

The label displays the following information:

<p>ABB TRIO-X-TL-OUTD-Y-400</p>     	<p>P/N: P/P/P/P/P/P/P/P/P/P</p> <p>SN: YYWWSSSSSS WK: WWYY</p> <p>WO: XXXXXXXX</p> <p>SO: SXXXXXXXXX Q1</p>	<ul style="list-style-type: none"> • Inverter model - X.X = Inverter power rating: - Y = Integrated disconnect switch • Inverter Part Number • Inverter Serial Number composed of: - YY = Year of manufacture - WW = Week of manufacture - SSSSSS = sequential number • Week/Year of manufacture
--	---	---



The officially required information is located on the approval label. The identification label is an accessory label which shows the information necessary for the identification and characterisation of the inverter by ABB.



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

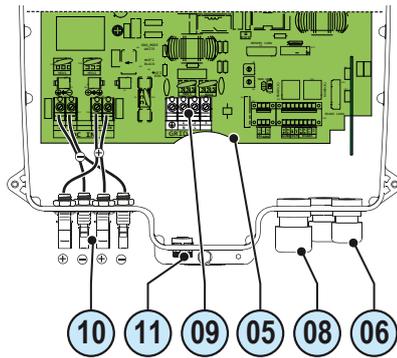
Inverter Components

For both of the inverter ② 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 ⑦

Standard version



S Version

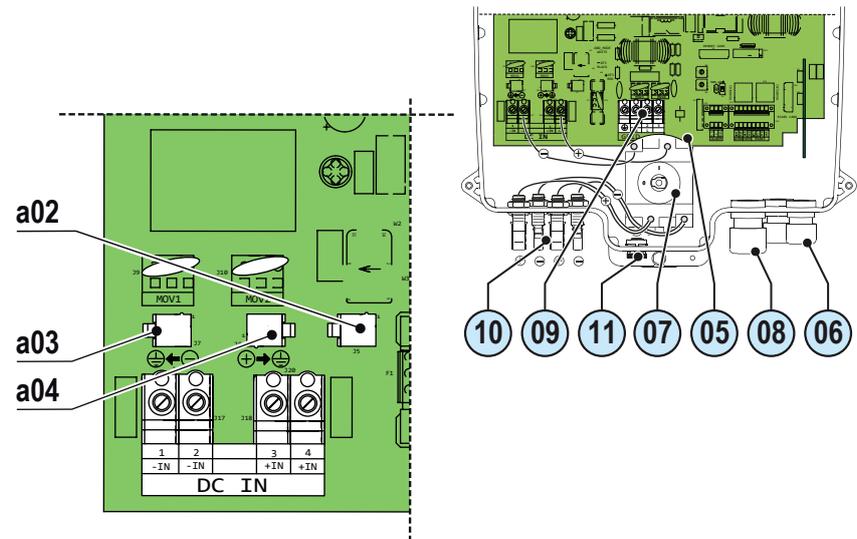


Table: electrical system components

Ref.	Description
⑤	main board
⑥	service cable glands
⑦	DC disconnect switch
⑧	AC cable gland
⑨	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

Characteristics and technical data

Table: Technical Data	UNO-2.0-I-OUTD	UNO-2.5-I-OUTD
Input		
Absolute Maximum DC Input Voltage ($V_{max,abs}$)	520 V	
Start-up DC Input Voltage (V_{start})	200 V (adj. 120...350 V)	
Intervallo Operativo di Tensione DC in Ingresso ($V_{dcmin}...V_{dcmax}$)	0.7 x $V_{start}...520$ V	
Rated DC Input Power (P_{dcr})	2100 W	2600 W
Number of Independent MPPT	1	
Maximum DC Input Power for each MPPT ($P_{MPPTmax}$)	"2300 W Linear Derating from MAX to Null [470V \leq VMPPT \leq 520V]"	"2900 W Linear Derating from MAX to Null [470V \leq VMPPT \leq 520V]"
MPPT Input DC Voltage Range ($V_{MPPTmin,f}...V_{MPPTmax,f}$) at P_{acr}	200...470 V	200...470 V
Maximum DC Input Current (I_{dcmax}) / for each MPPT ($I_{MPPTmax}$)	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 (P_{acr})	2000 W	2500 W
Maximum AC Output Power (P_{acmax})	2200 W ⁽⁴⁾	2750 W ⁽⁵⁾
Rated AC Grid Voltage ($V_{ac,r}$)	230 V	
AC Voltage Range	180...264 V ⁽¹⁾	
Maximum AC Output Current ($I_{ac,max}$)	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 ($\cos\phi_{iac,r}$)	> 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)	



Table: Technical Data	UNO-2.0-I-OUTD	UNO-2.5-I-OUTD
Operating performance		
Maximum Efficiency (η_{max})		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 50°C (122°F)	-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

Tightening torques

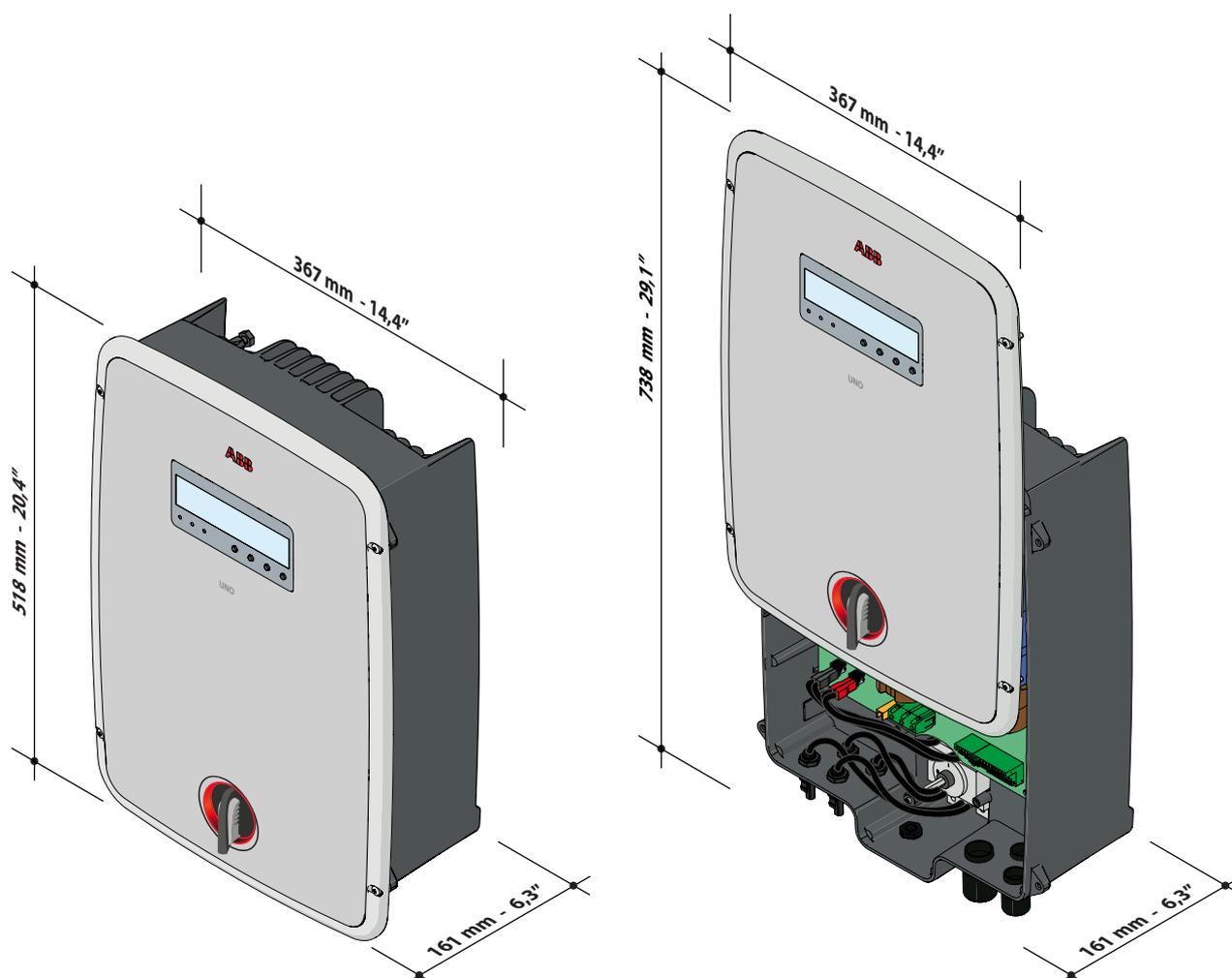
To maintain the IP65 protection of the system and for optimal installation, the following tightening torques must be used:

Front cover ④ screws	2,2 Nm
AC cable gland ⑧ M25	5,0 Nm
Service cable glands ⑥ M20	2,7 Nm
AC output screw terminal block ⑨ 6 mm ²	1,5 Nm
Signals terminal boards	0,25 Nm
Quick fit connectors WM / MC4	2.5 Nm



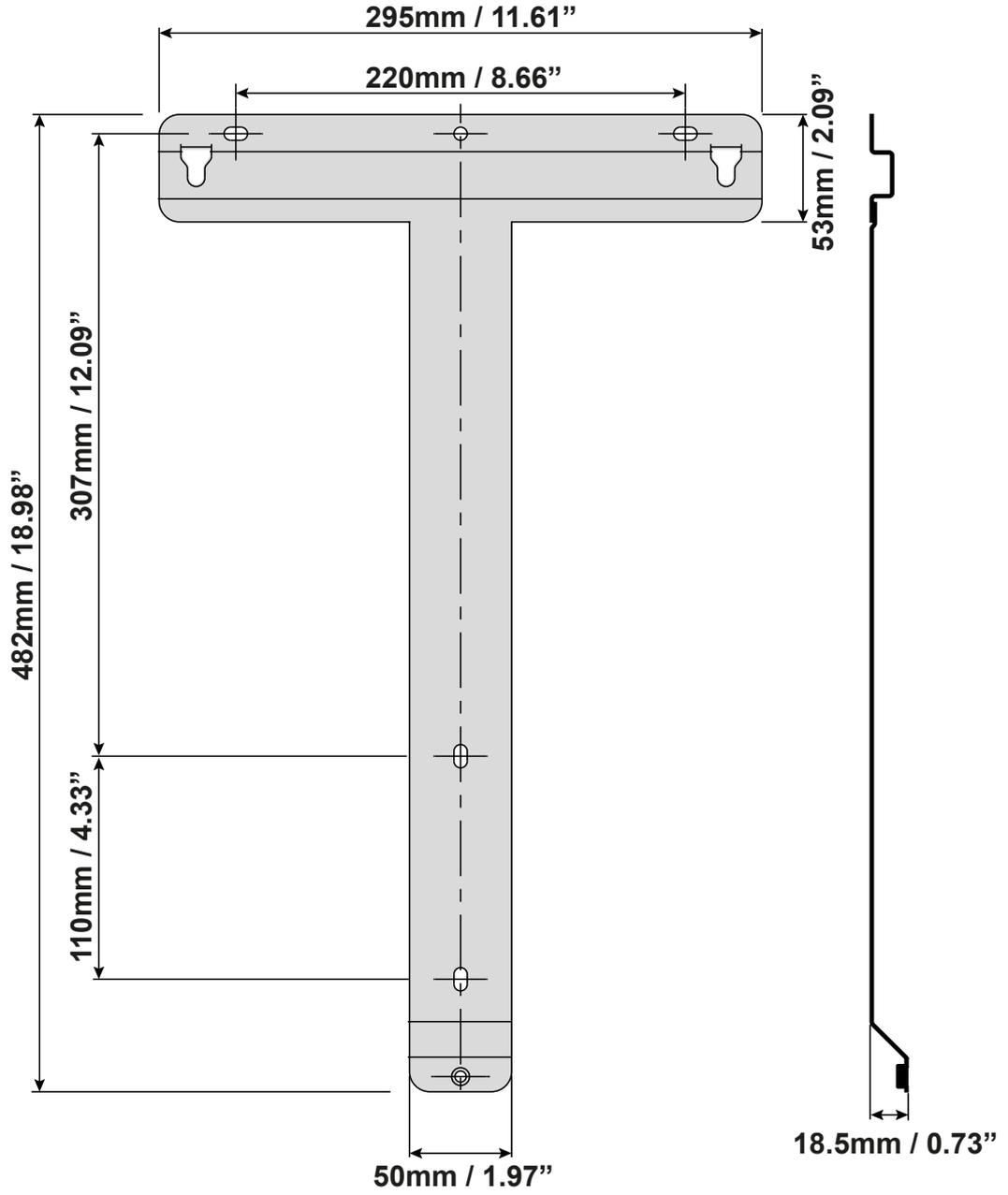
Overall dimensions

The overall dimensions are expressed in mm and in inches



Bracket dimensions

The overall dimensions are expressed in mm and in inches



Efficiency curves

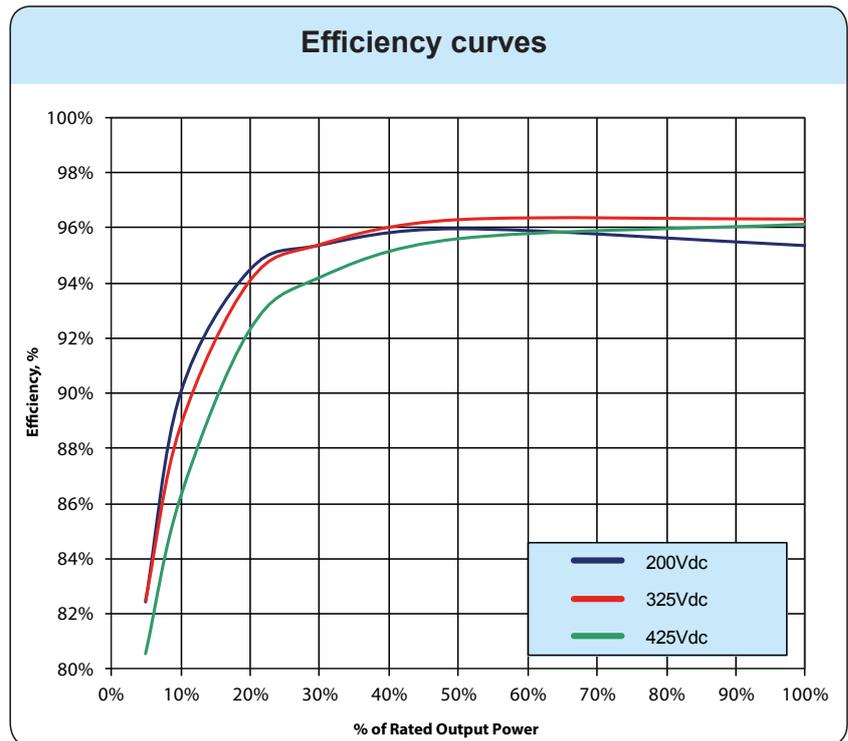
The equipment was designed in consideration of current energy conservation standards, to avoid waste and unnecessary leakage.

Graphs of the efficiency curves of all models of inverter described in this manual are shown below.

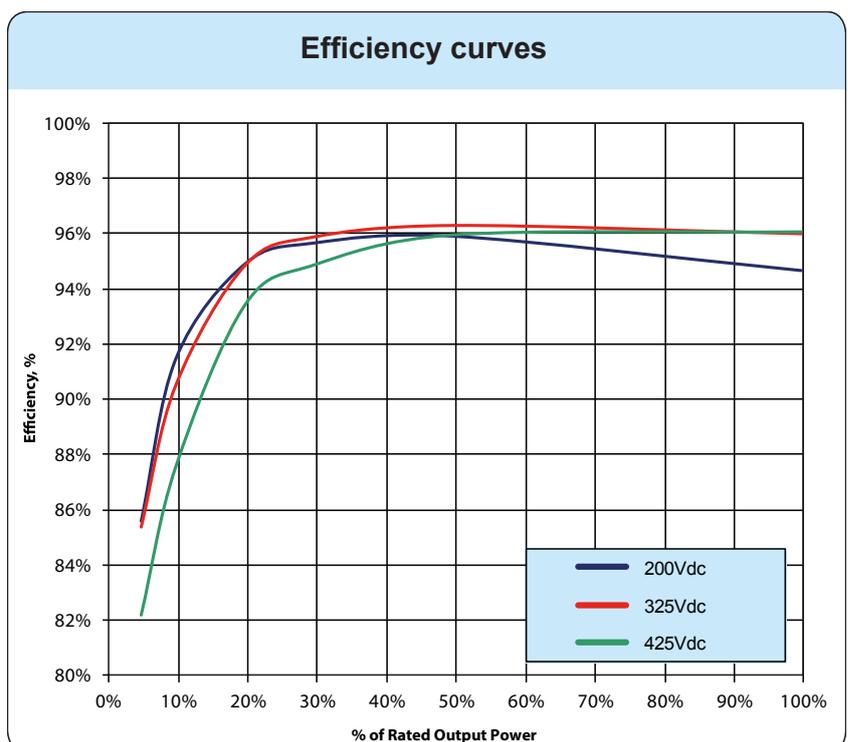
The efficiency curves are linked to technical parameters that are continually being developed and improved and should therefore be considered approximate.



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



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



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 limiting may occur due to:

- Adverse environmental conditions (thermal derating)
- Percentage of output power (value set by the user)
- Grid voltage over frequency (mode set by user)
- Grid over voltage $U > 10\text{min Der.}$ (enabling carried out by user)
- Anti-islanding
- Grid under voltage
- Input voltage values too high.
- Input current values too high.



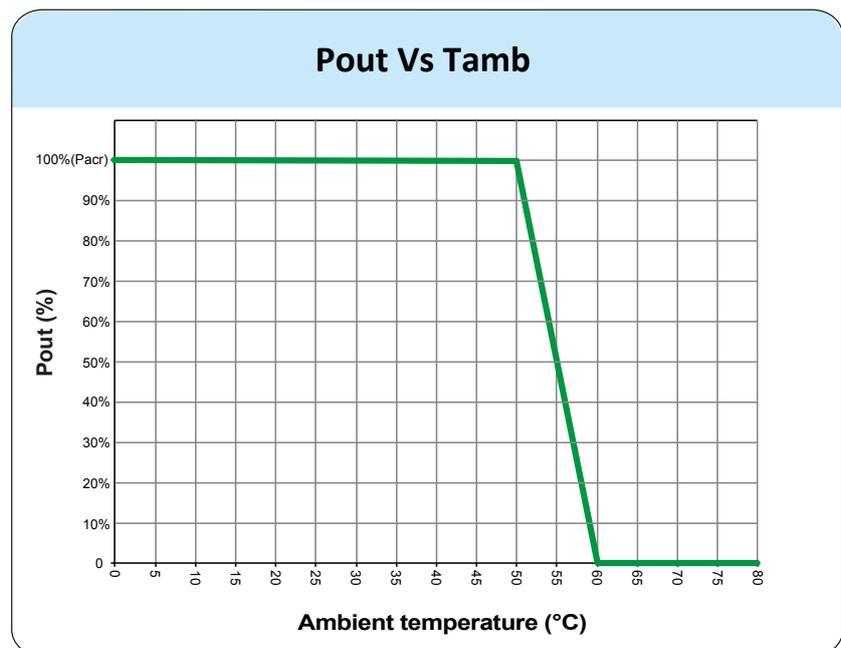
Power derating due to environmental conditions

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.

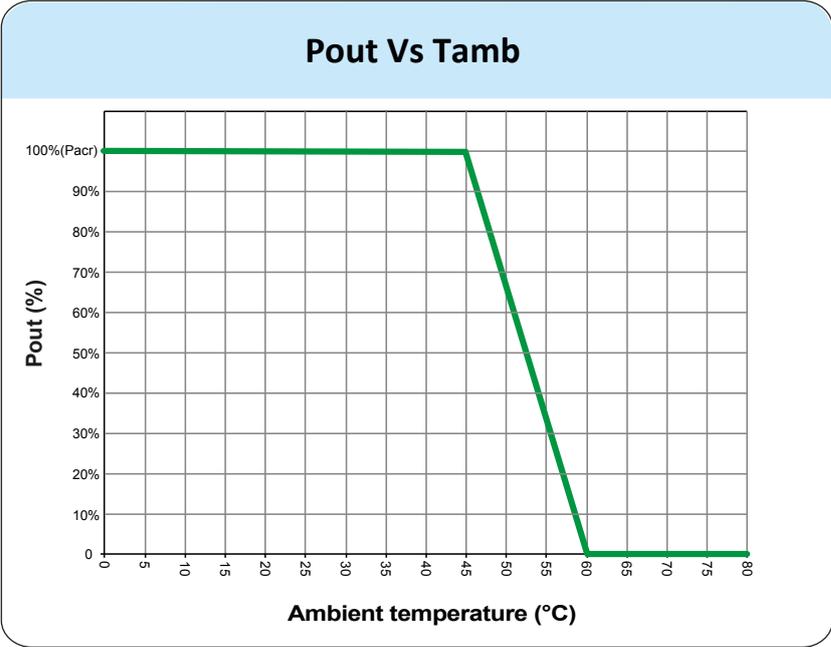
The inverter can therefore reduce the power during certain periods of the day according to the value of these parameters.

In any case, the inverter guarantees the maximum output power even at high temperatures, provided the sun is not shining directly on it.

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



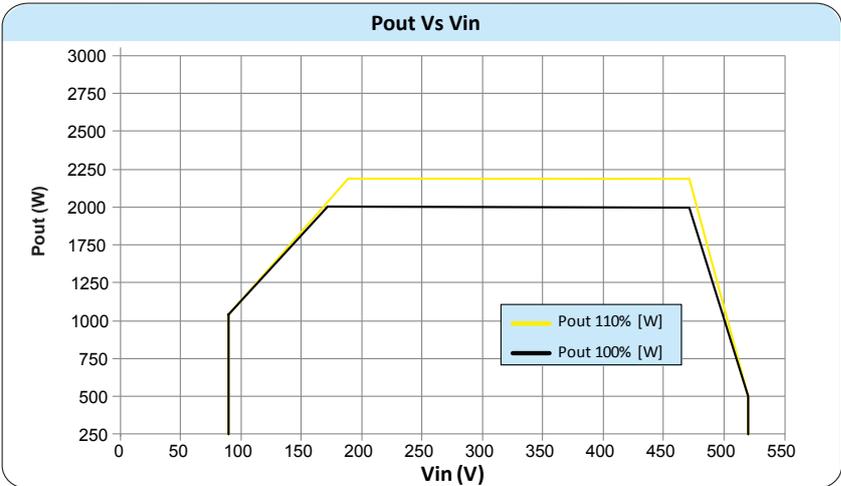
UNO-2.5-I-OUTD
UNO-2.5-I-OUTD-S



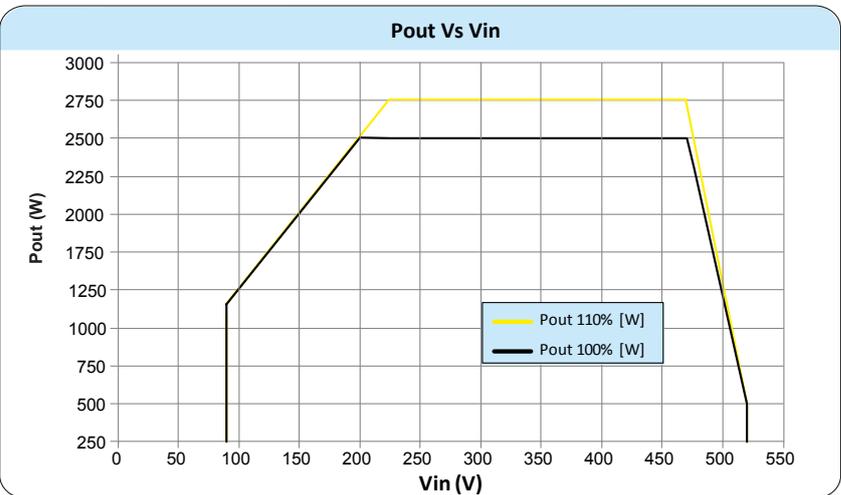
Power reduction due to the input voltage

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

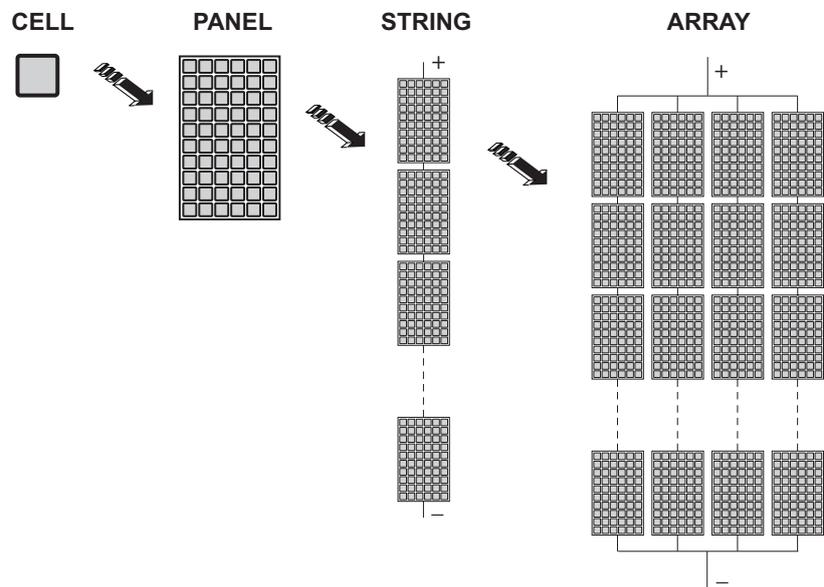
Strings and Arrays

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 an 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.

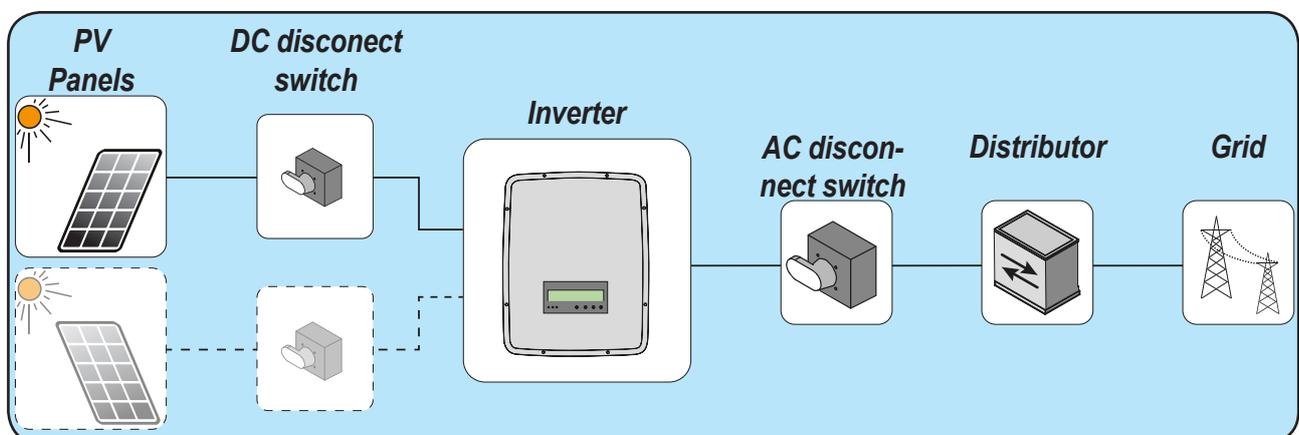
The solar energy system therefore powers all connected electrical devices, from lighting to household appliances, etc.

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



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 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 ABB

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 ABB 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 power to the grid do not reoccur (i.e. $V_{in} > 80VDC$), 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.

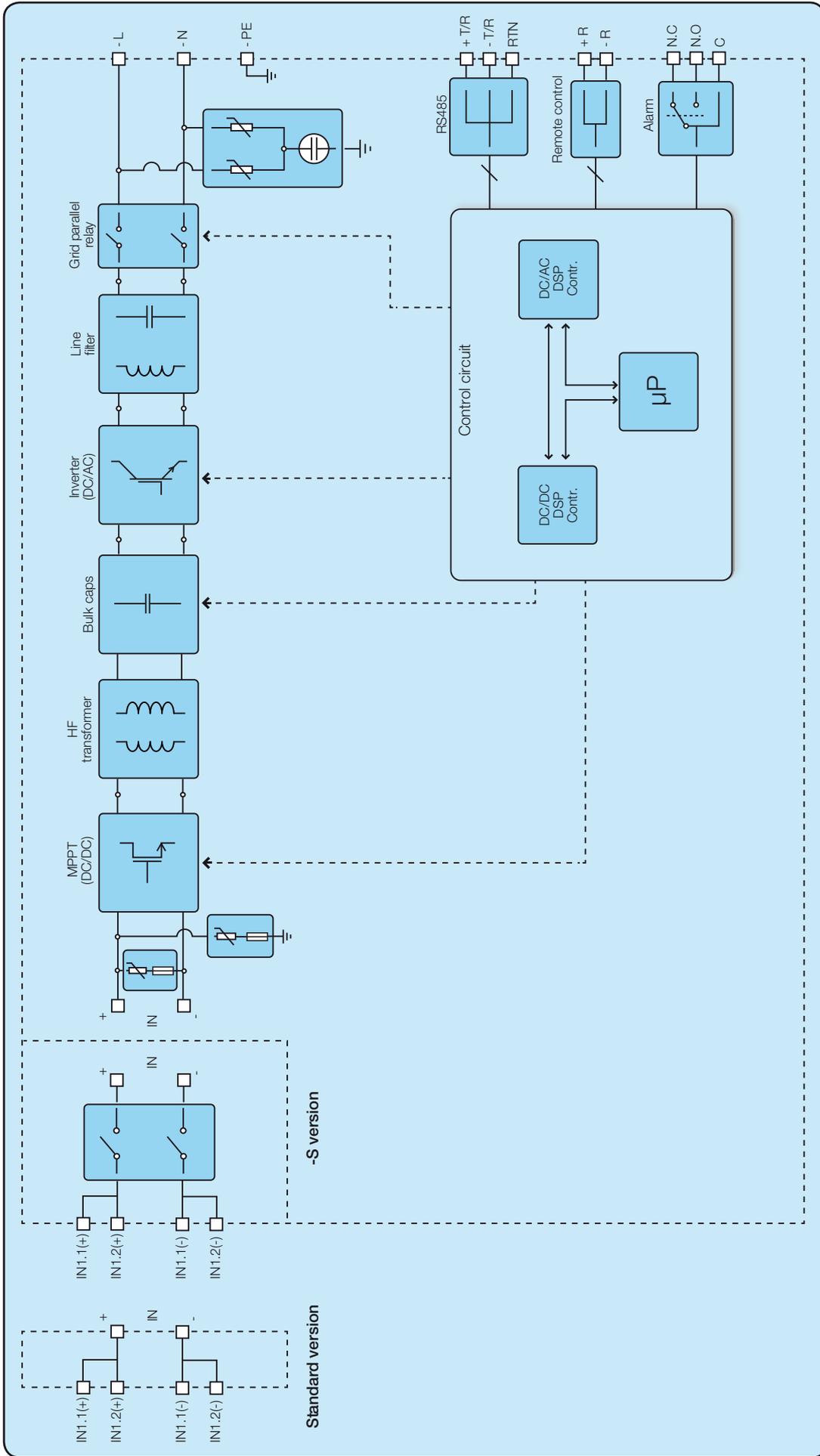
The connection to the power grid is thus kept under control by two independent monitors, in full compliance with the electric field norms both for power supply to the systems as well as security.

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.





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.

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.

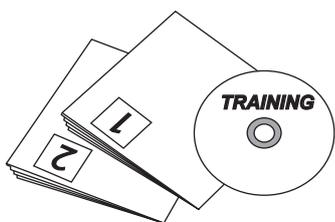


For obvious reasons, it is not possible to anticipate the great number of installations and environments in which the equipment will be installed; it is therefore necessary for the customer to appropriately inform the manufacturer about particular installation conditions.

ABB 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.



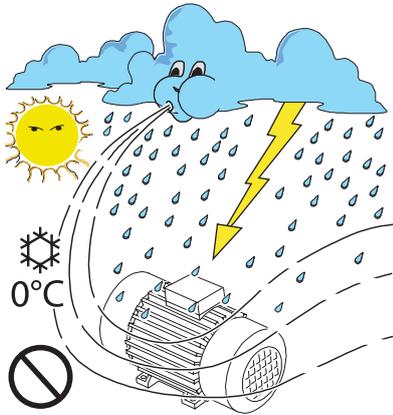
Do not use the equipment if you find any operating anomalies.

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. These conditions are reported on the technical data and on installation chapter.

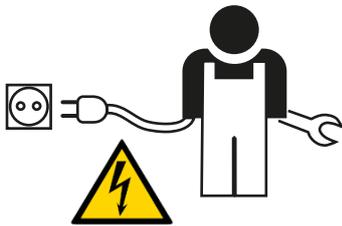
ABB CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.



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 Labels

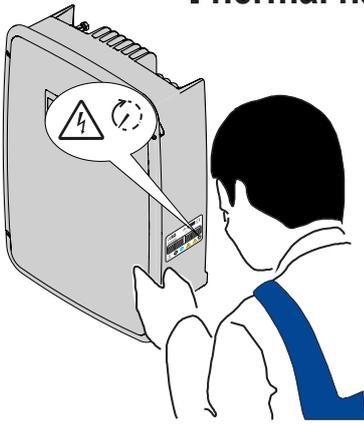


The labels attached to the equipment must absolutely **NOT** be removed, damaged, dirtied, hidden, etc.

The labels 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.)

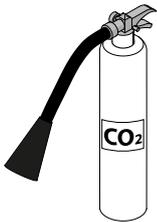
The technical data shown in this manual do not in any case replace those shown on the labels attached to the equipment.

Thermal hazard



WARNING: removal of guards or covers is allowed only 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 CO₂ extinguishers and use auto extraction systems to fight fire in closed environments.

Clothing and protective devices for staff

ABB 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 to prevent 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 down before switching on the equipment.
Inadequate cleaning: compromises cooling and does not allow the safety labels to be read.	Clean the equipment, labels 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, temporarily mounting the equipment or its components may be risky.	Be careful about and disallow access to the installation area.
Accidental disconnections of the quick-fit connectors with the equipment in operation, or wrong connections, may generate electric arcs	Be careful about and disallow access to the installation area.



General conditions

Some recommendation apply only to large size product or multiple small size packings.

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

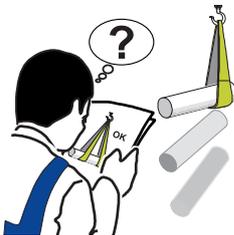


ABB usually stores and protects individual components by suitable means to make their transport and subsequent handling easier, but as a rule it is necessary to turn to the experience of specialized staff in change of loading and unloading the components.

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).

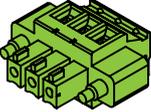
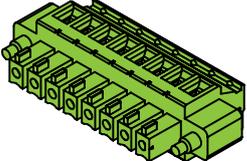
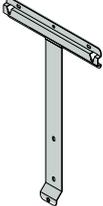
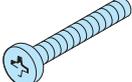
The components of the packaging must be disposed on in accordance with the regulations in force in the country of installation.

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 the Service ABB.

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 ③ for fastening of the inverter to the bracket	1
	Thecnical documentation	1



Equipment weight

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

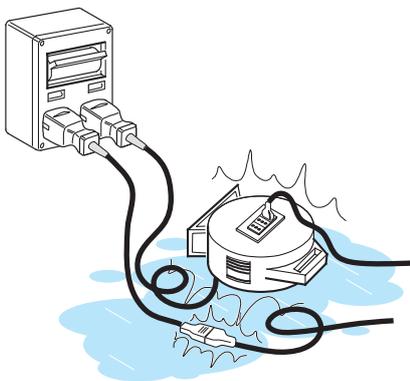


If the package is stored correctly, it can withstand a **maximum load of 6 pieces of equipment**. **DO NOT** stack with equipment or products other than those indicated.



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.



For Safety reason only a qualified electrician, who has received training and / or has demonstrated skills and knowledge in construction and in operation of this unit, can install this inverter.



The installation is done by qualified installers and/or licensed electrician according to the applicable local code regulations



The connection of an inverter energy system to an electrical installation connected to the electricity distribution network shall be approved by the appropriate electrical distributor.

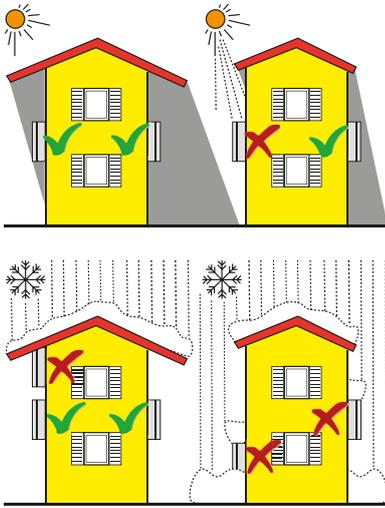


The installation must be carried out with the equipment disconnected from the grid and from the photovoltaic generator.



When the photovoltaic panels are exposed to light, these supplies a direct current voltage to the inverter.

Environmental checks



- Consult the technical data to check the environmental parameters to be observed (degree of protection, temperature, humidity, altitude, etc.)
- The installation to direct sunlight must be avoid because it may cause:
 - phenomena of power limitation by the inverter (with consequent reduction of energy production)
 - premature aging of electronic/electromechanical components
 - premature aging of mechanical components (gaskets) and user interface (display)
- 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 (about 50dB(A) at 1 m) that the inverter makes during operation.
- Avoid electromagnetic interference that can compromise the correct operation of electronic equipment, with consequent situations of danger.



The final installation of the inverter should not prevent access to any outside disconnection means.

Refer to the warranty conditions to evaluate the possible exclusions from warranty related to improper installation.

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:

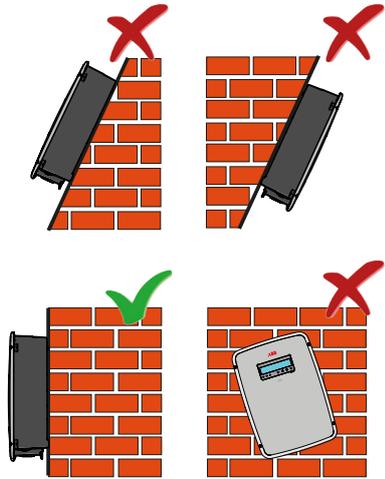


- Less efficient cooling and therefore a greater likelihood of the device going into derating because of high internal temperatures.
 - Reduction in the dielectric resistance of the air that, in the presence of high operating voltages (DC input), can create electric arcs (discharges) that can reach the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



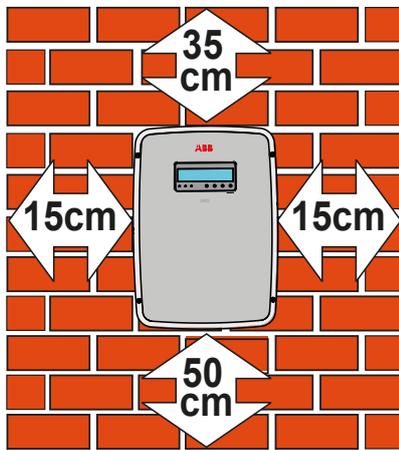
All installations at altitudes of over 2000 metres must be assessed case by case considering the aforesaid criticalities.

Installation position

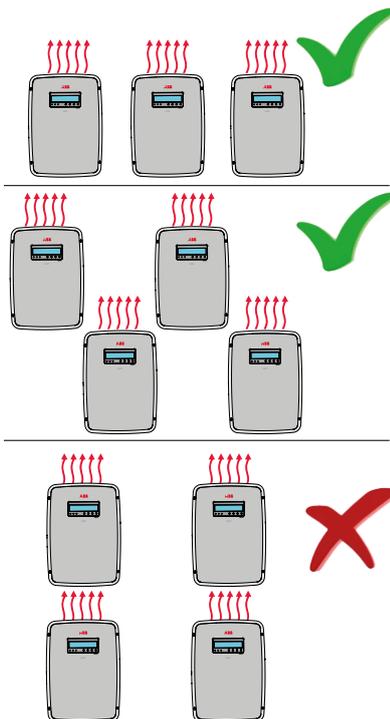


When choosing the place of installation, comply with the following conditions:

- 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 at a height that considers the heaviness of the equipment. If this condition is not complied with, it can create problems in the event of servicing unless suitable means are provided to carry out the operation.
- Install vertically with a maximum inclination of $\pm 5^\circ$. 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.

Wall/Pole mounting

During installation do not place the inverter ② with the front cover ④ facing towards the ground.

- Position the bracket ① 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 ① 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.

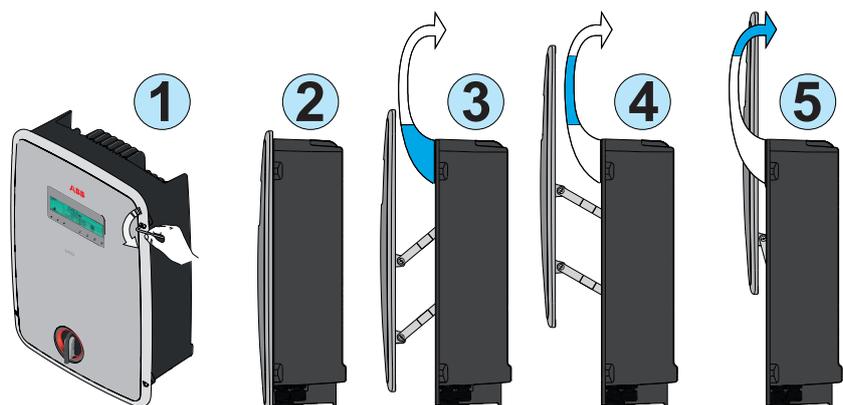
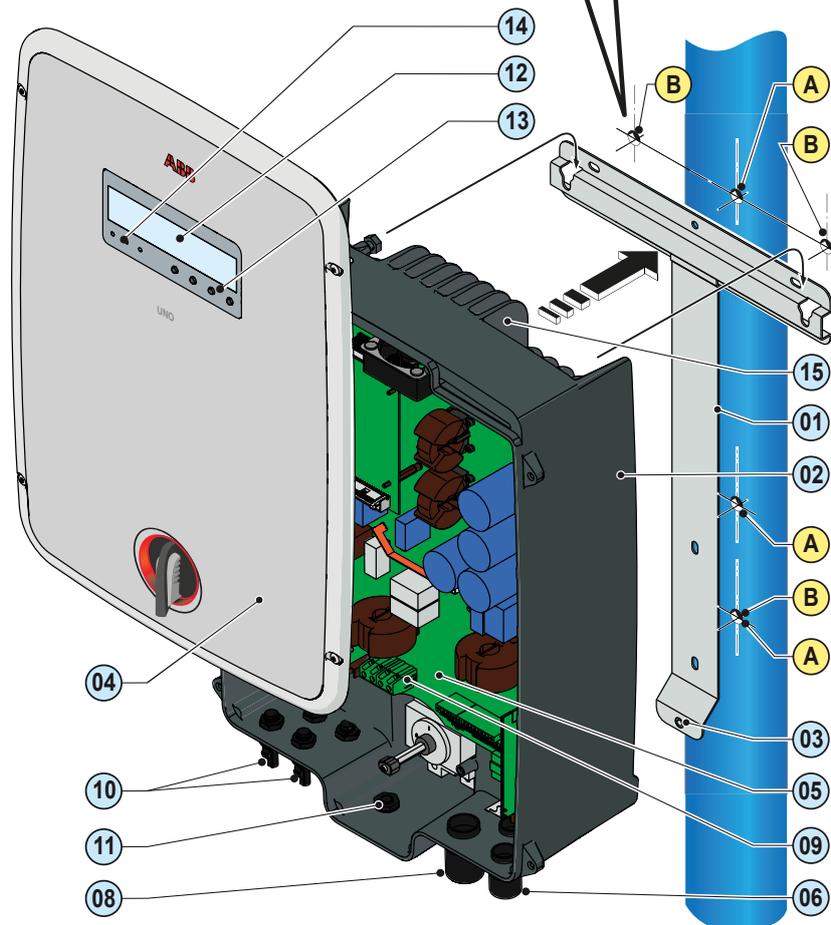
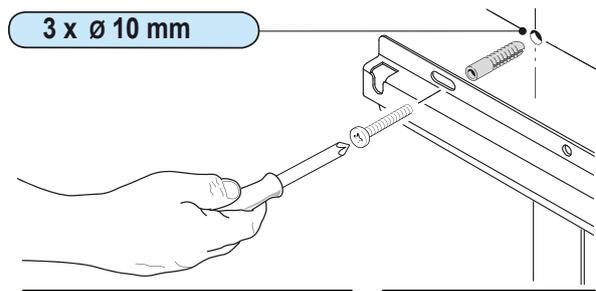
- Hook the inverter to the bracket by inserting the head of the rear screws in the slots as shown in the figure.

- Proceed to anchor the inverter to the bracket by tightening the locking screw ③ located on the lower side.

- Unscrew the 4 screws and open the front cover ④ 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.



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).



Inversion polarity can cause serious damage

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).

ABB 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.

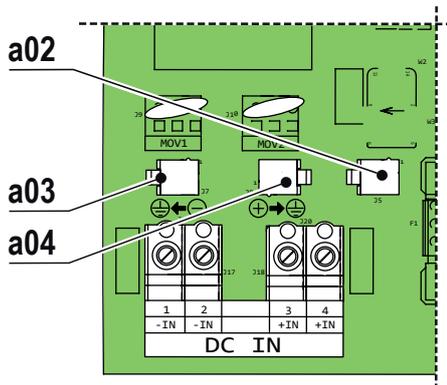
ABB declares that the ABB high-frequency isolated inverters are in terms of their construction continuous ground fault currents and therefore, in accordance with Article 712.413.1.1.1.2 of Section 712 of CEI 64-8/7 Norms there is no requirement that the differential installed downstream of the inverter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



The use of an AC type circuit breaker with differential thermal magnetic protection with tripping current of 30 mA is advisable so as to prevent false tripping, due to the normal capacitive leakage current of photovoltaic modules.

In the case of systems consisting of multiple inverters connected to a single switch with differential protection, it is recommended to install a device that allows the adjustment of the trip value and timing of intervention.

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!

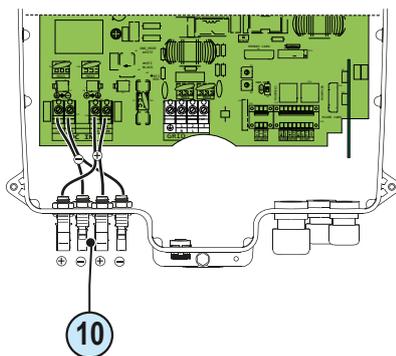
Input connection to the PV generator (DC side)

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

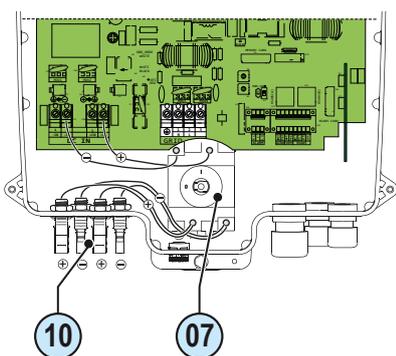


For the string connections it is necessary to use the quick fit connectors (multicontact or weidmüller) located on the bottom of the mechanism. **The maximum numbers of input strings which can be connected is 2.**

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



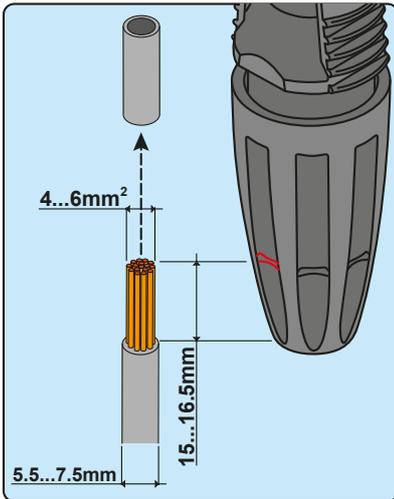
The two pairs of DC input connectors ⑩ are internally related to a single input channel, so there are no preferences on the connectors to be used in the case of installation of a single string.

Installation procedure for quick fit connectors

On equipment models with which quick fit connectors are supplied, they may be supplied in two different types:



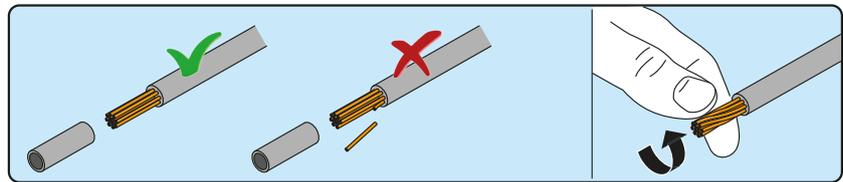
CAUTION: To avoid damage to the equipment, when attaching cables, pay particular attention to polarity.



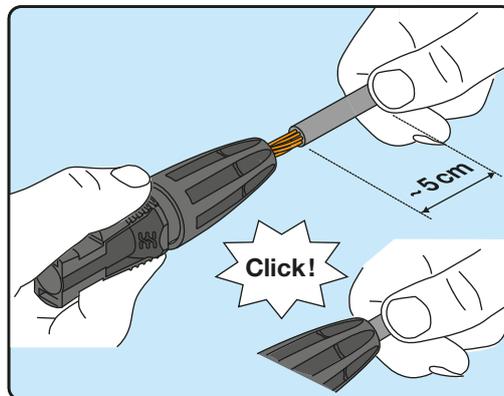
Weidmüller

Installation of Weidmüller connectors does not require any special tooling.

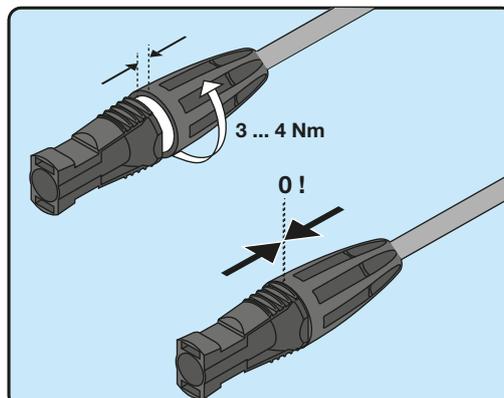
- Strip the cable to which you want to apply the connector (after verifying that it complies with the connector limits)

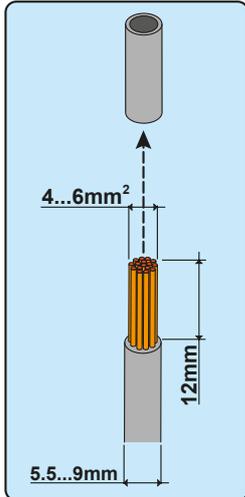


- Insert the wire into the connector until you hear a locking "click"



- Tighten the knurled ring nut for optimal clamping

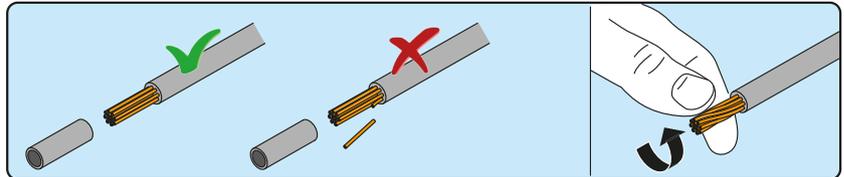




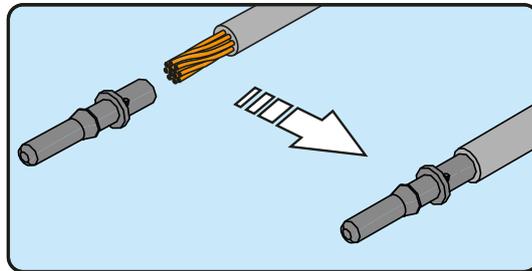
MULTICONTACT (or equivalents)

Installation of Multicontact connectors requires crimping to be carried out with suitable equipment.

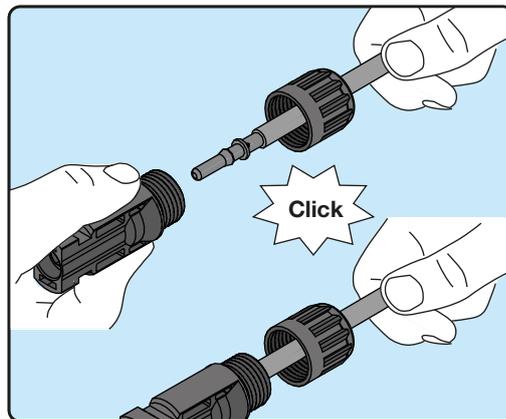
- Strip the cable to which you want to apply the connector (after verifying that it complies with the connector limits)



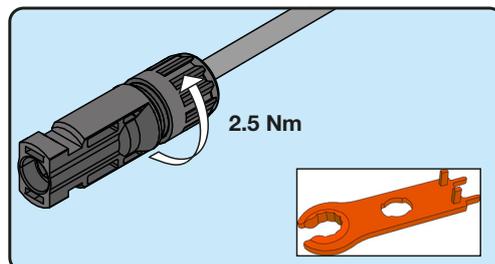
- Apply the terminal to the conductor using suitable crimping pliers



- Insert the cable with the terminal into the interior of the connector, until you hear the click indicating that the terminal is locked inside the connector.



- Firmly tighten the cable gland to finish the operation



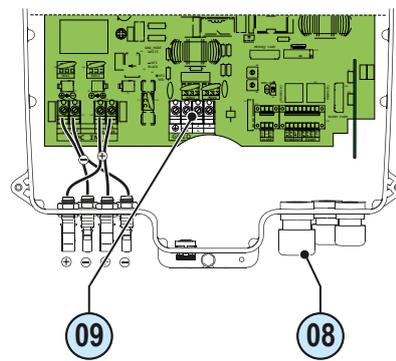
Grid output connection (AC side)

For the connection to the inverter grid you need 3 connections: ground, neutral and phase. **The ground connection to the inverter is obligatory.**

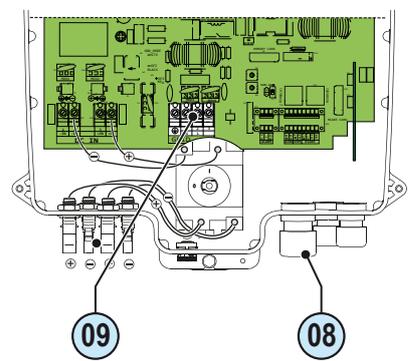
Plug the grid cable into the inverter using the specific AC cable gland ⑧ and connect the AC output screw terminal block ⑨.

Use a properly sized tripolar cable and check the tightness of the AC cable gland ⑧ at the end of the installation.

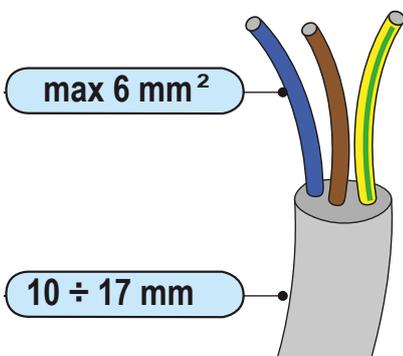
Standard version



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 (mm ²)	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)

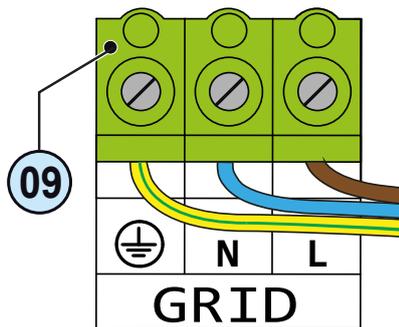
To protect the AC connection line of the inverter, we recommend installing a device for protection against over current and leakage with the following characteristics:

	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.



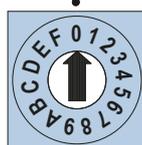
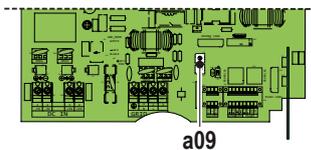
For all models you connect the AC output screw terminal block (09) by passing the cables through the AC cable gland (08).

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.

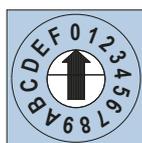
Unscrew the AC cable gland (08), remove the cover, insert the cable of suitable cross-section and connect the conductors (Ground, Neutral, and Phase) to the terminals on the AC output screw terminal block (09).

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.



1

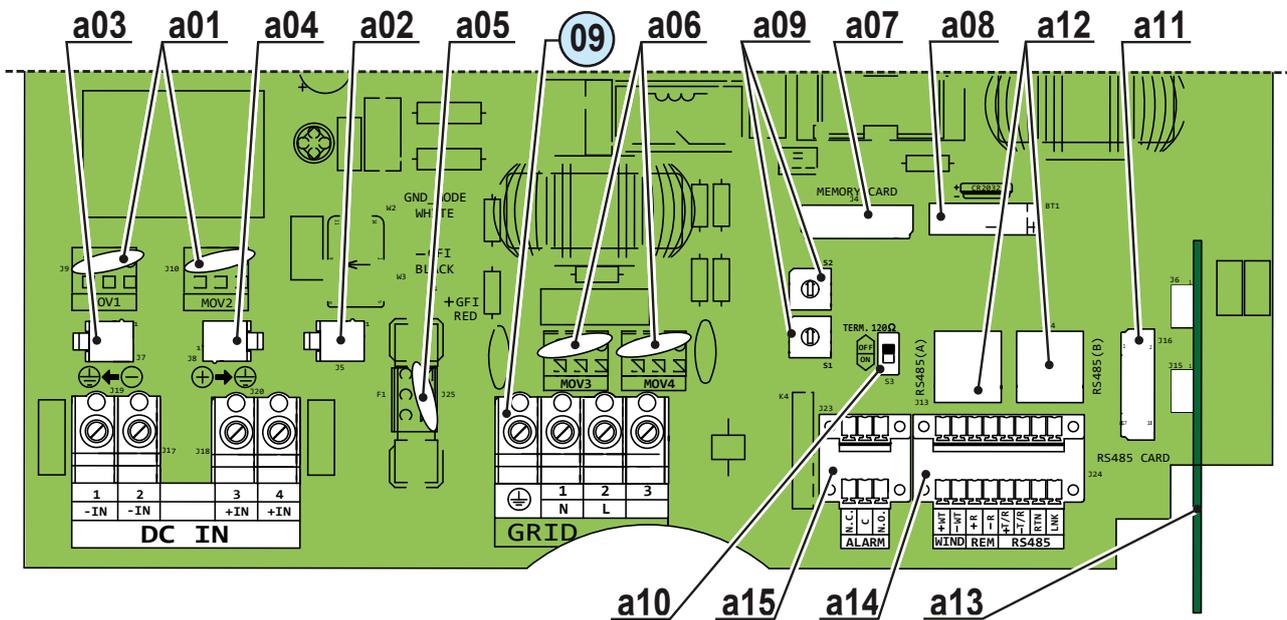


2

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



Main board ⑨

Ref. manual	Ref. inverter	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
⑨	J21 - J22	AC output terminal board

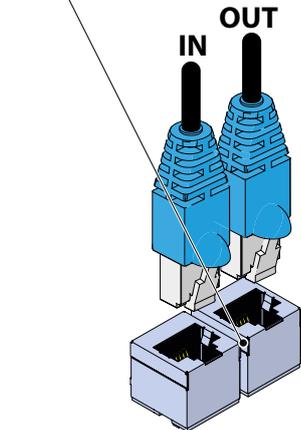
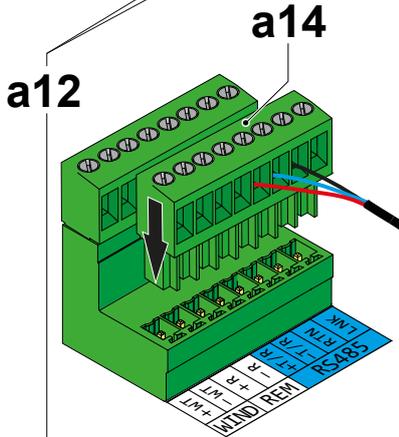
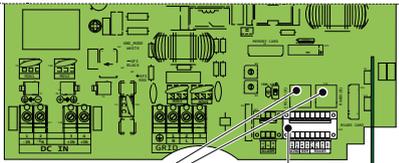
Connections of the signals to the main board

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).

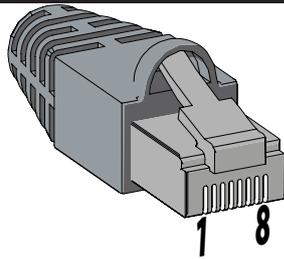
Connection of conductors with RJ45 connectors a12

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.

Table: crimping scheme connectors RJ45

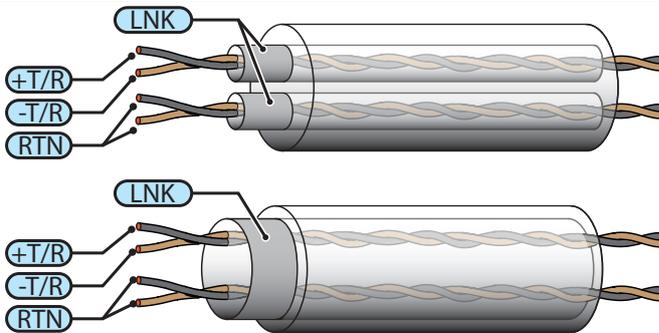
Pin N°	Function
3	+T/R
5	-T/R
7	RTN
1, 2, 4, 6, 8	not used



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 $Z_0=120\text{ Ohm}$ like the one shown in the following table:

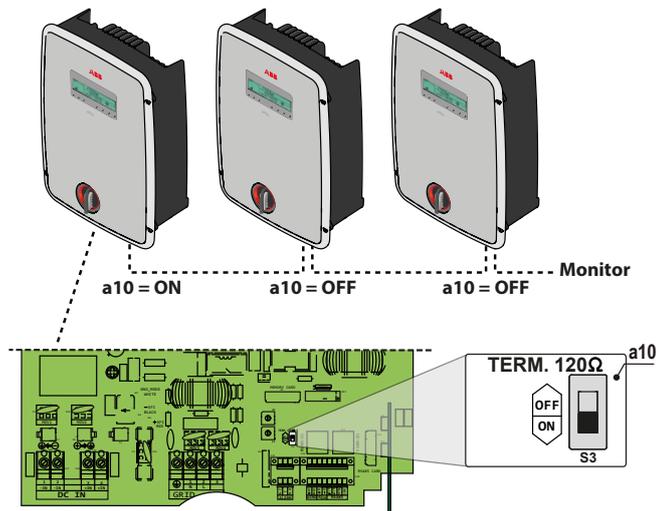
Signal	Symbol
Positive data	+T/R
Negative data	-T/R
Reference	RTN
Shield	LNK



Shield continuity must be provided along the communication line using the SH 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).

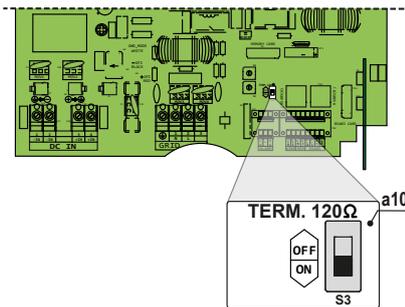


If a single inverter is connected to the monitoring system, activate the termination resistance of the communication line by switching switch a10 (to ON position).

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.*

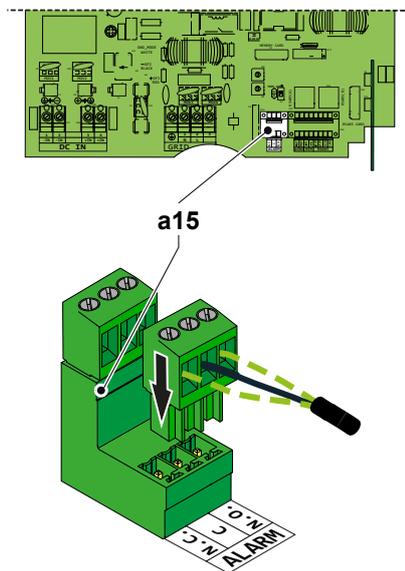


When using an RS-485 connection, if one or more inverters are added later to the system, you must remember to return to OFF position the switch of the termination resistance used of the inverter that was previously the last one of the system.

Each inverter is dispatched with two (2) as the predefined RS485 address and with switch for setting termination resistance a10 to OFF position.



Configurable relay connection



The inverter is equipped with a multifunction relay with configurable activation. 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).

Different types of devices (light, sound, etc.) can be connected to the relay, provided they comply with the following requirements:

Alternating current

Maximum Voltage: 240 V AC

Maximum Current: 1 A

Direct current

Maximum Voltage: 30 V DC

Maximum Current: 0.8 A

Cable requirements

External diameter: from 5 to 17 mm

Conductor cross-section: from 0.14 to 1.5 mm²

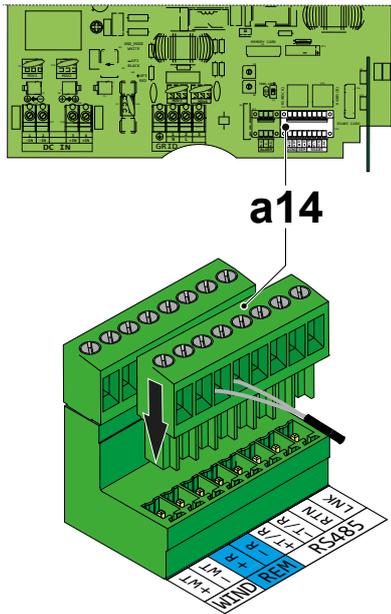
NC = Normally closed

C = Common contact

NO = Normally open

This contact can be used in different operating configurations that can be selected by accessing the “SETTINGS → Alarms” menu. The selectable modes are described in the paragraph on the “Settings Menu”

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).



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.*

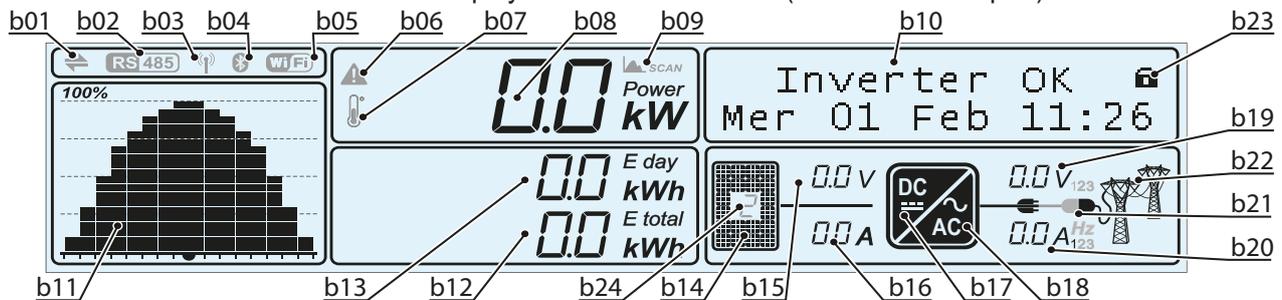
ABB cannot be held responsible for damage to the equipment or the operator if it is the result of incompetence, insufficient qualifications or lack of training.

Display and keyboard

Display fields and symbols description

Using the display, operating parameters for the equipment are shown. signals, alarms, channels, voltages, etc.

The display, when in operation, behaves dynamically, allowing cyclical display of certain information (see relevant chapter).

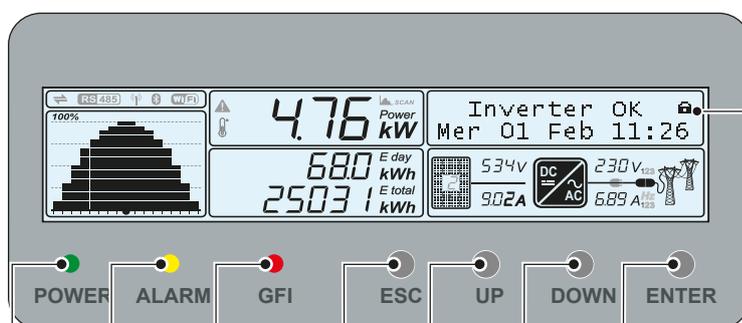


Ref. Description

b01	Indicates transmission and reception of data through the RS485 line
b02	Indicates presence of the RS485 communication line
b03	Indicates presence of the radio communication line (radio module board installed)
b04	Indicates presence and readiness of the Bluetooth communication line (NOT available)
b05	Indicates presence and readiness of the WiFi communication line (NOT available)
b06	Reports an active power derating for out-of-range input voltage or power restrictions set by the grid manager or by the display
b07	Reports a power derating due to high internal temperature
b08	Instantaneous power placed on the grid
b09	MPPT SCAN function active
b10	Text lines to cyclically display the inverter parameters, error codes, and for menu navigation
b11	Graph of power introduced to grid (from 0 to 100%). Timescale can be set to 8/16/24 hours
b12	Displays the total energy from the inverter installation
b13	Shows the energy produced throughout the day
b14	Indicates that the PV generator voltage is greater than the inverter Vstart
b15	Input voltage (DC)
b16	Input current (DC)
b17	Indicates the DC/DC input circuit (Booster)
b18	Indicates the DC to AC conversion circuit
b19	Output voltage of phase highlighted
b20	Output current of phase highlighted. At the end of the currents display the grid frequency (Hz) is shown
b21	Connection to the grid:  Inverter not connected /  Inverter connected
b22	State of grid voltage: Icon absent: grid voltage not present Flashing icon: grid voltage present but outside parameters set by the standard grid Icon present: Grid voltage present and within parameters set by the standard grid
b23	Main menu scrolling mode:  CYCLIC : Cyclic display of the main parameters of the inverter.  LOCKED : Display locked on the screen to be constantly monitored.
b24	Indicates the channel which refers to the values of voltage and input current displayed. In the event of independent channels, parameters are displayed cyclically (channel 1 or 2)

Description of keyboard and LED Panel

Using the combination of keyboard keys, under the display, it is possible to set values or scroll through the data items to view them. LED indicators are located alongside the keyboard, indicating the operating state of the inverter.



By pressing and holding the ENTER key, the cyclical display of the parameters can be:

-  Locked
-  Cyclical

Allows you to confirm the operation or enter the data set.

Allows you to read through the data in descending order on the display, or when inserting, correct the value set by reducing it

Allows you to read through the data in ascending order on the display, or when inserting, correct the value set by increasing it

Allows you to exit the current mode

The "GFI" (ground fault) LED indicates that the inverter has detected a ground fault in the DC side photovoltaic generator. When this fault is detected, the inverter immediately disconnects from the grid and displays the relevant error indication on the LCD display.

Indicates that the inverter has detected an anomaly. The type of problem will be shown in the display

Indicates that the inverter is functioning correctly.

When the unit is commissioned, while the grid is checked, this LED blinks. If a valid grid voltage is detected, the LED remains continuously lit, as long as there is sufficient sunlight to activate the unit. Otherwise, the LED will continue to blink until the sunlight is sufficient for activation. In this phase, the LCD display shows the message "Awaiting sun..."

The LEDs, in various multiple available combinations, can signal multiple conditions other than the original single condition; see the various descriptions explained in the manual.

The Keys, in various multiple available combinations, allow you to access actions other than the original single action; see the various descriptions explained in the manual.

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 and goes into stand-by mode.

The operating cycle is automatically restored when there is sufficient solar radiation. At this point, the luminous LEDs on the LED panel 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 the dedicated RS-485 serial line. Data may be collected by a PC or a data logger with an RS-485 port. Contact the ABB support service with any queries about device compatibility.

Types of data available

The inverter provides two types of data, which can be retrieved through the special interface software and/or the display.

Real-time operating data

Real-time operating data can be transmitted on request through the communication lines and are not recorded in the inverter.



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.

Measurement tolerance

The data supplied by the inverter may differ from measurements taken by certified measuring instruments (e.g. output meters, multimeters and grid analysers); since the inverter **is not a measuring instrument** it has wider tolerances for the measurements it makes.

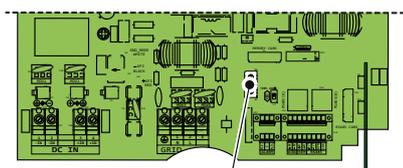
The tolerances are generally:

- ±5% for real-time measurements with output power below 20%
- ±3% for real-time measurements with output power above 20%
- ±4% for all statistical data

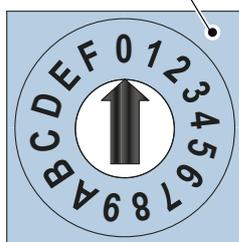
Standard grid setting of the country and language display

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

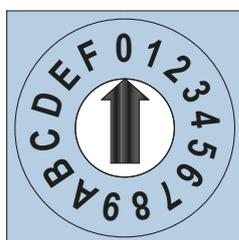
Setting the grid standard for the country of installation is a necessary operation before commissioning, and the installer must know the correct standard to be configured.



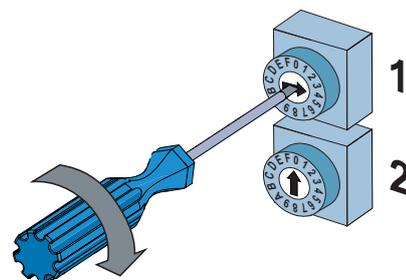
a09



1



2



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.

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

Table: country standard and language

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 RD 1699 @ 230V (RD 1699)	SPANISH
0	7	UK – G83 @ 230V (UK G83)	ENGLISH
0	9	IRELAND @ 230V (IRELAND)	ENGLISH
0	A	AUSTRALIA @ 230V (AS 4777)	ENGLISH
0	B	ISRAEL @ 230V (ISRAEL)	ENGLISH
0	D	FRANCE @ 230V (FRANCE)	FRENCH
0	E	NETHERLANDS @ 230V (NETHERL)	DUTCH
0	F	GREECE @ 230V (GREECE)	ENGLISH
1	0	PORTUGAL @ 230V (PORTUGAL)	ENGLISH
1	1	CORSICA @ 230V (CORSICA)	FRENCH
1	2	HUNGARY @ 230V (HUNGARY)	ENGLISH
1	3	CHINA @ 230V (CHINA)	ENGLISH
1	4	KOREA @ 220V (KOREA)	ENGLISH
1	5	TAIWAN @ 230V (TAIWAN)	ENGLISH
1	6	CHECA Republic @ 230V (CZECH)	ENGLISH
1	7	GERMANY–VDE AR-N-4105 @230V (VDE 4105)	GERMAN
1	8	ENEL CEI-021 @ 230V INTERNAL Prot. (CEI021 IN)	ITALIAN
1	9	CEI-021 @ 230V EXTERNAL Protec- tion (CEI021 EX)	ITALIAN
1	B	SOUTH AFRICA @ 230V (S.AFRICA)	ENGLISH
1	E	BELG C10-11 110%@230V (C1011 110)	FRENCH
1	F	BRAZIL @ 220V (BRAZIL)	ENGLISH



Set Country

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).



Invalid Selection

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

Grid standard of the country and display language saving

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 ABB’s technical support department with the part number and serial number of the inverter to hand.

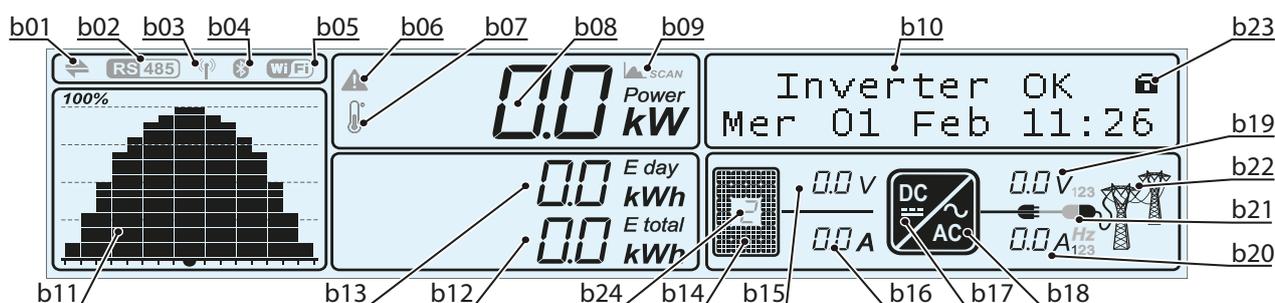


Commissioning

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.

The inverter commissioning procedure is as follows:

- Put the DC disconnect switch  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:

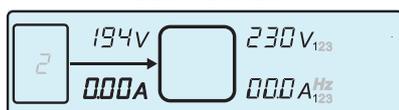
- Not present, if the mains voltage results as absent.

- flashing, if the mains voltage is present but outside the parameters dictated by the standard of the country of installation.

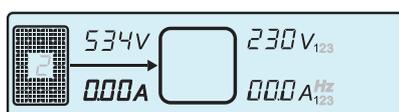
- Turns on, if the mains voltage is present and within the parameters dictated by the standard of the country of installation. In this condition, the inverter starts the sequence of grid connection.

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

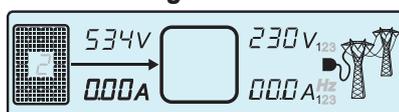
Vin < Vstart

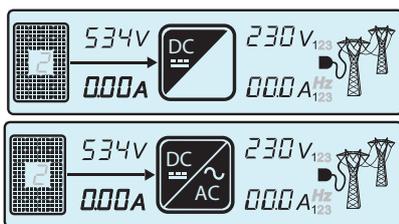


Vin > Vstart



Vgrid OK





• 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).

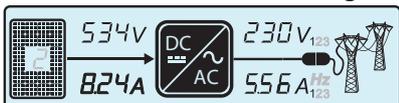
Immediately after this, the **b18** icon, which indicates the AC-DC circuit (inverter) part, will also behave normally.

Inverter not connected to the grid



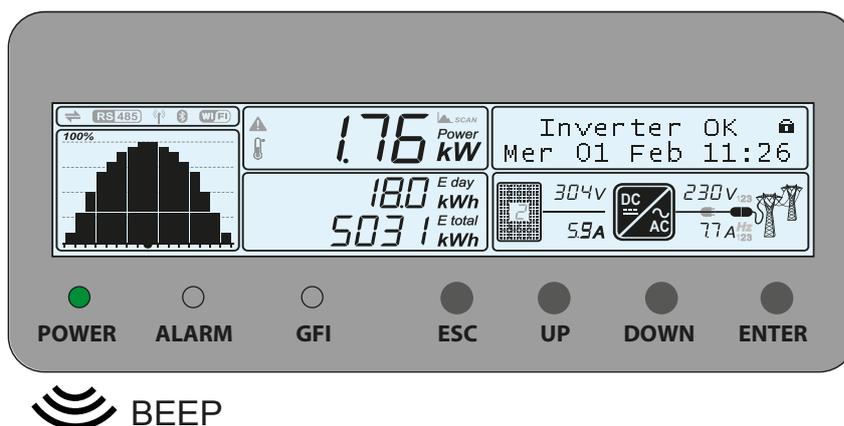
• Immediately after this the grid connection will start. During this phase the icons will be displayed in sequence on the **b21** board until the connection of the inverter. After the inverter is connected, the icons on the whole line **b21** will come on steady.

Inverter connected to the grid



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.



• 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.

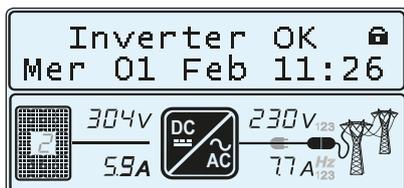
Display access and settings

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-I-OUTD) 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

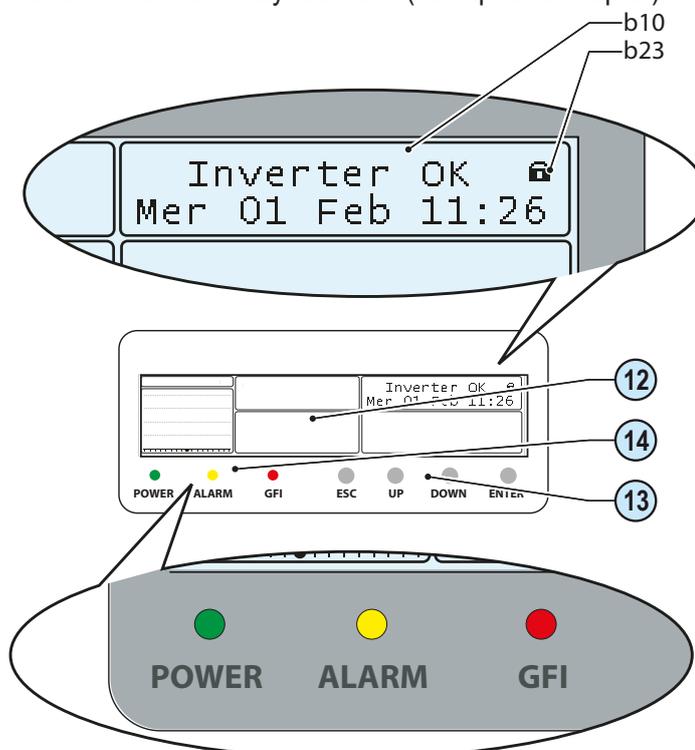
- = LED On
- ⊗ = LED flashing
- ⊗ = LED Off
- ⊗ = Any one of the conditions described above

The following table shows all the possible activation combinations of LEDs on the LED panel according to the operating status of the inverter.

LED status	Operating state
green: ⊗ yellow: ⊗ red: ⊗	Firmware programming The inverter firmware is being programmed
green: ⊗ yellow: ⊗ red: ⊗	Night mode (inverter automatically switches off) The inverter is in night time switch-off mode (input voltage less than 70% of the set start-up voltage).
green: ⊗ yellow: ⊗ red: ⊗	Inverter initialisation This is a transitional state during verification of the operating conditions. During this stage the inverter checks that the conditions for connecting to the grid are met.
green: ● yellow: ⊗ red: ⊗	The inverter is connected and is feeding power into the grid Normal operation During this stage, the inverter automatically tracks and analyses the photovoltaic generator's maximum power point (MPP).
green: ⊗ yellow: ● red: ⊗	Disconnection from the grid Indicates no grid voltage. This condition does not allow the inverter to connect to the grid (the inverter display shows the message "Missing Grid").
green: ⊗ yellow: ● red: ⊗	Indication of Warning (W message codes) or Error (E message codes) states Indicates that the inverter control system has detected a warning (W) or error (E). The display shows a message indicating the type of problem found (see Alarm messages).
	<ul style="list-style-type: none"> • Ventilation anomaly Indicates an anomaly in the operation of the internal ventilation system that could limit output power at high ambient temperatures.
	<ul style="list-style-type: none"> • Failed association of internal inverter components (after replacement) Indicates that the installed wiring box (only in the event of a replacement) was already associated with another inverter and cannot be associated with the new inverter
green: ⊗ yellow: ⊗ red: ⊗	<ul style="list-style-type: none"> • Overvoltage surge arresters triggered (where fitted) Indicates that any class II overvoltage surge arresters installed on the AC or DC side have been triggered
	<ul style="list-style-type: none"> • String protection fuses triggered (where fitted) Indicates that one or more input string protection fuses that may be installed have been triggered
	<ul style="list-style-type: none"> • Autotest (for Italian grid standards only) The inverter is performing a self-test
green: ⊗ yellow: ⊗ red: ●	Anomaly in the insulation system of the photovoltaic generator Indicates that a leakage to ground from the FV generator has been detected, causing the inverter to disconnect from the grid.

Specifications on the operation of the LEDs

In correspondence to each status of the inverter indicated by the constant or intermittent lighting of the specific LED, the display ⁽¹²⁾, section b10, also shows a message identifying the operation which is being carried out or the defect/anomaly recorded (see specific chapter).



In the case of malfunction it is extremely dangerous to intervene personally to try and eliminate the defect. The instructions below must be followed scrupulously; if you do not have the necessary experience and training to intervene safely, please contact a specialist.



LED insulation fault

Interventions after warning of insulation fault

When the red LED comes on, first try to reset the warning by pressing the multi-function ESC button on the LED panel ⁽¹⁴⁾.

Should the inverter reconnect normally to the network the fault was due to temporary phenomena.

You are advised to have the plant inspected by the installer or a specialist should this malfunction occur repeatedly.

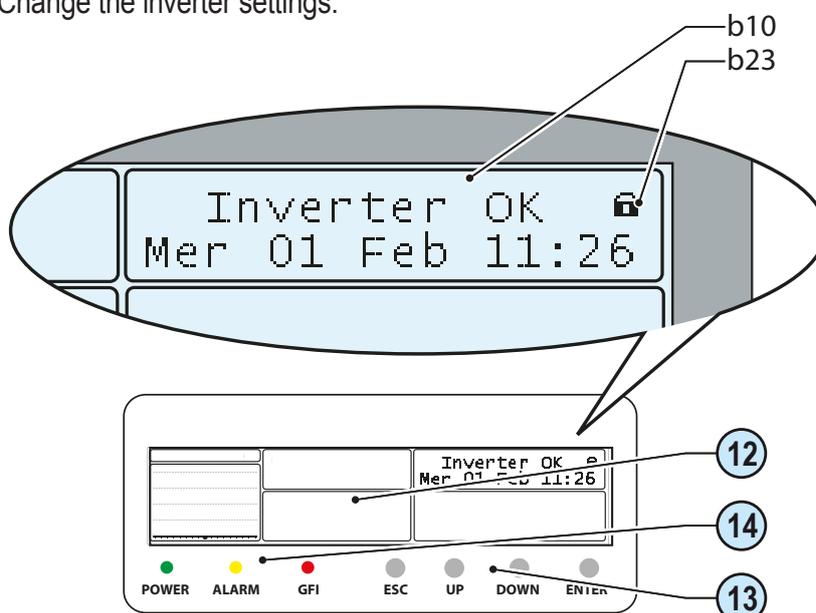
Should the inverter not reconnect to the grid, isolate it on both the AC and DC sides (by using the disconnect switches), then contact the installer or authorised centre to repair the fault in the photovoltaic generator.

Description of the menus

The display **12** has a section **b10** (graphic display) for moving through the menu by using the buttons **13**.

Section **b10** consists of 2 lines with 16 characters per line and can be used to:

- Cycle through the general information on:
 - Operating status and error/warning code indications
 - Inverter identification details
 - Active and reactive power management settings
 - Main parameters measured;
- Display statistical data;
- Display service messages for the operator;
- Change the inverter settings.

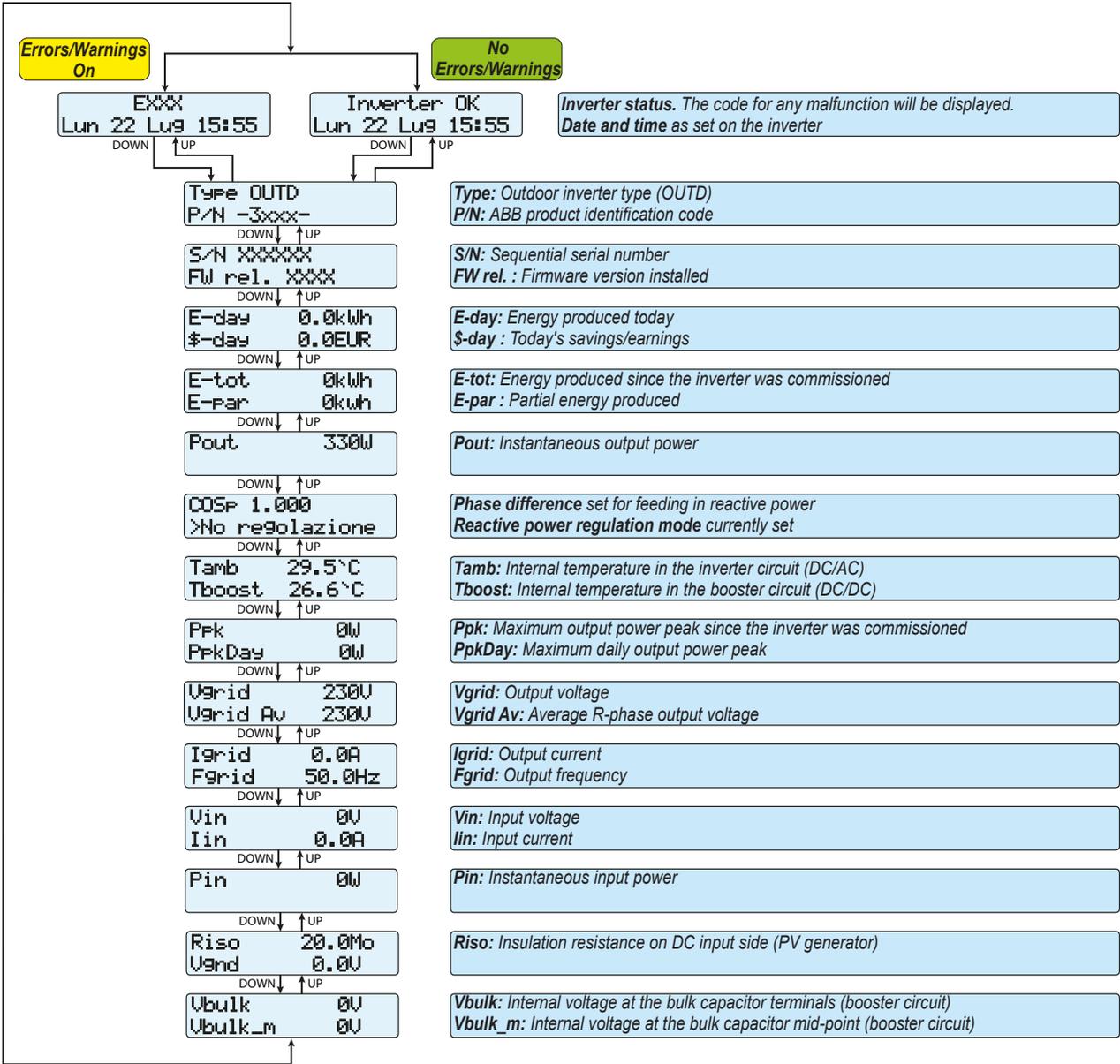


General information

While the inverter is operating, the display shows various items of information on the main parameters measured, the operating conditions and the inverter's operating status.

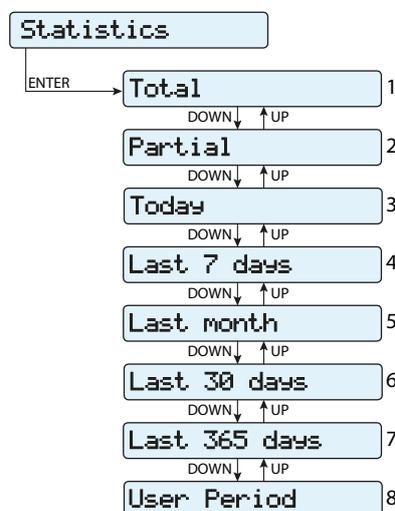
The display cycles through the information when the icon **b23** shows two curved arrows ; if it shows a padlock  it means that the display of information is locked and the UP and DOWN buttons can be used to scroll through the screens of information instead. You can switch between the two display modes by pressing the ENTER button.

The sequence of screens displayed is shown below, with a description of the parameters monitored.



Statistics Menu

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



1. Total

This section of the menu displays the Total statistics:

- **Time:** Total operating time
- **E-tot:** Total energy produced
- **Val. :** Total production value, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved compared to fossil fuels

2. Partial

This section of the menu displays the Partial statistics:

- **Time:** Partial operating time
- **E-par:** Partial energy produced
- **PPeak:** Peak power value
- **Val. :** Partial production value, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Partial amount of CO₂ 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.

3. Today

This section of the menu displays today's statistics:

- **E-day:** Energy produced today
- **Ppeak:** Today's peak power value
- **Val. :** Value of today's production, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved today

4. Last 7 days

This section of the menu displays the statistics for the last 7 days:

- **E-7d:** Energy produced over the last 7 days
- **Val. :** Value of production over the last 7 days, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved over the last 7 days

5. Last month

This section of the menu displays the statistics for the last month:

- **E-mon:** Energy produced during the current month
- **Val. :** Value of the last month's production, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved during the current month

6. Last 30 days

This section of the menu displays the statistics for the last 30 days:

- **E-30d:** Energy produced over the last 30 days
- **Val. :** Value of production over the last 30 days, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved over the last 30 days

7. Last 365 days

This section of the menu displays the statistics for the last 365 days:

- **E-365:** Energy produced over the last 365 days
- **Val. :** Value of production over the last 365 days, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved over the last 365 days

8. User period

This section of the menu displays the statistics for a period chosen by the user:

Once the start and end dates for the period have been set, the following data are available:

- **E:** Energy produced over the selected period
- **Val. :** Value of production over the selected period, calculated using the currency and conversion coefficient set in the relevant section of the SETTINGS menu
- **CO₂:** Amount of CO₂ saved over the selected period



Settings Menu

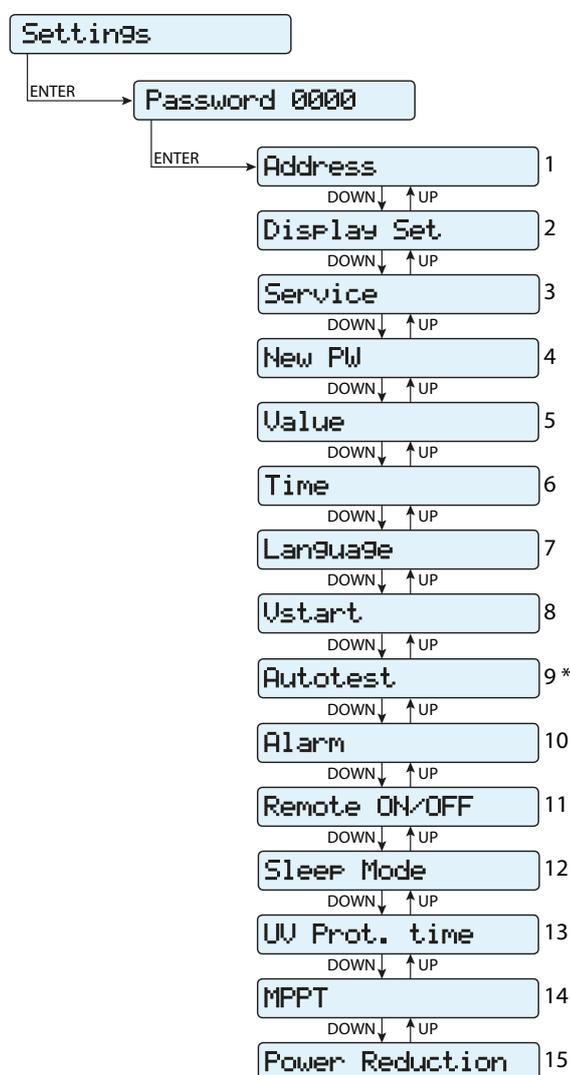
Selecting STATISTICS from the three main sub-menus brings up the first screen, asking for the password.

The default password is "0000".

This can be changed by using the display buttons, following the same procedure as always:

- ENTER scrolls through the digits (from left to right)
- ESC returns to the previous digit (from right to left)
- Press ESC several times to return to the previous menu
- DOWN scrolls down the numerical scale (from 9 to 0)
- UP scrolls up the numerical scale (from 0 to 9)

After entering the password, press ENTER to access the information in this section:



() Available for the Italian country standard only. Refer to the section on this topic in the manual.*

1. Address

This section of the menu allows you to set the serial port addresses of the individual inverters connected to the RS485 line.

The addresses that can be assigned are 2 to 63. The UP and DOWN buttons scroll through the numerical scale.

'AUTO' selection cannot be used at present.

2. Display Set

This section of the menu allows you to set the display properties:

- **Light:** sets the lighting mode and adjusts the display backlight

Mode:

ON: Light always on

OFF: Light always off

Auto: Automatic backlight control. The light is switched on whenever a button is pressed and stays on for 30 sec, after which it gradually dims out.

Intensity: adjusts display brightness (scale from 1 to 9)

- **Contrast:** adjusts display contrast (scale from 1 to 9)

- **Buzzer:** sets button sound

ON: button sound is on

OFF: button sound is off

3. Service

This section of the menu is reserved for installers.

A special access password is required, which may be obtained from the website <https://registration.ABBSolarinverters.com>.

Before connecting to the site, make sure you have all the information required to calculate your password:

Inverter Model, Serial Number, week of manufacture and Update field

When you have a password you can set the parameters in the menu.



Changing the above-mentioned parameters may prevent disconnection from the grid if the new values exceed those given in the standards of the country of installation. If these parameters are changed to values outside the standard range, an interface protection must be installed external to the inverter in accordance with the requirements of the country of installation.

The table below shows the parameters that can be changed and the range of values that may be set for each:

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 (restricted range)	Unom ... Unom x 1.3
Set U> (10Min)	Grid over-voltage (OV) threshold (average grid voltage value)	Unom ... Unom x 1.3
Set U<	Grid under-voltage (UV) threshold (restricted range)	10V ... Unom
Set F>	Grid over-frequency (OF) threshold (restricted range)	Fnom ... Fnom + 5Hz
Set F<	Grid under-frequency (UF) threshold (restricted range)	Fnom - 5Hz ... Fnom



Parameter	Description	Setting range	
Set Uconn>	Max. permissible voltage during checks prior to grid connection	Unom ... Unom x 1.3	
Set Uconn<	Min. permissible voltage during checks prior to grid connection	10V ... Unom	
Set Fconn>	Max. permissible frequency during checks prior to grid connection	Fnom ... Fnom + 5Hz	
Set Fconn<	Min. permissible frequency during checks prior to grid connection	Fnom - 5Hz ... Fnom	
Set Time U>>	Over-voltage U>> protection tripping time	0 ... 327670mS	
Set Time U<<	Under-voltage U<< protection tripping time		
Set Time F>>	Over-frequency F>> protection tripping time		
Set Time F<<	Under-frequency F<< protection tripping time		
Set Time U>	Over-voltage U> protection tripping time		
Set Time U<	Under-voltage U< protection tripping time		
Set Time F>	Over-frequency F> protection tripping time		
Set Time F<	Under-frequency F< protection tripping time		
Set time conn 1	Grid check time prior to connection		0 ... 65535mS
Set time conn 2	Grid check time prior to connection after a grid fault		
Disable U>>	Disables the U>> protection threshold		Enabled/Disabled
Disable U<<	Disables the U<< protection threshold		
Disable F>>	Disables the F>> protection threshold		
Disable F<<	Disables the F<< protection threshold		
Disable U>	Disables the U> protection threshold		
Disable U> (10Min)	Disables the U> (10Min) protection threshold		
Disable U<	Disables the U< protection threshold		
Disable F>	Disables the F> protection threshold		
Disable F<	Disables the F< protection threshold		
U> (10Min) Der.	Enables power derating mode due to high average grid voltage readings		
Slow Ramp	Enables gradual ramping up of power after the grid connection.		
 OF Derating	Selects the power derating mode in the event of grid over-frequency.	0 Derating disabled 1 BDEW derating 2 VDE-AR-N derating 3 CEI derating	
OF Der. Rest. T	Time period after OF derating in which the inverter checks that the frequency is back within the operating ranges (parameters Fconn< and Fconn>) required by the grid standard before ramping up the output from the derating condition	1 ... 1000S	
Amorph. Enable	Enables Amorphous Mode in the event that the negative input pole is grounded by installing the Negative Grounding Kit (not available)	Enabled/Disabled	
Reset Country S.	Unlocks the grid standard selection (resets the 24 hours available for changing the grid standard)	Reset	
Upgrade IP Addr	Allows manual setting of the Ethernet board IP address This function may be useful where static Ethernet board addresses are used (DHCP disabled)	xxx.xxx.xxx.xxx	

4. New PW

This section of the menu allows you to change the settings menu password (default 0000).

We advise you to memorize the new password with great care.

If the Password is lost you will not have access to the inverter, since there is no Reset function for security reasons

5. Value

This section of the menu allows you to set the name of the currency and the value of 1 kWh of energy produced. Setting these parameters correctly allows the actual earnings/savings achieved by the system to be displayed.

- **Nome:** sets the desired currency (default is Euro)
- **Val/KWh:** indicates the cost/incentive for 1 kWh in the chosen currency (default is 0.50).

6. Time

Allows you to set the current date and time (not counting summer time)

7. Language

Allows you to set the language you prefer for the menus

8. Vstart

This section of the menu allows you to set the Vstart voltage (for the two channels separately if they are configured independently) to suit the system requirements.

We advise changing the activation voltage only if really necessary and to set it to the correct value: the photovoltaic generator sizing tool available on the ABB website will indicate whether Vstart needs changing and what value to set it at.

9. Autotest

This section of the menu is available only for the Italian country standard. Refer to the section on this topic in the manual.

10. Alarm

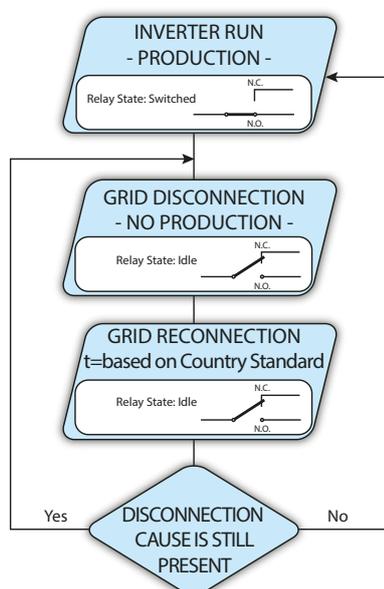
This section of the menu allows you to set the activation status of a relay (available either as contact normally open – N.O. – or as contact normally closed – N.C.).

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.

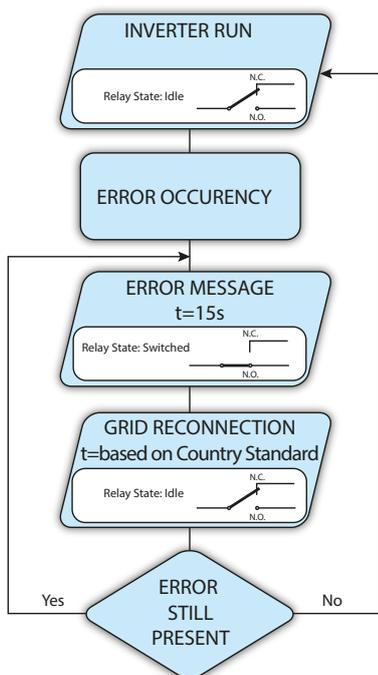
The relay can be set to switch in 4 different modes:

- **Production (display text “PRODUCTION”)**

The relay is activated (state: switched) whenever the inverter connects to the grid; as soon as the inverter is disconnected from the network (for whatever reason that caused disconnection), the relay is in its resting position



000068DG

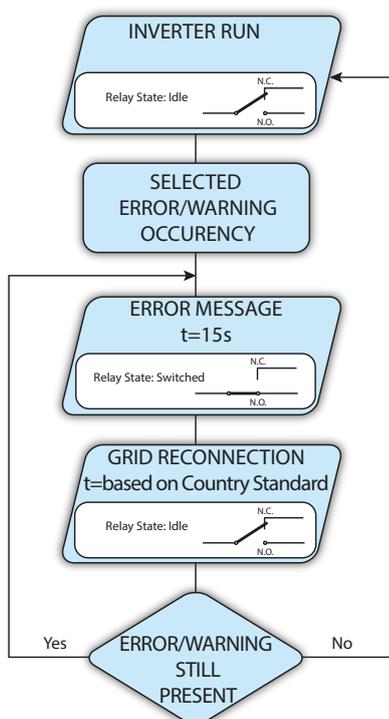


• **Alarm with reset at the end of the alarm signalling process (display text “ALARM”):**

The relay is activated (state: switched) whenever an error is present (code Exxx) on the inverter; this does not apply to warnings (Warning – code Wxxx). The alarm returns to its resting position when the alarm signal ends, i.e. before the inverter checks the grid parameters after the alarm state. This is because grid control state is not an alarm state but a state of normal operation.

Alarms for which the relay is activated

E001	E002	E003	E004	E005	E006
E007	E010	E011	E012	E013	E014
E015	E016	E017	E018	E019	E020
E021	E022	E023	E026	E029	E030
E031	E032	E033	E034	E046	E049
E050	E051	E053	E054	E055	E056
E057	E058	W003			



• **Configurable alarm with reset at the end of the alarm signalling process (display text “Alarm Conf.”)**

The relay is activated (state: switched) whenever an error is present (code Exxx) or a warning (code Wxxx) from those selected from the list in the dedicated submenu. The contact returns to its resting position when the alarm signal ends, i.e. before the inverter checks the grid after the alarm state. This is because grid control state is not an alarm state but a state of normal operation.

Selectable alarms for which the relay is activated

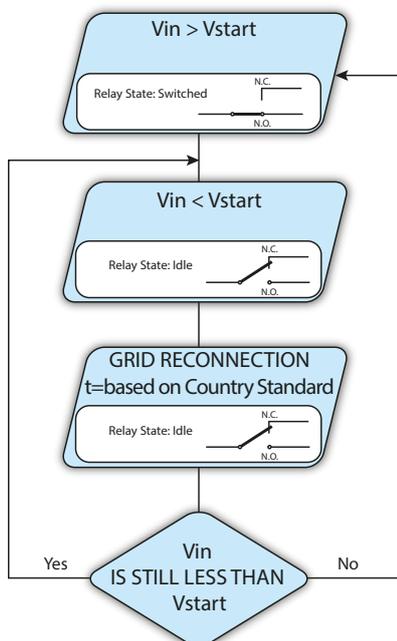
E001	E002	E003	E004	E005	E006
E007	E010	E011	E013	E014	E015
E017	E018	E019	E020	E021	E022
E023	E026	E027	E028	E029	E030
E031	E032	E033	E034	E046	E050
E051	E053	E054	E055	E056	E057
E058	W001	W002	W003	W008	W009
W011	W017	W018	W019	W021	W022
W023	W024	W025	W026	Ground fault	

For both configurable relay operating modes “ALARM” and “ALA”. CONF.” the following considerations apply:

If the alarm condition is persistent, the alarm contact cyclically switches from its resting state to its activated state.

In the presence of W003 signalling (Grid Fail – Network parameters out of tolerance), the alarm contact switches to then reset itself at the end of the alarm signal. This means that during the absence of grid voltage (display message “Vac Absent”) the alarm contact remains in its resting position.

In the presence of W002 signalling (UV Input – input voltage below the limit of operation), the alarm contact switches to then reset itself at the end of the alarm signal. This means that during the reduced input voltage (display message “Waiting sun”) the alarm contact remains in its resting position.



• Crepuscular (display text “CREPUSCULAR”)

The relay is activated (state: switched) as soon as the inverter input voltage exceeds the activation voltage set.

The relay is in its rest position when the input voltage drops below 70% of the activation voltage set.

This mode is useful for disconnecting any output transformers that could have unnecessary consumption during the night.

11. Remote ON/OFF

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 ON/OFF).

- **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 ON/OFF signal compared to the GND signal, as well as by the input (voltage from the photovoltaic generator) and output (grid voltage) parameters of the inverter.

12. Sleep Mode

This section of the menu allows you to enable/disable SLEEP mode. This feature allows the inverter logic to remain active overnight, thereby also keeping active any accessory boards installed in the inverter.

13. UV Prot. Time

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). ABB sets the time at 60 sec. The user can set it at any time from 1 to 3600 sec.

Example: with UV Prot. Time set at 60 seconds, if voltage V_{in} drops below 70% of Vstart at 9:00, the inverter stays connected to the grid (taking power from it) until 9:01.

14. MPPT

This section of the menu allows you to set the parameters of the maximum power point tracking (MPPT) function. This function is useful when there are areas of shade on the PV generator, which may create several points of maximum power on the operating curve.

- **MPPT Amplitude:** by setting this parameter you can choose the amplitude of the DC perturbation introduced to establish the optimal operating point. There are 3 settings to choose from (LOW, MEDIUM, HIGH). The default setting is MEDIUM.

- **Multi-max scan:** by setting 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 time between scans. It should be borne in mind that the shorter the scan interval the greater the loss of production, due to the fact that energy is transferred to the grid during the scan but not at the maximum power point. Each scan takes roughly 2 seconds.

- **Manual Scan:** this allows you to start a manual scan of the photovoltaic generator (at a different time from the interval set in Scan Interval) in order to track the maximum power point.

15. Power reduction

This section of the menu allows you to adjust the limit to the active power that the inverter can feed into the grid by setting the percentage of nominal power at which the limit should be triggered.

Setting it to 100% resets the default maximum power, which in some installation country standards may be 110% of nominal power.



Info Menu

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



1. Product ID

Displays the model code

2. Serial No

Displays the serial number and week and year of manufacture of the equipment

3. Firmware

Displays the firmware version installed in the equipment and the “update version” field required to request a second-level password for the Service menu (along with the Serial Number and Week of Production).

4. Country Select.

Displays information on the grid standard set with the rotary switches.

- **Actual value:** Displays the grid standard set.
- **New value:** Allows you to select a new grid standard (by using the UP and DOWN buttons), which will only become effective when the equipment has been switched off and on again, or when the selection has been confirmed in the Set new value submenu described below.
The grid standard can only be changed if the time allowed for doing so (24 hours of operation) has not expired.
- **Set new value:** This allows you to confirm/set the new grid standard set in the “New value” section of the previous menu.
- **Residual time:** 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.



AUTOTEST procedure in accordance with standard CEI 0-21

The autotest run in accordance with grid standard **CEI-021** may be initiated from the display menu or by using an RS485/USB converter with the dedicated interface software (Aurora Communicator).

The conditions required to perform an Autotest are:

- The grid standard must be set to CEI-021.
- You must not intervene in any way while the test is underway
- You must check that the device has a stable network connection.

Running the tests from the display menu

In the Autotest section of the SETTINGS menu, select the type of test the device is to run from the following:

OV Test – parameters:

U>>; U>; U> (10Min)

Disconnection from the distribution grid due to “Over-voltage”

UV Test – parameters:

U<<; U<

Disconnection from the distribution grid due to “Under-voltage”

OF Test – parameters:

F>> and F>

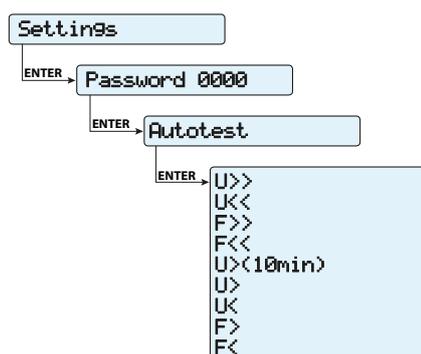
Disconnection from the distribution grid due to “Over-frequency”

UF Test – parameters:

F<< and F<

Disconnection from the distribution grid due to “Under-frequency”

Go to the SETTINGS > Autotest menu



Various signs may be displayed alongside the parameters on which the autotest can be performed. These have the following meanings:

N/A - Test cannot be performed because the relevant parameter is not active

Idle - Test enabled but not yet performed

OK - Test enabled and performed successfully

If one of the protections is disabled (from the Service menu), N/A (not applicable) will appear next to the name of the test.

While one of the tests is being performed, the set limits will be gradually increased/reduced (depending on the type of test) until the threshold at which the inverter is disconnected from the grid is reached. The procedures for running the Autotest comply with the legislation in force.



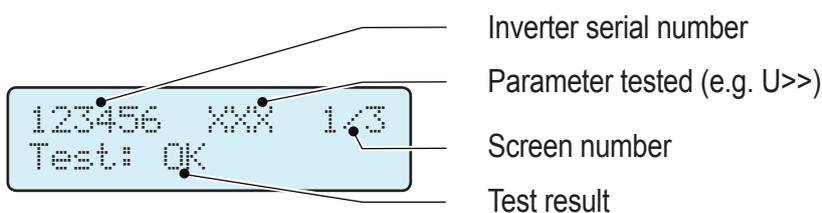
Test in corso
.....

The display shows the message “Performing Test” when the test has started.

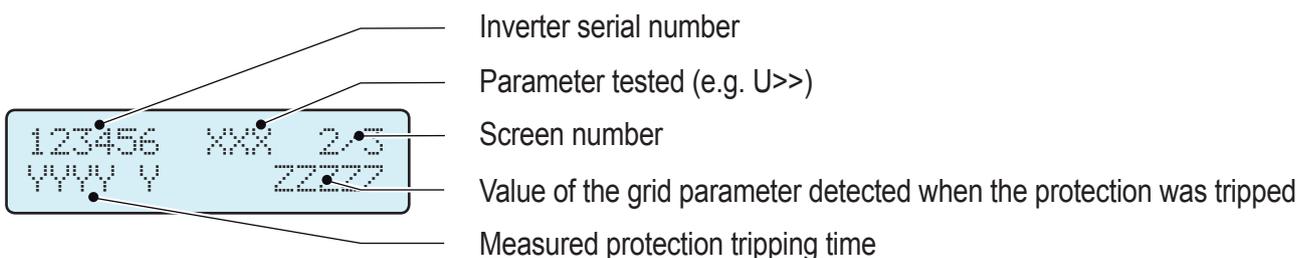
At the end of the test, when the inverter has disconnected from the grid, the results and values of the test performed will appear on the display. You can move from one screen to another using the UP/DOWN arrow keys.

Details of the data available in each screen are provided below:

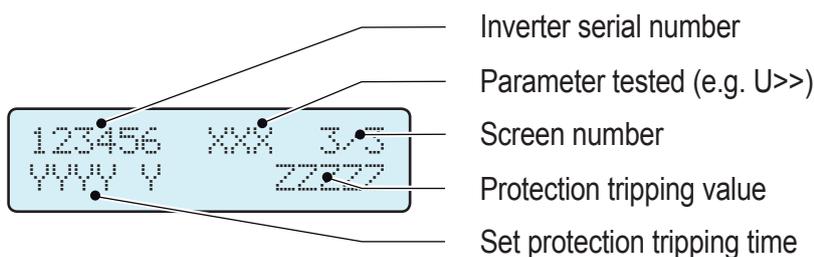
Screen 1 of 3



Screen 2 of 3



Screen 3 of 3



The test results should be considered valid on the basis of the following tolerances, as reported in the applicable legislation:

- $\leq 5\%$ for voltage thresholds
- ± 20 mHz for frequency thresholds
- $\leq 3\% \pm 20$ ms for tripping times

Press ESC to go back to the Autotest menu, from where you may select the next test to be performed



Maintenance

8

General conditions

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



Maintenance operations must be performed with the apparatus disconnected from the grid (power switch open) and the photovoltaic panels obscured or isolated, 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.

Routine maintenance

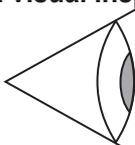
Scheduled maintenance operations are not mandatory, but are recommended to preserve the efficiency of the PV plant.



We recommend that maintenance operations be carried out by qualified personnel or by the personnel of ABB (as set forth in a maintenance contract).

The periodicity of the maintenance operations may vary in accordance with local environmental conditions and the installation

Table: routine maintenance

<p>Annual visual inspection</p> 	<ul style="list-style-type: none"> • Check that the inverter is operating correctly, and that no fault alarms are present • Ensure all the labels and safety symbols are visible • Test the integrity of the cables, connectors, and plugs external to the inverter • Check that the environmental conditions have not changed drastically since the installation of the system
<p>Annual operations</p> 	<ul style="list-style-type: none"> • Check that cable glands and connection block screws are tight • Check that the wiring box cover is properly closed • If no monitoring system is present, check the history log of alarms and errors using the instructions given in the manual in order to look for recent malfunction warnings
<p>Annual cleaning</p> 	<ul style="list-style-type: none"> • Clean the equipment; in particular the bottom grille of the wiring box and the heat sink

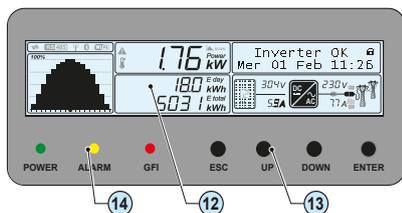
Troubleshooting

Follow the table shown in the following paragraph in order to understand and resolve warning (Wxxx) and error (Exxx) messages displayed by the inverter



The operations carried out on the inverter in order to identify and resolve malfunctions may be carried out only by the organization that carried out the installation or by qualified personnel

Alarm Messages



The equipment is able to indicate errors/warnings on the display only if the input voltage is higher than the Vdcm 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 gives the complete list of errors/warnings relating to string inverters. Some error/warning codes may not be used depending on the inverter model installed.

- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
- No code - Ground F -  Red LED	Ground fault of photovoltaic generator: The alarm is generated when a leakage current to ground is detected in the DC section of the system.	<ul style="list-style-type: none"> • Measure the insulation resistance using a megohmmeter positioned in the photovoltaic field (positive terminal short-circuited at the negative pole) compared to ground. The measurement is strongly influenced by the environmental conditions, so must be taken under the same conditions in which the error occurred. - If the value measured is lower than 1 megaohm, a check must be carried out by a technician/installer on the photovoltaic generator to identify and eliminate the problem. - If the value measured is higher than 1 megaohm and the error signal persists, contact customer assistance.
- No code - NEW COMPONENT REFUSED! -  Yellow LED lamp.	Lack of linkage of the new component: The components inside the inverter (e.g. display, fuse board, communication and control board, etc.) are not inter-linked. This occurs following the replacement of one of the components inside the inverter.	<ul style="list-style-type: none"> • Link the components inside the inverter by accessing the "Settings > Service > Accept boards" (refer to the procedure given in this manual). - If the signal persists also following the linking of the components, contact customer assistance.
- No code - SET COUNTRY or NO NATION -  No LED	SET COUNTRY or NO NATION: Indicates that in the installation phase the grid standard was not set on the inverter.	<ul style="list-style-type: none"> • Set the grid standard of the country of installation following the instructions given in this manual for the inverter. - If the signal persists also following setting the grid standard, contact customer assistance.
- No code - Vac absent -  Yellow LED	Vac absent: The inverter displays the "Vac absent" message when it does not record output voltage (AC side).	<ul style="list-style-type: none"> • Check the grid voltage on the inverter's AC terminal block. - Should it be absent, check any protection work on the line and the presence of grid voltage on the supply point.
- No code - Mem. broken -  Yellow LED	Memory broken: The inverter displays the "Memory broken" message when it records a communication problem with the memory board on which the inverter saves the daily value of energy produced.	<ul style="list-style-type: none"> • Remove the memory board and check the welding of all the connector's terminals. Subsequently reinsert the memory board and check that it is correctly inserted into the dedicated slot - If the signal persists also following the above checks, contact customer assistance.
- No code - Awaiting sun -  Green LED lamp.	Awaiting sun: The inverter displays the "awaiting sun" message when, following a W001 and/or W002 notice, the voltage from the photovoltaic generator is less than the activation voltage (Vstart).	<ul style="list-style-type: none"> • Check the input voltage on the inverter. - If it does not exceed Vstart, check for the presence of sufficient irradiation and the correct composition of the system. - If it exceeds Vstart, contact customer assistance
- W001 - Sun Low -  Yellow LED	Insufficient irradiation (Low input voltage on switching on the inverter): Incorrect configuration of the PV generator or an "on the limit" configuration for the inverter's minimum input voltage.	<ul style="list-style-type: none"> • Check the input voltage on the inverter. - If it does not exceed Vstart, check for the presence of sufficient irradiation and the correct composition of the system. - If it exceeds Vstart, contact customer assistance
 - W002 - Input UV -  Yellow LED	Insufficient irradiation (Low input voltage on switching off): Incorrect configuration of the photovoltaic generator or an "on the limit" configuration for the inverter's minimum input voltage.	<ul style="list-style-type: none"> • Check the input voltage on the inverter. - If it does not exceed Vstart, check for the presence of sufficient irradiation and the correct composition of the system. - If it exceeds Vstart, contact customer assistance
- W003 - Grid Fail -  Yellow LED	Parameters of grid voltage outside range: This error signal occurs when during the inverter's normal operation the grid parameters exceed the limits set by the operator: - Grid voltage absent (after the signal the inverter goes to "Vac Absent") - Unstable grid voltage (down or up) Unstable grid frequency	<ul style="list-style-type: none"> • Check the grid voltage on the inverter. - Should it be absent, check for absence of grid voltage on the supply point. - If, on the other hand, the voltage tends to rise (when the inverter is connected) there is high line or grid impedance. • Check the grid voltage also on the supply. - If it is high, it means that there is high grid impedance. In this case, ask the operator to adjust the grid voltage. If the operator authorises a change to the inverter's parameters, agree the new limits with customer assistance - If the voltage at the point of supply is much lower than that measured on the inverter, it is necessary to adjust the line (inverter-contactor). - If the voltage and the grid frequency come back within the limits (also when the inverter is connected to the grid) contact customer assistance
- W009 - Empty Table -  Yellow LED	Characterisation board for the wind generator not compiled (only WIND models)	(only WIND models)

- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
- W010 * - Fan broken! -  Yellow LED lamp. *not visualised on display	Fan broken: This error occurs when there is a malfunction in the fan/fans inside the inverter.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the alarm repeats persistently, contact customer assistance.
- W011 - Bulk UV -  Yellow LED	Bulk Under-voltage: The alarm (which is a warning and not an error) is generated when the voltage at the heads of the bulk capacitors does not reach the threshold for the operation of the inverter (internal unchangeable threshold).	<ul style="list-style-type: none"> • Raise the value of the activation voltage (Vstart) so as to have sufficient power from the PV generator at the time of the inverter's grid connection. • Check the input voltage on the inverter. - If it does not exceed Vstart, check for the presence of sufficient irradiation and the correct composition of the system. - If it exceeds Vstart, contact customer assistance
- W012 * - Batt. Flat -  Yellow LED *not visualised on display	Battery flat: The inverter displays the "Battery flat" message when it records a voltage for the buffer battery which is too low.	<ul style="list-style-type: none"> • Check that the date/time are set correctly and, if they are not, set them. Subsequently arrange to completely switch off the inverter (on both AC and DC) and wait a few minutes. Finally, restart the inverter and check whether the date/time are now correctly set or whether they have reset to 01/01/2000. In this case replace the battery with the inverter completely switched off (section AC and DC side) being careful to maintain the polarity
- W013 * - Clock broken -  Yellow LED *not visualised on display	Clock broken: The alarm occurs when there is a difference of over 1 minute in the time displayed compared to the internal time of the microprocessors and indicates a malfunction of the clock circuit.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the alarm repeats persistently, contact customer assistance.
- W017* - String Err. -  Yellow LED lamp. * (only for models with monitored string fuses)	Error recorded in measuring string currents: Damaged string protection fuse(s)	<ul style="list-style-type: none"> • Check with a multimeter the state of the fuses (positioned on the fuse boards). - If one or more fuses is open, arrange to replace them and check that the input current on the string(s) does not exceed the rating of the fuses (should parallel strings have been made outside the inverter). - If there are no damaged string fuses and the inverter continues to show 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).
- W018 * - SPD DC Err -  Yellow LED lamp. * (only for models with monitored SPD)	Intervention of overvoltage surge arresters on DC side: Damaged overvoltage surge arresters positioned on DC side	<ul style="list-style-type: none"> • Observe the inspection window 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 persists, even if all the surge arresters have a green inspection window, contact customer assistance.
- W019 * - SPD AC Err -  Yellow LED lamp. * (only for models with monitored SPD)	Intervention of overvoltage surge arresters on AC side: Damaged overvoltage surge arresters positioned on AC side	<ul style="list-style-type: none"> • Observe the inspection window 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 persists, even if all the surge arresters have a green inspection window, contact customer assistance.
- W022 * - Reactive power mode changed -  No LED *not visualised on display	Variation in means of managing reactive power: Variation in the means of managing reactive power; this change can be made through the display or advanced configuration software.	The variation in the means of managing reactive power is done directly by the customer/installer and is not an error. The information is only saved on the historic record of the events memorised by the inverter
- W023 * - date/time changed -  No LED *not visualised on display	Variation in the inverter's date and time: Variation of the inverter's date and time; this change can be made through the display or advanced configuration software.	The variation in the inverter's date and time is done directly by the customer/installer and is not an error. The information is only saved on the historic record of the events memorised by the inverter
- W024 * - Energy data reset -  No LED *not visualised on display	Zeroing of the statistical energy data memorised in the EEPROM: Reset of the energy data saved in the inverter; this operation can be handled through the display or advanced configuration software.	The zeroing of the partial energy values memorised by the inverter is done directly by the customer/installer and is not an error. The information is only saved on the historic record of the events memorised by the inverter <ul style="list-style-type: none"> • The notice may also occur on substitution of the Memory Card where the statistical production data is saved



- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
- E001 - Input OC - ● Yellow LED	Input over-current (photovoltaic generator): The alarm occurs when the inverter's input current exceeds the inverter's threshold for maximum input current.	<ul style="list-style-type: none"> • Check whether the composition of the PV generator enables input current which exceeds the maximum threshold allowed by the inverter and that the configuration of the inputs (independent or in parallel) is carried out correctly. - If both checks are positive, contact customer assistance.
- E002 - Input OV - ● Yellow LED	Input over-voltage (photovoltaic generator): The alarm is generated when the input voltage (from the PV generator) exceeds the inverter's threshold of maximum input voltage. The alarm occurs before reaching the absolute threshold over which the inverter is damaged. When the inverter's input voltage exceeds the Over Voltage threshold, the inverter will not start up due to the generation of the alarm.	<ul style="list-style-type: none"> • It is necessary to measure the input voltage inside the inverter with a voltmeter. - If it is higher than the maximum voltage of the operating range, the alarm is genuine and it is necessary to check the configuration of the PV generator. If the voltage has also exceeded the maximum input threshold the inverter could be damaged. - If it is lower than the maximum voltage of the operating range, the alarm is caused by an internal malfunction and it is necessary to contact customer assistance.
- E003 - No Parameters - ● Yellow LED	DSP initialisation error: The main microcontroller cannot initialise correctly the two DSPs (booster stage and inverter stage). The error is caused by communication problems on the inverter's internal bus.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E004 - Bulk OV - ● Yellow LED	"Bulk" over-voltage (DC-DC circuit): Error inside the inverter. The alarm is raised when the voltage at the heads of the bulk capacitors exceeds the Over Voltage threshold (internal unchangeable threshold).	<ul style="list-style-type: none"> • The alarm may be triggered by causes external to the inverter: - An excessive input voltage can be recorded as a condition for bulk over voltage. In this case it is advisable to check the inverter's input voltage and should this value be close to the input OV threshold, review the configuration of the photovoltaic generator. - Excessive grid voltage could cause the bulk voltage to rise in uncontrolled fashion with a consequent protection intervention and hence generation of the alarm. In these cases the alarm is transitory and the inverter automatically restarts - The alarm may be triggered by causes inside the inverter and in this case it is necessary to contact customer assistance.
- E005 - Comm.Error - ● Yellow LED	Communication error inside the inverter: The alarm occurs when there are communication problems between the control devices inside the inverter.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E006 - Output OC - ● Yellow LED	Output over current: The alarm occurs when the inverter's output current exceeds the inverter's threshold for maximum output current.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E007 - IGBT Sat - ● Yellow LED	Saturation recorded on the IGBT components: The alarm occurs when one of the inverter's active devices is in a saturated state.	Once the error occurs, the inverter tries to return to normal operation. <ul style="list-style-type: none"> - Should the error occur sporadically, it may be caused by a brusque transition of the grid voltage or of the input voltage, but is not due to a malfunction by the inverter. - If the error is connected to an internal breakdown, it will continue to appear and so it is necessary to contact customer assistance.
- E009 - Internal error - ● Yellow LED	Error inside the inverter: Error inside the inverter	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E010 - Bulk Low - ● Yellow LED	Low "Bulk" voltage (DC-DC circuit): <ul style="list-style-type: none"> • The alarm may be triggered by causes external to the inverter: a reduced input voltage on the inverter (just above the activation voltage) but which is not accompanied by a sufficient availability of power from the photovoltaic generator (typical condition of the stages with limited irradiation) 	<ul style="list-style-type: none"> - If the error signal occurs sporadically, it may be due to causes external to the inverter (limited irradiation and so limited power availability from the PV generator). - If the problem occurs systematically also in conditions of high irradiation and with input voltage which is significantly higher than the activation voltage, contact customer assistance.
- E011 - Ramp Fail - ● Yellow LED	Long wait for "Booster" regime to start: Error internal to inverter relating to start up time for DC-DC circuit regime (Booster)	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E012 - DcDc Fail - ● Yellow LED	Error in the "Booster" circuit (DC-DC side) recorded by the "Inverter" circuit (DC-AC side): Error internal to inverter relating to operation of the DC-DC circuit regime (Booster)	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.



- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
<ul style="list-style-type: none"> - E013 - Wrong Mode - Yellow LED 	<p>Incorrect configuration of inputs (set in parallel rather than independent): The alarm is generated solely when the inverter is configured with parallel inputs. In this particular configuration the inverter checks the input voltage of each of the two channels and if the two voltages differ by more than 20Vdc, the alarm is raised .</p>	<ul style="list-style-type: none"> • Check that the setting of the "IN MODE" switch is specifically set to "PAR" and that the bridges between the two input channels have been included. - If the configuration of the inverter is correct, check that the input strings have the usual number of standard panels of the usual brand and with the same inclination/orientation. - If both the configuration of the inverter and the characteristics of the PV generator conform with the specifications, contact customer assistance.
<ul style="list-style-type: none"> - E014 - Over Temp. - Yellow LED 	<p>Excessive temperature inside the inverter: External temperature over 60°C. This parameter also depends on the power which the inverter must supply since the measurement of temperatures is done internally and is influenced by the heat dissipated by the components of the inverter itself</p>	<ul style="list-style-type: none"> • Check that the inverter is not exposed to direct sunlight. Wait for the temperatures to which the inverter is exposed to return to the operating range and for the inverter to cool down. - If the problem (once the ambient temperature has returned to the range) persists, contact customer assistance. Remember to wait the time needed to allow the inverter to cool down
<ul style="list-style-type: none"> - E015 - Bulk Cap Fail - Yellow LED 	<p>Breakdown recorded on the "Bulk" capacitor: Error inside the inverter relating to a problem in the bulk capacitors.</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E016 - Inverter Fail - Yellow LED 	<p>Error in the "Inverter" circuit (DC-AC side) recorded by the "Booster" circuit (DC-DC side): The alarm is generated when a problem is recorded in the inverter circuit (DC/AC)</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E017 - Start Timeout - Yellow LED 	<p>Long wait for "Inverter" regime to start up: Error internal to inverter relating to start-up time for the DC-AC circuit regime (Inverter) • The alarm may be triggered by causes external to the inverter: a reduced input voltage on the inverter (just above the activation voltage) but which is not accompanied by a sufficient availability of power from the photovoltaic generator (typical condition of the stages with limited irradiation)</p>	<ul style="list-style-type: none"> - If the error signal occurs sporadically, it may be due to causes external to the inverter (limited irradiation and so limited power availability from the PV generator). - If the problem occurs systematically also in conditions of high irradiation and with input voltage which is significantly higher than the activation voltage, contact customer assistance.
<ul style="list-style-type: none"> - E018 - Ground Fault - Red LED 	<p>High leakage current measured on the DC side (photovoltaic generator): The alarm is generated when, during normal operation of the inverter, a leakage current to ground is detected in the DC section of the system. It is also possible that the inverter generates the alarm E018 message also due to AC leakage currents connected to the capacitive nature of the photovoltaic generator compared to ground.</p>	<ul style="list-style-type: none"> • Measure the insulation resistance using a megohmmeter positioned between the photovoltaic field (positive terminal short-circuited at the negative pole) compared to ground. The measurement is strongly influenced by the environmental conditions, so must be made under the same conditions in which the error occurred. - If the value measured is lower than 1 megaohm, a check must be carried out by a technician/installer on the photovoltaic generator to identify and eliminate the problem. - If the value measured is higher than 1 megaohm and the error signal persists, contact customer assistance.
<ul style="list-style-type: none"> - E019 - Ileak sense.fail - Yellow LED 	<p>Failure of test on sensor to measure the leakage current (DC side): Before connecting to the grid the inverter runs a self-test regarding the sensor for the leakage current. The test is carried out by "forcing", in the sensor of the leakage current, a current with a known value: the microprocessor compares the value read with the known value. The error is generated if the comparison between the read value and the known value during the test does not fall within the allowed tolerance.</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. By its nature, the alarm only occurs prior to connection to the grid - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E020 - Self Test Error 1 - Yellow LED 	<p>Failure of the test on the relay of the "Booster" (DC-DC circuit): Before connecting to the grid the inverter carries out internal tests. One of these tests concerns the correct operation of the booster relay. The test is carried out by "forcing" the switching of the relay and checking its operation. The error is generated if a problem is found in actioning the relay.</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. By its nature, the alarm only occurs prior to connection to the grid - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.



- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
- E021 - Self Test Error 2 - ● Yellow LED	Failure of the test on the inverter's relay (DC-AC circuit): Before connecting to the grid the inverter carries out internal tests. One of these tests concerns the correct operation of the inverter relay. The test is carried out by "forcing" the switching of the relay and checking its operation. The error is generated if a problem is found in actioning the relay.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. By its nature, the alarm only occurs prior to connection to the grid - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E022 - Self Test Error 4 - ● Yellow LED	Timeout of the tests undertaken on the relays inside the inverter: Execution time for the self-test carried out on the relay of the DC_AC (inverter) circuit too high. It may indicate a problem connected to the aforementioned relays	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E023 - DC in error - ● Yellow LED	Feeding of continuous current to grid outside of range: The error is generated if the continuous component of the current supplied to the grid exceeds the threshold of 0.5% of the normal operating current. In any case the inverter is not blocked due to the E023 error, but tries to reconnect to the grid. The sporadic repetition of the error is a sign of serious grid distortions or sharp irradiation changes, while systematic repetition of the error signal will indicate a breakdown on the inverter	Once the error occurs, the inverter tries to return to normal operation. <ul style="list-style-type: none"> - Should the error occur sporadically, it may be caused by a brusque transition of the grid voltage or of the input voltage, but is not due to a malfunction by the inverter. - If the error is connected to an internal breakdown, it will continue to appear and so it is necessary to contact customer assistance.
- E024 - Internal error - ● Yellow LED	Error inside the inverter: Error inside the inverter	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back nor) persists, contact customer assistance.
- E025* - Riso Low - ● Yellow LED *not visualised on display	Low value of insulation resistance: Before connecting to the grid the inverter measures the insulation resistance of the PV generator compared to ground. Should the measurement of the insulation resistance be below 1Mohm, the inverter does not connect to the grid and shows the "Riso Low" error. The causes may be: - PV panel(s) damaged; - Junction box(es) of the panels not correctly sealed, so as to permit infiltration by water and/or humidity; - Problems in connections between panels (not perfectly fit); - Poor quality of cable joints; - Presence in the DC section of unsuitable or damaged overvoltage surge arresters outside the inverter (reduced ignition voltage compared to the characteristics of the strings of the PV generator); - Presence of humidity inside any junction box	<ul style="list-style-type: none"> • Measure the insulation resistance using a megohmmeter positioned in the photovoltaic field (positive terminal short-circuited at the negative pole) compared to ground. The measurement is strongly influenced by the environmental conditions, so must be made under the same conditions in which the error occurred. - If the value measured is lower than 1 megaohm, a check must be carried out by a technician/installer on the photovoltaic generator to identify and eliminate the problem. - If the value measured is higher than 1 megaohm and the error signal persists, contact customer assistance.
- E026 - Vref Error - ● Yellow LED	Internal reference voltage outside of range: Wrong measurement of reference voltage inside inverter	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E027 - Error Meas V - ● Yellow LED	Grid voltage outside of range: Error in the internal measurement of grid voltage (set by law) in order to have a redundant measurement (2 measurements on the same parameter made by two different circuits)	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E028 - Error Meas F - ● Yellow LED	Grid frequency outside of range: Error in the internal measurement of grid frequency (set by law) in order to have a redundant measurement (2 measurements on the same parameter made by two different circuits)	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
- E029 - Mid Bulk OV - ● Yellow LED	Internal over voltage on the measurement of the "Mid bulk": Error internal to the inverter (only triphase models)	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.



- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
<ul style="list-style-type: none"> - E030 - Error Meas I/leak - Yellow LED 	<p>High leakage current (DC side): Error in the internal measurement (made when the inverter is grid connected) of the leakage current of the DC side (PV generator) compared to ground (set by law) in order to have a redundant measurement (2 measurements on the same parameter made by two different circuits)</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E031 - Error Read V - Yellow LED 	<p>Output relay damaged: Measurement of internal voltage on heads of the output relay outside of range. There is too great a difference in voltage between the input and output of the grid connection relay.</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E032 - Error Read I - Yellow LED 	<p>Imbalanced output currents: Measurement of the unbalance in the output voltage (made across the three phases) outside of range (only in triphase models)</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E033 - UTH - Yellow LED 	<p>Low ambient temperature: Temperature outside the inverter below -25°C</p>	<ul style="list-style-type: none"> • Wait for the temperatures to which the inverter is exposed to return to the operating range. - If the problem persists, contact customer assistance. Remember to wait the time needed to allow the inverter to warm up
<ul style="list-style-type: none"> - E034 - Interlock fail - Yellow LED 	<p>“IGBT” circuitry not ready: Error inside the inverter</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> - E035* - Remote Off - Yellow LED *not visualised on display 	<p>Inverter awaiting “remote ON” command: The inverter has been switched off remotely (remote OFF) and remains awaiting the signal which will switch it back on (Remote ON)</p>	<ul style="list-style-type: none"> • Switch back on the inverter remotely. If the unit does not switch back on, disable the remote off/on function and switch the equipment off completely and subsequently switch it back on. - If the problem (once the Remote ON/OFF function from the display has been reactivated) persists, contact customer assistance.
<ul style="list-style-type: none"> - E036 - Vout Avg error - Yellow LED 	<p>Average of the measurements of grid voltage outside of range: The average value of the grid voltage (sampled every 10 minutes) does not fall within the permitted ranges. The grid voltage in the point connected to the inverter is too high. This may be caused by too high a grid impedance. In the final stage of the timeout, the inverter limits the power to check whether the grid voltage has stabilised into regular parameters. If this does not happen, the inverter disconnects from the grid</p>	<ul style="list-style-type: none"> • Check the grid voltage in the connection point to the inverter. - If the grid voltage differs from the range due to the conditions of the distribution grid, ask the operator to adjust the grid voltage. If the operator authorises a change to the inverter's parameters, agree the new limits with customer assistance
<ul style="list-style-type: none"> - E037 - Riso Low - Red LED 	<p>Low value of the insulation resistance (only with the “Amorphous” mode activated): This error can occur only should the “Amorphous” mode be on. This function is on only in inverters equipped with a grounding kit and serves to monitor the voltage at the heads of the grounding resistance. The error occurs when the voltage at the heads of the resistance connected between ground and the pole of the photovoltaic generator exceeds 30V for more than 30 minutes or 120V for more than one second.</p>	<ul style="list-style-type: none"> • Check for the presence and correct contact between the two terminals of the grounding resistance installed inside the inverter • Measure the insulation resistance using a megohmmeter positioned in the photovoltaic field (positive terminal short-circuited at the negative pole) compared to ground. The measurement is strongly influenced by the environmental conditions, so must be made under the same conditions in which the error occurred. - If the value measured is lower than 1 megaohm, a check must be carried out by a technician/installer on the photovoltaic generator to identify and eliminate the problem. - If the value measured is higher than 1 megaohm and the error signal persists, contact customer assistance.
<ul style="list-style-type: none"> E046 - String self test fail - No LED 	<p>Error during the automatic check of the string voltages (only in models with the “fuse-control” board): In some inverter models it is possible to carry out the check test of the polarity of the strings connected to the input (e.g.:TRIO-20.0/27.6kW). This error signal occurs when, during the test stage, an inverted string is recorded</p>	<ul style="list-style-type: none"> • Section the inverter and check the polarity of the string(s) which the inverter has recorded as inverted. - Once all the strings have been correctly connected, activate the system once again; the inverter will once again check the correct polarity of the string inputs at the end of which it will carry out the checks for the grid connection. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.
<ul style="list-style-type: none"> E049 - AC FF Error - Yellow LED 	<p>Error in the “AC feed-forward” circuit: Error inside the inverter</p>	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.



- Code on display - Error message - Signal	Name of Alarm and Cause	Solution
E056 - Over Temp. (from external box) - ● Yellow LED	Excessive temperature measured inside the inverter's wiring box: High internal temperature. This error relates to the temperature measured on external boxes (e.g.:TRIO-20.0/27.6kW).	<ul style="list-style-type: none"> • Check that the inverter is not exposed to direct sunlight. Wait for the temperatures to which the inverter is exposed to return to the operating range and for the inverter to cool down. - If the problem (once the ambient temperature has returned to the range) persists, contact customer assistance. Remember to wait the time needed to allow the inverter to cool down
E057 - Vbulk reading error - ● Yellow LED	Input voltage (Vin) higher than booster voltage (Vbulk): The error occurs if the input voltage exceeds the Bulk voltage (voltage on the DC-DC circuit inside the inverter)	<ul style="list-style-type: none"> • It is necessary to measure the input voltage inside the inverter with a voltmeter. - If it is higher than the maximum voltage of the operating range, the alarm is genuine and it is necessary to check the configuration of the PV generator. If the voltage has also exceeded the maximum input threshold the inverter could be damaged. - If it is lower than the maximum voltage of the operating range, the alarm is caused by an internal malfunction and it is necessary to contact customer assistance.
E058 - Pin vs Pout check error - ● Yellow LED	Error in the check of Pin vs Pout: The error occurs if the difference between the measured value of input power and that of output power is greater than the limit imposed internally to the inverter.	<ul style="list-style-type: none"> • Error inside the inverter and cannot be checked externally. - If the problem (once the inverter has been switched off and back on) persists, contact customer assistance.

Power limitation messages

The equipment can signal possible output power limitations which may occur on the basis of:

- settings made by the user
- settings required by the grid standard of the country of installation
- protective devices inside the inverter

The notices of messages are shown on the highlighted part **b10** of the display .

The following table gives the complete list of power limitation messages relating to string inverters. Some messages may not be used depending on the inverter model installed.

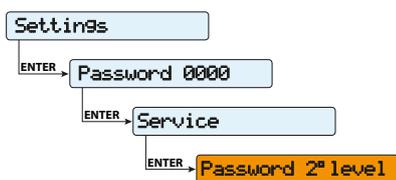


- Message on display - Signal	Name of Derating and Cause	Solution
- LIMxxx% CODE:00 - ▲ Display symbol b6	Power limitation: The message indicates that the user has set an output power limitation for the inverter. LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power	<ul style="list-style-type: none"> • Check the limitation value set in the "Settings > Power Limitation" menu
- LIMxxx% CODE:01 - ▲ Display symbol b6	Power limitation for over-frequency: The message indicates that the user has set a power limitation due to over frequency in order to reduce the maximum output power of the inverter when the grid frequency exceeds certain limits. LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power	<ul style="list-style-type: none"> • Check the limitation value set in the "Settings > Service > OF Derating" menu

- Message on display - Signal	Name of Derating and Cause	Solution
<p>- LIMxxx% CODE:02 - ▲ Display symbol b6</p>	<p>Power limitation for over-voltage: The message indicates that the user has set a power limitation due to over voltage (parameter U >(10 min)) in order to reduce the maximum output power of the inverter when the reading of the average grid voltage exceeds certain limits. The sampling of readings is done every 10 minutes (U>(10min)). LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power</p>	<ul style="list-style-type: none"> • Check the limitation value set in the “Settings > Service > U > (10 min) Der.” menu
<p>- LIMxxx% CODE:03 - ▲ Display symbol b6</p>	<p>Anti-islanding power limitation: The message indicates that a power limitation is active since an "islanding" condition has been recorded. LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power</p>	<ul style="list-style-type: none"> • If the inverter remains connected to the grid and the limitation is active, contact customer assistance
<p>- LIMxxx% CODE:04 - ▲ Display symbol b6</p>	<p>Power limitation due to low grid voltage: The message indicates that an output power limitation may occur since a low grid voltage (AC) condition has been recorded. LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power</p>	<ul style="list-style-type: none"> • Check that the grid voltage is lower than the minimal voltage. Should this condition persist, contact the grid operator to resolve the problem.
<p>- LIMxxx% CODE:05 - 🌡️ Display symbol b7</p>	<p>Power limitation due to excess temperature: The message indicates that a power limitation is active since an excess temperature condition has been recorded inside the inverter (This parameter depends also on the power which the inverter must provide since the measurement of temperatures is taken internally and is influenced by the heat dissipated by the components of the inverter itself). LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power</p>	<ul style="list-style-type: none"> • Check that the inverter is not exposed to direct sunlight. Wait for the temperatures to which the inverter is exposed to return to the operating range and for the inverter to cool down. - If the problem (once the ambient temperature has returned within the range) persists, contact customer assistance.
<p>- LIMxxx% CODE:06 - ▲ Display symbol b6</p>	<p>Power limitation for input over-voltage: The message indicates that a power limitation is active since an input over voltage (AC) has been recorded. LIM xxx% = Power reduction percentage Examples: LIM 100% = no power limitation LIM 50% = limitation to 50% of the output nominal power</p>	<ul style="list-style-type: none"> • It is necessary to measure the input voltage inside the inverter with a voltmeter. - If it is higher than the maximum voltage of the operating range, the alarm is genuine and it is necessary to check the configuration of the PV generator. If the voltage has also exceeded the maximum input threshold the inverter could be damaged. - If it is lower than the maximum voltage of the operating range, the alarm is caused by an internal malfunction and it is necessary to contact customer assistance.



Registration on “Registration” website and calculation of second-level password (Service Menu)



In order to obtain the second-level password needed to access the inverter's service menu, it is necessary to go through the following stages:

Stage 1 - Collection of information relating to the inverter.

Collect the following information relating to each inverter for which you wish to have a password:

- **S/N** - Serial number of the inverter. This information can be found on the label giving the identity details of the inverter or on the display by accessing the “INFORMATION” menu→Serial No.”

The serial number consists of 6 digits (the last 6 in models with a label giving a 10-digit S/N)

- **WK** - Production week. This information can be found on the label giving the identity details of the inverter or on the display by accessing the “INFORMATION” menu→Serial No.”

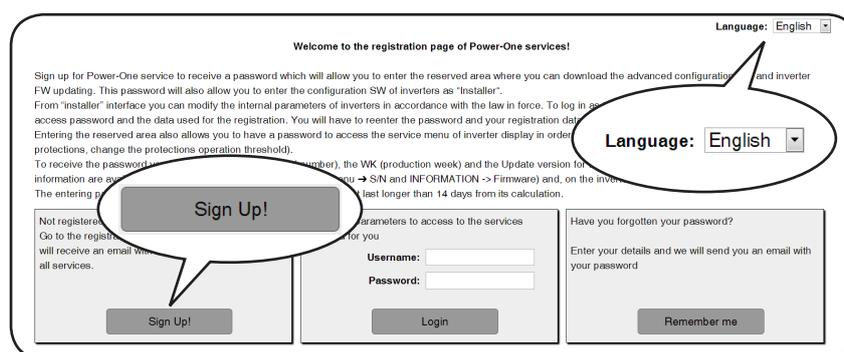
The production week consists of 4 figures, indicating the week (first 2 digits) and the year of production (last 2 digits)

- **Update Version** - This information is available only for some inverter models and can be found on the display by accessing the menu “INFORMATION→Firmware”.

Stage 2 - Registration on <https://registration.ABBSolarinverters.com>

- Go online and access <https://registration.ABBSolarinverters.com>

- Set the desired language and click on the specific icon to start registration



- Insert the personal data requested and end the registration stage

- An email will be sent to the email address used with a link to complete the registration process.

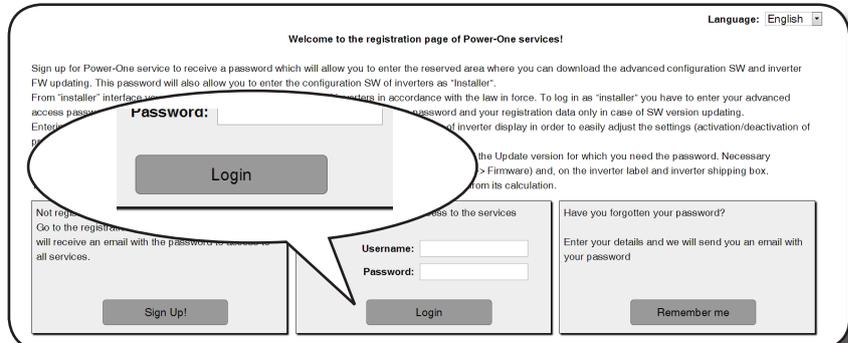
- Once the registration process is over, a further email will be sent with the password to access the website.



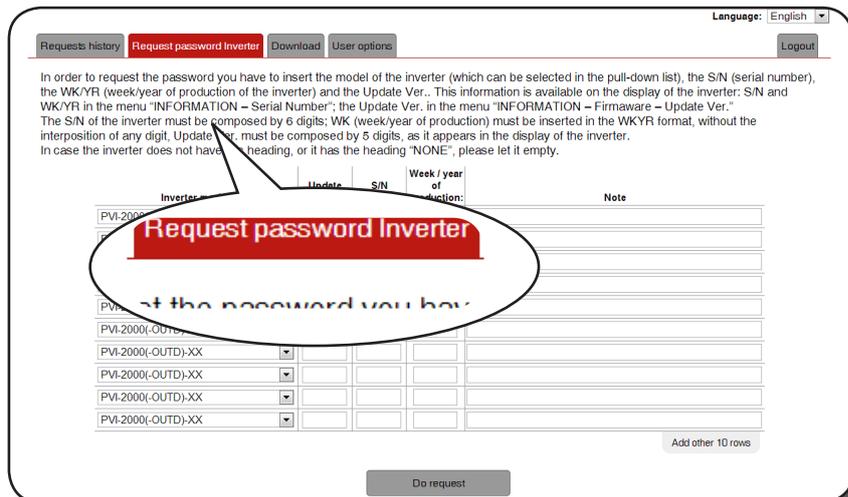
The password obtained enables access also to the advanced “Installer” mode present on the configuration software for inverters. The configuration software can be downloaded in a specific section of the website <https://registration.ABBSolarinverters.com>

Stage 3 - Request for second level password

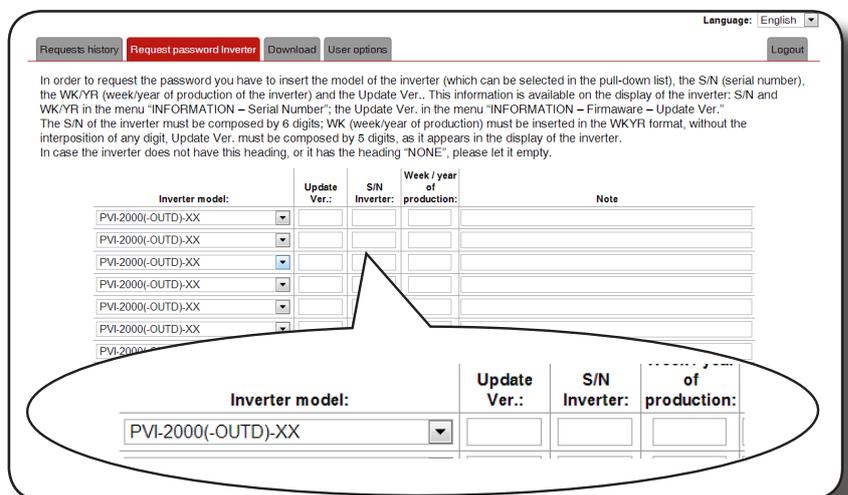
- Go online and access <https://registration.ABBSolarInverters.com>
- Insert the Username (corresponding to the email used during registration) and the Password obtained at the end of Stage 2



- Access the section dedicated to requesting the second-level password



- Choose the inverter model from the drop-down list and insert Update Ver., Serial Number and Week of Production of the inverter which were obtained previously (Stage 1)



- Click on icon to request password.

Language: English

Requests history Request password Inverter Download User options Logout

In order to request the password you have to insert the model of the inverter (which can be selected in the pull-down list), the S/N (serial number), the WK/YR (week/year of production of the inverter) and the Update Ver.. This information is available on the display of the inverter: S/N and WK/YR in the menu "INFORMATION – Serial Number"; the Update Ver. in the menu "INFORMATION – Firmware – Update Ver."
The S/N of the inverter must be composed by 6 digits; WK (week/year of production) must be inserted in the WKYR format, without the interposition of any digit, Update Ver. must be composed by 5 digits, as it appears in the display of the inverter.
In case the inverter does not have this heading, or it has the heading "NONE", please let it empty.

Inverter model:	Update Ver.:	S/N Inverter:	Week / year of production:	Note
UNO-2.04-OUTD	12345	123456	0513	
PVI-3.0-OUTD-XX		987654	0412	
TRIO-27.6-TL-OUTD	13052	564789	4812	
PVI-2000(-OUTD)-XX				

Do request

Add other 10 rows

Do request

Should there be an error in inputting data, the fields containing the error will be highlighted in red. If, on the other hand, the data are correct, the passwords will be shown in a new window and at the same time sent to the email address used for registration.



The second-level password enables access to the service menu which allows the inverter's sensitive parameters to be changed. Proceed to changing the aforementioned parameters only when requested by the grid operator or by customer assistance.



Resetting the time remaining to change the grid standard

From the time a valid grid standard is entered and the inverter is turned on, a period of 24 hours is available to modify the grid standard setting.



The 24 hours are counted only when the inverter is turned on. Check that the date and time are set correctly. Otherwise it may not be possible to access the "Service" menu to reset the timer.

After this period of time the system will block changes to the standard; and it will be necessary to carry out the following procedure to reset the remaining time and obtain another 24 hours to select a new grid standard:

Settings

1. Access the "SETTINGS" menu by entering the first-level password (default 0000)

Service

2. Access the "Service" sub-menu by entering the second-level password



The password to access the "Service" menu can be obtained by registering at the site <https://registration.ABBSolarinverters.com>

Before accessing the site it will be necessary to locate the information utilized to compute the password:

Inverter model

Serial number and week of manufacture

Update field

The "Update" field is available only if the firmware of the inverter has been previously updated. If not available leave the field blank when requesting the password

The password obtained is valid for a period of 15 days



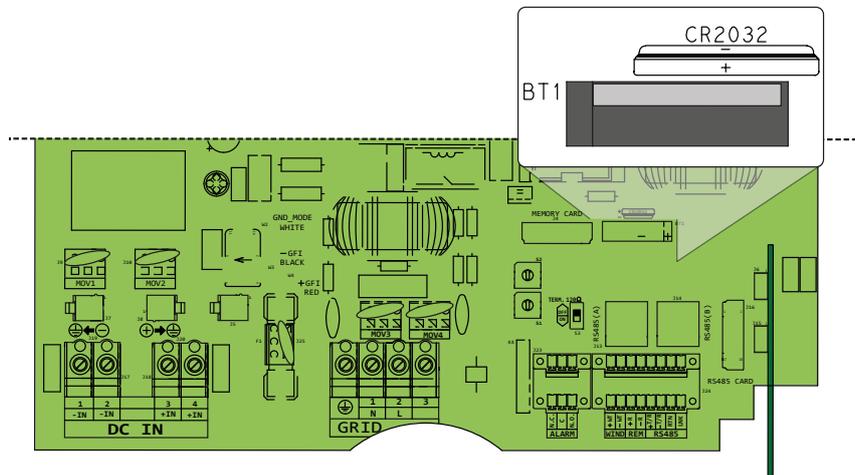
Reset Country S.

3. Select "Reset Country S." to reset the 24 hours of operation in which the grid standard may be modified..

Replacing the back-up battery

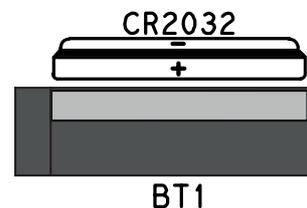
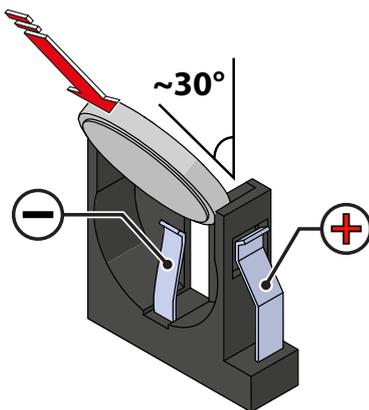
The back-up battery may need to be replaced when:

1. An error message is displayed
2. The date and time settings are reset



Back-up battery replacement procedure:

1. Disconnect the strings by opening the AC and DC disconnect switches external to the inverter.
2. Remove the battery to be replaced
3. Install the new battery taking care to handle it with insulating gloves to ensure it is not discharged and respecting the polarity displayed on the communication board silkscreen



4. Turn the inverter on

Verification of ground leakage

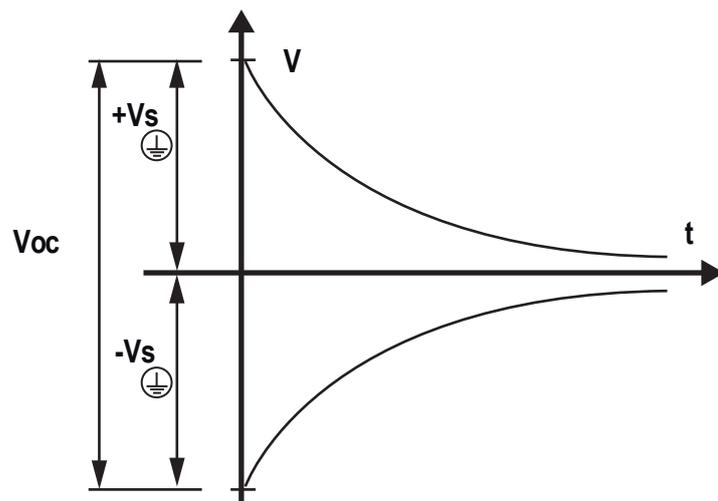
In the presence of anomalies or report of ground fault (where provided), there may be a ground leakage from the PV generator (DC side).

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 sufficient for the dimensions of the photovoltaic generator.

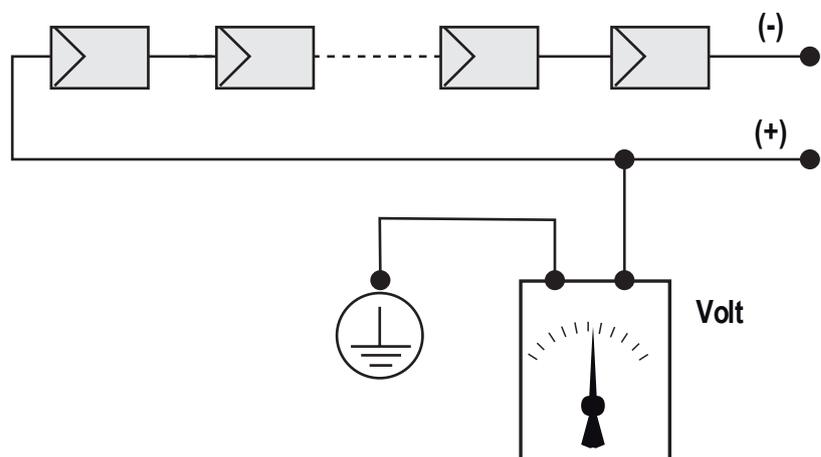
Behaviour of a system without leakage

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 $V_{oc}/2$, which will tend to stabilize to 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.



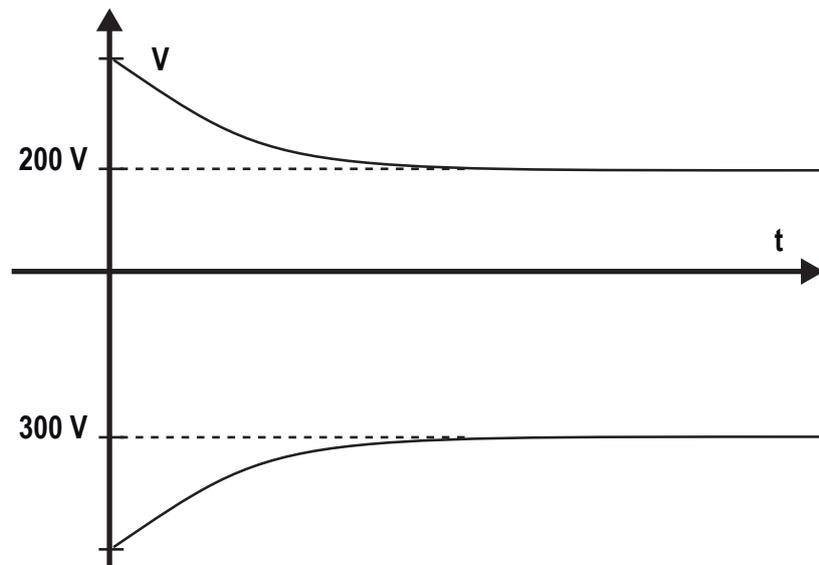
How to make the measurement:



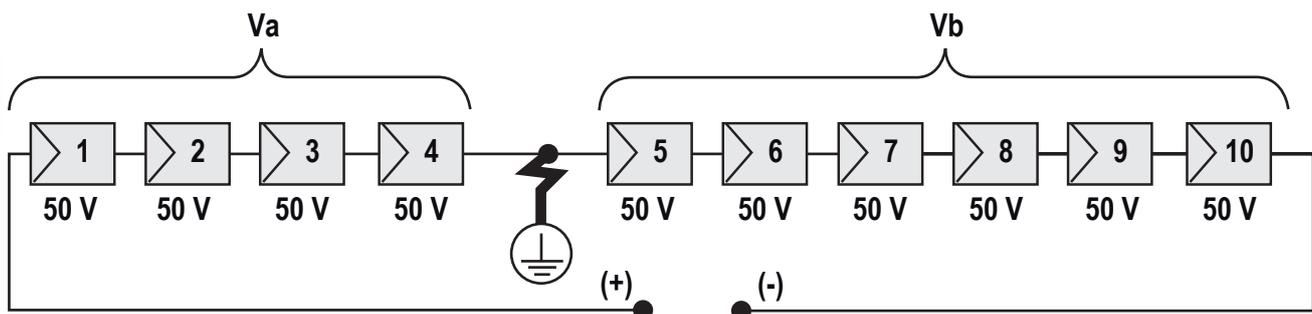
Behaviour of a system with leakage

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.



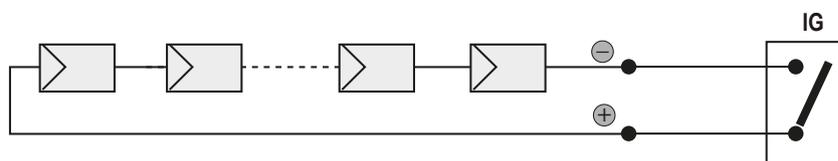
V_a = voltage measured between + pole and \oplus = 200V

V_b = voltage measured between - pole and \oplus = 300V

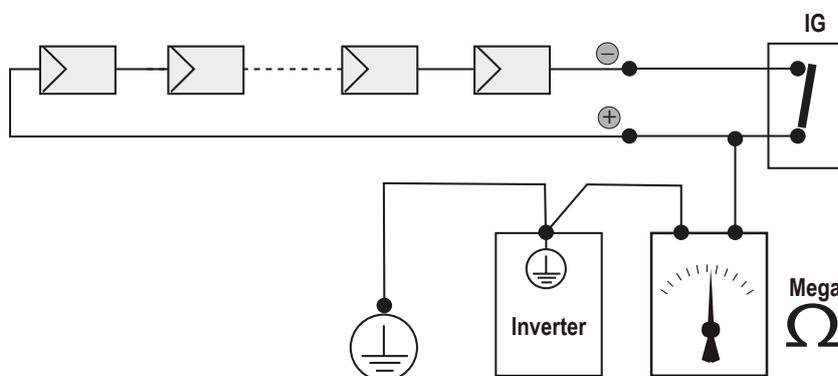
In all measurements with \oplus , the ground of the inverter is indicated.

Measuring the insulation resistance of photovoltaic generator

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



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



-TL MODELS (transformerless). If the measured insulation resistance (R_{iso}) 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 (R_{iso} 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

Further information

For more information on ABB products and services for solar applications, navigate to www.abb.com/solarinverters

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