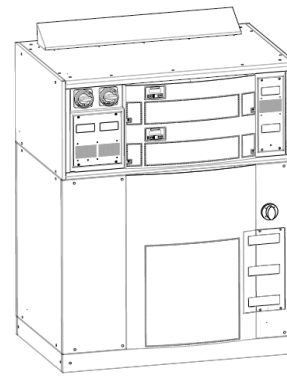
AURORA®

PHOTOVOLTAIC INVERTER

INSTRUCTION, INSTALLATION

AND MAINTENANCE MANUAL

Models:* ***PVI-CENTRAL-50-US (208)***
PVI-CENTRAL-50-US (480)
PVI-CENTRAL-100-US (208)
PVI-CENTRAL-100-US (480)



Rev. 1.2

IMPORTANT SAFETY INSTRUCTIONS



SAVE THESE INSTRUCTIONS

This manual contains important instructions for models indicated in front of Report that shall be followed during installation and maintenance of the inverter.

DOCUMENT REVISION TABLE

Document revision	Author	Date	Approved by	Modification
1.0	S. Soldani	16-07-08	D.Nocentini	First issue
1.1	S.Soldani	11-11-08	D.Nocentini	Various updating
1.2	T. Montemezzo	21-12-10	D.Nocentini	Upgraded GFD section

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1. GENERAL INSTRUCTIONS ON THE USE AND READING OF THIS MANUAL

This documentation is applicable to PVI-CENTRAL-50-US and PVI-CENTRAL-100-US products.

- The product to which this Manual refers must be used only for the purpose described in Chapter §3. Any other use is inappropriate and therefore dangerous. Power-One declines all responsibility for damage to property or persons due to use which is inappropriate and/or other than that foreseen.

- Before replacing the components in the device and mentioned in this Manual, particularly the dischargers and the fuses, the dealer must be contacted: Power-One shall accept no responsibility for damages consequent to the use of unsuitable spare parts.

- Power-One reserves the right to make any amendments to this Manual and to the product without advance notice: the most recent version of the Manual, indicating the revision number, is available at the site www.power-one.com

- This Manual contains important instructions regarding safety and functioning, which must be understood and carefully followed during installation and maintenance of the product.

1.1. Disposal of waste

As a manufacturer of the electrical device described in this Manual, and in compliance with country law, Power-One informs the buyer that when this product is scrapped it must be delivered to an authorised collection point.

1.2. Product labelling

Figure 1-1 shows an example of the product label.

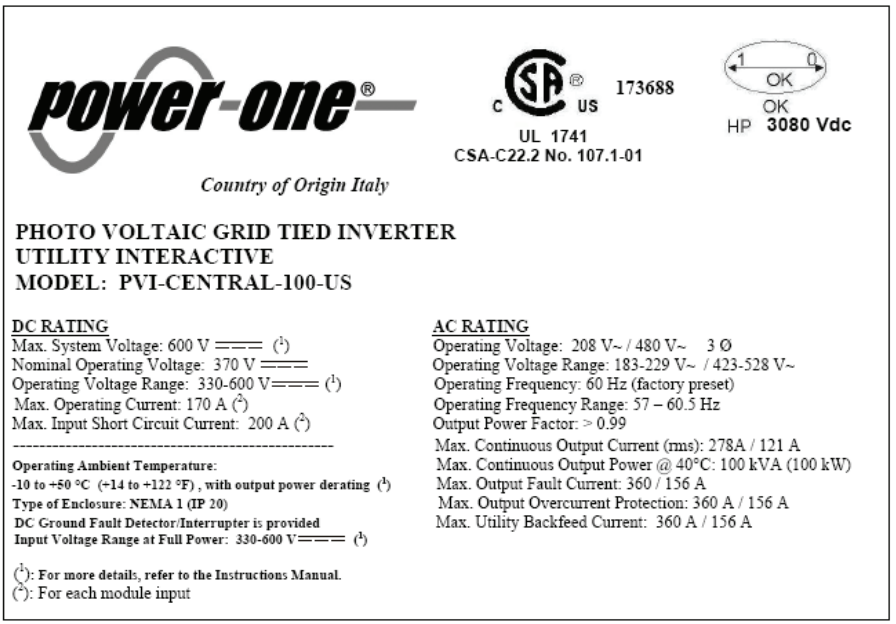


Figure 1-1: Product label (example: 100 kW)

The identity label affixed to the product contains the following relevant information:

1) Product origin
2) Model name
3) DC input data
4) AC output data
5) Certifications
6) Other information

Figure 1-2 : Identification label (example)

The small identification label shown in Figure 1-2, affixed to the PVI-CENTRAL, contains the following information:

1) Product code
2) Model name
3) Serial number
4) Week/year of manufacture
5) Any other information.

The label is normally affixed to the left side of the inverter.

1.3. Symbols used in this Manual

To reduce the risk of electric shock, and to ensure that the device is correctly installed and ready for use, special safety symbols are used in the Manual to indicate potential risks or useful information. The symbols are the following:

CAUTION
Paragraphs marked by this symbol contain actions and/or instructions which it is essential to understand and to carry out in order to avoid potential malfunctioning of the device or damage to the same and to property in general.

DANGER!
Paragraphs marked by this symbol contain specific indications which must absolutely be followed in order to avoid accidents or even death by electrocution.

IMPORTANT
Paragraphs marked by this symbol contain important information regarding use of the device.

PROTECTION!
Paragraphs marked by this symbol indicate the need for the use of adequate protection before carrying out operations (e.g. insulating gloves for operating with voltages up to 1000Vdc, protective goggles, etc.)

1.4. Symbols used on the PVI-CENTRAL

The device has various labels; those with a yellow background regard the safety devices provided.
Make sure that you have read and fully understand the labels before installing the device.
The most common symbols used on the device, referring to electrical parts, are the following, which are also used in this Manual:

	Earth conductor (protective earth network, PE)
	Alternate current value (AC)
+	Continuous positive voltage pole
-	Continuous negative voltage pole
	Direct current value (DC)
	Earthed

2. GENERAL INFORMATION AND FEATURES OF A PHOTOVOLTAIC SYSTEM

This chapter gives the PVI-CENTRAL user general information on photovoltaic plants which transform solar energy into electricity which can be used in the mains network.

2.1. Photovoltaic energy

In the energy transformation process, industrialised companies (the greatest energy consumers) have been experimenting methods for energy saving and for decreasing the issue of polluting substances for many years, by careful and rational consumption of known resources and by research into new forms of clean and inexhaustible energy.

Replaceable energy sources offer a fundamental contribution for the solution of the problem. In this sphere, the exploitation of solar energy to generate electricity (photovoltaic energy) is becoming increasingly important throughout the world.
Photovoltaic energy represents an enormous advantage as regards environmental protection, since the solar radiation which we receive from the sun is directly transformed into electricity without any combustion process and without the production of nature-polluting waste.

In compliance with local and national regulations, the energy produced can be sold to the distribution network or credited against future consumption, thus resulting in an economic saving.

2.2. Fundamental elements of a photovoltaic field: “Strings” and “Arrays”

To considerably reduce installation costs in the photovoltaic field, linked above all to wiring problems on the DC side of the inverter and the successive distribution on the AC side, the STRING technology has been developed.
A photovoltaic PANEL is composed of a great number of photovoltaic cells fixed onto a single supporting base. A STRING is composed of a certain number of panels connected in series. An ARRAY is one or more strings connected in parallel.
Large photovoltaic systems can be composed of several arrays, connected to one or more AURORA inverters.
Increasing the number of panels in each string, the cost and complexity of the connection systems of the whole are decreased.

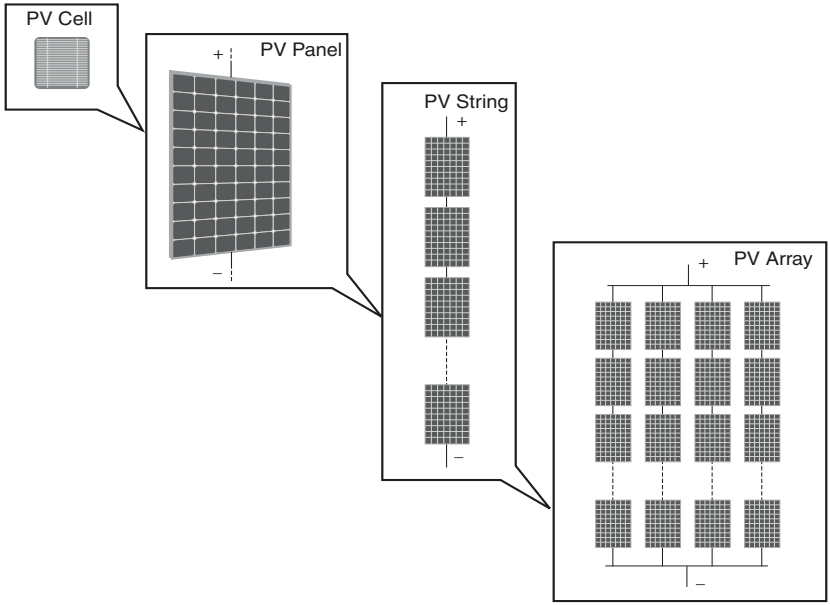
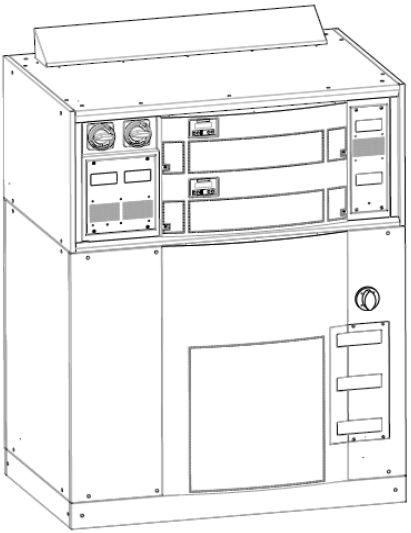


Figure 2-1: Array composition

CAUTION: In no case may the voltage of the string exceed the maximum voltage allowed, to avoid damage to the device (ref. § APPENDIX B: TECHNICAL DATA).

The current of each array must also be within the limits of the inverter downstream (rif. § APPENDIX B: TECHNICAL DATA).
Every AURORA inverter works independently of the others and supplies the network with the maximum power available from its own section of photovoltaic panels.
Decisions on how to structure a photovoltaic system depend on a number of factors and considerations, such as the type of panels, the available space, the future location of the system, long-term energy production targets, etc. the Power-One website (www.power-one.com) gives a configuration program which can aid correct dimensioning of a photovoltaic system.

3. FIELD OF APPLICATION AND GENERAL DESCRIPTION OF THE PRODUCT



PVI-CENTRAL-50-US
PVI-CENTRAL-100-US

Figure 3-1 : The PVI-CENTRAL-XXX-US series

The PVI-CENTRAL (Figure 3-1) are devices designed exclusively for the conversion of photovoltaic energy into electricity compatible with the mains network of the country in which they are sold. They are also provided with adequate electrical and mechanical protection.

If the inverters are connected to string combiners (PVI-STRINGCOMB(S)) they also allow for monitoring the whole photovoltaic field, by means of:

- Reading the string currents (10 channels available)
- Reading the total voltage of the field
- Checking the fuses, positioned in the system to protect the photovoltaic panels
- Other

AURORA PVI-CENTRAL is an inverter with the capacity of supplying the mains network with energy obtained from photovoltaic panels.
The photovoltaic panels transform the energy irradiated by the sun into electricity of the direct current “DC” type (through a photovoltaic field, also called a PV generator); however, to supply the mains network, and to allow for the use of the electricity, it must be transformed into the alternate current “AC” type. This conversion, known as DC-AC inversion, is achieved efficiently by AURORA without the use of rotating elements but only with static electronic devices.

When used in parallel with the mains network, the alternate current output from the inverter flows directly (or through an insulating transformer) into the industrial distribution circuit, connected in turn to the public distribution network (see Figure 3-2).
If the energy supply from the photovoltaic system is low, the quantity of energy necessary to guarantee normal functioning of the appliances connected is taken from the public distribution network. However, when the opposite occurs, i.e. an excess of energy is produced, it is directly sent into the public network, thus becoming available to other users.

In compliance with local and national regulations, the energy produced can be sold to the distribution network or credited against future consumption, thus resulting in an economic saving.

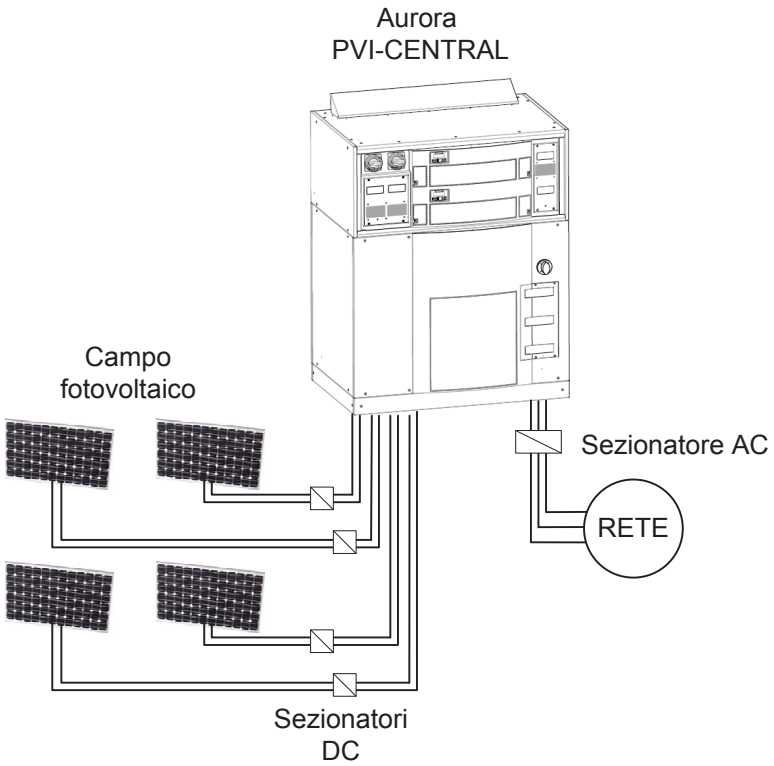


Figure 3-2 : Example of inverter connection

3.1. Description of PVI-CENTRAL

Figure 3-3 shows the diagram of the AURORA PVI-CENTRAL-300-TL-YY blocks. Lower models have the same block diagram but with fewer blocks. The main blocks are the 50kW DC/AC converters. All converters work at high commutation frequency (18kHz), taking up relatively little space and with a fairly low weight, which also facilitates maintenance.

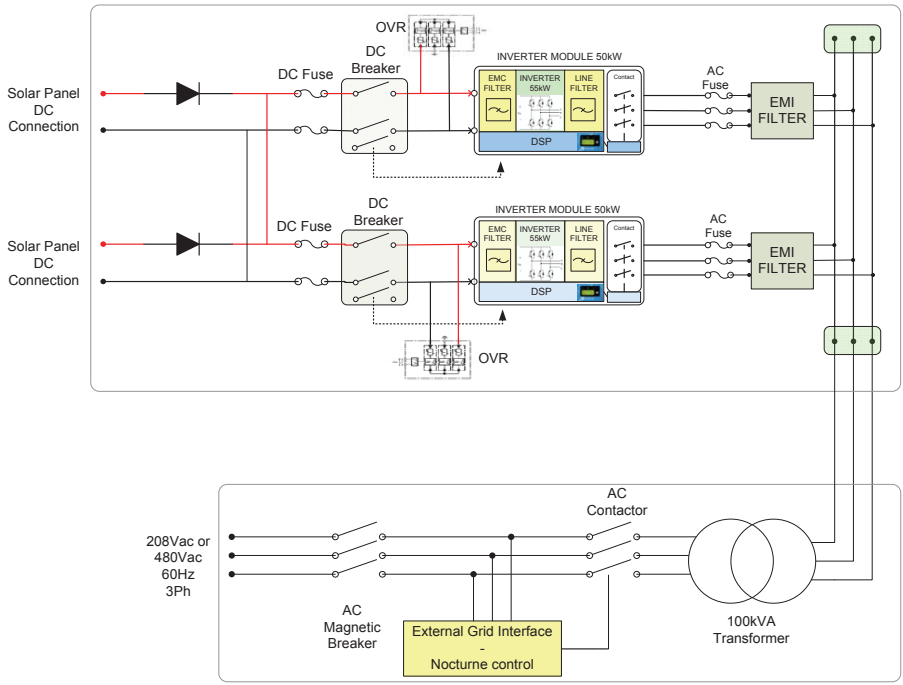


Figure 3-3 : Indicative electrical diagram of the PVI-CENTRAL

The block diagram shows the AURORA PVI-CENTRAL-100 model with its 2 converters. The converters function in the Master/Slave mode.
The PVI-CENTRAL-50 version has a single Master converter.

3.1.1 Master/Slave

In the Master/Slave mode the Master manages a single device controls the maximum power point target (MPPT) and the Slave follows the indications of the Master. The DC input section must be suitably configured (see **chapter §11**). In this case, the fields have the same polarity.

For this mode the functioning of the DC input switches must be clearly understood (see paragraph §9.2).

3.1.2 MPPT (Maximum Power Point Tracker)

The great advantage of using the PVI-CENTRAL is the possibility of extracting maximum power from the solar panels, regardless of environmental conditions.
A photovoltaic panel presents the current-voltage curves (I-V in bold type) and the power-voltage curves (P-V) shown in Figure 3-4. An array therefore has the same features. The highest point of maximum power. This point varies continuously according to the level of solar radiation which hits the surface of the cells.

On days with variable cloud, there will be very rapid and wide-ranging changes in solar power. There can easily be variations from 100W/m² to 1200W/m² in about 2 seconds. Aurora PVI-CENTRAL is designed to extract the maximum power from the array to which it is connected, and it will therefore always function at the ”knee” of the P-V curve. In addition, since the PVI-CENTRAL has very swift tracking / adjustment times, in particularly variable days it can produce much more energy than a slow inverter.

PVI-CENTRAL scans the photovoltaic field at every connection, allowing for the detection of possible multiple power peaks in the features of the field. In this way, the inverter immediately positions itself at the highest peak.

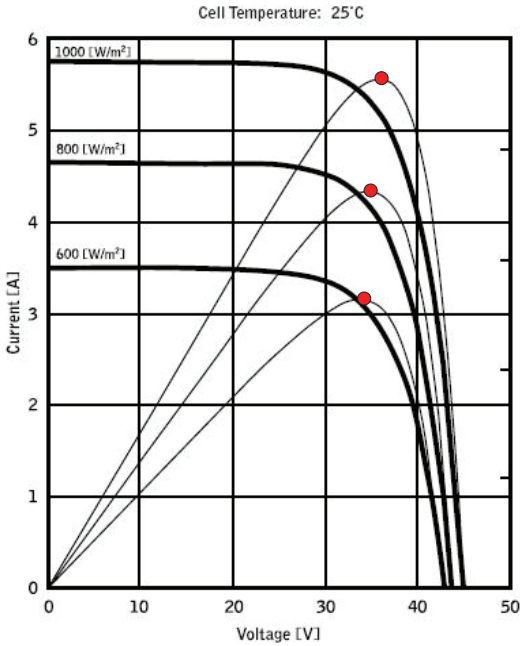


Figure 3-4 : Example of I-V and P-V curves of a solar panel

Unlike other inverters, PVI-CENTRAL follows extremely fast variation in illumination, allowing the MPPT to follow the light practically in real time.

3.1.3 Special features

Thanks to AURORA's high efficiency and large heat dissipation system, this inverter guarantees functioning at maximum power in a wide range of environmental temperatures.
The inverter is controlled for each module by a DSP (Digital Signal Processor) and by a central microprocessor.
This means that the breakdown of one module will not compromise the functioning of the whole system (only PVI-CENTRAL-100-US) but only the loss of 50 kWp: this always applies to a system in which the Slave has a breakdown, while in the case of a problem with the Master, and if the problem is not detected by the slave, the system loses its entire power.
In any case, it can be stated that:
"Lost power = (Available field power (kWp)) - 50kWp" (Master/Slave example: 70 kWp available – 50 kWp lost due to breakdown = 20 kWp effectively lost at the moment of the breakdown).

The dialogue between DSP and MICRO takes place via CAN BUS. The same protocol is also used for the dialogue between modules belonging to the system.
This guarantees optimal functioning of the whole electronic complex and high yield in all insulation and load conditions, always in full respect of directives, laws and provisions.

For system communication, the inverter is provided with two independent serial ports, of the RS485 type: a channel for user communication and a dedicated channel for the PVI-STRINGCOMB string combiners.

4. ESSENTIAL INFORMATION FOR SAFETY

If any doubts or perplexities arise when reading this information, contact your dealer.

4.1. Introduction



- The PVI-CENTRAL must be installed in compliance with national and local laws.
- For any type of maintenance or repair, contract your dealer. Unauthorised modifications can damage persons and property.
- We strongly recommend you to read all the instruction in this Manual and to observe the symbols of the single paragraphs before installing or using the device.
- It is extremely important and opportune to disconnect the inverter before connecting it to the photovoltaic field (installation and maintenance) by means of the DC switches inside the inverter itself, since there could be voltages capable of generating conditions of serious danger. The strings can be disconnected by means of the AURORA “PVI-STRINGCOMB(-S)” string combiner.
- The system must be connected to the mains distribution system only by qualified personnel and only after the Body appointed to distribute electricity has given its approval, as required by the national regulations in force.

  The PVI-CENTRAL staff or those who remove the protection from parts under voltage must wear suitable personal protection devices.

  The inverter is connected to the photovoltaic field and to the distribution network, and is therefore under voltage. Removal of the panels and/or any protection is prohibited, unless authorised by the person responsible for the system. Removal of the

aforesaid protection exposes the person to the risk of electrocution.

- The electrical connections must always be made correctly and in respect of the correct polarities, otherwise the device and the photovoltaic panels can be damaged.

In the case of breakdown, a photovoltaic arc could develop inside the PVI-CENTRAL, sustained by the DC source. In the worst case scenario, this could even damage the carpentry with the possible appearance of smoke, and therefore represents danger to persons and property.
Follow the indications in this Manual with extreme care, especially the chapter on installation (Chapter §10).

4.2. General Information

- Inappropriate use and/or incorrect installation can cause serious damage to persons or property.
- All operations regarding transport, installation and switching on, including maintenance, must be carried out by qualified, trained personnel (with respect for all national provisions on accident prevention).
- The device may not be placed in an environment where there is a risk of fire or explosion.

It is important that the qualified and suitably trained persons, referred to in basic safety information, are expert in the assembly, installation and functioning of the product and have the necessary requisites to carry out the work involved.

Power-One accepts no responsibility whatsoever for damage to persons or property due to incorrect interpretation of the instructions in this Manual or from inappropriate use of this device.

5. DESCRIPTION OF PARTS AND COMPOSITION OF THE PVI-CENTRAL

5.1. Overview

The figure below shows the main parts of the PVI-CENTRAL.

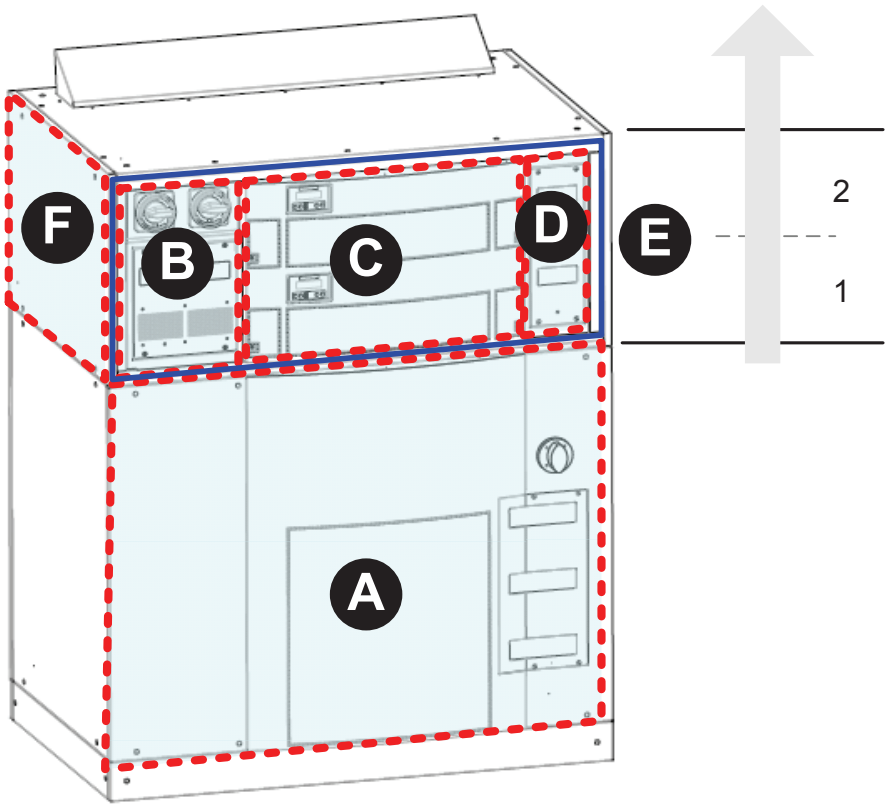


Figure 5-1 : Overview of the PVI-CENTRAL

5.2. Description of inverter parts

5.2.1 (A) ACBOX zone

In this zone there are, from left to right: Zone for the passage of the DC wires, 208≡480 or 208≡208 transformer (according to the version), bars for connection to the AC network, magneto-thermal network disconnecting switch, network counter for night-time disconnection of the transformer, auxiliary energy input point, connection for communications, signals. The panel is provided with a removable and washable filter (ref. §15.1.1.2).

5.2.2 (B) DC fuses zone

The removable panel allows for access to the fuses on the DC line. There is also a transparent inspection window which allows for the detection of broken fuses. Each panel has a removable and washable filter (ref. §15.1.1.3).

5.2.3 (C) 50kWp Module zone

This is the heart of the PVI-CENTRAL It contains two[1] DC/AC conversion modules which allow for the photovoltaic energy to be converted into electricity compatible with the mains distribution network.
Every module has led indicators and an interactive display. The modules can be extracted by first removing the convex panel. This latter is provided with a removable and washable filter (ref. §15.1.1.1).

5.2.4 (D) AC fuses zone

The removable panel allows for access to the fuses on the AC line of every single module. There are also two transparent inspection windows which allow for the detection of broken fuses. Each panel has a removable and washable filter (ref. §15.1.1.4).

5.2.5 (E) Framework

This group, called Framework, contains the B, C and D zones which may be complete (the 100kW version) or have certain parts missing (the 50kW version). In the PVI-CENTRAL-50 version the upper module is replaced by a cap.

[1] There is only one module in the PVI-CENTRAL-50 version.

5.2.6 (F) DC connections zone

The DC connection bars of the converter are accessible via the side panels. Every Framework includes the connection of a maximum of two DC subfields.

5.2.7 Enumeration of 50 kWp models

The enumeration of the models is as indicated in Figure 5-1. The lowest will always be number 1, while the last number depends on the type of inverter.

The enumeration of the models must not be confused with the serial number.
The use of the enumeration is useful when connecting the terminal board in the ACBOX zone.

6. PROTECTION

6.1.1 Protection against mains breakdowns

In the case of an interruption in the local mains supply on the part of the electricity company or if the apparatus is switched off for maintenance, AURORA must be physically disconnected under safe conditions in order to guarantee the protection of the persons who must work on the mains network, all in compliance with the relative national standards and laws. To avoid possible isolated functioning, AURORA is provided with an automatic protective disconnection system.

NOTE: For further details on the disconnection of AURORA or the causes of malfunctioning, please see paragraphs §16, § 19 e §20 - APPENDIX B: TECHNICAL DATA.

6.1.2 Further protection

AURORA has supplementary protective devices to guarantee safe functioning under any circumstances. This protection includes:

- constant monitoring of the mains voltage to guarantee that the voltage and frequency values remain within operating limits (according to standards in force in the country where it is sold);

- ANTISLANDING: makes it possible to detect, always and safely, the absence of a network. This ensures the disconnection from the network and protects any one who might be working on the line;

- GROUND FAULT DETECTOR/INTERRUPTOR: a special device determines whether the dispersion current towards the ground is too high on the DC side. In case of intervention the inverter disconnects from the mains and signals an alarm. For the maintenance procedures see §15.1.3.4 .

- Internal temperature control to automatically limit power if necessary and to guarantee that the unit does not overheat. The graph in the Figure 6-1 and Figure 6-2 shows the automatic derating of delivered power. I

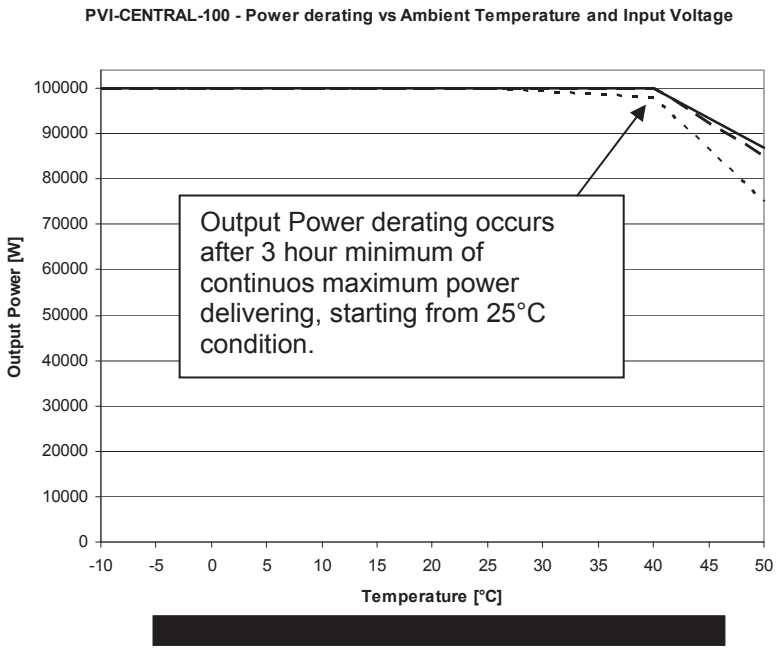


Figure 6-1 : PVI-CENTRAL-100 Derating Curves

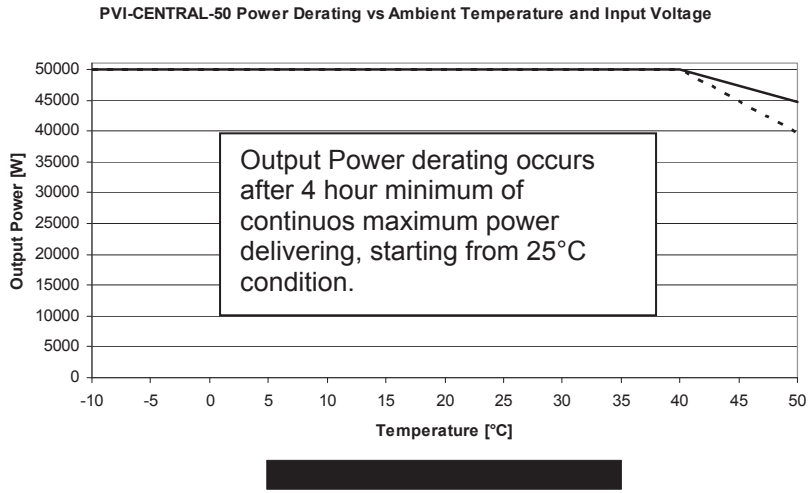


Figure 6-2 : PVI-CENTRAL-50 Derating Curves

AURORA's many control and protection devices, listed below, result in a redundant structure to guarantee functioning in absolute safety.

- Automatic measures:
  - The DC voltage of the photovoltaic field is measured and overvoltage (OV) is signalled
  - The independent AC voltage of each module is monitored
  - The independent AC voltage of each module is monitored
  - The independent network voltage frequency is monitored on each module
  - Independent thermal monitoring on each module
  - The input insulation resistance is monitored on the Master modules.

- Fuses:
  - DC side: one fuse on the positive pole of every 50 kWp module, for a total of 2 fuses per Framework
  - AC side: 3 fuses for each module, for a total of 6 fuses per Framework.

- Other protective measures:

- Magnetothermal switch on the input to the auxiliary supply network
- Magnetothermal switch on the input to the mains supply network (208 Vac or 480 Vac)
- DC side: protection against overvoltage (OVR), with replaceable cartridges
- AC side: protection against overvoltage (OVR), with replaceable cartridges on the 300Vac network, and on the auxiliary voltage
- Protection against overheating on each module

7. CONNECTION MODALITIES ON THE RS485 LINE

Connection for external communications from the PVI-Central is by means of an RS485 data line.
Up to 32 inverters can be connected on the same line.

The line termination (120 ohm) is already foreseen inside each inverter.

For the last PVI-CENTRAL of the chain, the enabled line termination (see Figure 7-1 e Figure 7-2), while for the others it will be disabled.
This operation is indicated in paragraph §11.2.6.

The use of a computer is not fundamental for functioning of the system. **This is only necessary for functional checking during installation and for system monitoring by PC.** (see paragraph §18).

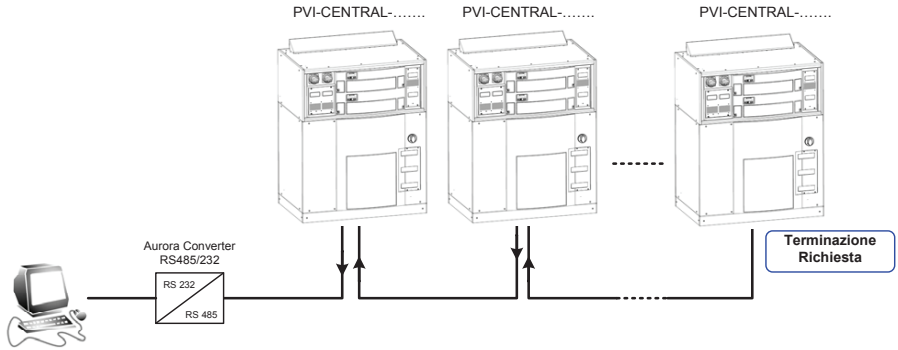


Figure 7-1 : Modalities for passage of the serial wire

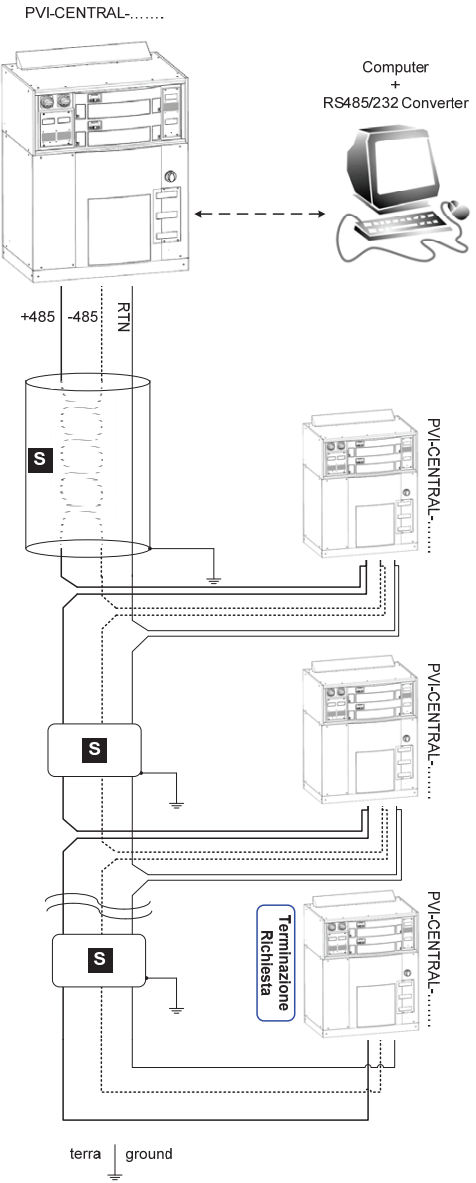


Figure 7-2 : Type of PVI-CENTRAL connection

7.1. Connection modes for monitorisation

There are 2 main modes for connection of the RS485 line from the PVI-CENTRAL, in order to monitor the inverter. These are A and B, while a third (C) does not include the connection to RS485. Figure 7-3 illustrates said modes:

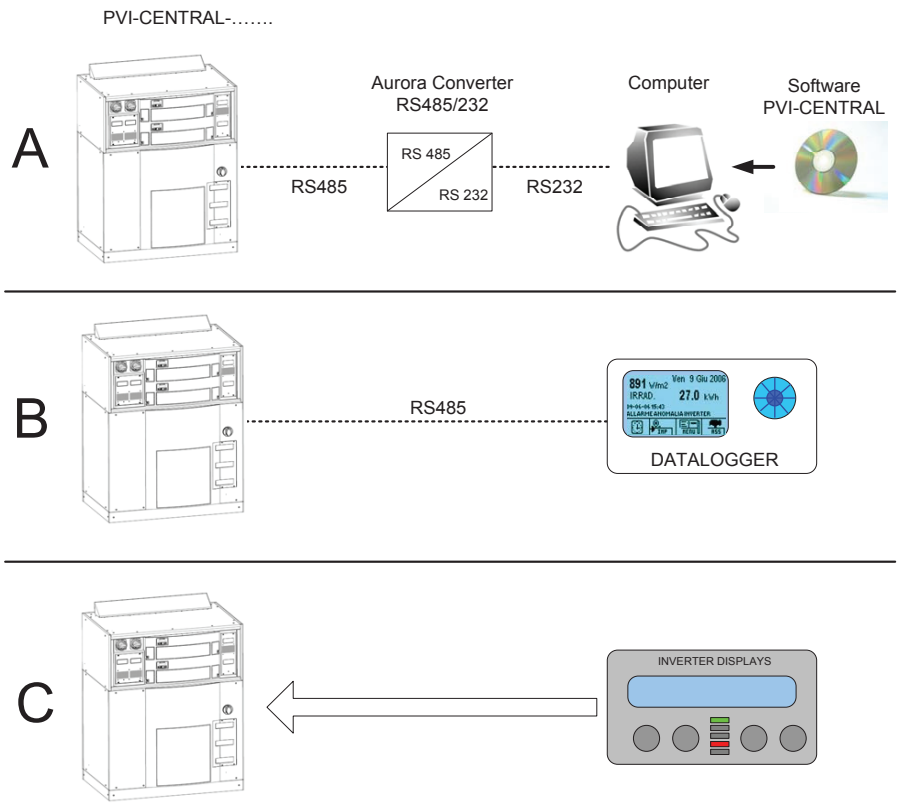


Figure 7-3 : Connection modes

Where:

A) Connection between PVI-CENTRAL and a PC. The Computer is connected to the RS495 of the inverter by means of the AURORA RS232/485 Converter adapter. The PVI-CENTRAL monitoring software must be installed in the PC (ref. §17 and §18).
This is the configuration used during installation and monitoring via PC.

B) Connection for remote control. The remote monitoring system, HYPERLOG, is connected directly to the RS485. For functioning of this system, please see the HYPERLONG instruction manual.

C) Stand-Alone connection. The PVI-CENTRAL is monitored only by the display of the PVI-CENTRAL inverter (ref. §16).

8. STORAGE AND HANDLING

8.1. Preliminary checks

NOTE: The dealer has delivered your AURORA to the forwarding agent safety packaged and in perfect condition. The forwarding agent, by accepting the package, assumes responsibility until delivery. In spite of care taken by the forwarding agent, the packaging and its contents may be damaged during transport.

Handling and storage of the device before installation require particular care. It is therefore good practice to follow the indications below:

Transport/storage temperatures must be respected (see APPENDIX B: TECHNICAL DATA).

Since here are electronic circuits inside the cabinet and electrical connectors, particular care must be taken to avoid falls or blows which could later endanger correct functioning of the inverter and compromise the safety of persons during installation and/or functioning.

It is important, before installation, to check that the device is intact. Any anomalies in packaging and/or the presence of freely moving objects which do not regard the accessories provided must be taken as an alarm bell. In such cases, contact the dealer.

In conclusion, the customer is invited to carry out the following checks:

- Examine the content of the shipment to check for visible damage: holes, cracks and any other sign of possible damage inside.
- Describe in writing any damage or lack of documents received; this must be undersigned by the carrier, with his full name.
- Open the container and examine the contents and check on possible damages inside. When removing the packaging, take care not to discard equipment, components or manuals. If any damage is found, contact the forwarding agent to determine the best measures to take. An inspection may be required; keep all the packaging material for the inspector!
- If the inspection results in the finding of damages, call the dealer or the authorised dealer. This latter will decide whether the apparatus must be returned for repairs and will give relative instructions.
- The customer is responsible for lodging a complaint with the forwarding agent. Failure to follow this procedure can lead to the loss of assistance under guarantee for any damages found.

8.2. Handling and extraction of the PVI-CENTRAL from the packaging

Every PVI-CENTRAL is normally transported in a wooden crate.

Handling the inverter inside the crate must be carried out according to the indications of paragraph §8.2.3.

8.2.1 Content of the packaging

Each package contains[2] the following material:

Material	Qty
PVI-CENTRAL-XXX-US	1
CLOSURE BASES	2
This Manual	1
Final Test Certificate	1
UL Certificate	1
CD (Software)	1

8.2.2 Removal of the inverter from the wooden crate

The packaging of the PVI-CENTRAL appears as in Figure 8-1. To extract the inverter the lid must first be removed, and then the side panel at the back of the inverter, which can be identified by the wording “lift from this side”.

Considering the particular nature of the front of the PVI-CENTRAL, this side should not be used for normal handling operations.
The front, indicated by the wording “do not enfork from this side”, need not be removed and, as mentioned above, it should be used only if indispensable, in order to avoid damaging the front part (Figure 8-2).

[2] There may be difference pursuant to agreements with the customer

Figure 8-1 : Transport crate (front and rear view)

Figure 8-2 : Do not lift from the front unless strictly necessary

After removing the rear part of the crate, the wooden base must then be removed in order to extract the PVI-CENTRAL.

Remove the wooden baseboard to allow for inserting the prongs of the forklift truck

Figure 8-3 : wooden base

The baseboards which will surround the base of the inverter are packaged separately and positioned on the top of the inverter. These must be fitted after the wires have been positioned.

Figure 8-4 : Front and rear closing baseboards

8.2.3 Handling the PVI-CENTRAL

After opening the crate, the inverter can be extracted. This operation must be carried out with the aid of specific equipment and in the way described in Figure 8-6. Figure 8-5 instead shows what must not be done.

It must be kept in mind that the weight of the inverter is not evenly distributed and therefore particular care must be taken when it is lifted.

Figure 8-5 : Prohibited movements

The inverter may be moved by forklift truck.

Since much of the weight is distributed in the upper part, it is absolutely essential to pay maximum attention when moving. It is important to lift the inverter in a way which guarantees the widest supporting base possible and which does not facilitate the risk of tipping up.

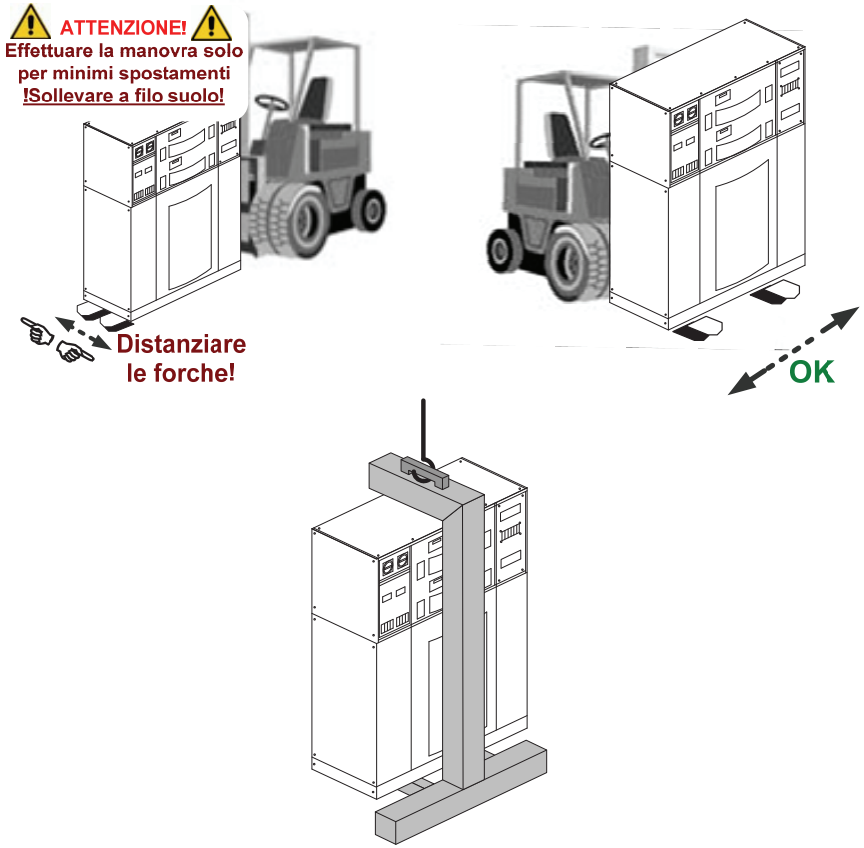


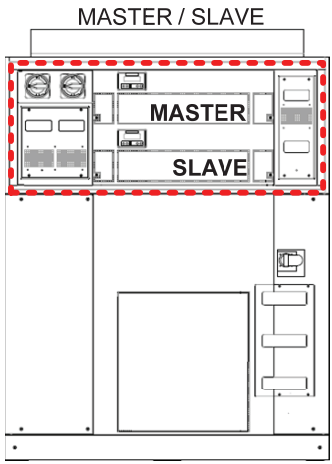
Figure 8-6 : Allowed movements

9. MASTER/SLAVE AND FUNCTIONS OF THE DC INPUT DISCONNECTING SWITCHES

9.1. Master/Slave configuration

Figure 9-1 shows the operation configuration of PVI-CENTRAL-XXX-US.

In the smallest system (50kW), even with fewer 50 kWp modules, all the following considerations hold firm.



The position of the master and of the slave inside a framework is not pre-established. The module with a larger number of series is always the master.

Figure 9-1 : Examples of PVI-CENTRAL composition

The type of configuration is prepared directly in the factory (before shipment) according to the customer's indications, in reference to the global configuration of the system.
The need to vary the pre-set configuration must be discussed and assessed with the constructor.

- It is necessary to install a DC disconnector upstream to the inverter in order to disconnect the entire photovoltaic field.

- Pay particular attention when manoeuvering the DC disconnecting switches (Ref. §9.2).

9.2. Function of the DC disconnecting switches in every Framework

Every Framework can contain up to a maximum of two 50 kWp modules.
In un Framework da 50kWp sarà installato solo il modulo più basso (L - low).
The switch on the right acts on the connection of the low module (L), while that on the right acts of the high (H) module).

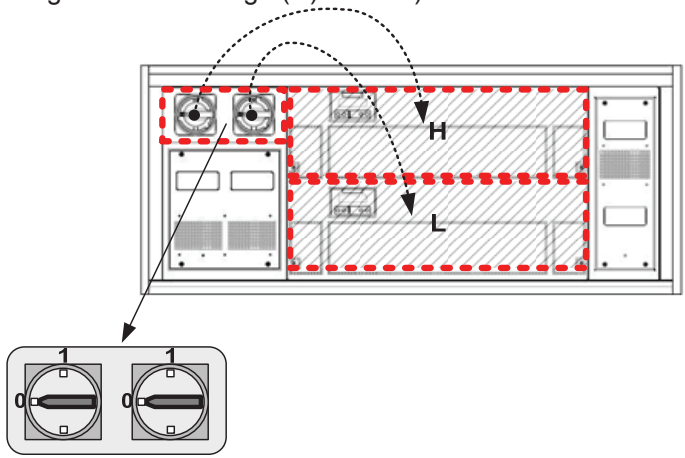


Figure 9-2 : Framework – detail of the action of the switches

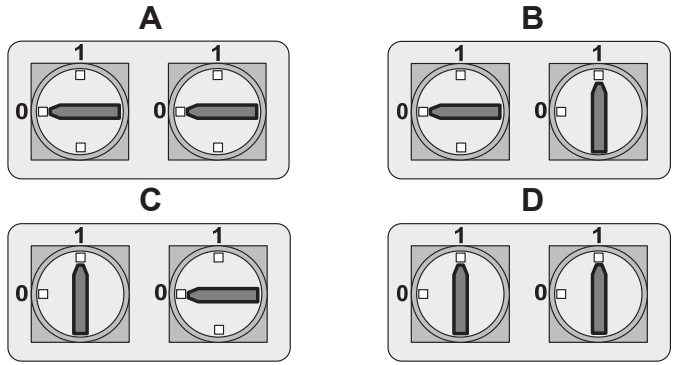


Figure 9-3 : Possible positions of the switches

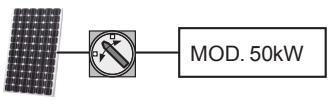
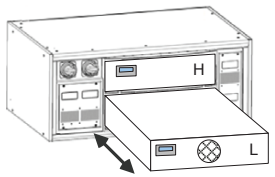
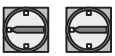
9.2.1 Master/Slave System

In this configuration, the two modules have the same photovoltaic field.

In this case, it is particularly important to understand the use of the DC disconnecting switches. Incorrect use can cause inverter breakdown.

The following table indicates, in the first column, the position of the switches, in the second whether the photovoltaic field is connected to the module, and in the third whether it can be removed or inserted in the seat.

Table 9-1 : TABLE OF OPERATIONS ALLOWED AND POSITION OF DC SWITCHES – MASTER/SLAVE

MASTER/SLAVE				
DC SWITCH POSITION	**PHYSICAL CONNECTION BETWEEN DC SOURCE AND MODULE** 		**EXRACTION/INSERTION OF MODULES*** 	
	H (high)	**L** (low)	**H** (high)	**L** (low)
A 	NO	NO	YES	YES
B 	YES	YES	NO	NO
C 	YES	YES	NO	NO
D 	YES	YES	NO	NO

*before extraction, wait 5 minutes after the last switch has been switched OFF.

10. INSTALLATION

The electrical installation of the PVI-CENTRAL must be carried out in compliance with pertinent local and national laws.

The environmental situation and positioning can condition the functioning of the PVI-CENTRAL, therefore the indications given below must be followed.

10.1. Installation location

The following warnings and indications on choice regard where to position the device:

Do not place the PVI-CENTRAL near inhabited spaces or places where access is difficult. Any escape routes must always be left free.
The place chosen must be protected from the external elements.
The room must be suitable for the installation of electrical systems.

Do not install the device in a position where it is directly exposed to the rays of the sun: excessive temperatures could compromise the functioning of the electronic components and also reduce inverter performance. **Install the inverter in a position protected from the sun**

The place where the inverter is position must be made of flameproof material There must be no inflammable material in the vicinity; in any case, the installation of a smoke detector device is advisable.

In the project phase, take into account the data regarding environmental conditions and ventilation (see APPENDIX B: TECHNICAL DATA). **In the case of use in particularly damp environments, use a heater or conditioner to reduce humidity.**
The quality and quantity of the air, humidity and dust can affect inverter functioning.

Maintenance of the inverter hardware is carried out mainly from the front (from both the modules zone and from the AC BOX zone (see Figure 5-1). It is good practice in any case to allow for access from all sides in order to facilitate possible intervention. Particular installations without side access must be discussed and agreed on in advance with the dealer.

10.2. Positioning on the chosen place

The due precautions in handling always holding firm, the inverter must be placed on base which guarantees the vertical position and which can adequately support the weight (see APPENDIX B: TECHNICAL DATA). Figure 10-1 gives the dimensions of the inverter base.

The inverter must be positioned vertically and not at an angle. The Rack must be absolutely stable and perfectly level.

In addition, the base on which it rests must be provided with anchorage points so that the inverter cannot be shifted accidentally.

Leave a sufficient space around the inverter to allow for easy installation and removal of the same.

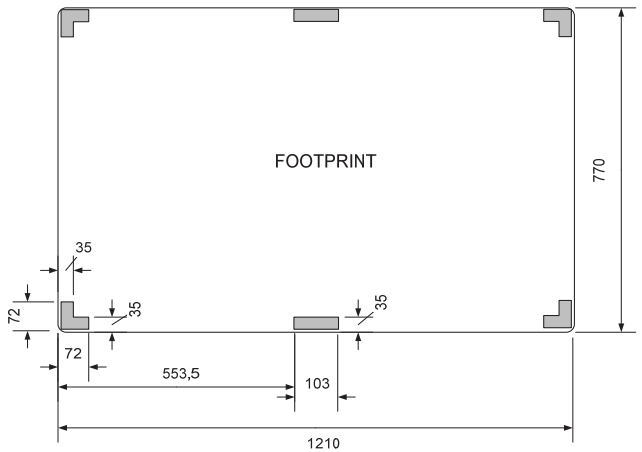


Figure 10-1 : Footprint of the base

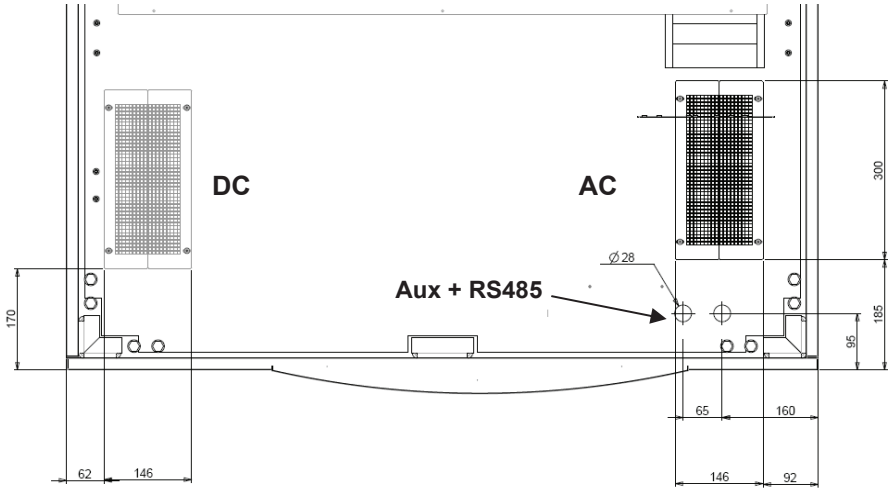


Figure 10-2 : Cables holes for DC, AC, Communication

10.2.1 Air vents

Every framework has a grilled hood on the top panel to allow for the outflow of hot air, as shown in Figure 10-3.

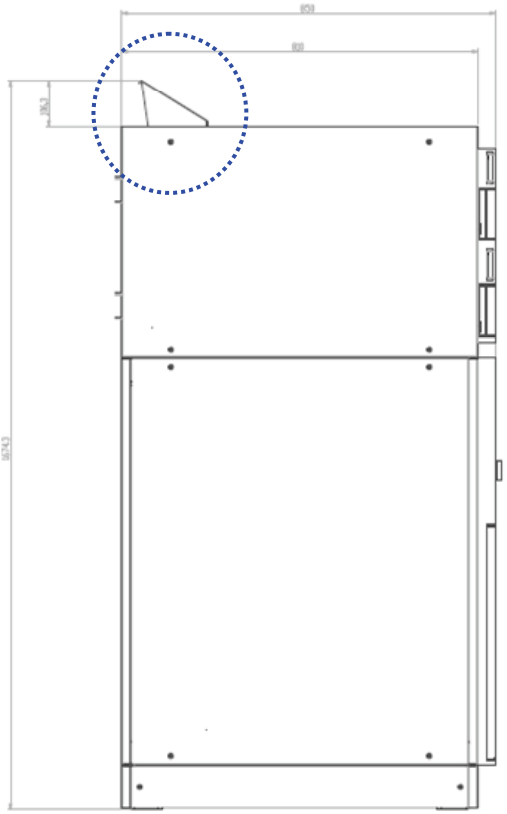


Figure 10-3 : Hot air outflow hood

10.2.2 Safety distance

The following figure shows the minimum recommended distances to be observed.

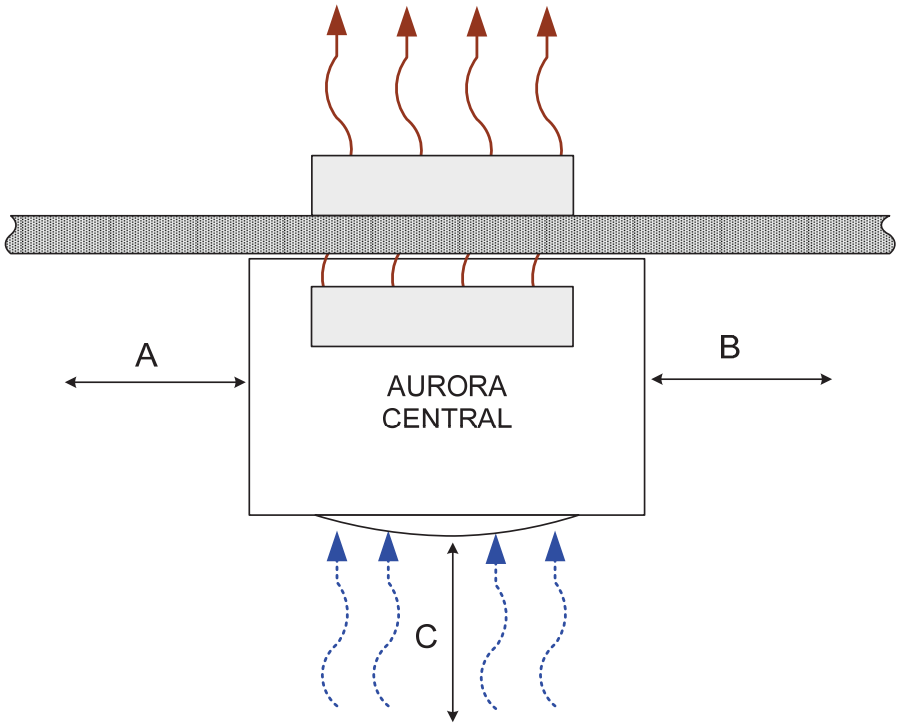


Figure 10-4 : Safety distances

Table 10-1 : Table of recommended distances*

A	B	C	-
400 mm	300 mm	800 mm	-

* Recommended distance, which may be adjusted in agreement with the customer and taking into consideration the type of installation.

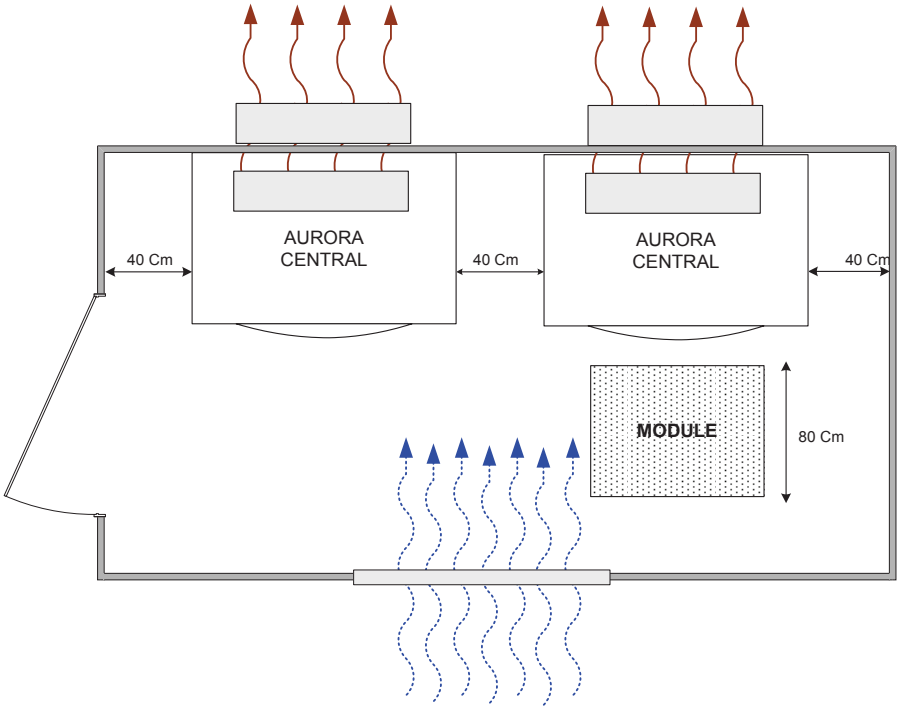


Figure 10-5 : Installation example

The example above shows a cabin with the following points:

- Air entry grill / filter
- 2 PVI-CENTRAL-XXX-US distanced from each other and from the side walls
- Simulation of the extraction of the 50 kWp module
- Hot air exit grills/ducts

As can be seen, in this example the indications of Table 10-1 have been observed.

10.2.3 Removal of panels to make the connections

Remove the panels indicated in Figure 10-6.

The front panel allows for access to the AC connections for connection to the mains network, to the 3P+N voltage (208 Vac or 480 Vac) which supplies the control logic and the internal fans and the front terminal boards where the RS485 connection, for communication, is located.

Use a hexagonal spanner to remove the screws indicated in the figure (6 screws at the front and 4 for each side panel).
To remove the front panel, the switch handle must be in the 0 (OFF) position.

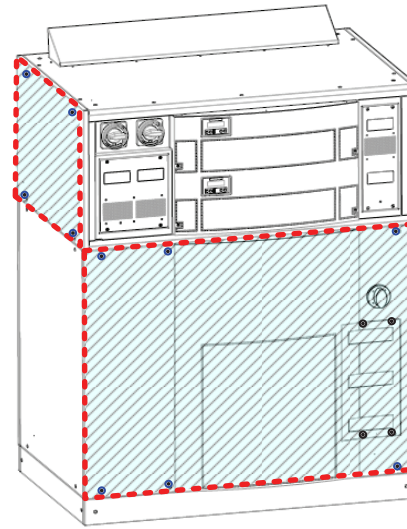


Figure 10-6 : Panels to be removed

To remove the panels it may be necessary to disconnect the wire of the earth connection. Remember to reconnect this wire before reclosing every single panel!

10.2.4 Composition of the AC BOX zone

After removing the front panel, the following zones can be identified:

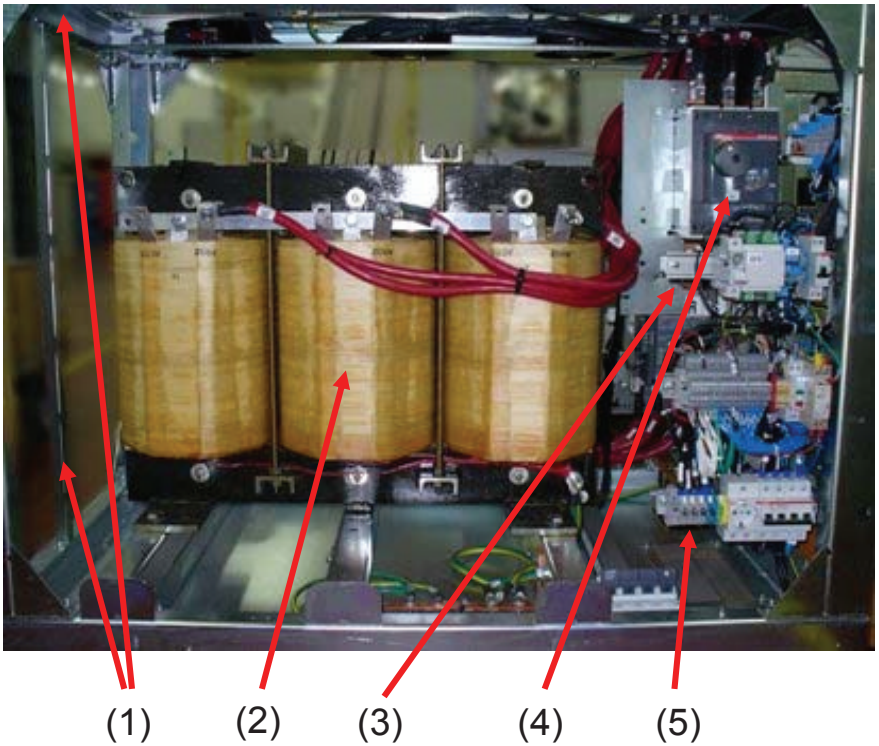


Figure 10-7 : Composition of the ACBOX zone

Where:

(1) Zone for the passage of the DC wires
(2) Insulation transformer
(3) AC power network connection bars
(4) Magnetothermal disconnecting and safety switch
(5) Zone for connection clamps for auxiliary AC and serial communications.

10.2.5 Zone for the passage of wires

Figure 10-8 shows how the aforesaid wires should be arranged on arrival. Pass the DC, AC, AC auxiliary, Earth and RS485 wires through the openings made in the base of the inverter (see Figure 10-9, Figure 10-10). These openings can easily be cut to suit the positioning of the wires.

Before handling any wire, make sure, using suitable instruments, that there is no dangerous voltage!

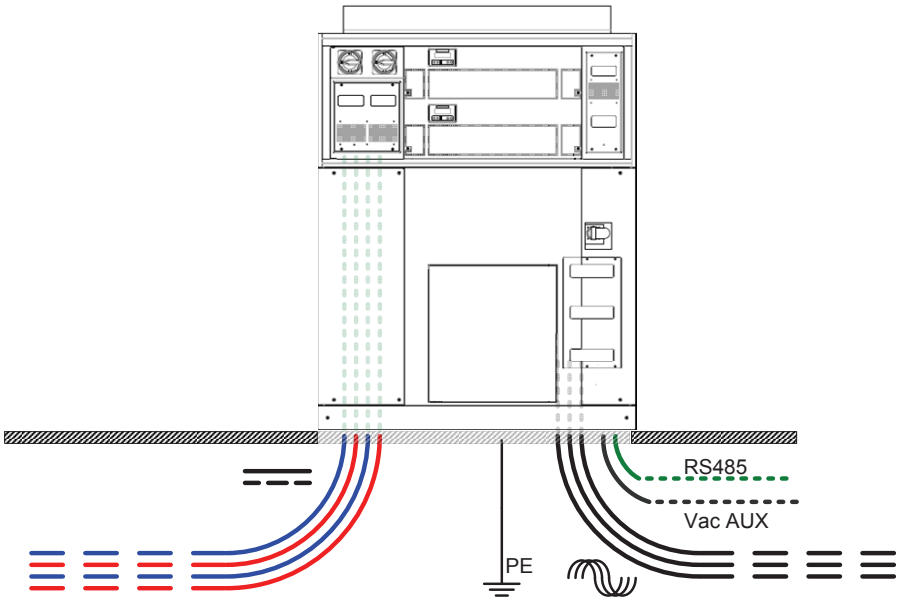
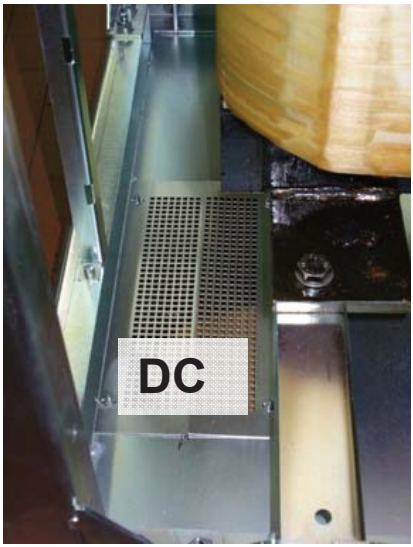


Figure 10-8 : Exit of wires from below the inverter



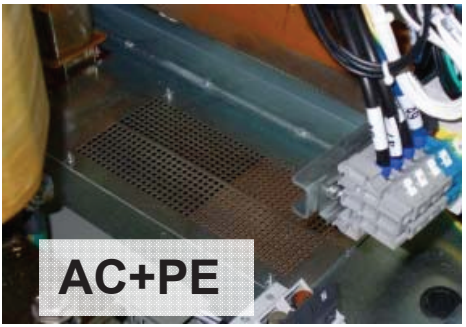


Figure 10-9 : Opening of passage for DC and AC wires

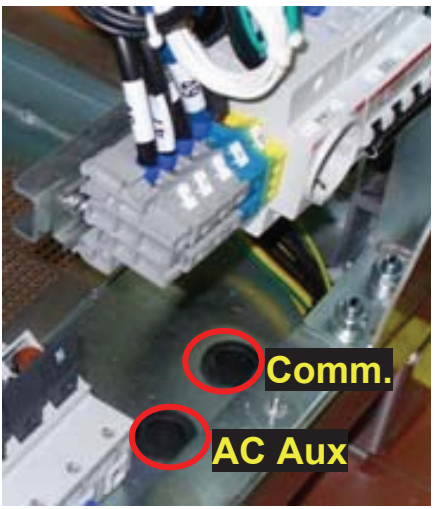


Figure 10-10 : Opening of passage for AC auxiliary wires and communication cables

11. UNDERSTANDING THE DC ENTRY CONFIGURATION

The figures below illustrate the MASTER-SLAVE configuration of the DC entry in the framework.

11.1. MASTER-SLAVE configuration

In this configuration, for every Framework, both a single photovoltaic field is allowed (i.e. a “+” wire and a “-“ wire) or two separate fields (i.e. two pairs of "+” and “-” wires). If a single field is used, the two “+” entries must be short circuited by a wire with a section of at least 3/0AWG. and with adequate insulation (600V), as shown in Figure 11-1 on the right.

In case of use only two wires must be used a section of at least 300 kcmil.
Shortcircuited cable must be a section of at least 3/0 AWG.

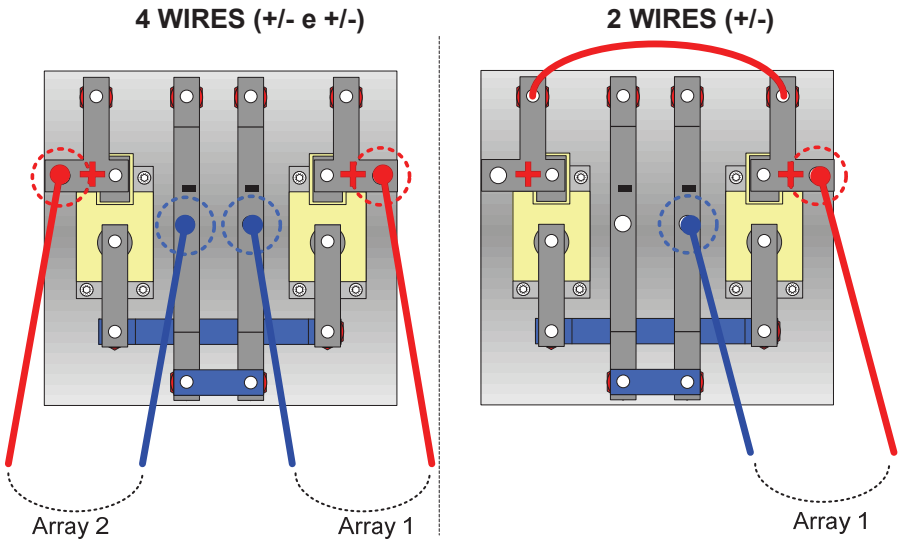


Figure 11-1- Master-Slave configuration

11.2. Electrical connection

The connection of AURORA to the mains electricity must be carried out only by qualified operators and only after having received authorisation from the electricity company in charge of the mains network.

11.2.1 Preliminary operations for the electrical connection

CAUTION: To reduce the risk of fire, connect Auxiliary Input only to a circuit provided with 25 amperes maximum branch circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.

Output circuits are isolated from the enclosure and system grounding, required by Sections 690-40 and 690-42 of the National Electric Code, ANSI/NFPA 70, is the responsibility of the installer.

National Electrical Code, ANSI/NFPA 70 wiring methods should be used.

For details of each single operation to be carried, the instructions given in this chapter (and in its sub-chapters) and all the safety warnings must be read carefully and followed step by step. Any operation which does not comply with these instructions could create a situation of danger for the operator/installer and damage the appliance.

It is extremely important and opportune to disconnect the photovoltaic field before making the connection to the inverter by means of the DC switches upstream, since there could be high voltages capable of generating conditions of serious danger.

Always respect the nominal voltage and current characteristics, as indicated in APPENDIX B: TECHNICAL DATA, when designing your own system. In particular, always keep in mind the following with regard to the photovoltaic system:

- Maximum array DC voltage input to each of the MPPT circuits found under any conditions.
- Maximum array DC current input to each of the MPPT circuits found under any conditions.

Once the inverter is correctly positioned (see Paragrafo §10.1) and the absence of dangerous voltage from the external wires has been ensured, the electrical connections can be made as indicated below.

11.2.2 Connection of DC wires from the photovoltaic field

After carefully reading and understanding the premises of paragraph §11, the wires from the photovoltaic field can be connected.

Since the Master/Slave or Multi-Master configuration is already carried out before delivery of the inverter, only the DC wires have to be connected.

Following the indications of Figure 11-3:

A. For every Framework (i.e. every dissipater), identify the wires from the relative photovoltaic field: these may be 2 or 4.
B. Connect the positive and negative of array 1 through the cable lug (ref. § APPENDIX B: TECHNICAL DATA) as indicated.
C. If present, connect the positive and negative of array 2 through the cable lug (ref. § APPENDIX B: TECHNICAL DATA) as indicated.
D. <u>Check that the polarities of the wires are correct!</u>

The passage of the DC wires towards the framework and another is possible via the opening indicated in Figure 11-2.

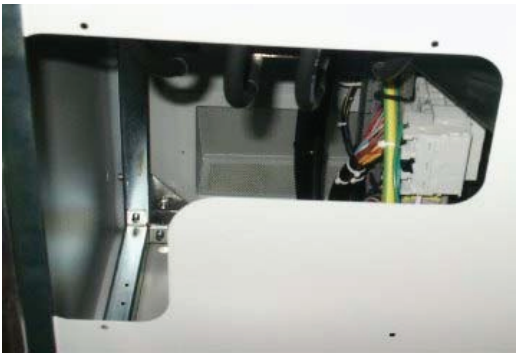


Figure 11-2 : Opening for DC wires between Frameworks – seen from below.

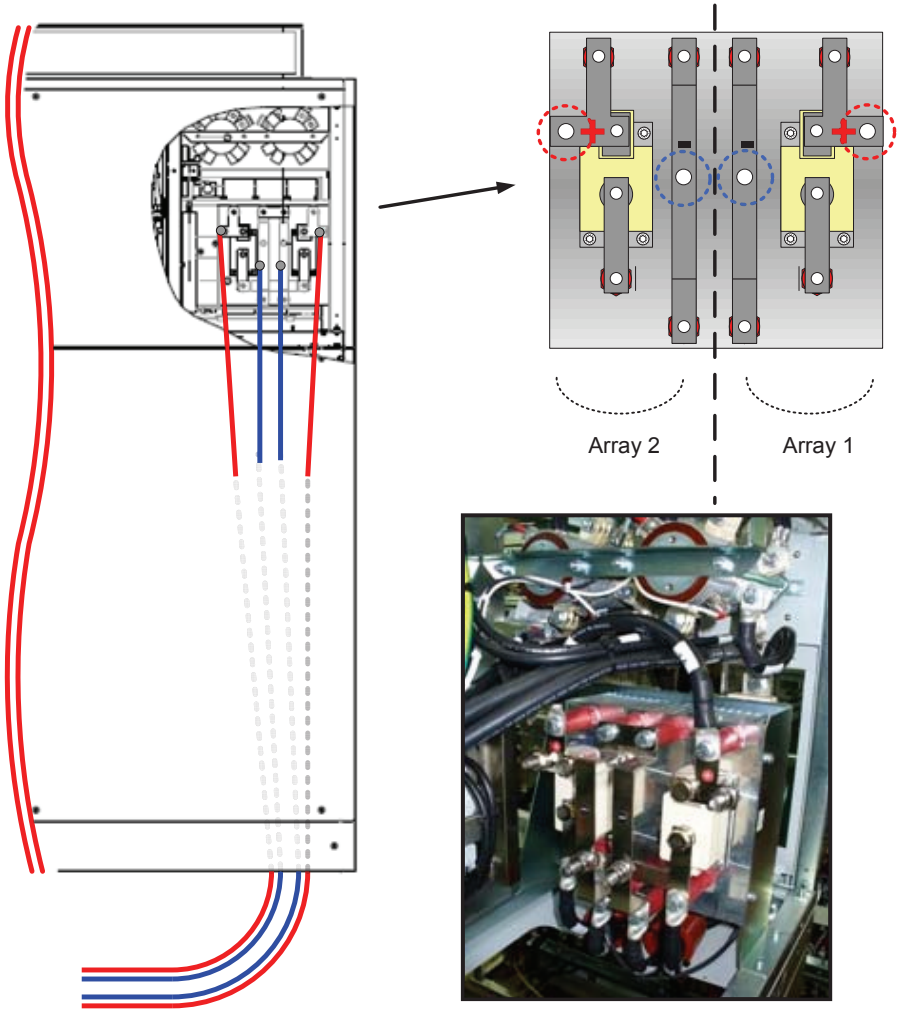


Figure 11-3 : Connection of DC wires – rear and lateral views

After having passed the wires through the hole it is important to make sure that the grill holes which were open are then closed, e.g. by expanded foam. This operation guarantees that no animals or dust can get inside.

11.2.3 Connection of earth wire protection (PE)

Connect the protective earth wire (yellow-green) to the special screw provided via the cable lug (see APPENDIX B: TECHNICAL DATA for that particular type of cable lug).

Figure 11-4 : Connection of earth wire protection (PE)

Before connecting the AC wires, it is absolutely indispensable for the protective earth wire to be connected first.

11.2.4 Connection of AC power wires

➲ Connect the power wires of the mains network to the three front bars. The type of cable lug suitable is indicated in APPENDIX B: TECHNICAL DATA.

Respect the sequence of the phases indicated on the specific labels.

After having passed the wires through the hole it is important to make sure that the grill holes which were open are then closed, e.g. by expanded foam. This operation guarantees that no animals or dust can get inside.

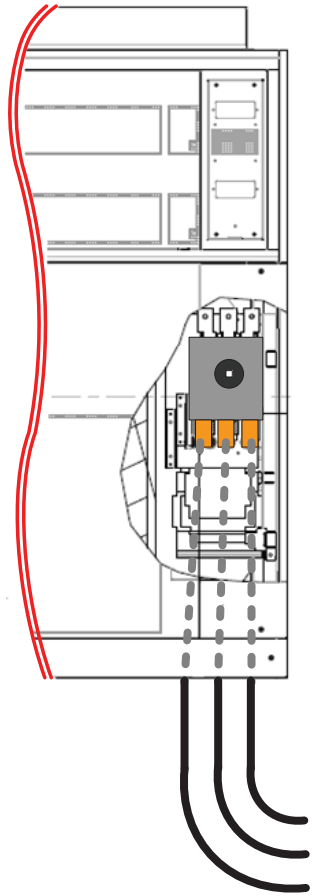


Figure 11-5 : Connection of AC power wires

11.2.5 Connection of auxiliary energy supply

➲ Connect the five-pole wire (3P+N+T) to the clamps indicated in Figure 11-6.

Pay maximum attention to the connection of the neutral wire! Lack of the neutral connection (blue clamp) or inversion of this with the three phases can cause the inverter to breakdown.

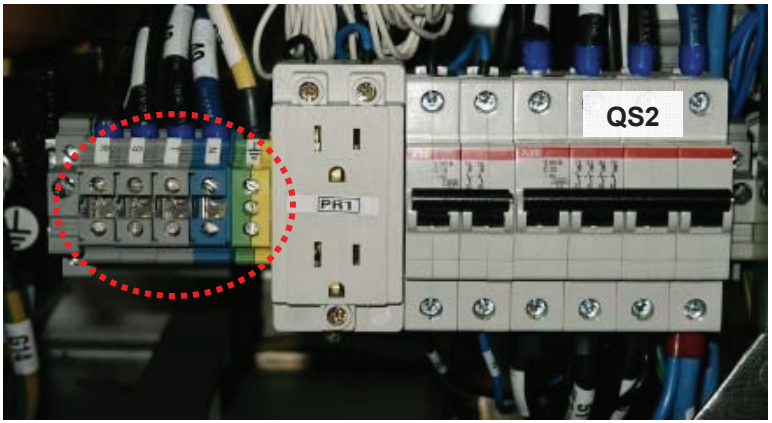


Figure 11-6 : Connection clamps of the auxiliary AC network and relative magnetothermal switch QS2

➲ Leave the QS2 switch in the OFF position (down).

The QS2 switch has two functions: to disconnect the auxiliary voltage and to cut off the system in the case of the breakdown of the OVR AC devices. Since this switch, after closing the front, is no longer directly accessible, it is advisable to install another general switch on an external LV panel for rapid access in the case of need.

➲ It is absolutely necessary to select the proper configuration for the auxiliary supply voltage.
Figure 11-7 shows what do do: in version 480 V you must connect wires 50, 51 and 52 in the back row. In version 208 V these must be moved to the back row.
CHECK THEIR POSITION BEFORE CLOSING QS2!

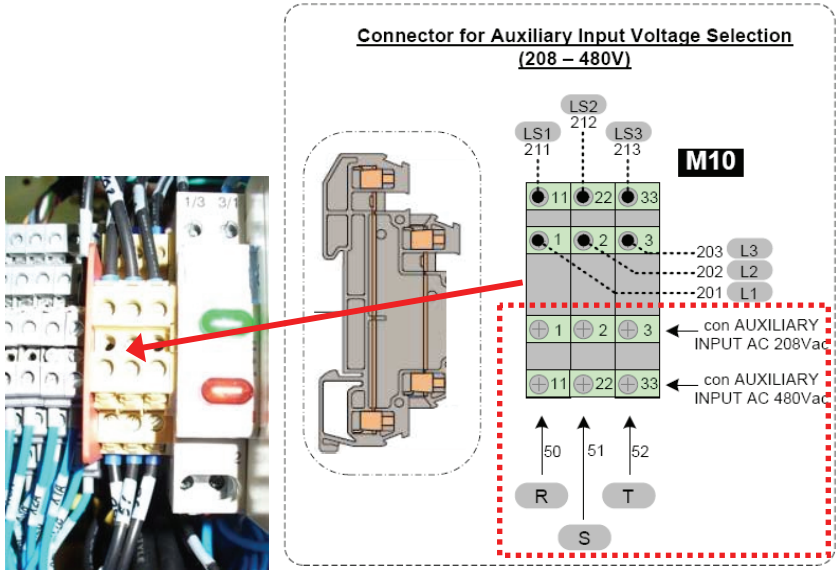


Figure 11-7 : 208 V or 480 V selection clamps for auxiliary AC

11.2.6 Connections for communications/state signals

➲ Take a flat screwdriver of the correct size for the clamp screws (with a tip of about 3.5 mm). Make the following connections, loosening the screws, inserting the wire/s and then tightening the screws again (maximum torque 0.5 N/m).

Do not tighten the screws with force to a torque of more than 0.5N/m to avoid damaging the clamp.

Figure 11-8 shows the terminal board in the ACBOX zone, placed above the connecting clamps of the auxiliary AC network.
The darkened zones are reserved or in any case may not be modified.
The X12 and X13 clamps are dedicated to the communications connection.
The clamps from X1 to X6 are dedicated to the state of the 50 kWp modules and are reserved for the “SUN-DETECT” internal command (ref. §11.2.6.4).

The clamps X9 and X10 are connections for switching on / off by an external command.

The figure also shows the composition of a single clamp: as can be seen connections C-F, B-E and A-D are through connections.

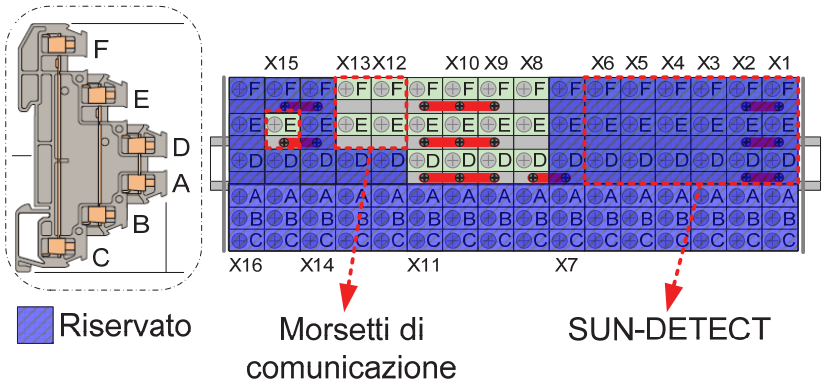


Figure 11-8: Terminal board in the AC BOX zone

The following table shows the signals present on the terminal board:

Table 11-1 : Communications signals on the terminal board

X15	
F	-
E	MASSA_5V_ISO
D	-
A	-
B	-
C	-

X13	
F	+485_USR
E	+485_2_USR
D	CANEXT_H
A	CANEXT_H
B	+485_2_USR
C	+485_USR

X12	
F	-485_USR
E	-485_2_USR
D	CANEXT_L
A	CANEXT_L
B	-485_2_USR
C	-485_USR

X9	
F	MASSA 7
E	MASSA 7
D	MASSA 7
A	MASSA 7
B	MASSA 7
C	MASSA 7

Table 11-2 : State signals on the terminal board

X6	
F	AUX_NC6
E	AUX_NA6
D	AUX_C6
A	AUX_C6
B	AUX_NA6
C	AUX_NC6

X5	
F	AUX_NC5
E	AUX_NA5
D	AUX_C5
A	AUX_C5
B	AUX_NA5
C	AUX_NC5

X4	
F	AUX_NC4
E	AUX_NA4
D	AUX_C4
A	AUX_C4
B	AUX_NA4
C	AUX_NC4

X3	
F	AUX_NC3
E	AUX_NA3
D	AUX_C3
A	AUX_C3
B	AUX_NA3
C	AUX_NC3

X2	
F	AUX_NC2
E	AUX_NA2
D	AUX_C2
A	AUX_C2
B	AUX_NA2
C	AUX_NC2

X1	
F	AUX_NC1
E	AUX_NA1
D	AUX_C1
A	AUX_C1
B	AUX_NA1
C	AUX_NC1

Table 11-3 : Command signals on the terminal board

X11		X10		X9		X8	
F	REMOTE 4	F	REMOTE 3	F	MASSA 7	F	MASSA 7
E	REMOTE 6	E	REMOTE 5	E	MASSA 7	E	MASSA 7
D	REMOTE 2	D	REMOTE 1	D	MASSA 7	D	MASSA 7
A	REMOTE 2	A	REMOTE 1	A	MASSA 7	A	MASSA 7
B	REMOTE 6	B	REMOTE 5	B	MASSA 7	B	MASSA 7
C	REMOTE 4	C	REMOTE 3	C	MASSA 7	C	MASSA 7

11.2.6.1 Connection for the user RS485 serial communication

Following the indications of paragraph § 7, the connections of the RS485 serial line are then made.
See also Table 11-1 for the names of the signals on the terminal board.

- Connect the 485+ signal/s to clamp X13F
- Connect the 485- signal/s to clamp X12F
- Connect the return/s (RTN or earth) to clamp X15E
- After every connection try pulling the wire to make sure that it is correctly screwed.
- If the PVI-CENTRAL Rack is not the last of the chain, it is necessary to make sure that the 120 ohm termination is not present, as explained in the following paragraph.

11.2.6.2 Setting of the 120 ohm termination of RS485

Every PVI-CENTRAL leave the factory with the 120 ohm termination of the RS485 communication line already set (i.e. active).
Figure 11-9 illustrates the three mechanical configurations which show the presence of a card[3] in every framework and the dip-switch relative to the termination.

[3] In some older models, there is no card.

PVI-CENTRAL-50_US
PVI-CENTRAL-100-US

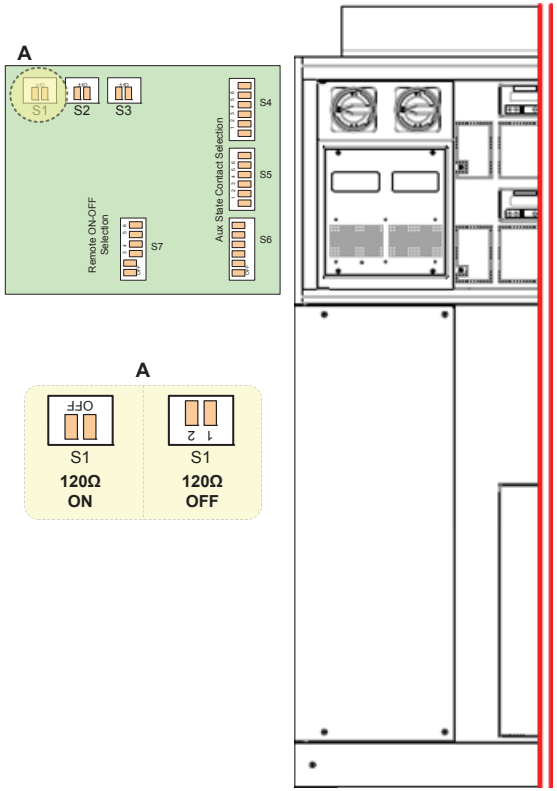


Figure 11-9: 120 ohm termination dip switch position

The card is ONLY accessible from the left side of the inverter!

If a daisy chain connection is used (Figure 7-1e Figure 7-2) the termination of all racks except the last must be disabled.

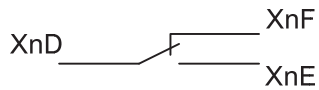
11.2.6.3 Connection for the RS485 serial communication with PVI-STRINGCOMB(-S)

Every PVI-CENTRAL inverter can manage up to 12 boxes for the connection of the PVI-STRINGCOMB(-S) strings.
Following the indications of the PVI-STRINGCOMB(-S) manual, the connection of the RS485 serial line is then made.
See also Table 11-1 for the names of the signals on the terminal board.

- Connect the 485_2+ signal to clamp X13E
- Connect the 485_2- signal to clamp X12E
- Connect the return (RTN or earth) to clamp X9F or X9E or X9D
- After every connection try pulling the wire to make sure that it is correctly screwed.

11.2.6.4 Connection for the state signalling of the single 50 kWp modules.

With reference to Table 11-2 and to Figure 11-8, the position of the AUX contact provides information regarding the presence of enough solar radiation, so that the box may connect to the network mains.
While in the rest position this contact is connected internally, as illustrated below.



Where n indicates the number of the 50 kWp box, according to the numeration indicated Figure 5-1 and paragraph §5.2.7.
E.g. in the case of a 100 kW system, only modules 1 and 2 will be available.

The contact operation mode is predetermined:

➲ ***SUN-DETECT mode***

- When the voltage of the solar field (Vpanel), detected by a module, drops below the preset threshold, the AUX contact switches from excited (XnD-XnE closed) to rest (XnD-XnE open) (seen also the previous figure). This causes the internal transformer to disconnect from the network mains, until there is power consumption during the night.

11.2.6.5 Connection for the on and off command of the single 50 kWp modules.

With reference to Table 11-3 and Figure 11-8, by means of the REMOTE n signals, the connection to the mains or otherwise of the single modules can be commanded.
In default mode, all the REMOTE n signals are connected to earth (X9) by bridges screwed onto the terminal board. These must be removed if you wish to make a connection manually, via a clean relay contact.

Do NOT connect signals under voltage to the REMOTE n clamps, otherwise the circuits of the modules will be irremediably damaged. <u>These must be open or connected exclusively to X9</u>.

11.2.6.6 Setting of the communication addresses.

- Put the QS2 switch in the ON position (up): if the auxiliary line is under voltage, all the displays will come on.
- From the display (ref. § 16 and Figure 16-3) set a different RS485 address on every module, according to the following indications:
  - If the 485 line is connected to a single rack, set a different address on every module of the rack.
  - If the 485 line is connected to more than one rack, set a different address on every module of every rack.
  - **MAKE SURE THAT NO 485 ADDRESSES IN THE SYSTEM ARE THE SAME.**

11.2.6.7 Final checks

- Close the front panel, taking care that the handle is positioned on 0, and insert and tighten the screws.

- Close all the other panels, after first reconnecting the respective earth wires to the inverter casing.

12. STARTING UP (SERVICE)

Before starting up the system, make sure that all connections have been made correctly and, more in general, that all safety conditions have been respected. In particular, it must be certain that all the voltage values are within the set limits (see APPENDIX B: TECHNICAL DATA).

12.1. Functioning conditions

The following diagram gives an indicative illustration of the various functional phases of the inverter.

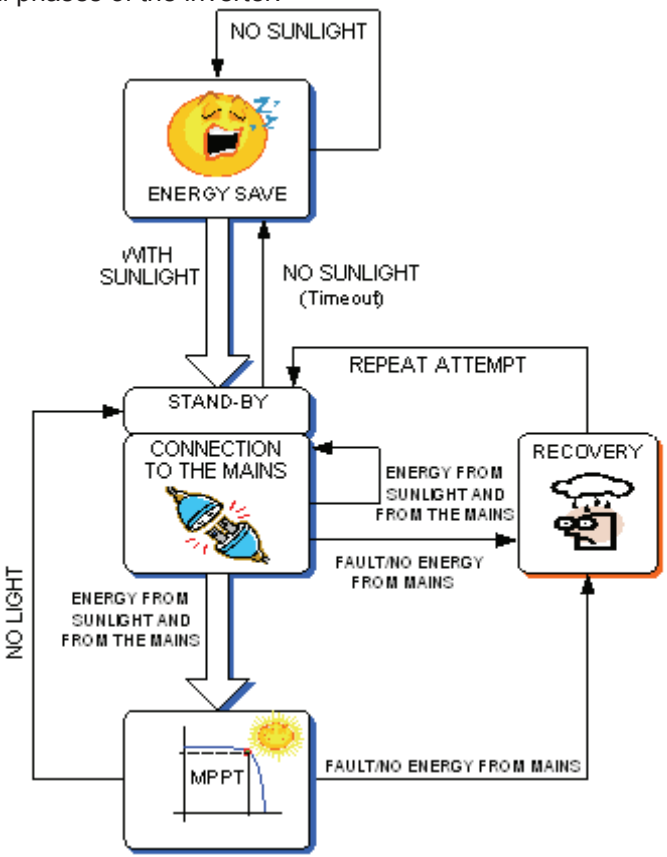


Figure 12-1 : Diagram of inverter functioning

12.2. Start up sequence

The procedure for starting up AURORA PVI-CENTRAL is the following:

1. Make sure that the mains switch is on 0 (horizontal position).
2. Make sure that the DC switches are on 0 (Figure 9-3 – A).
3. Make sure that the main switch QS2 is ON (up): the control logic of the system is activated and the displays on the front are on.
4. Check the front signalling displays on each framework (ref. §5.2.5):
    a. the MASTER LED is on only on the Master module. The presence of several MASTER LEDS on, in a master-slave system, indicates that there is an anomaly.
    b. the displays will show an alarm due to the open switches. The P/N of the system and the S/N of the modules will also be visualised cyclically.
    The POWER ON LED flashes.
    The ALARM LED is on.
    The MISSING GRID LED is on.
5. One at a time, close the DC switches on position 1 (see Figure 9-3 - D):
    a. The display of the module relative to the closed switch will signal the alarm that the AC switch is still open.
    The POWER ON LED flashes.
    The ALARM LED is on.
    The MISSING GRID LED is on.
6. Close the AC switch on position 1, i.e. turning it clockwise:
    a. The display of the module relative to the closed switch will signal the alarm that the AC switch is still open.
    The POWER ON LED flashes.
    The ALARM LED goes off (unless there are anomalies).
    The MISSING GRID LED goes off (unless there are anomalies on the network).
    b. The fans will come on if the DC voltage is sufficient to leave the energy saving mode* (SE).
    * (in the energy saving mode, indicated by the letters SE, the system places itself in a condition of only monitoring, and the fan system of the modules is deactivated).
    c. The display shows a “WAITING FOR SUN” message if the DC voltage is not sufficient to allow for connection to the mains network.

d. If the primary conditions[4] (presence of DC and AC voltage) are satisfied, the system will automatically connect to the AC network:
   - You might hear a noise when the transformer counter closes.
   - The Slaves always connect before the Master.
   - The display of the Master will show: “WAITING SLAVE” for about 20 seconds, then the connection will take place.
   - The POWER ON LED is on.
   - At every connection, the system makes a complete scan of the field to identify the maximum power point. In this phase there is a sudden increase in power, then a decrease, and then another increase. This phase lasts less than 5 seconds.

e. At this point, the Master or Masters will show the power sent to the network, and other parameters (see §16 per funzionamento display). The visualisation of the various parameters on the display occurs cyclically unless the “locked” symbol appears on the display. Otherwise, it is necessary to act manually (by means of the arrows) to obtain the visualisation.

[4] The conditions for connection to the network vary according to the country in which the inverter is sold.

13. SWITCHING OFF AND DISCONNECTING THE SYSTEM

If it is necessary to operate on exposed parts (not protected by panels), it is not sufficient to turn the mains network (AC) and field (DC) switches to 0, because **the input wires are always under voltage"** After switching off and disconnecting the inverter, **YOU MUST ABSOLUTELY DISCONNECT UPSTREAM!**

13.1. Disconnection from the AC network

The procedure for disconnecting AURORA from the network is the following:

1. It is advisable to set all the Master modules of the rack at the REMOTE OFF position by means of the display.
   a. In this way, the power entering the network is practically nil and the AC switch can be opened in the absence of charge.
2. Turn the AC switch to the 0 position, i.e. turning it anticlockwise.
   a. The inverter disconnects from the AC network and therefore no longer provides power.
   b. All the displays of the module relative to the open switch will signal an AC switch alarm.
      NOTE: In this phase, the modules may signal a different error in the first minute, since the opening of the mains network switch is interrupted and a Grid Fault type of alarm or similar may be triggered off. After the recovery time (60 sec), the signal will be the same on all the modules.
      The green LED flashes.
      The ALARM LED is on.
      The MISSING GRID LED is on.

13.2. Disconnecting the photovoltaic field

The procedure for disconnecting AURORA from the photovoltaic field (DC) is the following:

1. Make sure that the AC switch is in the 0 position, following the indications of paragraph §13.1.
2. One at a time, turn the DC switches to the 0 position (Figure 9-3 - A), i.e. rotating them anticlockwise:
    a. both the switches of a framework must be turned so that the modules are physically disconnected from the field (ref. §0 and Table 9-1).

Before going on to the next step, wait 30 minutes to guarantee for correct release of the heat via the system fans.

13.3. Disconnection from the auxiliary line

This operation is carried out by means of either the main switch upstream, if there is one (by the installer) or the internal QS2 switch, according to the following steps:

1. after following the indications of paragraphs §13.1 and §13.2, go on to the next point.
2. remove the front panel (Figure 10-6) and set the QS2 switch to OFF to disconnect the auxiliary power system..

At this point, the system is completely disconnected and switched off.

If it is necessary to operate on exposed parts (not protected by panels), it is not sufficient to turn the mains network (AC) and field (DC) switches to 0, because **the input wires are always under voltage"** After switching off and disconnecting the inverter, **YOU MUST ABSOLUTELY DISCONNECT UPSTREAM!**

13.4. Disconnection upstream of the inverter

If it is necessary to move/remove or scrap the PVI-CENTRAL, or in any case to completely insulate it from the rest of the plant, it is absolutely obligatory to disconnect the device from both the DC and AC sides, i.e. from the photovoltaic field and from the mains network. To do this, it is necessary to disconnect the DC input voltage and the output lines to the mains distribution connected to the AC clamps, and the 3P+N auxiliary power.
At this point, if necessary, the DC and AC wires to the inverter can be physically disconnected, removing the necessary panelling as indicated in §10.2.3.

13.5. Removal and insertion of a 50 kWp module

For some types of intervention it may be necessary to remove a 50 kWp module from its seat (for example, if the module itself breaks down or to replace the cartridge of the OVR DC protection device).

13.5.1.1 Initial preparations

A module weighs too much to be supported by a person, and it is therefore necessary to use a mechanical aid to facilitate the extraction operation and the successive insertion (see the example in the figure on the right).

1. Follow the indications of paragraphs §13.1, §13.2 and §13.3, and then go on to the next point.
2. Remove the convex panel on the front of the module to be removed (ref. Figure 15-1).
3. Identify the module to be extracted and remove the screws and the screw-on towers which support the convex panel.
4. Push and extract the two fold-away handles at the ends of the module.

13.5.1.2 Removing the module.

1. After completing il §13.5.1.1 continue as follows:
2. Position the lifting trolley with the platform or prongs in line with the base of the module to be extracted.

DO NOT JERK!

3. Pull the module about 15 cm from the framework and position the lifting trolley with the platform or prongs under the base of the module to be extracted.
4. Finish extracting the module completely from the seat.

13.5.1.3 Insertion of the module.

1. Align the platform, or prongs, on which the module to be inserted is positioned, with the supporting brackets of the framework.
2. Push the module into the framework, leaving it protruding about 15 cm.
3. Remove the trolley and push the 50 kWp module firmly so that it enters the framework.

DO NOT PUSH BY THE FAN VENTS!

4. Fold in the handles at the two ends.
5. Insert and screw on the screw-on towers into the bottom holes and the anchorage screws into the top holes.
6. Replace the convex panel and screw it on.

13.5.1.4 Final operations

1. After completing §13.5.1.3 continue as follows:
2. Carry out the start-up procedure again, following the instructions in paragraph §12.2.

14. DISPOSAL

When the PVI-CENTRAL must be disposed, it must be completely disconnected according to the indications of §13.
The PVI-CENTRAL must then be taken to an authorised collection point (see also paragraph §1.1).

15. MAINTENANCE/REPAIRS



This chapter describes the operations necessary to disconnect the device in order to carry out internal repairs in safety.
The type of disconnection depends on the action to be carried out.
If the product is to be scrapped, it must first be completely disconnected from the DC and AC wires (see §14).

To maintain the efficiency of AURORA PVI-CENTRAL and guarantee conditions of safety, the maintenance operations described below are necessary. Maintenance also includes checking, and if necessary replacing, components subject to wear during functioning.
This chapter also describes what to do in the case of battery failure.

Since most interventions require the removal of the panels, it is fundamental to make sure that before switching the inverter on again all the panels have been correctly replaces, with particular care given to the front panels of the fuses and the relative earth connections.

15.1. Routine maintenance

Maintenance inside the PVI-CENTRAL must be carried out following the procedures given below.

ROUTINE MAINTENANCE TABLE

ACTIVITY	FREQUENCY*	PAR.
Cleaning of filters and grills and internal inspection for dirt and/or water	Every six months	§15.1.1
Tightening screws and check on colour changes	Every six months	§15.1.2
Checks on AC BOX zone	Annually	§15.1.3
Check on Framework zone	Annually	§15.1.4
Check on warning cards and signalling devices	Annually	§15.1.5

* The frequency of maintenance operations could be increased according to the environmental conditions of the place where the inverter is situated.

15.1.1 Filter cleaning

To gain access to the filters, some panels must be removed. In this case, a general visual inspection of the PVI-CENTRAL is advisable.

15.1.1.1 Filter of the Modules zone

To clean the modules zone, the convex panel/s on the front of the inverter must be removed by unscrewing the 4 cross screws indicated in **Figure 15-1**.

NOTE: Although it is possible to remove the front panel with the inverter switched on, it is advisable to switch off before removal.

Figure 15-1 : Screws on the “Modules Zone” panel

After removing the panel, the filter fitted onto the internal side can be removed Figure 15-2) which can then be washed (without using solvents). Also clean the panel grills if necessary.

Figure 15-2 : The “Modules Zone” filter

NOTE: Before replacing the filter, make sure that it is perfectly dry!

If no further checks are necessary, replace the panel.

15.1.1.2 ACBOX zone filter

Before removing the panel, carry out the operations to switch off the inverter (see §13).

To clean in this zone, the lower panel on the front of the inverter must be removed by unscrewing the 6 screws indicated (see Figure 10-6).

After removing the panel, the filter fitted onto the internal side can be removed (see Figure 15-3) which can then be washed (without using solvents).
Also clean the panel grills if necessary.

NOTE: Before replacing the filter, make sure that it is perfectly dry and turn the knob of the power switch to 0.

If no further checks are necessary, replace the panel.

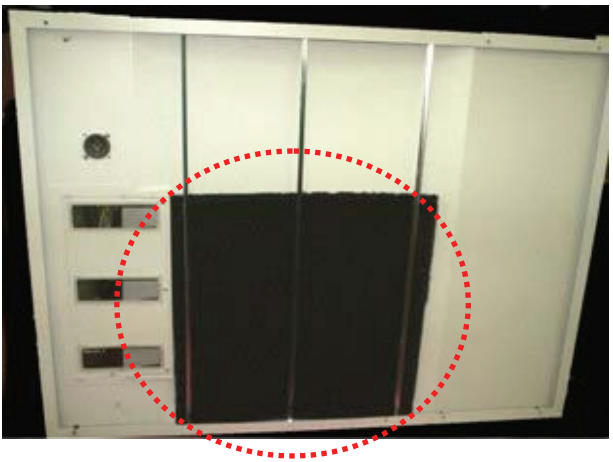


Figure 15-3 : "ACBOX Zone" filter

15.1.1.3 DC fuses zone filter

Before removing the panel, carry out the operations to switch off the inverter (vedi §13).
DISCONNECT the inverter upstream from DC and AC voltage and wait at least 5 minutes before removing!

To clean in this zone, the left front panel of the inverter must be removed by unscrewing the 4 screws indicated (see Figure 15-4 and Figure 15-5): After unscrewing the screws turn the panel forwards, as in Figure 15-5. A mechanical block will prevent it from falling. To remove it from the seat, bring it to a vertical position, then pull it towards you, then turn it slightly downwards and pull it towards you again.

After removing the panel, the filter fitted onto the internal side can be removed (see Figure 15-4) which can then be washed (without using solvents).
Also clean the panel grills if necessary.

NOTE: Before replacing the filter, make sure that it is perfectly dry!

When the work has been completed, refit the panel taking care that it is inserted correctly, i.e. first inserting the two mechanical hooks into the holes in the carpentry. In this way, the panel cannot come into contact with the electrical part.

Figure 15-4- "DC Fuses Zone" (the inside and the outside of the panel)

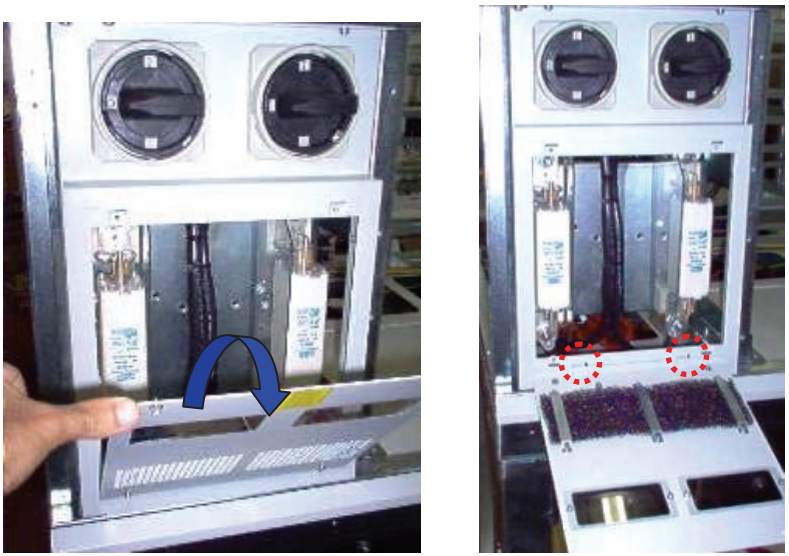


Figure 15-5- "DC Fuses Zone" (mechanical block)

15.1.1.4 AC fuses zone filter

ATTENTION: Before removing the panel, carry out the operations to switch off the inverter (see §13).
DISCONNECT the AC voltage and wait at least 5 minutes before removing!

To clean in this zone, the right front panel of the inverter must be removed by unscrewing the 4 screws indicated (see Figure 15-6): after unscrewing the screws and turning the panel forwards. A mechanical block will prevent it from falling. To remove it, bring it to a vertical position, pull it towards you, then turn it slightly downwards and pull it towards you again.

After removing the panel, the filter fitted onto the internal side can be removed (see Figure 15-6) which can then be washed (without using solvents).
Also clean the panel grills if necessary.

NOTE: Before replacing the filter, make sure that it is perfectly dry!

When the work has been completed, refit the panel taking care that it is inserted correctly, i.e. first inserting the mechanical hook into the hole in the carpentry. In this way, the panel cannot come into contact with the electrical part.

Figure 15-6- "DC Fuses Zone" (the inside and the outside of the panel)

15.1.2 Checks on screws and visual inspections

To check that screw are tight, the inverter must be opened. This implies the absolute necessity of disconnecting the whole system: on both the DC and the AC sides.

> If it is necessary to operate on exposed parts (not protected by panels), it is not sufficient to turn the mains network (AC) and field (DC) switches to 0, because **the input wires are always under voltage"** After switching off and disconnecting the inverter, **YOU MUST ABSOLUTELY DISCONNECT UPSTREAM!**

Once the system has been disconnected and the inverter panels have been removed (see Figure 10-6: In this case, also remove the panels on the other sides), you can then carry out the visual inspection and check that the screws are tight at the following anchorage points:

To be checked and/or tightened	Check points
Upper and lower EMI FILTER (placed inside the framework on the right)	Wire connection clamps (if present)
AC fuse box	Connection points
DC fuse box	Connection points
AC input clamps	Connection points
Clamps of DC input + of dissipater groups	Connection points + screws on the bars
AC network connection bars	Connection points
DC switches (n. 2)	Connection points

The internal inspection of the modules can only be carried out by a specialist, suitably trained technician.

The visual inspection also includes checking any points where there is an evident change in colour compared to other similar points.

- It is important to check that there is no change in colour over time at the anchorage points, around the screws and in the insulation. Any anomalous colouring indicates thermal stress and therefore possible functioning problems. In such a case, contact your dealer who will assess whether a replacement is needed. Also check on the presence of any corroded spots.

- When the checks have been completed, replace the panels and the relative earth connections correctly.

15.1.3 Checks on AC BOX zone

The following checks regard the cooling system and the protective devices positioned in the ACBOX zone, and it is therefore necessary to remove the front panel indicated in Figure 10-6 (also read paragraph §10.2.3).
Replace the panel after the checks have been completed.

Before removing the panel, carry out the operations to switch off the inverter (see §13). DISCONNECT the AC voltage and wait at least 5 minutes before removing!

15.1.3.1 To check the fans

The module fans are monitored automatically when the inverter is functioning, and therefore do not need to be checked.

To check on correct functioning of the fans in the ACBOX zone, carry out the following procedure:

Note the position at that moment of the thermostat shown in Figure 15-7 (in order to restore the initial condition later: it is normally set at about 40°C).

The thermostat is situated behind the clamps group of Figure 11-6.

- Turn the knob of the thermostat temperature completely anticlockwise (the QS2 switch must be ON).
- In this position, the fan thermostats will be activated. Check that they are all moving regularly, i.e. without producing anomalous noises.
- Turn the thermostat back to the value noted previously.

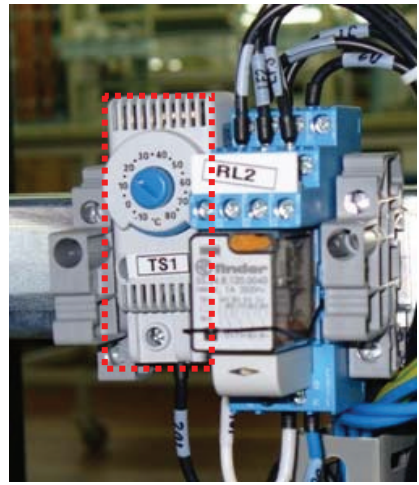


Figure 15-7: Thermostat

Figure 15-8: Position of the fans in the ACBOX compartment

15.1.3.2 To check the functioning of the power switch

For this check, press the button indicated by the arrow (see Figure 15-9) with a screwdriver and check that the knob moves from the “0” position to the yellow position “Tripped”.

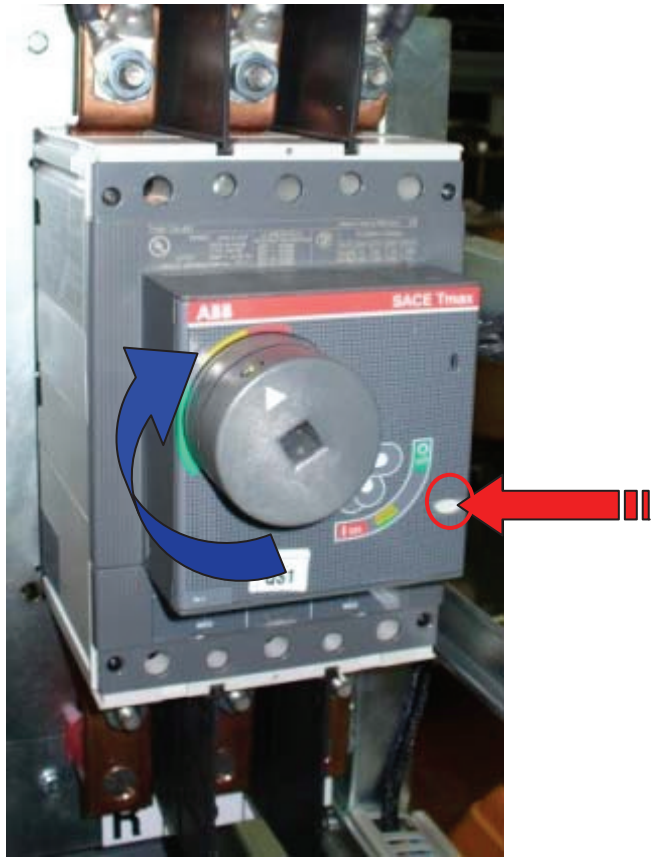


Figure 15-9- Power switch

Before replacing the panel, turn the AC knob anticlockwise to the 0 position (in the figure the return rod is not shown: use the aid of a hexagonal spanner as a lever against the rod, keeping the rod perpendicular to the switch).

15.1.3.3 To check the OVR AC devices

Check that the inspection windows are not coloured red. If they are, replace the faulty cartridges with others of the same type.

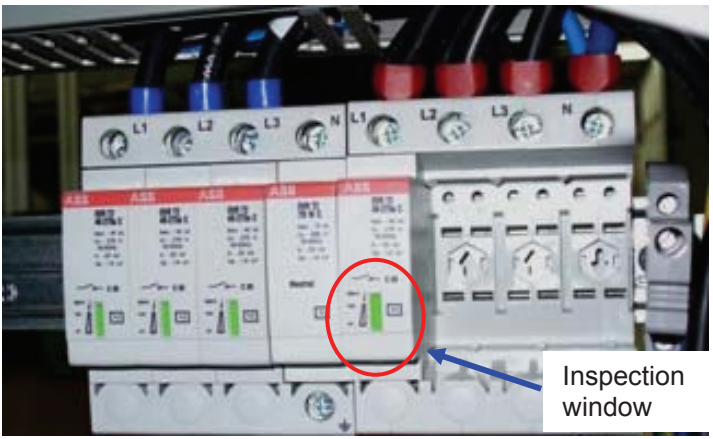


Figure 15-10- Dispositivi OVR AC

- If the cartridges must be replaced on the left hand device, the fuses in the fuse box F2 of Figure 15-11. Use 14x51 16A gG type fuses.

Figure 15-11- F2 fuse box for OVR AC protection

15.1.3.4 To check the fuse of the Ground Fault Detector (GFD) system.

If the red LED of the GFD is on, you must replace the fuse in the compartment indicated in Figure 15-12, so that the inverter can connect to the network normally.

Use the following fuse:
Littelfuse type KLKD, rated 3.5A 600Vdc for model PVI-CENTRAL-100-US.
Littelfuse type KLKD, rated 3A 600Vdc for model PVI-CENTRAL-50-US.
Littelfuse type KLKD, rated 2A 600Vdc for model PVI-CENTRAL-30-US.

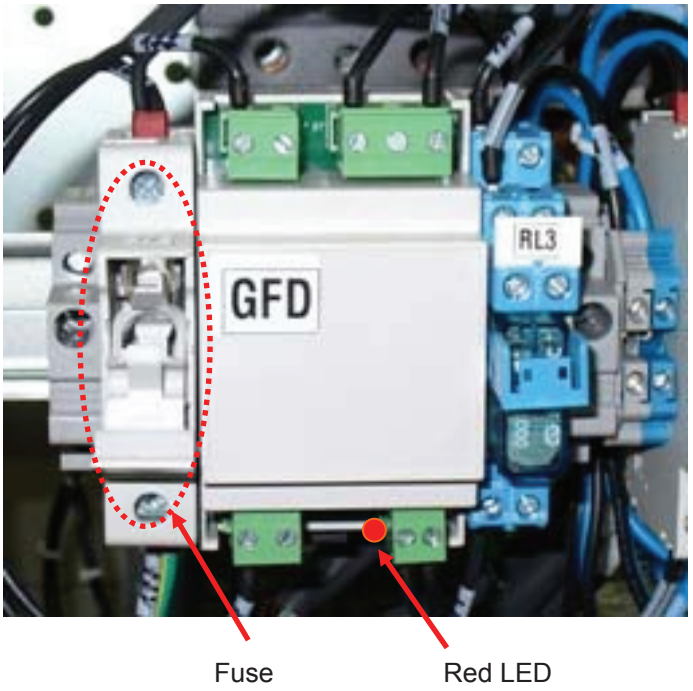


Figure 15-12- Ground Fault Detector fuse support

15.1.4 Checks on the Framework

15.1.4.1 To check the OVR DC devices

The check to ensure that the OVR DC device is intact is carried out automatically. The display will signal if it is not intact. In this case, the faulty cartridge must be replaced.

The OVR DC devices are to the left of every module, as indicated in the figure below.

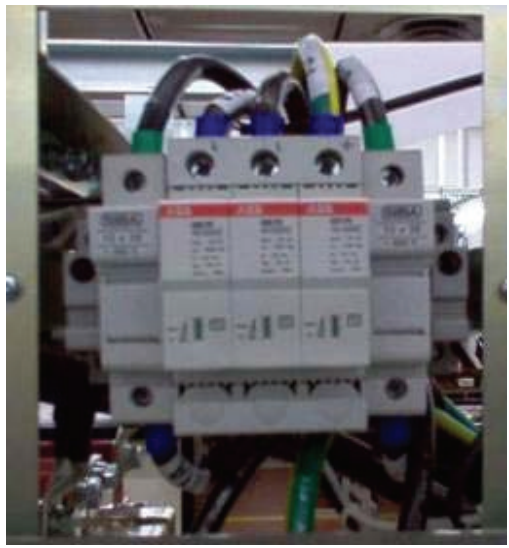


Figure 15-13: OVR DC device

In order to replace the faulty cartridge, the module which has signalled the problem must be removed.

> Also check that the fuses positioned in the two lateral fuse supports are not burned. If this is the case, replace them with identical fuses (10x38 4A gR 600V).

The module must be removed only by a trained technician and carried out according to the indications of paragraph §13.5.

15.1.4.2 Visual inspection of fuses

For this inspection, it is not necessary to open the panels and switch off the inverter: the fuses can be checked by visual inspection via the window shown in Figure 15-5 and Figure 15-6.

The state of the fuses is signalled by a small lever above each fuse: if the fuse is intact, the lever is horizontal and attached to the fuse box, otherwise the lever will be vertical.

In the case of a broken fuse, the inverter could fail to detect sunlight and always indicate that there is no sun.

15.1.5 Check on warning cards and signalling devices

Check that all the labels giving warnings or indications are intact and firmly adhered to the inverter chassis. The danger labels, in particular, must always be clearly visible.

15.2. Replacement of faulty battery

This component must be replaced only by a qualified technician.

To remove the battery, the module must be extracted from its seat.

Every 50 kWp module in the inverter has a buffer battery of the CR2032 type. It powers the internal clock for the statistical calculations.

If the system signals “Battery Fail” on the display, contact your dealer for replacement.

The system will continue to function, although the energy data will not be correct.

ADD Reference to remove the module

16. INTERACTIVE DISPLAY

16.1. How the display functions

The two-line LCD display (Figure 16-1) is situated on the front panel of every 50 kWp module and shows the following information:

- The functioning state of the inverter and the statistical data;
- Service messages for the operator;
- Alarm messages

During normal functioning, the data are shown cyclically. The screens change every 5 seconds, or can also be varied manually pressing the UP and DOWN keys.
In any case, to return to the preceding menu, just press the ESC key.

Activation of cyclical scrolling is indicated by the 2 arrows in the top left corner of the display.
Scrolling can be blocked by pressing the ENTER key. The padlock symbol will appear.

Cycle arrows  Padlock 

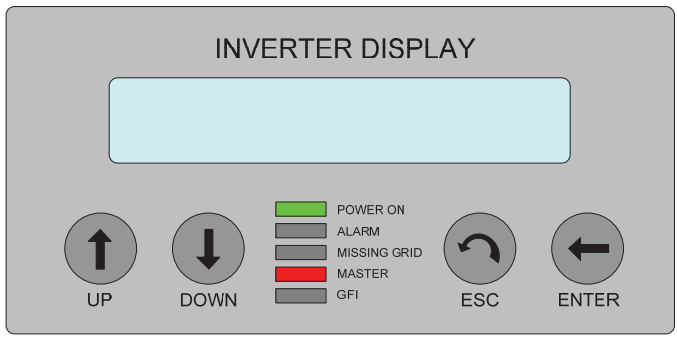


Figure 16-1 : Inverter display

The display shows only 2 lines, therefore to scroll up and down the items or to gain access to the sub-menus of the items, the side UP and DOWN keys must be used.
The item selected will be shown by an arrow on the left side of the display. when the item has been chosen, press ENTER to gain access to the relative sub-menu.

16.2. Entry of the password

If a password is requested, carry out the following procedure:

The default password is 0000. This can be modified by the settings menu (Figure 16-3).

Using the display keys, you can enter the numbers:

- With ENTER, you go from one number to another (from left to right)
- With ESC you return to the preceding number (from right to left)
- By pressing ESC several times you will return to the previous menus.
- DOWN scrolls downwards through the numbers (from 9 to 0)
- UP scrolls upwards through the numbers (from 0 to 9)

example

After entering the correct password, press ENTER to gain access to the various information saved in the protected section.

16.3. The display LEDs

The display also has several signalling LEDS:

POWER ON: [GREEN LED] This indicates the presence of energy and of connection / disconnection from the mains network.

ALARM: [RED LED] This indicates a problem.

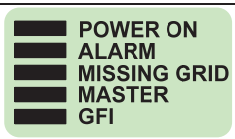
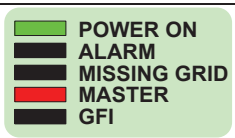
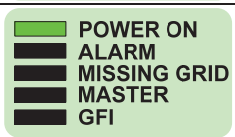
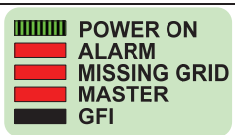
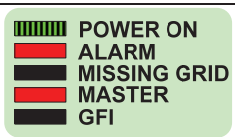
MISSING GRID: [RED LED] This indicates lack of voltage on the network or an anomaly of the same. A led may come on because the mains switch is open (in which case it twill be signalled on the display).

MASTER: [RED LED] This indicates whether the module is a Master (on) or a Slave (off).

GFI: [RED LED] Not used at present.

The following table shows the 5 configurations which can be indicated during functioning:

Table 16-1 : Meanings of the display LEDs

STATE OF LED	MEANING	
	➲ All the LEDS are off. ➲ The module is not receiving power and all signals are absent.	
	➲ The module is connected to the mains ➲ The module is a Master.	
	➲ The module is connected to the mains ➲ The module is a Slave.	
	➲ The module is not connected to the mains ➲ The module is a Master. ➲ The AC network is absent or out of range ➲ The module is in alarm state for a problem on the mains network.	
	➲ The module is not connected to the mains ➲ The module is a Master. ➲ The module is in alarm state for a problem.	

NOTE: In the table, the uniform colour indicates that the LED is on, while alternate colour indicates that it is flashing.

16.4. Functional diagram of the display (Menu)

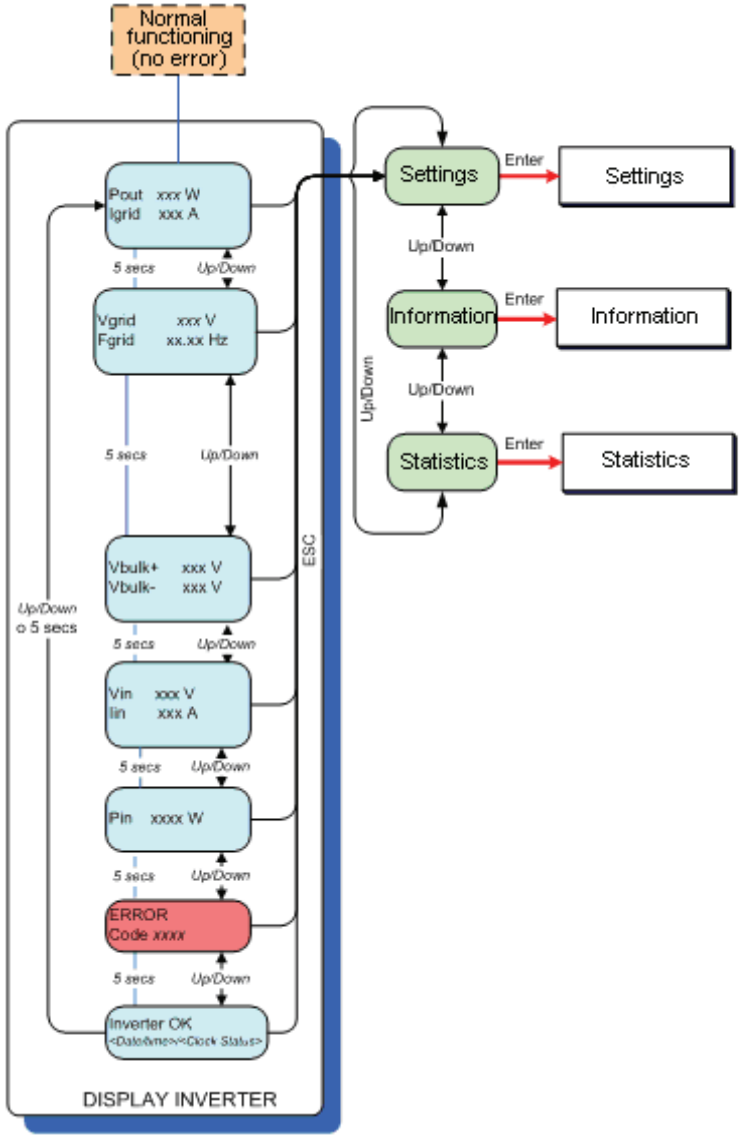


Figure 16-2 : Functional diagram of the display (main menu)

Figure 16-2 illustrates the information shown on the display during normal functioning.
By pressing the ENTER, ESC, UP, DOWN keys, you can move through the menus as indicated.

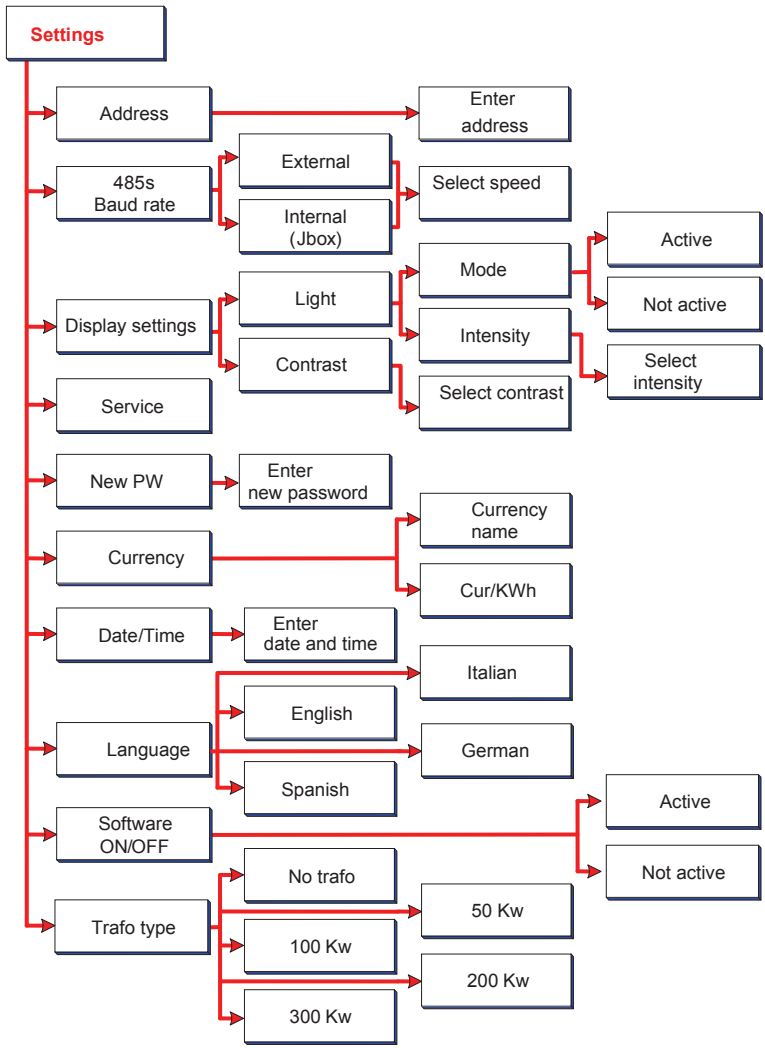


Figure 16-3 : Functional diagram of the display (main settings)

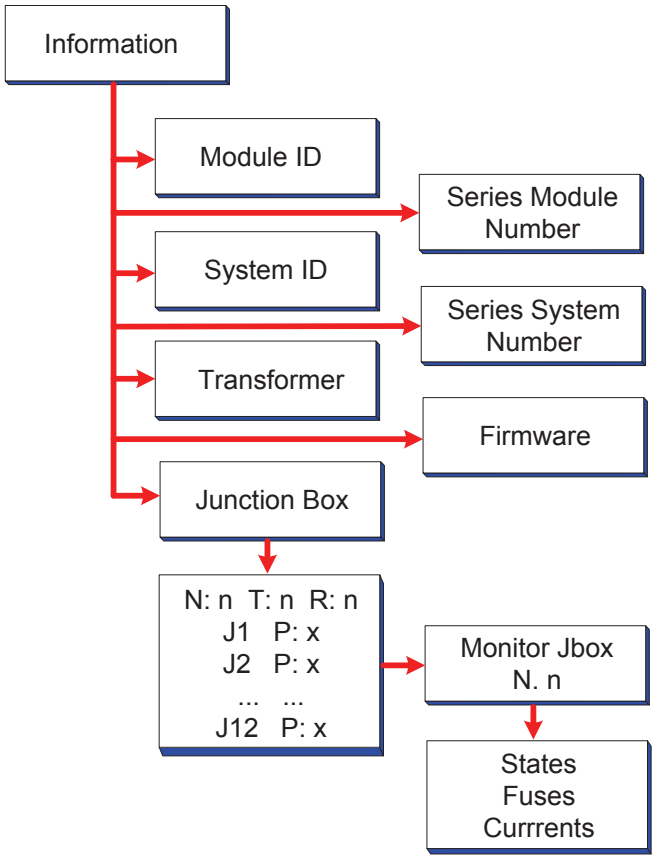


Figure 16-4 : Functional diagram of the display (information menu)

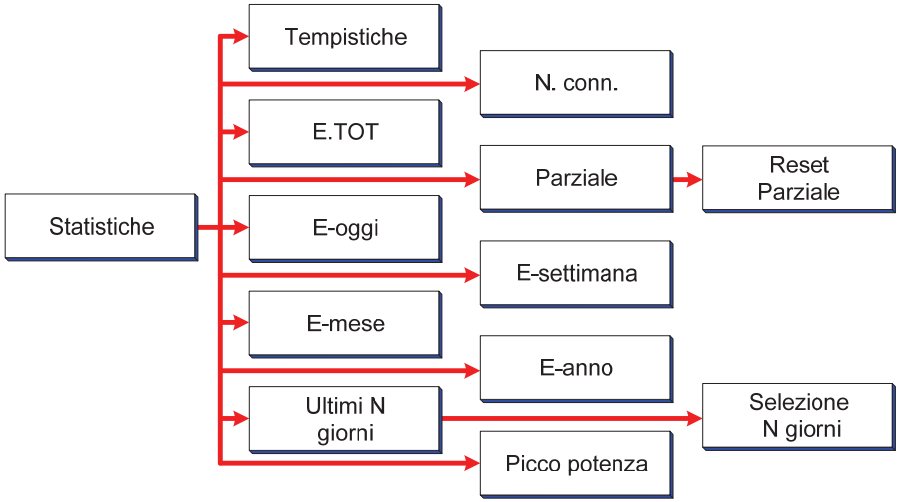


Figure 16-5 : Functional diagram of the display (statistical menu)

16.5. Information

By selecting the INFORMATION menu, the display will show a sub-menu indicated in Figure 16-4.

16.5.1 Module ID

By selecting this item, you will see the Part Number of the module selected which is part of the system.

16.5.2 Mod. Series N.

By selecting “Mod. Series N.), the following information will be shown:

- Series N.: Series number of the selected module
- Wk xx Yr xx: Module production week (Wk) and year (Yr).

16.5.3 System ID

Selecting this item, you will see 4 figures indicating the Part Number of the system.

16.5.4 Sys. Series N.

By selecting “Sys. Series N.), the following information will be shown:

- Series N.: The series number of the rack

16.5.5 Trafo type

By selecting “Trafo type”, the following information will be shown:

- Trafo yes/no: Whether there is a transformer or not
- Mod. N.: The number of modules in the system

16.5.6 Firmware

By selecting this item, the release of the software in the module will be shown.

16.5.7 Junction Box (only on the module designation for control)

This item of the menu allows for verification of the state of the StringCombs in the system.
By selecting “Junction Box”, the following information will be shown:

- N: n T: n R:n : (Nn) is the number n of StringCombs set by the installer.
  (Tn) is the number n of the rack (Rack N.) to which the StringCombs refer.
  (Rn) is the number n of StringCombs detected by the module. R must coincide with N, unless there is a fault.
- Jn P:x : (Jn) is the StringComb with Field number n. The number n varies from 1 to 12.
  (Px) indicates the presence Y/N of the PVI-STRINGCOMB. There can be a maximum of 12.

16.5.7.1 States

This item of the menu allows for verification of the state of all the parameters of the StringCombs selected previously. These can be OK or NOT OK:

- Fuses: State of fuses
- Temp: Temperature of the box
- Volt: Voltage of the field
- Balance: Currents of unbalanced strings
- Current: String current
- Power: Power of StringComb
- Comm.: Communication
- Cal: Calibration of currents

16.5.7.2 Fuses

This item of the menu allows for verification of the state of the single fuses of the StringComb selected previously. These can be OK or NOT OK:

- F1: State of fuse F1
- ... .
- F20: State of fuse F20

16.5.7.3 Currents

This item of the menu allows for verification of the state of the currents of the StringComb selected previously. These can be OK or NOT OK:

- I1: State of current I1
- ... .
- I20: State of current I20

16.6. Statistics

By selecting the STATISTICS menu, the display will show a sub-menu as indicated in Figure 16-5.

16.6.1 Timing

By selecting “Timing”, the following information will be shown:

- Life: Total functioning time
- Mains: Hours connected to the mains network

16.6.2 N. Conn (Number of Connections)

By selecting “N. Conn”, the number of connections with the mains network will be shown.

16.6.3 E-Tot

By selecting “E-Tot”, the following information will be shown:

- E: Total energy produced
- Val.: Economic gain

16.6.4 Partial

By selecting “Partial”, the following information will be shown:

- PT: Total functioning time since the last time the count was reset
- E: Total energy produced since the last time the count was reset
- Val.: Economic gain since the last time the count was reset

Partial reset: This allows for resetting the preceding parameters at zero.

16.6.5 E-today

By selecting “E-Today”, the following information will be shown:

- E: Total energy produced today
- Val.: Economic gain today

16.6.6 E-Week

By selecting “E-Week”, the following information will be shown:

- E: Total energy produced this week
- Val.: Economic gain this week

16.6.7 E-Month

By selecting “E-Month”, the following information will be shown:

- E: Total energy produced this current month
- Val.: Economic gain this current month

16.6.8 E-Year

By selecting “E-Year”, the following information will be shown:

- E: Total energy produced in the current year
- Val.: Economic gain in the current year

16.6.9 Last N Days

By selecting “Last N Days”, the following information will be shown:

- E: Total energy produced in the last number (N) of days
- Val.: Economic gain in the last number (N) of days

16.6.10 Power Peak

By selecting “Power Peak”, the following information will be shown:

- PPA: Value of the power peak on switching on
- PPT: Value of the power peak today

17. BEFORE USING THE SOFTWARE

The software produced for the PVI-CENTRAL allows for setting the transmission parameters (e.g. baud rate) and for control (e.g. power limit) and for monitoring the electrical dimensions (e.g. values of the phase voltages).

To be able to communicate with PVI-CENTRAL, the computer used must have a free COM serial port.

Since, as already described in Capitolo §7, the serial transmission standard of the PVI-CENTRAL is the RS485, while the COM port of the computer is used on the RS232 standard, **an Aurora RS232/485 converter must be used** (Aurora 232/485 Converter).

17.1. Software installation

Place the CD provided with the PVI-CENTRAL into the computer and launch the “setup.exe” program, then follow the instructions on the screen.

On conclusion, the icon  “Aurora CENTRAL CVI” will appear on your Desktop[5] and in the position *Start* → *Programs* → *Aurora CENTRAL CVI*.

The next chapter shows how to use the PVI-CENTRAL configuration and monitoring program.

[5] Future software versions could have a different icon.

18. MONITORING AND CONFIGURATION INTERFACE

18.1. Conventions used

In this chapter the following conventions are used in the text:

- **[BUTTON]**: indicates a button
- *(selection list):* Indicates a list for selection
- *Menu name:* Indicates the name of a menu
- *window name*

18.1.1 Rack and Modules

Hereinafter, the single 50 kWp boxes are indicates as "**Modules**".
The word "**Rack**" indicates a system composed of several modules.

18.2. Access levels

The software allows for two access level:

- **Standard (User)**: this allows only for monitoring. Some windows of the program have hidden and/or limited functions.
- **Advanced (Technic)**: this allows for monitoring and additional functions. All the program functions are enabled except for some which are for the exclusive use of the constructor.


The password for advanced access is "aurora"[6].

[6] The password cannot be changed. Always use small letters.

18.3. Diagram of monitoring software

The following “map” simplifies learning the monitoring program structure. The next paragraphs will describe in detail the single blocks of the diagram.

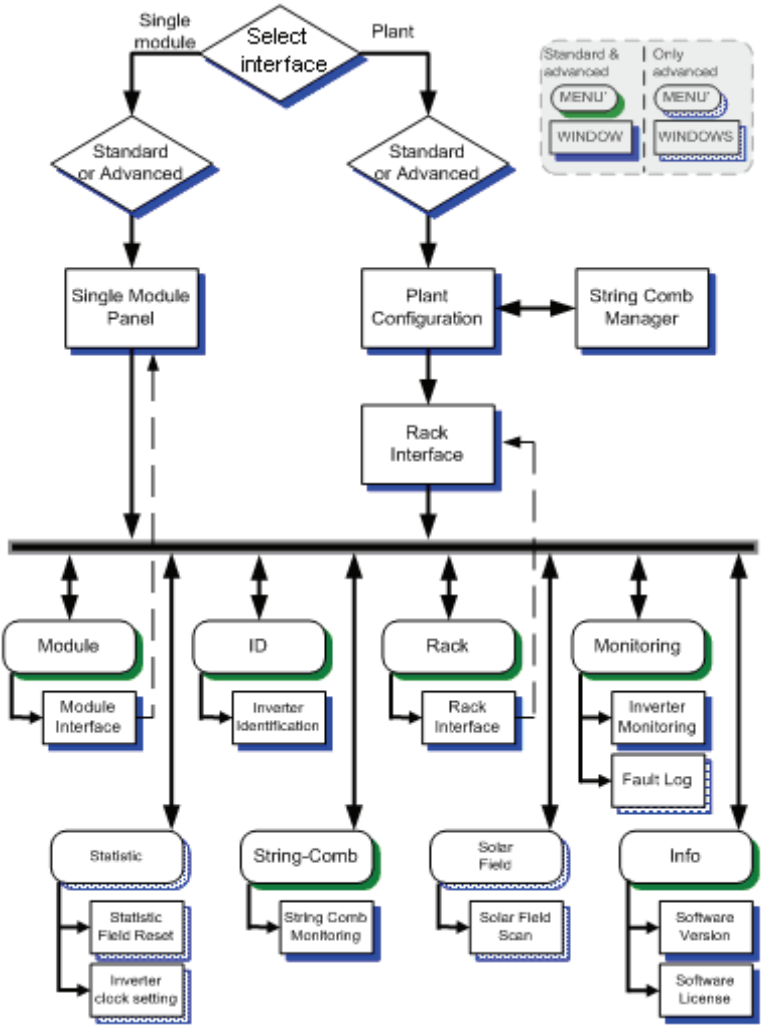
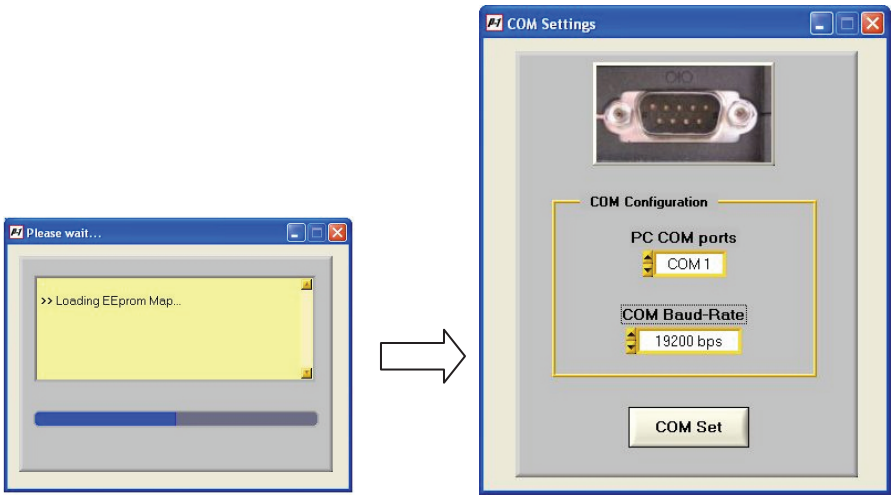


Figure 18-1 : Diagram of monitoring software

18.4. Diagram of monitoring software

➲ Click twice on the icon  of the “Aurora Central CVI” program and wait for the following window to appear:



➲ Choose the COM port (*PC COM Ports*) to which the RS485/232 converter is connected.
➲ Choose the communication speed (*COM Baud-Rate*).
➲ Press [**COM SET**].

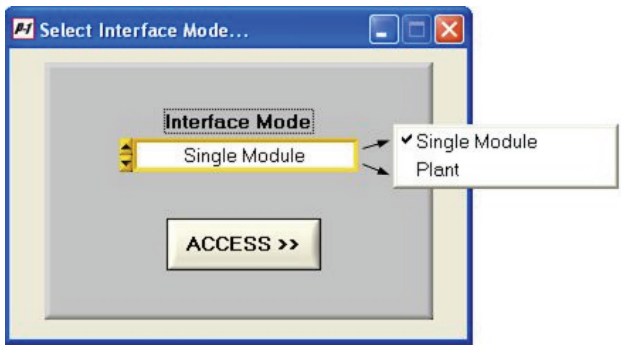


Figure 18-2 : Choice of interface type

- Choose the type of visualisation by (*Interface Mode*):
  - *Single Module*: all the modules connected to the RS485 line are visualised.
  - *Plant*: all the racks connected to the RS485 line are visualised.
  - Press [**ACCESS >>**].

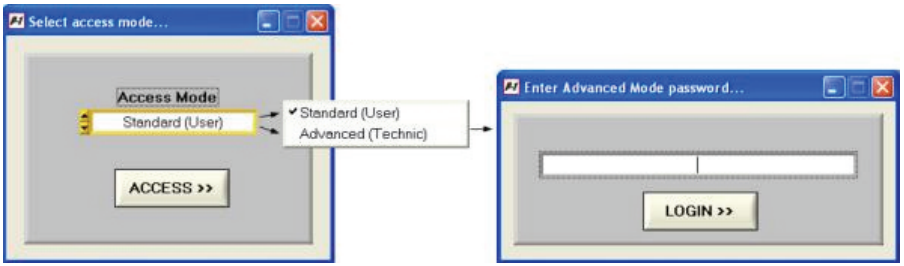


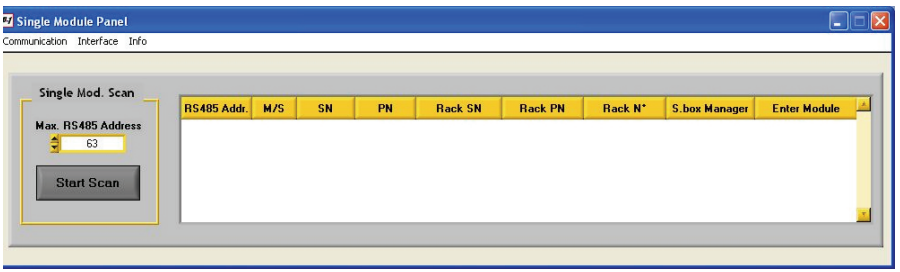
Figure 18-3 : Choice of Standard or Advanced mode

- Now select the standard or advance access mode (for the latter the password “aurora” must be entered).

In Standard mode, some menus will be disabled.

- According to the choice made previously, the window *Single Module Panel* (§18.4.1) or *Plant Configuration* (§18.4.2).

18.4.1 Single Module Panel



- Set the limit of the address on (*Max RS485 Address*): in this way the program, in order to reduce time, will scan to find all the modules within a limited number of addresses.
- Click on the [**Start Scan**] key: the system will search for all the connected and functioning modules.

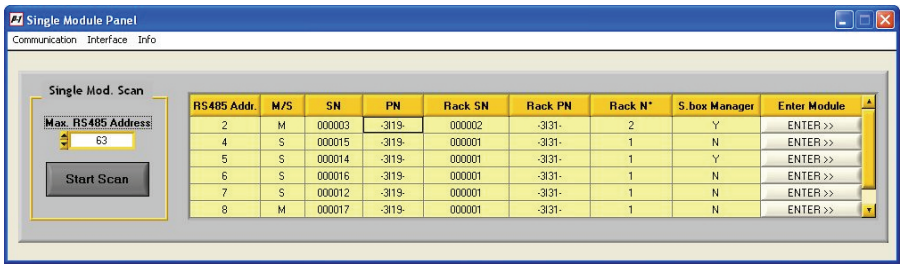
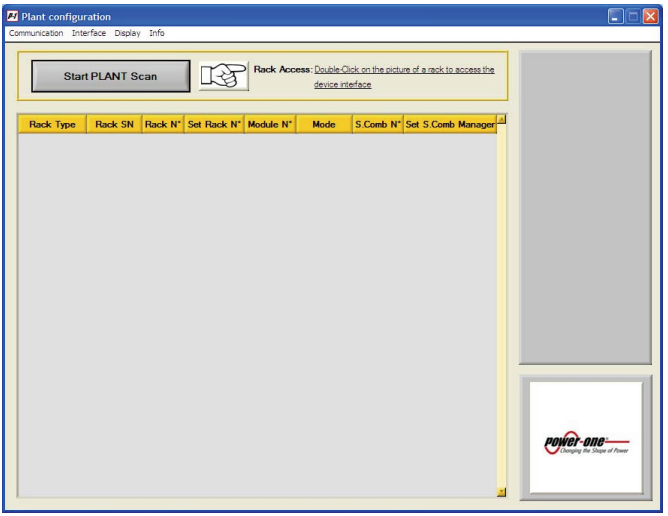


Figure 18-4 : Single Module Panel

- The window shows a summary table relative to all the models found. The parameters indicated are the following:
  - **RS485 Addr**.: Address assigned on RS485.
  - **M/S**: M=Master, S=Slave
  - **SN**: The series number of the Module
  - **PN**: The Module code
  - **Rack SN**: The series number of the Rack to which it belongs
  - **Rack PN**: The code of the Rack to which it belongs
  - **Rack N°**: The identity number of the Rack
  - **S.Box Manager**: This indicates whether the module is used for management of data with the boxes of the AURORA PVI-STRINGCOMB(-S) string.
- By pressing the corresponding [**ENTER >>**] button, access is gained to the management of the selected module (see Figure 18-9).

18.4.2 Plant Configuration

At first this window will be empty. This is because the first time the program has to scan to see how the plant is configured.



➲ Click on the [**Start PLANT Scan**] key: the system will search through all the connected and functioning Racks.

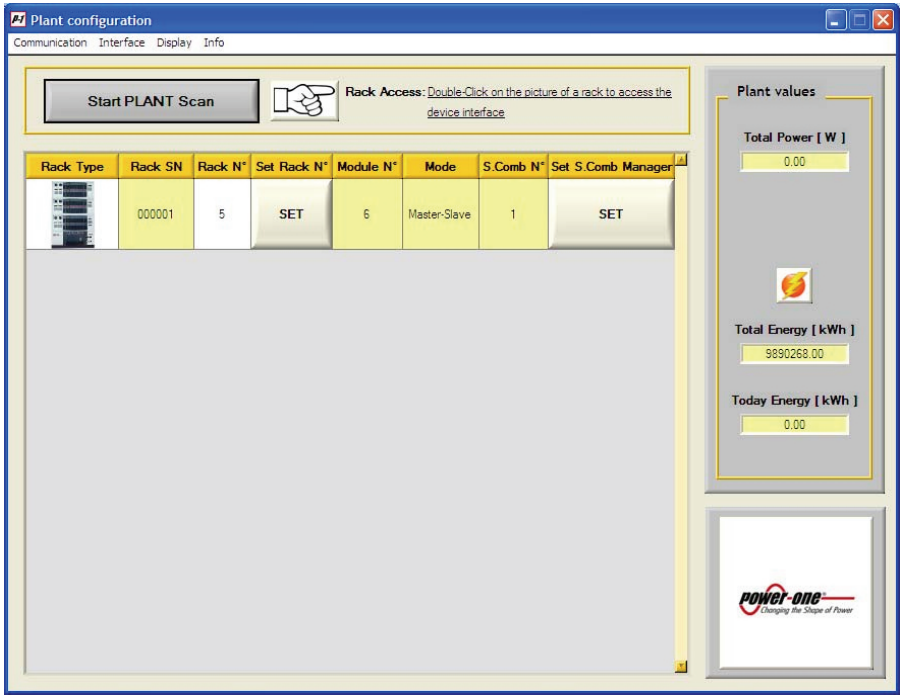


Figure 18-5 : Plant Configuration

The screen of Figure 18-5 gives the following information:

- **Rack ID**: in this area the rack series number and identity number are shown, the latter being assigned to the rack and to all the modules to identify the whole inverter. The rack number can be changed by entering a new number using the [**Set Rack Number**] button.
- The number of modules contained in the rack (Module N.), the operation mode (Mode) and the number of connected string-boxes (S.Comb N.). By means of [**Set S.Comb Manager**] access is gained to the menu (Figure 18-6) by which, pressing the [**SELECT>>**] key, the management and monitoring of the PVI-STRINGCOMB is assigned to the corresponding module.
  It is preferable to assign the string-box management to a slave, if there is one.

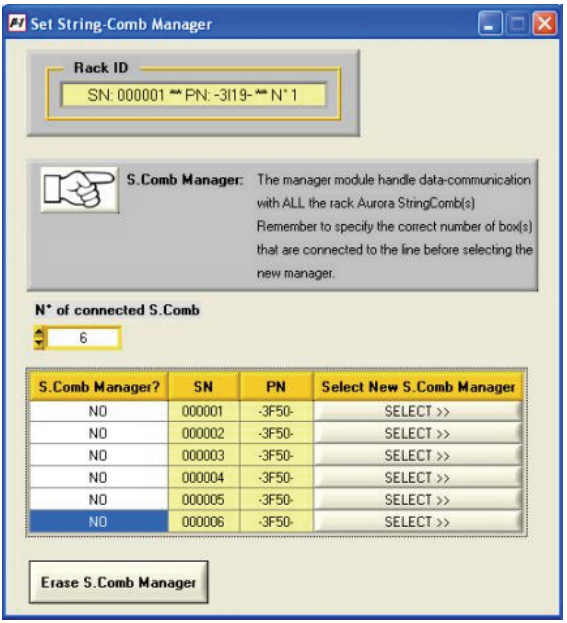


Figure 18-6 : Choice of the StringComb Manager

- **Plant value:** this gives information on the system: the instantaneous power produced (W), the daily energy and the total energy produced (kWh).

➲ Double-click on the image of the inverter to gain access to the rack management menu (Figure 18-8) in which it is possible to control and identify an alarm, and to then gain access to the single module.

➲ From the Display menu you can open a system monitoring screen, very useful to create a small monitoring system.

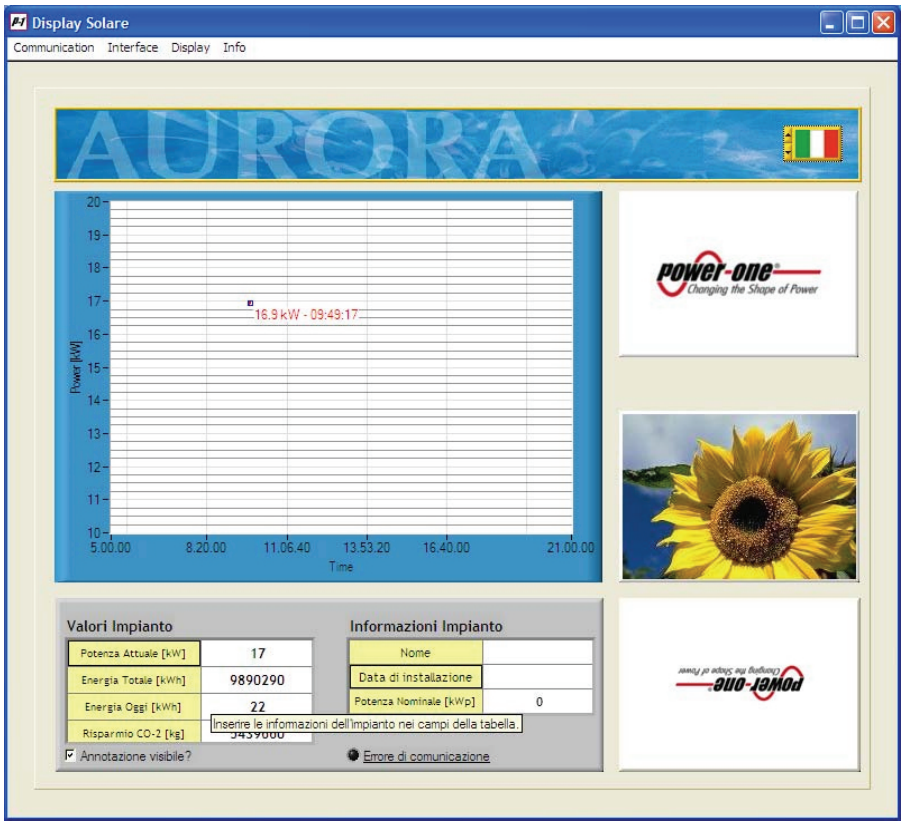


Figure 18-7 : Solar display

It is possible to personalise the logo, the image and plant information.

18.4.3 Rack Interface

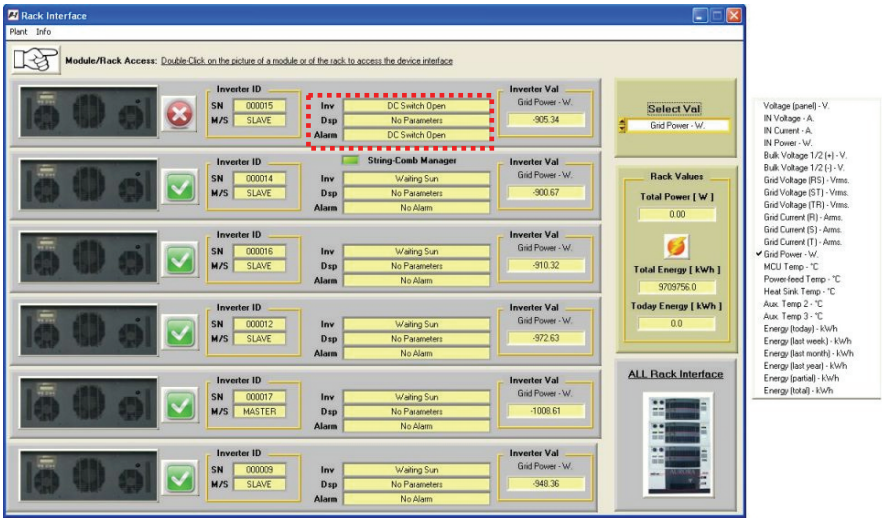


Figure 18-8 : Rack Interface – Rack Management

In this mode, the main parameters and the state of every module of the system can be observed.

- The symbol indicates that the module is operative, while the symbol identifies the module in alarm mode. In the zone indicated by the dotted line, the state of the Supervisor (Inv), of the digital signal processor (Dsp) and of the type of alarm (Alarm) can be read.
- **Inverter ID:** this shows the serial number (SN) and the state of the master or slave of the module (M/S).
- **Inverter Val**: this shows the value of the size selected by means of the list (*Select Val)*, placed at the top right.
  Figure 18-8 shows the content of the list where the following parameters can be seen:

  ✓ Voltage [Panel]: Voltage read by the supervisor (Vrms)
  ✓ IN Voltage: Field voltage (Vrms)
  ✓ IN Current: DC input current (Arms)
  ✓ IN Power: Input power (W)
  ✓ Bulk Voltage ½ (+): DC voltage on the internal capacities + [Vdc]

- ✓ Bulk Voltage ½ (-): DC voltage on the internal capacities - [Vdc]
- ✓ Grid Voltage (RS): Mains voltage linked to phases R-S (Vrms)
- ✓ Grid Voltage (ST): Mains voltage linked to phases S-T (Vrms)
- ✓ Grid Voltage (TR): Mains voltage linked to phases T-R (Vrms)
- ✓ Grid Power (W): Power sent to the mains network
- ✓ MCU Temp: Supervisor temperature [°C]
- ✓ Power Feed Temp: Internal power supplier temperature [°C]
- ✓ Heatsink Temp: Power dissipater temperature [°C]
- ✓ Aux Temp 2: N/A (the datum visualised is not used)
- ✓ Aux Temp 3: Framework environment temp. sensor [°C]
- ✓ Energy (today): Energy produced today [kWh]
- ✓ Energy (last week): Energy produced in the last week [kWh]
- ✓ Energy (last month): Energy produced in the last month [kWh]
- ✓ Energy (last year): Energy produced in the last year [kWh]
- ✓ Energy (partial): Energy produced since the last re-setting [kWh]
- ✓ Energy (total): Total energy produced until today [kWh]

➲ By clicking twice on the image of the single module, access is given to management of the same (Figure 18-9).
➲ By clicking twice on the image of the rack, you return to the rack interface menu (Figure 18-8).

Access to the menu for management of the single module (Figure 18-9) is gained as indicated above or, otherwise, by having chosen “single module” in Figure 18-2 and by pressing on the [**ENTER>>**] key of the *Single Module Panel* window (Figure 18-4).

18.4.4 Menus bar

According to either the standard or advanced mode, access is given to the following menus:

Menus in Standard mode

Module → Module interface (active in single module mode)
Rack → Rack interface (active in single plant mode)
ID → Inverter Identification.
Monitoring → Inverter Monitoring.
String-Comb → StringComb monitoring (Active only on modules dedicated to StringComb management).
Info → Software version.
→ Software license.

Menus in Advanced mode

Module	→ Module interface (active in single module mode)
Rack	→ Rack interface (active in single plant mode)
ID	→ Inverter Identification.
Monitoring	→ Inverter Monitoring.
	→ Fault Log.
Statistic	→ Statistic field - reset.
	→ Inverter clock settings.
String-Comb	→ StringComb monitoring (Active only on modules dedicated to StringComb management).
Solar filed	→ Solar field scan.
Info	→ Software version.
	→ Software license.

Module interface and Rack interface give the relative windows shown in paragraphs §18.4.1e 18.4.3

The functions (windows) available via these menus are explained in detail below.

18.4.5 Inverter IDentification

The window which summarises the plate data of a single module is the following:

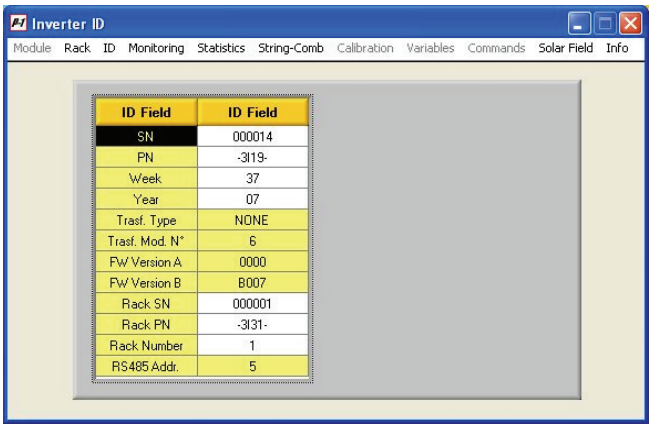


Figure 18-9 : Inverter ID - Single Module Interface

The parameters listed are the following:

- ✓ SN: Module series number
- ✓ PN: Module part number
- ✓ Week: Week of production
- ✓ Year: Year of production
- ✓ Trasf. Type: Type of transformer connected
- ✓ Trasf. Mod. N°: Number of modules connected to the rack
- ✓ FW Version A: DSP firmware version
- ✓ FW Version B: Supervisor firmware version
- ✓ Rack SN: The series number of the rack
- ✓ Rack PN Rack part number
- ✓ Rack Number: Identity number of the rack in the installation
- ✓ RS485 Addr.: RS485 address

18.4.6 Inverter Monitoring

This window allows for monitoring a single module on the rack side.

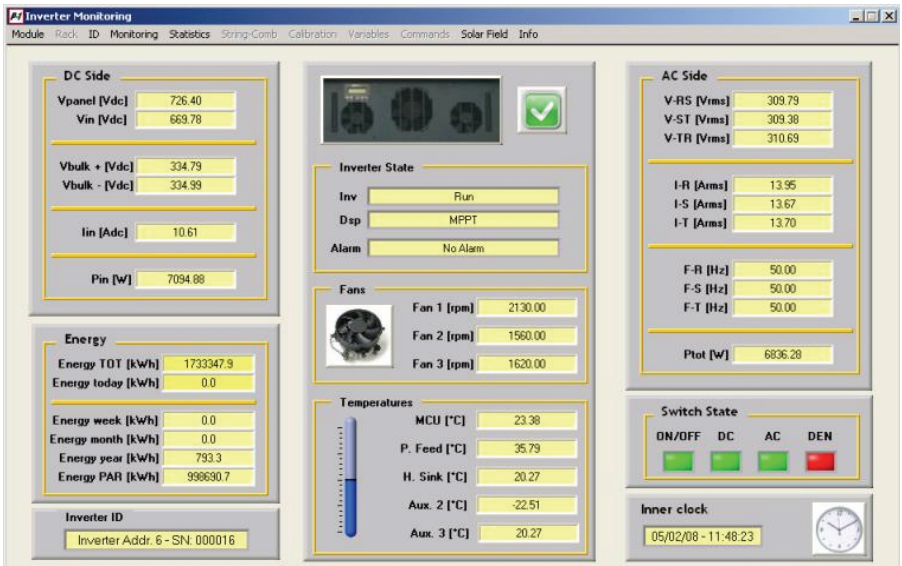
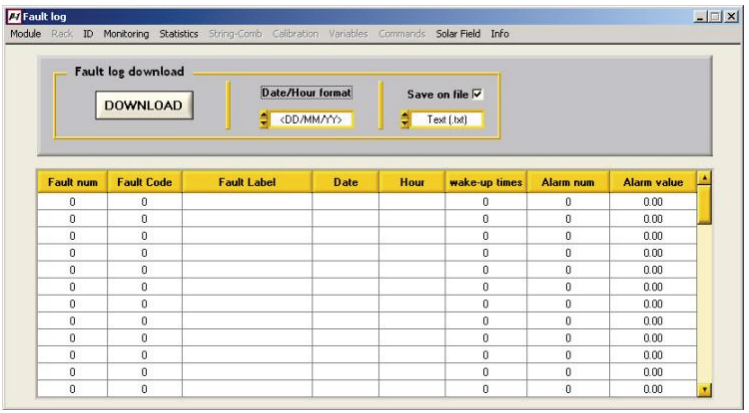


Figure 18-10 : Inverter Monitoring

- **DC Side**: in this area, the DC electrical dimensions are collected
- **Energy**: gives the total and partial energy of the world
- **Inverter State**: the state of the inverter
- **Fans**: this gives the rotation speed of the module fans
- **Temperatures**: this shows the temperature of the microprocessor (MCU), of the power supplier (P.Feed), of the dissipater (H.sink) and of the framework (Aux. 3). The Aux2 indication is not used.
- **AC Side**: this indicates the voltage, currents, frequency of the three phase triad and the power exported from the module.
- **Switch state**: closed switches are indicated in green, and open switches in red.
  - ON/OFF: Remote ON/OFF
  - DC: DC switch position
  - AC: AC switch position
  - SPD: indication of the OVR DC state

18.4.7 Fault Log

This window lists the faults/alarms registered by the selected module:



The (*Date*/*Hour format*) box allows for specification of the format of the date on which the data are visualised. The (*Save on file*) box, if enables, allows for saving the fault list in text (.txt) or excel (.xlm) format, according to the choice made in the box shown below.

By pressing on the [**DOWNLOAD**] button, the system downloads the faults from the inverter, visualising a wait window and then the list of the faults to be downloaded (Figure 18-12) and asks for the data to be saved in a file (Figure 18-11).

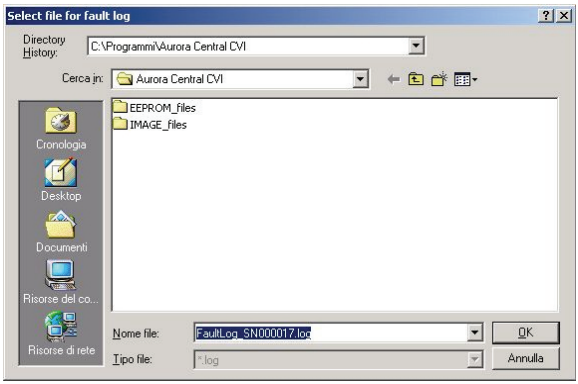
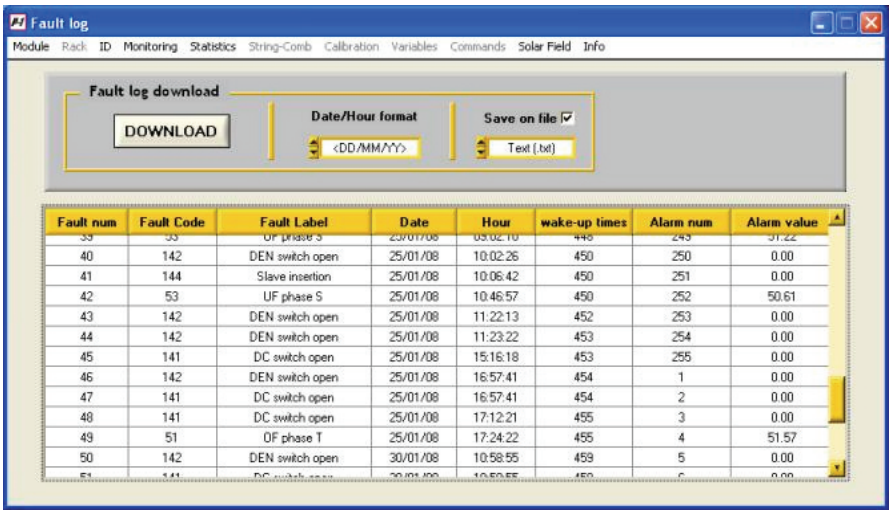


Figure 18-11 : Window for saving the fault list



Fault num	Fault Code	Fault Label	Date	Hour	wake-up times	Alarm num	Alarm value
40	142	DEN switch open	25/01/08	10:02:26	450	250	0.00
41	144	Slave insertion	25/01/08	10:06:42	450	251	0.00
42	53	UF phase S	25/01/08	10:46:57	450	252	50.61
43	142	DEN switch open	25/01/08	11:22:13	452	253	0.00
44	142	DEN switch open	25/01/08	11:23:22	453	254	0.00
45	141	DC switch open	25/01/08	15:16:18	453	255	0.00
46	142	DEN switch open	25/01/08	16:57:41	454	1	0.00
47	141	DC switch open	25/01/08	16:57:41	454	2	0.00
48	141	DC switch open	25/01/08	17:12:21	455	3	0.00
49	51	OF phase T	25/01/08	17:24:22	455	4	51.57
50	142	DEN switch open	30/01/08	10:58:55	459	5	0.00

Figure 18-12 : Fault log

The following information is given in the fault log column:

- ✓ Fault num: Progressive line number
- ✓ Fault code: Code assigned to the fault
- ✓ Fault label: Label describing the fault
- ✓ Date/hour: Date and time when the fault occurred
- ✓ Wake-up times: Progressive number of power start-ups.
- ✓ Alarm num: Progressive number indicating the number of alarms.
- ✓ Alarm value: Value of the dimensions which generated the fault.

18.4.8 Statistic Field Reset

This window allows for cancellation of the energy statistics values.

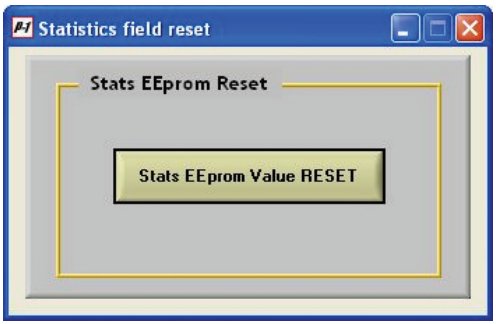
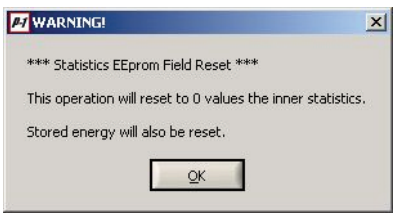
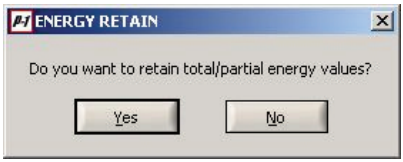


Figure 18-13 : Eeprom Reset

➲ Clicking on [**Stats Eeprom Value RESET**] will bring the following warning window:

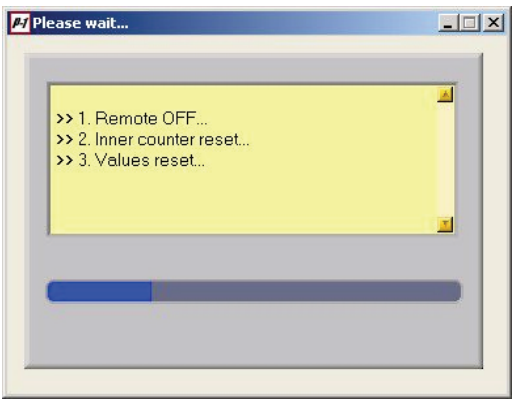


- Press OK: A window will open warning that this procedure will zero all the energy statistics and will ask whether the user wishes to keep the total and partial energy values produced:



- Confirmation of the reset operation will be requested: choose [**YES**] or [**NO**].

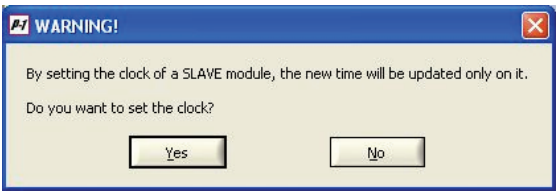
- If you choose **[YES]**, a window will open requesting the operator to wait for conclusion of the reset operations.



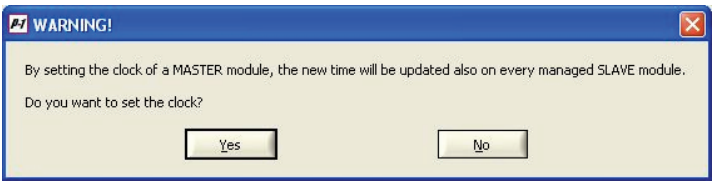
18.4.9 Inverter clock settings

This function allows for the system clock to be set.

- If the time is changed on a Slave module, the system warns that the modification will only affect that module.



- If the time is changed on a Master module, the system warns that the modification will also affect all the Slaves connected to that Master.



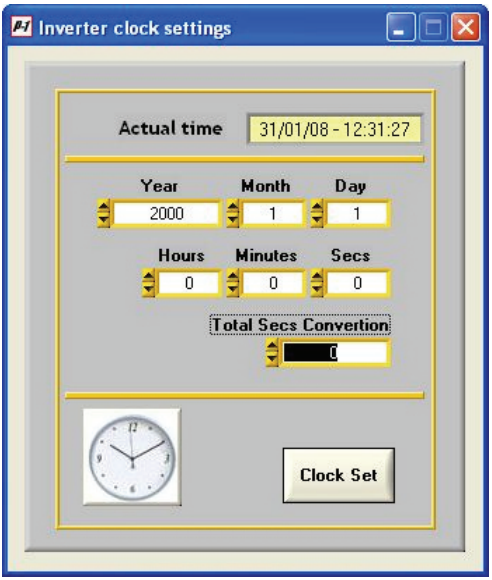


Figure 18-14 : Inverter clock settings

➲ The window shows the current date and time; to change them, fill the field with the new data and press [**Clock set**].

18.4.10 String Comb monitoring

If the system has the string boxes (StringComb), this window will allow for the parameters of this apparatus to be monitored.

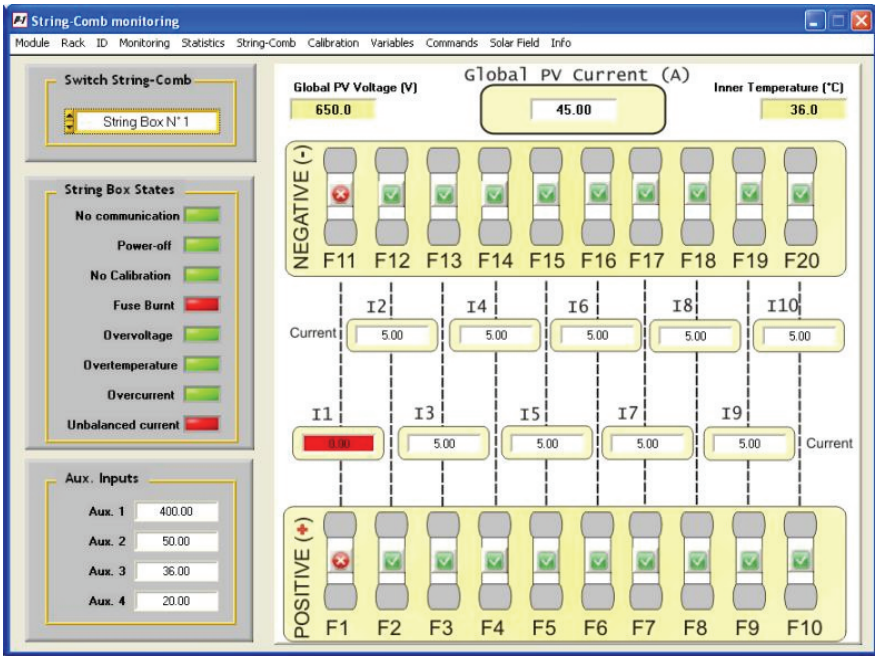


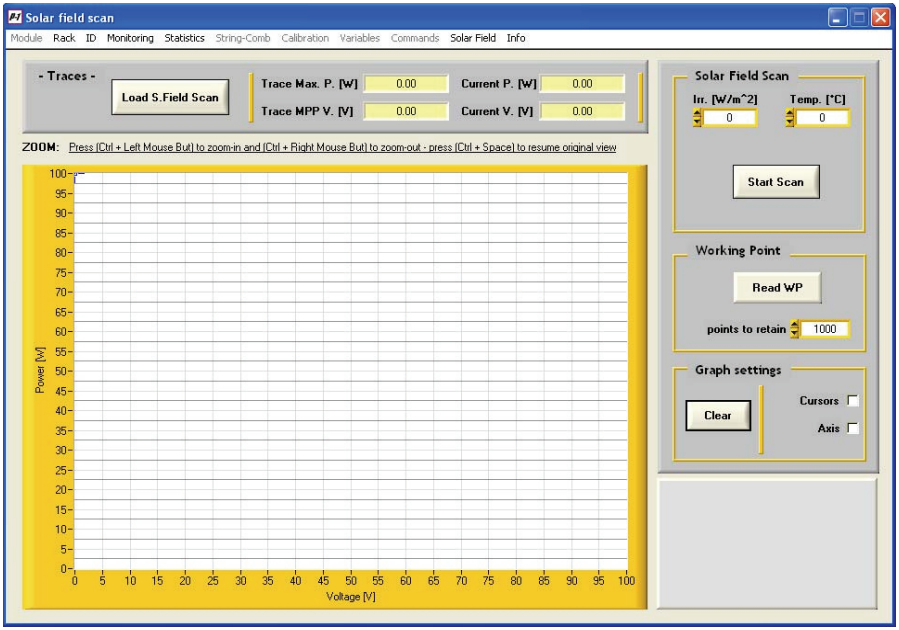
Figure 18-15 : StringComb monitoring

To use this program, please consult the manual of the PVISTRINGCOMB(-S): "**BOX FOR THE CONNECTION OF STRINGS FOR PHOTOVOLTAIC APPLICATIONS**" supplied with the string boxes.

18.4.11 Solar field scan

This function allows for scanning the photovoltaic field and gives the P-V curve of the field.

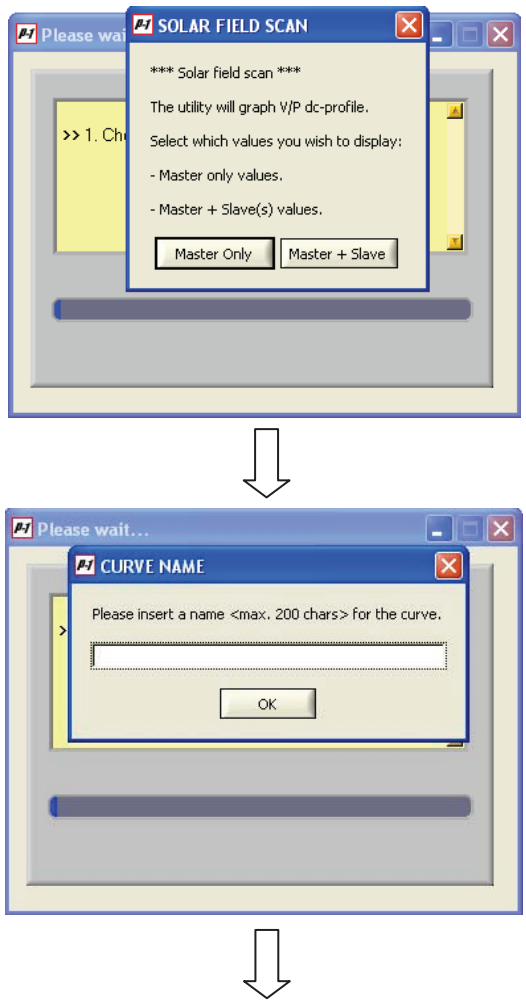
The following window is composed mainly of a blank area where the features detected in the field will be "drawn".

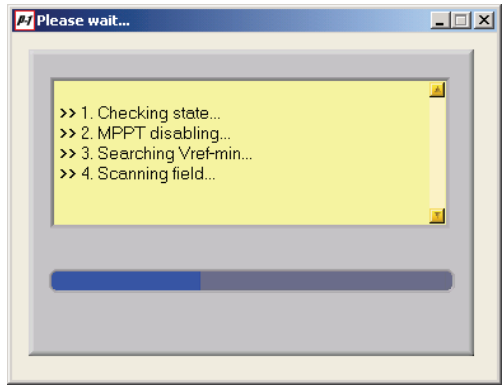


- **Solar Field Scan**: In this area, the environmental conditions can be indicated, by which the P-V characteristics can be measured. Press the [**Start Scan**] button to start the scan.
- **Working Point**: the [**Read WP**] button allows for visualisation of the work point and how many points to be shown in the graph.
- **Graph settings**: this allows for the visualisation of a classic cross cursor (cursor) and the projection of the point on its axes. The [**Clear**] button cancels the graph completely.

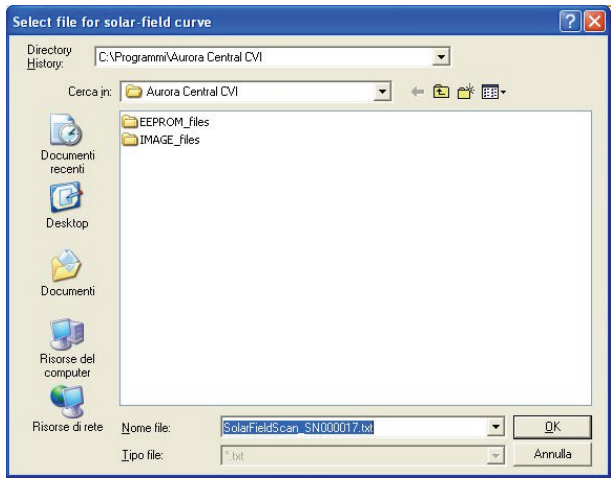
➲ If known, write the radiation and temperature values in the special boxes (this operation can also be omitted).

➲ Press the [**Start Scan**] key: The program asks whether the operator wishes to visualise the master curve ([**Master Only**] button) or of a master with slaves ([**Master + Slave**] button), then a name for the curve is requested After confirmation [**OK**], the inverter will automatically scan the field.


Please wai
SOLAR FIELD SCAN
*** Solar field scan ***
The utility will graph V/P dc-profile.
Select which values you wish to display:
- Master only values.
- Master + Slave(s) values.
Master Only
Master + Slave
Please wait...
CURVE NAME
Please insert a name <max. 200 chars> for the curve.
OK



➲ After the scan, the program asks for a name to be assigned to the data file.



➲ Enter a name and press [**OK**]. After the file has been saved, the curve is then drawn (rif. Figure 18-16).

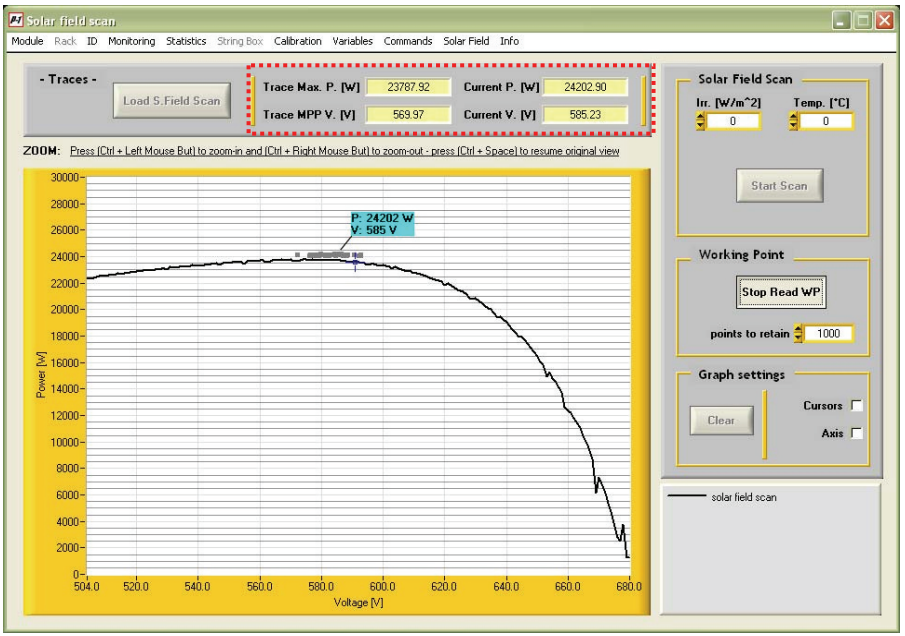


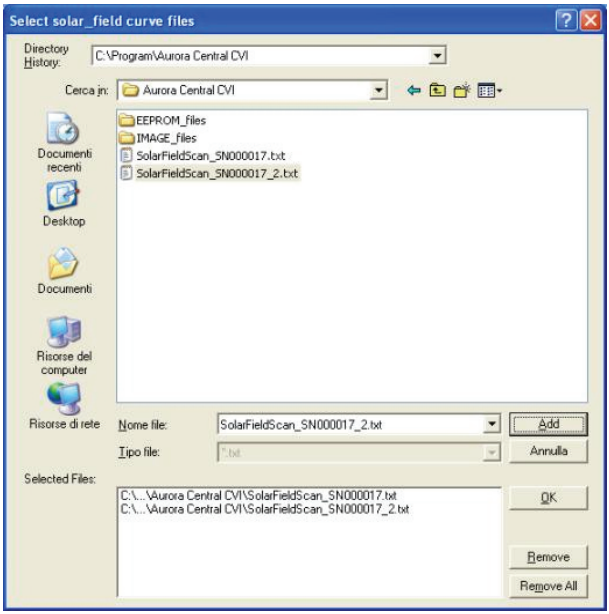
Figure 18-16 : Solar Field Scan

In the area indicated by the dotted line at the top, the values of exported power and voltage are visualised, as well as the maximum points reached by the curve.
Pressing the [**Read WP**] button allows for visualisation of the work point and as indicated in Figure 18-16.

18.4.11.1 Loading and visualisation of the P-V curved saved.

This function allows for the P-V characteristics found to be memorised in a file. In this way, an archive of the characteristics of the photovoltaic field will be formed.
This function is useful in the installation /maintenance phase.

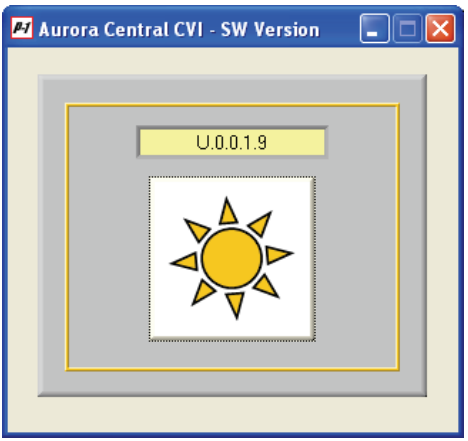
- By pressing the [**Load S. Field Scan**] key, a previously stored curve can be loaded.



- Select the file containing the curve and click of the [**Add**] button In this way, the selected curve is shown in the lower part of the window. Several curves can be visualised on the same graphs, by selecting them and clicking on [**Add**].
- In the case of error, a selected curve can be removed by pressing the [**Remove**] button. All curves can be removed by [**Remove All**]

18.4.11.2 Software Version

The window shows only the version of the software being used.



Press the button to close the panel and return to the previous screen.

19. TROUBLESHOOTING

Before the product is dispatched, various tests are carried out successfully, to ensure: functioning, protection devices, performance and duration.

These tests, together with the Power-One quality guarantee system, guarantee optimal functioning of AURORA.

If a problem arises, the following events occur on one or all of the modules:

- The red *"ALARM"* LED comes ON and remains on.
- The green *"POWER ON"* LED flashes.
- The module concerned, or all the modules, disconnect from the mains network.

In the case of a fault, the system waits 1 minute (standard value), then annuls the fault signal and attempts to reconnect the module/s to the mains network.
If, after this time, the system continues to signal an error, deal with the problem according to the following instructions.

Follow the indications in the following table if the problem detected coincides with one of the cases described.
If there are no doubts, and if none of the solutions is of help, you must contact your dealer.

Table 19-1 : Troubleshooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
Software		
The serial communication of one or more Modules does not work	a) the line is interrupted b) the termination is incorrect c) an address has been repeated d) a card is faulty	Check that: a) there are no interruptions on the line b) the termination must be enabled only on the last of the chain (ref. §7 and §11.2.6.2) c) no address has been repeated (§11.2.6.6) d) contact the dealer
The communication seems to work but not all the modules can be “seen" by the scan program	The baud rate configuration of the Modules is different from that of the converters	Use the configuration at 9600 baud rate of the default mode
Signals on the Display		
Unloader (SPD / OVR) fault	The SPD has intervened (for excess voltage) and must be replaced.	Replace the damaged cartridge/s (ref.§0 and §15.1.4.1)
The *“Missing Grid”* LED is on.	a) the mains network switch is open b) an anomaly on the mains distribution network has been detected	a) Make sure that the mains switch is ON. b) make sure there are no problems on the electricity network due to the provider (in which case, wait for the service to be restored)
The display signals *"Remote wait on”*	a) the command “Software ON/OFF” of the display has been enabled b) the signal “Remote ON/OFF” of the terminal board has been opened	a) remove the command, resetting it at “Not Active” (see paragraph §Figure 16-3) b) Reclose the signal as indicated in §11.2.6.5

PROBLEM	POSSIBLE CAUSE	SOLUTION
The display signals *"Wait sun"*	The photovoltaic system is not supplying enough energy to connect the inverter e.g. the sky is very overcast)	Wait until the weather improves
The inverter signals a generic fault on a StringComb	Check the cause by access to the display of the inverter	Check if the indications in the PVI-STRINGCOMB cover this case. If necessary, contact the dealer
The inverter does not receive DC voltage from the panels and remains in energy save (SE) mode	a) the DC switch is open b) there is an interruption in the DC line	a) Close the DC switch on the front of the inverter b) are the DC wires connected? Is there a switch upstream?

19.1. Before contacting the technician (Questionnaire)

In the case of problems which cannot be solved directly, and in any event whenever it is necessary to contact the dealer, we advice you make a note of the following information:

19.1.1 Problems on the StringCombs

INFORMATION ON THE STRINGCOMBS TO HAVE READY

(1) Type of problem
(2) Number of PVI-STRINGCOMB(-S) in the system
(3) Number of PVI-STRINGCOMB(-S) involved in the problem
(4) Where are they installed? (ground, roof, etc.)
(5) Has the last PVI-STRINGCOMB(-S) of the series chain been terminated?
(6) How many strings enter the PVI-STRINGCOMB(-S)?
(7) Composition of a string:
(8) Number of panels in a series.
(9) Type of panels (constructor and Model).
(10) Any other information (e.g. Are there any diodes?
(11) Is the photovoltaic field insulated from the ground?

19.1.2 Problems on the PVI-CENTRAL

INFORMATION ON THE INVERTER TO HAVE READY

Information available directly from the LCD display

(1) AURORA model?
(2) Serial number?
(3) Week of production?
(4) What is the state of each LED? (flashing, on or off?)
(5) What signals are visualised on the display
(6) Brief description of the fault
(7) Have you noticed that malfunctioning is linked to any specific operation?
(8) If so, which?
(9) Have you noted if the malfunctioning is cyclical?
(10) If so, how often?
(11) Was the malfunctioning apparent at the moment of installation?
(12) Describe the atmospheric conditions at the moment when the fault appeared.

INFORMATION on the Photovoltaic Field

(13) Make and model of the photovoltaic panels
(14) Plant structure
- Maximum array voltage and currant
- number of array strings
- number of panels for each string

20. APPENDIX A: ERROR MESSAGES AND CODES

The state of the system is indicated by a warning sign (Warning) or an error sign (Error) visualised on the LCD display.
The tables which follow briefly describe the two types of signals which may appear.

20.1. Warning

These indicate the state of the AURORA, and are not therefore caused by a fault and do not imply the need for any action (lack of mains network, of sun, etc.) These will disappear as soon as conditions return to normal. Warnings are indicated in the table below by a “W”.

20.2. Error

This indicates a possible fault in the apparatus or the elements connected to the same. Also in this case, the signal will disappear as soon as the causes are identified. The appearance of an error signal generally implies the need for action, which is carried out by AURORA as far as possible, or it will give opportune indications to help the person who must action on the apparatus or plant in order to carry out the necessary maintenance Errors are indicated in the table below by an “E”.

After connection, if the inverter receives erroneous information during the test cycle the system will interrupt the said cycle and signal the warning or error code.
The system will continue to repeat the visualisation of the error message until the error has been removed.

After removal of the error, the inverter re-sets all the functions in progress and automatically repeats the connection (see also §12.1).

Table 20-1 : Messages and Errors Code table

	Messaggio	W (warning)	E (error)	Description
	OC Panel		E001	Current input above maximum threshold
	Bulk OV		E004	Voltage of condensators above maximum threshold
	Communication		E005	Error in communication with the DSP
	OC		E006	Exit current above maximum threshold
	OCH		E007	IGBT current above maximum threshold or IGBT sat.
	Over Temp		E014	Overheating (detail visible from software)
	Delta Bulk		E015	Difference in voltage of DC condensers above maximum threshold
	Grid OV	W004		OV mains network voltage
	Grid UV	W005		UV mains network voltage
	Grid OF	W006		OF mains network
	Grid UF	W007		UF mains network
	Forbidden State		E024	Non-admitted state
	Fan Fail	W010		Left fan blocked
	UTH		E033	Temperature below minimum threshold (detail visible from software)
	Remote OFF		E035	Remote Off
	Pneg	W014		Zero power exported
	Grid df/dt	W015		Df/dt network
	DEN Switch Open SPD Switch Open	W016		Surge Protector Device (SPD) failure (cartridge to be replaced)
	UC Panel		E037	Negative input current above maximum threshold
	FAN Stuck		E038	Central or right fan is blocked
	DC Switch Open		E039	DC disconnecting switch open
	JboxFail	W017		One or more StringCombs have communicated a problem
	TRAS Switch Open		E040	AC disconnection switch open
	Relay AC		E041	Internal AC contactor has not switched over
	Bulk UV		E042	Voltage of condensators below minimum threshold
	Auto exclusion		E043	Self-exclusion of module due to repeated faults
	RISO		E025	Insulation resistance below minimum threshold

21. APPENDIX B: TECHNICAL DATA

The following tables give the PVI-CENTRAL-XXX-US characteristics:

Characteristics	PVI-CENTRAL-50-US (208V)	PVI-CENTRAL-100-US (208V)
Input Parameters		
Maximum recommended PV power (KWp)	55	110
Absolute maximum input voltage (Vdc)	600	600
MPPT input voltage range Vdc	330 - 600 (370 nominal)	330 - 600 (370 nominal)
Number of MPPT (Master/ Slave)	1	1
Total Maximum input current (Adc) Per module	170 170	340 170
Input Reflected Ripple voltage	<3%	< 3%
Number of DC inputs available	1	2
Input overvoltage protections	1	2 (1 for each input)
Output Parameters		
Nominal AC Output Power (KWp)	50,00	100
Nominal AC Output Current (Arms)	139	278
AC Output Voltage range (Vrms)	3 x 208 (183Vac – 229Vac)	3 x 208 (183Vac – 229Vac)
Nominal AC Frequency (Hz)	60	60
Power Factor (cos φ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
AC Current Harmonics (THD%)	< 4% (@ Pac nominal)	< 4% (@ Pac nominal)
Inverter Switching Frequency (KHz)	18	18
AC side overvoltage protection	Yes	Yes
Conversion Efficiency		
Peak Efficiency % (@ Vin 330)	95,6	95,6
CEC Efficiency %	95	95
Environmental Parameters		
Environmental Protection Degree	IP20	IP20
Operating Temperature Range	-10°C...+50°C (with Pout derating)	-10°C...+50°C (with Pout derating)
Relative Humidity (non-condensing)	< 95%	< 95%
Storage Temperature	-10°C...+50°C	-10°C...+50°C
General Data		
Auxiliary Voltages Consumption (W)	<0.4% of PACnom	<0.3% of PACnom
Night time losses (W)	<15W	<30W
Local Communication	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB)	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB)
Remote Communication (optional)	Sistema HYPERLOG	Sistema HYPERLOG
User Interface	2-lines Display (on each inverter module)	2-lines Display (on each inverter module)
Mechanical Characteristics		
DC CONNECTIONS (max wire / cable lug)	2x 3/0AWG 90° / M10	4x 3/0AWG 90° / M10
AC CONNECTIONS (max wire / cable lug)	3x 2/0AWG 90° / M10	3x 250 Kcmil 90° / M10
PE CONNECTION (max wire / cable lug)	1x 2/0AWG 90° / M12	1x 2/0AWG 90° / M12
Dimensions (WxHxD) (mm)	1250 x 1675 x 850	1250 x 1675 x 850
Overall Weight (Kg) (*) to be confirmed	700(*)	850
50kW module Weight (kg)	70	70
Required Ambient Air Cooling Flow	1500m^3/h	2000m^3/h

Some data may be amended without notice.

Table 21-1 : Technical data PVI-CENTRAL - 50-US / 100-US (208V)

The following tables give the PVI-CENTRAL-XXX-US characteristics:

Characteristics	PVI-CENTRAL-50-US (480V)	PVI-CENTRAL-100-US (480V)
Input Parameters		
Maximum recommended PV power (KWp)	55	110
Absolute maximum input voltage (Vdc)	600	600
MPPT input voltage range Vdc	330 - 600 (370 nominal)	330 - 600 (370 nominal)
Number of MPPT (Master/ Slave)	1	1
Total Maximum input current (Adc) Per module	170 170	340 170
Input Reflected Ripple voltage	<3%	< 3%
Number of DC inputs available	1	2
Input overvoltage protections	1	2 (1 for each input)
Output Parameters		
Nominal AC Output Power (KWp)	50,00	100
Nominal AC Output Current (Arms)	60,5	121
AC Output Voltage range (Vrms)	3 x 480 (423Vac – 528Vac)	3 x 480 (423Vac – 528Vac)
Nominal AC Frequency (Hz)	60	60
Power Factor (cos φ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
AC Current Harmonics (THD%)	< 4% (@ Pac nominal)	< 4% (@ Pac nominal)
Inverter Switching Frequency (KHz)	18	18
AC side overvoltage protection	Yes	Yes
Conversion Efficiency		
Peak Efficiency % (@ Vin 330)	95,8	95,8
CEC Efficiency %	95	95
Environmental Parameters		
Environmental Protection Degree	IP20	IP20
Operating Temperature Range	-10°C...+50°C (with Pout derating)	-10°C...+50°C (with Pout derating)
Storage Temperature	-10°C...+50°C	-10°C...+50°C
Relative Humidity (non-condensing)	< 95%	< 95%
Storage Temperature	-10°C...+50°C	-10°C...+50°C
General Data		
Auxiliary Voltages Consumption (W)	<0.4% of PACnom	<0.3% of PACnom
Night time losses (W)	<15W	<30W
Local Communication	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB)	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB)
Remote Communication (optional)	Sistema HYPERLOG	Sistema HYPERLOG
User Interface	2-lines Display (on each inverter module)	2-lines Display (on each inverter module)
Mechanical Characteristics		
DC CONNECTIONS (max wire / cable lug)	2x 3/0AWG 90° / M10	4x 3/0AWG 90° / M10
AC CONNECTIONS (max wire / cable lug)	3x 1AWG 90° / M10	3x 2/0AWG 90° / M10
PE CONNECTION (max wire / cable lug)	1x 2/0AWG 90° / M12	1x 2/0AWG 90° / M12
Dimensions (WxHxD) (mm) (*) Output Air conduit not included	1250 x 1675 x 850	1250 x 1675 x 850
Overall Weight (Kg) (*) to be confirmed	700(*)	850
50kW module Weight (kg)	70	70
Required Ambient Air Cooling Flow	1500m^3/h	2000m^3/h

Some data may be amended without notice.

Table 21-2 : Technical data PVI-CENTRAL - 50-US / 100-US (480V)

22. TIGHTENING TORQUE FOR CONNECTORS

The table below report the thightening torque for pressure wire connectors installed on the inverter.

CONNECTORs	AWG range	Torque (N*m) range
AUXILIARY Connectors	12 ÷ 4	1.5 ÷ 1.8
AUXILIARY Connectors for Voltage selection	18 ÷ 12	0.5 ÷ 1
SIGNAL Connectors	20 ÷ 12	0.4 ÷ 0.6

Table 22-1 : Tightening torque for connectors

23. ADJUSTABLE TRIP POINTS

The table below report the adjustable trip points of the inverter.

	DEFAULT VALUES		Timeout
DISPLAY Variable	Grid Voltage (V)	Frequency (Hz)	sec
19 (read only)	106.08	-	0.16
45	183.04	-	-
46	-	-	2
43	228.8	-	-
44	-	-	1
17 (read only)	247.5	-	0.16
27 (read only)	-	60.5	0.16
26	-	59.3	0.16

Table 23-1 : Default values for voltage and frequency limits for utility interaction

	Adjustable Trip points		Timeout
DISPLAY Variable	**Grid Voltage (V)**	**Frequency (Hz)**	sec
19 (read only)	$V < 0.51\ V_{nor}$ [V < 106.08]	-	0.16
-	$0.51\ V_{nor} \leq V < Vuv$ [106.08 ≤ V < Vuv]	-	Tuv
45	Vuv is adjustable from $0.55\ V_{nor}$ to $0.88\ V_{nor}$ [114.4 to 183.04]	-	-
46	-	-	Tuv is adjustable from 2 to 5
-	$Vov < V < 1.19\ V_{nor}$ [Vov < V < 247.5]	-	Tov
43	Vov is adjustable from $1.10\ V_{nor}$ to $1.18\ V_{nor}$ [228.8 to 245.44]	-	-
44	-	-	Tov is adjustable from 1 to 5
17 (read only)	$1.19\ V_{nor} \leq V$ [247.5 ≤ V]	-	0.16
27 (read only)	-	f > 60.5	0.16
-	-	f < (Fmin)	0.16
26	-	Fmin is adjustable from 57 to 59.8	-

Table 23-2 : Voltage and frequency limits for utility interaction adjustable trip points

24. APPENDIX C: UL CERTIFICATION

CSA INTERNATIONAL

Certificate of Compliance

Certificate: 2022026 **Master Contract:** 173688

Project: 2357802 **Date Issued:** October 14, 2010

Issued to: **Power-One, Inc**

740 Calle Plano
Camarillo, CA 93012
USA
Attention: Mr. Robert White

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

C US

Rob Hempstock

Issued by: Rob Hempstock, AScT.

PRODUCTS

CLASS 5311 09 - POWER SUPPLIES - Distributed Generation Power Systems Equipment
CLASS 5311 89 - POWER SUPPLIES - Distributed Generation - Power Systems Equipment
- Certified to U.S. Standards

Utility Interactive Inverter, Models PVI-CENTRAL-100-US, MSWI-100-US, PVI-CENTRAL-50-US, MSWI-50-US, and PVI-CENTRAL-30-US, permanently connected.

For details related to rating, size, configuration, etc., reference should be made to the CSA Certification Record, Annex A, or the Descriptive Report.

APPLICABLE REQUIREMENTS

CSA-C22.2 No 107.1-01 - General Use Power Supplies

UL Std No. 1741- Second Edition - Inverters, Converters, Controllers and Interconnection System Equipment for Use in Distributed Energy Resources (January 28, 2010)

DQD 507 Rev. 2009-09-01 Page: 1

CSA INTERNATIONAL

Supplement to Certificate of Compliance

Certificate: 2022026 **Master Contract:** 173688

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
2357802	October 14, 2010	Update to include change to GFDI fuse rating.
2336957	August 13, 2010	Update to include models MSWI-50-US and MSWI-100-US.
2283285	March 10, 2010	Update to include an alternate conformal coating.
2187029	February 3, 2010	Update to include Utility Interactive Inverter Model PVI-CENTRAL-30-US.
2022026	October 10, 2008	Original Certification of Models PVI-CENTRAL-100-US and PVI-CENTRAL-50-US. (C/US)

Page: 1

CSA INTERNATIONAL

Page 1 CSA Ref. No. 173688-2022026 **(2336957)**

ANNEX A – Ratings

Utility Interactive Inverter, Models PVI-CENTRAL-100-US, **MSWI-100-US**, PVI-CENTRAL-50-US, **MSWI-50-US**, and PVI-CENTRAL-30-US, permanently connected, system ratings as follows:

Model PVI-CENTRAL-100-US and **MSWI-100-US**		208 V ac	480 V ac
INPUT RATINGS:			
Maximum input voltage		600 V dc	600 V dc
Range of input operating voltage		330-600 V dc	330-600 V dc
Maximum input current (dc)		170 A	170 A
Maximum input short circuit current		200 A	200 A
Maximum input source backfeed current to input source		360 A	156 A
OUTPUT RATINGS:			
Output power factor rating		> 0.99	> 0.99
Operating voltage range (ac) (L-L)[1]		183-299 V~	423-528 V~
Operating frequency range or single frequency[1]		57-60.5 Hz	57-60.5 Hz
Number of phases		3	3
Nominal output voltage (ac)		208 V ac	480 V ac
Normal output frequency		60 Hz	60 Hz
Maximum continuous output current (ac) per line		278 A	121 A
Maximum continuous output power (ac)		100 kVA (100 kW)	100 kVA (100 kW)
Maximum output fault current (ac) and duration		592 Apk, 11 mS	292 Apk, 21 mS
Maximum output overcurrent protection		360 A	156 A
Utility interconnection voltage and frequency trip limits and trip time accuracy.			
Trip limit and trip time accuracy	Voltage:	+/-2%	+/-2%
	Frequency:	+/-0.1 Hz	+/-0.1 Hz
	Time	0.033 secs	0.033 secs
Normal operation temperature range		-10 - +50°C	-10 - +50°C
Maximum full power operating ambient		+40°C	+40°C
Enclosure Rating Type		1	1

2022026 Annex A Ratings_2357802.doc\1\dw

power-one™ Changing the Shape of Power

ANNEX A – Ratings

Model PVI-CENTRAL-50-US **and MSWI-50-US**		208V ac	480V ac
INPUT RATINGS:			
Maximum input voltage		600 V dc	600 V dc
Range of input operating voltage		330-600 V dc	330-600 V dc
Maximum input current (dc)		170 A	170 A
Maximum input short circuit current		200 A	200 A
Maximum input source backfeed current to input source		180 A	78 A
OUTPUT RATINGS:			
Output power factor rating		> 0.99	> 0.99
Operating voltage range (ac) (L-L)[1]		183-229 V~	423-528 V~
Operating frequency range or single frequency[1]		57-60.5 Hz	57-60.5 Hz
Number of phases		3	3
Nominal output voltage (ac)		208 V ac	480 V ac
Normal output frequency		60 Hz	60 Hz
Maximum continuous output current (ac) per line		139 A	61 A
Maximum continuous output power (ac)		50 kVA (50 kW)	50 kVA (50 kW)
Maximum output fault current (ac) and duration		360 Apk, 41 mS	172 Apk, 28 mS
Maximum output overcurrent protection		180 A	78 A
Utility interconnection voltage and frequency trip limits and trip time accuracy.			
Trip limit and trip time accuracy	Voltage:	+/-2%	+/-2%
	Frequency:	+/-0.1 Hz	+/-0.1 Hz
	Time	0.033 secs	0.033 secs
Normal operation temperature range		-10 - +50°C	-10 - +50°C
Maximum full power operating ambient		+40°C	+40°C
Enclosure Rating Type		1	1

2022026 Annex A Ratings_2357802.doc\2\dw

ANNEX A – Ratings

Model PVI-CENTRAL-30-US		208V ac	480V ac
INPUT RATINGS:			
Maximum input voltage		600 V dc	600 V dc
Range of input operating voltage		330-600 V dc	330-600 V dc
Maximum input current (dc)		107 A	107 A
Maximum input short circuit current		200 A	200 A
Maximum input source backfeed current to input source		180 A	78 A
OUTPUT RATINGS:			
Output power factor rating		> 0.99	> 0.99
Operating voltage range (ac) (L-L)[1]		183-229 V~	423-528 V~
Operating frequency range or single frequency[1]		57-60.5 Hz	57-60.5 Hz
Number of phases		3	3
Nominal output voltage (ac)		208 V ac	480 V ac
Normal output frequency		60 Hz	60 Hz
Maximum continuous output current (ac) per line		97 A	42 A
Maximum continuous output power (ac)		30 kVA (30 kW)	30 kVA (30 kW)
Maximum output fault current (ac) and duration		360 Apk, 41 mS	172 Apk, 28 mS
Maximum output overcurrent protection		180 A	78 A
Utility interconnection voltage and frequency trip limits and trip time accuracy.			
Trip limit and trip time accuracy	Voltage:	+/-2%	+/-2%
	Frequency:	+/-0.1 Hz	+/-0.1 Hz
	Time	0.033 secs	0.033 secs
Normal operation temperature range		-10 - +50°C	-10 - +50°C
Maximum full power operating ambient		+40°C	+40°C
Enclosure Rating Type		1	1

2022026 Annex A Ratings_2357802.doc\3\dw

ANNEX A – Ratings

Notes:

1. Utility Interconnection Voltage and Frequency Trip Limits and Trip Times:

Condition	Simulated utility source		Maximum time (sec) at 60 Hz before cessation of current to the simulated utility
	Voltage (V)	Frequency (Hz)	
A	$< 0.50\ V_{nor}$	Rated	0.16
B	$0.50\ V_{nor} \leq V < 0.88\ V_{nor}$ (Adjustable Set Points)	Rated	2 to 5 (Adjustable Set Points)
C	$1.10\ V_{nor} < V < 1.20\ V_{nor}$ (Adjustable Set Points)	Rated	1 to 5 (Adjustable Set Points)
D	$1.20\ V_{nor} \leq V$	Rated	0.16
E	Rated	$f > 60.5$	0.16
F	Rated	$f < (59.8 - 57.0)$ (Adjustable Set Points)	0.16
G	Rated	$f < 57.0$	0.16

2. Utility interactive evaluations were conducted with the following firmware:

   DSP Firmware versions: C002 Check sums: 386E hex
   MICRO Firmware versions: D002 Check sums: 0E5F hex

3. Surge Testing for Combination Wave (1.2/50us) was done at 6 kV/3 kA, 2 ohms effective impedance, and Ringwave (0.5us-100 kHz) was done at 6 kV/0.5 kA, 12 ohms effective impedance. Tests were performed using both polarities, for common mode and differential mode coupling, 20 pulses each test. After surge testing the unit was operational with control functionally verified by frequency and voltage disconnect tests.

4. **Models MSWI-50-US and MSWI-100-US are intended for operation with an AC Generated supply (i.e. wind or hydro). These inverters are intended to receive an input supply from a Certified or Listed interface module (passive or active generator controller which converts AC voltage from an AC generator into a regulated DC voltage).**

CSA INTERNATIONAL

Letter of Attestation

Document: 2022026 **Master Contract:** 173688

Project: 2022026 **Date Issued:** October 10, 2008

Issued to: **Power-One Italy S.p.A**
Via San Giorgio 642
Terranuova Bracciolini, Arezzo 52028
Italy

Attention: Mr. Gianfranco Iannuzzi

CSA International hereby confirms that it has completed an evaluation of

Utility Interactive Photovoltaic Inverters,

Models PVI-CENTRAL-100-US and PVI-CENTRAL-50-US

CSA International hereby attests that the product identified above and described in CSA report 2022026 dated October 10, 2008, complies with the following standards/tests, to the extent applicable:

The testing of the subject inverters were completed according to the following sections of the test protocol entitled "Performance Test Protocol for Evaluating Inverters Used in Grid-Connected Photovoltaic Systems" prepared by "Sandia National Laboratories, Endecon Engineering, BEW Engineering, and Institute for Sustainable Technology", dated October 14, 2004 as modified by the "CEC Guideline for the use of the Performance Test Protocol for Evaluating Inverters Used in Grid-Connected Photovoltaic Systems - (draft for immediate use)" prepared by KEMA-Xenergy, and BEW Engineering, dated March 1, 2005 with deviations according to the requirements of the California Energy Commission New Solar Homes Partnership Guidebook 2nd edition (CEC-300-2007-008-CMF), Appendix 3, Section B – "Inverters":

- ***Maximum Continuous Power***
- ***Conversion Efficiency***
- ***Tare Losses***

Notes:

1. For summary of test results refer to Appendix A (Model PVI-CENTRAL-100-US 208Vac), Appendix B (PVI-CENTRAL-100-US 480Vac), Appendix C (Model PVI-CENTRAL-50-US 208Vac) and Appendix D (Model PVI-CENTRAL-50-US 480Vac).

Issued by:

Rob Hempstock, AScT

DQD 507.06 Rev. 2006-02-23