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AURORA®

OUTDOOR PHOTOVOLTAIC INVERTERS

USER MANUAL

INSTALLATION and MAINTENANCE

Models*:   **PVI-CENTRAL-250-US**
PVI-CENTRAL-300-US
PVI-CENTRAL-250.0-CAN-600
PVI-CENTRAL-300.0-CAN-600

(*) "US or CAN" indicates the country in which the product is on sale.

Rev. 3.0

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INPORTANT 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.

![Power-One logo — Changing the Shape of Power]

LEGEND

Marks the reference to a paragraph in a chapter containing important safety information and warnings which must always be respected.

Symbols of this type refer to warnings in the same paragraph or otherwise to the page indicated. They contain information on personal safety and tips on how to reduce the risk of accidents and injuries.

Refers to a warning on possible damage contained in the same paragraph or on the page indicated.

Texts marked with this symbol contain indications concerning environmental protection.

Texts marked with this symbol contain additional information and insights.

Paragraphs marked with this symbol indicate the necessity of using adequate protection prior to operations (e.g. use of insulating gloves for work with voltages up to 600 VDC, use of goggles, etc.).

DANGER

Texts marked with this symbol indicate provisions which, if not met, could result in death or serious injury to the person or persons involved.

WARNING

Texts marked with this symbol indicate provisions which, if not met, could result in slight or serious injury to the person or persons involved.

NOTICE

Texts marked with this symbol indicate provisions which, if not met, could result in potential damage or malfunction of the device and things in general.

THANK YOU FOR YOUR TRUST

The "AURORA" Power-One Inverter you have purchased is an *excellent* device containing the latest technologies.

Before using this device for the first time, read these user instructions in order to fully and quickly learn the commands and functions, as well as the potential dangers for you and for others, and how to avoid them.

For further information about the device or in case of failure to provide part of the documentation that makes up the manual, contact "CUSTOMER SERVICE" available on website Power-one (www.power-one.com).

Questions, criticisms and suggestions are always welcome.

REVISION TABLE

Revision Document	Author	Date	Approved by	Description of Modification
0.0	A. Morucci S. Soldani	06-05-10	D.Nocentini	Issue For New Design
1.0	A. Morucci S. Soldani	12-09-10	D.Nocentini	Changes after UL approval for 250/300kW. Insert UL certificate and Technical data Table
2.0	A. Morucci S. Soldani	01-01-11	D.Nocentini	Only 250/300kW version
3.0	A. Morucci S. Soldani	06-05-11	D.Nocentini	Insert description of 250/300kW for Canadian market

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1. HOW TO USE AND READ THE MANUAL

⮞   The product covered by this Manual shall be used solely for the use described in the Manual itself. Any other use is considered improper and therefore dangerous. Power-One declines any liability for damage to property or persons due to inappropriate use and/or other use than the intended one.

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⮞   Before replacing the components in the device and mentioned in this Manual, with particular reference to dischargers and fuses, contact the dealer. Power-One shall not be liable for damages consequent to the use of inappropriate spare parts.

⮞   Power-One reserves the right to make changes to this Manual and to the product without prior notice: the latest version of the Manual indicating the revision number will be available soon on the site (www.power-one.com).

⮞   The figures are for approximate information and some details may not exactly correspond to the product referred to in this manual.

⮞   This Manual describes all equipment and models. Some models and versions are not marked as such. It is therefore possible that the product you have may not be endowed with certain equipment.

⮞   This Manual contains important safety and operation instructions that must be understood and accurately followed during the installation and maintenance of the product.

1.1. Disposal of waste

By design this is a long life product. Individual inverter modules can be replaced as needed. Retired modules or entire system at end of life is to be considered electronic waste and should be treated according to the laws and regulations of the local jurisdiction where deployed and disposed of in an environmentally sound manner.

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1.2. Symbols used with the product

The symbols referring to the electrical parts of the device and that may also be used in this Manual are the following:

⏚	**Connection point for earth conductor**
+	**Continuous positive voltage pole**
-	**Continuous negative voltage pole**
═══	**Direct current (VDC)**
⏚	**Earthing (GRD)**

1.3. Labels used with the product

Make sure that you have read and fully understood the labels before installing the product. The device is provided with several labels, some of them with yellow background related to safety devices.
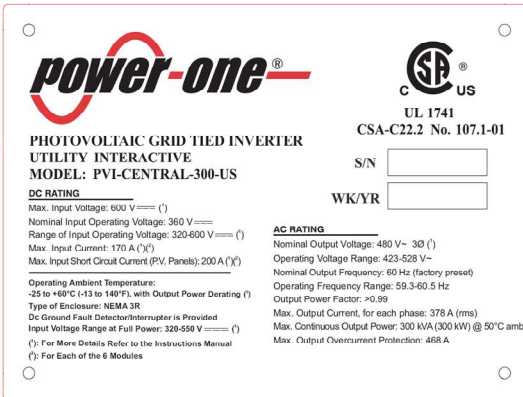
Figure 1-1: Example of certification mark and safety labels

Figure 1-2: Example of identification label

1. Generic code "Part Number"
2. Serial order
3. Serial order total quantity
4. Shipping configuration
5. Serial Number
6. Production date
7. General description of the product
8. Country and Factory of origin.

1.4. Documents provided with the device

- This Manual
- Test Certificate
- CD

2. IMPORTANT SAFETY INFORMATION

! NOTICE

The installation of the PVI-CENTRAL-XXX (US or CAN) must be performed in compliance with national and local regulations.
We strongly recommend to read all instructions in this Manual and notice the symbols of the single paragraphs before installing or using the product.

! NOTICE

For each type of maintenance or repair (not covered in this manual), please contact the dealer. Prohibited changes may damage the device and things in general, causing the loss of product warranty.

! NOTICE

Electrical connections must always be made correctly and with the correct polarity in order to avoid possible damage to the device and the photovoltaic panels.

⚠ WARNING

The connection to the distribution grid should be made only after receiving approval from the Body responsible for electricity distribution, as required by national regulations in force and can be done exclusively by a qualified personnel.

Recommended use of appropriate tools

⚠ WARNING

In case of failure, an electric arc may have been produced within the PVI-CENTRAL-XXX (US or CAN), supported by the DC source. At worst, this may even damage carpentry, with possible presence of smoke, and thus being a danger to persons and property.
Carefully follow all instructions in this Manual, paying particular attention to the chapter about installation.

Chapter §10

⚠ **DANGER**

The personnel operating inside the PVI-CENTRAL-XXX (US or CAN), or removing the protections on live parts, must wear suitable personal protection equipment. The inverter is connected to the photovoltaic field and to the distribution grid, and is therefore energised. Do not remove the panels and/or any other protection, unless authorised by the plant manager. Removal of these protections exposes the person to possible electric shock hazards.

Recommended use of appropriate tools

⚠ **DANGER**

It is extremely important and opportune to disconnect the inverter prior to its connection to the photovoltaic field (installation and/or maintenance) by means of the DC switch within the device, as there may be voltages that can result in serious hazard situations. Strings may be disconnected by means of the AURORA PVI-STRINGCOMB-US string combiner (if present).

Recommended use of appropriate tools

2.1. General Information

① NOTICE

Inappropriate use and/or incorrect installation can cause serious damage to persons or property. All operations concerning transport, installation and switch on, including maintenance, must be carried out by a qualified and trained personnel, possessing the skills necessary to perform the required tasks (all national standards for the prevention of accidents must be observed).

⚠ WARNING

The installer is encharged with the completion of all tests and measures to ensure the adequacy of the final plant, in accordance with the laws and directives in force, and the applicable regulations. Failure to comply involves the decline of any form of warranty and liability by Power-One. Records of the tests performed during installation shall be kept available for subsequent inspections and for the purposes intended by the standards and laws in force.

Power-One assumes no liability for damage to persons and property due to incorrect interpretation of the instructions in this Manual or from improper use of the device.

3. GENERAL INFORMATION AND FEATURES OF A PHOTOVOLTAIC SYSTEM

The purpose of this chapter is to provide the user of "AURORA PVI-CENTRAL-XXX (US or CAN)" general information concerning the photovoltaic systems that transform solar energy into electrical energy, usable in the distribution grid.

3.1. Photovoltaic energy

In the process of energy conversion, for many years, industrial companies (great energy consumers) have been experimenting with forms of energy saving and lower emission of pollutants, through a prudent and rational use of known resources and the research of new forms of clean and inexhaustible energy.

Renewable energy sources provide a major contribution to solving the problem. In this context, the exploitation of solar energy to generate electricity (photovoltaic) is becoming increasingly important worldwide. Photovoltaic energy represents an enormous advantage in terms of environmental protection because the solar radiation we receive from the sun is directly converted into electricity without any combustion process and without the production of nature-polluting waste.

Photovoltaic panels convert the energy radiated by the sun into electrical energy of "DC" type (by means of a photovoltaic field, also called a PV generator). In order to supply the distribution grid so this electricity can be used, it should be converted into alternating current "AC". This conversion, known as DC to AC conversion, is carried out efficiently by the AURORA inverters without the use of rotating elements, but only by means of static electronic devices.

When used in parallel with the grid, the alternating current output from the inverter flows directly through the insulation transformer (where required) into the industrial distribution circuit, connected in turn to the public distribution grid.
If the supply from the photovoltaic field is low, the amount of energy necessary to guarantee the normal operation of the connected appliances is taken from the public distribution grid. However, if the opposite occurs, i.e. a surplus of energy is produced; it is directly introduced in the grid, thus becoming available for other users.

i In compliance with local and national regulations, the energy produced can be sold to the distribution grid or credited against future consumption, thus producing energy savings.

3.2. Fundamental elements of the photovoltaic field: "Strings" and "Arrays"

In order to significantly reduce installation costs of the photovoltaic field, especially related to the wiring problem on the inverter DC side and the subsequent distribution on the AC side, the STRING technology was developed.

A photovoltaic PANEL is made up of many photovoltaic cells mounted on the same support base. A STRING is made up of a certain number of panels connected in series. An ARRAY is made up of one or more strings connected in parallel.

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

Maximizing the number of panels in each string, the cost and complexity of the connection systems of the plant may be reduced.
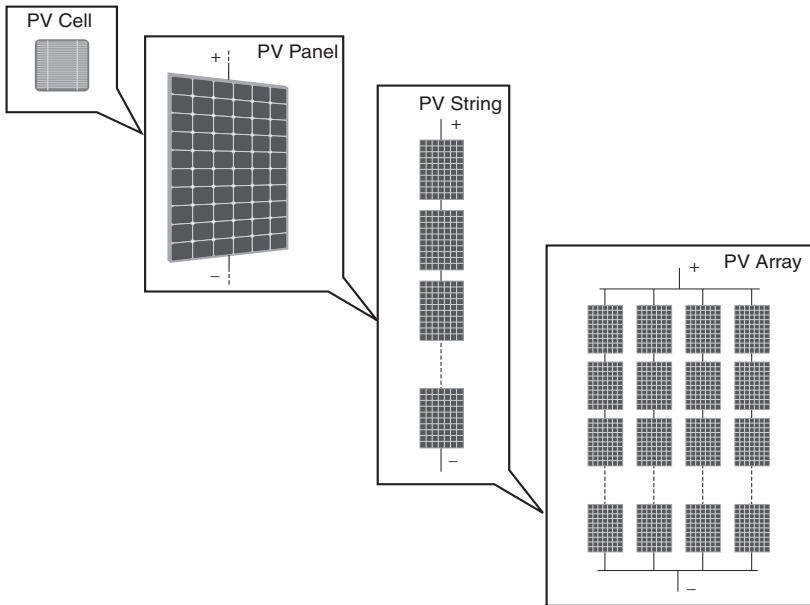
Figure 3-1: Example of Array composition

NOTICE

In no case should the voltage of the string exceed the maximum permissible voltage, in order to avoid damage to the device.

Chapter §22

The current value of each "array" must also be within the limit values of the inverter located downstream.

Decisions on how to structure a photovoltaic system depend on a number of factors and considerations to be made, such as the type of panels, the available space, the future location of the system, long-term energy production targets, etc.. on the Power-One website (www.power-one.com).
A configuration program is available, that can help with the correct dimensioning of the photovoltaic system.

4. SCOPE AND GENERAL DESCRIPTION OF THE PRODUCT
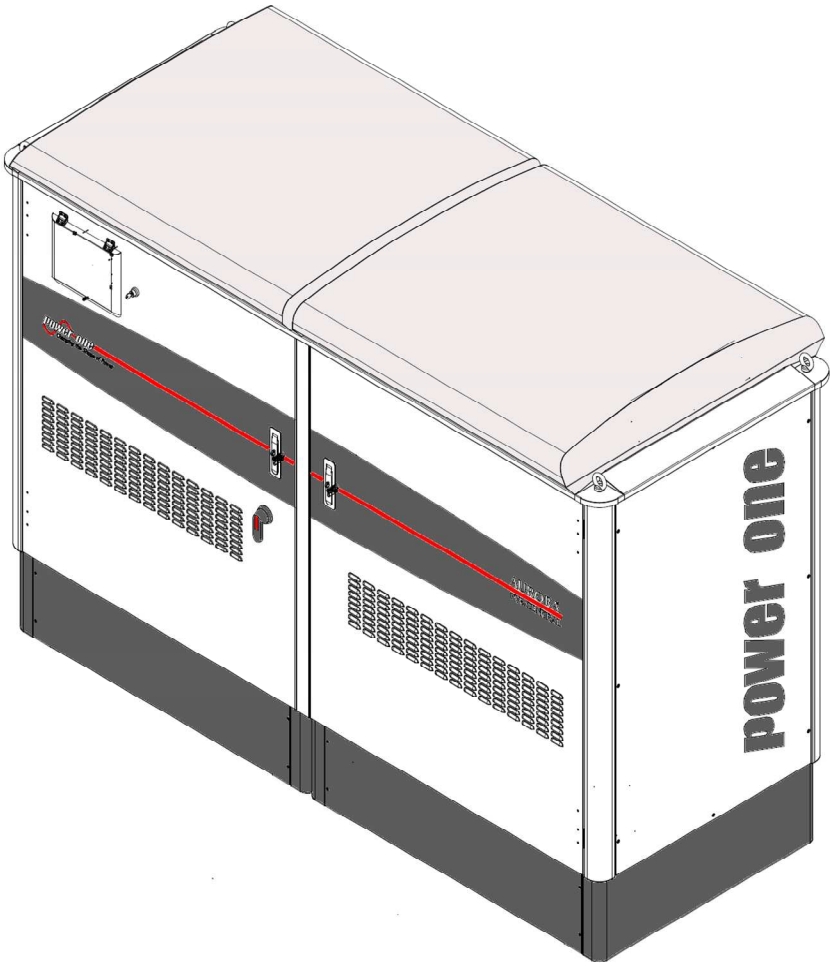
Figure 4-1: PVI-CENTRAL-XXX (US or CAN) Series

The PVI-CENTRAL-XXX (US or CAN) (Figure 4-1) are devices designed exclusively for converting solar energy into electricity compatible with the grid of the country where it is marketed. They are also equipped with adequate electrical and mechanical protection.

i If the inverters are connected to string combiners (AURORA PVI-STRINGCOMB-US), they also allow the monitoring of the entire photovoltaic field, via the following inspections:

- Reading the string currents (10 channels available)
- Reading the total voltage of the field
- Checking the functioning of the inside fuses, to protect the photovoltaic panels.
- Other functions.

AURORA PVI-CENTRAL-XXX (US or CAN) is a device that can feed the electricity grid with energy from the photovoltaic panels.

Chapter §3

When used in parallel with the grid, the inverter alternating current output flows in the industrial distribution circuit, connected in turn to the public distribution grid (Figure 4-2).
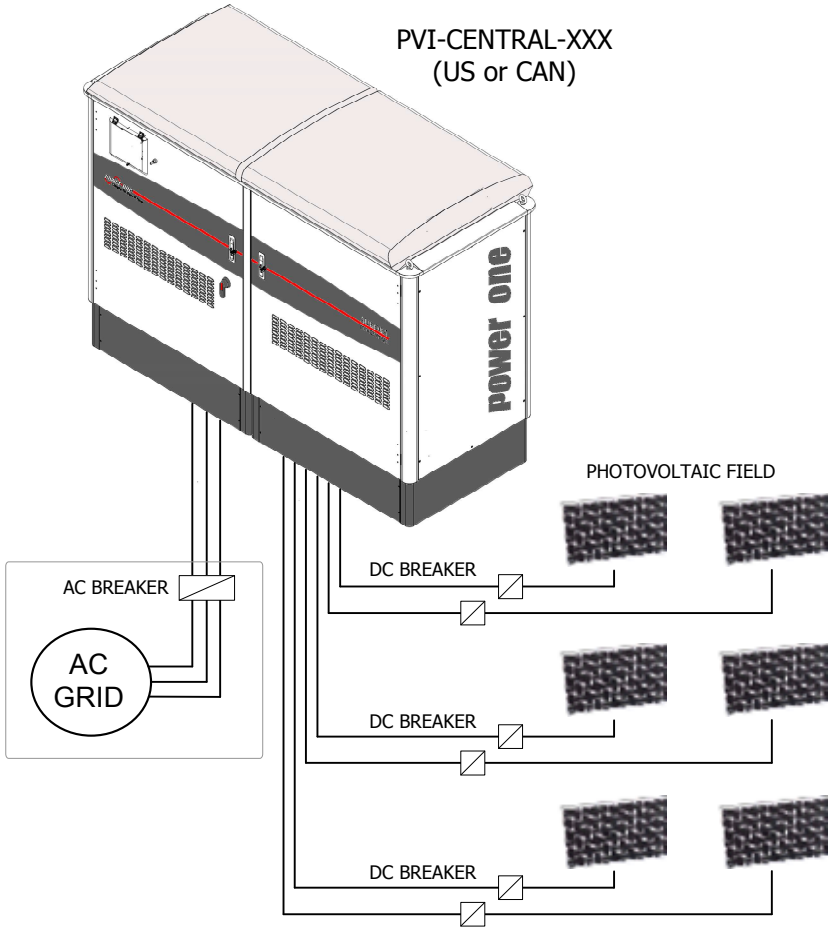
Figure 4-2: Example of connection to the AC grid of the inverter

4.1. Technical Description of AURORA PVI-CENTRAL-XXX (US or CAN)

Figure 4-3 shows the block diagram of AURORA PVI-CENTRAL-300 (US or CAN).
In both configurations, models with lower power (250kW) have the same block diagram, but a smaller number of 50 kWp modules.

i What are "MODULES"?
They are the DC/AC converters of 50kW and are the core of AURORA PVI-CENTRAL-XXX (US or CAN). All converters function at high switching frequency (18kHz), taking up relatively little space and a fairly low weight, facilitating maintenance.
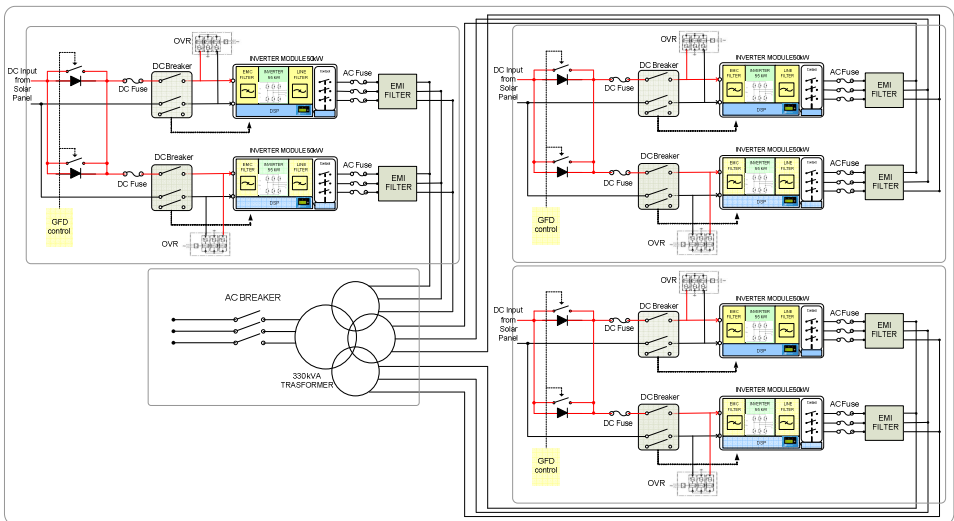
Figure 4-3: Electrical diagram PVI-CENTRAL-300 (US or CAN)

The block diagram of Figure 4-3 shows the AURORA PVI-CENTRAL-300 (US or CAN) model with its 6 independent converters (Multi-Master/Slave mode).

Converters can operate in two different modes, according to the type of device required. Configuration is done in the factory prior to delivery: Multi-Master/Slave and 1Master/N.Slave.

4.1.1 Multi-Master/Slave

In the Multi-Master/Slave mode, the Framework[1] Master/Slave manages the maximum power point (MPPT).

Chapter §6.1.1

In this case, the fields connected to each Framework have the same polarity.

4.1.2 1Master/N.Slave (Inverter ≥ 300kW)

In 1Master/N.Slave mode, a single Master manages the maximum power point (MPPT) for the entire device.

Chapter §6.1.2

In this case, the fields connected to the entire device have the same polarity.

! AVVISO

It is important that the operation of the DC input switches be well understood.

4.1.3 MPPT (Maximum Power Point Tracker)

The great advantage in using the PVI-CENTRAL-XXX (US or CAN) is the ability to extract maximum power from the solar panels, regardless of environmental conditions.

A photovoltaic panel shows the curves of current-voltage (I-V in bold) and power-voltage (P-V) illustrated in Figure 4-4.

An array, therefore, has the same characteristic. The highest point is the maximum power. This point of the feature varies continuously depending on the level of solar radiation hitting the surface of cells.

i On days with variable cloudiness, solar power changes occur very fast and wide-ranging.
Variations between 100W/m² and 1200 W/m² can be easily detected in about 2 seconds.

AURORA PVI PVI-CENTRAL-XXX (US or CAN) is designed to extract maximum power from the array it is connected to, thus it will always work in the "knee" of the Voltage-Power curve.

Moreover, since the device in question has fast tracking / settling periods, especially on variable days it may produce much more energy than a "slow" inverter.

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[1] For "FRAMEWORK" definition.

Chapter §5.2.4

i PVI-CENTRAL-XXX (US or CAN) scans the photovoltaic field at each connection, allowing discovering any possible multiple power peaks in the field characteristic. In this way, the inverter is placed immediately on the highest peak.
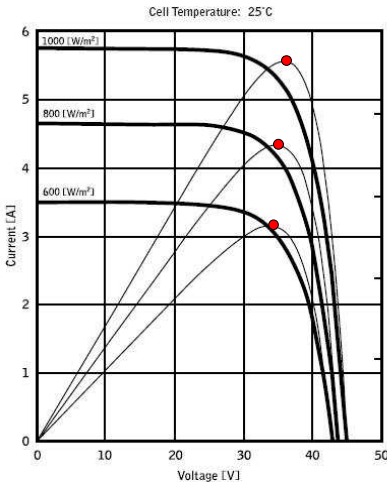
Figure 4-4: Example of I-V curves (Current-Voltage) and P-V (Power-Voltage) of a solar panel

i Unlike other inverters, PVI-CENTRAL-XXX (US or CAN) follows very fast variations in illumination, allowing the MPPT system to follow the light practically in real time.

4.1.4 Special features

Due to the high efficiency of AURORA and the system of heat dissipation amply sized, this inverter ensures operation at maximum power over a wide ambient temperature range.

Chapter §22

The inverter is controlled in each module by a DSP (Digital Signal Processor) and by a central microprocessor. This means that the failure of a slave module does not compromise the whole system but only the loss of up to 50kWp. In a Multi-Master/Slave system, in case of failure of the Master, undetectable by the Slave module, the system loses 100kWp, while in case of failure of Master detected by the Slave module it loses up to 50kWp.

The dialogue between DSP and the Microprocessor occurs via a CAN BUS communication. The same protocol is used for dialogue between modules belonging to the same system but with different Frameworks. This guarantees optimum operation of the entire device and a high performance in all insulation and load conditions, always in full compliance with its relative guidelines, standards and regulations.

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

Chapter §8

5. DESCRIPTION OF COMPONENTS AND COMPOSITION OF THE PVI-CENTRAL-XXX (US OR CAN)

5.1. Overview

Figure 5-1 shows the main components of the PVI-CENTRAL-XXX (US or CAN). The main characteristic of the device for these models is the presence of an insulation Transformer together with three FRAMEWORK-(E) (two overlapping and one above the Transformer compartment) to contain five or six power modules "MODULI 50 kW".
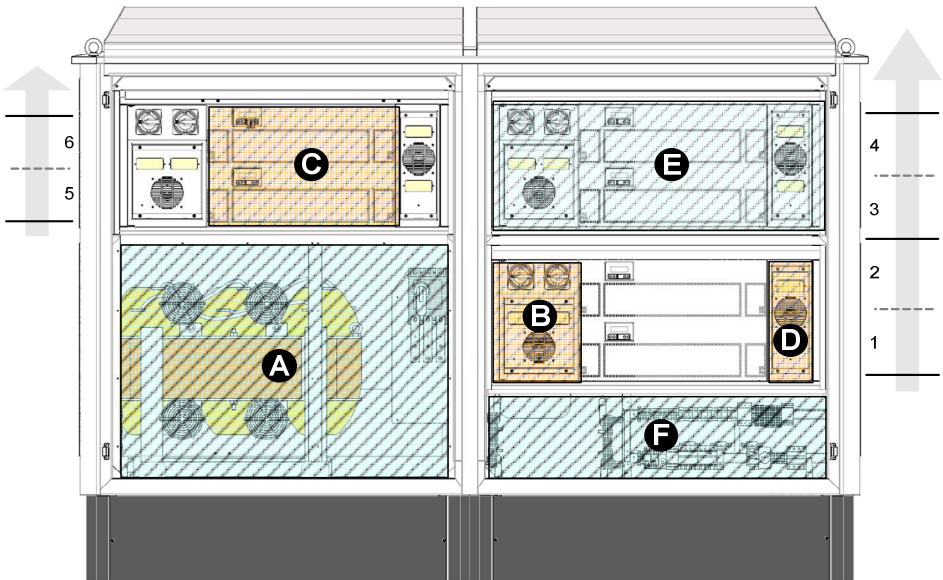
Figure 5-1: General overview of the PVI-CENTRAL-XXX (US or CAN)

5.2. Description of the inverter parts
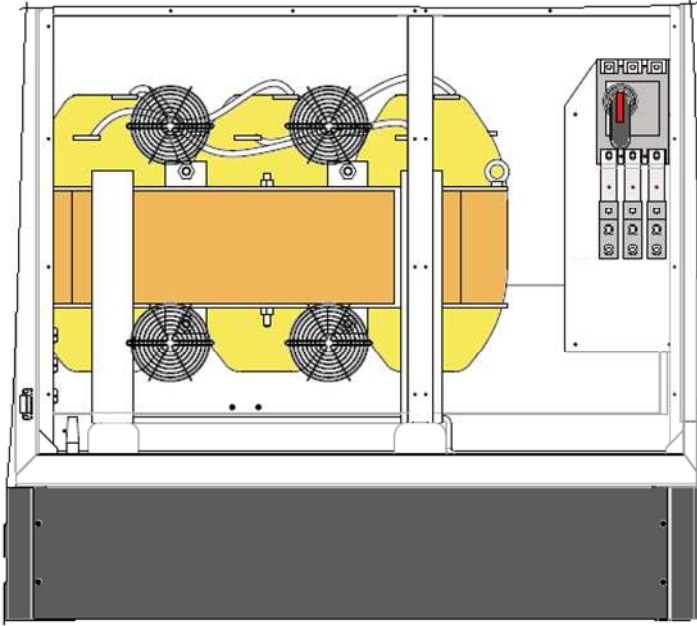
Figure 5-2: General view of ACBOX (A)

INPUT/OUTPUT
ALARM AND
CONTROL SIGNALS

INPUT DC
CABLE

AUXILIARY AC
INPUT
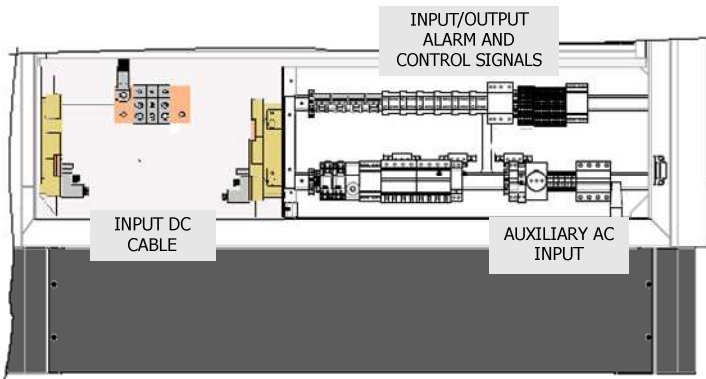
Figure 5-3: General view of ACBOX (F)
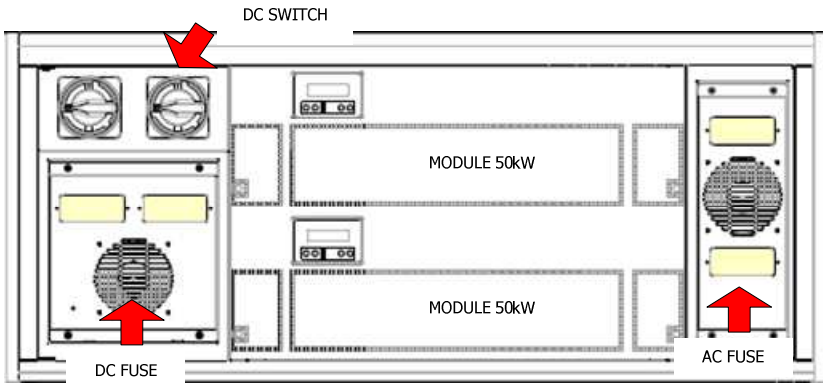
Figure 5-4: General view of FRAMEWORK (E)

5.2.1 ACBOX (A)(F)

The connection area of DC cables coming from the photovoltaic field is located in the (F) area of the ACBOX (with frontal view to the left of the inverter). Positive inputs are on the left and negative inputs on the right (Figure 5-5). The numbers corresponding to "MODULI 50 kW" go from the outermost (module 1) to the innermost one.
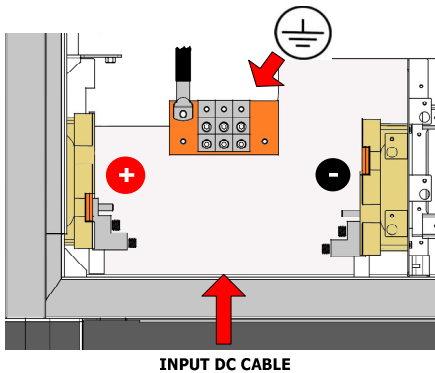
The insulation Transformer is located in the ACBOX T (Figure 5-1 (A)).

It is cooled by four cooling fans located on the front panel. The AC breaker with the connection bars and the Contactor are located in the same compartment, to the right of the Transformer. (Figure 5-6).

Figure 5-5: DC Cable Input
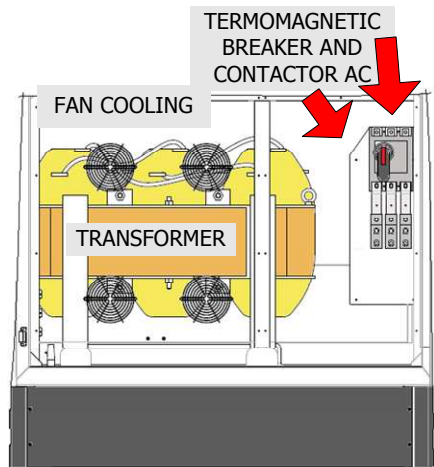
Figure 5-6: AC Cable Input

5.2.1.1 Control devices and electro-mechanic parts contained in the ACBOX (A)

 Figure 5-7, Illustrates the electro-mechanic devices and components contained in the Transformer compartment. The compartment contains the protection device against over current in the AC grid and its respective fuses, the control thermostat and the hygrostat for the compartment in which the Transformer is located.
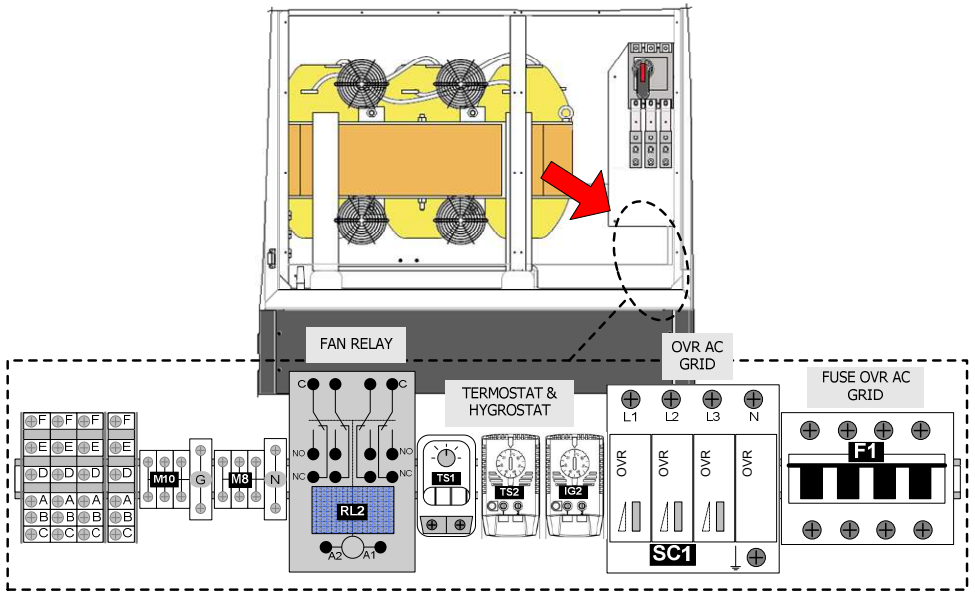
Figure 5-7: ACBOX (A) signal terminal board

5.2.1.2 Control terminal board, devices and electro-mechanic devices contained in ACBOX (F)
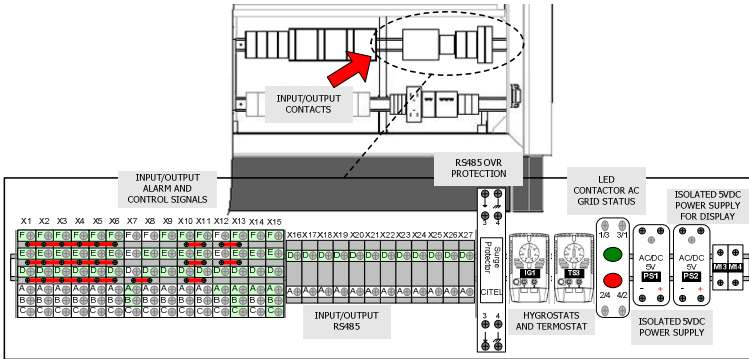
Figure 5-8: Input/Output control and alarm signals

Figure 5-8 starting from the left, illustrates the input and output terminal board for the control signals. The terminal board in the centre allows for serial communication with an over current protection device. More to the right there is an IG1 hygrostat for the detection of humidity and a TS3 thermostat. Even more to the right, there are a status signaler for the main AC counter and two AC/DC 5V insulated suppliers, PS1 and PS2.
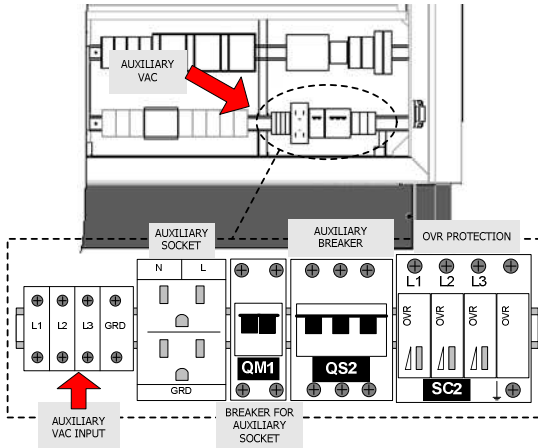
Figure 5-9: Auxiliary AC Input

Figure 5-9 starting from the right, shows the auxiliary supply terminal board (normally cabled from the inside), a service socket with a dedicated QM1 switch, breaker QS2 for auxiliary voltage and over current protection devices SC2.

Figure 5-10 illustrates the distribution terminal boards for auxiliary voltage and the AC/DC supplier (PS3) for the cooling fans of the fuses located in the framework.
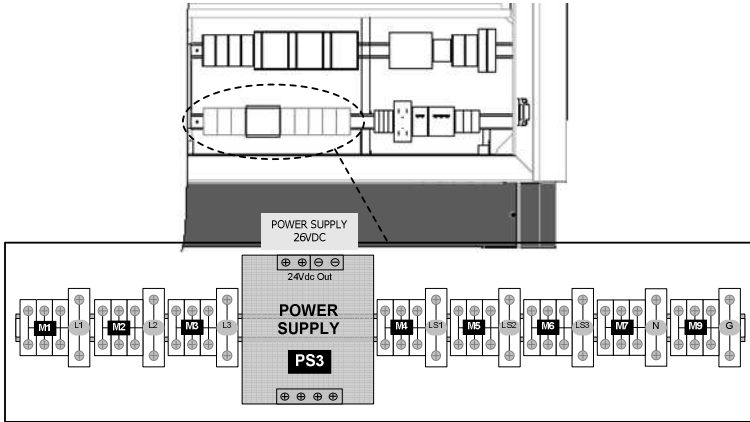
Figure 5-10: Various devices

Figure 5-11, starting from the left, illustrates the devices for ground fault detection (GFD) and relative fuses, therefore the relays for the commanding of the internal functions (opening/closing the counter, switching the cooling fans on/off etc).
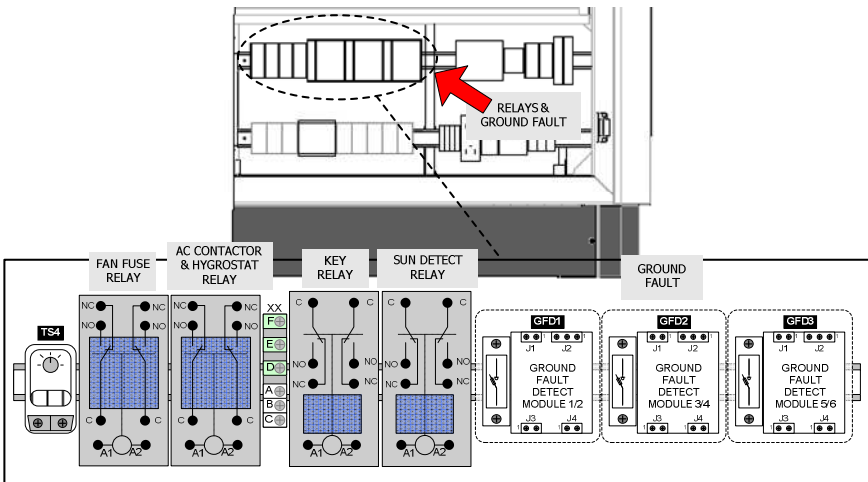
Figure 5-11: Relays and Ground Fault

5.2.2 50kWp Modules area (C)

This is the core of the PVI-CENTRAL-XXX (US or CAN). It is connected to two[1] DC/AC conversion modules that can convert photovoltaic power into electric power compatible with the distribution grid. Each module is equipped with signalling LEDs and an interactive display.

5.2.3 AC Fuses area (D)

Removing this panel you can access the fuses on the AC line of each module. In addition, two transparent windows allow inspecting if one or more fuses are faulty.

Chapter §17.1.4.2

5.2.4 Framework (E)

This unit contains areas B, C and D and can be complete (100 kW version) or devoid of the electro-mechanic parts that correspond to the upper module (50 kW version).

5.2.5 Enumeration of the 50kWp Modules

The enumeration of modules is similar to the one indicated in Figure 5-1. The right-lower module will always have the number 1, while the final number depends on the inverter model (e.g. for the model from 250kW the enumeration ranges from 1 to 5).

NOTICE

The enumeration of modules must not be confused with the serial number of the single module. The use of enumeration of single modules facilitates the connections on the DC side (where there are labels with the corresponding enumeration).

Chapter §5.1

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[1] In case of a 250kW versions, only one module may be present.

6. DESCRIPTION OF THE INPUT CONFIGURATIONS AND DC SWITCHES OPERATION

6.1. Possible field configurations

There are various ways of configuring the AURORA PVI-CENTRAL-XXX (US or CAN) input in order to meet the construction requirements of the photovoltaic field.

Chapter §4.1

The type of configuration depends on the model of the inverter ordered.

6.1.1 Multi-Master-Slave

In this configuration the inverter behaves like several 100kW-powered separated inverters (Figure 6-1 dotted lines), as many inverters as half the number of modules present. This means that each Framework works separately with an MPPT that is independent from the others.

Chapter §4.1.1

The position of the Master and the Slave within a Framework is not predefined. The module with the highest serial number is always the Master.

6.1.2 Master-Slave with a single Master

In this configuration the entire device behaves like a single Master-Slave inverter, and therefore with a single Master (Figure 6-2).

In this case, however, the following points must be fulfilled:

- The company or person responsible for the construction of a photovoltaic system must install a DC switch uphill to the inverter in order to break the entire photovoltaic field.

- Particular attention must be given to the DC switches maneuvers.

Chapter §6.1.2.1

The position of the Master and the Slave within an Inverter is not predefined. The module with the highest serial number is always the Master.
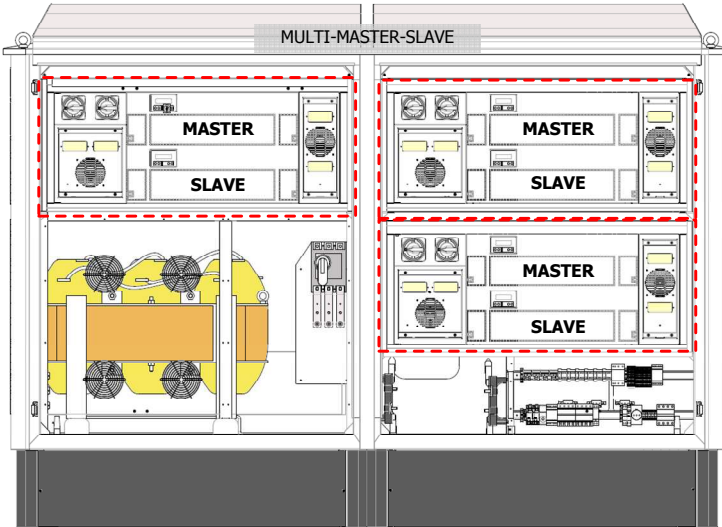
Figure 6-1: PVI-CENTRAL-300 (US or CAN) (Multi-Master/Slave)
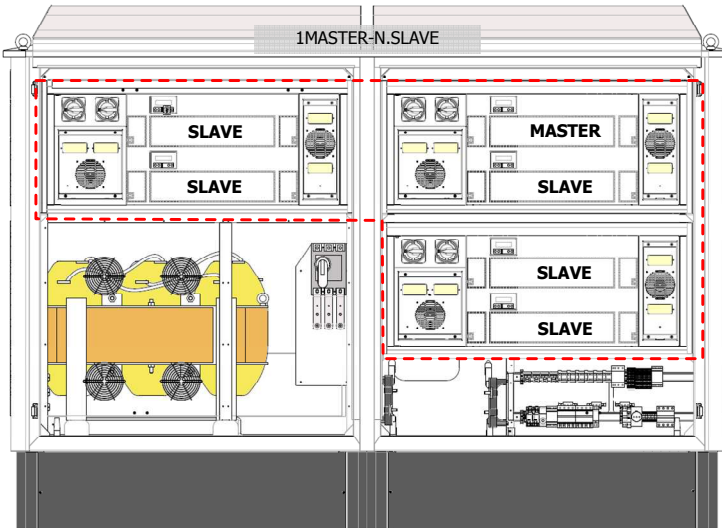
Figure 6-2: PVI-CENTRAL-300 (US or CAN) (1 Master-N.Slave)

6.1.2.1 Features of the external DC switch

It is important that the external DC switch is selected according to these characteristics:

- Earth insulation: 600 Vdc.

- Rated voltage: 600 Vdc.

- Rated current: 170 A x number of Modules (example, PVI-CENTRAL-300: 170x6 = 1020 Adc).

- Check the serial connection mode of the poles of the switch to ensure breaking at 600 Vdc.

- In case of switches with thermal breakers, make sure the temperature threshold does not intervene with the maximum admitted room temperature for operation.

6.2. Function of the DC disconnecting switches in every Framework

Inside the side panel, the switch on the lower right side acts on the connection of the low module (L-Low), while the switch on the top right acts on the high module (H-High).
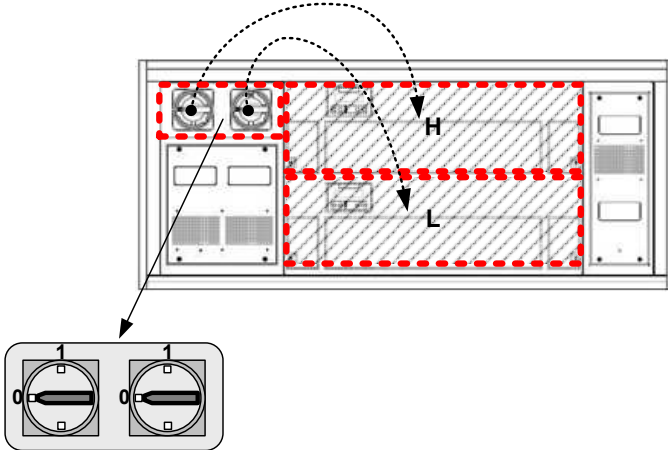
Figure 6-3: Framework - detailed action on DC switches
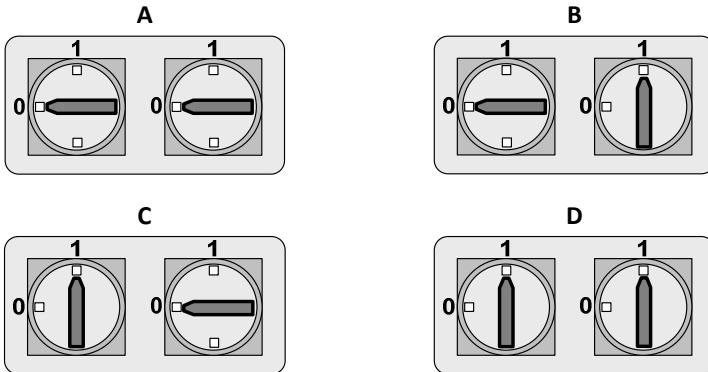
Figure 6-4: Possible switch positions

Every Framework can contain up to a maximum of 2 50kWp modules.
In a 50kWp Framework, only the lowest module (L-Low) will be installed.

6.2.1 Multi-Master-Slave System
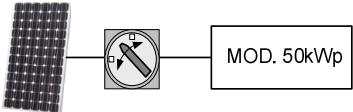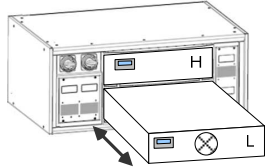
In this configuration, the two modules of the Master-Slave Framework have the same photovoltaic field. <u>Each DC disconnecting switch is linked to the other of the same Framework</u>.

> ## ❗ NOTICE
>
> In this case, it is particularly important to understand the use of the DC disconnecting switches. <u>Improper use may cause the inverter to breakdown</u>.

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 6-1: Admitted operations and position of the DC switches

MULTI - MASTER – SLAVE				
POSITION DISCONNECTING SWITCHES DC Figure 6-4	**PHYSICAL CONNECTION BETWEEN DC SOURCE AND MODULE**		**WITHDRAWAL / 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 withdrawal, wait 5 minutes after the last disconnecting switch was positioned on 0 (OFF).

6.2.2 1Master-N.Slave System

In this configuration, all modules have the same photovoltaic field. <u>Each DC disconnecting switch is linked to the others and to the other Frameworks</u>.

> (!) **NOTICE**
>
> In this case, it is particularly important to understand the use of the DC disconnecting switches. <u>Improper use may cause the inverter to breakdown</u>.

The following table indicates the allowed operations for the DC switches of each framework, according to the position of the external DC switch.

Table 6-2: Admitted operations and position of the DC switches

1 MASTER – N. SLAVE		
POSITION DISCONNECTING SWITCH EXTERNAL DC	**POSSIBLE ACTIONS ON DC SWITCHES**	**PROHIBITED ACTIONS ON DC SWITCHES**
OPEN (OFF)*	**After 5 minutes of the opening of the external switch, the switches can be operated without problems***	-
CLOSED	**DC disconnecting switches can be opened after having turned off the relative module via remote OFF, or after having disconnected the AC grid.**	(!) <u>**Open switches cannot be closed**</u> **(in this case it is absolutely necessary to first open the external disconnecting switch and wait 5 minutes)**

- before extraction, wait 5 minutes after the external disconnector has been switched OFF (0).

7. PROTECTIONS

7.1. Protection for grid failure

In case of an interruption of the local distribution grid from the electricity company or if the apparatus is switched off for maintenance, AURORA must be physically disconnected in safe conditions in order to guarantee the protection of the persons operating on the grid, all in compliance with the relative applicable national standards and laws.

To avoid possible island operations, AURORA is provided with an automatic protective disconnection system.

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7.2. Additional protection

AURORA is equipped with additional protections to guarantee the safe operation under any circumstances. Such protections include:

- 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 marketed).

- 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.

Chapter §11.6

- Internal temperature control to automatically limit power if necessary and to guarantee that the unit does not overheat. The graph in the Figure 7-1 e Figure 7-2 shows the automatic derating of delivered power.
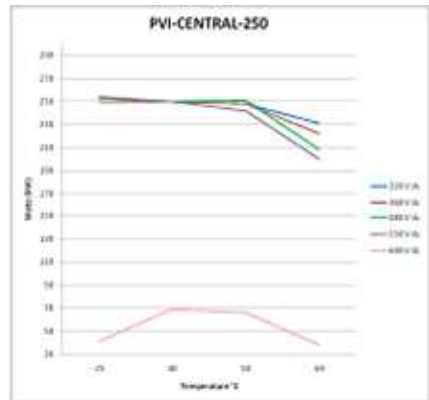
Figure 7-1: Power derating 250kW

Table 7-1: Table of power derating 250kW

Vdc	@-25°C [kW]	@40°C [kW]	@50°C [kW]	@60°C [kW]
320	250	250	248	231
360	250	250	248	222
480	253	250	251	208
550	254	250	241	200
600	41	69	66	38
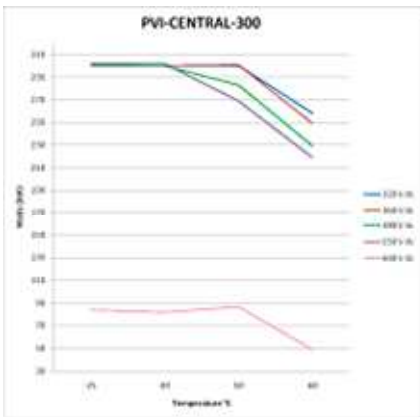
Figure 7-2: Power derating 300kW

Table 7-2: Table of power derating 300kW

Vdc	@-25°C [kW]	@40°C [kW]	@50°C [kW]	@60°C [kW]
320	300	300	300	258
360	301	300	301	249
480	300	300	283	229
550	302	302	269	219
600	84	82	87	49

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

Automatic measures:

- The DC voltage of the photovoltaic field is measured and the independent overvoltage (OV) is signalled on each module.
- The independent AC voltage on each module is measured.
- The independent AC current of each module is measured.
- The independent grid voltage frequency is measured on each module.
- Independent thermal measures on each module.

Protection fuses:

- DC side: presence or not of the fuses, according to the input configuration for each Framework.
- AC side: 3 fuses for each module, for a total of 6 fuses per Framework.

Other protective measures:

- Magnetothermic switch at the input of the auxiliary supply network.
- Magnetothermic switch at the input of the distribution grid (480 Vac).
- DC side: protections against over voltages (OVR), with replaceable cartridges.
- AC side: protections against over voltages (OVR), with replaceable cartridges on the 480Vac grid and the auxiliary voltage.
- Protection against over voltages (OVR), with replaceable cartridges on the RS485 serial line.
- Protections against overheating on each module.

8. RS485 SERIAL LINE

8.1. Connection modalities of the RS485 line

The connection for communication with the exterior of the PVI-CENTRAL-XXX (US or CAN) occurs by means of the RS485 data serial line. Up to 10 inverters can be connected to the same line.

The termination must be inserted by activating the switch beneath the main display (Figure 14-2).

NOTICE

The last PVI-CENTRAL-XXX (US or CAN) of the chain must have the line termination enabled (Figure 8-1, Figure 8-2), while the others must have it disabled.

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The use of a computer is not fundamental for the operation of the system. This is necessary only for functional verification during installation and system monitoring from a PC.

Chapter §16
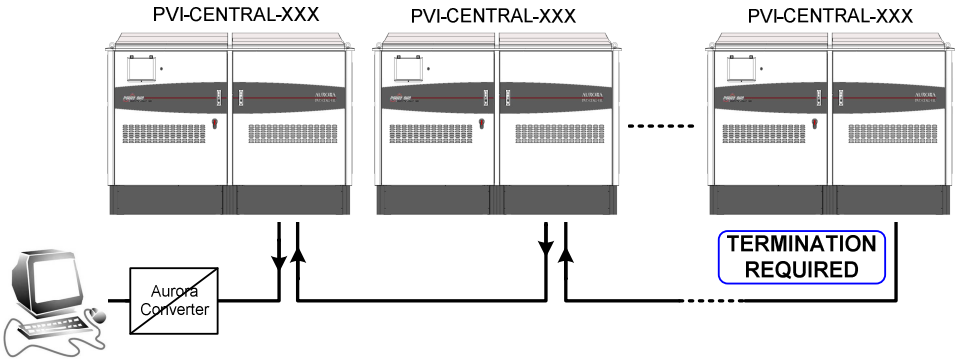
Figure 8-1: Passage mode of the PVI-CENTRAL-XXX (US or CAN) serial cable

PVI-CENTRAL-XXX (US or CAN) of various types may be connected in "daisy-chain". It is possible to connect devices of different types and sizes.
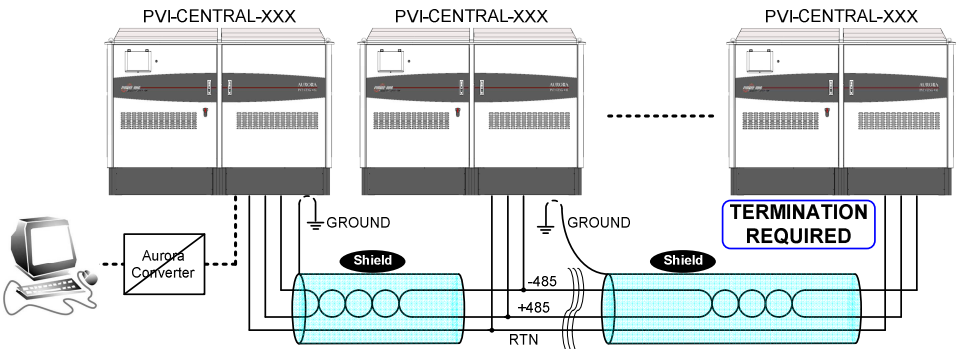
Figure 8-2: Type of connection of the PVI-CENTRAL-XXX (US or CAN)

8.2. Connection modes for monitoring

There are 2 main modes (A and B) to connect the RS485 line from the PVI-CENTRAL-XXX (US or CAN), in order to carry out the monitoring of the inverter, while a third and fourth mode (C and D) does not require the RS485 connection. Figure 8-3 shows the modes:
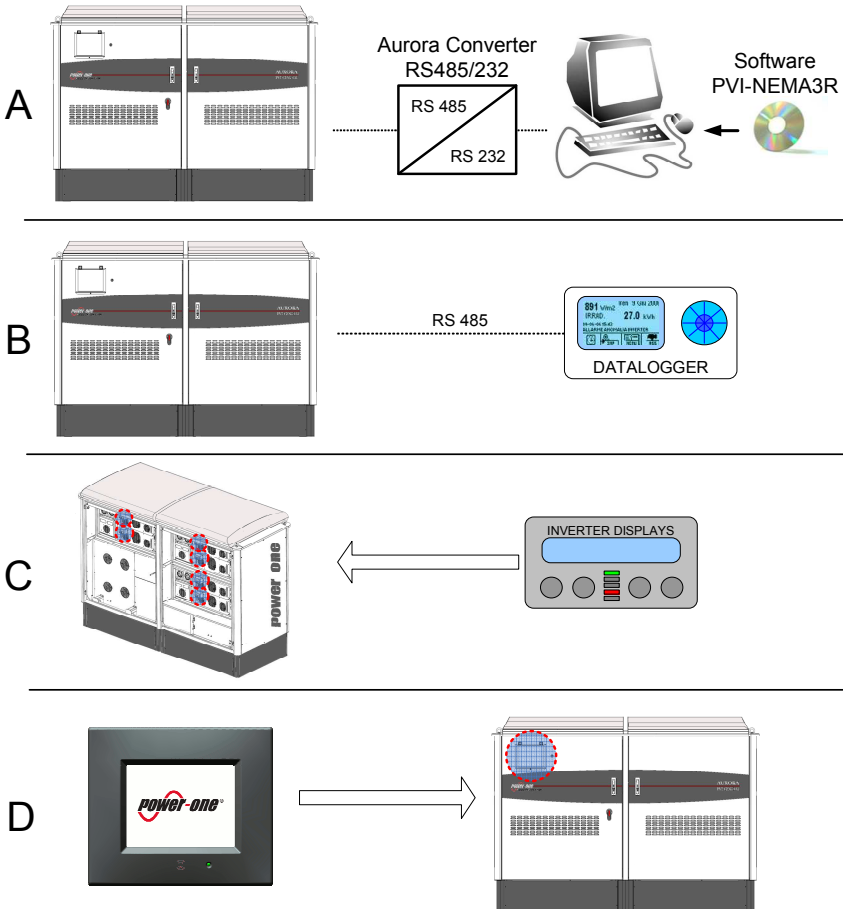
Figure 8-3: Connection modes

Where:

A) <u>Connection to the PVI-CENTRAL-XXX (US or CAN) with a PC</u>.
The Computer is connected to the RS485 of the inverter by means of the Aurora RS232/485 Converter adapter. The PC must have the monitoring software installed for the PVI-CENTRAL-XXX (US or CAN). This is the configuration used during installation and monitoring via PC.

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Chapter §16

B) <u>Connection for remote control</u>.
The WEBLOGGER remote monitoring system is connected directly to the RS485. For the operation of this system, see the WEBLOGGER user manual.

C) <u>Stand-Alone Connection at Module 50kW.</u>
<u>The monitoring of the PVI-CENTRAL-XXX (US or CAN) occurs only through the display of the "50kw MODULES".</u>

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D) <u>Stand-Alone Connection at PVI-CENTRAL-XXX (US or CAN).</u>
<u>The monitoring of the PVI-CENTRAL-XXX (US or CAN) occurs only through the display assembled on the front door of the inverter</u>

Chapter §14

9. STORAGE AND HANDLING

9.1. Preliminary checks

The dealer has safely delivered your AURORA to the forwarding agent, and in perfect condition. The forwarding agent, by accepting the package, assumes responsibility until delivery. In spite of the 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 necessary to follow the indications below.

NOTICE

Transport and storage temperatures must be observed.

Chapter §22

NOTICE

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

NOTICE

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 shipping container for signs of 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 shipping container and examine the contents for signs of any damage inside. When unpacking be careful 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 al the packaging material for the inspector!

- If the inspection reveals damages, call the dealer or the authorised dealer. He will decide whether the equipment should be returned for repair and provide instructions in this regard.

- It is the customer's responsibility to make a complaint with the forwarding agent. Failure to follow this procedure can lead to the loss of assistance under guarantee for any damages found.

9.2. Handling and withdrawal of the PVI-CENTRAL-XXX (US or CAN) from the packaging

The package with which is delivered every PVI-CENTRAL-XXX (US or CAN) is usually a wooden crate.

NOTICE

The handling of the inverter in the cage must be done following the instructions in this manual.

Chapter §9.2.3

9.2.1 Content of the packaging

Each package contains the following materials[1]:

Material	Qty
PVI-CENTRAL-XXX (US or CAN)	1
Mechanical Parts	4
This Manual	1
Final Test Documents	1
CD (Software)	1

---

[1] There may be differences pursuant to agreements with the customer.

9.2.2 Removal of the inverter from the wooden crate

> ⓘ **NOTICE**
>
> The packaging of the PVI-CENTRAL-XXX (US or CAN) is done as in Figure 9-1. To withdraw the inverter it is necessary to remove the lid first, and then the side panel.
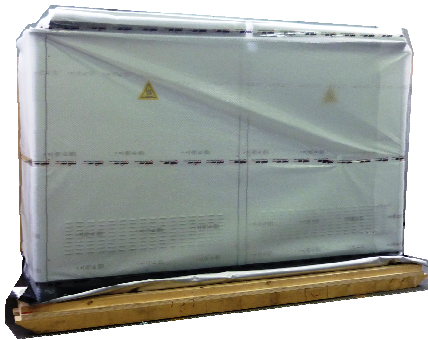
Figure 9-1: Transport crate

After removing the walls of the packaging, remove the inverter protection wrapping. The mechanic parts that make up the base are packaged separately and positioned inside the crate. These parts must be assembled after the device and the connection cables have been placed in their definite position.

9.2.3 Handling of the PVI-CENTRAL-XXX (US or CAN)

After opening the crate, the inverter may be withdrawn.

> ⓘ **NOTICE**
>
> Extraction of the device from the packaging and its positioning must be performed with the help of specific equipment and according to the instructions in Figure 9-2. Please keep in mind that the weight of the inverter is not uniformly distributed and therefore be particularly careful when lifting it.

> ⓘ **NOTICE**
>
> 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 fork up the inverter in a way which guarantees the widest supporting base possible and which does not facilitate the risk of tipping up.
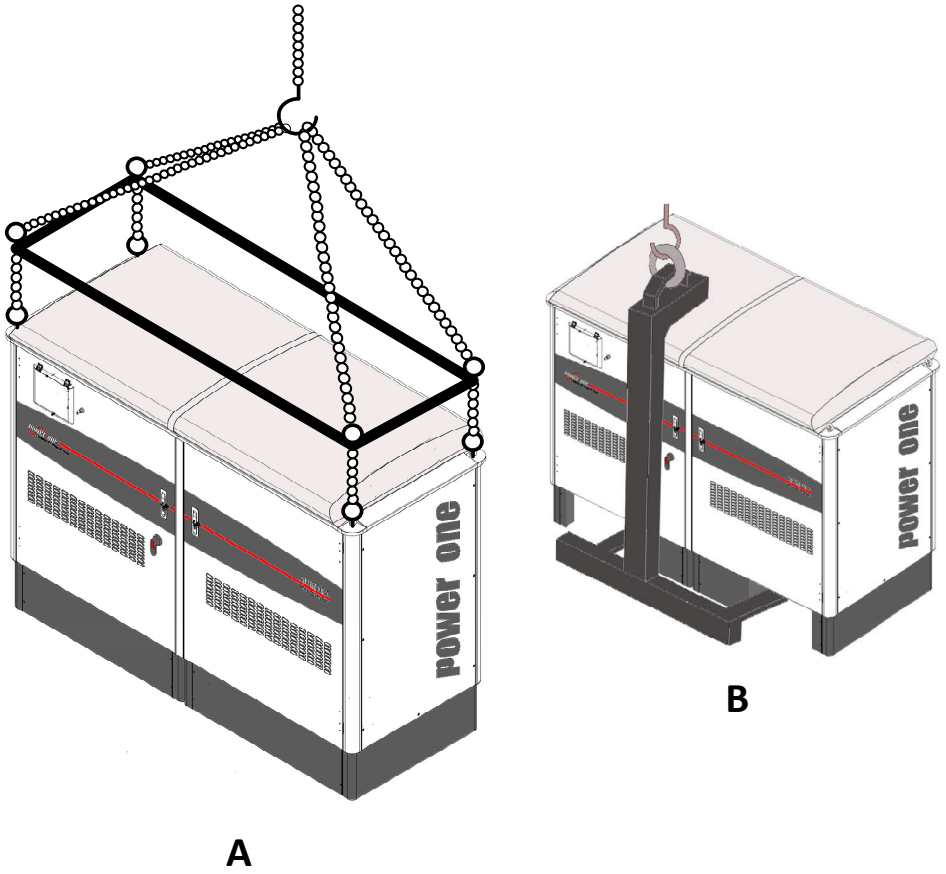
Figure 9-2: Allowed handling

In Figure 9-2 illustrates the recommended handling procedures for PVI-CENTRAL-XXX (US or CAN). In figure A, for the lifting it is advisable to use the framework as pivot to keep the chains in vertical traction in relation with the eyebolts. Figure B illustrate another lifting procedure.

10. INSTALLATION

DANGER

The electrical installation of the PVI-CENTRAL-XXX (US or CAN) must be carried out in compliance with the applicable local and national laws. All cables used and connected to the device or under field voltage, must comply with the minimum insulation requirements of 600Vdc. In case the low voltage cables are carried together with the wires from the photovoltaic field, the installer must ensure that the main electrical insulation conditions are guaranteed.

10.1. Installation location

The environmental situation and the position may affect the functioning of the PVI-CENTRAL-XXX (US or CAN). The following warnings and indications on choice are being provided with regard to the position of the device:

NOTICE

Possibly do not install the device in a position where it is directly exposed to the rays of sun: excessive temperatures could reduce inverter performance. Install the inverter in a position protected from sun.

WARNING

Do not place the PVI-CENTRAL-XXX (US or CAN), near inhabited areas or in places with difficult access. Any escape routes must always be left free.
THE INSTALLATION PLACE MUST BE ACCESSIBLE AT ANY GIVEN TIME.

NOTICE

In the design phase of the plant, take into consideration the data concerning environmental and ventilation conditions.
The quality and quantity of the air, humidity and dust can affect the good functioning of the inverter.

Chapter §22

WARNING

The place where the inverter is placed must be made of flameproof material. There must be no inflammable material in the vicinity.

The hardware maintenance carried out mainly from the front (either the modules area or the AC BOX area (Figure 5-1). However, it is necessary to allow access on all sides in order to facilitate any possible intervention.

10.2. Positioning in the selected place and characteristics of the support base

Follow the precautions in handling, the inverter must be placed on a base which guarantees the vertical position and which can adequately support the weight.

Chapter §22

The sub-base of the inverter must be dimensioned according to these criteria:

- It must be capable of sustaining the weight of the inverter.
- It must be made of reinforced concrete.
- It must be level.
- The foundation must be laid uniformly and not present indents which exceed 0.1 inch per metre.

Figure 10-1 shows the dimensions of the inverter's base (the base anchorage points are highlighted (Figure 10-3)).
Figure 10-2 shows the cable passage.

NOTICE

The inverter must be absolutely stable and perfectly level. Must be secured to the foundation through the provided holes to ensure proper stability.

THE INVERTER MUST BE FIXED TO THE GROUND!

The base on which it rests must be provided with anchorage points so that the inverter cannot be shifted accidentally (Figure 10-3).
Leave sufficient space around the inverter to allow for easy installation and removal from the positioning surface. (Figure 10-4)
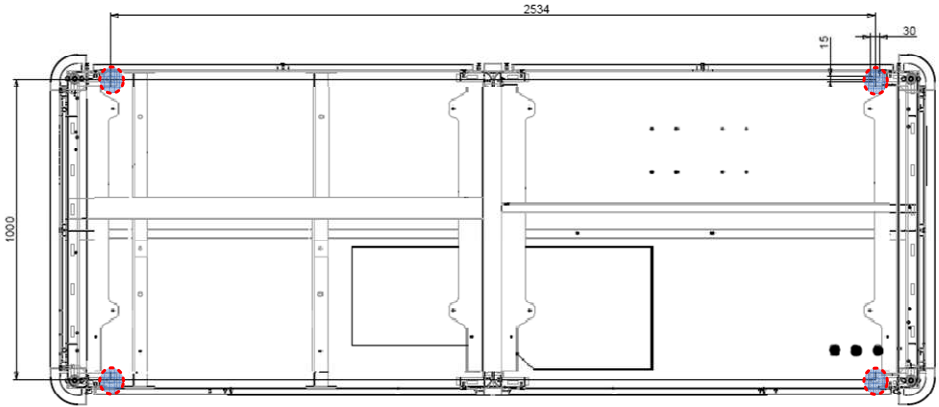
Figure 10-1: Footprint of the base
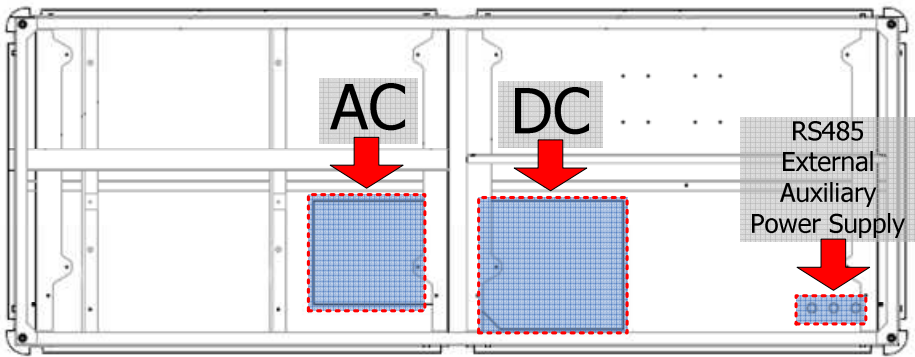
Figure 10-2: Cable passage
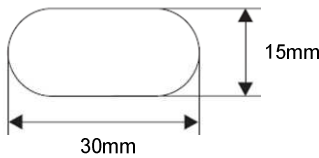
Figure 10-3: Inverter base anchorage orifice

10.2.1 Safety distance

The figure and the table below indicate the minimum distances that should be kept:
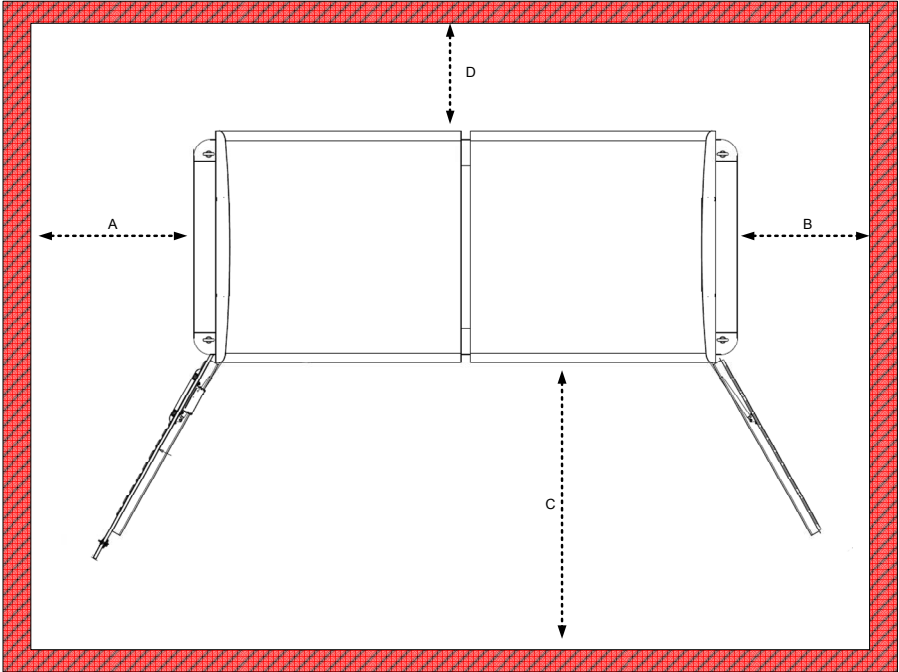
Figure 10-4: Safety distance

Table 10-1: Table of recommended distances

A	B	C	D
600mm	600mm	1500mm	800mm

10.2.2 Accesible sep area

The figure and the table below indicate the minimum dimensions for the step area so as to ensure optimal access to all inverter parts.

i   In case of removal of the 50 kW modules, it is absolutely important to have a stable area that can be stepped on in order to operate in safe conditions.

Chapter §18.5
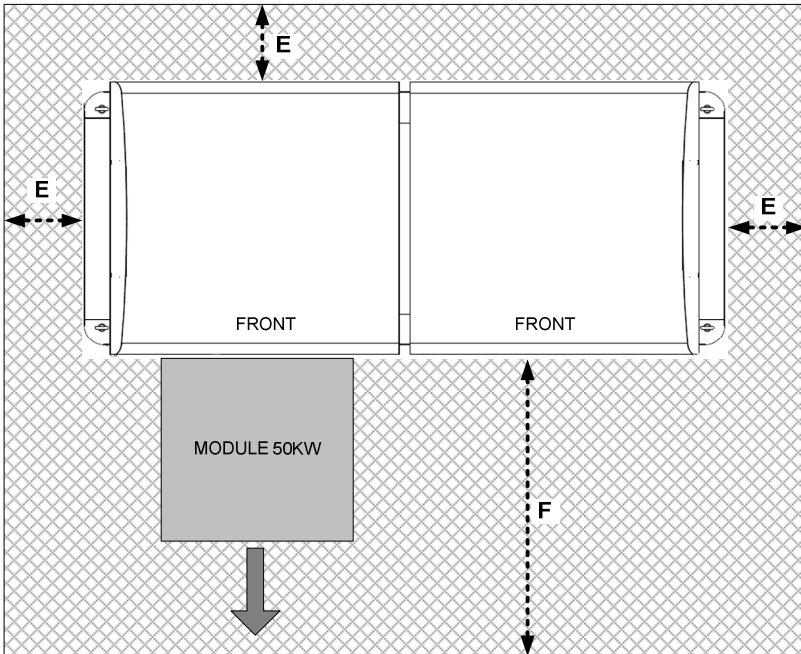
Figure 10-5: Step access area

Table 10-2: Table of recommended distances for access area

E	F
500mm	1000mm

10.2.3 Air vents

Air is suctioned through the front of the inverter and then blown out from the rear according to Figure 10-6.
The air input area contains removable, washable filters.

Chapter §17.1.1
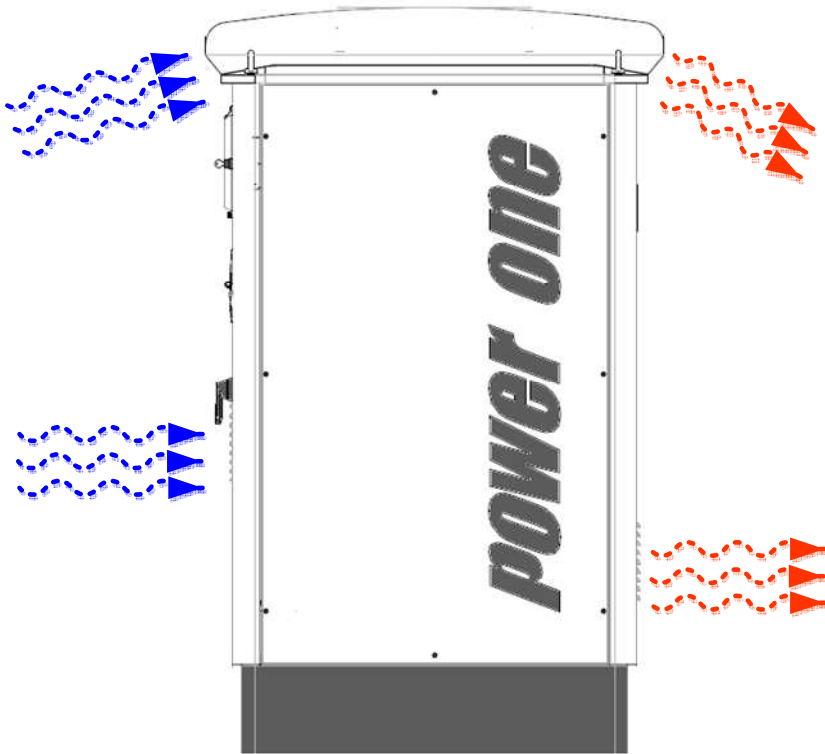
Figure 10-6: Air passage through the inverter

10.2.4 Removal of panels to make the connections

Remove the panels indicated below in the Figure 10-7:

- Rimuovere il pannello (G) per l'accesso alle connessioni AC per l'allacciamento alla rete di distribuzione a 480Vac.

- Rimuovere il pannello (H) per l'accesso alle connessioni della tensione ausiliaria che alimenta la logica di controllo, le ventole interne e per l'accesso alla morsettiera frontale dove è presente la connessione RS485 per le comunicazioni.

- Rimuovere il pannello (L) per l'accesso alle connessioni DC provenienti dal campo fotovoltaico.
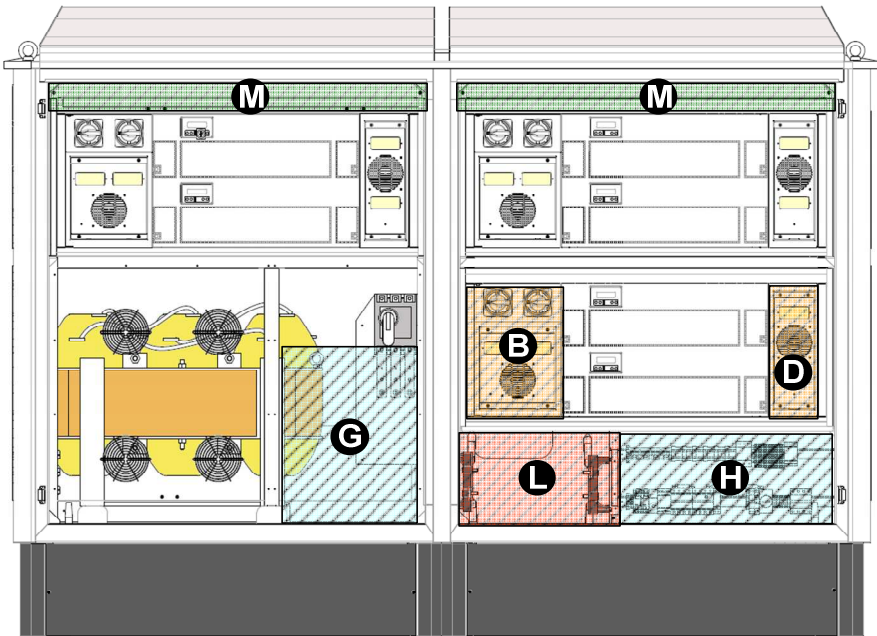
Figure 10-7: Panels to be removed for PVI-CENTRAL-XXX (US or CAN)

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

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10.2.5 Composition of the ACBOX area

After removing the front panel, the following area can be identified:
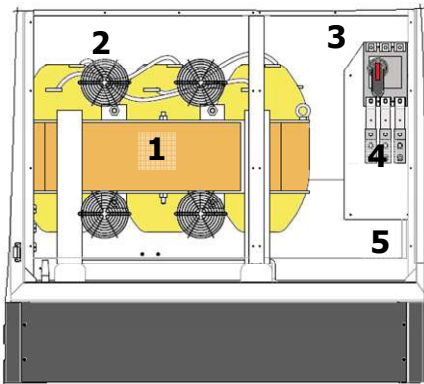
Figure 10-8: Composition of the ACBOX (A)

(1)   Insulation Transformer.
(2)   Fan Cooling of Transformer.
(3)   Magnetothermal breaking and protection switch and, on the rear, transformer breaking contactor.
(4)   AC power network connection bars.
(5)   Transformer connection Contactor.
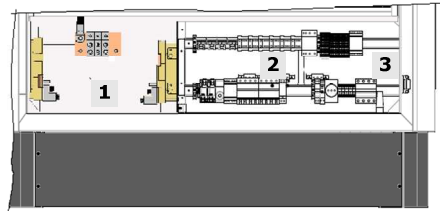
Figure 10-9: Composition of the ACBOX (F)

Where:

(1)   DC cable connection area.
(2)   Area for connection clamps for auxiliary AC and serial communications.
(3)   Area for thermostat, hygrostat and OVR AC side protection.

10.2.6 Cable passage area

Figure 10-10 show the correct position of the inverter input/output cables.

Pass the DC, AC, auxiliary AC, ground and RS485 through the openings in the base of the inverter (Figure 10-2).

These openings can easily be drilled to adapt to the position of the cables.
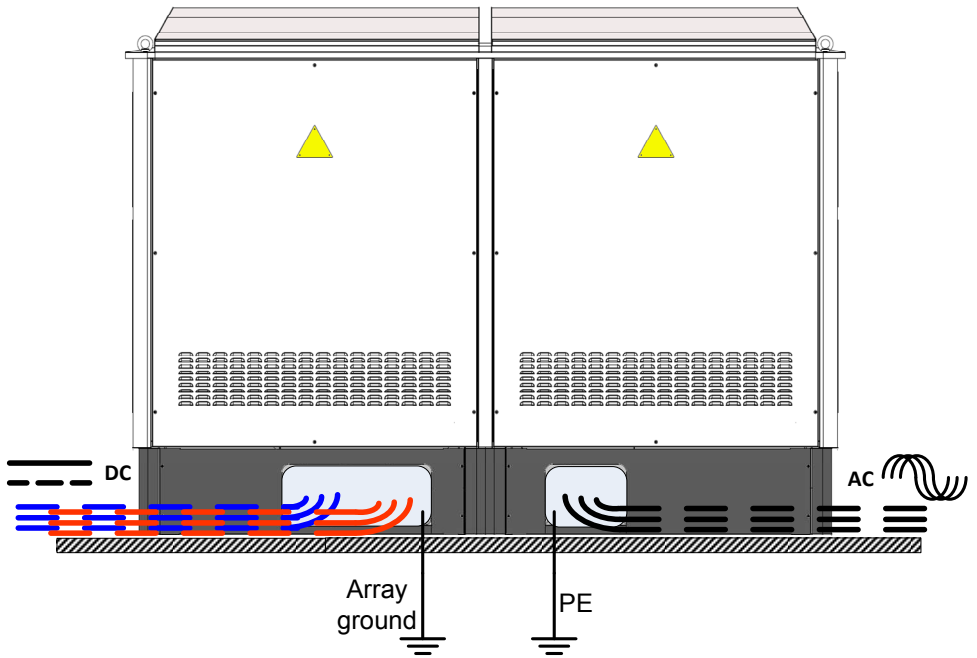
Figure 10-10: Cable output under the PVI-CENTRAL-XXX (US or CAN)

11. ELECTRICAL CONNECTION

⚡ **DANGER**

Before handling any cable, make sure, using suitable instruments, that there is no dangerous voltage.

⚠ **WARNING**

The connection of AURORA to the electrical grid must be carried out only by qualified operators and only after having received authorisation from the electricity company that administrates the mains.

⚠ **WARNING**

CAUTION: To reduce the risk of fire, connect Auxiliary Input only to a circuit provided with 25 amperes maximum branch circuit "over current" 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, are the responsibility of the installer.

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

11.1. Preliminary operations for the electrical connection

For details of each single operation to be carried out, 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 upstream DC switches, since there could be high voltages capable of generating conditions of serious danger.

Always respect the nominal voltage and current characteristics, 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.

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11.2. Connection of the DC cables from the photovoltaic field

After having carefully read and understood the premises of the preceding paragraphs, the cables from the photovoltaic field can be connected.

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Chapter §10.2.4

i As the configuration is made before delivering the inverter, only the DC cables must be connected.

Table 11-1: Minimum recommended dimensions DC copper cables

Model	Section	Temp
CENTRAL-XXX-US	4/0AWG	90° C
CENTRAL-XXX-CAN	4/0AWG	90° C

Follow the directions in the points and of the following figures:

➲ Locate the DC cables from the photovoltaic field.
➲ Connect the cables in the input terminal block (Figure 11-1) respecting the correct polarities.
➲ Follow the numbering of the input bars according to the numbering of modules 50 kW.

Chapter §5.2.1

⚠ ❗ After the cable passage it is important to make sure that the open holes are closed, e.g. by means of expanded foam. This operation guarantees that no animals or dust can get inside.

INPUT DC CABLE
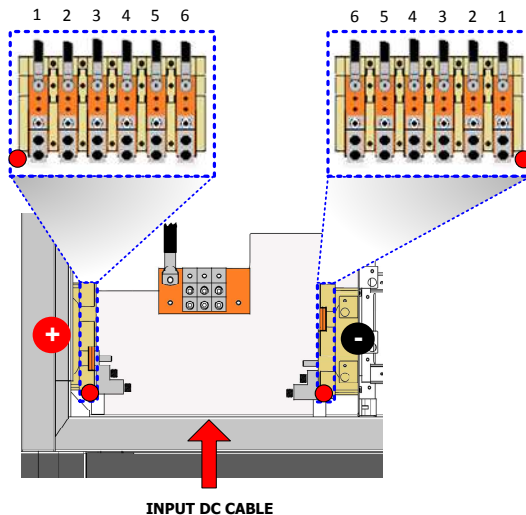
Figure 11-1: DC Cable connection

11.3. Connection of the protection earth cable (PE)

⚠ WARNING

For the safety of the system, the ground connection of the system must be sufficiently resistant. The ground connection must be established before switching on the system for the first time (Table 11-2 and Table 11-3 displays the minimum sections advised for use). The person or company in charge of the installation, in accordance with the laws in force, is responsible for dimensioning the ground conducer according to the characteristics of the inverter used and those of the system, in order to minimize the resistance of the ground connection. Connection must be made to the equipotential bar using a ground cable with grounding lug (Figure 11-2 and Figure 11-3).

Table 11-2: Minimum recommended dimensions grounding copper cables (AC side)

Model	Section	Lug
CENTRAL-XXX-US	4/0AWG	M 10
CENTRAL-XXX-CAN	4/0AWG	M 10
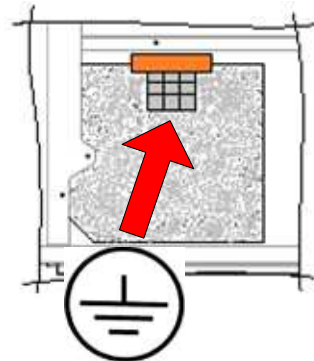
Figure 11-3: Connection of the protection Earth cable DC side (PE)

Table 11-3: Minimum recommended dimensions grounding copper cables (DC side)

Model	Section	Temp
CENTRAL-XXX-US	4/0AWG	90° C
CENTRAL-XXX-CAN	4/0AWG	90° C

Figure 11-2: Connection of the protection Earth cable AC side (PE)

11.4. Connection of the AC power cables

- ➲ Remove, the front plastic cover protection placed in front of the bars, by means of the anchorage screws.
- ➲ Connect the AC power cables as indicated in Figure 11-4.

! NOTICE

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

⚠ WARNING

It is important that the AC cables have a dielectric strength of at least 600Vdc.

Table 11-4: Minimum recommended dimensions AC copper cables

Model	Section	Temp
CENTRAL-XXX-US	250 Kcmil	90° C
CENTRAL-XXX-CAN	250 Kcmil	90° C

⚠ ! After the cable passage it is important to make sure that the open holes are closed, e.g. by means of expanded foam. This operation guarantees that no animals or dust can get inside.
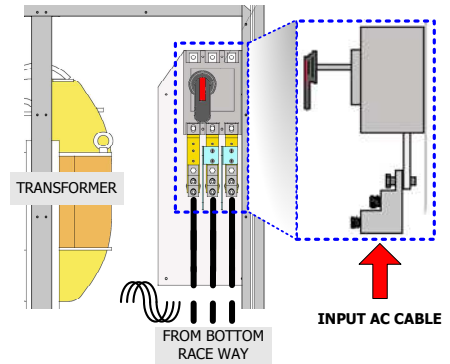
Figure 11-4: Connection of the AC power cables

11.5. Connection of auxiliary energy supply

Auxiliary power supply for the inverter is directly derived from the power grid (by means of direct internal connection). The absence of the power grid will therefore result in the inverter fully switching itself off.

If this power supply needs to be separated, follow these indications:

➲ Disconnect the connected highlighted in Figure 11-5.
➲ Now remove this cable connected to the terminal board.

➲ Connect the cable (3P+T) to the terminal boards indicated in Figure 11-5.
➲ Leave the QS2 switch in the OFF position (down).

The QS2 switch has two functions:

• disconnect the auxiliary voltage

• disconnect the system in the case of breakdown of the OVR AC devices.

This switch is always accessible.
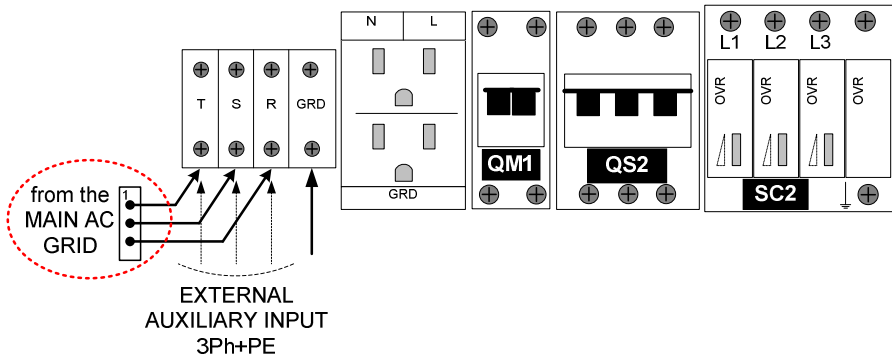
Figure 11-5: Clamps for connecting the auxiliary AC grid and the relative magnetothermic

11.6. Connection of GFD (GROUND FAULT DETECTOR)

Aurora PVI-CENTRAL-XXX (US or CAN) inverters are equipped with control circuits in case of ground faults.

GFD stands for ground fault detector device. The function of fault current interruption is performed by a suitable fuse, while visual signalling of the intervention is done by a red LED on the GFD module (Figure 5-11, Figure 11-6).

i   As versions Multi-Master-Slave are connected to three distinct photovoltaic fields, they present 3 ground fault detectors.

Versions 1Master/N.Slave contains a single device.

Chapter §17.1.3.1

i   The connection of this device is made in factory.
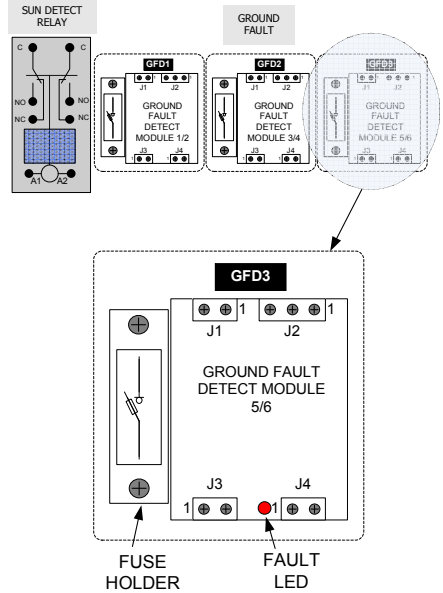
Figure 11-6: GFD (Multi-Master-Slave)

11.7. Connections for communications / state signals
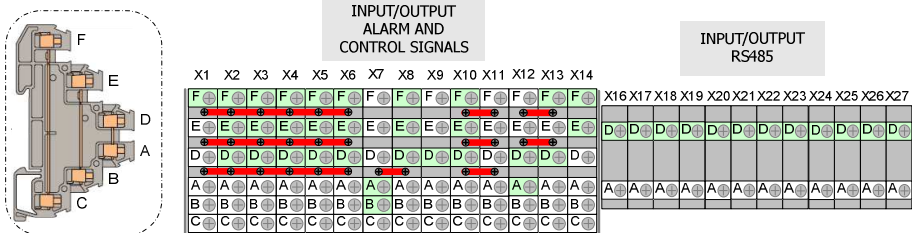
Figure 11-7: Internal terminal block ACBOX (F) area

➲ Get a flat screwdriver of the correct size for the clamp screws (with a tip of approx. 3.5 mm). Make the following connections, loosening the screw, inserting the cable/s and then tightening the screw 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.

ℹ Figure 11-7 replicates the terminal block in the ACBOX area.

📖 Chapter §5.2
Figure 5-8

The X16 and X27 clamps are dedicated to the communication connection (Table 11-5).

Clamps from X1 to X6 are dedicated to the state of the 55kWp modules (Table 11-6).

Clamps X10 and X11 are connections for switching on / off via an external command (Table 11-7).

ℹ In Figure 11-7, on the left, is also indicated the composition of a single clamp (from X1 to X14): as it can be seen, connections C-F, B-E and A-D are through connections.

The following tables show the signals present on the terminal board:

Table 11-5: Communication signals in the terminal block

X16		X17		X18		X19	
D	485_USR_RTN	D	+485_USR	D	-485_USR	D	GRD
A	485_USR_RTN	A	+485_USR	A	-485_USR	A	GRD

X24		X25		X26		X27	
D	GRD 7	D	+485_USR_2	D	-485_USR_2	D	GRD
A	GRD 7	A	+485_USR_2	A	-485_USR_2	A	GRD

Table 11-6: State signals in the terminal block

X1		X2		X3		X4		X5		X6	
F	-	F	-	F	-	F	-	F	-	F	-
E	-	E	-	E	-	E	-	E	-	E	-
D	-	D	-	D	-	D	-	D	-	D	-
A	AUX_C1	A	AUX_C2	A	AUX_C3	A	AUX_C4	A	AUX_C5	A	AUX_C6
B	AUX_NO1	B	AUX_NO2	B	AUX_NO3	B	AUX_NO4	B	AUX_NO5	B	AUX_NO6
C	AUX_NC1	C	AUX_NC2	C	AUX_NC3	C	AUX_NC4	C	AUX_NC5	C	AUX_NC6

Table 11-7: Control signals in the terminal block

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

! NOTICE

To the state clamps (Table 11-6) a low voltage signal can be connected (e.g. 12V or 24V) with an absolute maximum amperage of 1A.

11.7.1 Connection for the user RS485 serial communication

Proceed with the connection of the RS485 serial line.
See also Table Figure 11-7 and Table 11-5, for the position and names of the signals in the terminal block.

Chapter §8

i The clamps from X16 to X19 and X24 to X27 are fully removable, facilitating the connection operation.

Figure 11-8: Removable clamp RS485

- ➲ Connect the 485+ signal/s to the X17D clamp.
- ➲ Connect the 485- signal/s to the X18D clamp.
- ➲ Connect the return/s (485_USR_RTN) to the X16D clamp.
- ➲ Connect the shield of the shielded cable to the X19D clamp.
- ➲ After every connection try pulling the cable to make sure that it is correctly screwed.
- ➲ If PVI-CENTRAL-XXX (US or CAN) is not the last of the chain, it is necessary to make sure that the 120 ohm termination is not present.

11.7.2 Setting of the 120 ohm termination of RS485

Each PVI-CENTRAL-XXX (US or CAN) leaves the factory with the 120ohm RS485 termination <u>enabled</u>.

(!) If a daisy-chain connection is used (Figure 8-1 e Figure 8-2), it is important that all racks, except the last one, <u>must</u> have the termination disabled.

(i) The termination must be inserted by activating the switch beneath the main display (Figure 14-2 e Figure 14-3).

11.7.3 Connection for the RS485 serial communication with PVI-STRINGCOMB-US

Each PVI-CENTRAL-XXX (US or CAN) inverter can manage up to 12 boxes for the connection of the PVI-STRINGCOMB-US strings.
Following the indications of the PVI-STRINGCOMB-US manual, the connection of the RS485 serial line is then made.
See also Table Figure 11-7 and Table 11-5, for the position and names of the signals in the terminal block.

➲ Connect the 485_2+ signal to the X25D clamp.
➲ Connect the 485_2- signal to the X26D clamp.
➲ Connect the return (RTN or earth) to the X24D clamp.
➲ Connect the shield of the shielded cable to the X27D clamp.
➲ After every connection try pulling the cable to make sure that it is correctly screwed.

(!) The 120 ohm termination is already active within the inverter.

11.7.4 Setting of the communication addresses.

➲ Put the QS2 (Figure 11-5) switch at ON: if the auxiliary line turns on, all MODULE-50kW displays, in the inverter, will light up.
➲ If line 485_USR is connected more inverter PVI-CENTRAL-XXX (US or CAN), set by main display (placed on the front door), the address of all inverter with the right procedure.

📖 Chapter §14.5.4

(!) <u>**MAKE SURE THAT THERE ARE NO SIMILAR 485 ADDRESSES IN THE SYSTEM. IN THIS CASE COMMUNICATION PROBLEMS WILL HAPPEN.**</u>

11.7.5 Final checks.

➲ Close the front panels, taking care that the handles, if present, are positioned on 0 (OFF) and insert and tighten the screws.
➲ Close all the other panels, after first reconnecting the respective earth cable to the inverter casing.

12. START UP (SERVICE)

 Before starting up the system, make sure that all connections have been made correctly and, in general, that all safety conditions have been complied with. In particular, make sure that all voltage values are within the set limits.

Chapter §22
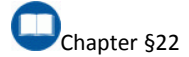
12.1. Operating conditions

 The following diagram gives an indicative illustration of the various functional phases of the inverter.
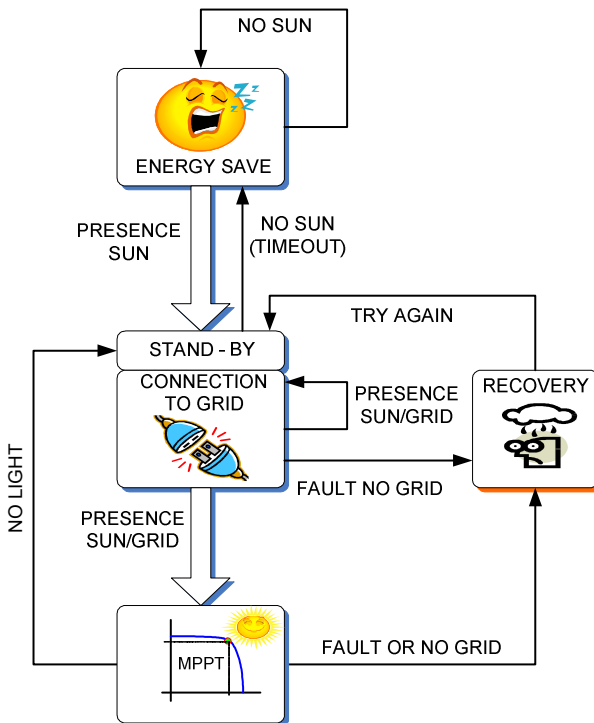
Figure 12-1: Inverter's operation diagram

12.2. Sequence for commissioning the Multi-Master/Slave systems

1. Take care that the grid switch is on 0 (horizontal position).
2. Take care that the DC switches are on 0 (Figure 6-4 (A)).
3. Take care that the main QS2 switch is in ON position (up): the logic control of the system is activated and the displays on the front are on.
4. Turn ON the main display.

Chapter §1.1

5. Check the front signalling displays on each framework:

    a. In case of Multi-Master/Slave the MASTER LED will only light up on one of the 50 kW modules which compose the Master/Slave unit. The presence of two MASTER LEDs turned on; on a master-Slave unit indicate there is a malfunction.

    b. In both cases: 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 LED flashes. POWER ON
    The ALARM LED is on.
    The MISSING GRID LED is on.

    i In the PV Plants built with one or more inverters connected in the same serial communication line, set the RS485 addresses by acting on the main display.

    Chapter §14.6

i In case of a commissioning repetition after a maintenance operation please associate the MODULE 50KW directly from the main display.

Chapter §14.6

6. One at a time, close the DC switches in position 1 (Figure 6-4 (D)):

    a. The display of the module related to the closed switch, will set off the alarm that the AC switch is still open.
    The LED flashes. POWER ON
    The ALARM LED is on.
    The MISSING GRID LED is on.

    b. The main display will signal the presence of the open AC switch.

7. Close the doors and close the AC switch in position 1, i.e. turn it clockwise:

    a. The open switch signal should disappear from the main display.

    b. The fans are activated if the DC voltage is sufficient to leave the energy saving mode* (SE). the DC voltage

    i (in the energy saving mode, indicated by the letters SE, the system sets itself in a monitoring-only condition and the ventilation 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 grid. If the primary conditions1 (presence of DC and AC voltage) are satisfied, the system will automatically connect to the AC grid:

The Slaves are connected to the grid with the Master.

At each connection, the system will perform a complete scan of the field to locate the maximum power point. In this phase, power will suddenly peak and plummet for less than 5 seconds.

d. The main parameters visualization will be shown on the main display.

Chapter §14

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[1] The conditions connection to the grid, vary according to the country in which the inverter is sold.

power-one
Changing the Shape of Power

12.3. Sequence for commissioning the 1Master/N.Slave systems

1. Take care that the grid switch is on 0 (horizontal position).
2. Take care that the external DC switch is on 0 (OFF).
3. Take care that the DC switches are on 0 (Figure 6-4 (A)).
4. Take care that the main QS2 switch is in ON position (up): the logic control of the system is activated and the displays on the front are on.
5. Turn ON the main display.

Chapter §1.1

6. Check the front signalling displays on each framework:

   a. In case of Multi-Master/Slave the MASTER LED will only light up on one of the 50 kW modules which compose the Master/Slave unit. The presence of two MASTER LEDs turned on; on a master-Slave unit indicate there is a malfunction.

   b. In both cases: 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 LED flashes. POWER ON
   The ALARM LED is on.
   The MISSING GRID LED is on.

   i In the PV Plants built with one or more inverters connected in the same serial communication line, set the RS485 addresses by acting on the main display.

Chapter §14.6

i In case of a commissioning repetition after a maintenance operation please associate the MODULE 50KW directly from the main display.

Chapter §14.6

7. One at a time, close the DC switches in position 1 (Figure 6-4 (D)).

8. Close the external DC switch on position 1 (ON):

   a. The display of the module related to the closed switch, will set off the alarm that the AC switch is still open.
   The LED flashes. POWER ON
   The ALARM LED is on.
   The MISSING GRID LED is on.

   b. The main display will signal the presence of the open AC switch.

9. Close the doors and close the AC switch in position 1, i.e. turn it clockwise:

   a. The open switch signal should disappear from the main display.

   b. The fans are activated if the DC voltage is sufficient to leave the energy saving mode* (SE). the DC voltage

   i (in the energy saving mode, indicated by the letters SE, the system sets itself in a monitoring-only condition and the ventilation 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 grid. If the primary conditions1 (presence of DC and AC voltage) are satisfied, the system will automatically connect to the AC grid:

The Slaves are connected to the grid with the Master.

At each connection, the system will perform a complete scan of the field to locate the maximum power point. In this phase, power will suddenly peak and plummet for less than 5 seconds.

d. The main parameters visualization will be shown on the main display.

Chapter §14

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[1] The conditions connection to the grid, vary according to the country in which the inverter is sold.

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13. INTERACTIVE MODULE 50KW DISPLAY

13.1. How the display functions
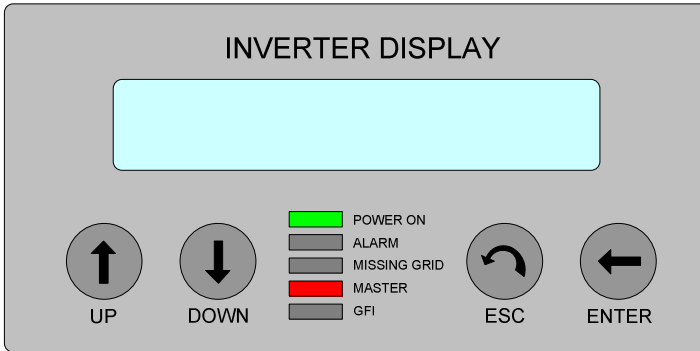
Figure 13-1: Display of the 50kWp module

The two-line LCD display (Figure 13-1) is located on the front panel of each 50kWp 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 displays change every 5 seconds, or they can also be changed manually by pressing the **UP** and **DOWN** keys.

In any case, to return to the preceding menu, just press the ESC key.

i 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.

Cyclical arrows	
Padlock	
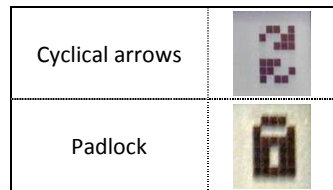
The display shows only 2 lines, therefore to scroll up and down the items or to gain access to the submenus of the items, use the **UP** and **DOWN** side keys.

The selected item, is highlighted by an arrow on the left side of the display. Upon selection of the chosen item, type **ENTER** to enter the submenu.

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13.2. Password entry

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

i The default password is 0000. It can be modified from the settings menu Figure 13-3.

Using the display keys, you can enter the numbers:

- Pressing **ENTER** you scroll from one number to another (from left to right).
- Pressing **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)

```
Password
0000
```

After typing the correct password, press **ENTER**, accessing the various information items saved in the protected section.

13.3. The display LED

The display is provided with several signalling LEDS:

POWER ON: [GREEN LED] Indicates the presence of energy and of connection / disconnection from the grid.

ALARM: [RED LED] Indicates a problem.
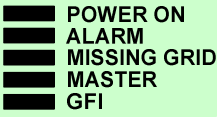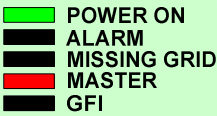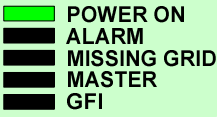
GFI: [RED LED] Not used at present.

MISSING GRID: [RED LED] If on, it indicates lack of voltage of a grid or an anomaly of the grid. The lighting may be due to the open grid switch (in this signalled on the display).

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

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

Table 13-1: Meaning of the display LEDs

STATE OF LEDs	MEANING
▬ POWER ON ▬ ALARM ▬ MISSING GRID ▬ MASTER ▬ GFI	• All the LEDS are off. • The module is not receiving power and all signals are absent.
▬ POWER ON ▬ ALARM ▬ MISSING GRID ▬ MASTER ▬ GFI	• The module is connected to the grid. • The module is Master.
▬ POWER ON ▬ ALARM ▬ MISSING GRID ▬ MASTER ▬ GFI	• The module is connected to the grid. • The module is Slave.
▬ POWER ON ▬ ALARM ▬ MISSING GRID ▬ MASTER ▬ GFI	• The module is not connected to the grid. • The module is Master. • The AC grid is absent or out of range. • The module is in alarm state due to a problem in the grid.
▬ POWER ON ▬ ALARM ▬ MISSING GRID ▬ MASTER ▬ GFI	• The module is not connected to the grid. • The module is Master. • The module is in alarm state due to a problem.

i NOTE: In the table, the uniform colour indicates the fixed LED on, while the alternate colour indicates the flashing.

13.4. Functional diagram of the display (Menu)
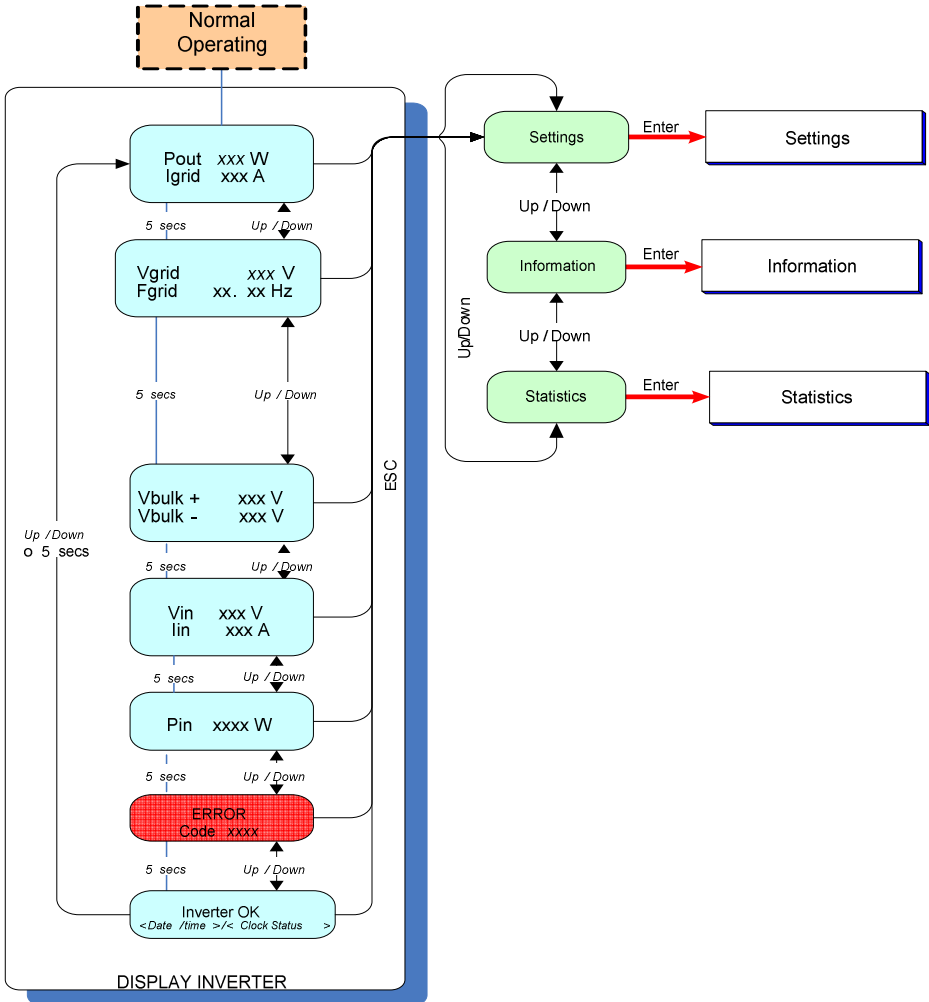
Figure 13-2: Functional diagram of the display (Main Menu)

The Figure 13-2 shows the information displayed during normal operation. By pressing **ENTER, ESC, UP or DOWN**, you can scroll among menus as indicated.
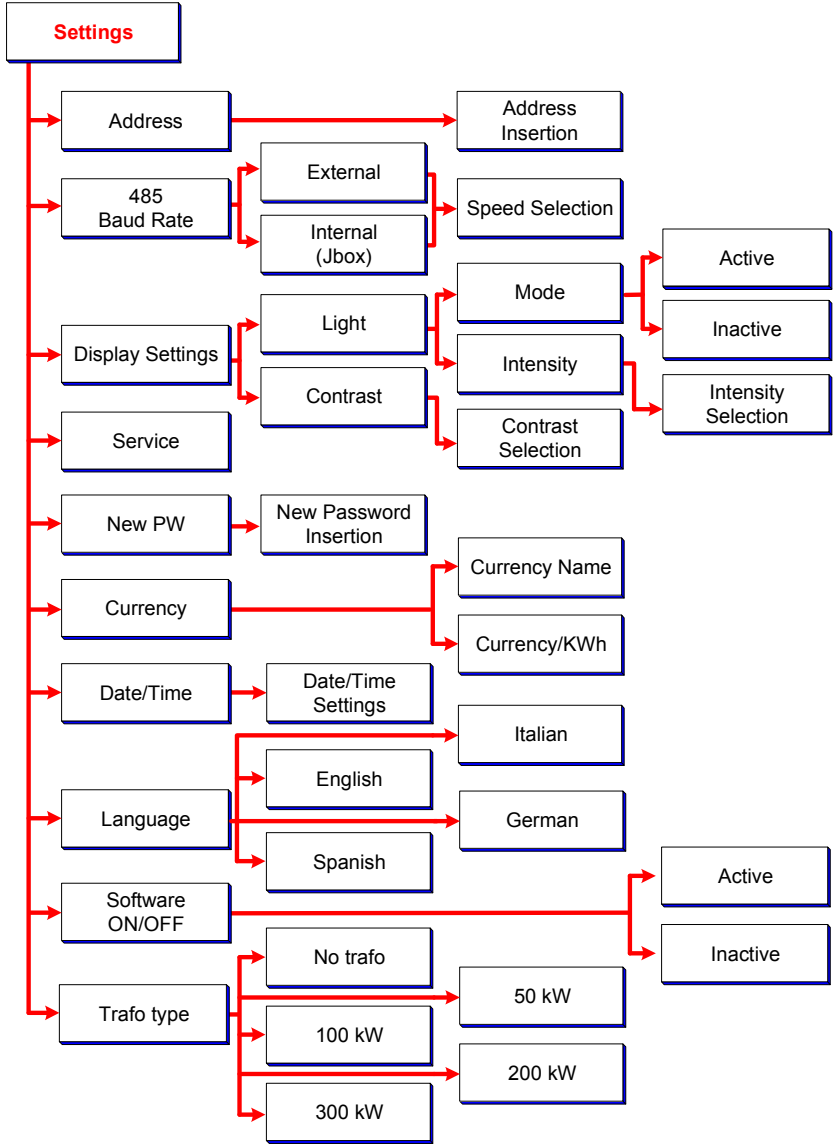
Figure 13-3: Functional diagram of the display (Setting menu)
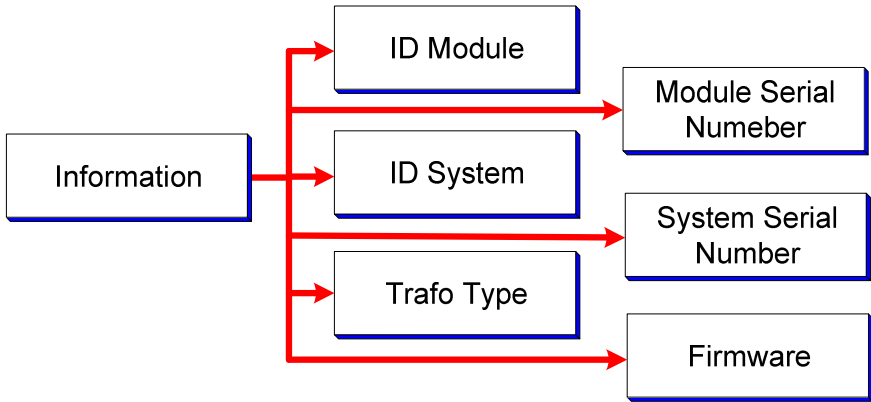
Figure 13-4: Functional diagram of the display (Information menu)
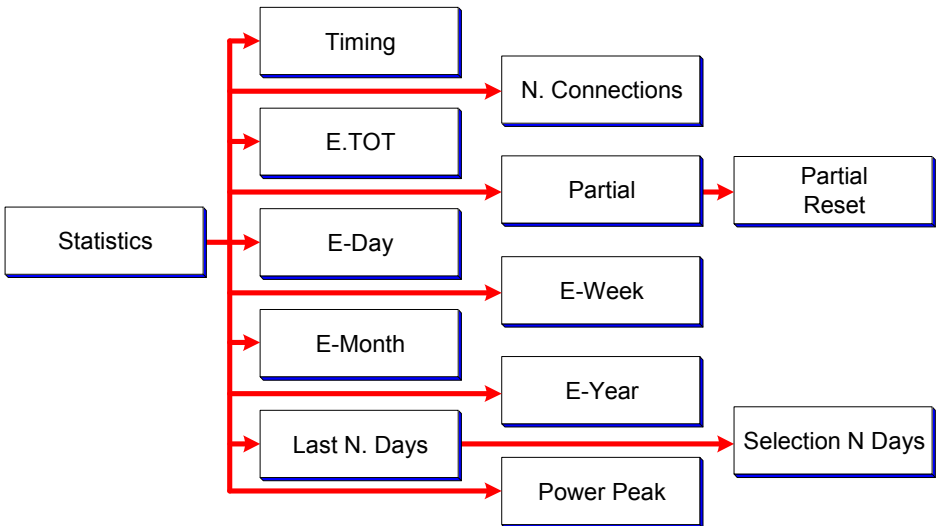
Figure 13-5: Functional diagram of the display (Statistics menu)

13.5. Information

By selecting the INFORMATION menu, the display will show a submenu as shown in Figure 13-4.

13.5.1 ID. module

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

13.5.2 Mod. SeriesNo.

By selecting "Mod.Series N." the following information will be shown:

- **Series No.**: Series number of the selected module.
- **Wk xx Yr xx**: Production week (Wk) and year (Yr) of the module.

13.5.3 System ID

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

13.5.4 Sys. Series No.

By selecting "Sys. Series No." the following information will be shown:

- **Series No.**: Series number of the rack.

13.5.5 Trafo type

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

- **Trafo yes/no**: Presence of the transformer or not.
- **Mod. No.**: Number of modules in the system.

13.5.6 Firmware

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

13.5.7 Junction Box (only on the module designated 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:

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

13.5.7.1 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**: Unbalanced string currents.
- **Current**: String current.
- **Power**: StringComb supply.
- **Comm.**: Communication.
- **Cal**: Current calibration.

13.5.7.2 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.

13.5.7.3 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 l1.
- **….**
- **I20**: State of current l20.

13.6. Statistics

By selecting the STATISTICS menu, the display will show a submenu as indicated in Figure 13-5.

13.6.1 Timing

By selecting "Timing", the following information will be shown:

- **Life**: Total operating time.
- **Grid**: Hours of connection to the grid.

13.6.2 N. Conn (Number of Connections)

By selecting "N. Conn", the number of connections with the grid will be shown.

13.6.3 E-Tot

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

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

13.6.4 Partial

By selecting "Partial", the following information will be shown:

- **PT**: Total operating 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: Allows to reset the preceding parameters to zero.

13.6.5 E-today

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

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

13.6.6 E-Week

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

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

13.6.7 E-Month

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

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

13.6.8 E-Year

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

- **E**: Total energy produced this year.
- **Val**.: Economic gain this year.

13.6.9 Last N Days

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

- **E**: Total energy produced in the last days indicated by N.
- **Val**.: Economic gain in the last days indicated by N.

13.6.10 Power Peak

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

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

14. AURORA CENTRAL PVI MONITOR

14.1. How the display works

Figure 14-1: Display touch screen

Display TFT-LCD 5.7" (Figure 14-1) is located in the left door of the front panel of PVI-CENTRAL-XXX (US or CAN). It is possible to have more than one 50 kW module under surveillance at the same time, up to a maximum of eight modules, and to use the touch-screen display to visualize the following information:

- Operation status of all 50 kW modules of the inverter and static data.

- Operation status of all PVI-STRINGCOMB-US connected to the inverter.

- Alarm messages.

The display can also communicate with other devices (e.g. a normal laptop computer) by means of a Type B USB port. This type of communication is made possible by the use of a special software. ("Aurora Communicator" official tool Power-One)

The graphic visualization allows for a simple and intuitive use by the operator, with the possibility of navigating through the various menus using the touch-screen.
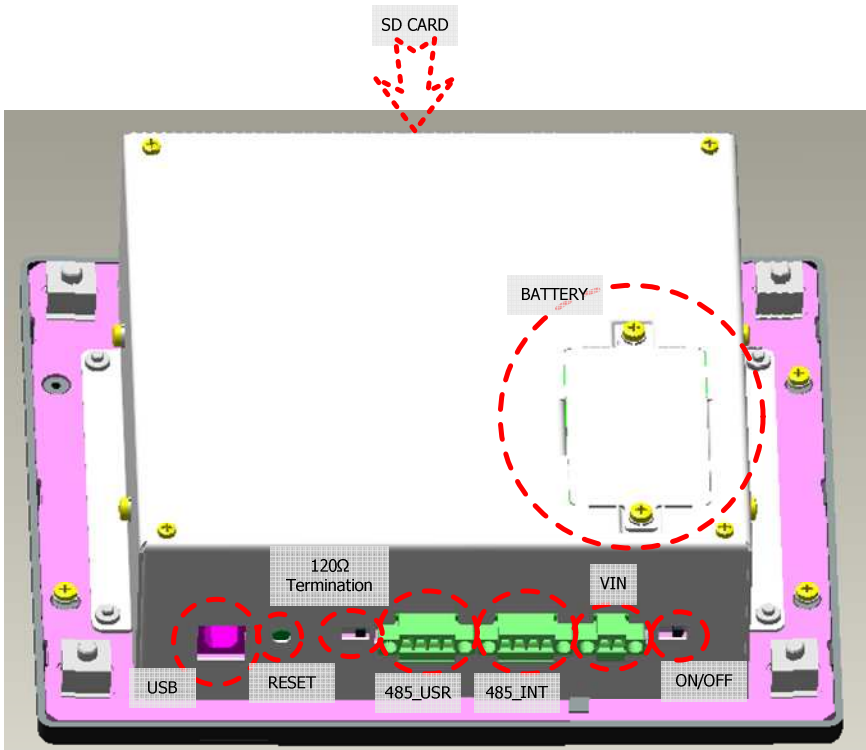
Figure 14-2: Interactive display

In the bottom part of the display, which can be accessed by opening the left door of the PVI-CENTRAL-XXX (US or CAN), contains:

- Type B USB for connection to personal computer.

- Reset button.

- Switch for termination 120ohm for the RS485 communication (Figure 14-3).

- Connector for external (USER) RS485 communication.

- Connector for internal RS485 communication.

- Power connector (5VDC).

- ON/OFF switch (Figure 14-4).
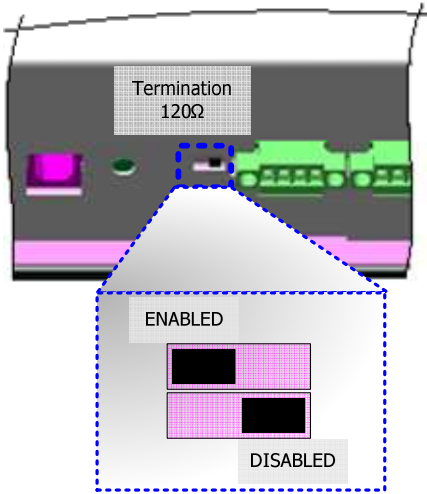
Figure 14-3: 120ohm termination switch for RS485

Also, on the rear side, there is a compartment. Remove the screws to access the lithium battery, clock battery CR2032 and a selector for the configuration of MODULE-50kW RS485 (settings on factory).

On the upper side, there is a SD card to save data regarding the system (indispensable for display operation).

14.2. Start Up

During the start up of the inverter it is mandatory to turn on the main display.
Act, by setting the power switch to "ON", shown in Figure 14-4.
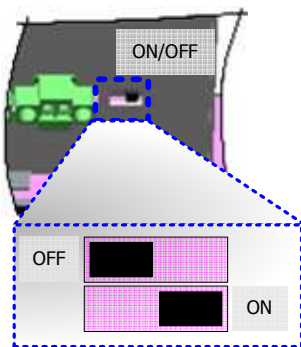
Figure 14-4: Power On Switch

ℹ️ This procedure is performed only for the first start up during the commissioning service.
The main display will be activated after about 60 seconds.

14.3. Front status LED signalling

The anterior part of the display contains a status LED. This LED changes colour according to the status of Aurora Central PVI Monitor. The different operation statuses and their corresponding colours are:

- **LED OFF:**   No external (5Vdc) power supply.
- **GREEN LED:**   Battery charged; at least one power supply connected (DC or USB).
- **ORANGE LED:**   Battery is charging.
- **RED LED:**   Low battery; no power supply connected (DC or USB).
- **BLUE BLINKING LED:** Aurora Central PVI Monitor ON (STAND-BY).

14.4. Default screen

The Aurora Central PVI Monitor, stays in a default condition, on an intuitive screen that sums up the important data of the system and it's operation status. (Figure 14-5).
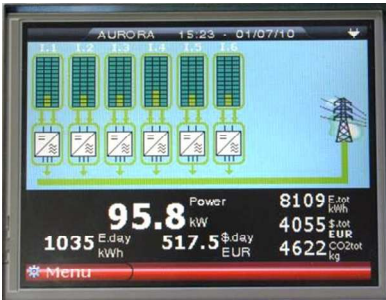
Figure 14-5: Default screen

The bar at the top of the screen contains the following information:

- Date and time.
- Power from battery or power supply.
- Battery level.

In the central coloured part of the display the 50 kW modules present in the monitored system are visualised. Each 50 kW module contained in the device is surrounded by a line which indicates the status based on it's colour:

- <u>Green line</u>:   Inverter connected and operating correctly.
- <u>Yellow line</u>:   Inverter on but not yet connected to the power grid.
- <u>Red line</u>:   Inverter in alarm.
- <u>Blue line</u>:   Inverter off.

Click on the images of the 50 kW modules to open a balloon containing the identification data of the single module and its operation status. (Figure 14-6)

Figure 14-6: 50kW modules information

The black central part of the screen shows a summary of the data relative to the entire system, i.e. generated instantaneous power, power produced today, average, total power produced by the system since installation, overall average, reduction of CO_2.

Click on any point of the black section to display detailed information on the system. (Figure 14-7)

Figure 14-7: General information on the device

The screen shows the graph of the power produced by the system throughout the day and, by clicking on the related tabs, by each single inverter. In addition, the left part shows a summary of the sensitive parameters. The central black section and the bar at the top show the same information as in the default screen.

Click on the tabs to select the graphs and data related to each inverter or to the system as a whole. The tabs also show permanently visible information about the status of the inverters and a power meter that indicates the power exported on graph.

The red area at the bottom contains the Menu button to access the menu.

14.5. Main menu

From either of the previous screens, click on the Menu button to access the main screen. The menu of Aurora Central PVI Monitor is divided in several sections, and each section has its own submenus for displaying, setting or altering the configurations of the object.

14.5.1 Statistics menu

From this section (Figure 14-8) it is possible to display all production data related to the system for determined intervals of time. The subsections indicate the interval of time for which you wish to visualise production figures (Total, Partial, Today, 7 Days, 30 Days, 365 days, User).
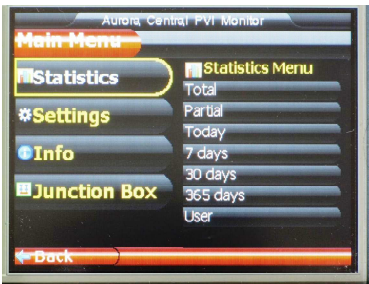
Figure 14-8: Statistic menu

14.5.2 Settings menu

In this section (Figure 14-9) it is possible to enter or change the object configuration parameters.
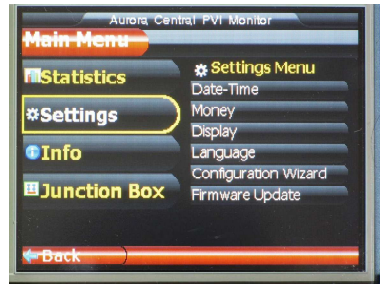
Figure 14-9: Settings menu

- **Date-Time:** changes the date and time.
- **Money:** inserts the current currency to calculate energy saving/earnings.
- **Display:** sets the backlight from a 0 to 9 and recalibrates the touch screen.
- **Language:** changes the system language.
- **Configuration wizard:** opens a guided procedure that makes it possible to reconfigure[1] the communication channel.

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- **Firmware update:** starts a procedure to update the firmware of Aurora Central PVI Monitor in order to obtain the latest version released.

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---

[1] The first configuration is factory set.

14.5.3 Information menu

The subsections of this menu provide information about the serial number of Aurora Central PVI Monitor, the serial number of all inverters connected to the system and the firmware version installed.
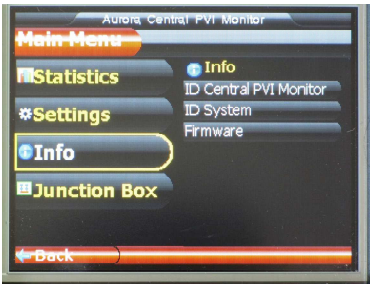
Figure 14-10: Information menu

14.5.4 Junction Box menu

The subsection of this menu allows visualising the information related to the String combiner boxes PVI-STRINGCOMB-US connected to the inverter. Such menu pops up only in the case in which at least one Stringcomb is connected to the inverter and configured. (Figure 14-11)
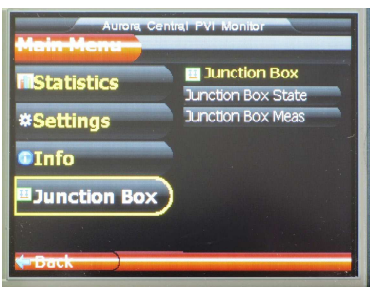
Figure 14-11: Junction Box menu

14.5.4.1 Junction Box State

Clicking on **[Junction Box State]** (Figure 14-11) it is possible to access the screen related to the status of the first Stringcomb connected to the inverter. It is possible to visualise the information related to the other Stringcomb connected by using the arrows top right of the screen. In this section the following parameters are visualised:

- Serial number.
- Part number.
- Fuse states.
- Current state.
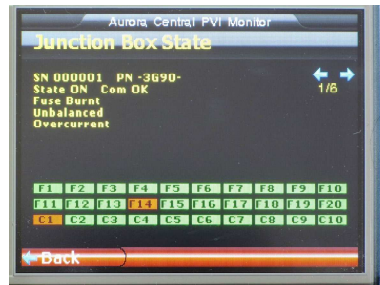
Figure 14-12: Junction Box State

power-one
Changing the Shape of Power

14.5.4.2 Junction Box Meas

Clicking on the **[Junction Box Meas]** (Figure 14-13) you may access to the display related to the status of the first Stringcomb connected to the inverters. It is possible to visualise the information related to the other Stringcombs present in the System by using the arrows top right of the screen. In this section the following parameters are display:

- Global Voltage Plant.
- String Current.
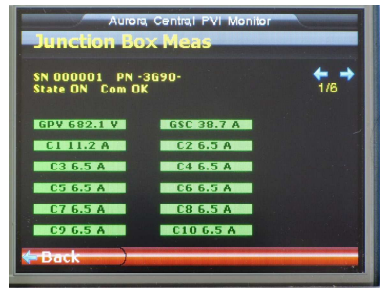
Figure 14-13: Junction Box Meas

14.6. Settings configuration parameters

NOTICE

The setting of parameters is performed only in the case of commissioning of PV-Plants with two or more inverters enchained or in case of maintenance.

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It is possible to communicate with the inverters PVI-CENTRAL-XXX (US or CAN) on behalf of the line RS485. On the same line a maximum of 12 inverters can be connected. In case of Plants with two or more inverters it is <u>mandatory</u> to respect the following conditions:

- ⊃ Enable the termination 120ohm on the last inverter of the enchainment serial and disable it on all the remaining inverters. This operation is performed by acting on the switch under the main display. (Figure 14-3).

- ⊃ Set a different address on each and every display of the enchainment of serials.

14.6.1 Configuration Wizard

- ⊃ In the Settings Menu click on the tab **[Configuration Wizard]** (Figure 14-9). The welcome screen will appear (Figure 14-14) which confirms the start up of the guided configuration of the communication.
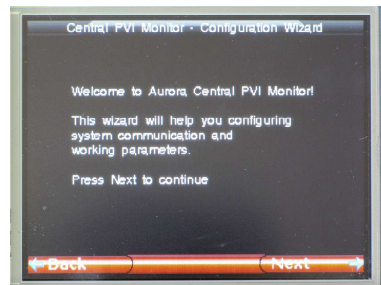
Figure 14-14: Configuration Wizard

Click on **[Next]** to access the following functions.

- ⊃ The following screen (Figure 14-15), allows setting date and time of the installation location. In this screen it is only possible to set date and time for the main display.
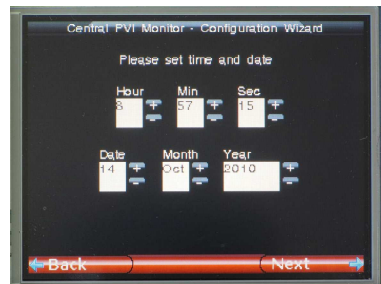
Figure 14-15: Date/Time setting

Click on [Next] to access the following functions.

⊃ The following screen (Figure 14-16), allows both to set the RS485 address of the main display of the inverter, and of the 50kW MODULE address in the latter. In the first row it is possible to set the address of the main display from number 100 until number 163. In the second row it is possible to set the starting address of the 50kW MODULE, part of the inverter we are treating. All PVI-CENTRAL-XXX (US or CAN) inverters are provided with a main display default address equal to 100 and with a starting address on the 50KW MODULE equal to 1.

i Example: on a PV-Plant built with two PVI-CENTRAL-300 composed by 6 modules each, you should set the main display address to 100 on the first inverter and the address of the starting module on 1, whereas on the second inverter you should set the address on the main display to 101 and the address of the starting module on 7.

⊃ In PV-Plants with two or more inverters it is therefore necessary to apply the re addressing procedure without acting on display addresses of the 50 KW MODULE on the module itself. Aurora Central PVI-MONITOR assigns to each 50kW MODULE an absolute address. An example of correspondence between the address of a 50 KW MODULE and the absolute address in the chain is given in the Table 14-1.
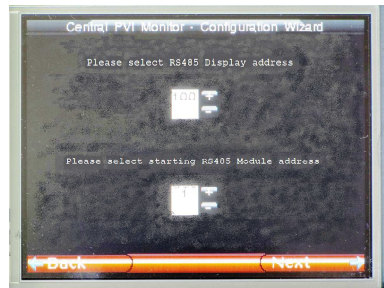
Figure 14-16: Address setting

Table 14-1: Address

Display	Starting	Module	Absolute
100	1	1	1
		2	2
		3	3
		…	…
		8	8
101	9	1	9
		2	10
		3	11
		…	…
		8	16
102	17	1	17
		2	18
		3	19
		…	…
		8	24

Click on **[Next]** to access the following functions.

⊃ The following screen (Figure 14-17), allows setting the period of "polling", such as the interval of time between two savings of the statistic data in SD card.

ℹ️ Set the "polling" period to 15 minutes.
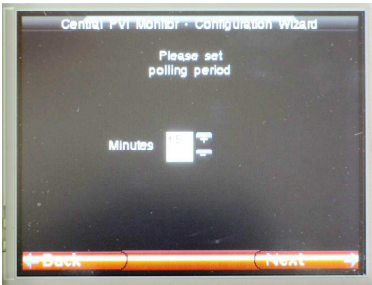
Figure 14-17: Polling Timeout

Click on **[Next]** to access the following functions.

➲ The following screen (Figure 14-18), allows the scanning of the 50kW MODULES in an inverter. Select *"Scan Now".*
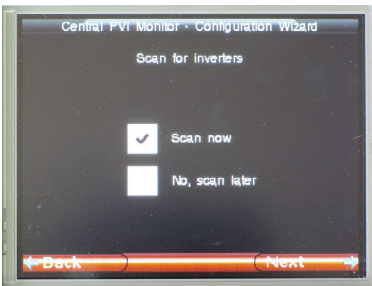
Figure 14-18: Scan Module

Click on **[Next]** to access the following functions.

➲ The following screen (Figure 14-19), allows visualisation of the "serial number" and "part number" of the MODULE 50kW in one inverter.
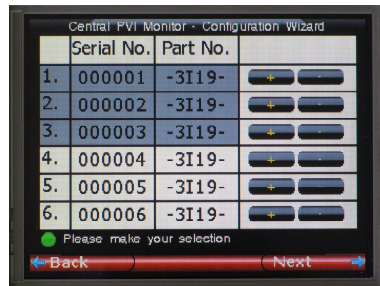
Figure 14-19: Scan Module Table

- Gray line: associated Module.
- White line: NOT associated Module.

Associate one module at a time on behalf of the tab **[+].** Un-associate one module at a time on behalf of the tab **[-].** Click on **[Next]** to access the following functions.

➲ The following screen (Figure 14-20), allows closing the procedure.

Figure 14-20: End of Procedure

Click-on **[YES].** After few seconds the display will switch back to the "default" and the setting procedure is concluded.

ℹ️ The display will synchronize with all modules in the inverter. The procedure lasts about five minutes.

14.7. Firmware update

Aurora Central PVI Monitor evolves continuously and it might therefore be necessary to update it so that new functions can be implemented. The update requires a very simple procedure, described below:

i   In order to take the steps described below it is necessary to have basic knowledge regarding the creation of directories and renaming of files on Windows OS.

➲   The first step for the update is checking that the latest firmware is available. This can be done by contacting the assistance on web site www.power-one.com .

➲   In order to update Aurora Central PVI Monitor, it is necessary to extract the SD card (press it lightly to remove it) and insert it in a reader connected to the PC. At this point, follow the instructions below:

1. Check whether the SD card is formatted by right-clicking on it and selecting "Properties". Make sure formatting is FAT and not FAT32.

2. Open the SD card, which will contain several folders (language, theme etc), including the BOOT folder. If it is not present, create it.

3. Copy the file received from the Power-One assistance into the BOOT folder and rename it as "boot.ben".

4. Remove the SD card from the computer using the safe hardware removal procedure and insert it in Aurora Central PVI Monitor again.

5. Navigate through the menu until you find the firmware update section.

6. Click on Next: Aurora Central PVI Monitor will start the update procedure.

7. Once the new software has been read and loaded, the display will ask you to make a selection. From this screen you may decide whether to install the new firmware, return to the previous version or cancel the procedure and maintain the current firmware.

8. Wait until Aurora Central PVI Monitor finishes the installation operations. Once the operation is concluded, the default screen will automatically be displayed.

15. BEFORE USING THE SOFTWARE

The software produced for the PVI-CENTRAL-XXX (US or CAN) 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).

i To be able to communicate with PVI-CENTRAL-XXX (US or CAN), the computer used must have a free COM serial port.

i Since, as already described, the serial transmission standard of the PVI-CENTRAL-XXX-(US or CAN) is the RS485, while the COM port of the computer is used on the RS232 standard, **an Aurora RS232/485 adapter must be used** (Aurora 232/485 Converter).

Chapter §8

15.1. Software installation

> **!** **NOTICE**
>
> Place the CD provided with the PVI-CENTRAL-XXX-(US or CAN) into the computer and launch the "setup.exe" program, then follow the instructions on the screen.

In conclusion, the icon "Aurora CENTRAL CVI" will appear on your Desktop[1] and in the position:

Start →
    Programs →
        Aurora CENTRAL CVI

The next chapter shows how to use the PVI-CENTRAL-XXX-(US or CAN) configuration and monitoring program.

---

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

16. MONITORING AND CONFIGURATION INTERFACE

16.1. 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.*

16.1.1 Rack and Modules

Hereinafter, the single 50kWp boxes will be indicated with "**Modules**".
The name "**Rack**" indicates a system composed of several modules. Each Rack can have up to 6 Modules.

i In this manual the name Tower or Rack have the same meaning.

16.2. 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.

i The password for advanced access is "aurora"[1].

---

[1] The password cannot be changed. Always use lower case.

16.3. Diagram of the monitoring software

The following "map" simplifies the learning of the monitoring program structure. The next paragraphs will describe in detail the single blocks of the diagram.
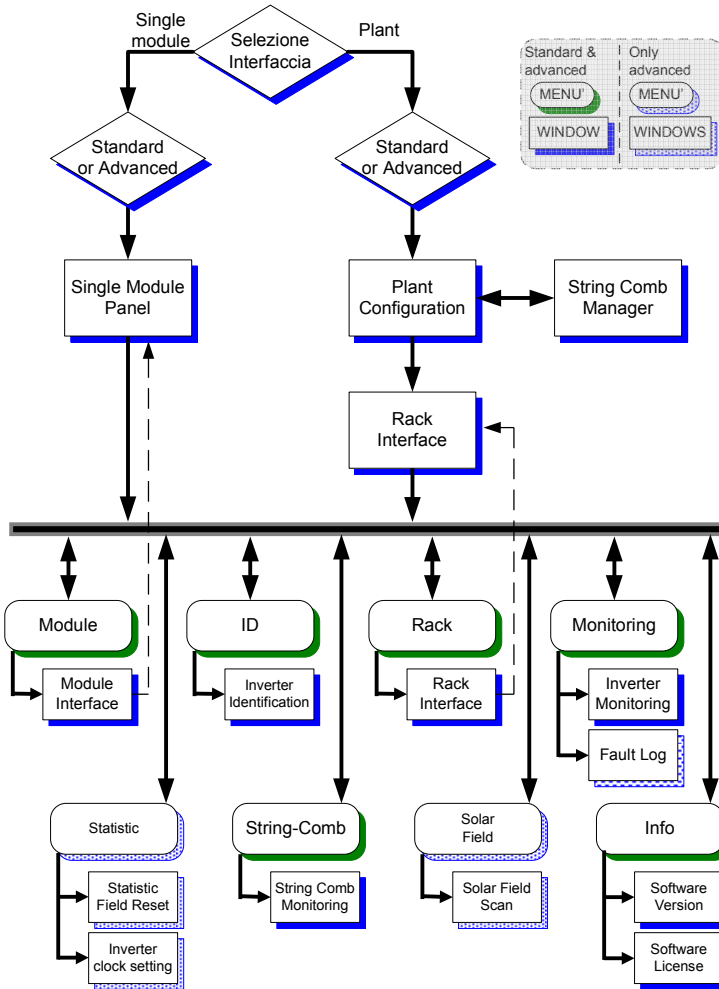
Figure 16-1: Software map of monitoring the

16.4. Use of the monitoring program

➲ Click twice on the icon of the "Aurora Central CVI" program and wait for the following window to appear:
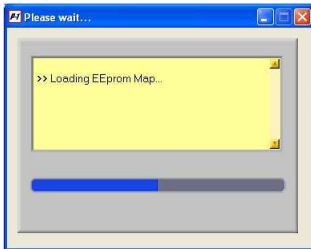
➲ Choose (*PC COM Ports*) to which the RS485/232 adapter is connected. COM port
➲ Choose the communication speed (COM Baud-Rate).
➲ Press [**COM SET**].
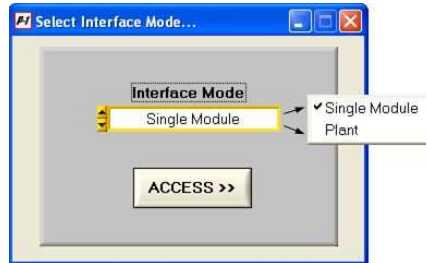
Figure 16-2: Choice of the interface type

➲ Choose the type of visualisation through (*Interface Mode*):

- *Single Module*: all modules connected to the RS485 line are visualised.
- *Plant*: all racks connected to the RS485 line are visualised.
- Press [**ACCESS >>**].
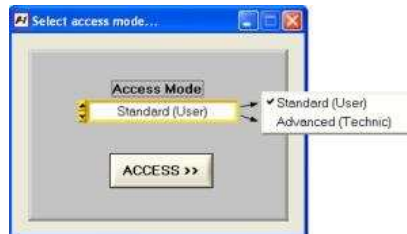
Figure 16-3: Choice of Standard or Advanced mode

➲ Now select the standard or advanced access mode.

| i | For the "advanced" mode it is necessary to insert the password "aurora". In "standard" mode, some menus will be disabled. |

⊃ Based on the choice done before, the *Single Module Panel* (Figure 16-4) or *Plant Configuration* window will appear.

Chapter §16.4.2

16.4.1 Single Module Panel

After scanning
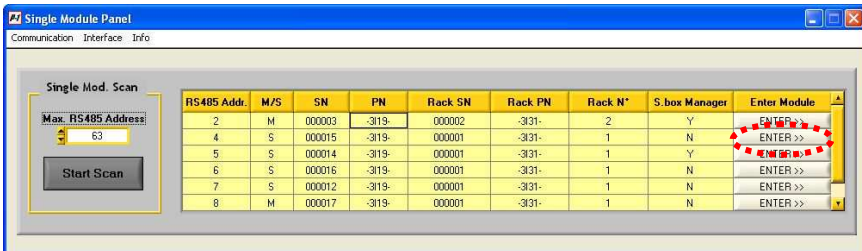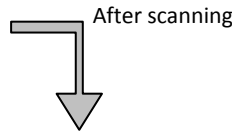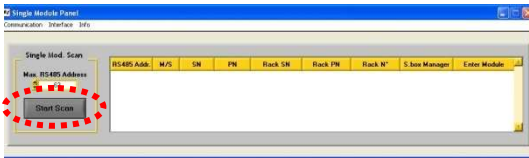
Figure 16-4: Single Module Panel

⊃ 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 button [**Start Scan**]: the system will search for all the connected and functioning modules.

⊃ The window shows a summary table relative to all models found. The parameters indicated are the following:

RS485 Addr.: Address assigned on RS485.
M/S: M=Master, S=Slave
SN: Series number of the Module

PN: Module code
Rack SN: Series number of the Rack to which it belongs
Rack PN: Code of the Rack to which it belongs
Rack No.: ID number of the Rack
S.Box Manager: Indicates whether the module is used for management of data with the boxes of the AURORA PVI-STRINGCOMB-US string.

⊃ By pressing the corresponding [**ENTER >>**] button, access is gained to the management of the selected module (Figure 16-9).

16.4.2 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.
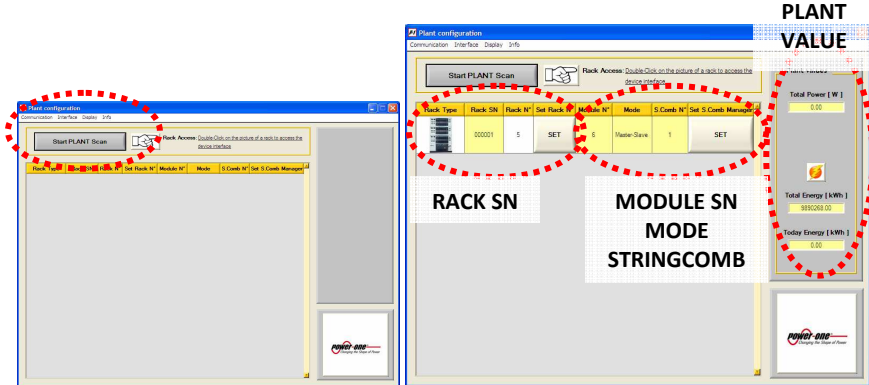
Figure 16-5: Plant Configuration

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

The screen of Figure 16-5 shows the following information:

- **Plant value**: will display information about the instantaneous power output (W), the daily energy and the total energy produced (kWh).
- The rack serial number (Rack SN) and identity number (Rack No.), the latter being assigned to the rack and to all the modules to identify the whole tower. 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 No.), operating mode (Mode) and the number of connected string-boxes (S.Comb N.)[1]. By pressing the [**Set S.Comb Manager**] button you can access the (Figure 16-6) menu by which, pressing the [**SELECT>>**] button, the management and monitoring of the PVI-STRINGCOMB-US is assigned to the corresponding module.

  i It is preferable to assign the string-box management to a 50kW slave module, if present.

---

[1] Before assigning the Stingcomb manager it is necessary to configure the RS485 line of the StrinComb by means of the StringComb software installer (See StringComb Manual).
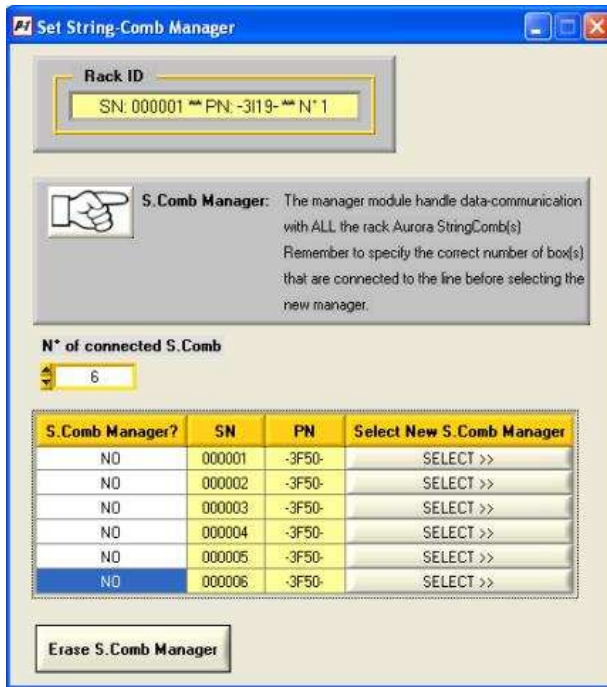
Figure 16-6: Choice of the StringComb Manager

➲ By double-clicking on the tower image you can access the rack management menu (Figure 16-11) in which it is possible to control and identify an alarm, and to gain access to the single module.

➲ From the Display menu, it is possible to open a system monitoring page that is very useful to create a small monitoring system (Figure 16-7).

ⓘ The LOGO, the image and system information can be all customised.
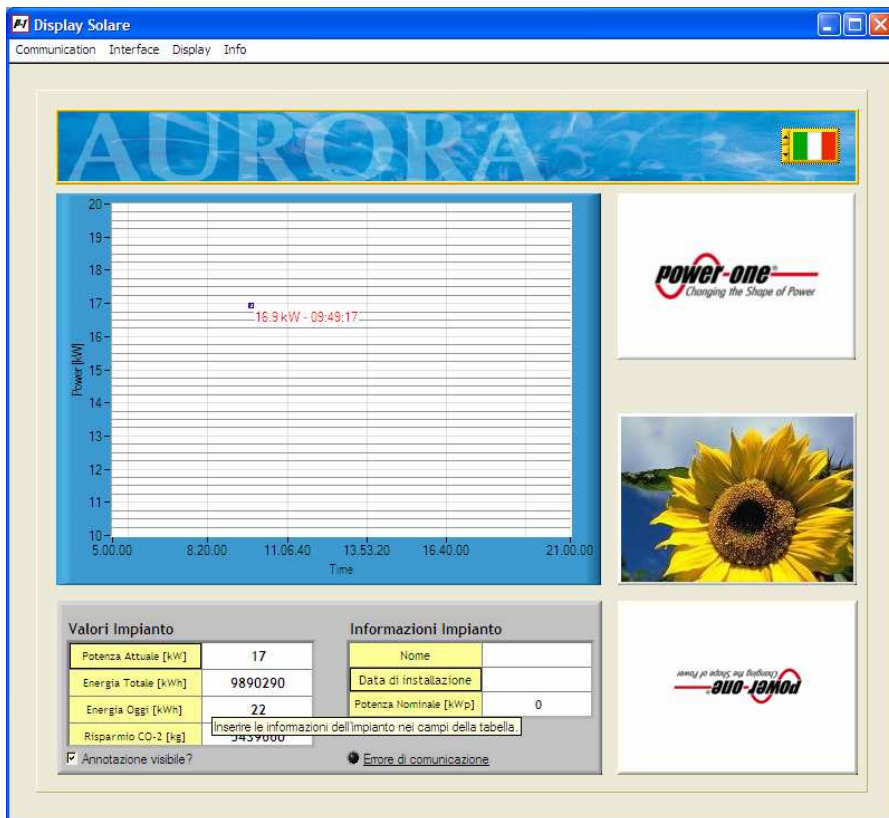
Figure 16-7: Display of Solar monitoring

16.4.3 Rack Interface
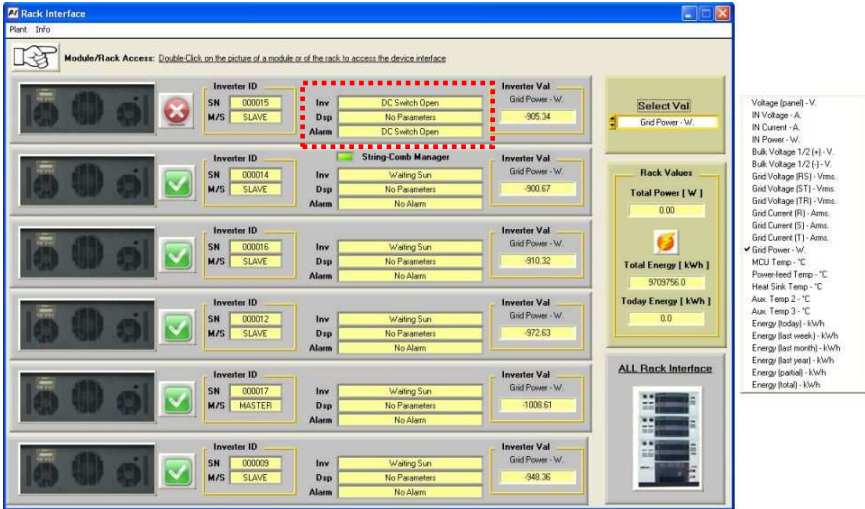
Figure 16-8: Rack Interface – Rack Management

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 area 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:** shows the serial number (SN) and the state of the master or slave of the module (M/S).
- **Inverter Val**: shows the value of the size selected from the list (*Select Val)*, in the top right side.

Figure 16-8 shows the content of the list where the following sizes 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)**: Grid voltage linked to phases R-S [Vrms]
- ✓ **Grid Voltage (ST)**: Grid voltage linked to phases S-T [Vrms]
- ✓ **Grid Voltage (TR)**: Grid voltage linked to phases T-R [Vrms]
- ✓ **Grid Power (W)**: Power sent to the grid
- ✓ **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 data visualised is not used)
- ✓ **Aux Temp 3**: Framework environment temp. sensor [°C]
- ✓ **Energy (today)**: Energy produced today [kWh]
- ✓ **Energy (last week)**: Energy produced last week [kWh]
- ✓ **Energy (last month)**: Energy produced last month [kWh]
- ✓ **Energy (last year)**: Energy produced last year [kWh]
- ✓ **Energy (partial)**: Energy produced since the last re-setting [kWh]
- ✓ **Energy (total)**: Total energy produced until today [kWh]

- ➲ By double clicking on the image of the single module you can access the management menu of the single module (Figure 16-10).
- ➲ By double clicking on the image of the rack, you return to the rack interface menu (Figure 16-11).

You can access the management menu of the single module (Figure 16-10) as indicated above or, otherwise, by choosing "single module" in Figure 16-2 and pressing the [**ENTER>>**] button of the *Single Module Panel* window.

16.4.4 Menus bar

From the standard or advanced mode, you may access the following menus:

Menus in Standard mode

Module	→ Module interface[1]
Rack	→ Rack interface[2]
ID	→ Inverter Identification.
Monitoring	→ Inverter Monitoring.
String-Comb	→ StringComb monitor.[3]
Info	→ Software version.
	→ Software license.

Menus in Advanced mode

Module	→ Module interface[1]
Rack	→ Rack interface[2]
ID	→ Inverter Identification.
Monitoring	→ Inverter Monitoring.
	→ Fault Log.
Statistic	→ Statistic field - reset.
	→ Inverter clock settings.
String-Comb	→ StringComb monitor.[3]
Solar filed	→ Solar field scan.
Info	→ Software version.
	→ Software license.

i Module interface and Rack interface show the relative windows illustrated in paragraphs.

📖 Chapter §16.4.1
Chapter §16.4.3

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

---

[1] Active in single module mode.
[2] Active in single plant mode.
[3] Active only on modules dedicated to Stringcomb management.

16.4.5 Inverter Identification

The window which summarises the plate data of a single module is the following:
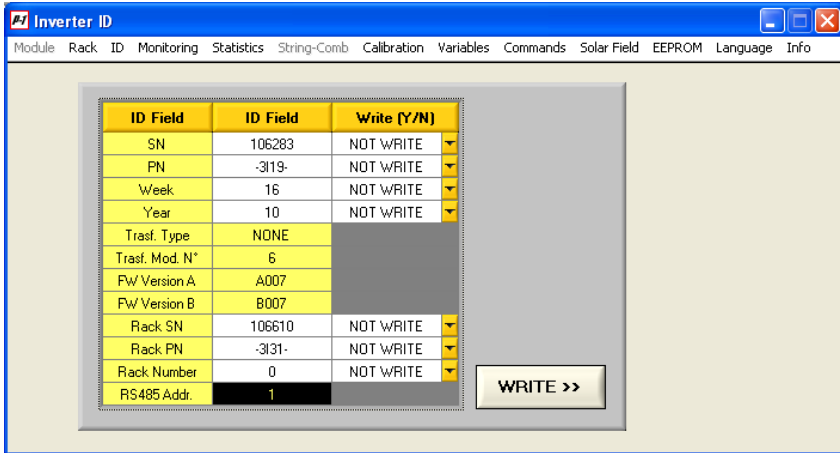
Figure 16-9: Inverter ID – Single Module Interface

The parameters listed are the following:

- ✓ **SN**: Series number of the module
- ✓ **PN**: Part number of the module
- ✓ **Week**: Week of production
- ✓ **Year**: Year of production
- ✓ **Transf. Type**: Type of connected transformer
- ✓ **Transf. Mod. No.**: Number of modules connected to the rack
- ✓ **FW Version A**: DSP firmware revision
- ✓ **FW Version B**: Supervisor firmware revision
- ✓ **Rack SN**: Series number of the rack
- ✓ **Rack PN**: Part number of the rack
- ✓ **Rack Number**: Identification number of the rack in the plant
- ✓ **RS485 Addr.**: Address RS485

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16.4.6 Inverter Monitoring

This window allows for monitoring a single module on the rack side.
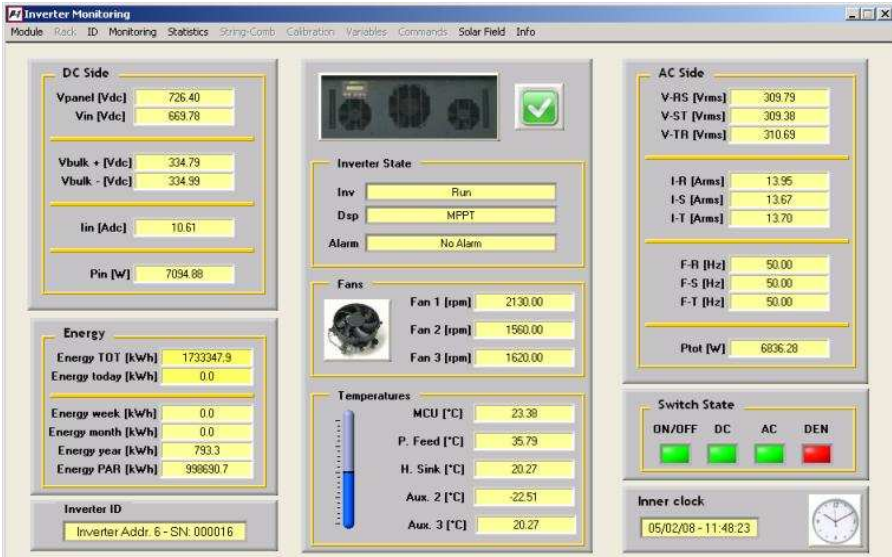
Figure 16-10: Inverter Monitoring

- **DC Side**: in this area, the DC electrical dimensions are collected.
- **Energy**: shows the total and partial energy of the module.
- **Inverter State**: the state of the inverter
- **Fans**: shows the rotation speed of the module fans.
- **Temperatures**: 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**: indicates the voltages, 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.

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16.4.7 Rack Monitoring

This window allows for monitoring all modules that are part of the rack.
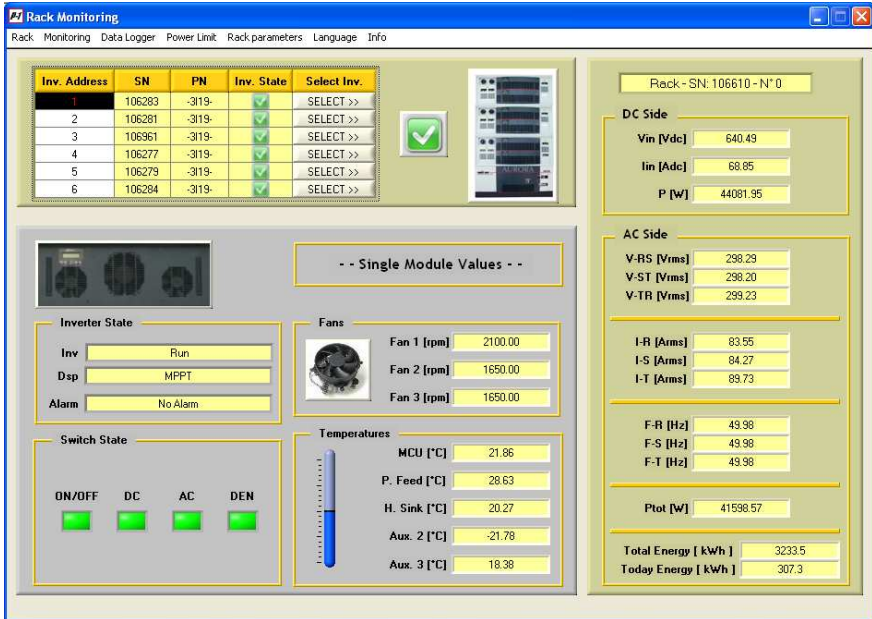
Figure 16-11: Rack Monitoring

- **DC Side**: in this area, the DC electrical dimensions are collected.
- **AC Side**: indicates the voltages, currents, frequency of the three phase triad and the power exported from the module.
- **Energy**: shows the total and partial energy of the module.
- **Select**: offers the possibility to choose the module to be displayed and that is part of the rack.
- **Single Module Values**: the state of the selected inverter.

- **Fans**: shows the rotation speed of the module fans.
- **Temperatures**: shows the temperatures as in the Inverter Monitoring.
  Switch state: closed switches are indicated in green, and open switches in red as in Inverter Monitoring.

16.4.8 Fault Log

This window lists the faults/alarms registered by the selected module:
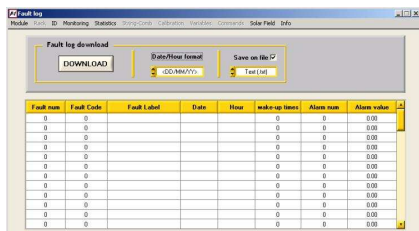
Figure 16-12: Window for saving the fault list

The (*Date/Hour format*) box allows to specify the format of the date on which the data will be visualised. The (*Save on file*) box, if enabled, allows to save the fault list in text (.txt) format or in excel (.xls) format, based on the choice made in the box below.

By pressing the [**DOWNLOAD**] button, the system downloads the faults from the inverter, displaying a wait window, and then the list of the downloaded faults (Figure 16-14). Afterwards, a window will appear to request saving the data to a file (Figure 16-13).
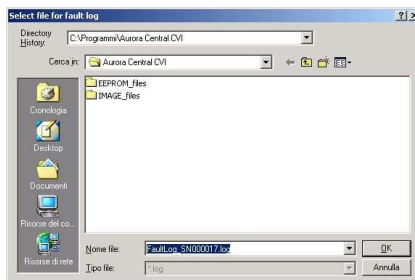
Figure 16-13: Window for saving the fault list

Figure 16-14: 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.

16.4.9 Statistic Field Reset

This window allows for cancellation of the energy statistics values.
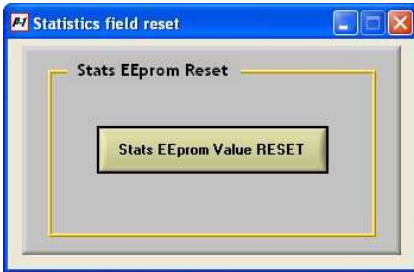
Figure 16-15: Eeprom Reset

➲ By clicking on the [**Stats EEprom Value RESET**] the following warning window will appear:

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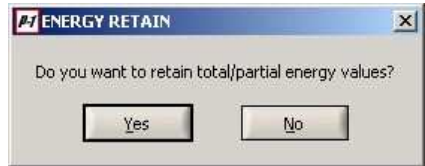
➲ Confirmation of the reset operation will be requested. Choose [**YES**] or [**NO**]:

➲ If you choose [**YES**] a wait window will open for the reset operations:

16.4.10 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.
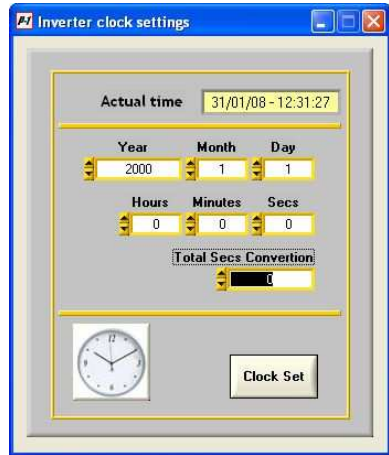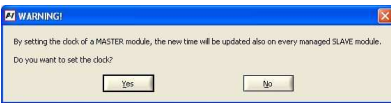
Figure 16-16: Inverter clock settings

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

16.4.11 String Comb monitoring

If the system has the string boxes (StringComb), this window will allow for the parameters of this apparatus to be monitored.
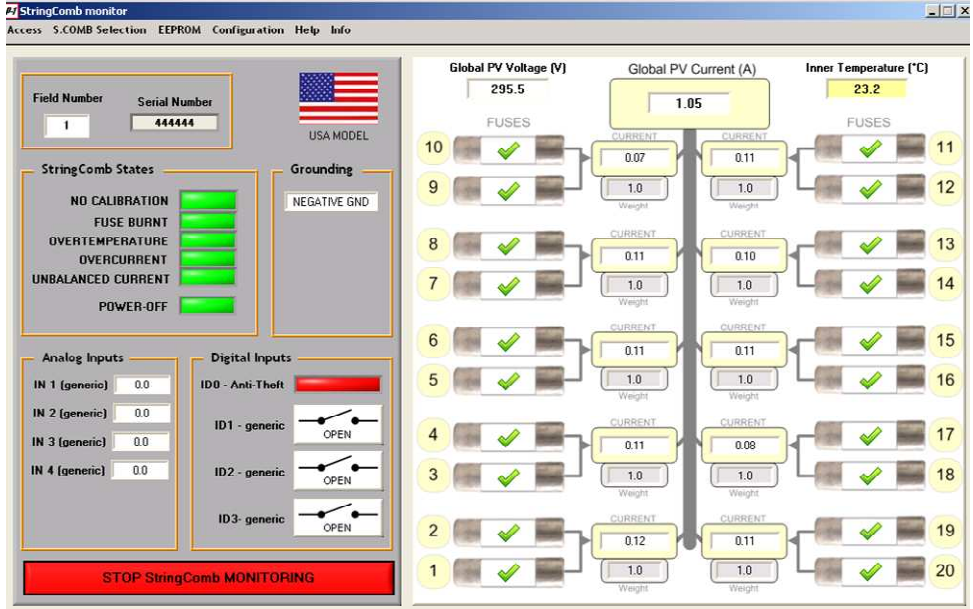
Figure 16-17: StringComb monitoring

| i | To use this program, please consult the excellent manual of the PVI-STRINGCOMB-US: "Boxes for the string connection for photovoltaic applications" supplied with the string boxes. |

16.4.12 Solar field scan

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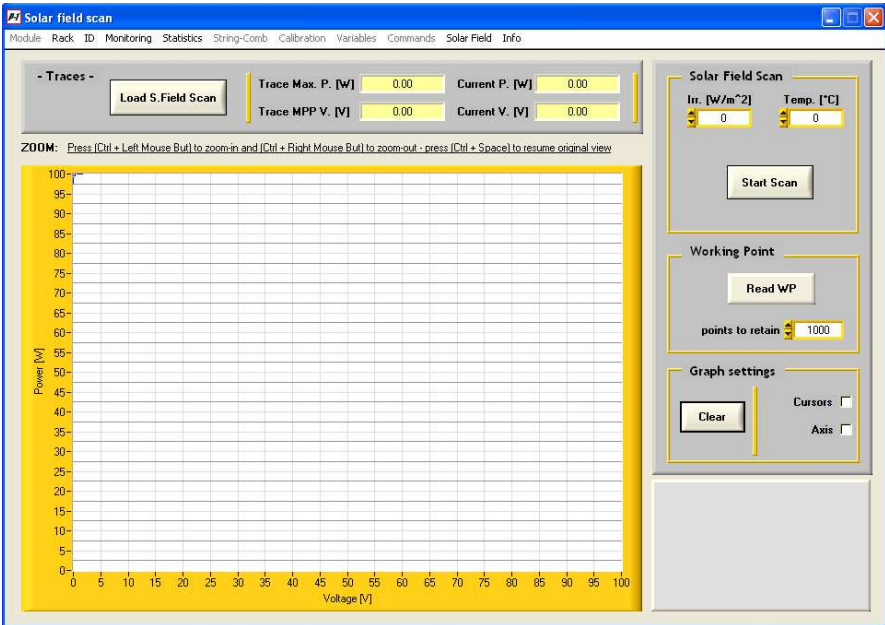
- **Solar Field Scan**: in this area, the environmental conditions can be indicated, by which the P-V characteristics can be measured. Press the [**Start Scan**] button to start the scan.
- **Working Point**: the [**Read WP**] button allows visualising the work point and how many points to be shown in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

- ⊃ If known, write the radiation and temperature values in the special boxes (this operation can also be omitted).
- ⊃ Press the [**Start Scan**] button. The program asks whether the operator wishes to visualise the master curve ([**Master Only**] button) or the master with the slaves ([**Master + Slave**]button), requesting a name for the curve. After the confirmation [**OK**] the inverter will start the field scan.
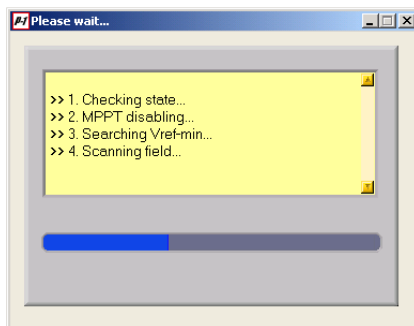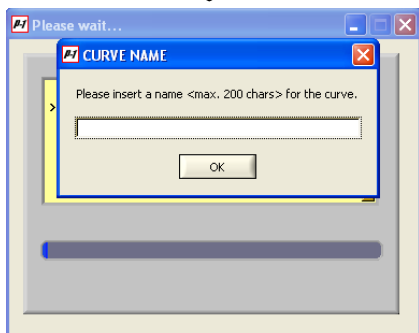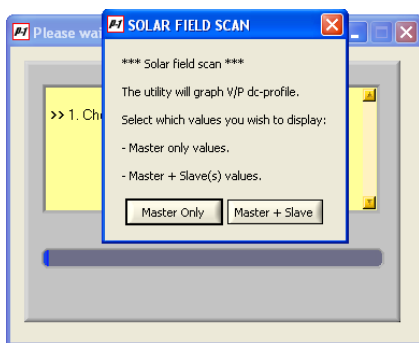
- ⊃ After the scan, the program asks for a name to be assigned to the data file.

⮞   Enter a name and press [**OK**]. After the file has been saved, the curve is drawn (Figure 16-18)
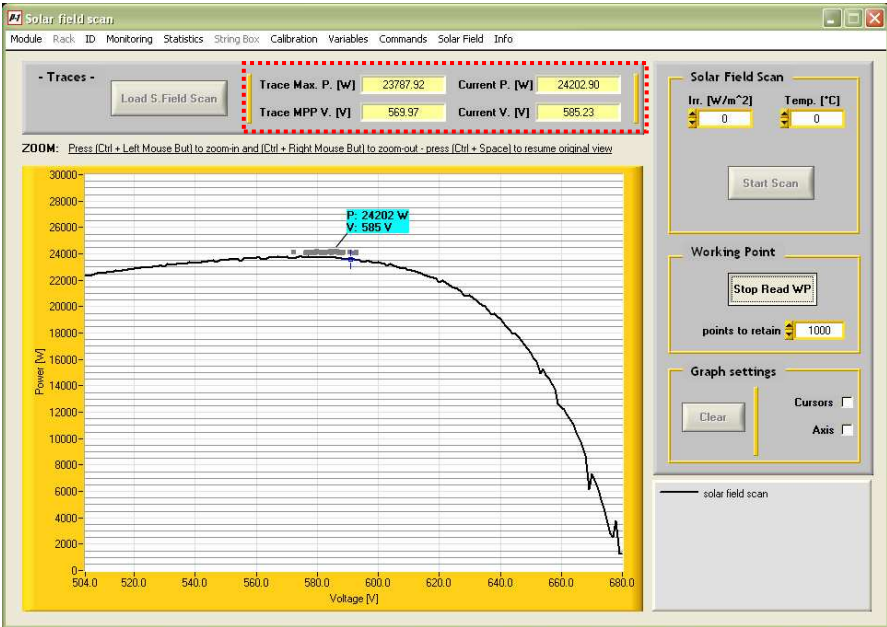
Figure 16-18: Solar Field Scan

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 the visualisation of the work point as indicated in the example in Figure 16-18.

16.4.12.1 Loading and visualisation of the P-V curves saved

This function allows the P-V characteristics found to be saved in a file. In this way, an archive of the characteristics of the photovoltaic field will be created.

This function is useful in the installation /maintenance phase.

➲ By pressing the [**Load S. Field Scan**] button you can create a curve previously saved.
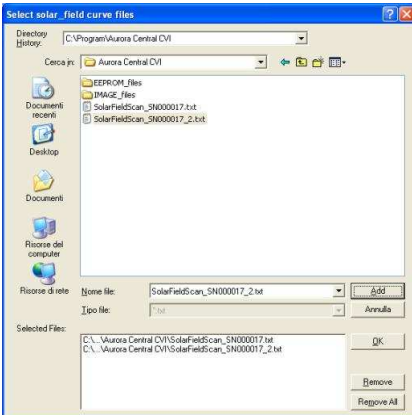
➲ Select the file that contains the curve and click on the [**Add**] button: in this way the selected curve will be added in the bottom window. Several curves may be visualised on the same graphs, by selecting them and clicking on [**Add**].

➲ In case of error, a selected curve can be removed by pressing the [**Remove**] button. By [**Remove All**] all curves may be removed.

16.4.12.2 Software Version

The window shows only the version of the software is being used.
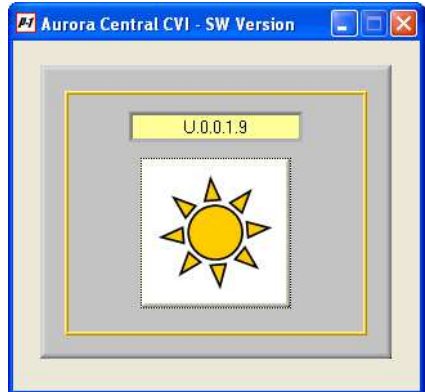
Press the ❌ button to close the panel and return to the previous screen.

17. MAINTENANCE / REPAIRS

This chapter describes the operations necessary to disconnect the device in order to carry out internal repairs in safety conditions.

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 cables.

Chapter §19

To maintain the efficiency of AURORA PVI-CENTRAL-XXX (US or CAN) and guarantee safety conditions, the maintenance operations described below are necessary. Maintenance also includes checking, and if necessary replacing components subject to wear during functioning.

i The equipment is designed to provide a lifetime operation of not less than five years, in the environment and for the type of application specified. Unscheduled maintenance interventions are not generally predictable and are due to verify the installation and to replace faulty components.

i The routine or unscheduled maintenance activities should be performed whenever possible during periods of lower production efficiency, in order to reduce costs.

⚠ **DANGER**

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

17.1. Routine maintenance

Maintenance inside the PVI-CENTRAL-XXX (US or CAN) must be carried out following the procedures shown in Table 17-1.

Table 17-1: Table of routine maintenance

ACTIVITY	FREQUENCY*	PAR.
Cleaning of filters and grills and internal inspection for dirt and/or water	Every Six Months	§17.1.1
Tightening screws and check on colour changes	Annually	§1.1.1
Checks of the AC BOX area	Annually	§1.1.1
Checks of the transformer ACBOX area	Annually	§17.1.3
Checks of Framework area	Annually	§17.1.4
Check of warning cards and signalling devices	Annually	§17.1.5

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

17.1.1 Filter cleaning

To access the filters it is necessary to remove some of the panels (Figure 17-1). Use the occasion to make a general visual inspection of PVI-CENTRAL-XXX (US or CAN).
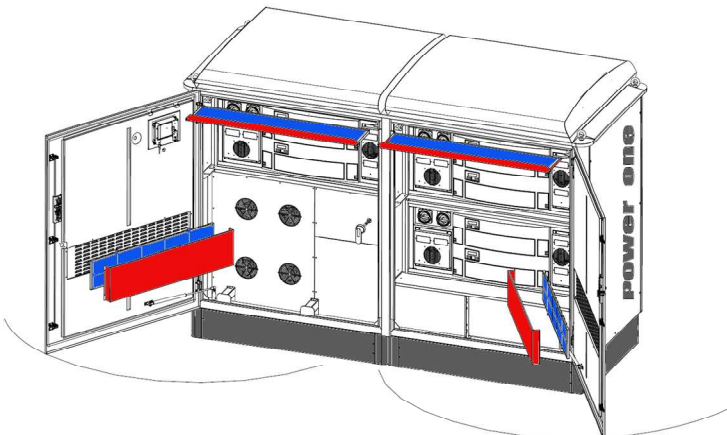
Figure 17-1: Position of the air filter panels

17.1.1.1 Upper input air filters

To clean the filter it is necessary to remove the panel at the top of the inverter. To remove the filter, unscrew the two locking screws and pull the panel towards yourself (Figure 17-2 e Figure 17-2).

After removing the frame, it is possible to remove the filter fitted inside and wash it (do not use solvents!). Also remember to check the input grills and intervene in case of obstruction.

! **NOTICE**

Before replacing the filter, make sure that it is perfectly dry.

If no further checks are necessary, replace the panel.
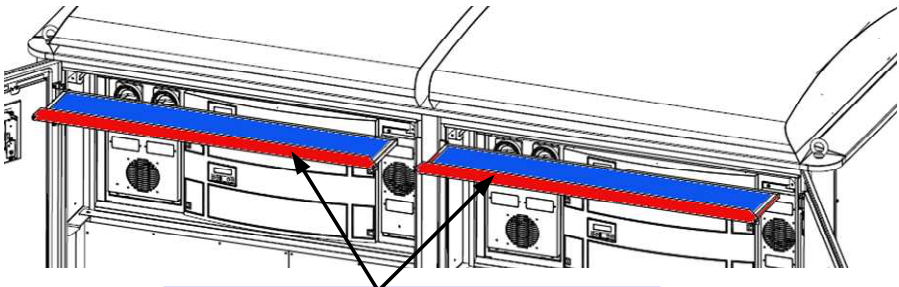
AIR FILTER and FRAME FILTER

Figure 17-2: Upper filter panel

17.1.1.2 Upper air input filters

To clean the filter, remove the panel on the back of the inverter doors. To remove the filter, unscrew and remove first the protection panel and then unscrew and remove the frame that houses the filter itself (Figure 17-1 e Figure 17-3).

Once the frame has been removed, it is possible to remove the filter inside for washing (do not use solvents!). Also check the input grills and intervene in case of obstruction.

> ⓘ **NOTICE**
>
> Before replacing the filter, make sure that it is perfectly dry.
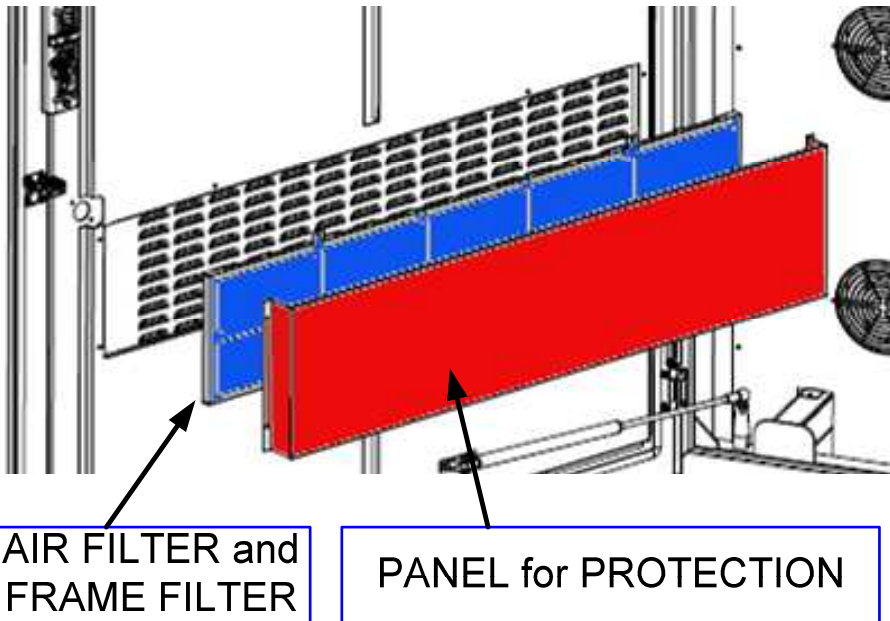
Figure 17-3 Frontal filter panel

AIR FILTER and FRAME FILTER

PANEL for PROTECTION

17.1.2 Visual and screw inspections

In order to check the screws it is necessary to open the inverter. This means it is absolutely necessary to section off the entire system, from the DC as well as from the AC side.

<div style="border:2px solid black">

![warning triangle] **DANGER**

If it is necessary to operate on exposed parts (not protected by panels), it is not sufficient to turn the grid switches (AC) and field switches (DC) to 0 (OFF), because the input cables are always under voltage!
Turn off and disconnect the inverter.

Chapter §18

MANDATORY UPSTREAM

</div>

Once the system has been disconnected and the inverter panels have been removed Figure 10-7 and Figure 17-4, check as indicated in the
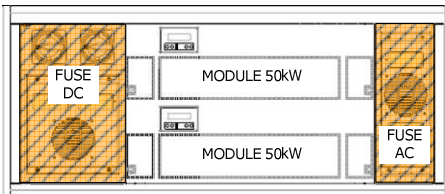
Table 17-2.

Figure 17-4: Panels to be removed to acces DC and AC Fuses.

Table 17-2: Table of visual and screw checks

To be checked and/or tightened	Check point
AC fuse box	Connection points (visible by removing the AC panel of Figure 17-4)
DC fuse box	Connection points (visible by removing the DC panel of Figure 17-4)
AC input bars	Connection points Figure 5-6 and Figure 11-4
DC input bars	Connection points Figure 5-5 and Figure 11-1
DC array ground	Connection points Figure 5-5 and Figure 11-3
DC switches	Connection points (visible by removing the DC panel of Figure 17-4)

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!

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 no-uniform anomalous colouring indicates thermal stress and therefore possible functioning problems. In such case, contact your dealer who will assess whether a replacement is needed.
Also check for any corroded spots.

➲ If checks have been completed, replace the panels and the relative earth connections correctly.

17.1.3 Checks of the ACBOX area

The following checks regard the cooling system and the protection devices positioned in the ACBOX area, and it is therefore necessary to remove the front panel (G and H) indicated in Figure 10-7.

Chapter §10.2.4

⚠ DANGER

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

Replace the panel after the checks have been completed.

17.1.3.1 GFD fuse check

If a GFD device signals a ground fault, it means that the related fuse needs to be replaced. (Figure 17-5)

➲ Open the fuse compartment and remove the tripped fuse. Replace it with an equivalent fuse.
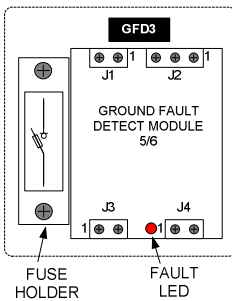
Figure 17-5: GFD and fuse holder

If the replace fuse trips again, it will be necessary to check the system to locate the ground fault.

17.1.3.2 Fan control[1]

The module 50Kw fans are monitored automatically when the inverter is functioning, and therefore they do not need to be checked.

To check the correct functioning of the fans in the ACBOX area and Framework area, carry out the following procedure:

➲ Note the current position of the thermostat shown in Figure 17-6 and Figure 17-7 (in order to restore the initial condition later: it is normally set at approx. 40°C).

➲ Turn the knob of the thermostat temperature completely counter-clockwise (the QS2 switch must be ON).

➲ In this position of the thermostat the fans will be activated. Make sure all are moving regularly and do not produce unusual noises.

➲ Turn the thermostat back to the value noted previously.

---

[1] Also valid for Acbox Trasformer
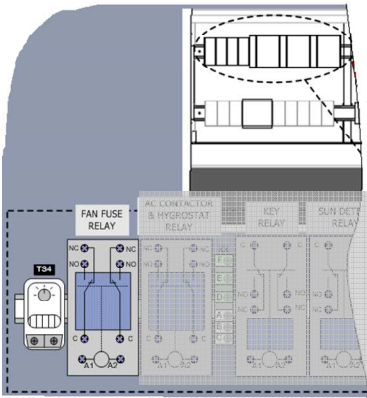
Figure 17-6: Fan Framework Thermostat
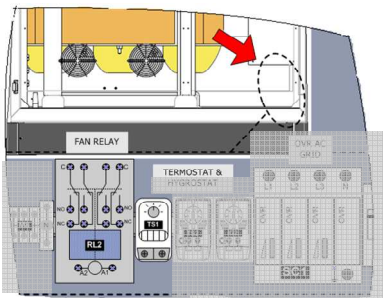
Figure 17-7: Fan Transformer Thermostat

17.1.3.3 Check of the power switch operation

- ➲ To check, press with a screwdriver the button indicated with the word TEST on the disconnecting switch (Figure 10-8 – (4)). Make sure that the knob turns clockwise from the "0" position to the yellow "Tripped" position.
- ➲ Before replacing the panel, rotate counter-clockwise in "0" position. Use a hex wrench to leverage on the rod and keep the shaft perpendicular to the switch). AC knob.

17.1.3.4 OVR AC device check.

Check that the inspection windows are not coloured in red. If so, replace the faulty cartridges with others of the same type (Figure 17-8 and Figure 17-9).
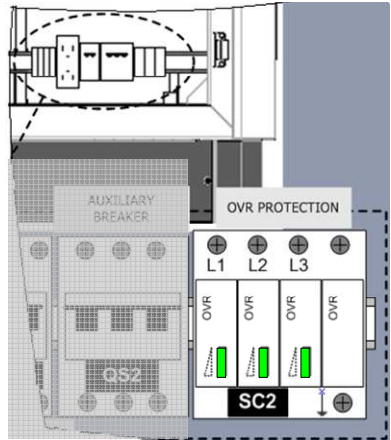
Figure 17-8: OVR Auxiliary VAC Devices

- ➲ It is necessary to check the fuses in the fuse boxes (F1) of Figure 17-9.

Figure 17-9: OVR VAC Grid

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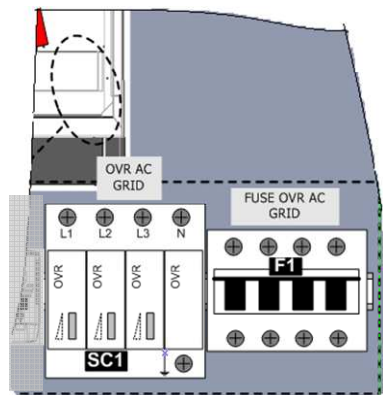
17.1.4 Checks on the Framework

17.1.4.1 OVR DC device check.

The check of the integrity of the DC OVR device is performed automatically: the display will signal this accordingly. In this case the faulty cartridge must be replaced. Check the fuses as well.

DC OVR devices are located inside the left part of the framework and it is necessary to extract the 50 kW module in order to act on the device.
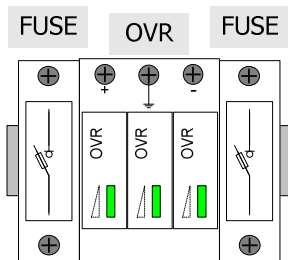
Figure 17-10: OVR DC Devices

17.1.4.2 Check of the AC fuses

For this inspection, it is not necessary to open the AC panel and switch off the inverter: you can visually check if the fuses are intact through the appropriate windows (Figure 17-4).

The state of the fuse is signalled by a small lever above each fuse: when the fuse is intact, the lever is horizontal and attached to the fuse box; in case of interruption the lever will be vertical.

17.1.4.3 Check of the DC fuses

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

For this inspection, it is necessary to open the AC panel and switch off the inverter: you can visually check if the fuses are intact through the appropriate windows (Figure 17-4).

17.1.5 Check of warning cards and signalling devices

Check that all labels bearing warnings or indications are intact and well bonded to the chassis of the inverter. In particular, the danger labels should always be clearly visible.
If necessary, contact Power-One.

17.2. Replacement of faulty battery

> ### (!) NOTICE
>
> This component must be replaced only by a qualified technician.

To remove the battery, the module must be withdrawn from its seat.
Each 55kWp module present in the inverter has a Lithium buffer battery of CR203 type2.

Its function is to keep the internal watch powered for statistical calculations.
If the system signals "Battery Fail" on the display, contact your dealer for possible replacement.

> (i) If the battery fails, the system will still function, even if the energy data will not be correct.

18. SWITCHING OFF AND DISCONNECTING THE SYSTEM

⚠️ **DANGER**

If it is necessary to operate on exposed parts (not protected by panels), it is not sufficient to turn the grid switches (AC) and field switches (DC) to 0 (OFF), because the input cables are always under voltage!

Turn off and disconnect the inverter.

📖 Chapter §18

MANDATORY UPSTREAM DISCONNECTION

18.1. Disconnection from the AC grid

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

1. It is advisable to set all Master modules of the rack on the REMOTE OFF position by means of the display.

   i In this way, the power fed into the grid is practically null and the AC switch can be opened in the absence of any load.

2. Turn the AC switch to the 0 position, i.e. turn it counter-clockwise:

   a. The inverter disconnects from the AC grid and therefore it no longer supplies power.

   b. All the displays of the rack relative to the open switch will signal an AC switch alarm.
   The LED flashes. POWER ON
   The ALARM LED is on.
   The MISSING GRID LED is on.

i In this phase, it is possible that the modules display a different error in the first minute, since the opening of the grid switch is interrupted and a Grid Fault alarm or similar may be triggered off. After the recovery time (e.g. 60 sec), the signal will be the same on all modules.

18.2. Disconnecting the photovoltaic field

Below, the procedure for disconnecting AURORA module 50kW from the photovoltaic field (DC):

1. Make sure that the AC switch is in 0 (OFF) position.

    Chapter §18.1

2. Open the door.
3. One at a time, turn the DC switches to the 0 (OFF) position (Figure 6-4 (A)), i.e. turn them counter-clockwise:

    Chapter §6

    a. In the case of Multi-Master/Slave (250/300kW), both switches of a framework must be turned so that the modules are physically disconnected from the field (Table 6-1).

    b. In the case of 1Master/n.Slave (350/400kW TL), all switches of a rack must be turned so that the modules are physically disconnected from the field (Table 6-2). Disconnection is also possible from the external DC switch.

⚠️ **WARNING**

Before proceeding to the next step, wait 30 minutes to ensure there is a proper heat dissipation through the system fans.

18.3. Disconnection from the auxiliary line

To perform this operation it is necessary to act on the possible main switch located upstream (by the installer) or to act on the internal QS2 switch, according to the following steps:

1. Follow the directions regarding the disconnection of the AC and DC, and then go to next step.

    Chapter §18.1
    Chapter §18.2

2. Set the QS2 switch to OFF to disconnect the auxiliary supply (Figure 11-5).

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

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18.4. Upstream disconnection of the inverter

If it is necessary to move/remove or scrap the PVI-CENTRAL-XXX (US or CAN), or in any case to completely insulate it from the rest of the plant, it is absolutely mandatory to disconnect the device from both the DC and AC sides, i.e. from the photovoltaic field and from the grid. To do this, it is necessary to disconnect the DC input voltage and the output distribution lines connected to the AC clamps, and the 3P+N auxiliary power.

__This operation is only possible by using the switches on the photovoltaic field and on the distribution line, and not the switches on board the inverter.__

At this point, if necessary, the DC and AC cables can be physically disconnected from the inverter, removing the necessary panelling.

Chapter §10.2.4, Chapter §18.1
Chapter §18.2, Chapter §18.3

18.5. Removal and insertion of a 50kWp module

For some types of extraordinary intervention it may be necessary to remove a 50kWp module from its seat (for example, in case of module breakdown).

18.5.1 Preliminary operations

A module weighs too much to be supported by a person, therefore it is necessary to use a mechanical aid to facilitate the withdrawal operation and the further insertion (see the figures below as an example).

1. Follow the directions regarding the disconnection of the AC and DC.

   Chapter §18.1
   Chapter §18.2

2. Perform the un-association of the modules on behalf of the main display.

   Chapter §14.6

3. Follow the indications related to the sectioning of the auxiliary AC voltage.

   Chapter §18.3

18.5.2 Removing the module

After having completed the previous paragraph, follow the indications:

1. Place the lifting trolley with the platform or prongs in line with the base of the module to be withdrawn.

! NOTICE

DO NOT JERK!

2. Pull the module approx. 15cm from the framework and place the lifting trolley with the platform or prongs under the base of the module to be withdrawn.

3. Finish withdrawing the module completely from the seat.

18.5.3 Insertion of the module

1. Align the platform on which the module to be inserted is positioned, with the supporting brackets of the framework.

2. Push the module into the framework, leaving off approx. 15cm.

! NOTICE

DO NOT PUSH THE FAN GRILLS!

3. Remove the trolley and push the 50kWp module firmly so that it enters the framework.

4. Insert the 4 blocking screws of the 50kWp module.

18.5.4 Final operations

After having completed the previous paragraph, follow the indications:

1. Perform the commissioning again following the relative instructions.

📖 Chapter §12

! NOTICE

IT IS MANDATORY TO ASSIGN TO THE FRESHLY REPLACED UNIT. THE SAME RS485 ADDRESS OWNED BY THE MODULE REMOVED DURING THE NEW COMMISSIONING!

19. SCRAPPING

When the PVI-CENTRAL-XXX (US or CAN) must be scrapped, it must be completely disconnected.

📖 Chapter §18

Take the PVI-CENTRAL-XXX (US or CAN) to an authorised collection point.

📖 Chapter §1.1

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20. TROUBLESHOOTING

20.1. FAQ (Frequently Asked Question)

Before the product is dispatched, various tests are carried out successfully, in order to check: the functioning, the protection devices, the performances.

Such tests, together with the Power-One quality assurance system, guarantee optimal operation of AURORA.

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

```
IIIIIII  POWER ON
         ALARM
```

- **The red LED "*ALARM*" is always on (ON)**
- **The green LED "*POWER ON*" flashes**
- **The module concerned, or all the modules, disconnect from the grid.**

In the case of breakdown, the system waits 60 seconds (standard value), then cancels the fault signal and attempts to reconnect to the distribution grid.

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 20-1: **Troubleshooting**

PROBLEM (FAQ)	POSSIBLE CAUSE	SOLUTION
Software		
The serial communication of one or more Modules does not work	a) Interrupted line b) Wrong termination c) Repeated addresses d) Faulty card	Make sure that: a) There are no interruptions of the line b) The termination must be enabled only on the last one of the chain Chapter §8, Chapter §11.7.2 c) There should not be similar address among PVI-CENTRAL-XXX in the whole chain Chapter §11.7.4 d) Contact the dealer
The communication seems to be working but all the modules are not "visible" from the scanning program.	The configuration baud rate of the Modules is different from that of the adapters.	Use the default 9600 baud-rate configuration.
Signalling on the Display		
Faulty (SPD / OVR) Discharger	The SPD has intervened (for overvoltage) and must be replaced.	Replace the damaged cartridge/s Chapter §17.1.4.1
The LED "*Missing Grid*" is on	a) Grid switch open b) An anomaly was detected on the distribution grid	a) Make sure that the grid switch is in ON position b) Make sure there are no electrical grid problems due to the manager (in this case wait for recovery)
The display signals "*Waiting remote on*"	a) The "Software ON/OFF" control was enabled from the display b) The "Remote ON/OFF" signal was opened on the terminal block	a) Cancel the SOFTWARE ON/OFF command by setting it on "Not Active" (Figure 13-3) b) Close the signal.

PROBLEM	POSSIBLE CAUSE	SOLUTION
The display signals "*Waiting for sun*"	The photovoltaic system does not provide enough power to connect the inverter (e.g. cloudy sky)	Wait until environmental conditions are favourable
The inverter indicates a fault on one of the StringComb.	One or more parameters controlled by the string box is/are over the limit	Verify that the information in the PVI-STRINGCOMB manual covers this series. If necessary contact the dealer.
The inverter does not receive DC voltage from the panels and remains in Energy save (SE)	a) DC switch is open. b) Interruption in the DC line c) The field voltage is insufficient	a) Close the DC switch placed on the front of the inverter. b) Are the DC cables connected? Is there an open switch upstream? c) check the DC voltage of the field.

20.2. Before contacting the dealer (Questionnaire)

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

20.2.1 Problems on the StringCombs

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

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20.2.2 Problems on the PVI-CENTRAL-XXX (US or CAN)

INFORMATION ON THE INVERTER
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 if the fault is due to any specific operation ?
- (8)   If so, which ?
- (9)   Have you noticed if the fault is cyclical ?
- (10)   If so, how often ?
- (11)   Was the fault apparent at the moment of installation ?
- (12)   Describe the atmospheric conditions at the time of occurrence of the fault.

INFORMATION on the Photovoltaic Field

- (13)   Make and model of photovoltaic panels
- (14)   Plant structure:
    - maximum array voltage and current values
    - number of array strings
    - number of panels for each string

21. 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 Table 21-1 which follows briefly describes the two types of signals that may appear.

21.1. Warning

These indicate the state of AURORA, therefore they are not caused by a fault and do not imply the need for any action (lack of grid, sun, etc.). These will cease to be displayed as soon as normal conditions will be restored. Warnings are indicated in the table below by a "W".

21.2. Error

Indicate a possible fault of the apparatus or of the elements connected to it. Also in this case, the signal will disappear as soon as the causes are identified.

The occurrence of an error signal generally implies an intervention that is maintained by Aurora as much as possible, or it will provide appropriate indications in order to assist the person working on the device or plant, to perform the necessary maintenance. Errors are indicated in the table below by an "E".

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

Once the error has been removed, the inverter resets all functions in progress and automatically restarts the connection.

Chapter §12.1

Table 21-1: Table of Error Messages and Codes

	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

22. TECHNICAL DATA

22.1. System Ratings data tables

Table 22-1: Utility Interactive Inverter, System Ratings (US markets)

Characteristics	PVI-CENTRAL-250-US	PVI-CENTRAL-300-US
Input Ratings		
Maximum input voltage (Vdc)	600	600
Range of input operating voltage (Vdc)	320 - 600	320 - 600
Total Maximum input current (Adc) For module (Adc)	850 170	1020 170
Maximum input short circuit current (Adc)	200 (for each module)	200 (for each module)
Maximum input source backfeed current to input source (Adc)	390	468
Output Ratings		
Power Factor (cos φ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
Operating voltage range (Vrms)	423Vac - 528Vac	423Vac - 528Vac
Operating frequency range (Hz)	59.3 - 60.5	59.3 - 60.5
Number of phases	3	3
Nominal output voltage (Vrms)	480	480
Nominal output frequency (Hz)	60	60
Maximum continuous output current (A)	303 (for each phase)	363 (for each phase)
Maximum continuous power (kVA)	250,00	300,00
Maximum output fault current and duration (A)	534 Apk 63 Arms @ 60mS	522 Apk 80 Arms @ 60mS
Maximum output overcurrent protection (A)	390	468
Utility interconnection voltage and frequency trip limits and trip time accuracy	Chapter §22.3	Chapter §22.3
Trip limit and trip time accuracy	[Voltage] +/- 2% (V) [Frequency] +/- 0.1% (Hz) [Time] 0.033 (Sec)	[Voltage] +/- 2% (V) [Frequency] +/- 0.1% (Hz) [Time] 0.033 (Sec)
Environmental Ratings		
Normal operating temperature range	-25°C...+60°C	-25°C...+60°C
Maximum full power operating ambient	+50°C	+50°C
Environmental Protection Degree	Nema3R	Nema3R

Table 22-2: Utility Interactive Inverter, System Ratings (Canadian markets)

Characteristics	PVI-CENTRAL-250.0-CAN-600	PVI-CENTRAL-300.0-CAN-600
Input Ratings		
Maximum input voltage (Vdc)	600	600
Range of input operating voltage (Vdc)	320 - 600	320 - 600
Total Maximum input current (Adc)	850	1020
For module (Adc)	170	170
Maximum input short circuit current (Adc)	200 (for each module)	200 (for each module)
Maximum input source backfeed current to input source (Adc)	390	468
Output Ratings		
Power Factor (cos φ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
Operating voltage range (Vrms)	528Vac - 660Vac	528Vac - 660Vac
Operating frequency range (Hz)	59.3 - 60.5	59.3 - 60.5
Number of phases	3	3
Nominal output voltage (Vrms)	600	600
Nominal output frequency (Hz)	60	60
Maximum continuous output current (A)	241 (for each phase)	289 (for each phase)
Maximum continuous power (kVA)	250,00	300,00
Maximum output fault current and duration (A)	424 Apk 90 Arms @ 60mS	415 Apk 109 Arms @ 60mS
Maximum output overcurrent protection (A)	310	372
Utility interconnection voltage and frequency trip limits and trip time accuracy	Chapter §22.3	Chapter §22.3
Trip limit and trip time accuracy	[Voltage] +/- 2% (V) [Frequency] +/- 0.1% (Hz) [Time] 0.033 (Sec)	[Voltage] +/- 2% (V) [Frequency] +/- 0.1% (Hz) [Time] 0.033 (Sec)
Environmental Ratings		
Normal operating temperature range	-25°C...+60°C	-25°C...+60°C
Maximum full power operating ambient	+50°C	+50°C
Environmental Protection Degree	Nema3R	Nema3R

22.2. Tightening torque for connectors

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

Table 22-3 : Tightening torque for connectors

CONNECTORs	AWG range	Torque (in/lbs) range
AUXILIARY Connectors	12 - 4	13.2 - 15.9
SIGNAL Connectors	20 - 12	3.5 - 5.3

22.3. Adjustable TRIP POINTs

Table 22-4 : Default values for voltage and frequency limits for utility interaction (@208Vac)

DISPLAY Variable	DEFAULT VALUES		Timeout
	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)	248	-	0.16
27 (read only)	-	60.5	0.16
26	-	59.3	0.16

Table 22-5 : Voltage and frequency limits for utility interaction adjustable trip points

| DISPLAY Variable | Adjustable Trip points | | Timeout |
	Grid Voltage (V)	Frequency (Hz)	sec
19 (read only)	$V < 0.50\ V_{nor}$	Rated	0.16
45	Vuv Adjustable Set Points from $0.50\ V_{nor}$ to $0.88\ V_{nor}$ (from 55% to 88%)	Rated	Tuv
46	Vuv	Rated	Tuv = 2 (default) Adj. from 2 to 5
43	Vov Adjustable Se Points from $1.10\ V_{nor}$ to $1.20\ V_{nor}$ (from 110% to 118%)	Rated	Tov
44	Vov	Rated	Tov = 1 (default) Adj. from 1 to 5
17 (read only)	$1.20\ V_{nor} \leq V$	Rated	0.16
27 (read only)	Rated	$f > 60.5$	0.16
26	Rated	Fmin < 59.3 (default) Adj. from 57 to 59.8	0.16
-	Rated	$f < 57$	0.16

22.4. Data sheet

Table 22-6: Data Sheet PVI-CENTRAL-XXX-US

Characteristics	PVI-CENTRAL-250-US	PVI-CENTRAL-300-US
Input Parameters		
Maximum recommended PV power (KWp)	275	330
Absolute maximum input voltage (Vdc)	600	600
MPPT input voltage range Vdc	320 - 600	320 - 600
Number of MPPT (Master/ Slave)	3	3
Total Maximum input current (Adc)	850	1020
For module	170	170
Input Reflected Ripple voltage	<3%	< 3%
Number of DC inputs available	5	6
Input overvoltage protections	5 (1 for each input)	6 (1 for each input)
Output Parameters		
Nominal AC Output Power (KWp)	250	300
Nominal AC Output Current (Arms)	303 (for each phase)	363 (for each phase)
AC Output Voltage range (Vrms)	480V Δ (423Vac – 528Vac)	480V Δ (423Vac – 528Vac)
Nominal AC Frequency (Hz)	60	60
Power Factor (cos φ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
AC Current Harmonics (THD%)	< 3% (@ Pac nominal)	< 3% (@ Pac nominal)
Inverter Switching Frequency (KHz)	9	9
AC side overvoltage protection	Yes	Yes
Conversion Efficiency		
Peak Efficiency % (@ Vin 330)	97,2	97,2
CEC Efficiency %	96,5	96,5
Environmental Parameters		
Environmental Protection Degree	Nema3R	Nema3R
Operating Temperature Range	-25°C...+60°C (with Pout derating)	-25°C...+60°C (with Pout derating)
Storage Temperature	-25°C...+60°C	-25°C...+60°C
Relative Humidity (non-condensing)	< 95%	< 95%
General Data		
Auxiliary Voltages Consumption (No Heater)	< 0,30 % (P.nom)	< 0,35 % (P.nom)
Night time losses (W) (No Fan, No Heater)	104	115
Local Communication	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)
User Interface	Touch screen display	Touch screen display
Mechanical Characteristics		
DC CONNECTIONS (max wire)	20 x 300 Kcmil 90°C	24 x 300 Kcmil 90°C
AC CONNECTIONS (max wire)	6 x 300 Kcmil 90°C	6 x 300 Kcmil 90°C
PE CONNECT AC side (max wire / cable lug)	1 x 4/0AWG 90°C / M10	1 x 4/0AWG 90°C / M10
PE CONNECT DC side (max wire)	6 x 300 Kcmil 90°C	6 x 300 Kcmil 90°C
Dimensions (WxHxD) (mm)	2933 x 2147 x 1250	2933 x 2147 x 1250
Overall Weight (Kg)	2900	3000
50kW module Weight (kg)	70	70
Required Ambient Air Cooling Flow (m³/h)	7000	8000

Table 22-7: Data Sheet PVI-CENTRAL-XXX-CAN-600

Characteristics	PVI-CENTRAL-250.0-CAN-600	PVI-CENTRAL-300.0-CAN-600
Input Parameters		
Maximum recommended PV power (KWp)	275	330
Absolute maximum input voltage (Vdc)	600	600
MPPT input voltage range Vdc	320 - 600	320 - 600
Number of MPPT (Master/ Slave)	3	3
Total Maximum input current (Adc)	850	1020
For module	170	170
Input Reflected Ripple voltage	<3%	< 3%
Number of DC inputs available	5	6
Input overvoltage protections	5 (1 for each input)	6 (1 for each input)
Output Parameters		
Nominal AC Output Power (KWp)	250	300
Nominal AC Output Current (Arms)	241 (for each phase)	289 (for each phase)
AC Output Voltage range (Vrms)	600V Δ (528Vac – 660Vac)	600V Δ (528Vac – 660Vac)
Nominal AC Frequency (Hz)	60	60
Power Factor (cos φ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
AC Current Harmonics (THD%)	< 3% (@ Pac nominal)	< 3% (@ Pac nominal)
Inverter Switching Frequency (KHz)	9	9
AC side overvoltage protection	Yes	Yes
Conversion Efficiency		
Peak Efficiency % (@ Vin 330)	97,65	97,65
CEC Efficiency %	97	97
Environmental Parameters		
Environmental Protection Degree	Nema3R	Nema3R
Operating Temperature Range	-25°C...+60°C (with Pout derating)	-25°C...+60°C (with Pout derating)
Storage Temperature	-25°C...+60°C	-25°C...+60°C
Relative Humidity (non-condensing)	< 95%	< 95%
General Data		
Auxiliary Voltages Consumption (No Heater)	< 0,30 % (P.nom)	< 0,35 % (P.nom)
Night time losses (W) (No Fan, No Heater)	105	119
Local Communication	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)
User Interface	Touch screen display	Touch screen display
Mechanical Characteristics		
DC CONNECTIONS (max wire)	20 x 300 Kcmil 90°C	24 x 300 Kcmil 90°C
AC CONNECTIONS (max wire)	6 x 300 Kcmil 90°C	6 x 300 Kcmil 90°C
PE CONNECT AC side (max wire / cable lug)	1 x 4/0AWG 90°C / M10	1 x 4/0AWG 90°C / M10
PE CONNECT DC side (max wire)	6 x 300 Kcmil 90°C	6 x 300 Kcmil 90°C
Dimensions (WxHxD) (mm)	2933 x 2147 x 1250	2933 x 2147 x 1250
Overall Weight (Kg)	2900	3000
50kW module Weight (kg)	70	70
Required Ambient Air Cooling Flow (m³/h)	7000	8000