AURORA®

Photovoltaic Inverters

INSTALLATION AND OPERATOR MANUAL

Model number: PVI-3.8/4.6-I-OUTD-US *Rev. 1.1*

TABLE OF CHANGES

Document Revision	Author	Date	Change Description
1.0	Federico Mastronardi	03/08/10	First draft
1.1	Federico Mastronardi	09/12/10	First revision

KEEP THESE INSTRUCTIONS!

IMPORTANT SAFETY INSTRUCTIONS

INSTRUCTIONS FOR READING THE MANUAL

This manual contains important instructions for safety and operation which must be understood and carefully followed during installation and maintenance of the equipment.
In order to reduce the risk of electric shock and to be sure that the equipment is correctly installed and ready to operate, special safety symbols are used in the manual to highlight potential safety risks or useful information. The symbols are the following:

WARNING: Paragraphs marked with this symbol contain actions and instructions which must be fully understood and followed in order to avoid potential harm to persons.

NOTE: Paragraphs marked with this symbol contain actions and instructions which must be fully understood and followed in order to avoid damage to the equipment and faults.

The equipment has various labels; those with a yellow background regard the safety devices provided.
Make sure that you have read and fully understood the labels before installing the equipment.
The symbols used are the following:

	System earth conductor (main grounding protective earth, PE)
	Alternating Current (AC) Value
	Direct Current (DC) Value
	Phase
	Grounding (earth)

USEFUL INFORMATION AND SAFETY REGULATIONS

FOREWORD

- AURORA must be installed in compliance with national and local laws.
- AURORA has no user-serviceable parts.
  Please contact the nearest authorized repair centre for all maintenance and repairs.
  Please contact the retailer to find out the nearest assistance point.
- We strongly recommend you read all instructions in this manual and notice the symbols of the single paragraphs before installing or using the equipment.
- The system must be connected to the distribution network only by qualified personnel and only after the Body appointed to distribute electricity has given its approval, as required by the national regulations in force.
- The entire solar panel must be covered with dark opaque sheets before being connected to the equipment. This is because its connection cables to AURORA could have high voltage and generate serious hazard conditions.

NOTE: All the pictures present in this manual are only for clarification. The final model may differ in some aspects from these pictures.

FCC REMARKS

These devices comply with Part 15 of the FCC rules. Operation is subject to following two conditions: (1) these devices may not cause harmful interference, and (2) these devices must accept any interference received, including interference that may cause undesired operation.

GENERAL

During inverter operation, parts may be powered, may lose proper insulation and may move or rotate. In addition, some surfaces may become hot.
Unauthorized removal of necessary protections, improper use, faulty installation and incorrect operation may lead to serious injury to people and/or equipment damage.
All operations regarding transport, installation and switching on, including maintenance, must be carried out by qualified, trained personnel (in compliance with all national provisions on accident prevention!!!).
Basic safety rules require using qualified and trained personnel that possess the skills for assembly, mounting, start-up and operation of the product and the necessary requirements for their trade.

ASSEMBLY

Devices should be assembled and cooled according to the specifications shown in their corresponding documents.
In particular, during transport and handling, parts should not be bent and/or the insulation distances should not be changed. There should be no contact between electronic parts and connection terminals.
Electrical parts must not be mechanically damaged or destroyed (this could cause potential health risks).

ELECTRICAL CONNECTION

When working with the inverter powered on, the current national regulations for the prevention of accidents must be observed.
Electrical connections (e.g. conductor sections, fuses, PE connection, etc.) must always be made in accordance with applicable regulations.

OPERATION

Systems with inverters should be provided with additional control and protective devices in compliance with the corresponding prevailing safety rules, such as those relating to the compliance with technical equipment, accident-prevention regulations, etc. Calibration changes are permitted by means of the operating software. Anytime that the inverter has been disconnected from the power network, powered parts and electrical connections should not be touched as some capacitors could still be charged. Consequently, comply with all corresponding marks and symbols present on each device. Ensure that all covers and doors are closed during operation.

MAINTENANCE AND SERVICE

The manufacturer's documentation must be complied with.

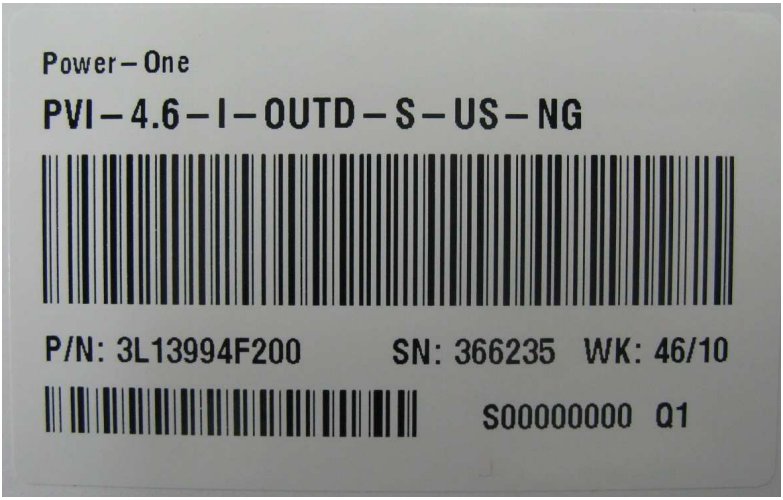
FIGURES AND IMAGES ON THIS MANUAL

Some of the images on this manual are from prototypes and only as example. The real unit may differ in some particular from images.

KEEP ALL DOCUMENTS IN A SAFE PLACE!

PVI-3.8-I-OUTD-S-US-PG
PVI-3.8-I-OUTD-S-US-NG
PVI-3.8-I-OUTD-US-PG
PVI-3.8-I-OUTD-US-NG
PVI-4.6-I-OUTD-S-US-PG
PVI-4.6-I-OUTD-S-US-NG
PVI-4.6-I-OUTD-US-PG
PVI-4.6-I-OUTD-US-NG

This document applies only to the inverter versions shown above.



Product name plate (PVI-4.6-I-OUTD-S-US-NG)

The name plate affixed to the inverter provides the following information:

1) Manufacturer code
2) Model code
3) Serial number
4) Week/Year of production

TABLE OF CONTENTS:

1 INTRODUCTION

This document contains a technical description of the AURORA Photovoltaic Inverter which provides the installer and user with the information required for its installation, operation, and use.

1.1 PHOTOVOLTAIC ENERGY

In the process of energy conversion, for many years, industrial companies (major 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 field, the exploitation of solar energy to generate electricity (photovoltaic) is becoming increasingly important worldwide.
Photovoltaic energy is 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.

2 DESCRIPTION OF THE SYSTEM

AURORA is an inverter with the capability to supply the grid with energy obtained from photovoltaic panels.
The photovoltaic panels convert the energy irradiated by the sun into electricity of the direct current 'DC' type (through a photovoltaic field, also called a PV generator); however, to use the electricity, it must be transformed into the alternating current 'AC' type. This conversion, known as DC-AC inversion, is achieved efficiently by AURORA without the use of rotating elements but only with static electronic devices.
When used in parallel with the network, the alternating current output from the inverter flows directly into the domestic or industrial distribution circuit, connected in turn to the public distribution network.
The solar energy system can thus feed all the connected user electrical loads.
If the energy supply from the photovoltaic system is lower than the user's load requirement, the quantity of energy necessary to guarantee normal functioning of the connected appliances is taken from the public distribution network. However, when the opposite occurs, i.e. an excess of energy is produced, it is directly sent into the public network, thus becoming available to other users.
In compliance with local and national regulations, the energy produced can be sold to the distribution network or credited against future consumption, thus producing energy savings.

Available Versions

PVI-3.8-I-OUTD-S-US-PG
PVI-3.8-I-OUTD-S-US-NG
PVI-3.8-I-OUTD-US-PG
PVI-3.8-I-OUTD-US-NG
PVI-4.6-I-OUTD-S-US-PG
PVI-4.6-I-OUTD-S-US-NG
PVI-4.6-I-OUTD-US-PG
PVI-4.6-I-OUTD-US-NG

The S-US-xx models are provided with an integrated 600V, 25A DC switch.

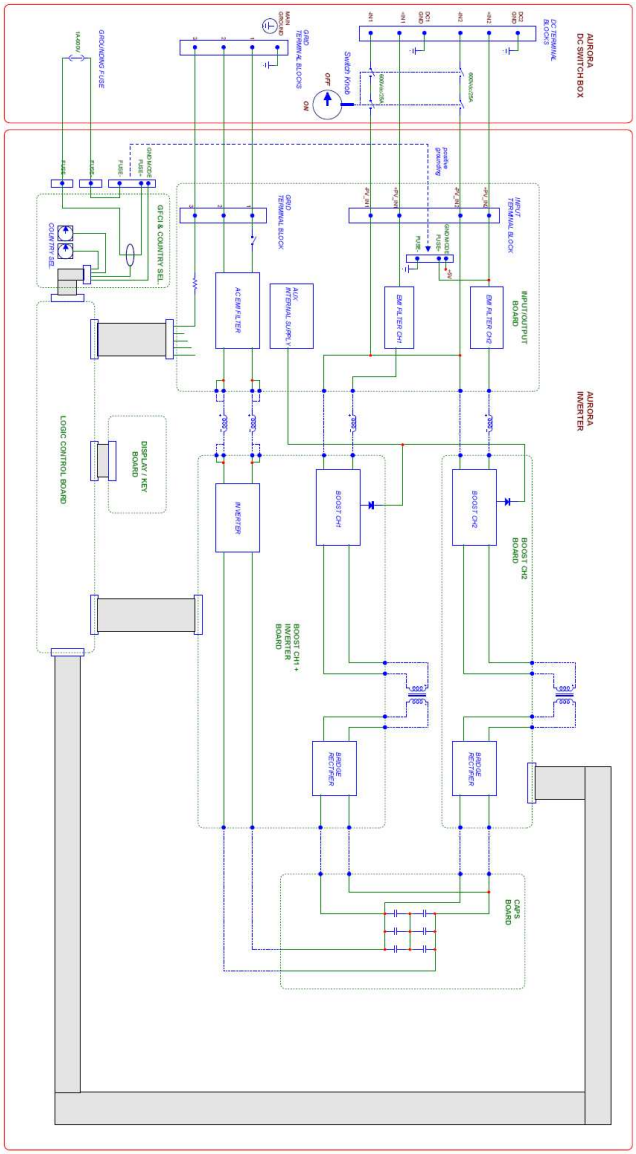


Fig. 1a - Block diagram of version with integrated DC switch –PG

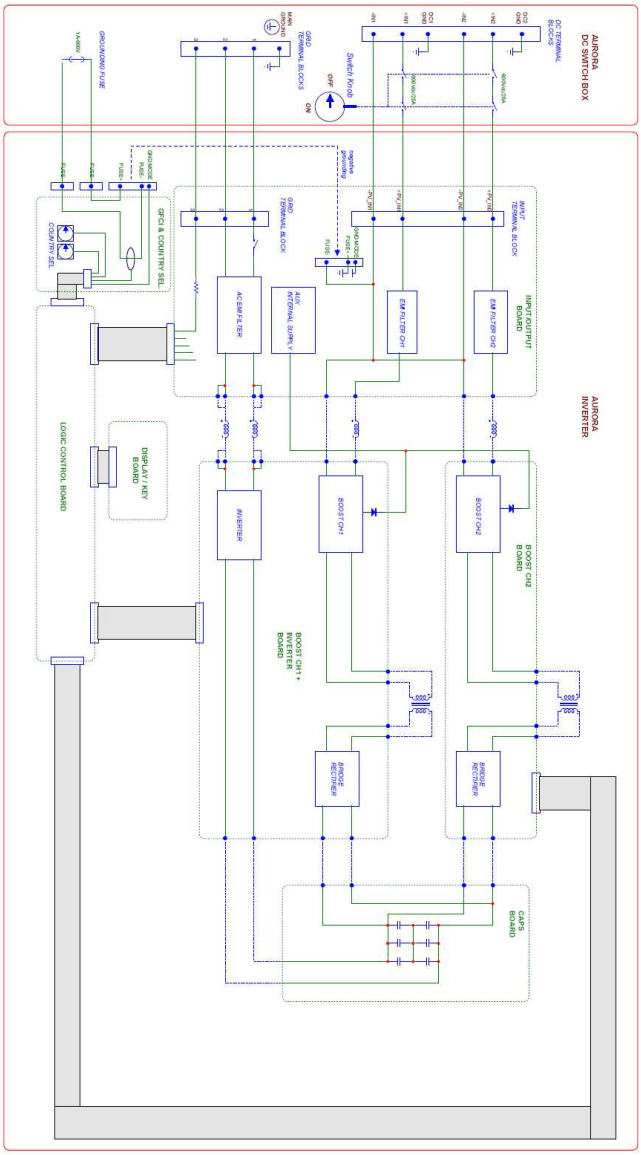


Fig. 1b - Block diagram of version with integrated DC switch -NG

The -US-xx models are supplied without a switch box and therefore without a 600V integrated switch.
The -PG models are supplied with positive input grounded fig.1a (to be used only in parallel mode).
The -NG models are supplied with negative input grounded fig.1b.

WARNING: The electrical schematics in Fig. 13 shows -NG models. In that case the switch will physically disconnect only the positive DC inputs while the negative are always grounded by the fuse. For -PG models the switch will physically disconnect only the negative DC inputs while the positive are always grounded by fuse.

2.1 Fundamental Elements of a Photovoltaic System: 'STRINGS' and 'ARRAYS'

In order to significantly reduce installation costs of the photovoltaic system, 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 composed of a great number of photovoltaic cells fixed onto a single supporting base. A STRING is made up of a certain number of panels connected in series. An ARRAY is one or more strings connected in parallel.
Large photovoltaic systems can be composed of several arrays, connected to one or more AURORA inverters.

Maximizing the number of panels in each string, the cost and complexity of the connection systems of the plant may be reduced.

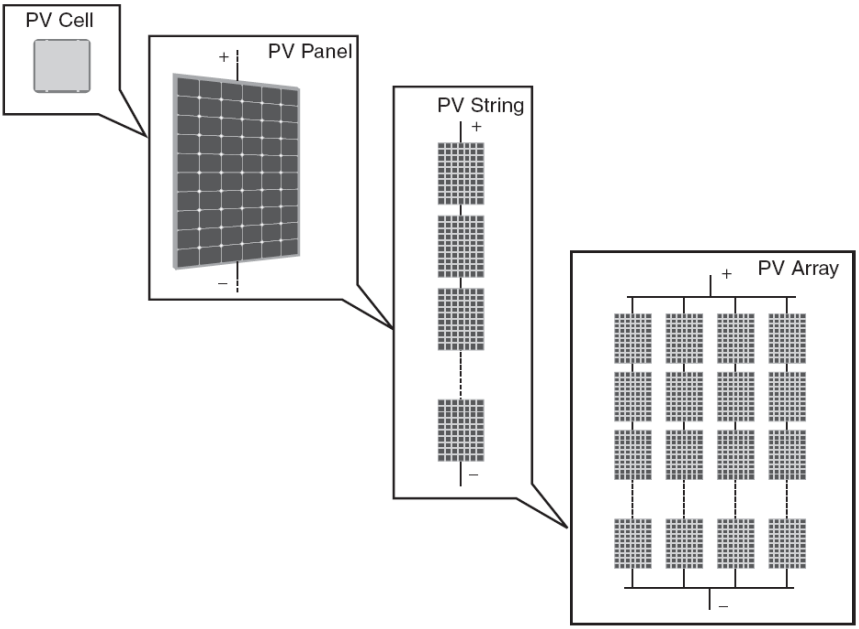


Fig. 2 - Array Composition

WARNING: To avoid equipment damage, the string voltage must not exceed 520 Vdc for any reason. Because of the negative thermal coefficient of the photovoltaic modules' open circuit voltage, maximum voltage is obtained in conditions of minimum environmental temperature. It is recommended to check the photovoltaic generator's configuration with the Aurora Designer dimensioning software.

NOTE: A minimum Vstart input voltage of 200 Vdc (the voltage can be set from the control panel in a range between 120 Vdc and 350 Vdc) is required for the Aurora inverter to start the grid connection sequence. Once connected, the inverter will transfer the maximum available power for any Vdc input voltage value in a range between 70% of the value set by Vstart and 520V to the grid (see Fig. 31 and Fig. 32 Fig. 1for clarification).

The current of each array must also be within the inverter's limits. For AURORA the maximum current from each input can be 14 Adc for PVI-4.6-I-OUTD, 12.5 A for PVI-3.8-I-OUTD.
If the output of photovoltaic system exceeds the capacity of a single inverter, additional AURORA inverters can be added to the system; each inverter will be connected to an adequate section of the photovoltaic field on the DC side and to the distribution network on the AC side.
Every AURORA inverter works independently of the others and feeds power into the grid with the maximum power available from its own section of photovoltaic panels.
Decisions on how to structure a photovoltaic system depend on a number of factors and considerations, such as the type of panels, the available space, the future location of the system, long-term energy production targets, etc. A configuration program (Aurora Designer) which can aid correct dimensioning of a photovoltaic system is available on the Power-One website (www.power-one.com).

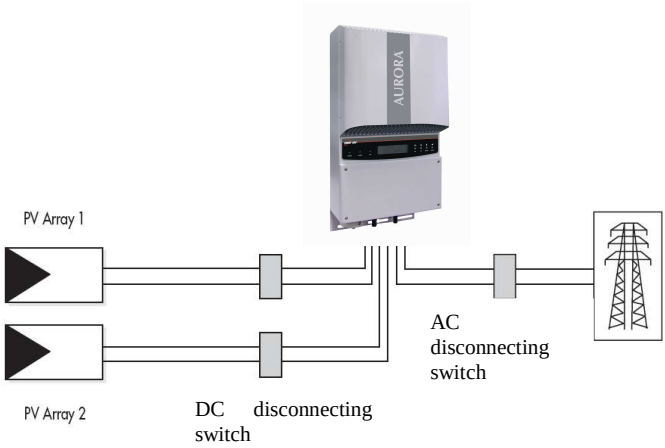


Fig. 3 - Simplified diagram of a photovoltaic system

2.2 Data Transmission and Check

When more than one inverter is used, remote monitoring can be implemented through a sophisticated communication system based on an RS-485 serial interface. An optional Aurora Easy-Control system is also available for remote monitoring via the Internet, analog modem. Moreover, with another option, a radio monitoring system can be used (PVI-Desktop + PVI-Radiomodule) to obtain a remote display terminal connected wireless.

2.3 Technical Description of AURORA

Fig. 1 shows the block diagram for AURORA. The main blocks are the input DC-DC converters (termed 'boosters') and the output inverter. Both the DC-DC converters and the output inverter operate at a high switching frequency to enable a compact design and relatively low weight.
These versions of AURORA have a high frequency transformer, i.e. with galvanic insulation between input and output. The high frequency transformer allows the primary (DC side) to have galvanic isolation from the secondary (AC side) maintaining very high performance in terms of energy yield and export. AURORA is equipped with the necessary protective devices to ensure safe operation in compliance with applicable regulations as described in the paragraph on protective devices.

The block diagram shows an AURORA PVI-3.8/4.6-I-OUTD with two independent input DC-DC converters; each converter is dedicated to a separate array with independent Maximum Power Point Tracking (MPPT) control. This means that the two arrays can be installed with different positions and facing different directions. Each array is controlled by an MPPT control circuit.
Thanks to AURORA's high efficiency and large heat dissipation system, this inverter provides operation at maximum power in a broad range of ambient temperatures.
The inverter is controlled by two independent Digital Signal Processors (DSP) and one central microprocessor.
This way, network connection is controlled by two independent computers in full compliance with electrical power supply and safety regulations.
The AURORA inverter operating system communicates with the related parts to perform data processing.
This guarantees optimal performance levels of the whole complex and high yield in all insulation and load conditions, always in full respect of directives, laws and provisions.

2.4 Protective Devices

2.4.1 Anti-Islanding

When the local distribution network fails due to a fault or when the equipment is shut down for maintenance operations, the Aurora inverter should be physically disconnected under safety conditions, so as to protect any personnel working on the network, all in full compliance with the applicable national standards and laws. To avoid possible islanding operations, AURORA is provided with an automatic disconnection protection system called 'Anti-Islanding'.
The AURORA PVI-3.8/4.6-I-OUTD model is equipped with a state-of-the-art anti-islanding protection system certified to the following standards and regulations:

- CSA-C22.2 N.107.1-01 UL Std N.1741

2.4.2 Grounding/differential Protection Fault

WARNING: Some national and local regulations make it compulsory for one of the DC input terminals to be connected to the system's earth. Carefully evaluate the national standard so that the inverter's input is correctly grounded.

A sophisticated ground protection circuit continually monitors the ground connection; when it detects a ground fault, this circuit shuts down AURORA and turns on a red LED on the front panel to indicate a ground fault condition. The Aurora inverter is equipped with a terminal for the system ground conductors.
For further details on the grounding of the terminals and protective devices, please refer to section 3.3.10.

NOTE: For further details of AURORA shutdown or possible causes of malfunction, please refer to paragraphs 5.3.

The protective devices for ground failures comply with these standards:

- CSA-C22.2 N.107.1-01 UL Std N.1741

2.4.3 Additional Protective Devices

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

- Constant monitoring of grid voltage to ensure that voltage and frequency remain within the specified operational limits (in accordance with UL 1741 standard);
- Automatic power limitation control based on internal temperature monitoring to avoid overheating (heat sink temperature ≤158°F).

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

3 INSTALLATION

WARNING: The electrical installation of the Aurora inverter must be performed in accordance with the electrical standards prescribed by the local regulations and by the National Electric Code (ANSI/NFPA 70 standard).

WARNING: The connection of an Aurora inverter to the electrical distribution grid must be performed only after receiving authorization from the utility that operates the grid.

3.1 Package Inspection

NOTE: The distributor delivered your Aurora inverter to the carrier safely packaged and in perfect condition. Upon acceptance of the package, the carrier assumes responsibility for its safe delivery. In spite of careful handling, transportation damage to the package or its contents is always a possibility.

The customer is encouraged to perform the following checks:

- Inspect the shipping box for apparent damage, such as holes, cracking, or any other sign of possible damage to its contents.
- Describe any damage or shortage on the receiving documents and have the carrier sign his/her full name.
- Open the shipping box and inspect the contents for internal damage. While unpacking, be careful not to discard any equipment, parts, or manuals. If any damage is detected, call the delivering carrier to determine the appropriate action. Save all shipping material in the event that the carrier sends an inspector to verify damage!
- If the inspection reveals damage to the inverter, contact your supplier, or authorized distributor. They will determine if the equipment should be returned for repair. They will also provide instructions on how to get the equipment repaired.
- It is the customer's responsibility to file a claim with the carrier. Failure to file a claim with the carrier may void all warranty service rights for any damage.
- Save the Aurora inverter's original shipping package in the event that you should ever need to return the inverter for repair.

3.1.1 Inspecting package contents

Description	Quantity (No.)
Aurora Inverter	1
Bag containing: Nr.4 6.3x70 screws, nr.4 SX10 blocks, 2 cables AWG10, Torx20 wrench, nr.1 6x10 screw, nr.5 d.18 washer, 2 counterparts for signal connectors (3 poles), 2 counterparts for signal connectors (8 poles) Nr.1 wall mounting bracket	1
Installation and Operator's Manual	1
Certificate of warranty	1
CD-ROM with communication software	1

3.2 Selecting the installation location

Installation location should be selected based on the following considerations:

- Height from ground level should be such as to ensure that the display and status LEDs are easy to read.
- Select a well-ventilated location sheltered from direct sun radiation. Choose a location that allows unobstructed airflow around the inverter.
- Allow sufficient room around the inverter to enable easy installation and removal from the mounting surface.
- A door is provided on the front of the inverter to allow for hardware maintenance.

The following figure shows the recommended minimum clearances around the inverter:

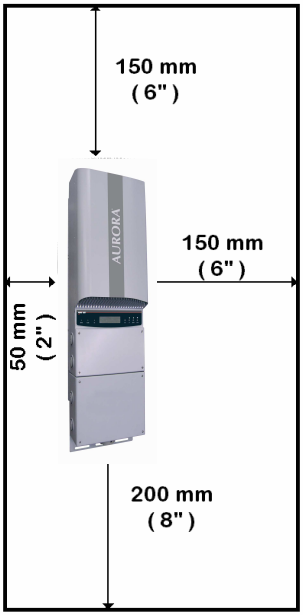


Fig. 4 - Installation Location - Minimum Clearances around the Aurora Inverter

Fig. 5 - Recommended Installation of Aurora Inverters

NOTE: Tilted mounting is permitted (see Fig. 6), but will reduce heat dissipation and may result in self-derating.

WARNING: The inverter surface may become hot to the touch during operation. To avoid burn injury, DO NOT touch the inverter surface during operation.

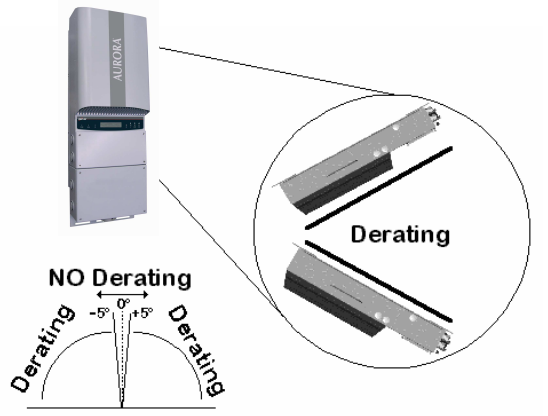


Fig. 6 - Tilted Mounting

The Aurora inverter should be mounted vertically as shown in Fig. 6. Always follow the relative mounting instructions provided in this section.

NOTE. It is recommended that you DO NOT expose the Aurora inverter to direct sun radiation or any other heat source, including heat generated by other Aurora inverters (see Fig. 5).

When the ambient temperature rises above 122°F for PVI-4.6-I-OUTD, 140°F for PVI-3.8-I-OUTD the inverter may self-derate the output power.

- Always make sure that the airflow is not blocked in any installations.

3.2.1 Wall mounting for -S-US models

Included in the shipping package is a mounting kit with 4 screws and 4 wall plugs provided for mounting the metal bracket to a concrete wall. The screws should be mounted in the 4 holes present in the bracket (shown as pos B in Fig. 7).

If needed to ensure stability of the inverter, you can use 2 additional screws in the 2 holes shown as pos A in Fig. 7.

WARNING: The bracket needs to be mounted vertically to the wall and the side with the hook (shown as pos C in Fig. 7) should be mounted with the hook pointing upward as shown in the picture.

NOTE: If the installation is done on a concrete wall, the wall plugs provided should be used, and the mounting holes in the wall should have a 0.4" diameter and 3" depth.

NOTE: When the wall is made of a different material (other than concrete), the installation should be done using adequate mounting material. Power-One recommends always using stainless steel screws.

After the bracket is secured to the wall, install the inverter as shown in Fig. 7.

The inverter should be hung onto the bracket using the hooks D and F that need to be well inserted into their counterparts C and E (D connects to C and F connects to E).

The inverter needs to be lifted up and then slid down over the hooks making sure that the connecting points in the bracket and in the back of the inverter engage properly.

After the inverter is hung onto the wall mounting, it needs to be secured using a M6x10 screw and the relative washer that will pass through the opening on the lower side of the inverter (shown as pos H in Fig. 7) and into to the PEM fastener in position G of the bracket.

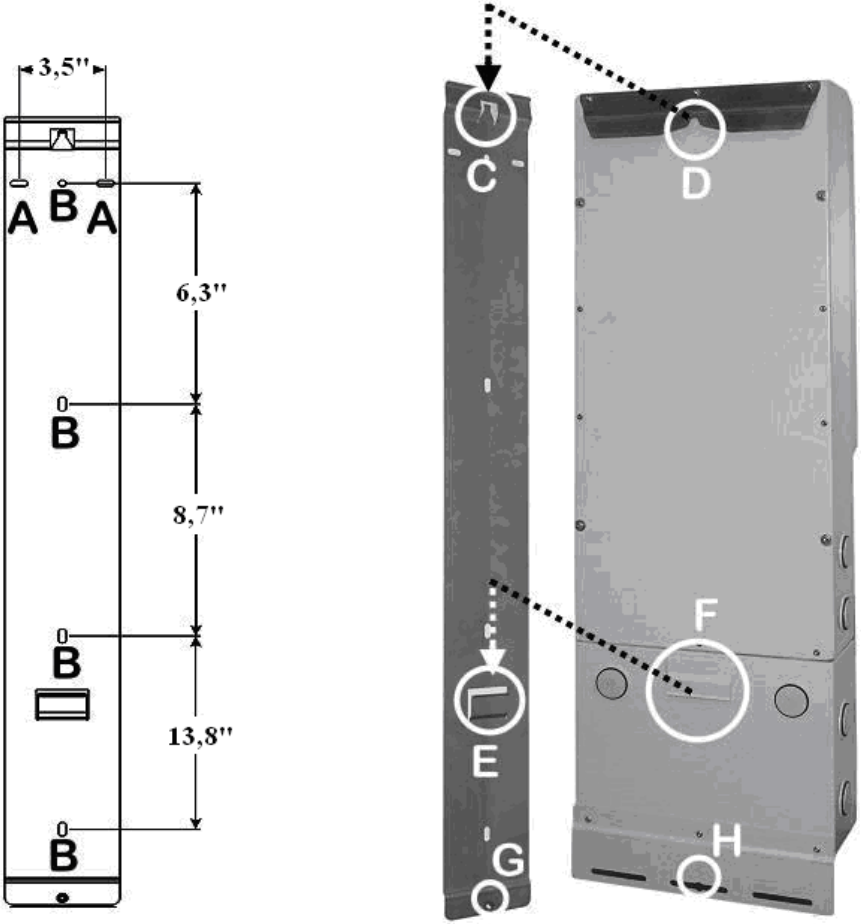


Fig. 7 - Wall Bracket and Wall Mounting (only -S-US models)

3.2.2 Wall mounting for -US models

Included in the shipping package is a mounting kit with 4 screws and 4 wall plugs provided for mounting the metal bracket to a concrete wall. The screws should be mounted in the 3 holes present in the bracket (shown as pos B in Fig. 8).

If needed to ensure stability of the inverter, you can use 2 additional screws in the 2 holes shown as pos A in Fig. 8.

WARNING: The bracket needs to be mounted vertically to the wall and the side with the hook (shown as pos C in Fig. 8) should be mounted with the hook pointing upward as shown in the picture.

NOTE: If the installation is done on a concrete wall, the wall plugs provided should be used, and the mounting holes in the wall should have a 0.4" diameter and 3" depth.

NOTE: When the wall is made of a different material (other than concrete), the installation should be done using adequate mounting material. Power-One recommends always using stainless steel screws.

After the bracket is secured to the wall, install the inverter as shown in Fig. 8.

The inverter should be hung onto the bracket using the hook D that need to be well inserted into its counterpart C.

The inverter needs to be lifted up and then slid down over the hook making sure that the connecting points in the bracket and in the back of the inverter engage properly.

After the inverter is hung onto the wall mounting, it needs to be secured using a M6x10 screw and the relative washer that will pass through the opening on the lower side of the inverter (shown as pos H in Fig. 8) and into to the PEM fastener in position G of the bracket.

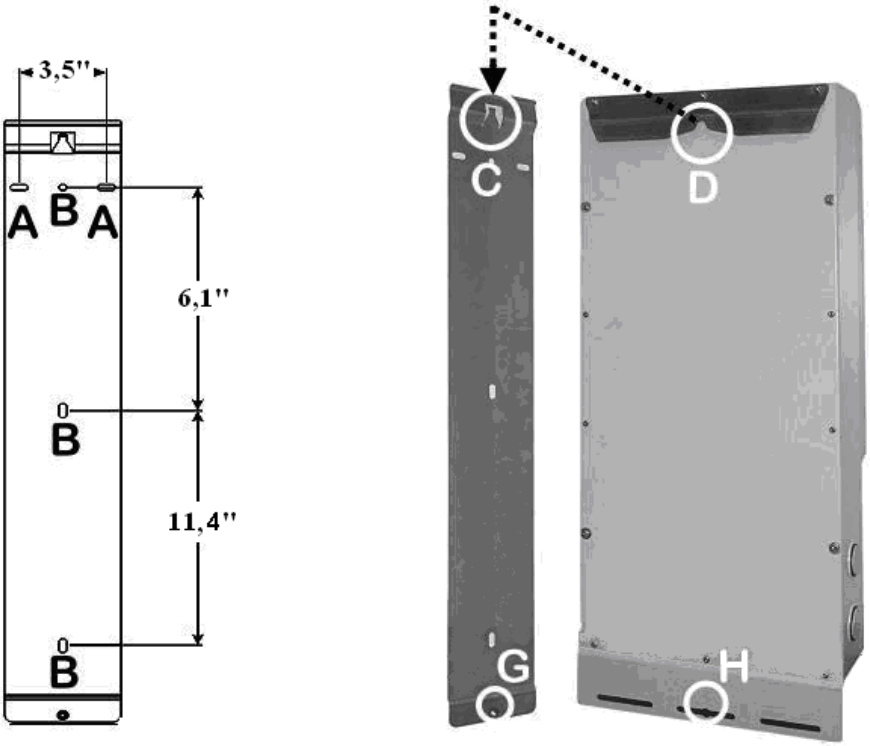


Fig. 8 - Wall Bracket and Wall Mounting (-US models)

3.3 Before Performing the Electrical Connections

WARNING: Before performing any operation on the Switch Box power input or on the inverter ALWAYS PERFORM the disconnection procedure as explained in sections 3.3.1 or 3.3.2 of this manual.

WARNING: The electrical connections must be connected only after the Aurora inverter is firmly mounted to the wall.

WARNING: The connection of the Aurora inverter to the electrical distribution grid must be performed by qualified and trained personnel and only after receiving authorization from the utility that operates the grid.

WARNING: For a step-by-step description of the correct procedure, please read - and closely follow - the instructions provided in this section (and its subsections) and all safety warnings. Not complying with the instructions that follow can lead to hazards and possible injury to personnel and/or equipment damage.

WARNING: All field wiring connected to signal circuits (WIND, ALARM, REM & RS485) must be UL/CSA certified, rated 600 Vdc or higher, and must be additionally protected by means of a non-metallic conduit. Take care to provide means for securing all the above mentioned wiring away from both AC side and DC side field wiring. Moreover, AC side field wiring should be secured away from DC side field wiring.

WARNING: Always respect the nominal ratings of voltage and current defined in section 8 (Technical Features) when designing your system. Please observe these considerations in designing the photovoltaic system:

- Maximum array DC voltage input to each MPPT circuit: 520 Vdc under any condition.
- Maximum array DC current input to each MPPT circuit: 14 Adc (PVI-4.6-I-OUTD), 12.5A (PVI-3.8-I-OUTD).

WARNING: The electrical installation of the Aurora inverter must be performed in accordance with the electrical standards prescribed by the local regulations and by the National Electric Code (ANSI/NFPA 70 standard).

On the AC output side an automatic magnetothermic switch should be inserted between the Aurora inverter and the distribution grid (see sections 3.3.1 or 3.3.2 of this manual).

WARNING: To reduce the risk of fire, connect only to a circuit provided with 25A maximum branch circuit overcurrent protection for PVI-3.8-I or with 32A maximum branch circuit overcurrent protection for PVI-4.6-I in accordance with the National Electric Code (ANSI/NFPA 70)

-S-US-xx models have an integrated DC switch 600V-25A. -US-xx models don't have an integrated DC switch, it must be externally provided by the installer.

3.3.1 ELECTRICAL CONNECTING and/or DISCONNECTING procedure (only -S-US-xx models)

WARNING: THE FOLLOWING OPERATIONS MUST ALWAYS BE PERFORMED before accessing the power input of the Switch Box in order to avoid injury to personnel and/or damage to equipment.

STEP 1 If the inverter is connected to the AC Grid (Fig. 17 - Terminal Block for AC Connection– pos. "1", "2" and "3") DISCONNECT the inverter from the AC Grid by opening the switch indicated as Part "D" in Fig. 9 - Electrical Connection Diagram.

STEP 2 Disconnect the DC side switch integrated in the witch Box.

STEP 3 Carefully cover all the photovoltaic panels using appropriate cover or perform the grid CONNECTION and/or DISCONNECTION operation during night hours. Ensure that the no photovoltaic panel can provide energy during this operation.

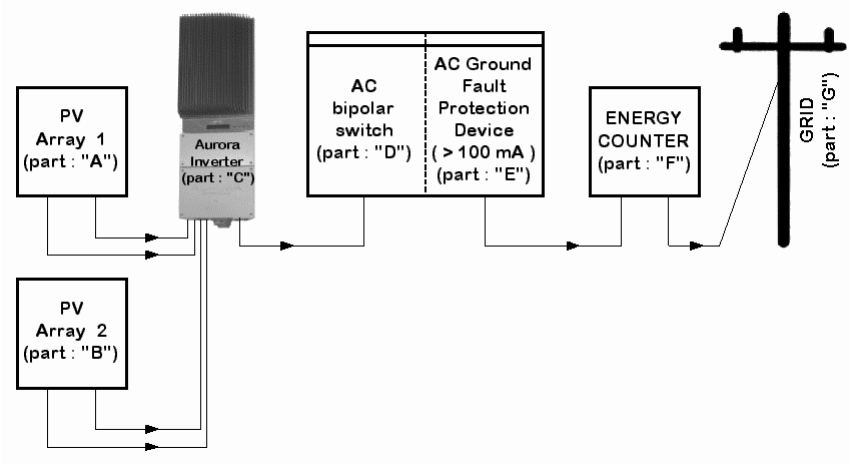


Fig. 9 - Electrical Connection Diagram (-S-US models)

WARNING: To avoid the risk of electric shock from energy stored in capacitors, wait 5 minutes after disconnecting both AC and DC sides before opening the front panel.

WARNING: A requirement, when selecting the electrical cables, is to carefully evaluate the nominal operating voltage, the insulation rating, the max operating temperature, the current rating, and the flammability rating in accordance with the local safety standards.

When selecting the wire for the installation, the correct size needs to be selected in order to avoid efficiency loses. Refer to Table CN-01 (section 3.3.7.1) "AC Grid Connections" to select the cable size.

3.3.2 ELECTRICAL CONNECTING and/or DISCONNECTING procedure (only -US-xx models)

WARNING: FOLLOW EACH STEP OF THIS PROCEDURE EXTREMELY CAREFULLY in order to avoid injury to personnel and/or equipment damage. The Aurora inverter works at high voltage levels that may be extremely dangerous if all precautions are not observed.

WARNING: THE FOLLOWING OPERATIONS MUST ALWAYS BE PERFORMED before accessing the power input of the inverter in order to avoid injury to personnel and/or damage to equipment.

STEP 1 If the inverter is connected to the AC Grid (Fig. 18- Inverter Terminal Block for AC Connection – pos. "1", "2" and "3") DISCONNECT the inverter from the AC Grid by opening the switch indicated as Part “D” in Fig. 10- Electrical Connection Diagram.

STEP 2 Disconnect the DC side external switch indicated as part “H” in Fig. 10.

STEP 3 Carefully cover all the photovoltaic panels using appropriate cover or perform the grid CONNECTION and/or DISCONNECTION operation during night hours. Ensure that the no photovoltaic panel can provide energy during this operation.

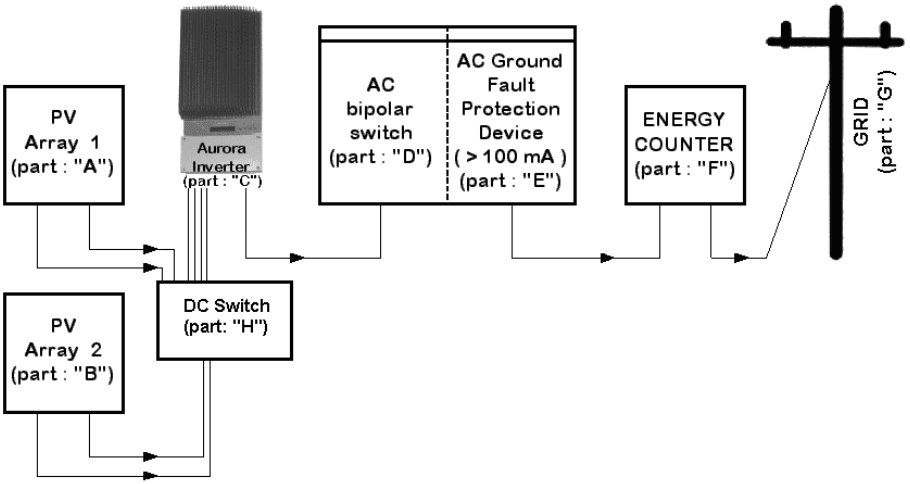


Fig. 10 - Electrical Connection Diagram (-US models)

WARNING: To avoid the risk of electric shock from energy stored in capacitors, wait 5 minutes after disconnecting both AC and DC sides before opening the front panel.

WARNING: A requirement, when selecting the electrical cables, is to carefully evaluate the nominal operating voltage, the insulation rating, the max operating temperature, the current rating, and the flammability rating in accordance with the local safety standards.

When selecting the wire for the installation, the correct size needs to be selected in order to avoid efficiency loses. Refer to Table CN-01 (section 3.3.7.1) "AC Grid Connections" to select the cable size.

3.3.3 Removing the Front Cover and Accessing the Internal Terminal Block.

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

To remove the front cover of the inverter, loosen the 4 screws shown in Fig. 11, pos "A" using the torx screwdriver provided in the box with the inverter.
To remove the front cover of the switch box, loosen the 4 screws shown in Fig. 11, pos "B" using the torx screwdriver provided in the box with the inverter.

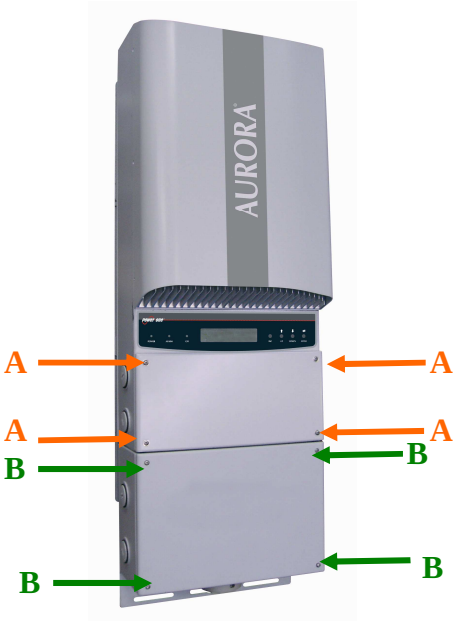


Fig. 11 - Aurora Inverter Front Panel and Dc Switch

When the connection operations are completed, reinstall the front cover and tighten the 4 screws into the cover with at least 1.5Nm (13.2 in-lbs) torque to ensure proper waterproof sealing.

3.3.4 Aurora Switch Box Description

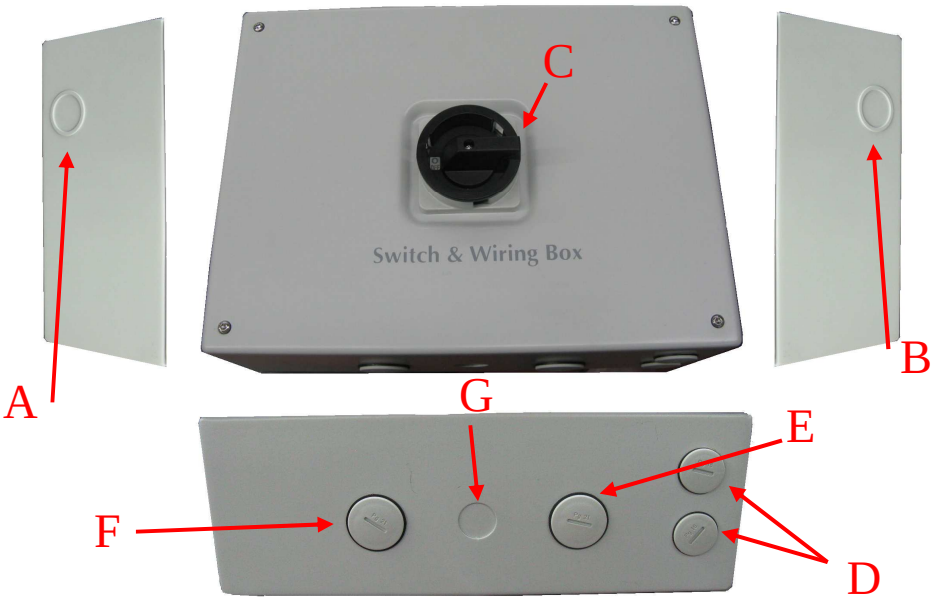


Fig. 12 - DC Switch Box Layout

Pos. Fig. 11	Description
A	DC Power cable knockouts – SIZE: 1", ¾"
B	AC Power cable knockouts – SIZE: 1", ¾"
C	DC Switch
D	Signal cable entries – SIZE: ½"
E	AC Power cable hole – SIZE: ¾"
F	DC Power cable hole – SIZE: ¾"
G	Ground cable knockout – SIZE: ½"

WARNING: The Switch Box disconnects the DC current from the photovoltaic panels when the switch is in "OFF" position (see the electrical schematics in Fig. 12 and DOES NOT disconnect the AC line going to the

Grid. To disconnect the inverter from the AC Grid, the AC switch (not included in the Switch Box) must be disconnected (see Fig. 9- "Connection Diagram").

WARNING: Due to the high voltage present on the power cable in the Switch Box, ALWAYS disconnect the Switch Box from the DC power cables as described in the section 3.3.1 prior to working on the cables.

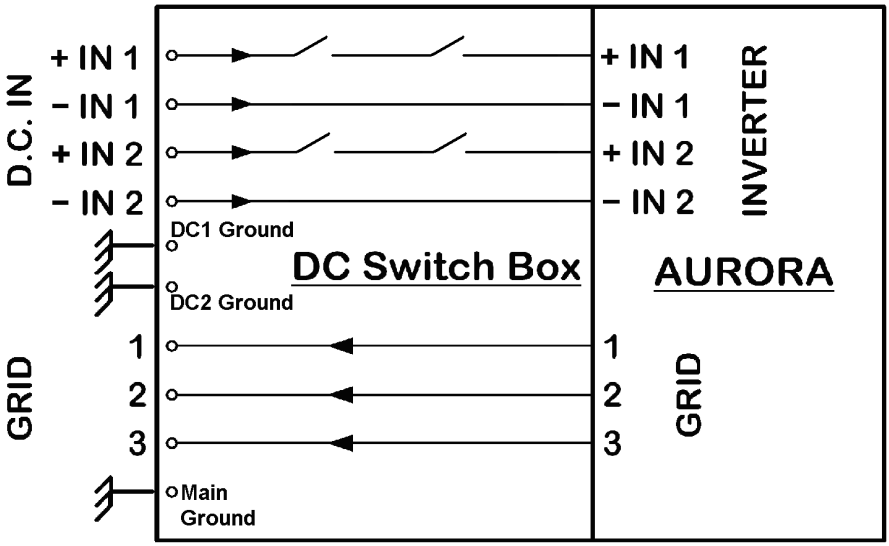


Fig. 13 - Switch Box DC Electrical Schematic (only for -NG models)

WARNING: The electrical schematics in Fig. 13 shows -NG models. In that case the switch will physically disconnect only the positive DC inputs while the negative are always grounded by the fuse. For -PG models the switch will physically disconnect only the negative DC inputs while the positive are always grounded by fuse.

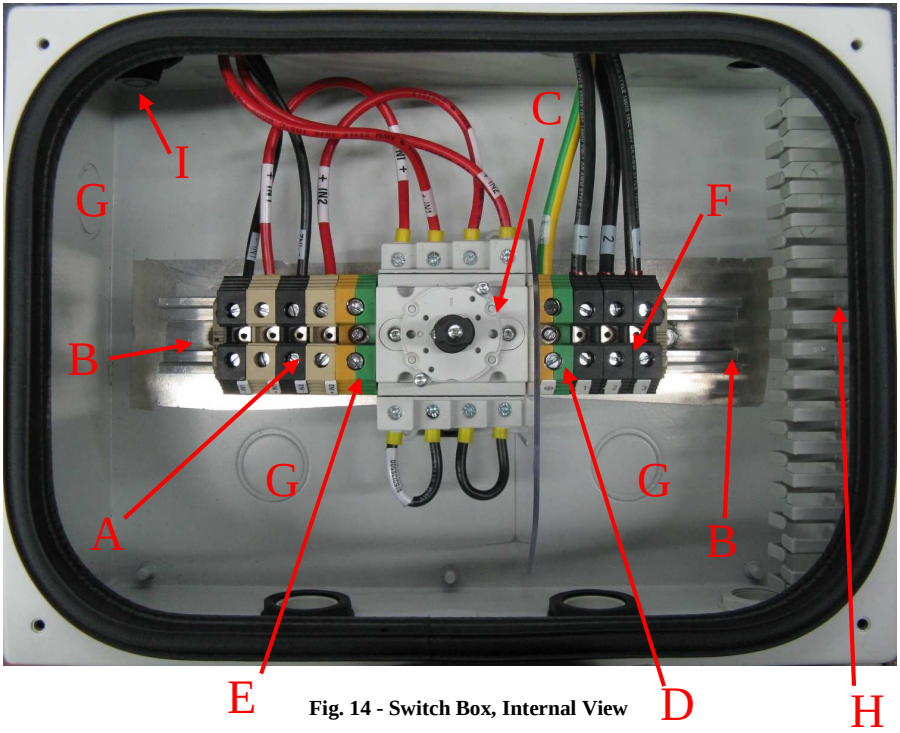


Fig. 14 - Switch Box, Internal View

POS	Details
A	DC terminal input
B	DIN bars for accessories
C	DC switch
D	Main Ground ⏚ - Max Wire Size = AWG# 4 (Refer to local code for minimum wire size)
E	Ground
F	AC terminal output
G	Cable Knockouts : SIZE 1", ¾"
H	Plastic conduit for signal cables
I	Fuse Holder

Table SBD – Switch Box Internal Parts Summary.

3.3.4.1 *AC and DC wire selection*

The following tables help installers to select the proper cable size and tighten correctly to the screw terminals

PVI-3.8-I-OUTD			
		AWG 167°F (75°C)	**AWG 194°F (90°C)**
DC input wiring	**PVI-3.8-I-OUTD-S-US-xx**	**8-4**	**10-4**
	PVI-3.8-I-OUTD-US-xx	**8-6**	**10-6**
Ground	**PVI-3.8-I-OUTD**	**4**	**4**
AC output wiring	**PVI-3.8-I-OUTD-S-US-xx**	**8-4**	**10-4**
	PVI-3.8-I-OUTD-US-xx	**8-6**	**10-6**
Main ground	**PVI-3.8-I-OUTD**	**6**	**6**

PVI-4.6-I-OUTD			
		AWG 167°F (75°C)	**AWG 194°F (90°C)**
DC input wiring	**PVI-4.6-I-OUTD-S-US-xx**	**8-4**	**10-4**
	PVI-4.6-I-OUTD-US-xx	**8-6**	**10-6**
Ground	**PVI-4.6-I-OUTD**	**4**	**4**
AC output wiring	**PVI-4.6-I-OUTD-S-US-xx**	**8-4**	**8-4**
	PVI-4.6-I-OUTD-US-xx	**8-6**	**8-6**
Main ground	**PVI-4.6-I-OUTD**	**6**	**6**

3.3.5 AURORA Inverter Typical Electrical Installations.

WARNING: THE INPUT CURRENT shall not exceed 14 Adc for PVI-4.6-I-OUTD, 12.5A for PVI-3.8-I-OUTD for each input channel.

3.3.5.1 *Installation of -S-US-xx models*

WARNING: For -S-US-xx models, before performing any operation on the Switch Box power input, ALWAYS perform the disconnection procedure explained in section 3.3.1 of this manual.

Step 1: Disconnect from the AC Grid by turning Off the"AC Bipolar Switch" – Part "D" in Fig. 9.

Step 2: Remove the Switch Box cover and the Inverter cover as described in section 3.3.3 and connect the DC cable to the terminal block at pos "A" in Fig. 14 carefully check the correct polarity of the DC cable.

Step 3: Connect the AC cable by following the instructions in section 3.3.7. Refer to Table CN-01 "AC Grid Connection"

Step 4 (optional): Open the inverter cover as described in section 3.3.3 and connect the signal cable. Pass the cables inside the Switch Box through the input knockouts (see pos "D" Fig. 12), put the signal cables inside the plastic conduit (see pos "H" Fig. 14), and then inside the inverter through the cable gland placed in the upper side of the Switch Box; finally screw the cables to the connectors counterparts present in the mounting kit and connect it to the inverter.

Step 5: Remove the cover from the photovoltaic panel or wait for the sun to irradiate the panel

WARNING: Verify that the DC voltage in the Switch Box input (terminal block pos. "A" Fig. 14) has the correct polarity and is within the operational range.

If the parameters are within the operating range defined in the specification, close and secure the inverter and the Switch Box covers and follow the instructions in section 4, “START-UP”.

3.3.5.2 *Installation of -US-xx models*

WARNING: For -US-xx models, before performing any operation on the Inverter power input, ALWAYS perform the disconnection procedure as explained in section 3.3.2 of this manual.

Step 1: Disconnect from the AC Grid by turning off the"AC Bipolar Switch" – Part "D" in Fig. 10.

Step 2: Remove the Inverter cover as described in section 3.3.3 and connect the DC cable to the terminal block on the PCB. Be sure respecting marking (+In1, -In1, +In2, -In2) and carefully check the correct polarity of the DC cable.

Step 3: Connect the AC cable by following the instructions in section 3.3.7. Refer to Table CN-01 "AC Grid Connection"

Step 4 (optional): Connect the signal cable. Screw the cable to the appropriate connector counterpart present in the mounting kit and connect it inside the inverter.

Step 5: Remove the cover from the photovoltaic panel or wait for the sun to irradiate the panel

3.3.6 Possible Aurora DC Input Configuration

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

The Aurora inverter can be configured with an independent MPPT for each DC input channel or with the 2 input DC channels connected in parallel with one MPPT. If the inverter is configured with 2 independent MPPTs, the max current for each channel shall not exceed 14 Adc for PVI-4.6-I-OUTD, 12.5 Adc for PVI-3.8-I-OUTD and the power input for the single channel shall not exceed 3 kW.

WARNING: THE INPUT CURRENT SHALL NEVER EXCEED 14 Adc (PVI-4.6-I-OUTD), 12.5 Adc (PVI-3.8-I-OTD) for each channel (single contact in the terminal block "D.C. / ± IN1 e ± IN2").

WARNING: THE INPUT POWER FOR SINGLE CHANNEL SHALL NEVER EXCEED 3 kW.

After the DC connection is completed, follow the instructions in section 3.3.7.

3.3.6.1 *Independent Connection of the Aurora DC inputs*

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

User who wants to use each channel independently has to remove the parallel cables in Fig. 16 and to connect DC wiring to each channel.

The switch "S1" indicated in Fig. 15 should be placed to position "IND" in order to configure the inverter in independent mode.

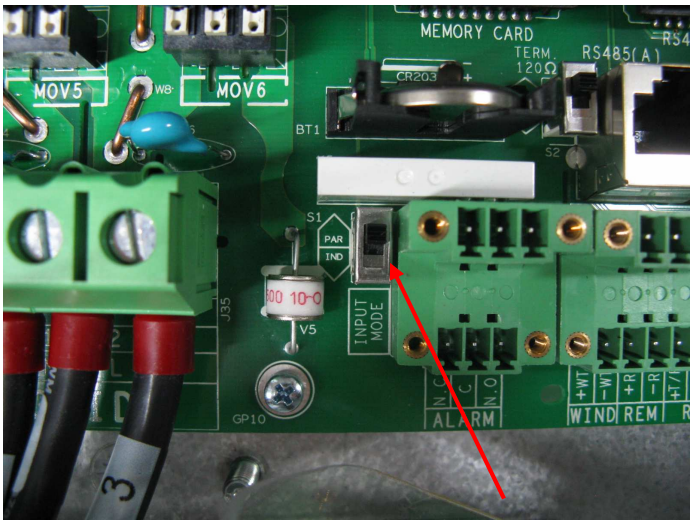


Fig. 15 - Configuration switch

3.3.6.2 *Parallel Connection of the Aurora DC inputs (default set-up)*

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

WARNING: When the current from the photovoltaic array exceeds 14 Adc (PVI-4.6-I-OUTD), 12.5 Adc (PVI-3.8-I-OTD), when the array power exceeds the limit for the single channel (see table in 8.1 paragraph) OR when there is a consistent unbalance of the power between two arrays, it is necessary to parallel the 2 inputs.

WARNING: When the inverter is configured with parallel input the current to the 2 input terminals in the Switch Box shall be equally distributed in such a way to limit to 14 Adc (PVI-4.6-I-OUTD), 12.5 Adc (PVI-3.8-I-OTD).

To parallel the 2 inputs, 2 AWG10 cables should be used to connect the terminal block –IN1 and –IN2, and +IN1 and +IN2 as shown in Fig. 16 (1 black and 1 red cable)

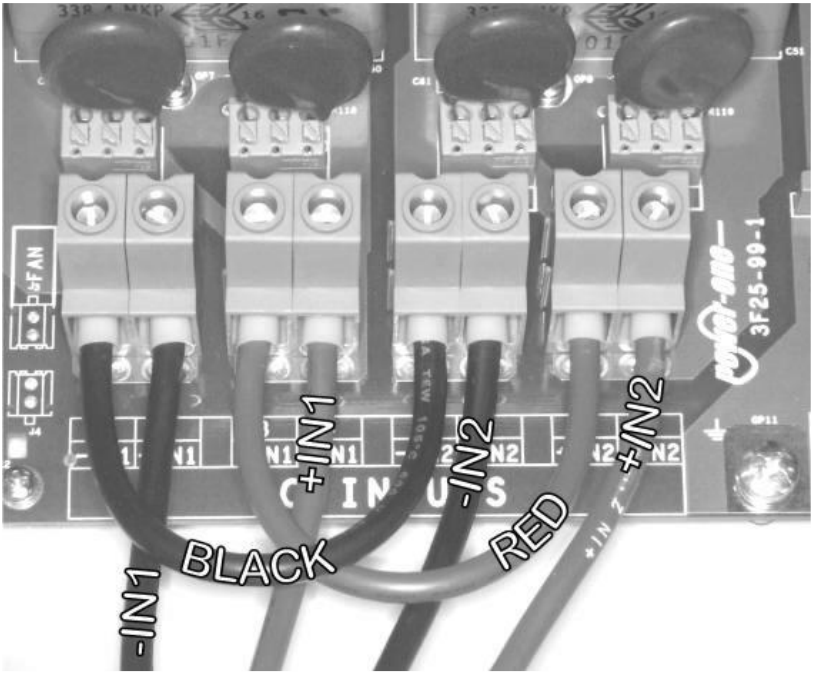


Fig. 16 - Parallel Connection

The switch "S1" indicated in Fig. 15 should be placed to position "PAR" (default position) in order to configure the inverter in parallel mode (default set-up).

After switching the Aurora inverter to parallel mode configuration, the front panel should be reinstalled (apply 13.2 in-lbs of torque to each of the 4 screws). After the front panel is secured, it is possible to begin the START-UP procedure. (see section 4).

3.3.7 Connection to the AC GRID

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

3.3.7.1 *Connection to the AC GRID for -S-US-xx models*

Step 1: Remove the Switch Box front panel (remove the 4 screws in pos “B” of Fig. 11).

Step 2: Lay down the cable between the Aurora inverter and the AC disconnect switch.

Step 3: Pass the AC cable inside Aurora through one of the cable glands present in the lower side of the Switch Box (see Fig. 12 pos. "B" or "E").

Step 4: Connect the 3 AC wires to the relative terminal block present inside the Switch Box (Fig. 17). The AC wire connections should be done based on the type of AC Grid by following Table CN-01 –"AC Grid Connection ". The ground cable shall be connected to the terminal block indicated by the pointer of pos. "F" of Fig. 14.

WARNING: The photovoltaic grounding shall be installed per the requirements of sections 690.41 through 690.47 of the NEC, ANSI/NFPA 70 and it is responsibility of the installer.

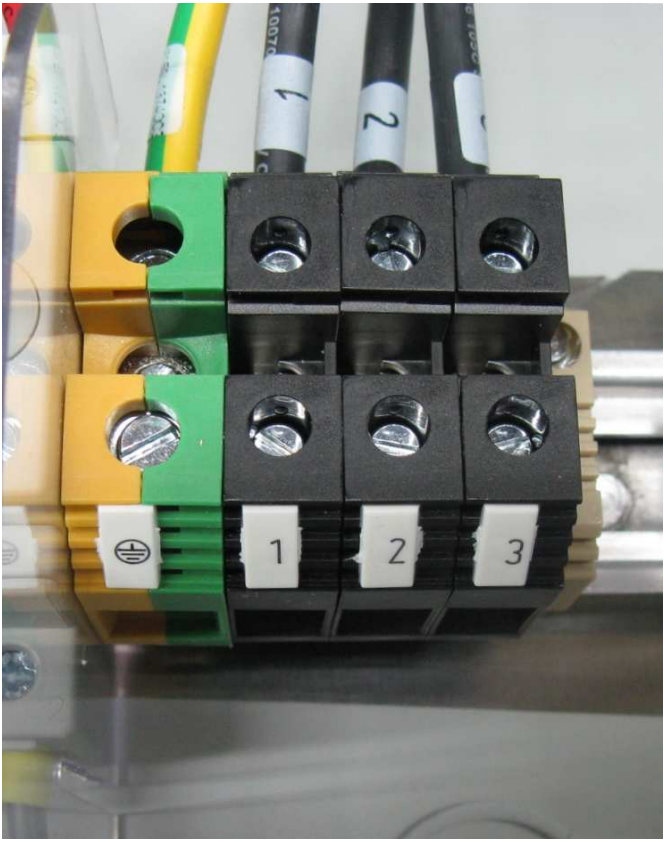


Fig. 17 - Terminal Block for AC connection (-S-US models)

Based on the local GRID standards, it is possible to select different connection types. The available configurations are shown in the following table (**Table CN-01 – "AC Grid Connections").**

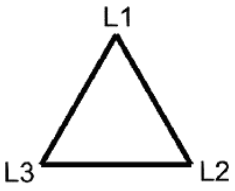
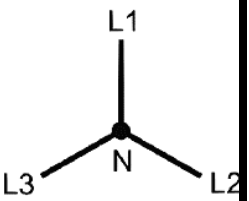
GRID STANDARD									
	208V~ 3PH - Δ			**240V~** SPLIT- PHASE			**277V~** 3PH - Y		
TERMINAL	1	2	3	1	2	3	1	2	3
WIRE	L1 *	L2 *	-	L1	L2	N	N	L1 *	-
AWG #	4 - 8								

Table CN-01 – AC Grid Connections

(*) IMPORTANT: If several Aurora inverters are installed in a tree-phase AC GRID, it is recommended to distribute the inverters between the phases in order to reduce the power unbalances between the phases. Always refer to the local standards.

3.3.7.2 *Connection to the AC GRID for -US-xx models*

Step 1: Remove the Inverter front panel (remove the 4 screws in pos “A” of Fig. 11).

Step 2: Lay down the cable between the Aurora inverter and the AC disconnect switch.

Step 3: Pass the AC cable inside Aurora through one of the cable glands present in the lower side of the Inverter

Step 4: Connect the 3 AC wires to the relative terminal block present inside the Inverter (Fig. 18). The AC wire connections should be done based on the type of AC Grid by following Table CN-01 –"AC Grid Connection ". The ground cable shall be connected to the terminal block indicated by the pointer of pos. "A" of Fig. 18.

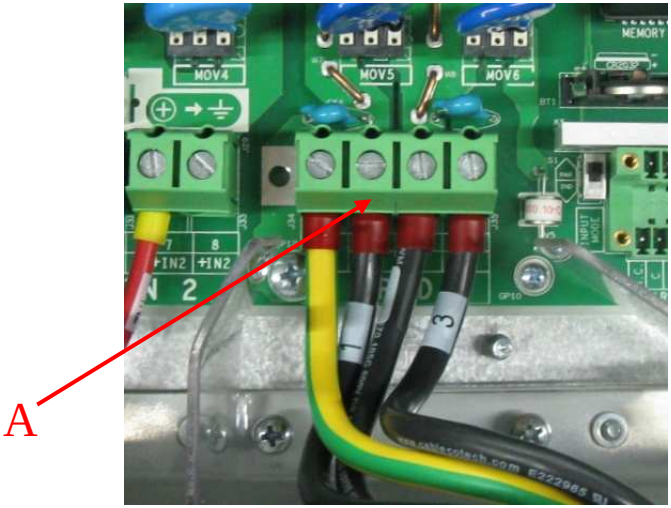


Fig. 18 - Terminal Block for AC connection (-US models)

3.3.8 Connection of RS485 and Alarm contact (optional)

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

3.3.8.1 *Connection of the RS485 and Alarm contact for -S-US-xx models*

Step 1: Remove the Switch Box front panel (remove the 4 screws in pos "B" of Fig. 11). Remove also the cover of the Aurora inverter (screw pos. "A" of Fig. 11) in order to gain access to the terminal block board.

Step 2: Lay down the cables between the Aurora inverter and the outside passing trough the provided holes and cable plastic conduit on the Switch Box.

Step 3: Connect the communication and the alarm cables to the communication and alarm terminal block on the right side of the inverter. Follow the marking on the terminal block for appropriate connection.

WARNING: All the screws on the electrical input/output terminal block of the inverter should be tightened using 13 in/lbs torque.

3.3.8.2 *Connection of the RS485 and Alarm contact for -US-xx models*

Step 1: Remove the cover of the Aurora inverter (screw pos. "A" of Fig. 11) in order to gain access to the terminal block board.

Step 2: Lay down the cables between the Aurora inverter and the outside passing trough the provided holes and cable glands on the Inverter.

Step 3: Connect the communication and the alarm cables to the communication and alarm terminal block on the right side of the inverter. Follow the marking on the terminal block for appropriate connection.

WARNING: All the screws on the electrical input/output terminal block of the inverter should be tightened using 13 in/lbs torque.

3.3.9 Selection of the grid standard

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

The inverter has a couple of selectors Fig. 19 allowing installer to set the proper grid standard. The unit will leave the factory with these selectors in ‘0’’0’ position (default setting). The installer must select the right grid standard in order to allow the proper inverter connection to grid.
To access the selectors remove the inverter front panel as explained in section 3.3.3.

WARNING: Before selecting the grid standard on the unit check accurately what is the necessary standard.

NOTE: Default position of selectors ‘0’’0’ is a position that doesn’t allow connection

Perform the selection of the grid standard basing on the following table

Left selector	Right selector	Grid standard	Display language
0	0	Default	English
0	1	VDE (Germany)	German
0	2	UL - 208 Single Phase	English
0	3	UL - 240 Split Phase	English
0	4	UL - 277 Single Phase	English
0	5	Enel (Italy)	Italian

Once installer has selected the standard the 24h counter will start decrease. During the first 24h of grid connection it is still possible to change standard (in case of mistakes). User can check the counter residual time scrolling the menu

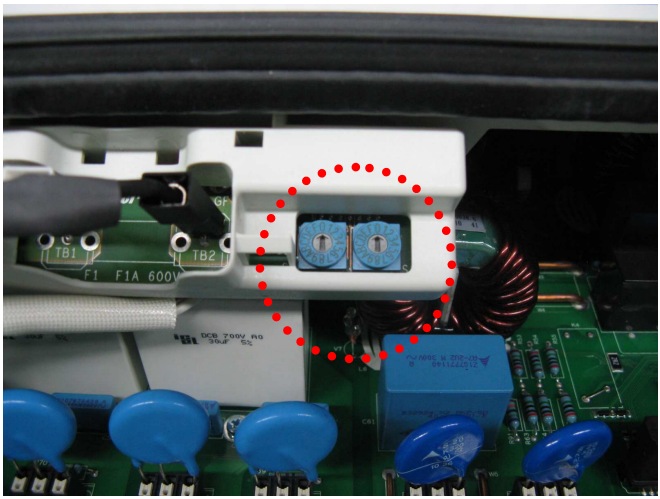


Fig. 19 - Grid Standard selectors

3.3.10 Grounding mode and Ground fuse replacement

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

Aurora units grounding mode is identified by PN; -xx-PG indentify a unit with Positive Grounding while -xx-NG a unit with Negative Grounding.

NOTE: Choose the PN in order to fulfil plant requirements.

Fuse holder is place on the bottom of the inverter (inside the Switch Box for -S-US models) as shown on Fig. 14 Part "I". Unscrew the fuse holder in order to change the fuse if necessary. Replace only using appropriate fuses:

Littelfuse KLKD-1

3.4 Disconnecting the AURORA Inverter from the DC Switch Box (only -S-US-xx models).

Use the procedure in paragraph 3.4.1 anytime that it is necessary to electrically disconnect the Aurora inverter from the DC Switch Box.

3.4.1 ELECTRICAL DISCONNECTION OF THE INVERTER FROM THE SWITCH BOX PROCEDURE

WARNING: The Aurora inverter operates at high voltages that can be extremely dangerous! CARFULLY FOLLOW EACH STEP OF THIS PROCEDURE in order to avoid injury to personnel and/or equipment damage.

STEP 1: Disconnect the inverter from the AC Grid using the AC disconnect switch shown as " Part "D" in Fig. 9 " Connection Diagram".

STEP 2: Disconnect the High Voltage DC power line coming from the photovoltaic arrays using the appropriate switch (switch "C" of the Switch Box shown in Fig. 12). Turn the switch to the OFF position as shown on the silk print shown in Fig. 12.

STEP 3: Wait about 5 minutes to allow the internal capacitors to discharge (verify that the LEDs on the front panel are OFF). **This step completes the electrical disconnection of the inverter from the DC Switch Box.**

After the ELECTRICAL DISCONNECTION OF THE INVERTER FROM THE SWITCH BOX PROCEDURE has been completed, remove the 2 front panels from the AURORA inverter as shown in section 3.3.3.

Disconnect the DC cable from the inverter board (remove the 4 screws from the terminal block + and – IN1 and + and – IN2 in Fig. 16)

Disconnect the 3 AC cables (“1", "2" and "3") from the inverter pos "A", "B" and C in Fig. 18.

Remove signal cables disconnecting from inverter.

Place the DC cable inside the Switch Box; close the hole in the upper side of Switch Box using the following water-tight caps.

Quantity	Size	Alternative
2	G1″	M32
2	G1/2″	PG16, M20

Close the Switch Box cover using the 4 screws.

3.5 CR2032 Lithium Battery Replacement

WARNING: Before performing any operation on the Switch Box power input or on the Inverter, ALWAYS perform the disconnection procedure as explained in section 3.3.1 or 3.3.2 of this manual.

Inside the Aurora inverter there is a CR2032 lithium battery. When this battery is at end-of-life, a message will be shown in the display informing that the battery needs to be replaced.

The battery is visible after removing the Aurora inverter's front panel. Refer to section 3.3.3 for the procedures to remove the front panel.

To insert the new battery into the battery holder the battery needs to be slid at a 30° angle as shown in Fig. 20, and when pushed in on insertion it should seat into the correct position within the holder.

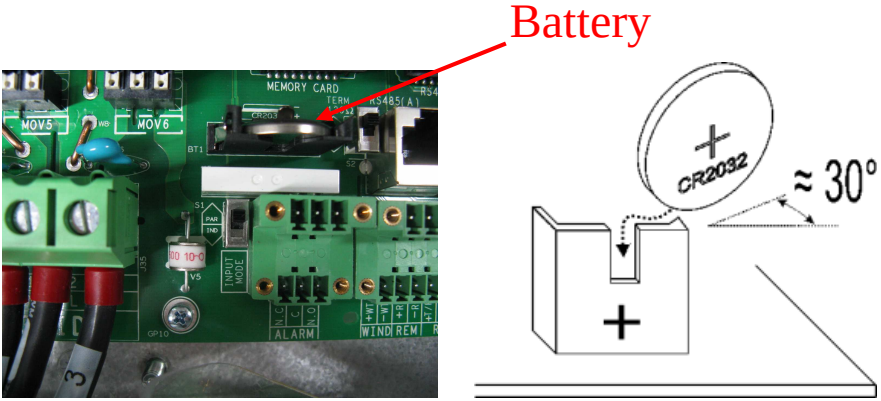


Fig. 20 - Lithium Battery Replacement

WARNING: The replacement of this battery should be performed only by trained personnel.

After battery replacement is completed, reinstall and secure the front panel of the inverter and perform the START-UP procedure in section 4.
It is necessary to set Date and Time from display menu.

4 STARTING UP AND SWITCHING THE INVERTER OFF

WARNING: Do not place any items on the AURORA inverter during operation.

WARNING: Do not touch the heat sink when the inverter is operating, as some parts may be hot and cause burns.

4.1 Start-Up Procedure

WARNING: To start the inverter a DC voltage of at least 130V can be supplied or, with no DC present but with grid voltage present, press on the side key indicated as STBY SUPPLY for at least 2 seconds. The position of the key is shown in Fig. 21. For further information on the use of the start-up key, please refer to 4.2.

Depending on the DC input voltage present, the inverter behaves as follows:

a) When the inverter is switched off, it will start as soon as the input voltage value of 130 Vdc is reached.
b) The inverter will display the message 'Waiting Sun' until the input voltage exceeds the set Vin start value (see paragraph 5.5.6.8).
c) When the Vin start value is exceeded, the inverter will display the message Vac absent if the grid is not connected or it will connect to the grid if it is there.
d) The inverter will remain connected to the grid if the input voltage is between 70% of the Vin start set and 520 Vdc. If the input voltage value is outside this range, the inverter disconnects itself from the grid.

The procedure for commissioning AURORA is the following:

1) Set the inverter's integrated DC disconnect switch (for the photovoltaic panels) to ON

2) Set the AC disconnect switch (for the grid) external to the inverter to ON.
There is no specific order for closing the two switches.

3) Once both switches are closed, the inverter starts the grid connection sequence. This routine is indicated by the flashing green LED labelled POWER over the display.
This routine may take from 30 seconds up to several minutes, depending on grid condition. Three screens are shown in sequence on the LCD display during this routine:

- Grid voltage value and status compared to specified values (within/outside range).
- Grid frequency value and status compared to specified values (within/outside range).

4) When the connection sequence is completed, AURORA starts operating; proper operation is indicated by a warning sound and the green LED staying on steady.

5) If the grid check routine does not give a positive result, the unit will repeat the procedure until all grid voltage and frequency parameters and grid configuration are found to be within the specified range. During this process, the green LED will keep flashing.

4.2 Start-Up using side button

In case of missing DC voltage, when the AC is properly connected and present, user can turn on the inverter only pressing for more than 2 seconds on the side key Fig. 21. A “beep” will indicate the detection of pressed key from the inverter.
The key is located on the right side of the inverter.
The inverter will stay on for 10 minutes allowing every type of control on the display (statistics, settings etc.). The inverter will not connect to the grid until a valid DC input will appear.
If turned on with no DC voltage the inverter will use energy from the grid to stay on (less than 20W).

Fig. 21 - Stand by supply key

4.3 Shut-Down Procedure

There are three options for shutting down the inverter:

1) Disconnect the DC and the AC grid, by disconnecting their disconnect devices (in any order). The inverter will shut down after a few seconds, which are needed to discharge the internal capacities.
2) Disconnect the DC, by disconnecting its disconnect device and waiting for the set UV port. Time (see paragraph 5.5.6.12).
3) Disconnect the grid, by disconnecting its disconnect device with a DC input of less than 130 Vdc.

5 USER INTERFACE, MONITORING AND DATA TRANSMISSION

5.1 User Interface Mode

Normally, the AURORA inverter operates automatically and needs no particular supervision. When solar radiation is not enough to generate power for the grid (for instance, at night), AURORA disconnects automatically and goes into standby mode.
The operating cycle is resumed automatically the moment solar radiation becomes strong enough. This is indicated by the LEDs.
The AURORA inverter provides operational data through the following instruments:

- Indicator lights (luminous LEDs)
- Operational data on the LCD display
- Data transmission on a dedicated serial RS-485 line. Data can be collected by a PC or a data logger equipped with an RS-485 port. If an RS-485 line is used, it may be convenient to use the AURORA USB/RS-485_232 serial interface converter model number PVI-USB-RS485_232. An optional AURORA Easy Control data logger is also available.

WARNING: The RS-485 cable must assure a protection of at least 600V.

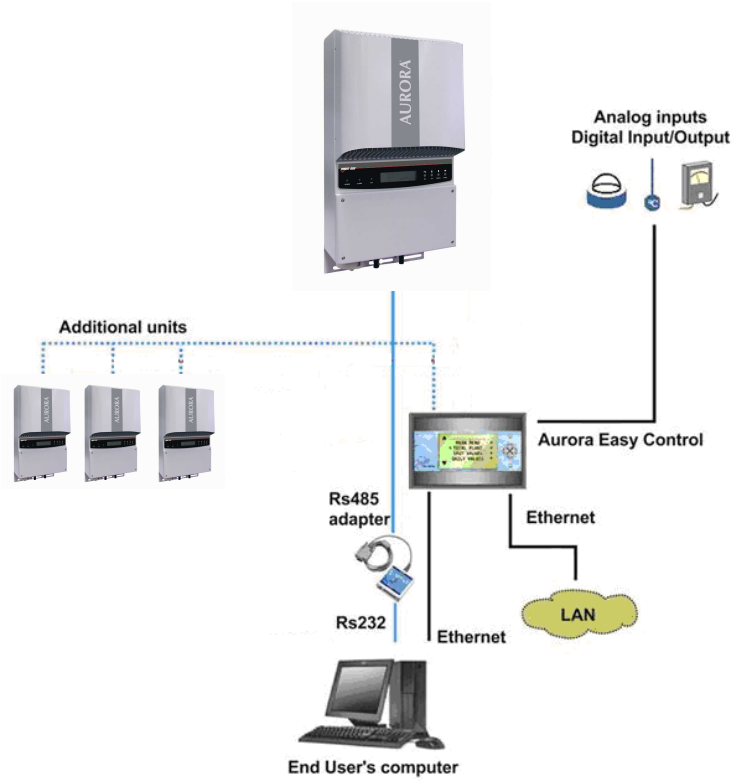


Fig. 22 - Data Transmission Options

Data Types Available

AURORA provides two types of data that can be collected using the display and/or the appropriate interface software.

5.1.1 Real-Time Operational Data

Real-time operational data can be transmitted on demand through the communication lines and are not stored inside the inverter. The free AURORA Communicator software (available on the installation CD) may be used to transmit data to a PC. Please check at www.power-one.com for the latest updated version.

The following data is available:

- Grid voltage
- Grid current
- Grid frequency
- Power transferred to the grid
- Voltage of photovoltaic array 1
- Current of photovoltaic array 1
- Voltage of photovoltaic array 2
- Current of photovoltaic array 2
- Serial Number/Code
- Week of production
- Firmware revision code
- Daily energy
- Leakage current of the system
- Total energy
- Partial energy
- Mean grid voltage
- Insulation resistance
- Leakage current to ground
- Date, time

5.1.2 Internally Logged Data

AURORA stores the following data internally:

- Total and partial counter of grid connection time
- Total and partial counter of energy transferred to the grid
- Energy produced daily (365 values)
- Energy transferred to the grid every 10 seconds for the last 8,640 periods of 10 seconds (which on average cover more than 2 days of logged data)
- Last 100 fault conditions with error code and time stamp

The first two types of data are displayed on the LCD display and through the RS-485 interface, while all other data can be displayed only through the RS-485 interface.

5.2 LED Indicators

There are three LEDs at the side of the display: The first LED from the left (POWER) indicates proper operation of the inverter, the LED in the middle (FAULT) indicates a fault condition, whereas the LED on the right (GFI) indicates a ground fault.

1. The green 'Power' LED indicates that AURORA is operating correctly.
   This LED flashes upon start-up, during the grid check routine. If a correct grid voltage is detected and solar radiation is strong enough to start up the unit, the LED stays on steady. If not, the LED keeps flashing until solar radiation becomes strong enough to start up the inverter. In this condition, the display will read 'Waiting Sun….'
2. The yellow 'FAULT' LED indicates that the Aurora inverter has detected a fault condition. A fault description will appear on the display.
3. The red 'GFI' (ground fault) LED indicates that AURORA is detecting a ground fault in the DC side of the photovoltaic system. When this kind of fault is detected, the AURORA inverter disconnects from the grid and the corresponding fault indication appears on the LCD display. AURORA remains in this condition until the operator presses the ESC key to re-start the grid connection sequence. If AURORA does not reconnect to the grid, contact the technical assistance service to have the system repaired.

Fig. 23 - Location of the buttons and LEDs

The following table shows all the possible LED activation combinations in regard to the operational status of AURORA.

Key:

LED on

LED flashing

LED off

Any of the above conditions

	LED STATUS	OPERATIONAL STATUS	NOTES
1	green: ☒ yellow: ☒ red: ☒	AURORA self-disconnection during night-time	Input voltage less than 90 Vdc at both inputs
2	green: ◪ yellow: ☒ red: ☒	AURORA initialization, settings loading, and waiting for grid check	It is in transition status while operating conditions are being checked.
3	green: ■ yellow: ☒ red: ☒	AURORA is powering the grid	Standard machine operation (search for maximum power point or constant voltage)
4	green: □ yellow: □ red: ■	System insulation device faulty	Leakage to ground found
5	green: ☒ yellow: ■ red: ☒	Defect – fault!!!	The fault can be inside or outside the inverter. See the alarm appearing on the LCD display.
6	green: ☒ yellow: ◪ red: ☒	Installation Phase: AURORA is disconnected from the grid.	During installation, it indicates set-up phase of the address for RS-485 communication.

7	green: ◪ yellow: ■ red: ☒	Grid disconnection	Indicates a missing grid condition

NOTE: Inverter status is indicated by the corresponding LED turning to a steady on condition or flashing, and by a message on the AURORA LCD displaying a description of the existing operation or fault condition (see the following sections).

G ☒
Y ☒
R ☒

1) Night-time mode

AURORA disconnected during night-time; this occurs when input power is too low to feed the inverter.

G ◪
Y ☒
R ☒

2) AURORA initialization and grid check

Initialization is in progress: Input power sufficient to feed the inverter; AURORA is verifying start-up conditions (for instance: Input voltage value, insulation resistance value, etc.) and a grid check routine is launched.

G ■
Y ☒
R ☒

3) AURORA is feeding the grid

After completing a set of auto-test routines, the system starts the grid connection process.

As mentioned above, during this stage AURORA automatically tracks and analyzes the maximum power point (MPPT) of the photovoltaic field.

G ☐
Y ☐
R ■

4) Ground insulation fault

AURORA indicates that insulation resistance was found to be too low.

This may be due to an insulation fault in the connection between the photovoltaic field inputs and the ground.

WARNING: It is extremely dangerous to attempt to correct this fault yourself. The instructions below have to be followed very carefully. In case you are not experienced or skilled enough to work safely on the system, contact a specialized technician.

What to do after an insulation fault has been found

When the red LED turns on, try to reset the fault indication by pressing the multi-function ESC key at the side of the LCD display. If AURORA reconnects to the grid, the fault was due to a transient event (such as condensation and moisture getting into the panels). If this trouble occurs frequently, have the system inspected by a specialized technician.

If AURORA does not reconnect to the grid, open both the AC and DC disconnect switches to place AURORA into a safe condition and contact an authorized service centre to have the

system repaired.

G ☒
Y ■
R ☒

5) Malfunction/Fault indication

Every time the AURORA inverter's check system detects an operating malfunction or fault of the monitored system, the yellow LED comes on and a message showing the type of problem found appears on the LCD display.

G ☒
Y ◪
R ☒

6) RS-485 address setup indication

During installation, the yellow LED will keep flashing until the address is acknowledged. For further information about the address entry mode, refer to section 6.3.

7) Grid disconnection

G ◪
Y ■
R ☒

If a grid failure event occurs while the system is in normal operation, the yellow LED turns on steady and the green LED flashes.

5.3 Messages and Error Codes

The system status is identified through message or error signals displayed on the LCD display.
The tables which follow briefly describe the two types of signals which may be displayed.

MESSAGES identify the current AURORA inverter status; they do not relate to faults and nothing has to be done; the messages disappear as soon as the system is back to normal operating conditions. See the W lines in the following table.

ALARMS identify a possible equipment fault or a fault of the connected parts. Alarm signals will disappear as soon as the causes are removed, except for ground insulation faults in the photovoltaic panels, which have to be corrected by qualified personnel in order to restore normal operation. This appearance of an alarm signal will be managed as much as possible by AURORA or, in case this is not possible, AURORA will supply all the necessary help information to the person who will have to perform the maintenance operations to fix the fault on the equipment or system. See the E lines in the following table.

Message	Error Warning	Error Type	Description
Sun Low	W001	//	Input Voltage under Vstart threshold
Input OC	//	E001	Input Overcurrent
Input UV	W002	//	Input Undervoltage
Input OV	//	E002	Input Overvoltage
Int.Error	//	E003	No parameters
Bulk OV	//	E004	Bulk Overvoltage
Int.Error	//	E005	Communication Error
Out OC	//	E006	Output Overcurrent
Int. Error	//	E007	IGBT Sat
Sun Low	W011	//	Bulk Undervoltage
Int.Error	//	E009	Internal Error

Message	Error Warning	Error Type	Description
Grid Fail	W003	//	Grid Fail
Int.Error	//	E010	Bulk Low
Int.Error	//	E011	Ramp Fail
DC/DC Fail	//	E012	DcDc Error revealed by inverter
Wrong Mode	//	E013	Wrong Input setting (Single instead of dual) or wrong grounding mode
Over Temp.	//	E014	Overtemperature
Cap. Fault	//	E015	Bulk Capacitor Fail
Inv. Fail	//	E016	Inverter fail revealed by DcDc
Int.Error	//	E017	Start Timeout
Ground F.	//	E018	I leak fail
Int.Error	//	E019	Ileak Sensor fail
Int.Error	//	E020	DcDc relay fail
Int.Error	//	E021	Inverter relay fail
Int.Error	//	E022	Autotest Timeout
Int.Error	//	E023	Dc-Injection Error
Grid OV	W004	//	Output Overvoltage
Grid UV	W005	//	Output Undervoltage
Grid OF	W006	//	Output Overfrequency
Grid UF	W007	//	Output Underfrequency
Z Grid HI	W008	//	Z grid out of range
Int.Error	//	E024	Unknown Error –
---------	//	E025	Riso Low (Log Only)
Int.Error	//	E026	Vref Error
Int.Error	//	E027	Vgrid Measures Fault
Int.Error	//	E028	Fgrid Measures Fault
Int.Error	//	E029	Zgrid Measures Fault

Message	Error Warning	Error Type	Description
Int.Error	//	E030	Ileak Measures Fault
Int.Error	//	E031	Wrong V Measure
Int.Error	//	E032	Wrong I Measure
Empty Table	W009	//	No wind table (only wind -W versions)
Fan Fail	W010	//	Fan Fail (No disconnection)
Int.Error	//	E033	UnderTemperature
	//	E034	Interlock Fail (Not Used)
	//	E035	Remote Off
	//	E036	Vout Avg Error
	W012	//	Clock Battery Low (No disconnection)
	W013	//	Clock Failure (No disconnection)

5.4 LCD Display

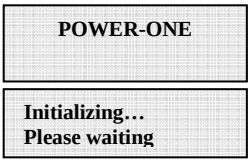
5.4.1 Connection of the System to the Grid

The two-line LCD display is located on the front panel and shows:

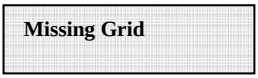
- ✓ Inverter operating status and statistics;
- ✓ Service messages for the operator;
- ✓ Alarm and fault messages.

During regular operation, the display will cycle through available data. The display changes to a different screen every 5 seconds, or screens may be scrolled manually by pressing the UP (2nd key from display) and DOWN keys (3rd key from display).

1) These 2 screens are displayed at inverter start-up:



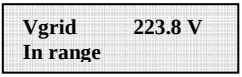
2) The following screens may appear while waiting for the connection to be established:



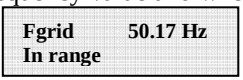
- While the system checks for grid connection to be established ('Missing Grid'), the yellow LED next to the display turns on steady, while the green LED flashes;
- When waiting for solar radiation ('Waiting Sun'), the green LED turns on steady.
- As soon as the 'Missing Grid' and 'Waiting Sun' conditions are met successfully, the inverter is connected.

3) Shows the time (seconds) remaining to complete the output voltage and frequency values check.

4) Shows the instant output voltage value and whether it is within/outside range.



5) Displays the instant output frequency value and whether it is within/outside range.

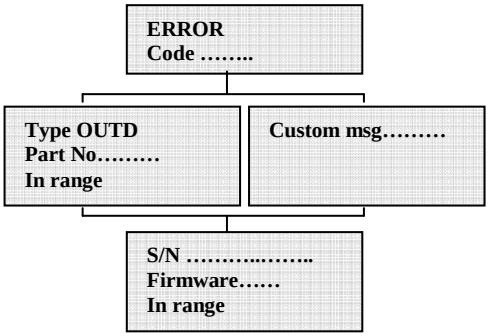


6) If the measured instant values of voltage (point 4) and frequency (point 5) are outside the allowed range, the following screens are shown alternately
- Next connections (screen 3)
- Vgrid (screen 4)
- Fgrid (screen 5)

7) Measurement of instant value for insulation resistance (only for configurations without connected grounding and inputs in parallel mode)

5.4.2 Error Messages

After the connection is established, the inverter runs a test cycle; if the wrong data is found, the cycle is interrupted and an error code is displayed. Please refer to the table in section 5.4 for error codes and their meanings.
To customize the message shown on the display, you must carry out the programming procedure described in section 5.5.6.15 'Alarm Message'.
The system will continue to cycle through the following screens until the error has been rectified:



Once the error has been removed, the inverter resets all functions in progress and re-starts the connection (Sect. 5.5.2 Connection of the system to the grid, item 2).
- Missing grid
- Waiting sun

5.4.3 First Phase - Electric Parameter Check

A FEW POINTERS ON DISPLAY KEY OPERATION:
During regular operation, the display will cycle through available data. The display changes to a different screen every 5 seconds, or screens may be scrolled manually by pressing the UP (2nd key from display) and DOWN keys (3rd key from display).
In any case, to return to the preceding menu, just press the ESC key (1st key from display).

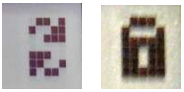


Fig. 24

Activation of cyclical scrolling is indicated by the 2 arrows in the top left corner of the display (Fig. 24).
Scrolling can be blocked by pressing the ENTER key (4th key from display). A padlock symbol will appear (Fig. 24).

1A) If the measurements taken previously (see section 5.5.1) are found to be correct, the system will proceed to the next checks. The 12 screens outlined below are shown alternately as listed in the section **'A FEW POINTERS ON DISPLAY KEY OPERATION'.**

Type OUTD **PN----------**

2A) shows the inverter serial number and firmware revision level.

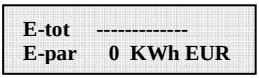
S/N--------- xxxxxx **FW rel. C.0.1.1**

3A)

E-da 0 Wh **$-da 0.0 EUR**

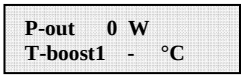
E-da: Daily energy output.
$-da: Daily energy savings. The value is expressed in the set currency.

4A)



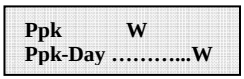
E-tot: Total energy output (since first installation)
E-par : Partial energy output during the period selected by us

5A)



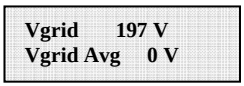
P-out: Measured instant output power
The second line of the display shows the higher of the two temperatures:
T-boost1: Booster channel 1 switching device temperature
T-boost2: Booster channel 2 switching device temperature

6A)



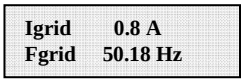
Ppk: Maximum peak power achieved since the 'partial' function was activated
Ppk-Day: Indicates the maximum peak power achieved during the day. The counter will reset when unit is powered off.

7A)



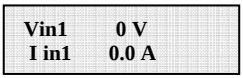
Vgrid: Measured instant grid voltage
Vgrid Avg: Average grid voltage calculated over the last 10 minutes of inverter operation

8A)



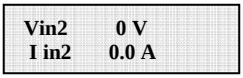
Igrid: Measured instant grid current
Fgrid: Measured instant grid frequency

9A)



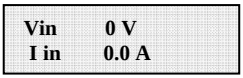
Vin1: Instant input voltage value measured at channel 1 input
Iin1: Instant input current value measured at channel 1 input

10A)



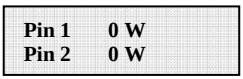
Vin2: Instant input voltage value measured at channel 2 input
Iin2: instant input current value measured at channel 2 input

Or:

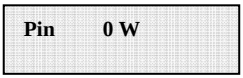


In a configuration with one input connected and a second input connected in parallel, this screen is shown instead of the 2 screens previously described.

11A)

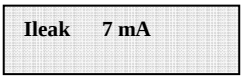


Pin1: Measured instant input power of channel 1
Pin2: Measured instant input power of channel 2



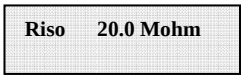
In a configuration with one input connected and a second input connected in parallel, this screen is shown instead of the screens shown above.

12A)



Ileak: Value of the leakage current passing through the grounding fuse. This value is only displayed in the case of the connected positive or negative terminal being grounded.

Or:



Riso: Measured insulation resistance. Unlike the parameters described above, this is not an instant value but a one-of-a-kind measurement taken at inverter start-up. The Riso measurement is only taken in the case of a configuration without grounding and with channels in parallel. Values above 20Mohm should be considered outside reading range.

13A)

If all items described above tested OK, the inverter shows a corresponding message in the display top line along with the date and time. Clock malfunctioning or other non-function-related faults (meaning faults that do not affect the inverter's ability to generate energy) are shown in the second line of the display instead of the date and time.
The following error messages are provided:
- CLOCK FAILURE indicates clock malfunction; contact service
- BATTERY LOW
- ADJ. TIME, appears the first time the unit is powered up or after the battery has been replaced.
- FAN FAILURE: Does not affect the inverter's proper operation; replace the fan at the first convenient opportunity.
- MEMORY FAILURE: Data logging malfunction. Call service for recovery.

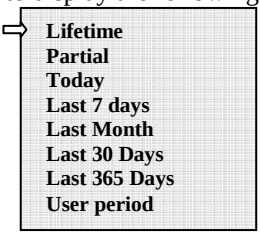
5.4.4 Main Menu

When the grid connection sequence and all electrical parameter checks are completed, other screens become available which allow us to monitor the inverter's operation from different viewpoints.
Pressing the ESC key (1st key from display) gives access to 3 new screens:

A FEW POINTERS ON DISPLAY KEY OPERATION:
- Press the UP (2nd key from display) and DOWN keys (3rd key from display) to scroll through items.
- Press the ESC key (1st from display) to go back to the previous session described in section 5.5.3.
- Press ENTER (4th key from display) to open the selected submenu.

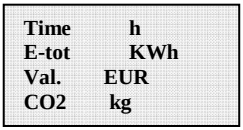
5.4.5 Statistics

Select the STATISTICS menu to display the following submenu:



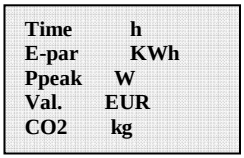
The display shows only 2 lines; use the keys at the side of the display to scroll through items or open the corresponding submenus as described in section: 5.5.3 A FEW POINTERS ON DISPLAY KEY OPERATION.
An arrow on the left side of the display highlights your current selection as shown in the following figure:

5.4.5.1 *Lifetime*
Select Lifetime to view the following information:



Time: Lifetime operation time
E-tot: Total energy produced
Val. : Economic gain
CO2: CO_2 saving compared to fossil fuels

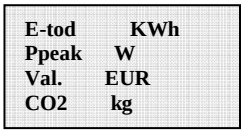
5.4.5.2 *Partial*
Select Partial to view the following information:



Time: Total operation time since the counter was last reset *
E-par: Total energy produced since the counter was last reset *
PPeak: Maximum peak power measured since the 'partial' counter was activated
Val. : Economic gain since the counter was last reset*
CO2: CO_2 saving compared to fossil fuels since counter was last reset *

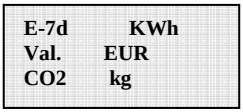
* Hold the ENTER key (4^{th} key from display) depressed for over 3 seconds to reset all counters in this submenu. After this time, a warning sound is repeated 3 times.

5.4.5.3 *Today*
Select Today to view the following information:



E-tod: Total energy produced during the day
Ppeak: Peak power value achieved during the day
Val. : Economic gain during the day
CO2: CO_2 saving for the day compared to fossil fuels

5.4.5.4 *Last 7 days*
Select Last 7 Days to view the following information:

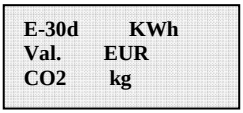


E-7d: Total energy output over the last 7 days
Val. : Economic gain over the last 7 days
CO2: CO_2 saving over the last 7 days compared to fossil fuels

5.4.5.5 *Last Month*
Select Last Month to view the following information:

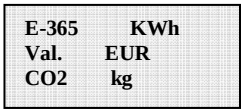
E-mon: Total energy output this month
Val. : Economic gain this month
CO2: CO_2 saving this month compared to fossil fuels.

5.4.5.6 *Last 30 Days*
Select Last 30 Days to view the following information:



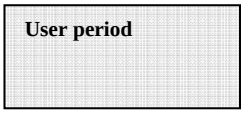
E-30d: Total energy output over the last 30 days
Val. : Economic gain over the last 30 days
CO2: CO_2 saving over the last 30 days compared to fossil fuels.

5.4.5.7 *Last 365 Days*
Select Last 365 Days to view the following information:



E-365: Total energy output over the last 365 days
Val. : Economic gain over the last 365 days
CO2: CO_2 saving over the last 365 days compared to fossil fuels

5.4.5.8 *User Period*



This feature measures energy saving during the period selected by us.
Press ENTER from the 'User period' screen to access the following submenu:

Use the display keys to set the start and end date of the period as follows:

- Use ENTER to move from one field to the next (from left to right)
- Use ESC to go back to the previous field (from right to left)
- Press ESC repeatedly to go back to the previous menus as described in section 5.5.3

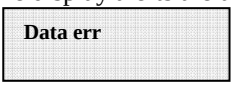
To set the day:

- Press DOWN to scroll numbers backwards (from 31 to 1)
- Press UP to scroll numbers forwards (from 1 to 31)

To set the month:

- Press DOWN to scroll months from December to January
- Press UP to scroll months from January to December

If the dates set are inconsistent, the display alerts the user to the problem:



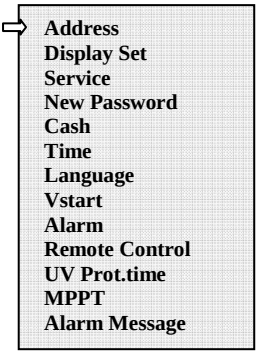
5.4.6 Settings

Select 'SETTING' from the Main menu (section 5.5.4) to display the first screen, which refers to the password:

The default password is 0000. It can be changed using the display keys in the usual way:

- Use ENTER to move from one figure to the next (from left to right)
- Use ESC to go back to the previous figure (from right to left)
- Press ESC repeatedly to go back to the previous menus as described in section 5.5.3
- Press DOWN to scroll numbers backwards (from 9 to 0)
- Press UP to scroll numbers forwards (from 0 to 9)

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



The display has 2 lines; use the keys at the side of the display to scroll through items or open the corresponding submenus as described in section 5.5.4 **A FEW POINTERS ON READING THE DISPLAY.**
An arrow on left side of the display highlights your current selection. Once the chosen item is selected, type ENTER to enter its submenu.

5.4.6.1 *Address*

This function is used to set addresses for communication of the single inverters connected in the system on an RS485 line. You can assign numbers from 2 to 64. Press the UP and DOWN keys to scroll numbers.

If you do not want to manually set the address of each inverter, select the AUTO function and they will be distributed automatically.

5.4.6.2 *Display Set*

This function is used to set the display features:

1) **Light**: Display light setting:

- Use the MODE key to set the display backlighting.

Select the Mode item with the arrow, and press ENTER to open the relevant submenu. The next screen is:

ON: Light always on

OFF: Light always off

AUTO: Automatic light setting. It turns on every time a key is pressed and stays on for 30 seconds then gradually turns off.

- Use the INTENSITY key to set the intensity of backlighting from 1 to 9

2) **Contrast:** Display light contrast
Available display light tones go from 0 to 9.
Press UP and DOWN keys to scroll the numbers and then press ENTER to confirm the selection.

3) **Buzzer:** Key tone setting
Selecting:
ON: The key tone is on
OFF: The key tone is off

5.4.6.3 *Service*
Only installing staff can gain access to this function. It is password-protected and the dedicated code is supplied by Power-One.

5.4.6.4 *New Password*
This function is used to change the default password 0000.
To set your personal code, use the display keys as follows:

- Use ENTER to move from one digit to the next (from left to right)
- Use ESC to go back to the previous digit (from right to left)
- Press ESC repeatedly to go back to the previous menus as described in section 5.5.3
- Press DOWN to scroll numbers backwards (from 9 to 0)
- Press UP to scroll numbers forwards (from 0 to 9)

NOTE: Save new password in a safe place!!!

5.4.6.5 *Cash*
This function is about energy output earnings.

Name	**EUR**
Val/KWh	**00.50**

Name: Set desired currency, using the keys in the usual manner. The default currency is the Euro.
Val/KWh: This indicates the cost of 1 kWh expressed in the currency set. The default setting is Euro 0.50.

5.4.6.6 *Time*

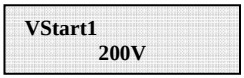
If necessary, the time and date settings can be adjusted from this section.

5.4.6.7 *Language*

It is possible to set the national language or English.

5.4.6.8 *START-UP Voltage*

The start-up voltage for both input channels can be set according to the available photovoltaic system. The voltage can range from 120V to 350V. The default setting for Aurora is 200V. This parameter can be changed by means of the display keys.



When the independent input mode is selected it's possible to set different start-up voltage for channel 1 and channel 2.

5.4.6.9 *Alarm*

The inverter features an alarm function that opens or closes a relay contact (available both as contact normally open – N.O. – and as contact normally closed – N.C.). The contacts can be accessed through the front panel as shown in Fig. 25. This contact can be used for instance to activate a siren or a visual alarm: In any case the contact's voltage/current rating of 230V/1A must not be exceeded.

This function can activate 2 different alarm modes. Press the ENTER key to open the relevant submenu:

An arrow on left side of the display highlights your current selection. When the chosen item is selected, press ENTER to confirm activation of the chosen mode.

Fig. 25 - Alarm contact terminal block

- **PRODUCTION**: The relay is only activated when the inverter is connected to the grid.

For instance, if the N.O. (or N.C.) contact is chosen, the contact will remain open (closed) as long as the inverter is not connected to the grid; once the inverter is connected to the grid and starts to export power, the relay switches its status and closes (opens). When the inverter is disconnected from the grid, the relay contact returns to its rest position, i.e. open (closed).

- **FAULT**: Triggers relay activation (code E).

For instance, if the N.O. (or N.C.) contact is chosen, the contact will remain open (closed) as long as the inverter does not show a fault (IT DOES NOT SWITCH IN THE CASE OF A WARNING or Code W); once the inverter shows a fault, the relay switches its status and closes (opens). The contact stays switched compared to its rest condition until normal operation in parallel with the grid is restored.

To select the alarm contact's operational mode, access the alarm submenu from the settings menu, select the desired operational mode with the UP and DOWN arrows and press the ENTER key to confirm the selection.

5.4.6.10 *Remote Control*

This control is used to disable the inverter manual switch-off. Set as follows:
- ENABLE, to activate the manual ON/OFF function
- DISABLE to disable manual ON/OFF function, so that Aurora operation will only depend on external solar radiation.

Remote ON/OFF Enable	Remote ON/OFF Disable

Manual ON and OFF input is read on the inverter digital input. When +R and –R are shorted the inverter shut off. When set to OFF, the display will cycle through the following screens:

Remote OFF	Waiting Rem.ON… to restart

To shut ON the inverter is necessary removing the short between +R and –R.

5.4.6.11 *UV Prot.time*

This function is used to set the inverter connection time after the input voltage drops below the Under Voltage limit, set at 90V.
For example: If UV Prot.time is set at 60 seconds, and Vin voltage drops below 90V at 9.00 hrs, the inverter stays connected to the grid (at 0 power) up to 9.01 hrs.

Power-One sets this time at 60 seconds. The user can change this setting and set it from 1 second to 3,600 seconds.

5.4.6.12 *MPPT*

This function is used to automatically set the parameters for the Maximum Power Point Tracker function.

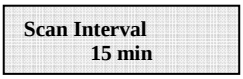
1) MPPT Amplitude: Set this parameter to choose the amplitude of the disturbance introduced in DC in order to establish the optimal work point. There are 3 options (LOW, MEDIUM, HIGH). The default setting is LOW.

MPPT Amplitude LOW

2) It can be set by enabling or disabling the scan function to detect the maximum multiples.

MPPT scan En/Dis Enable

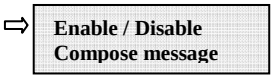
This function is used to set the time interval for system maximum multiple scan. The default setting is 15 minutes.



5.4.6.13 *Alarm Message*

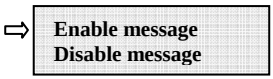
Use the following procedure to program the error message shown on the display:

Press the ENTER key to open the relevant submenu

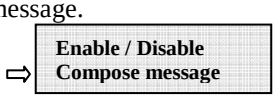


Select the desired function with the arrow on the left side of the display, scrolling it with the UP (2nd key) and DOWN (3rd key) display keys. When the chosen item is selected, press ENTER (4th key) to confirm activation of the chosen mode.

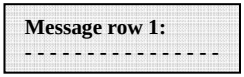
The following screen will appear in the ENABLE/DISABLE menu. Here you can enable or disable the customized message settings function:



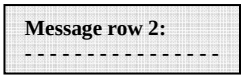
With arrow in line with the ENABLE MESSAGE line, press ENTER and go to the next screens for writing the message.



Select COMPOSE MESSAGE and you will be able to write the first line of the message.



The maximum number of characters that can be used is 16. Press the Enter key 17 times and go to the second line.



To write the message always use the display keys in the following way:

- Use ENTER (4th key) to move from one figure to the next (from left to right)
- Use ESC (1st key) to go back to the previous position (from right to left)
- Press ESC repeatedly to go back to the previous menus as described in section 5.5.3
- Use UP (2nd key) to scroll upwards through the numbers, letters and symbols
- Use DOWN (3rd key) to scroll downwards through the numbers, letters and symbols

5.4.7 Info

This menu is used to display all Aurora data, the grid standard and chosen language by means of the special selectors.

- Part No. (part number)
- Serial No. – Wk – Yr (serial number, week, year)
- Fw rel (firmware revision level)
- Country Selector

The last menu allows user to display what standard is currently set in the inverter (Current Value), what standards will be applied when it is next switched on (New Value) after acting on the selectors, set the new value (Set Value), and check the time remaining for changes made to the applied standard (Residual Time).

6 DATA CHECK AND COMMUNICATION

6.1 Connection through RS-485 Serial Port or RJ12 Connectors

6.1.1 RS-485 Serial Port

The RS-485 serial port uses a three-wire cable: Two wires are for signals and the third is for ground connection. The cable is routed through the holes located on the bottom of the inverter which are blanked with waterproof plugs (see Fig. 26).
The supplied cable gland must be installed in the hole selected for use.

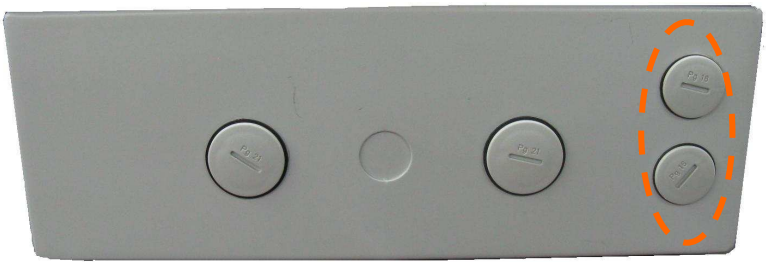


Fig. 26 - Cable routing for RS-485 connection

For ease of installation, the inverter is provided with two holes to differentiate the input cable route from the output cable route when several units are daisy chained as described below.

After passing through cable gland, the cables are connected inside the unit to RS-485 terminal blocks which can be accessed by removing the front cover. Refer to paragraph 3.7 for details on correct front cover removal and reassembly.

- The signal wires must be connected to +T/R and –T/R terminals
- The ground wire must be connected to the RTN terminal

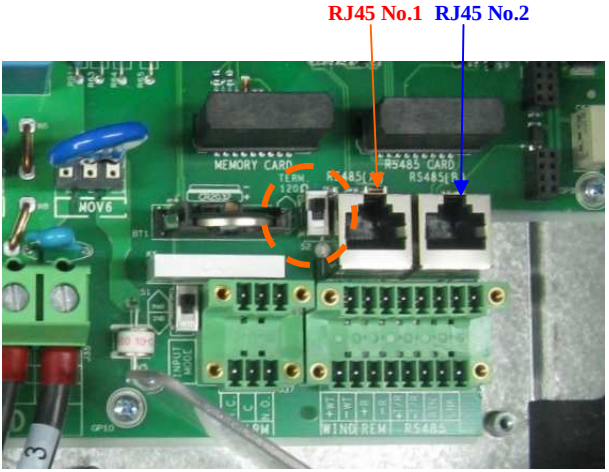
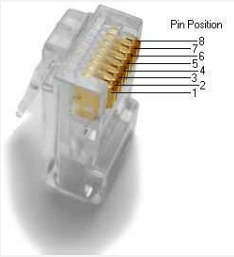


Fig. 27 - Terminals for connection to RS-485 and S2 switch

6.1.2 RJ45 Connectors

As an alternative to RS485 serial connection, whether using single units or a daisy chain, inverter connection can be performed by means of RJ45 connectors (see Fig. 27).

The wiring is still routed through the holes located on the bottom of the inverter which are blanked with waterproof plugs (see Fig. 26). Input wiring passes through one hole and is to be assembled to one of the RJ45 connectors; it does not matter whether it is no. 1 or no. 2 as the signals are the same since they are connected in parallel.
Output wiring goes out from the other RJ45 connector through the other hole and extends to the next unit.

RJ45 connectors			
	**Pin #**	**Signal Name**	**Description**
	1		Not Used
	2		Not Used
	3	**+TR**	***+ Data Line*** Required for RS485 communication.
	4	**+R**	***Remote OFF*** Required or Remote OFF control (see chapter 5.5.6.11 for details).
	5	**-TR**	***- Data Line*** Required for RS485 communication.
	6		Not Used
	7	**RTN**	***Signal Return*** Common reference for logical signals.
	8		Not Used

Daisy Chain

The RS-485 terminal block or RJ45 connectors can be used to connect a single Aurora inverter or multiple Aurora inverters connected in a daisy chain. The maximum number of inverters that can be connected in a daisy chain is 64. The recommended maximum length of this chain is 1,200 metres.
In a case where multiple inverters are connected in a daisy chain, it is necessary to assign an address to each unit. Refer to paragraph 5.5.6.1 for instructions on how to change addresses.
In addition, the last inverter of the chain must have line termination contact active (S2 switch -120Ω TERM set to ON). See Fig. 27.

Every AURORA device is supplied with default address two (2) and with the S1 switch in the OFF position.

In order to ensure optimum communication on the RS485 line, Power-One recommends connecting the PVI-RS232485 adapter to a location between the first unit of the daisy chain and the computer. See Fig. 28 for further details.
Other equivalent devices available on the market can also be used but Power-One does not assure correct connection operation since these devices have never been specifically tested.
Please note that these other equivalent commercial devices could require external termination impedance, which is not necessary for Aurora PVI-232485.
The following diagram shows how to connect multiple units into a daisy chain configuration.

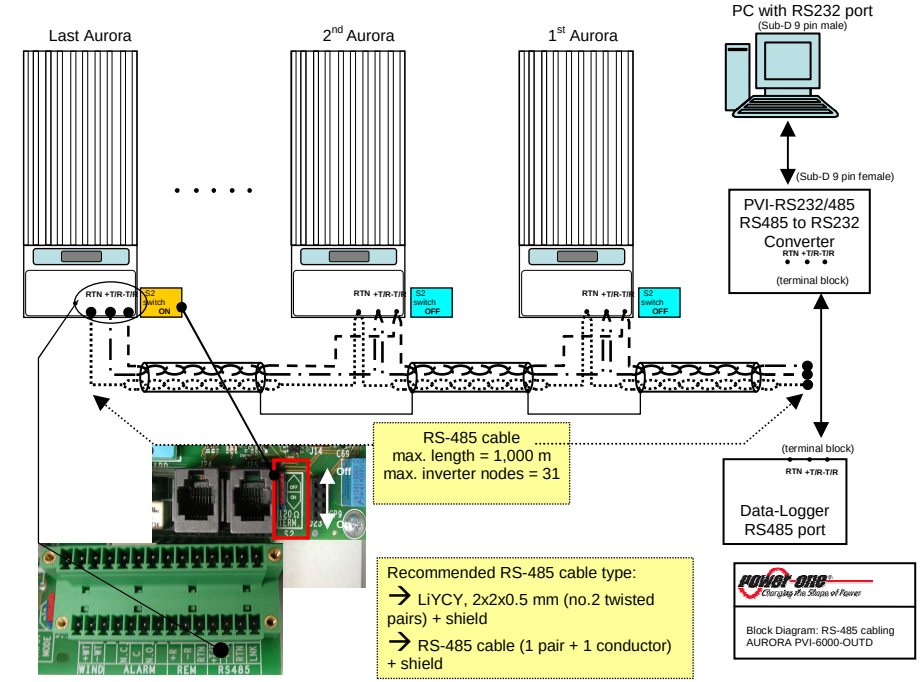


Fig. 28 – Daisy Chain Connection

NOTE: When using an RS-485 link there can be up to 64 inverters connected on the same link. Choose any address between 2 and 64.

NOTE: When using an RS-485 link, in case one or more inverters are added later to the system, please remember to switch the inverter switch of the former last inverter of the system back to the OFF position.

6.2 Measurement Accuracy

Every measurement should consider possible errors.
The tables below show the following information for each reading:

- the units of measurement;
- the range;
- the resolution.

	Name of measured variable	Unit of measure-ment	Resolution		Maximum percentage of error
			Display	Value	
Input voltage PV No. 1	VP1	Vdc	1 V	600mV	2%
Input voltage PV No. 2	VP2	Vdc	1 V	600mV	2%
Input current PV No. 1	IP1	Adc	0.1 A	25mA	2%
Input current PV No. 2	IP2	Adc	0.1 A	25mA	2%
Output power PV No. 1	Pin1	W	1 W	10W	2%
Output power PV No. 2	Pin2	W	1 W	10W	2%
Output voltage	Vout	V	1 V	-	2%
Output current	Iout	A	0.1 A	-	2%
Output power	Pout	W	1 W	-	2%
Frequency	Freq	Hz	0.01	0.01	0.1%

	Name of measured variable	Unit of measure-ment	Resolution		Maximum percentage of error
			Display	Value	
Accumulated energy	Energy	Wh	1 Wh		4%
Time counter	Lifetime	hh:mm:ss	1 s		0.2
Partial time counter	Partial Time	hh:mm:ss	1 s		0.2

7 TROUBLESHOOTING

AURORA inverters comply with the standards set for grid-tied operation, safety, and electromagnetic compatibility.

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

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

In case of any possible malfunction of the inverter, solve problems as follows:

- ✓ Work under safe conditions, as stated in section 3.5 and following, check that connections between AURORA, photovoltaic field and power distribution network have been made correctly.

- ✓ Carefully observe which LED is flashing and read the signal appearing on the display; then, following the instructions given in sections 5.3, 5.4, and 5.5, try to identify the type of fault found.

If the malfunction cannot be removed by following these instructions, contact the service centre or the installer (see the instructions in the following page).

Before contacting the service centre, we ask you to make the following information available in order to maximize the effectiveness of the intervention:

INFORMATION ON AURORA

NOTE: Information available directly from the LCD display

- ✓ AURORA model?
- ✓ Serial number?
- ✓ Week of production?
- ✓ Which LED is flashing?
- ✓ Steady or flashing light?
- ✓ What signals are shown on the display?

- ✓ Brief description of the fault?
- ✓ Have you noted whether the fault can be reproduced?
- ✓ If so, how?
- ✓ Have you noticed if the fault is cyclical?
- ✓ If so, how often?
- ✓ Was the fault apparent at the time of installation?
- ✓ If so, has it got worse?
- ✓ Describe the atmospheric conditions at the time the fault appeared.

INFORMATION on the Photovoltaic Field

- ✓ Brand and model of photovoltaic panels
- ✓ System structure: - Maximum array voltage and current values
  - Number of strings in the array
  - Number of panels for each string

8 TECHNICAL CHARACTERISTICS

8.1 Input Values

WARNING: The photovoltaic field and system wiring must be configured in such a way that the PV input voltage is less than the maximum upper limit independent of the type, the number, and the operating conditions of the chosen photovoltaic panels.
As panel voltage also depends on working temperature, the number of panels per string shall be chosen according to the minimum ambient temperature expected in that special area (see table A).

WARNING: The inverter is provided with a linear output power derating depending on the input voltage, starting from 470 Vdc (100% output power) to 520 Vdc (10% output power)

WARNING: The open circuit voltage of the photovoltaic panels is affected by the ambient temperature (the open circuit voltage increases as the temperature decreases). Make sure that the minimum temperature estimated for the installation does not cause the panels to exceed the maximum upper voltage limit of 520 Vdc. As an example, the following table shows for typical panels of 36, 48, and 72 cells the maximum voltage of each panel as a function of the temperature (assuming a rated open circuit voltage of 0.6 Vdc per cell at 77°F and a temperature coefficient of -0.0041V/°F). The table shows, therefore, the maximum number of panels that can be connected in series as a function of the minimum temperature at which the system will operate. Consult the panel manufacturer for the correct temperature coefficient of V_{oc}, before calculating the maximum voltage of the photovoltaic array.

Panel Min. Temp. [°F]	36 Cell Panels		48 Cell Panels		72 Cell Panels	
	Panel Voltage	Max. Number of Panels	Panel Voltage	Max. Number of Panels	Max. Number of Panels	Panel Voltage
77	21.6	27	28.8	20	43.2	13
68	22.0	27	29.4	20	44.0	13
59	22.4	26	29.9	20	44.9	13
50	22.8	26	30.5	19	45.7	13
41	23.3	25	31.0	19	46.5	12
32	23.7	25	31.6	19	47.3	12
23	24.1	24	32.1	18	48.2	12
14	24.5	24	32.7	18	49.0	12
5	24.9	24	33.2	18	49.8	12
-4	25.3	23	33.8	17	50.7	11
-13	25.7	23	34.3	17	51.5	11

Table A

Description	Value PVI-3.8-I-OUTD	Value PVI-4.6-I-OUTD
Max. recommended DC power input	4,420 W	5,260 W
Rated DC power input	4,000 W	4,840 W
Rated input voltage	330 Vdc	330 Vdc
Max. absolute input voltage	520 Vdc	520 Vdc
Input voltage, MPPT operating range	from 90 Vdc to 520 Vdc	from 90 Vdc to 520 Vdc
Input voltage, MPPT operating range at full power	from 200 Vdc to 470 Vdc	from 200 Vdc to 470 Vdc
Max. short circuit current (of each array)	15.6 Adc	17 Adc
Max. operating input current (of each array)	12.5 Adc	14 Adc
Max. input power (of each array)(1)	3,000 W	3,000 W
PV ground fault connection	1A 600V fuse	1A 600V fuse
Input channel (array) configuration	Parallel / Independent (2)	Parallel / Independent (2)

(1) The total input power shall not exceed the max. recommended DC power
(2) The configuration Independent is not available for –PG models

NOTE: If the input current supplied by the photovoltaic field connected to the inverter is above the maximum usable value and the input voltage is within the allowed range, the inverter will not be damaged.

8.2 Output values

Description	Value PVI-3.8-I-OUTD	Value PVI-4.6-I-OUTD
Rated output power	3,800 W	4,600 W
Max. continuous output power	4,200W/ 3,800W/ 3,300W	5000W/ 5000W/ 5000W
Grid voltage, maximum range	183 to 304 Vac	183 to 304 Vac
Grid voltage, rated	277V single phase or 240V split phase or 208V single phase (setting required)	277V single phase or 240V split phase or 208V single phase (setting required)
Grid voltage, operating range in compliance with UL1741 regulations	88% to 110% of nominal voltage (211 to 264Vac for V=240Vac)	88% to 110% of nominal voltage (211 to 264Vac for V=240Vac)
Grid frequency, maximum range	47 to 63 Hz	47 to 63 Hz
Grid frequency, rated	60 Hz	60 Hz
Grid frequency, operating range in compliance with UL1741 regulations	59.3 to 60.5 Hz	59.3 to 60.5 Hz
Rated output current	13.7A/ 15.8A/ 16A	16.6A/ 19.1A/ 22.1A
Max. output current	16A/ 16A/ 16A	20A/ 20A/ 23A
Output overcurrent protection	20A/ 20A/ 20A	25A/ 25A/ 30A

8.3 Grid Protection Characteristics

Anti-islanding protection	Complies with: CSA-C22.2 N.107.1-01 UL Std N.1741

8.4 General Characteristics

Description	Value PVI-3.8-I-OUTD	Value PVI-4.6-I-OUTD
Maximum efficiency	96.5%	96.5%
Internal consumption on stand-by	< 8 W	< 8 W
Internal consumption at night-time	< 2 W	< 2 W
Operating ambient temperature	from -13°F to +140°F (*)	from -13°F to +140°F (*)
Casing protection rating	IP65 / Nema 4X	IP65 / Nema 4X
Audible noise with internal fan operating	< 50 dbA @ 3.28 ft	< 50 dbA @ 3.28 ft
Size (height x width x depth):	3 ft x 0.65 ft x 1.06 ft (-S-US model) 2.33 ft x 0.65 ft x 1.06 ft (-US model)	3 ft x 0.65 ft x 1.06 ft (-S-US model) 2.33 ft x 0.65 ft x 1.06 ft (-US model)
Weight	48 lbs (-S-US model) 44 lbs (-US model)	48 lbs (-S-US model) 44 lbs (-US model)
Relative humidity	0 – 100% condensation point	0 – 100% condensation point

(*) Full power guaranteed up to T.amb = 122°F for PVI-4.6-I-OUTD, up to 140°F for PVI-3.8-I-OUTD (provided unit is not exposed to direct solar radiation)

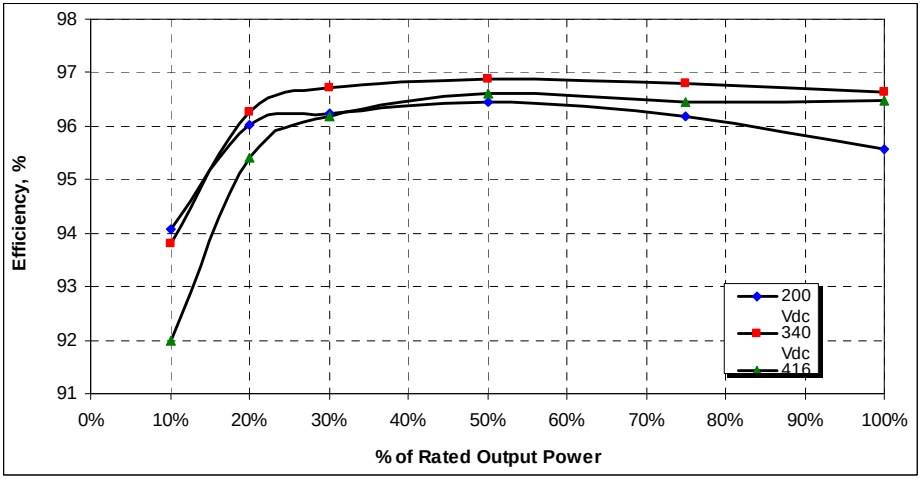


Fig. 29 - Efficiency curve PVI-3.8-I-OUTD

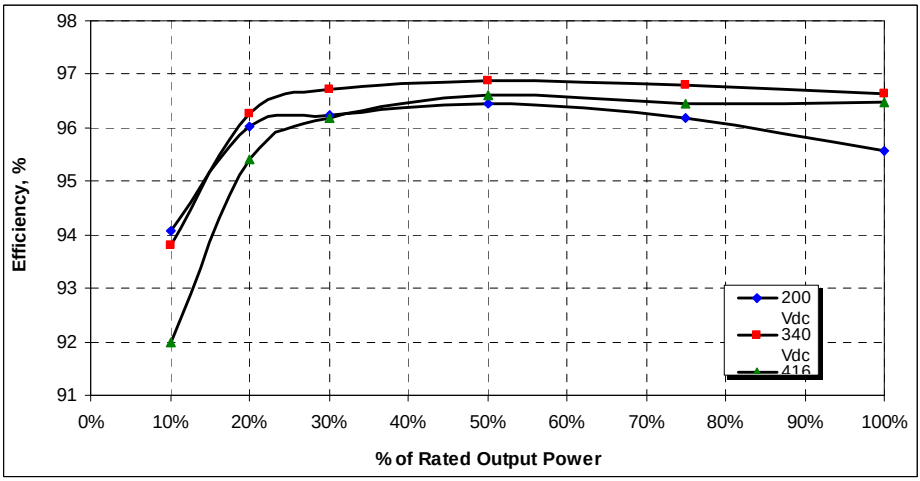


Fig. 30 - Efficiency curve PVI-4.6-I-OUTD

8.5 Power Derating

In order to ensure inverter operation under safe conditions both from the temperature and electrical point of view, the unit automatically decreases power input to the grid. Power derating can occur in two cases:

Power reduction due to environmental conditions
Power reduction and temperature at which it occurs depend on many operating parameters other than ambient temperature, such as input voltage, grid voltage, and power available from the photovoltaic panels. AURORA can thus decrease power output during certain periods of the day according to these parameters.
In any case, AURORA ensures maximum power up to 122°F for PVI-4.6-I-OUTD, up to 140°F for PVI-3.8-I-OUTD provided it is not directly exposed to the sun.

Power reduction due to input voltage
The graph shows automatic power output derating when input or output voltage is too high or too low.

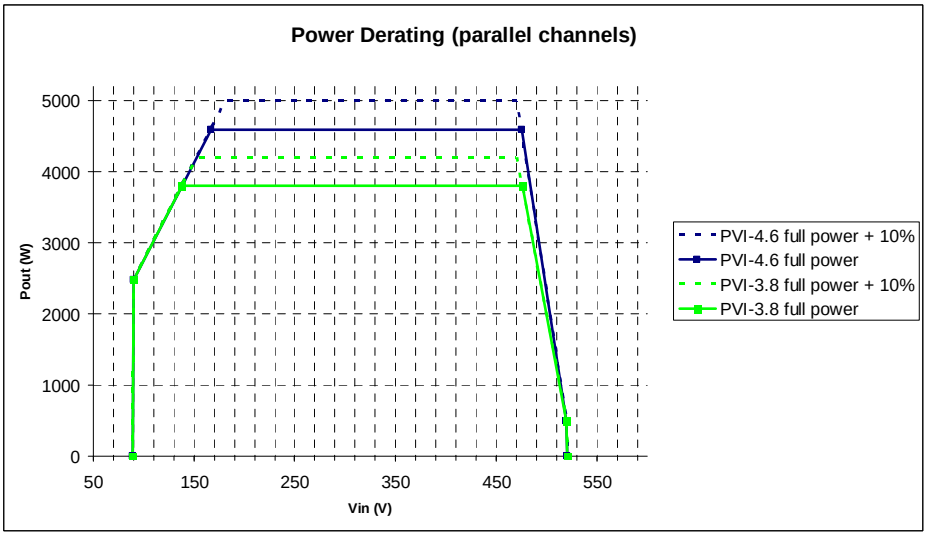


Fig. 31 - Derating curve against input voltage – Both channels used

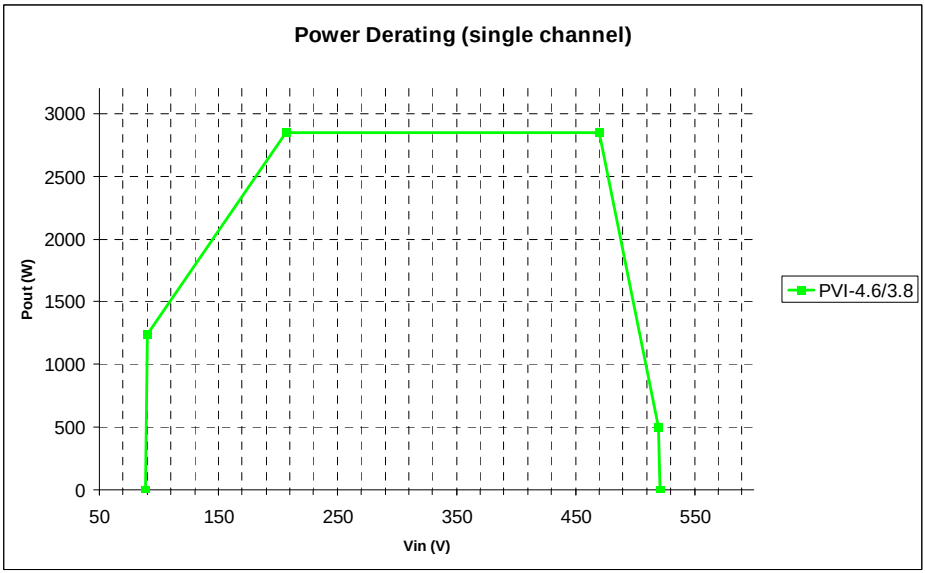


Fig. 32 - Derating curve against input voltage – Only CH1 used

NOTE: The curve for parallel channel configuration shows an area of non-operation up to 90V, a linear derating area up to 170V (PVI-4.6), 140V (PVI-3.8), an area of constant rated power and derating at high voltage starting from 470V. In reality the non-operating area at low voltage depends on how the minimum start-up voltage is set (default 200V). The converter, once started up, will continue to operate according to the curve until a minimum value of 70% of the start-up voltage set (i.e. with the default value set at 200V, the inverter will have a minimum operating voltage of 140V).
The curve for single channel configuration shows an area of non-operation up to 90V, a linear derating area up to 210V an area of constant rated power and derating at high voltage starting from 470V.

Necessary conditions for power derating due to environmental conditions and to input voltage can occur at the same time, but in this instance power derating will always consider the lowest value detected.