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INSTRUCTION MANUAL – USE AND INSTALLATION

15 kW-WIND-INTERFACE 25 kW-WIND-INTERFACE



ORIGINAL INSTRUCTIONS

IMPORTANT SAFETY INSTRUCTIONS

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

KEEP THESE INSTRUCTIONS!

This manual must be regarded as an integral part of the equipment, and must always be available to people interacting with the equipment itself. The manual must always be kept with the equipment, even in case of transfer to another user.

Operators are required to read this manual and scrupulously follow the instructions given in it, since **Power-One** cannot be held responsible for damage caused to people and/or things, or the equipment, if the conditions described below are not observed.

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-1 - Introduction and general information

Warranty and Supply Conditions

The warranty conditions **are described in a special certificate supplied with the equipment**. Furthermore, the warranty conditions are considered to be valid if the customer adheres to the indications in this manual; any conditions deviating from those described herein must be expressly agreed in the purchase order.

Power-One declares that the equipment complies with the pertinent legislation currently in force in the country of installation and it has issued the corresponding declaration of conformity (available online at www.power-one.com or by request from the Power-One Service).

Not included in the supply



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

It is absolutely forbidden to modify the equipment. Any modification, manipulation, or alteration not expressly agreed with the manufacturer, concerning either hardware or software, shall result in the immediate cancellation of the warranty.

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

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

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

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



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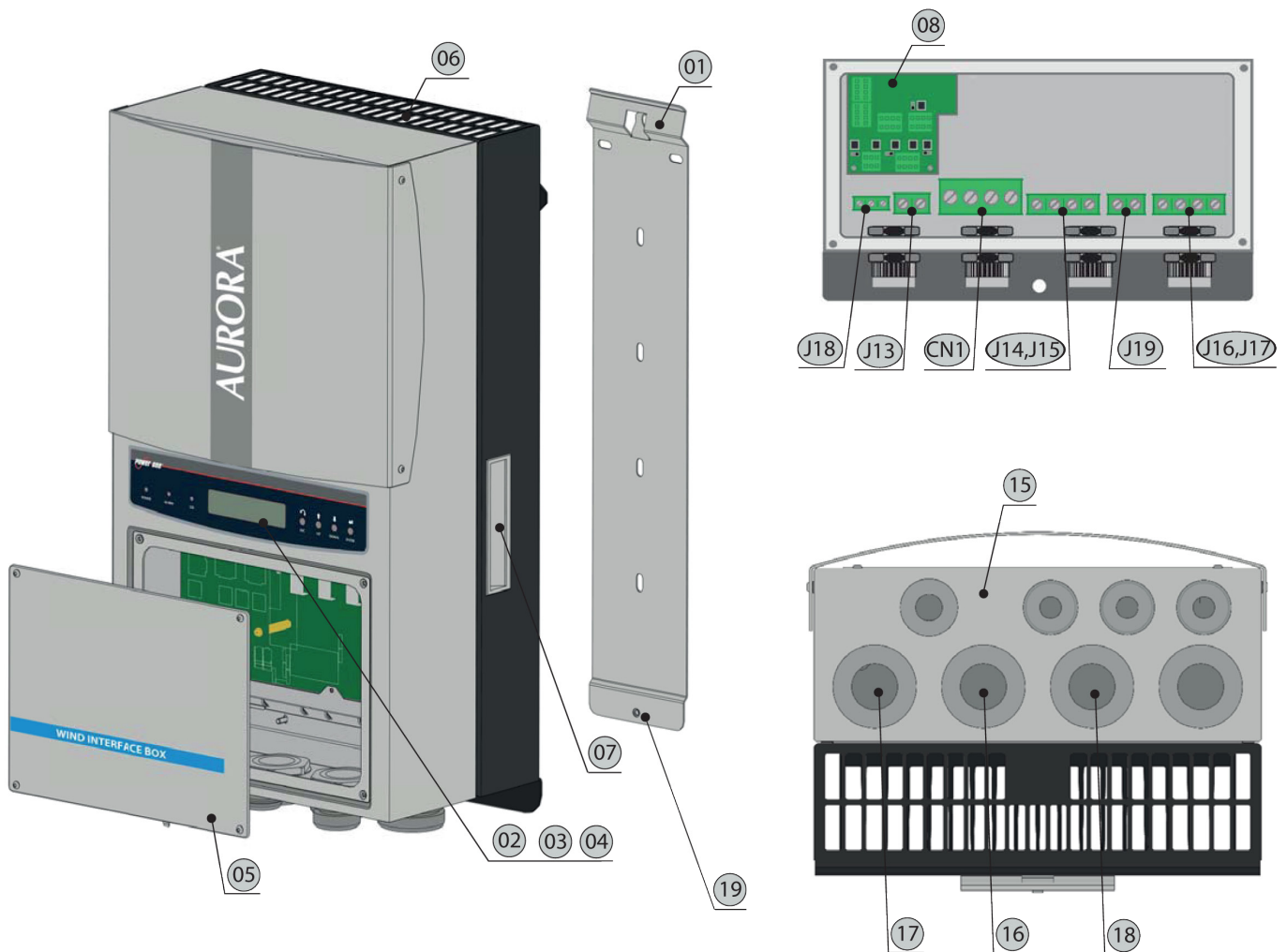
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Reference number index

01, bracket	07, handles	J13, terminal brake load
02, display	08, digital board	J18, Auxiliary voltage terminal block
03, keyboard	CNI, input terminal board	15, service holes
04, LED panel	J14;J15, output terminal board (+)	16, AC hole
05, front cover	J16;J17, output terminal board (-)	17, Auxiliary voltage hole
06, heat sink	J19, diversion load	18, DC hole

Graphical representation of references



The document and who it is for

Purpose and structure of the document

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



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



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

List of annexes

In addition to this operating and maintenance manual, (if applicable or on request) the following enclosed documentation is supplied:

- EC declaration of conformity
- quick installation guide
- warranty



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

Staff characteristics



The customer must make sure that the operator has the necessary skill and training to do his/her job. Personnel in charge of using and maintaining the equipment must be expert, aware and skilled for the described tasks and must reliably demonstrate their capacity to correctly interpret what is described in the manual.



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



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



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



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

Symbols and signs

Table: Symbols

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

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

2 - Characteristics

General conditions

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

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

- Contents
- Reference number index

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



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



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

Intended use

Power-One is not responsible for damage of any type due to improper or careless installation, operation or maintenance and is not liable for any resulting loss or damage.



The product must not be used in applications other than for which it is designed. It must not be used by unqualified persons, nor used in ways not in accordance with this manual.

Intended use

The AURORA WIND® Interface is a rectifier designed to transform AC current from a wind turbine into a continuous (DC) current to be input to one or more AURORA inverters, and for connection to braking resistors. The AURORA WIND Interface does not supply a safety system for the wind turbine.

Limits on use

The inputs of the rectifier may be connected only to a wind turbine, not to batteries or other sources of power.

The AURORA WIND Interface must be used only within its technical specifications and ratings.

Improper use

The following must be avoided:



- *Installation in flammable environments, or under extreme temperatures or humidity beyond the specifications*
- *Use of the rectifier with security features disabled or otherwise non-functional*
- *Use of the rectifier or parts of it, connected to machines or equipment other than specified*
- *Modification of the working parameters not normally accessible to an operator*
- *Modifying or changing the AURORA WIND Interface or its components to vary the settings*
- *Modifying or changing the insulation*
- *Use of corrosive cleaners that may cause corrosion, or use of items that may generate electrostatic charges*
- *Use or installation of the rectifier or components without having read and correctly understood this manual*
- *Drying rags on the warm parts of the equipment -- not only is this dangerous, it compromises the ventilation system and component cooling*

Models

The AURORA WIND Interface units covered in this manual are available in two power levels:

- **25kW model**

25kW-WIND-INTERFACE: European and Asia-Pacific version

25kW-WIND-INTERFACE-US: North American version

- **15kW model**

15kW-WIND-INTERFACE: European and Asia-Pacific version

15kW-WIND-INTERFACE-US: North American version

Product and Manufacturer markings

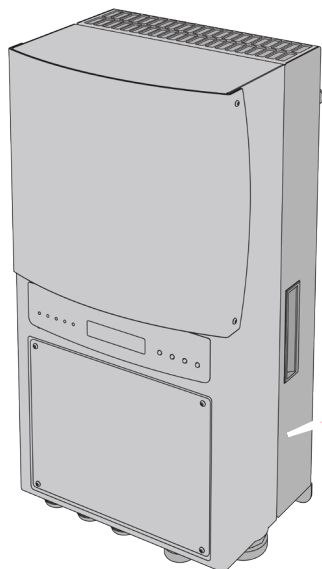


The technical data in this manual does not replace that on the labels on the equipment. The labels on the equipment must not be removed, damaged, covered, allowed to remain dirty, etc.



N.B. Labels must not be hidden with extraneous objects, such as rags, boxes, other equipment.

They must be cleaned periodically and always legible and in view.



Version UE and APAC

 	
WIND INTERFACE BOX	MODEL: 25kW-WIND-INTERFACE
AC RATING Range of Input Operating Voltage: 0 – 600 V~ (rms) 3 Ø, 3 W Operating Frequency Range: 0 – 600 Hz Max. Input Current: 85 A (rms)	DC RATING Output Voltage: 860 V --- max. Operating Voltage Range: 0 – 860 V --- Max. Continuous Output Current: 80 A Max. Continuous Output Power: 25 kW Max. Brake Resistor Current: 50 A Max. Aux. Brake Resistor Current: 30 A
Operating Ambient Temperature: -25 to +50 °C (-13 to +122 °F) Protection Degree: IP65	
  	

 	
WIND INTERFACE BOX	MODEL: 15kW-WIND-INTERFACE
AC RATING Range of Input Operating Voltage: 0 – 600 V~ (rms) 3 Ø, 3 W Operating Frequency Range: 0 – 600 Hz Max. Input Current: 55 A (rms)	DC RATING Output Voltage: 860 V --- max. Operating Voltage Range: 0 – 860 V --- Max. Continuous Output Current: 50 A Max. Continuous Output Power: 15 kW Max. Brake Resistor Current: 30 A Max. Aux. Brake Resistor Current: 15 A
Operating Ambient Temperature: -25 to +50 °C (-13 to +122 °F) Protection Degree: IP65	
  	

Version US

 	
WIND INTERFACE BOX	MODEL: 25kW-WIND-INTERFACE-US
AC INPUT RATING Range of Input Operating Voltage: 0 – 400 V~ (rms) 3 Ø, 3 W Operating Frequency Range: 0 – 600 Hz Max. Input Current: 85 A (rms)	DC OUTPUT RATING Output Voltage: 600 V --- max. Operating Voltage Range: 0 – 600 V --- Max. Continuous Output Current: 80 A Max. Continuous Output Power: 25 kW Max. Brake Resistor Current: 40 A Max. Aux. Brake Resistor Current: 20 A
AC AUXILIARY INPUT RATING Range of Input Operating Voltage: 90 – 246 V~ (rms) Operating Frequency Range: 60 Hz Max. Input Current: 0.25 A	
Operating Ambient Temperature: -25 to +50 °C (-13 to +122 °F) Type of Enclosure: NEMA 4X	
 	

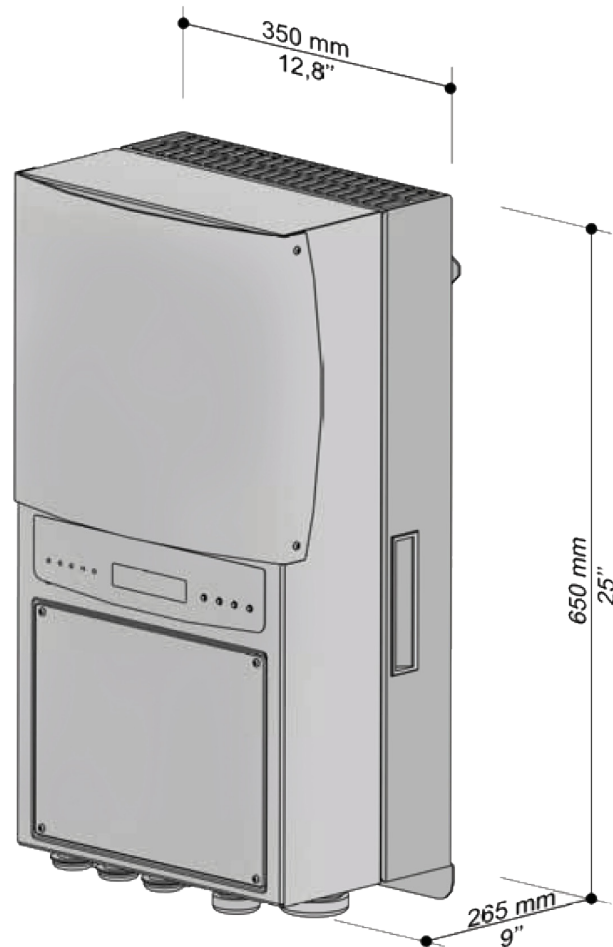
 	
WIND INTERFACE BOX	MODEL: 15kW-WIND-INTERFACE-US
AC INPUT RATING Range of Input Operating Voltage: 0 – 400 V~ (rms) 3 Ø, 3 W Operating Frequency Range: 0 – 600 Hz Max. Input Current: 55 A (rms)	DC OUTPUT RATING Output Voltage: 600 V --- max. Operating Voltage Range: 0 – 600 V --- Max. Continuous Output Current: 50 A Max. Continuous Output Power: 15 kW Max. Brake Resistor Current: 30 A Max. Aux. Brake Resistor Current: 15 A
AC AUXILIARY INPUT RATING Range of Input Operating Voltage: 90 – 264 V~ (rms) Operating Frequency Range: 60 Hz Max. Input Current: 0.25 A	
Operating Ambient Temperature: -25 to +50 °C (-13 to +122 °F) Type of Enclosure: NEMA 4X	
 	

Technical Data

Table: Technical Data	25kW	25kW-US	15kW	15kW-US
Input				
Input AC voltage range (no damage, Vacd, min...Vacd, max)	0...600 V	0...400 V	0...600 V	0...400 V
Input AC Operating voltage range (Vacmin.. Vacmax)	35...600 V	35...400 V	35...600 V	35...400 V
Frequency operating range (Fmin..Fmax)	0...600 Hz			
Absolute maximum AC input current (Iacmax)	85 A		55 A	
Absolute maximum braking resistor current (IMBR,max)	50 A	40 A	30 A	
Main braking resistance voltage range (VBRmin...VMBRmax)	0...1000 V	0...600 V	0...1000 V	0...600 V
Absolute maximum auxiliary (dump load) braking resistor current (IABR, max)	30 A	20 A	15 A	
Auxiliary braking resistance (dump load) voltage range (VABRmin...VABRmax)	0...850 V	0...600 V	0...850 V	0...600 V
Type of input connection	Screw terminal block with cable glands			
Input Protection				
Input overvoltage protection - # Varistors	4			
Input fuse size	3 x 100 A	-	3 x 100 A	-
Output				
Absolute maximum output power (Pdcmax)	25 kW		15 kW	
Output voltage range (Vdc,min...Vdc,max)	50...850 V	50...600 V	50...850 V	50...600 V
Absolute maximum output current (Idc,max)	80 A		50 A	
Type of output connector	Screw terminal block with cable glands			
Output Protection				
Output overvoltage	Yes			
Output Efficiency				
Peak efficiency	99.6 %			
Stand-by power consumption	< 14 W			
Communication				
Local monitoring system	RS 485			
User Interface	2-line LCD with 16 characters/line			
Environmental Characteristics				
Ambient Temperature (operating)	-25...+50°C / -13...122°F			
Relative humidity	100% condensing			
Acoustic emissions	< 50 dB(A)			
Maximum operating altitude without derating	2000 m / 6560 ft			
Physical Characteristics				
Ingress protection rating and enclosure type	IP 65	NEMA 4X	IP 65	NEMA 4X
Cooling	Natural convection			
Dimensions (height x width x depth)	650mm x 350mm x 265mm / 25" x 12.8" x 9"			
Weight	25 kg/55.1 lb		22 kg / 48.5 lb	
Mounting system	Wall brackets			
Safety and EMI standards				
Certifications	CE; cCSAus			
Safety and EMC standards	EN 59178, EN 61000-6-2, EN 61000-6-4UL 1741, CSA - C22.2 N. 107.1-01			

Outer Dimensions

Dimensions are shown in mm and in inches.



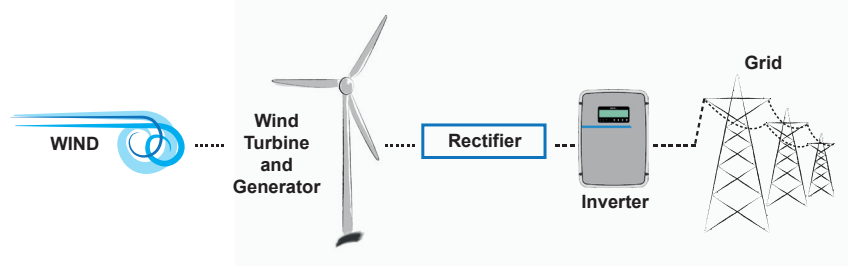
Torque

The following torques are required for proper installation and to maintain the IP 65 protection rating:

Auxiliary power supply terminal block	0.6N-m
Load brake terminal block	1.5N-m
Input terminal block	4.5N-m
(+) output terminal block	1.5N-m
(-) output terminal block	1.5N-m
Dump (diversion) load terminal block	1.5N-m
Communication card signal terminal blocks	0.25N-m
Front cover	1.7N-m

Wind power system characteristics

A wind power system is a set of components (hydraulic, mechanical and electrical) which combine to convert wind energy into a directly usable energy form. In Wind Electric Conversion Systems (WECS), wind energy is converted into electricity with a conversion system known as a Wind Turbine Generator.



A WECS for Mini and Micro wind power systems normally comprises:

- **Wind Turbine**

A hydrodynamic device which converts wind energy into mechanical energy. The turbine is equipped with a number of blades (usually 2 or 3) coupled to a driveshaft. This can either be horizontal or vertical: these configurations are referred to as HAWT (Horizontal Axis Wind Turbine) and VAWT (Vertical Axis Wind Turbine).

- **Generator**

The generator converts the mechanical power furnished by the turbine into electricity. Mini wind power systems normally use a synchronous permanent magnet generator (PMG). The voltage produced by the PMG has an amplitude and frequency that depends on the rotational speed of the turbine. Thus, before being connected to the power distribution grid, this generated power must first be transformed to have a fixed amplitude and frequency compatible with the grid.

- **Rectifier**

The rectification unit rectifies and filters the alternating current (AC), thus producing a direct current (DC) output.

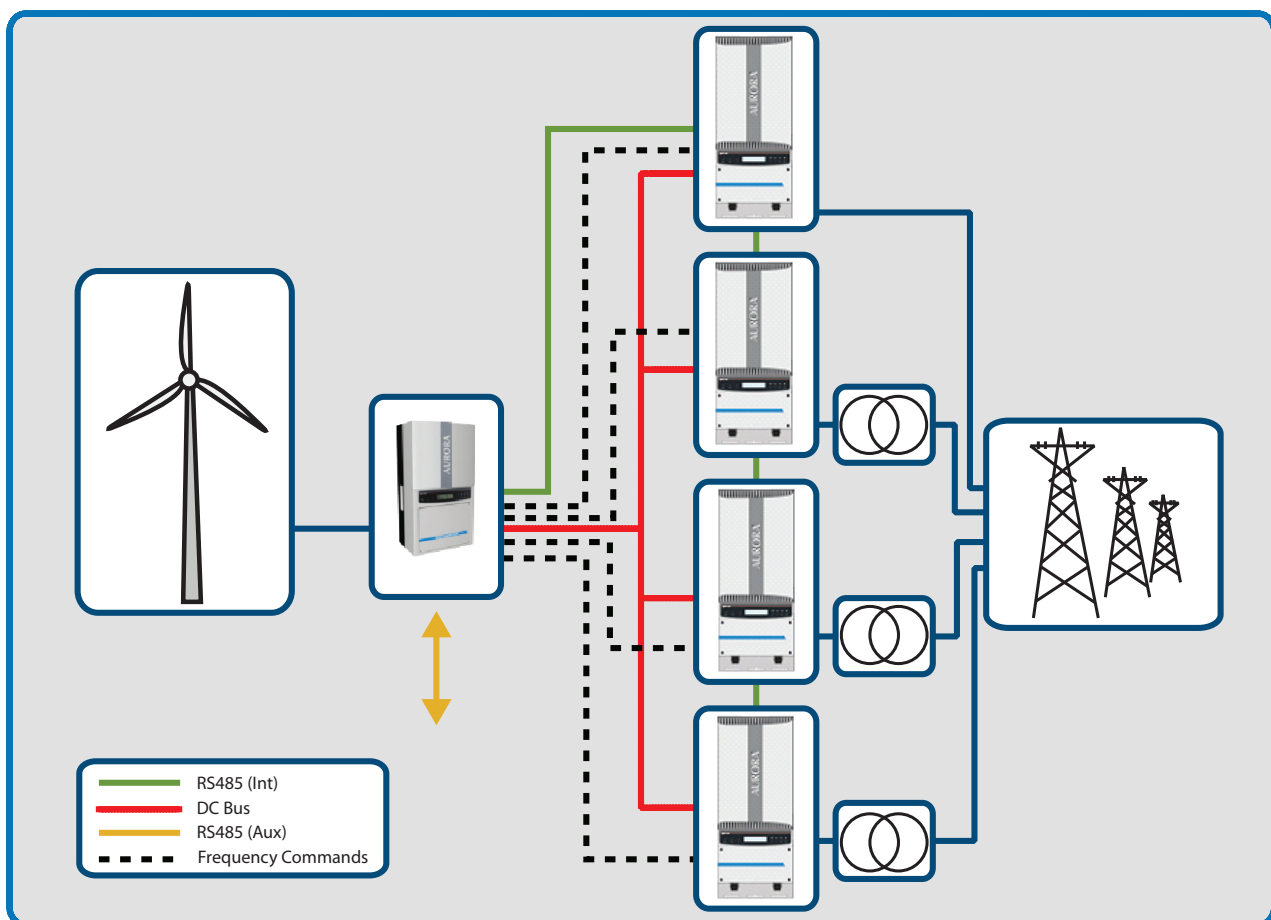
- **Inverter**

The conversion from direct current (DC) to alternating current (AC), compatible with grid standards, is efficiently carried out by the inverter. When connected in parallel with the grid, the alternating current from the inverter flows directly into the domestic distribution circuit, which is in turn connected to the public distribution grid.

Wind turbine system and its components

The AURORA WIND Interface rectifier is connected between a wind turbine and up to four inverters, and across two resistors (the brake resistor and the dump load or diversion resistor). The internal RS-485 bus and up to four frequency commands are used to drive the inverter(s).

The system works in Master-Slave mode; the AURORA WIND Interface is the master and the inverters are the slaves. The rectifier also connects to a personal computer through its auxiliary RS-485 port, so the wind turbine power curve can be uploaded, and certain plant operation settings entered using the software supplied with the product.



The AURORA WIND Interface can drive both isolated (-I in the Power-One part number) and non-isolated transformerless (-TL in the part number) inverters. However, when using transformerless inverters, the wind turbine system may have only one inverter connected directly to the electrical grid. Any remaining inverters must be connected to the grid through an isolation transformer.

AURORA WIND Interface components and their functions

The AURORA WIND Interface is an “intelligent” rectifier with the following features:

- **Rectification and filtering**

There are two separate and independent rectification and filtering circuits fed from the wind turbine’s 3-phase voltage. The first pathway feeds an optional brake resistor (BRK1). The second feeds the inverter and an optional dump load (diversion) resistor (BRK2). A semicontrolled 3-phase bridge in the inverter path allows the inverters to be disconnected if the DC voltage exceeds their input ratings: With proper choice of the trip threshold, overvoltage damage to the inverters is avoided.

- **Wind turbine power curve management**

Every wind turbine has a characteristic power curve determined after a series of tests executed in a wind tunnel or in the field. The power curve must be stored inside the AURORA WIND Interface so that it can drive the inverters in the most efficient way. The power curve can be defined as a function of the turbine rotation velocity (RPM) or it can be based on the turbine DC output voltage.



Remember that the characterization of a wind turbine, in terms of Power = $f(V_{dc})$ or Power = $f(RPM)$, must be supplied by the wind turbine manufacturer.

- **Control of the [optional] dump (diversion) load (BRK2)**

The dump load controller will switch, in PWM mode, an optional external resistor wired in parallel with the inverter. The thresholds for the initiation of PWM braking and for braking with 100% duty cycle may be set through software or from the AURORA WIND Interface display.

The purpose of the dump load is to help keep the turbine under control under two conditions without triggering the external braking systems (both electrical and mechanical). Those conditions are:

1. Inverter disconnected from the electrical grid. Without the inverter on the grid, the turbine would turn freely, unloaded. This calls for a method to avoid runaway and keep the turbine within its specified operating range, reducing the need to invoke mechanical protection mechanisms (disc brakes, pitch control, etc).
2. Exceeding the maximum power of the inverter. At sites where the maximum power rating of the inverter will be exceeded only a few times per year, it's possible to employ a dump load instead of an inverter with a higher power rating. During strong winds, the excess power that can't be handled by the inverter is shunted to the resistive load.



The correct sizing of the dump load resistor is dictated by the characteristics of the individual site and the characteristics of the individual wind turbine, and is beyond the scope of this manual. The determination of the resistor value (ohms) and dissipation rating (watts) is the responsibility of the wind turbine system designer or the customer.

Remember that the values IABR(max) and IDC(max) must never exceeded.

- **Activation of the optional brake resistor (BRK1)**

When the rectifier output voltage exceeds the absolute maximum DC input voltage rating of the inverters (the voltage parameter is programmable), both the inverters and the dump load will be disconnected, and at the same moment, the [optional] brake resistor will be activated. It has the job of stalling the wind turbine. The braking resistor will also be activated anytime there's a fault detected by the AURORA WIND Interface. This is discussed further in the Installation section of this manual.



The correct sizing of the brake resistor is dictated by the wind turbine system (both turbine and permanent magnet generator), and is beyond the scope of this manual. The determination of the resistor value (ohms) and dissipation rating (watts) is the responsibility of the wind turbine system designer or the customer.

Remember that the values IMBR(max) and IAC(max) must never exceeded.



The AURORA WIND Interface may not always be able to prevent runaway (if, for example, the generator fails), therefore it's necessary to have an external Safety Brake circuit, electrical and/or mechanical, that brakes the system.

- **Configurable relays**

The AURORA WIND Interface has 3 relays available for use by the system designer.

GP1: Use for controlling an [optional] external contactor to control an external parking resistor connected directly to turbine's 3-phase voltage. Relay GP1 may be energized after the brake resistor (BRK1), and the time delay, in msec, is programmable through the software supplied with the product.

GP2: Use to turn on an optional cooling fan for the parking and/or brake resistors. The turn off time is programmable.

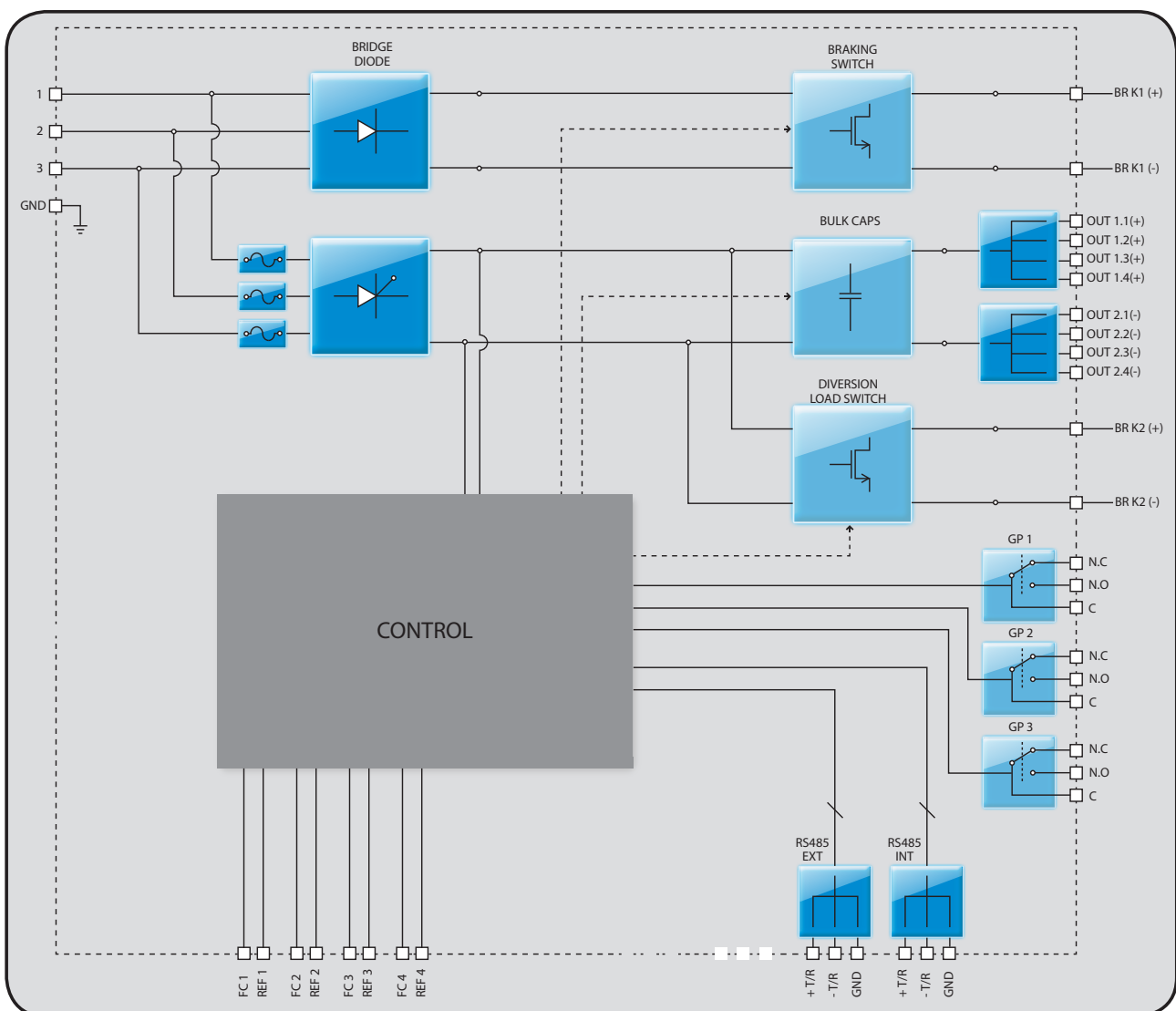
GP3: This relay is energized when the wind turbine is stopped for >20 minutes, and may be used to disconnect any external transformer that might be present in the system. This avoids needless power consumption in the absence of wind.

Block diagram

The figure below is a block diagram of the AURORA WIND Interface. The main power path is through a semicontrolled bridge and bulk capacitors. These two sections together convert the wind turbine's 3-phase voltage to DC for the inverters.

The alternate path for the energy from the turbine, through a bridge and the braking switch, is to an optional external braking resistor where the excess energy may be dissipated

Thanks to an embedded microprocessor, the AURORA WIND Interface efficiently manages the power curve of the wind turbine, continuously driving up to 4 inverters. The microprocessor also automatically controls the activation of the dump load and braking resistors, and controls the opening of the semicontrolled bridge to avoid exposing the inverters to an overvoltage.



Protection features

Fuses

In the European models, both 15kW and 25kW, a 100A fuse is installed on each of the 3 input phases to protect the AURORA WIND Interface from excessive input current. North American models are not fused.



The fuses are not replaceable. If one fails, contact Power-One Customer Service.

Additional protection features

Additional features help guarantee fail-safe operation. These include:

- monitoring of the input voltage and current to avoid exceeding the maximum rated values;
- control of the internal temperatures to avoid overheating either the unit or its bulk capacitors.

Power limiting

To guarantee reliable operation under a variety of temperatures and wind conditions, the AURORA WIND Interface may reduce the power available to the inverters during certain times of day, due to the ambient temperature, DC voltage, grid voltage, etc.

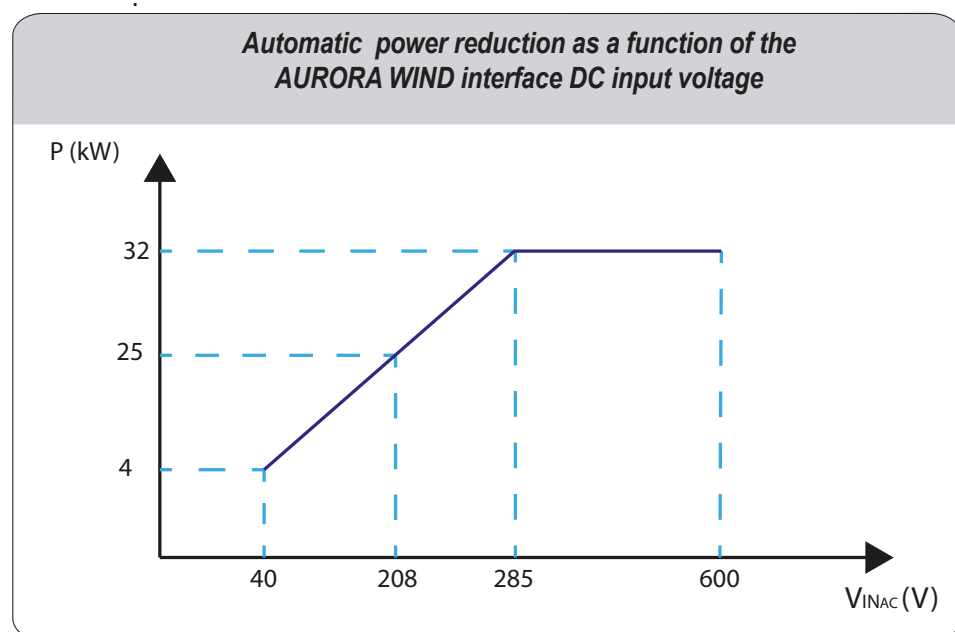
Power reduction due to environmental causes

In any condition, the AURORA WIND Interface outputs the maximum power available when the ambient temperature is $\leq 40^{\circ}\text{C}$.

Always avoid exposing the AURORA WIND Interface to direct sun or sources of heat.

Power reduction due to DC voltage

Power limiting due to temperature and due to the DC voltage may occur simultaneously. In this case, the power throughput will be limited to the smaller value of the two. The graph below shows the automatic power limiting as a function of the DC voltage at the input to the AURORA WIND Interface.



3 - Safety and accident prevention

Safety instructions and general information

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



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

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



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



The instructions given in the manual do not replace the safety devices and technical data for installation and operation stuck on the product, and they certainly do not replace the safety regulations in force in the country of installation and common sense rules.

The manufacturer is willing to train staff, at its premises or on site, in accordance with conditions to be set out in the contract.



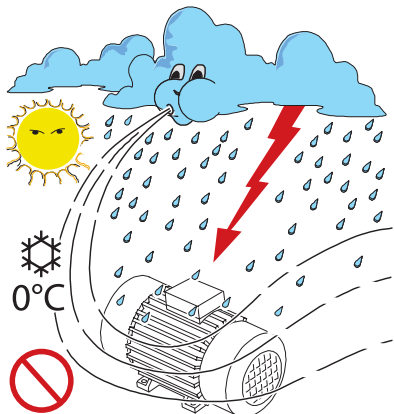
Do not use the equipment if you find any operating anomalies.

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

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

Hazardous areas and operations

Environmental conditions and risks



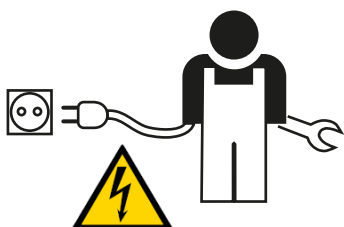
The equipment can be installed outdoors, but only in environmental conditions that do not prevent its regular operation. These conditions are reported on the technical data and on installation chapter.

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

The same precautions should be adopted for dismantling the equipment.



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



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

Signs and Labels



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

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

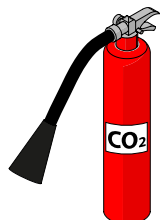
The technical data shown in this manual do not in any case replace those shown on the labels attached to the equipment.

Thermal hazard



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

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



In the event of fire, use CO₂ extinguishers and use auto extraction systems to fight fire in closed environments.

Clothing and protective devices for staff

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



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



All operations on the equipment should be performed with suitably insulated clothes and instruments.

E.g.: Insulated gloves (class 0, category RC)



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

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

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

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



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

Residual risks



Despite the warnings and safety systems, there are still some residual risks that cannot be eliminated.

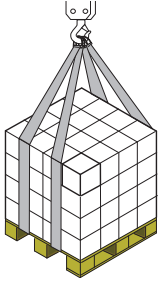
These risks are listed in the following table with some suggestions to prevent them.

Table of residual risks

RISK ANALYSIS AND DESCRIPTION	SUGGESTED REMEDY
Noise pollution due to installation in unsuitable environments or where staff work permanently.	Reassess the environment or the place of installation.
Suitable local ventilation that does not cause overheating of the equipment and is sufficient not to create discomfort to people in the room.	Restore suitable ambient conditions and air the room.
External weather conditions, such as water seepage, low temperatures, high humidity, etc.	Maintain ambient conditions suitable for the system.
Overheating of surfaces at temperature (transformers, accumulators, coils, etc.) can cause burns. Also be careful not to block the cooling slits or systems of the equipment.	Use suitable protective equipment or wait for the parts to cool down before switching on the equipment.
Inadequate cleaning: compromises cooling and does not allow the safety labels to be read.	Clean the equipment, labels and work environment adequately.
Accumulation of electrostatic energy can generate hazardous discharges.	Ensure the devices have discharged their energy before working on them.
Inadequate training of staff.	Ask for a supplementary course.
During installation, temporarily mounting the equipment or its components may be risky.	Be careful about and disallow access to the installation area.

4 - Lifting and transport

General conditions



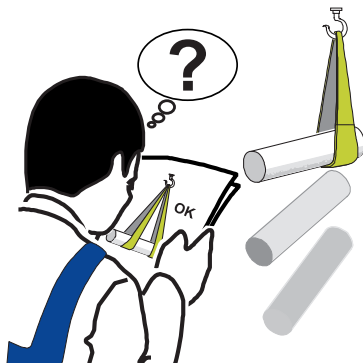
Some recommendation apply only to large size product or multiple small size packings.

Transport and handling



Lifting

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



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

Where indicated and/or where there is a provision, eyebolts or handles, which can be used as anchorage points, are inserted and/or can be inserted.

The ropes and means used for lifting must be suitable for bearing the weight of the equipment.

Do not lift several units or or parts of the equipment at the same time, unless otherwise indicated.

Unpacking and checking



We remind you that the packaging elements (cardboard, cellophane, staples, adhesive tape, straps, etc.) may cause cuts and/or injuries if not handled with care. They should be removed by suitable means and not left in the hands of irresponsible people (e.g., children).

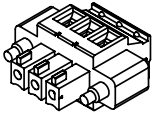
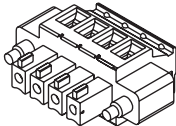
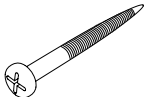
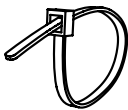
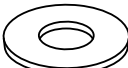
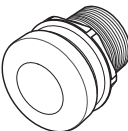
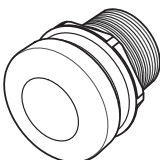
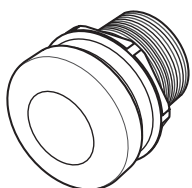
The components of the packaging must be disposed on in accordance with the regulations in force in the country of installation.

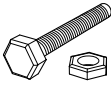
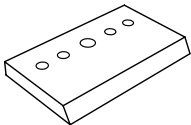
When you open the package, check that the equipment is undamaged and make sure all the components are present.

If you find any defects or damage, stop unpacking and consult the carrier, and also promptly inform the **Service Power-One**.

Packing list

Table: Components supplied with the AURORA WIND Interface

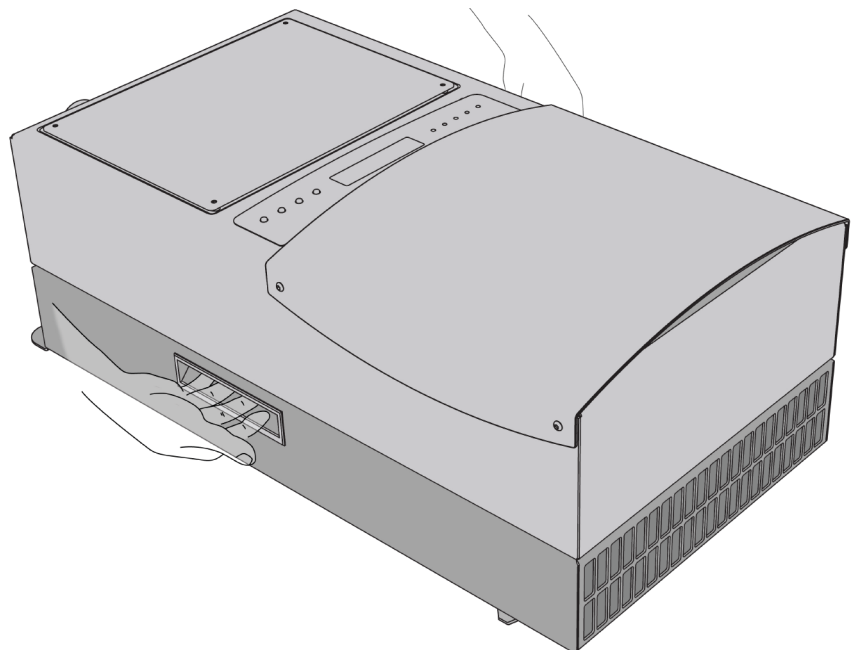
	Components used on all models	Quantity
	3-terminal connector	3
	4-terminal connector	2
	Wall anchor SX10	4
	Screws 6.3x70mm	4
	Screws M6x16	5
	Cable ties	1
	T20 Torx key wrench	1
	Washer M6 UNI6593	1
	Lock washer M6 UNI1751	1
	PG16 cable glands	3
	PG21 cable glands	1
	PG36 cable glands	4

	Components available only for North American models	Quantity
	M6 nuts and screws	5
	Copper bus bar to connect cables to Ground	1

Weights

Table: Weights	Mass (weight) in kg	Number of hand holds
	WIND-INTERFACE 15 kW: 22 kg WIND-INTERFACE 25 kW: 25 kg	2

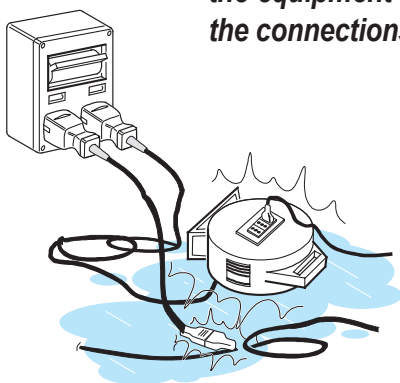
The packaging, with proper handling and storage, will support a **maximum of 4 units**. DO NOT stack other equipment or other products on or with the AURORA WIND Interface



5 - Installation

General conditions

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



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

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



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



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

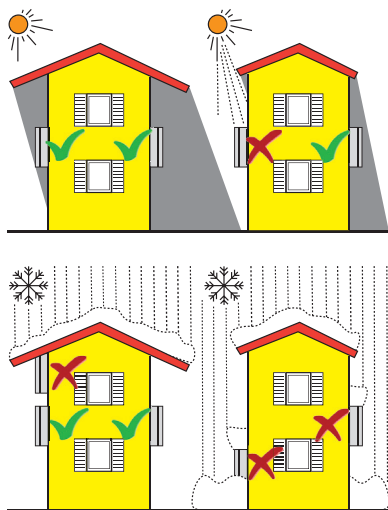


The connection of an inverter energy system to an electrical installation connected to the electricity distribution network shall be approved by the appropriate electrical distributor.



The installation must be carried out with the equipment disconnected from the grid and with the wind generator in safety.

Environmental checks



- Consult the technical data to check the environmental parameters to be observed (degree of protection, temperature, humidity, altitude, etc.)
- The installation to direct sunlight must be avoided because it may cause:
 - phenomena of power limitation by the inverter (with consequent reduction of energy production)
 - premature aging of electronic/electromechanical components
 - premature aging of mechanical components (gaskets) and user interface (display)
- Do not install in small closed rooms where air cannot circulate freely.
- To avoid overheating, always make sure the flow of air around the inverter is not blocked.
- Do not install in places where gases or flammable substances may be present.
- Do not install in rooms where people live or where the prolonged presence of people or animals is expected, because of the noise (about 50dB(A) at 1 m) that the inverter makes during operation.
- Avoid electromagnetic interference that can compromise the correct operation of electronic equipment, with consequent situations of danger.



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

Refer to the warranty conditions available on the website www.power-one.com to evaluate the possible exclusions from warranty related to improper installation.

Installations above 2000 metres



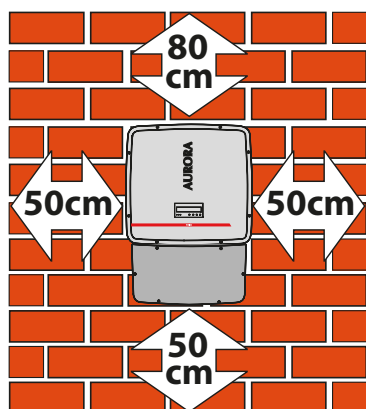
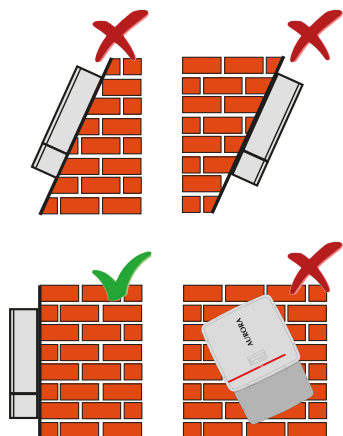
On account of the rarefaction of the air (at high altitudes), particular conditions may occur that should be considered when choosing the place of installation:

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



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

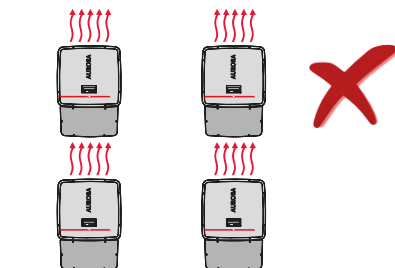
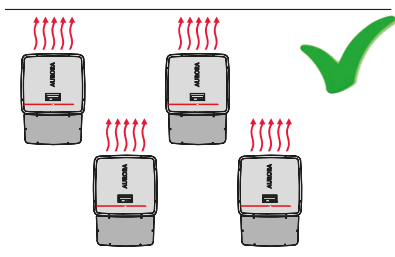
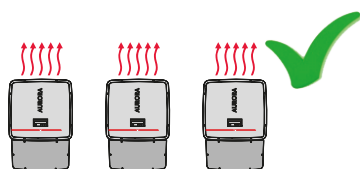
Installation position



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

- Install on a wall or strong structure suitable for bearing the weight.
- Install in safe, easy to reach places.
- If possible, install at eye-level so that the display and status LEDs can be seen easily.
- Install at a height that considers the heaviness of the equipment. If this condition is not complied with, it can create problems in the event of servicing unless suitable means are provided to carry out the operation.
- Install vertically with a maximum inclination of $\pm 5^\circ$. If this condition is not complied with, the inverter could go into temperature derating because of the worsening of heat dissipation.

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



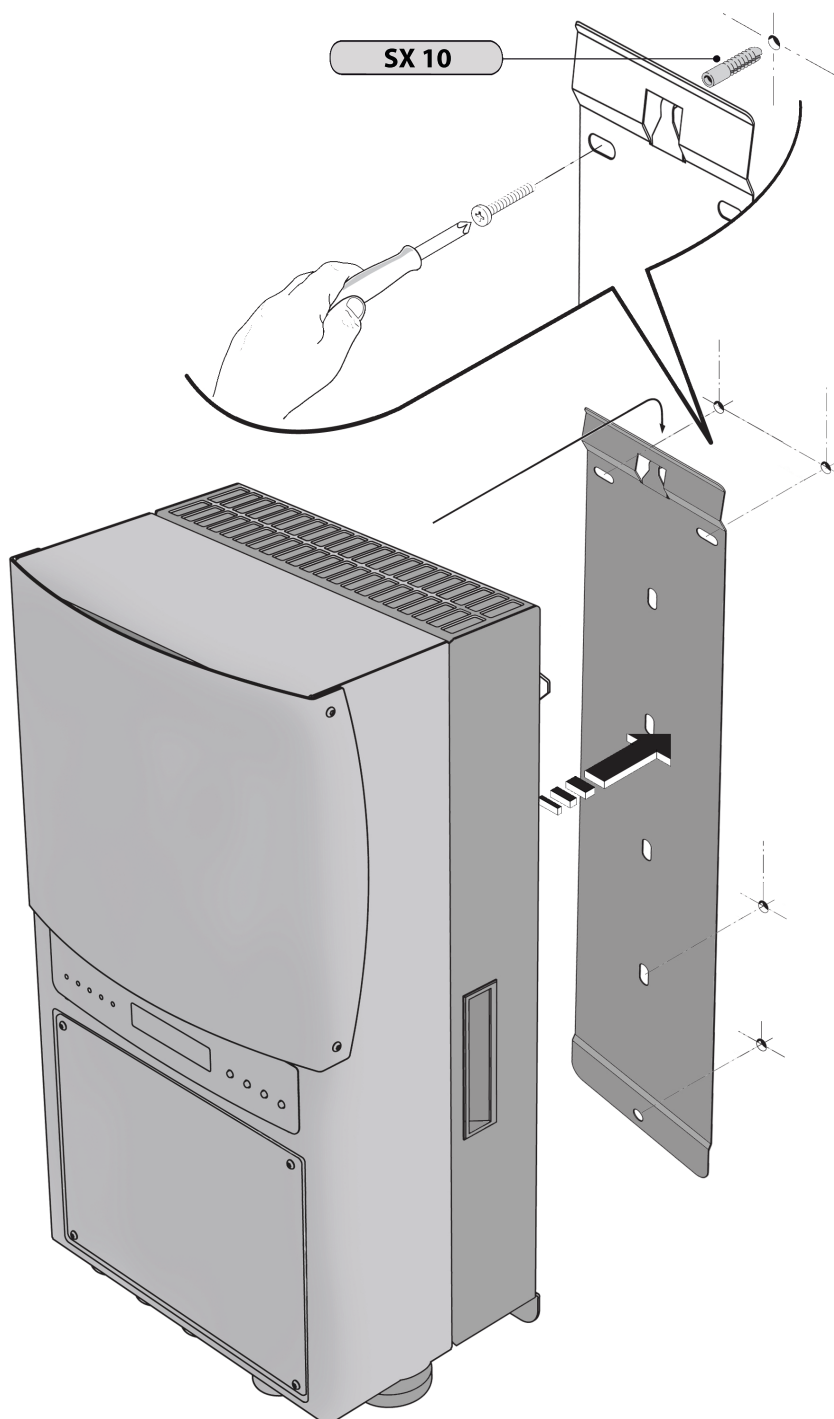
- For a multiple installation, position the inverters side by side.

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

Mounting on the wall

Note, that this chapter details the Installation process steps. The actual installation is called out in Chapter 7.

- Line up the bracket (01) perfectly level and use it a template for drilling
- Drill the 4 required holes, using a 6-8mm drill bit. The hole depth should be 70mm.
- Attach the bracket to the wall with the four anchors (Sx10) and the 4 screws (M6.3 x 70) which came with the hardware.
- Hang the AURORA WIND Interface on the bracket. To help in lifting, use the handholds **07**.
- Attach the AURORA WIND Interface to the bottom of the bracket using an M6 x 10 screw in hole **19**.



Connecting the auxiliary voltage



To avoid electric shock or electrocution, all wiring operations must be carried out with the upstream disconnects (to the turbine) and the downstream disconnects (to the inverters) OPEN, and locked out or tagged out.

The auxiliary voltage (110Vac or 220Vac) is used to power the logic board. The auxiliary voltage cables must pass through opening **17**. The AURORA WIND Interface hardware kit includes cable glands which allow use of any type of conduit on the market; rigid, flexible, spiraled, corrugated, etc. with outer diameter 37mm - 42mm.

Electrical cable must be 3-wire (see "Characteristics and sizing of auxiliary cables and conduit" table below).

Procedure:



- 1) Unscrew the cover from opening **17** and remove it.
- 2) Insert and firmly screw in the cable glands.
- 3) Insert the conduit, which must have sufficiently large external diameter, in the cable glands.
- 4) Tighten the cable glands to securely hold the conduit. Confirm it is held securely in place.
- 5) Insert the 3-wire cable in the conduit.
- 6) Connect the wires (Ground, line, neutral) to the terminals in terminal block **J18**.

Characteristics and sizing of auxiliary cables and conduit

The table below shows the maximum cross-section for the auxiliary wiring.

Conductor:	maximum allowed cross-section (mm ²)
GND,L,N	4

The conduit that has the auxiliary wiring must have the following characteristics:

Type of conduit:	outer diameter (mm)
Rigid, flexible, spiral, corrugated	37-42

Choose the cable cross-sectional area based on the actual operating current.

Service mode

Normally terminals R, S, and T are for the wind turbine voltages, not the grid. For Service mode, two phases (110Vac in North America, 230Vac in Europe) are applied to terminals R and S, permitting the AURORA WIND Interface to feed the inverters with sufficient DC voltage (~160Vdc in North America, 325Vdc in Europe) to turn them and confirm system operation.

AC side cables must pass through any of the four openings marked 16. The hardware kit has cable glands that allow one to connect, through the preferred opening, any type of conduit available -- rigid, flexible, spiral, corrugated, etc -- with outer diameter 37mm-42mm. The electrical cable must be 3-wire.

Sizing and required characteristics of the AC cables and conduit

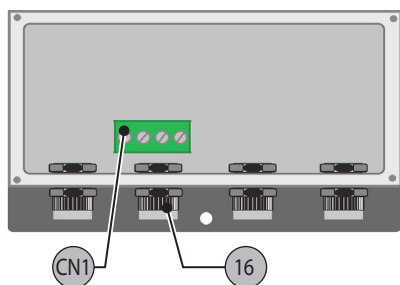
The table below shows the maximum cross-section for the AC-side wiring.

Conductor:	maximum allowed cross-section (mm ²)
S,R,GND	25

The conduit that has the AC-side wiring must have the following characteristics:

Type of conduit:	Diametro Esterno del Tubo (mm)
Rigid, flexible, spiral, corrugated	37-42

Connections for Service mode



Procedure:

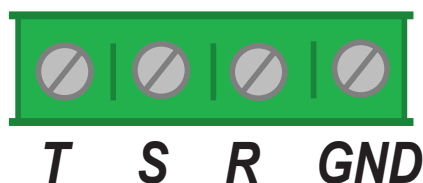
- 1) Unscrew and remove the plug from the opening (16) in the chassis
- 2) Insert and firmly screw in the cable glands.
- 3) Insert the conduit (which must have sufficiently large external diameter) in the cable glands.
- 4) Tighten the cable glands to securely hold the conduit, then confirm it is secure.
- 5) Insert the 3-wire cable in the conduit.
- 6) Connect the wires to terminal block **CN1** (refer to next the paragraph, "Connection to the AC side terminal block")

Connection to AC side terminal block



Wiring must be done with the inverter disconnected from the grid--both the grid-side switch (S2) and the turbine side switch (S1) must be open. The turbine itself must be parked and in safety mode.

Insert the 3-wire cable in the conduit and connect a line (120Vac) and neutral to terminals R and S. Connect the Ground to GND on terminal block CN1. The "T" connection should remain open. Confirm the ground wire is in the correct location.



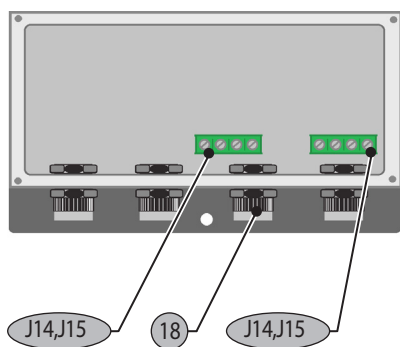
Output connections (DC side)



Wiring must be done with the inverter disconnected from the grid; both the grid-side switch (S2) and the turbine side switch (S1) must be open. The turbine itself must be parked and in safety mode.

The connection of the AURORA WIND Interface output to the DC cables from the inverter inputs will be as follows:

DC cabling must pass either or both of the openings **18**. The AURORA WIND Interface hardware kit includes cable glands which allow use of any type of conduit on the market (rigid, flexible, spiraled, corrugated, etc.) with outer diameter 37mm - 42mm.



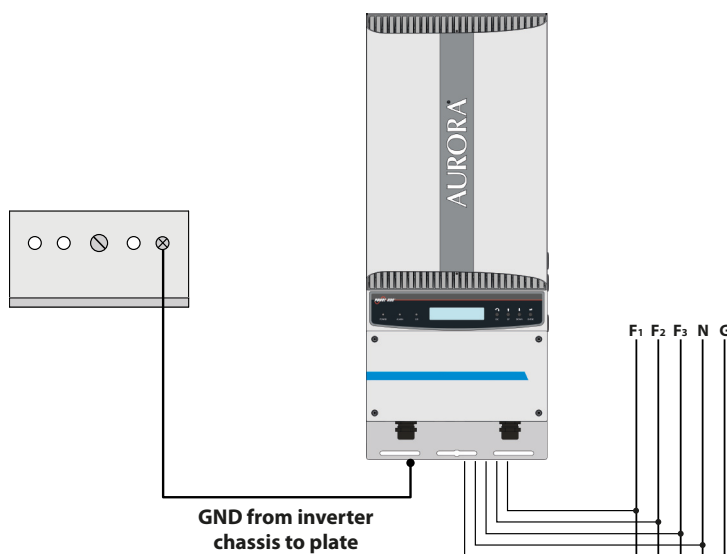
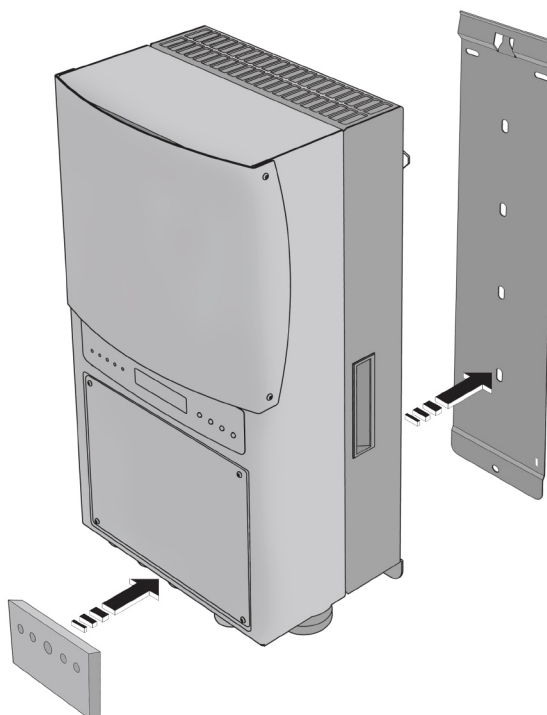
- 1) Unscrew and remove the plug from an opening (**18**) in the chassis.
- 2) Insert and firmly screw in the cable glands.
- 3) Insert the conduit (which must have sufficiently large external diameter), in the cable glands.
- 4) Tighten the cable glands to securely hold the conduit, then confirm it is secure.
- 5) Insert the 3-wire cable in the conduit.
- 6) Connect the wires to power board terminals **J14, J15 (+)** and **J16, J17 (-)** [page 5]. Confirm the polarity.



For North American (-US) models, the ground wires from the inverters must be attached to the metal bus bar included in the hardware kit. Follow the instructions below:

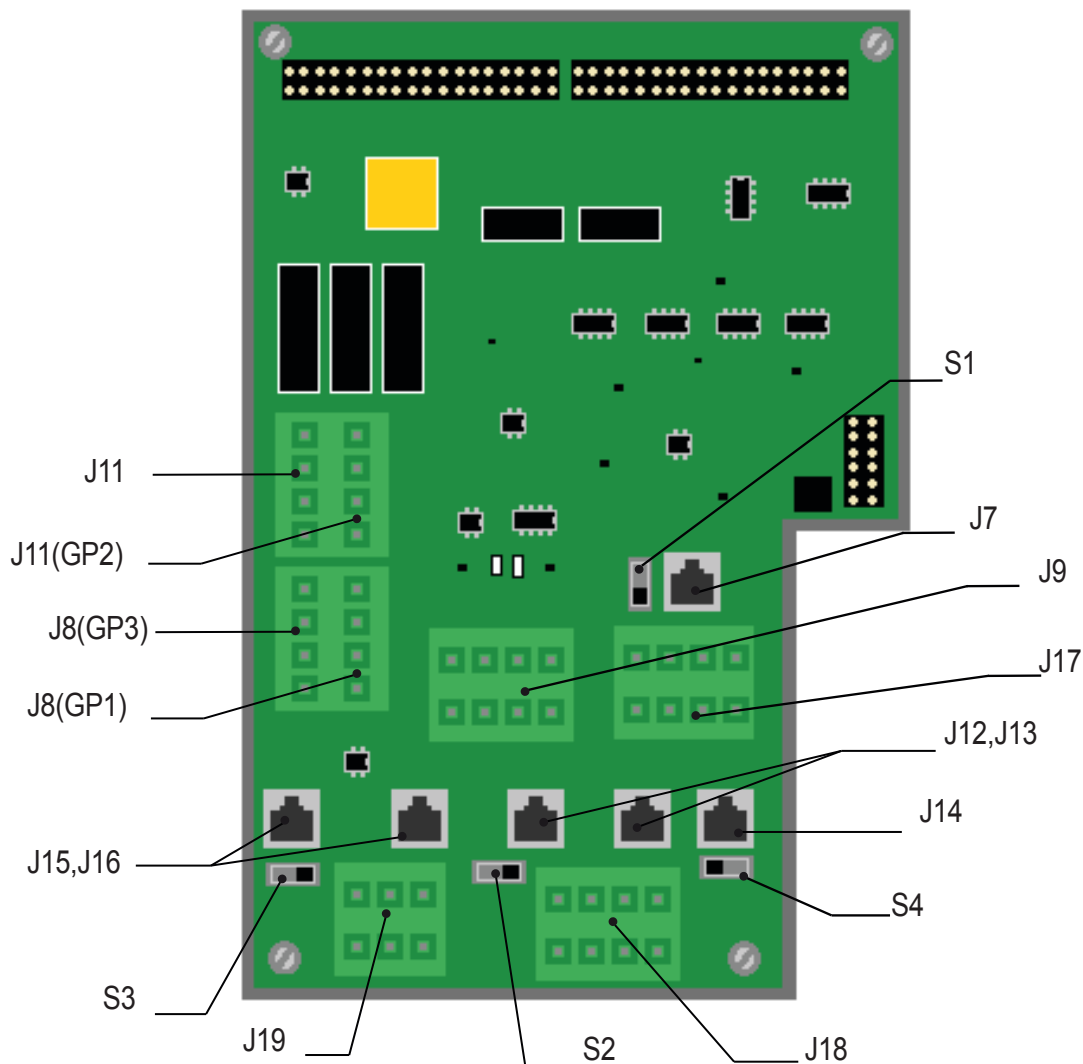
Installation of the copper ground bus bar (North American (-US) models only)

Attach the copper bus bar to the AURORA WIND Interface with the M6 screws and bolts in the hardware kit.



Connect the Ground wires from the inverters to the copper bus bar with the M6 screws, bolts and with terminal lugs.

Communication card

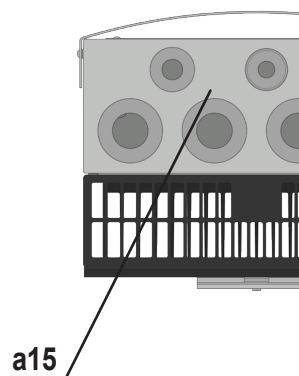


communication card **09**

Reference Designator	Description	Wire Gauge
J17	Auxiliary RS-485 bus connector	1.5mm ² , 16AWG
J14	Auxiliary RS-485 bus - on an RJ45 connector	RJ45
J18	Internal RS-485 bus	1.5mm ² , 16AWG
J12,J13	Internal RS-485 bus - on RJ45 connectors	RJ45
J9	Inverter frequency command connector	1.5mm ² , 16AWG
J8 (GP1)	Relay GP1 connector	1.5mm ² , 16AWG
J11 (GP2)	Relay GP2 connector	1.5mm ² , 16AWG
J8 (GP3)	Relay GP3 connector	1.5mm ² , 16AWG
J7	not used	RJ45
J19	not used	1.5mm ² , 16AWG
J15,J16	not used	RJ45
J11	Emergency Stop signal connector	
S4	switch for setting auxiliary RS-485 termination resistance	
S2	switch for setting internal RS-485 termination resistance	
S1, S3	not used	

Communication card (Logic board) connections

Every wire which is to be connected to the communications card must pass through one of the four service openings **15** [page 5].



- One opening is type PG-21 (21mm). The corresponding cable glands [in the hardware kit] fits conduit with outer diameter 23mm - 25.5mm.
 - Three other openings are of type M20 (20mm) and the appropriate cable glands accept conduit with outer diameters between 20mm and 22mm.
1. Unscrew and remove the plugs from the openings which are to be used for communications board wiring.
 2. Insert and firmly screw in the cable glands.
 3. Insert the conduit (which must be of sufficient outer diameter) in the cable glands.
 4. Tighten the cable glands to securely hold the conduit, then confirm it is secure.

Inverter frequency command signals

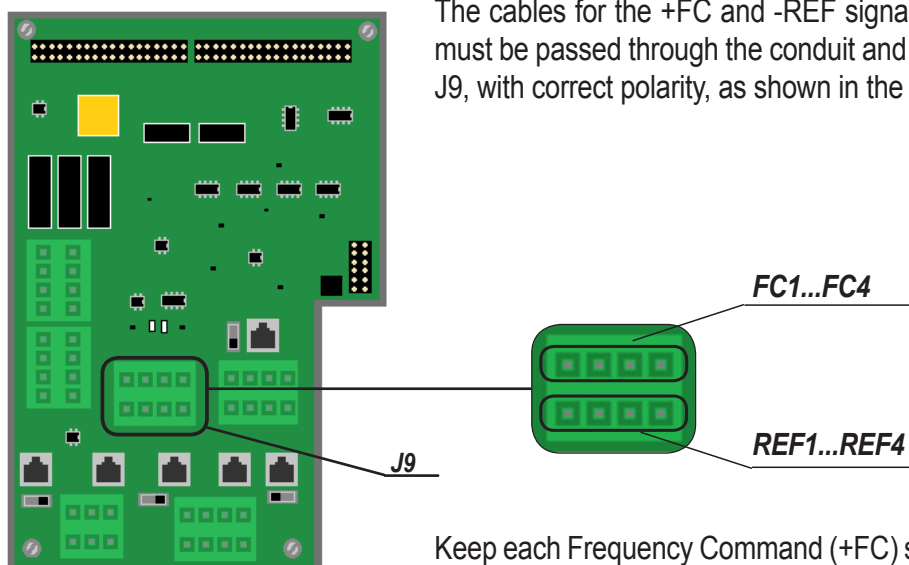
The frequency commands are used to drive each inverter connected to the AURORA WIND Interface.



NOTE 1: A maximum of four (4) inverters may be driven by an AURORA WIND Interface.

NOTE 2: Each inverter's signal pair is isolated from the others.

The cables for the +FC and -REF signals, one pair from each inverter, must be passed through the conduit and then attached to terminal block J9, with correct polarity, as shown in the figure:



Keep each Frequency Command (+FC) signal paired with its corresponding (-REF) signal.

Serial Communication (RS-485)

There are two RS-485 communication buses in the AURORA WIND Interface, the Aux[iliary] and the Int[ernal].

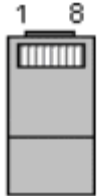
AUX – The auxiliary RS-485 line is dedicated to connecting the AURORA WIND Interface to a personal computer (PC). The PC will be used to modify certain parameters in the product, upload the wind turbine power curve and monitor the plant.

INT – The internal RS-485 line is for communication between the AURORA WIND Interface and its inverter(s).

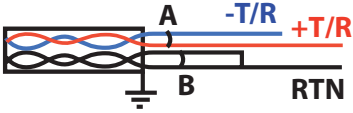
The RS-485 buses (both AUX and INT) may be connected at the communication card's terminal blocks J17 and J18, and/or at the RJ45 connectors at J14 (AUX) and J12, 13 (INT) [page 35]. J12 and J13 are equivalent, and can be used interchangeably for either incoming or outgoing signals with daisy-chained inverters. Details are given in the following section.

i.e. For each RS-485 bus, two types of connections are possible:

- Use terminal block J18 (signals +T/R, -T/R and GND)
- Use RJ45 connectors J12, J13 crimping the wires as follows: :

TOP		Pin Number	Function
		1	not used
FRONT		2	not used
		3	+T/R
		4	not used
		5	-T/R
		6	not used
		7	GND
		8	not used

For connections from some distance away, it's preferable to connect to the terminal block. Use a cable with two twisted pairs with a shield, with characteristic impedance $Z_0 = 120 \Omega$. Wire the two differential data signals on one of the twisted pairs, and the references on the other twisted pair. See the table below:

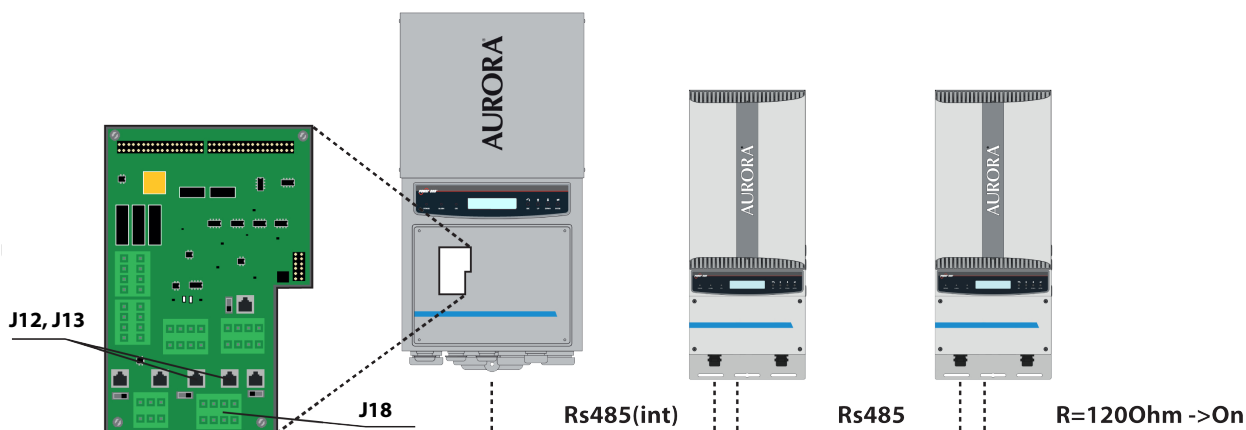
	Signal	Symbol	Twisted Pair
	Positive data	+T/R	A
	Negative data	-T/R	A
	Reference lines	RTN	B

Instructions for connecting the RS-485 (Int) wiring

The internal RS-485 (INT) bus wires must be run through conduit and connected to the inverters in daisy-chain fashion. The wires must not be crossed! Remember to turn on the RS-485 termination resistor in the last inverter in the daisy chain (the inverter farthest from the AURORA WIND Interface). See the inverter manual for instructions.

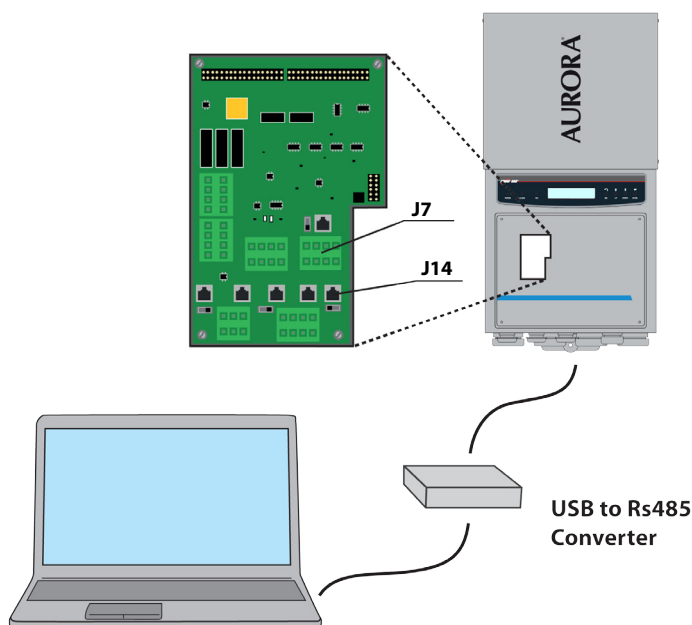


NOTE: Give each inverter a different RS-485 address: The inverter connected at +FC1 and REF1 must have address 2. The inverter connected at +FC2 and REF2 must have address 3, and so on. The RS-485 addresses may be set through the inverter display and/or keypad (see the inverter manual).



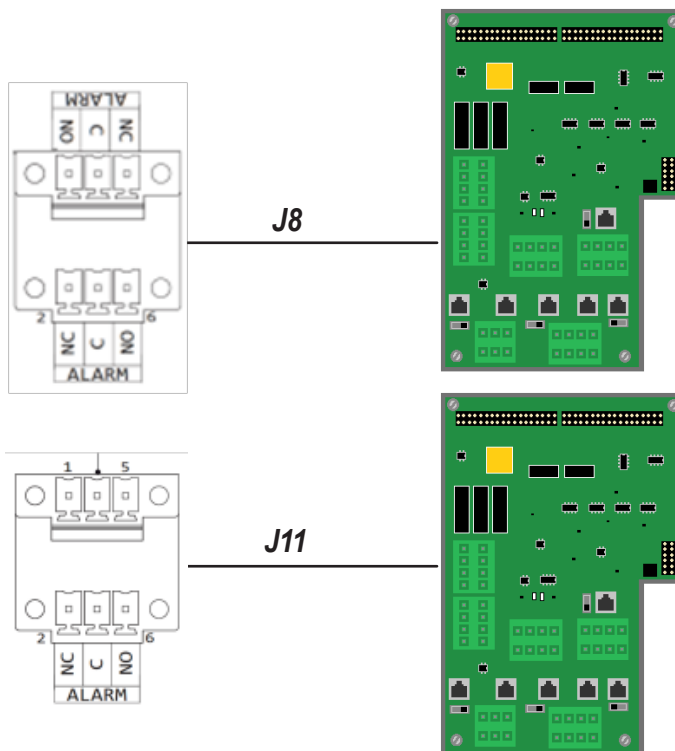
Instructions for connecting the RS-485 (Aux) wiring

Run the RS-485AUX wires to an RS-485/RS-232 or RS-485/USB converter (e.g. Power-One's PVI-USB-RS485_232). The PC-compatible converter and Power-One AURORA WindBoxCVI software are required for communication between the AURORA WIND Interface and a PC.



Configurable Relays

The AURORA WIND Interface has 3 relays for use with optional external components. All 3 may be connected normally open (connecting to the N/O terminal and to C) or normally closed (connecting to the N/C terminal and to C).



Relay GP1 is energized every time there's a "FAULT" detected by the AURORA WIND Interface. In particular, it may be used to drive a dump load to help park the turbine. Relay GP1 may be energized after the brake resistor (BRK1), and the time delay, in msec, is programmable through the software supplied with the product.

Relay GP2 is activated when one wishes to turn on an optional cooling fan for the brake or dump load resistor.

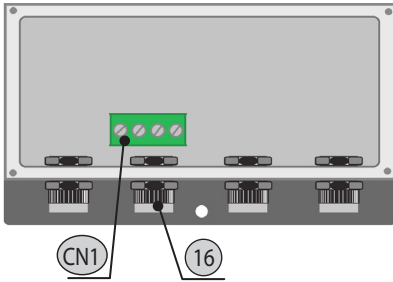
Relay GP3 may be used to disconnect any transformer that might be present in the system from the wind turbine, so to avoid loss of efficiency. During normal operation the relay remains closed, but it opens if there's no DC output from the AURORA WIND Interface for 20 minutes

Emergency Stop button Status



The signal at connector **J11** is for monitoring the status of an external, system Emergency Stop button, external to the AURORA WIND Interface or the inverters. When activated and when grid voltage is present, the AURORA WIND Interface initiates braking

Connection to the Wind Turbine (AC side)



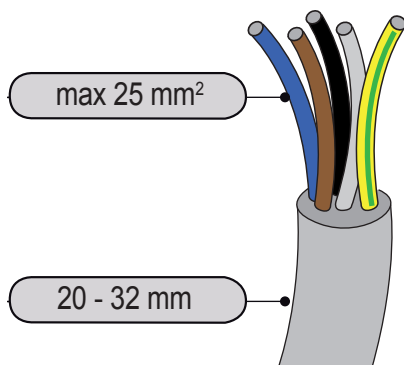
4-wire cable must be used to connect to the wind turbine. It will be run through conduit and connected at terminal block **CN1**.

Characteristics and sizing of the cables and conduit

The table shows the maximum allowable cross-section for the AC-side wires. Remember that the AURORA WIND Interface is required to have a ground connection.

Signal name	maximum cross-sectional area (mm ²)
Line 2, line2, line 3, GND(*)	25

(*) The ground conductor must have the same cross-section as the three phase conductors, at least 10mm²



The conduit containing the AC-side wires must have the following characteristics:

Type of conduit	maximum outer diameter (mm)
Rigid, flexible, spiral, corrugated	20-32

AC circuit breaker

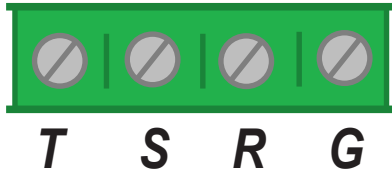
A circuit breaker which can withstand the maximum input current is required to protect the AURORA WIND Interface. The circuit breaker must have the following characteristics, depending on the model:

	EU and APAC models	US models
Type	Automatic switch with magnetic-thermal protection	
Voltage/current/rating	600V/125A	480V/125A
Magnetic protection characteristic	B/C	B/C
Number of poles	3	3

Connection to the AC-side terminal block



To avoid electric shock or electrocution, the upstream disconnects (to the turbine) and the downstream disconnects (to the inverters) must be OPEN and locked out or tagged out when wiring the AURORA WIND Interface.



Run the 4-wire cable through the conduit and connect the wires (Line 1 (R), Line 2 (S), and Line 3 (T) and GND) to terminal block **CN1**.

Connection of the dump load resistor (BRK2)



BRK2

Run the 2-wire conductor from the dump load resistor through the conduit and connect to terminal block BRK2.



The sizing of the dump load resistor is dictated by the characteristics of the individual site and the characteristics of a given wind turbine, and is beyond the scope of this manual. The determination of the resistance (ohms) and dissipation rating (watts) is the responsibility of the wind turbine system designer or the customer. Remember that the values $I_{ABR(max)}$ and $IDC(max)$ must never be exceeded.

Connection of the brake resistor (BRK1)



BRK1

Run the 2-wire cable from the brake resistor through its conduit and connect to terminal block BRK1.



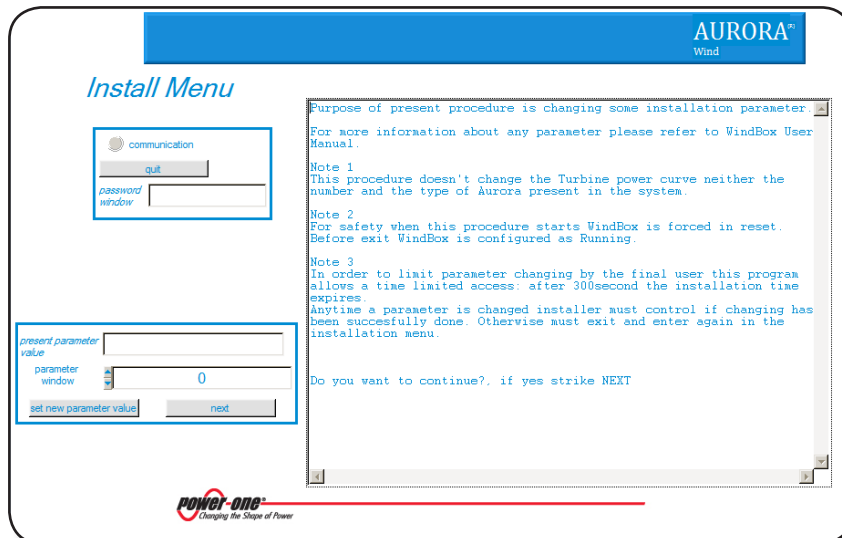
The AURORA WIND Interface is not a safety system for the wind turbine. It does provide the designer and installer some options to reduce the use of external protection devices, but those devices are, nonetheless, necessary.



The correct sizing of the brake resistor is dictated by the individual wind turbine system, and is beyond the scope of this manual. The determination of the resistor value (ohms) and dissipation rating (watts) is the responsibility of the wind turbine system designer or the customer. Remember that the values $IMBR(max)$ and $IAC(max)$ must never be exceeded.

Modifying Wind Interface (control) parameters

1) From the main screen in the AURORA WindBoxCVI software, click, “Reading” and then “Install Menu” and the following screen will appear:



- 2) Click on the “NEXT” button.
- 3) Type “740” in “password windows” and click “NEXT”.
- 4) Click “NEXT” repeatedly, choose the parameter of interest.
- 5) Insert the desired value in “parameter windows” and save it by clicking “set new parameter value.” (For a complete list of modifiable parameters, and a brief description, see the table and text below item 7).
- 6) Repeat steps 4) and 5) for all the parameters which need modifying.
- 7) Exit by clicking “quit” from the installation menu.

List of modifiable parameters

Parameter number	Name	Value Range	Default
95	Polepair	1-60	12
142	GenVmin	20 - 80 V	75 V
141	GenFmin	3 - 50 Hz	6 Hz
149	Brake1Present	0-1	0
122	MaxAuroraBulk	0 - 993 V	850 V
137	Br2StartV	268 - 709 V	669 V
60	TurbinenomPower	0-200000 W	2000W
138	Br2V100	334 - 776 V	736 V
150	EmergencyEnable	0-1	0
51	Service	0-1	0
171	Gp1DelayTime	ms	-
170	DynamicSoftStart	0-1	-
56	BR1StopTime	ms	10000
143	NoSoftStartV	72.5-196.5V	100V

Pole Pair - Enter the number of pole pairs in the wind turbine's permanent magnet generator. This information permits the software to calculate the number of revolutions/minute (RPM).

GenVmin - GenVin is the minimum voltage at which the wind turbine produces sufficient energy to power the inverters. Below this voltage the AURORA WIND Interface turns off its semicontrolled bridge and disconnects from the inverter.

GenFmin - GenFmin is the minimum frequency where the wind turbine produces sufficient energy to power the inverters. Below this frequency AURORA WIND Interface turns off its semicontrolled bridge and disconnects from the inverter.

Brake1Present - Set to a value = 1 if the wind turbine system has a principal brake resistor (BRK1) connected to the AURORA WIND Interface. Otherwise, set to a value = 0. This disables the BRK1 signals.

MaxAuroraBulk - MaxAuroraBulk is the DC voltage at which the AURORA WIND Interface semicontrolled bridge will be opened to protect the inverters from an overvoltage.

Br2StartV - This is the voltage that switches in the dump load resistor (with a PWM signal).

Br2V100 - This is the voltage at which the dump load will be at its full load (full rated power dissipation; PWM at 100%).

EmergencyEnable - Set the value = 1 to enable reading of the status of the wind plant's emergency stop button. Enabling this parameter allows feedback about the status of the plant, and a history of the use of an optional E-stop.

Set the value = 0 to disable reading of the E-stop status.

Service - Set the value = 1 to enable the feeding of power to the AURORA WIND Interface and the inverters from the electrical grid to the inverters. This permits the system to be tested in the absence of wind. Set the value = 0 to disable Service mode and feed the AURORA WIND Interface from the wind turbine. For more details, refer to Chapter 7.

TurbineNomPower - This defines the wind turbine's nominal power (watts).

Gp1DelayTime - This is the delay time, in milliseconds, between the switching of signal BRK1 and relay GP1.

DynamicSoftStart - This parameter may be set to "0" or to "1," and determines which of two operating modes are active for the AURORA WIND Interface. See the paragraph below on operating modes for details.

Br1StopTime - If the turbine doesn't stop within this time, the AURORA WIND interface will post the message "Brake 1 fault" on its display.

NoSoftStartV - Start-up voltage over which special precautions are taken to prevent elevated inrush current into the bulk capacitors. The method used depends on the choice of the "DynamicSoftStart" parameter.

Operating Modes

The wind interface has two operating modes, determined by how DynamicSoftStart (parameter 170) is set during installation.

Mode 1 - DynamicSoftStart (parameter 170) = 0

Use Mode 1 with wind turbines that require braking and stalling when there is high wind or no grid (i.e. use the braking and parking resistor to limit the activation of the mechanical brake).



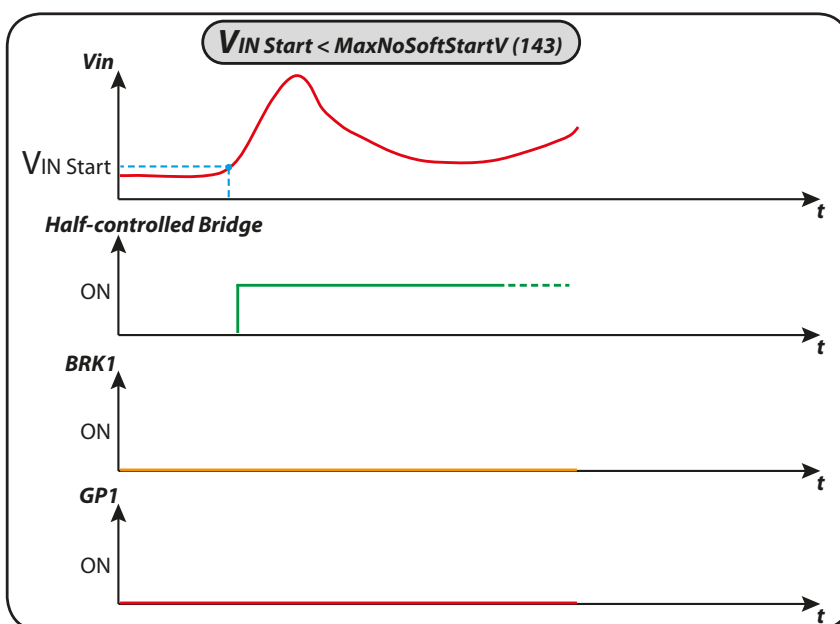
The brake load, connected to the terminal block BRK1 RES, and the parking resistor, connected to the contactor driven by relay GP1, must be always present. If the brake load and parking resistors are not present, a “Brake1Fault” error will be generated by the AURORA WIND Interface during the first attempt at braking.



The AURORA WIND Interface is not a safety system for the wind turbine. It does provide the designer and installer some options to reduce the use of external protection devices, but those devices are, nonetheless, necessary.

- **Start-up procedure**

The AURORA WIND Interface checks its input voltage before starting up. When the input voltage is between GenVmin (parameter 142) and NoSoftStartV (parameter 143), the semicontrolled bridge will be closed and the system can begin to export energy to the grid.



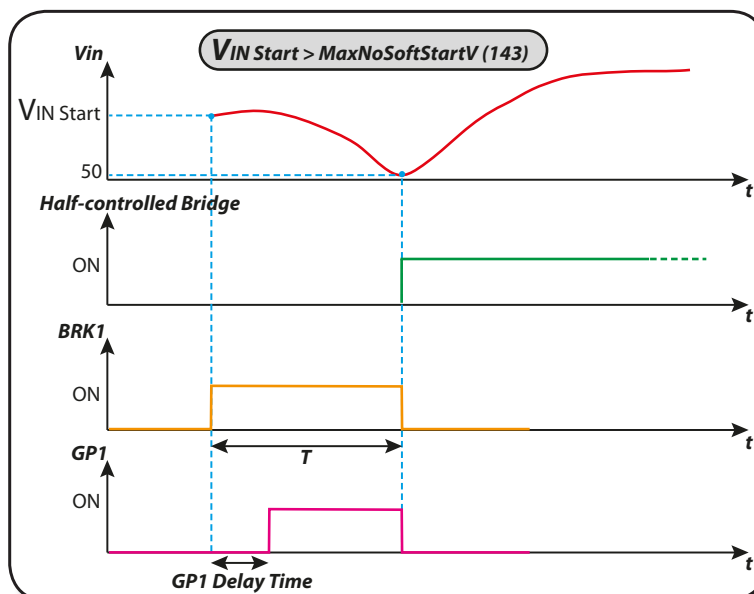
If voltage generated by the wind turbine at startup exceeds the value NoSoftStartV(143), the AURORA WIND Interface activates brake [resistor] BRK1, and then relay GP1, to stop the turbine, and then retries the startup procedure.



Stopping the turbine is necessary to avoid the semicontrolled bridge being closed when the turbine voltage is so high that it would result in excessive [bulk capacitor] inrush current.



T (time) must be less than Br1StopTime(56). Otherwise the AURORA WIND Interface will display a Br1Fault error.



The wind turbine is deemed stopped or stalled when its output voltage, measured by the Wind Interface, is <50V.

If, during time interval T (with upper limit Br1StopTime(56)), the AURORA WIND Interface is unable to bring the wind turbine voltage (which had been >MaxNoSoftStart(143)) under the 50V turbine stop voltage, a Brake1Fault error will be displayed.

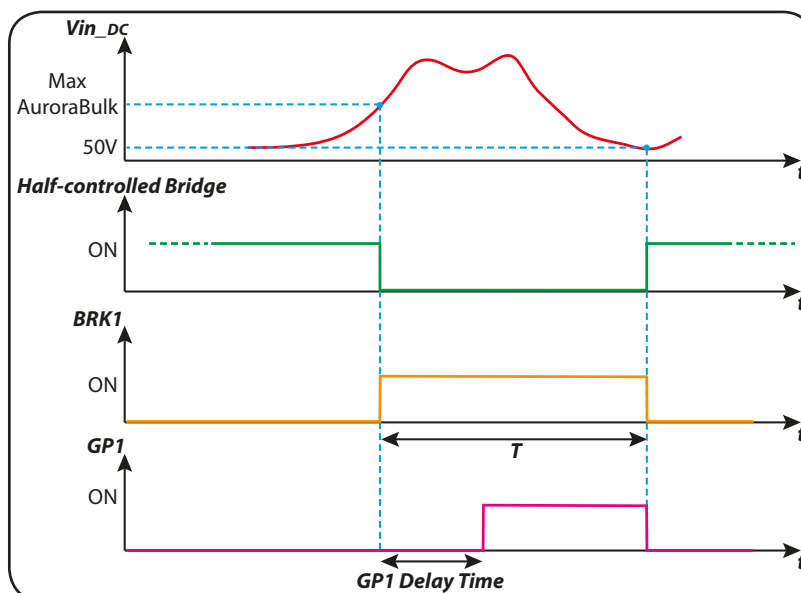
10 seconds after a fault, the Wind Interface will reset and try the brake procedure again.

- **Exceeding the overvoltage specification**

If the overvoltage trip point, set by variable MaxAuroraBulk(122), is exceeded, the semicontrolled bridge will be opened, activating the BRK1 signal and Relay GP1, to protect the inverter from an overvoltage.



T must be less than Br1StopTime(56). Otherwise the Wind Interface will display a Br1Fault error.

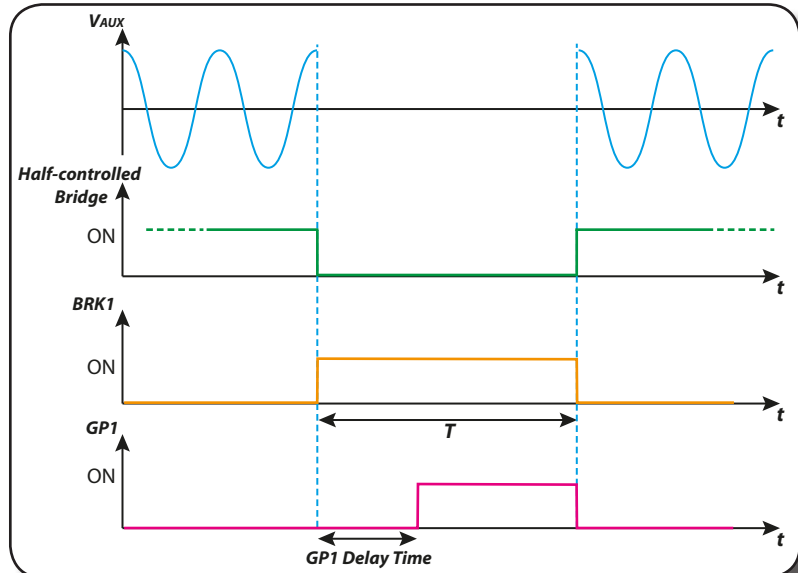


- **Absence of auxiliary power to the AURORA WIND Interface**

The absence of auxiliary supply power to the AURORA WIND Interface is handled in the same manner as an overvoltage. Details are shown in the figure below:



T must be less than Br1StopTime(56). Otherwise the AURORA WIND Interface will display a Br1Fault error.



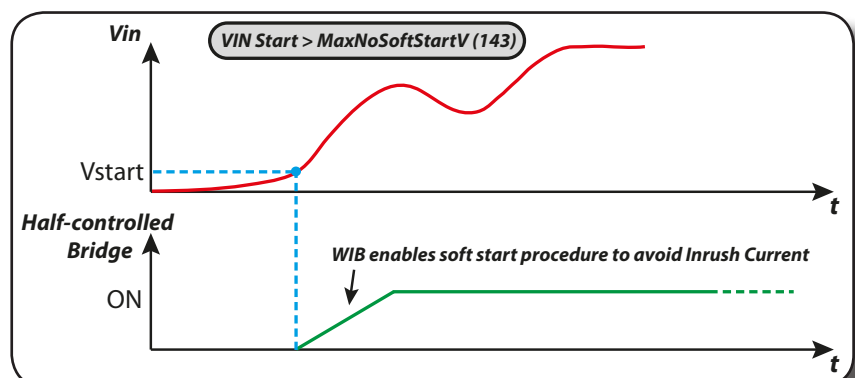
Mode 2 - DynamicSoftStart (parameter 170) = 1

Mode 2 is used with turbines which have an integrated, internal braking system and don't require external electronic or mechanical braking.

- **Start-up procedure**

The AURORA WIND Interface checks its input voltage at startup. When voltage is between GenVmin(142) and NoSoftStartV(143), the semicontrolled bridge will be closed and the system can begin to export energy to the grid.

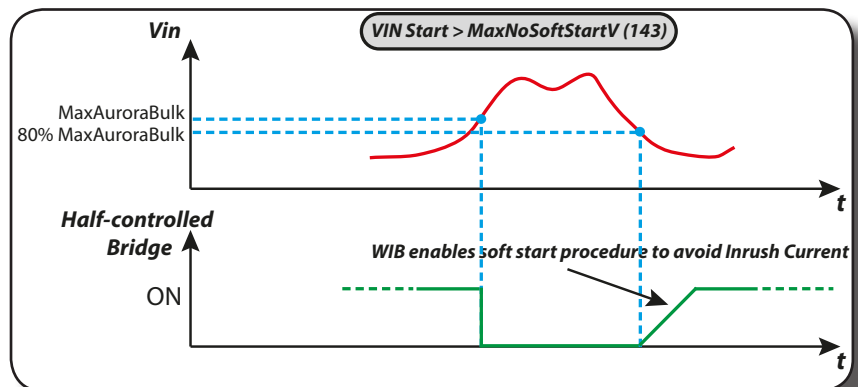
If, instead, the voltage generated by the wind turbine at startup exceeds the value NoSoftStartV(143), the AURORA WIND Interface begins an automatic soft start to avoid excessive inrush current into its bulk capacitors.



- **Exceeding overvoltage specifications**

If the overvoltage trip point, set by variable MaxAuroraBulk(122), is exceeded, the semicontrolled bridge will be opened to protect the inverter from an overvoltage.

When the voltage drops back below 80% of MaxAuroraBulk(122), the soft start process begins, closing the semicontrolled bridge and restarting the inverter.



Entry and modification of the wind turbine power curve

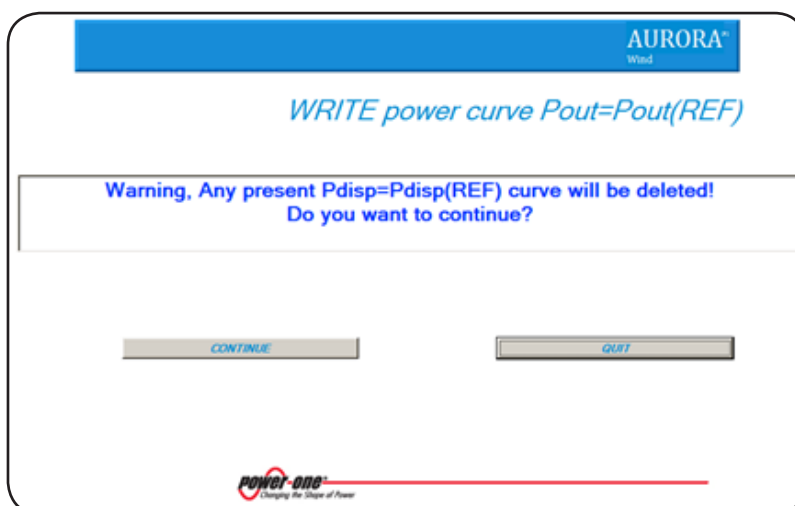


Note: As with all of Chapter 5, this is to be executed when commissioning as described in Chapter 7.

The entry and configuration of the wind turbine power curve must be completed before putting the system in service.

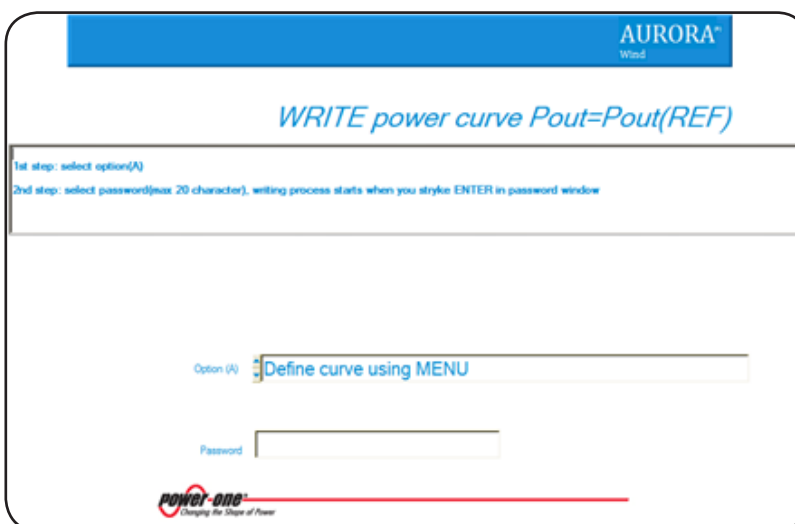
1) In the main menu of the AURORA WindBoxCVI program, click the “reading” button.

2) Click the “WRITE Pout = Pout(REF)” button.
The screen shown in the figure below will open.
Click on “CONTINUE”.



3) Under “Option (A),” choose one of the following two options for entering the power curve:

- **Define curve Using MENU:** Choose this option to define the power curve by entering values in a table.



Choose a password to encrypt the power curve, and press “Enter.” The screen for creating the power curve will appear (following figure):

- Choose whether to define the power curve in terms of DC voltage, or in terms of RPM.
 - “Compile the table” by entering the power curve’s values. If not all 16 points are entered, the table will be completed automatically.
 - Click “SAVE” to save the power curve in the AURORA WIND Interface.
- Copy curve from file “CurveParameter.CRT”:** Choose “Copy curve from file CurveParameter.CRT” to use the second option for defining the power curve, by uploading a curve previously saved on the PC.



The file “CurveParmater.CRT” is automatically saved in the installation path of the AURORA WindBoxCVI software: It must be in the same location as the software.

Choose a password to encrypt the power curve, press “Enter,” and the automatic power curve upload will begin.

6 - Instruments

General conditions



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



Do not use the equipment if:

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

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

Keypad and display

Use various keys on the keypad on the LED panel (04) to input settings and scroll through the data. The LED panel also houses the LEDs which give the operating status of the AURORA WIND Interface.

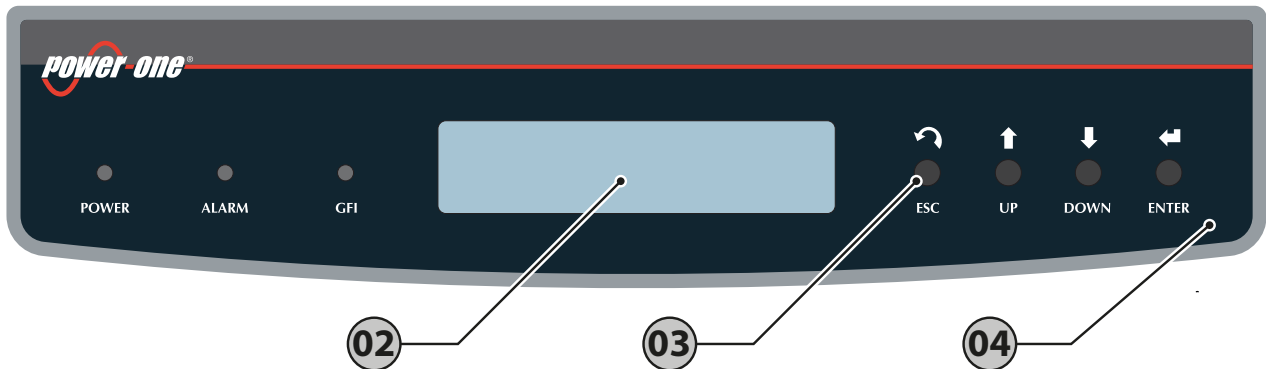


Table: LEDs and key functions

Green POWER LED	Flashes every second to indicate the AURORA WIND Interface is functioning normally (Auxiliary voltage must be present).
Yellow ALARM LED	Indicates the AURORA WIND Interface has sensed an anomaly, and the problem type is shown on the liquid crystal display 04.
Red [GFI] LED	The red LED turns on only in case of a severe fault which disables the system and locks it off.
ESC key	Exits the current mode.
UP key	Scrolls up through the data present on the display, OR, in insert mode, increases the value of the setting being entered.
DOWN key	Scrolls down through the data present on the display, OR, in insert mode, decreases the value of the setting being entered.
ENTER key	Confirms the selected operation, OR inserts the data entered.

7 - Operation

General conditions



Before checking the operation of the equipment, it is necessary to have a thorough knowledge of the INSTRUMENTS chapter and the functions that have been enabled in the installation.

The equipment operates automatically without the aid of an operator; operating state is controlled through the instruments.

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



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

Consult the technical data for further details.

Even during operation, check that the environmental and logistic conditions are correct (see installation chapter).

Make sure that the said conditions have not changed over time and that the equipment is not exposed to adverse weather conditions and has not been isolated with foreign bodies.

Monitoring and transmission of data

User-interface operation

The AURORA WIND Interface provides information about its operation and status through the following means:

- LEDs on the front display.
- Liquid crystal display (LCD) with operating data.
- Data transmitted on the AUX RS-485 serial bus.

These data may be collected on a PC, but an RS-485/RS-232 or RS-485/USB converter will likely be needed. Contact Power-One customer service if there are doubts about the compatibility of a converter.

Types of data available

The AURORA WIND Interface provides two types of data that may be processed through the appropriate software and/or the front display **02**.

Real time operating data

Real time operating data may be transmitted upon request through the communications bus, and are not stored internally by the AURORA WIND Interface. For data transmission to a PC, use the software provided with the AURORA WIND Interface. Confirm at www.power-one.com that the latest version is in use.

Internally stored data

The AURORA WIND Interface will store a series of data points necessary for statistics, and for an error log with time stamps.

Commissioning

Two main tasks are involved in launching a wind turbine system into operation:

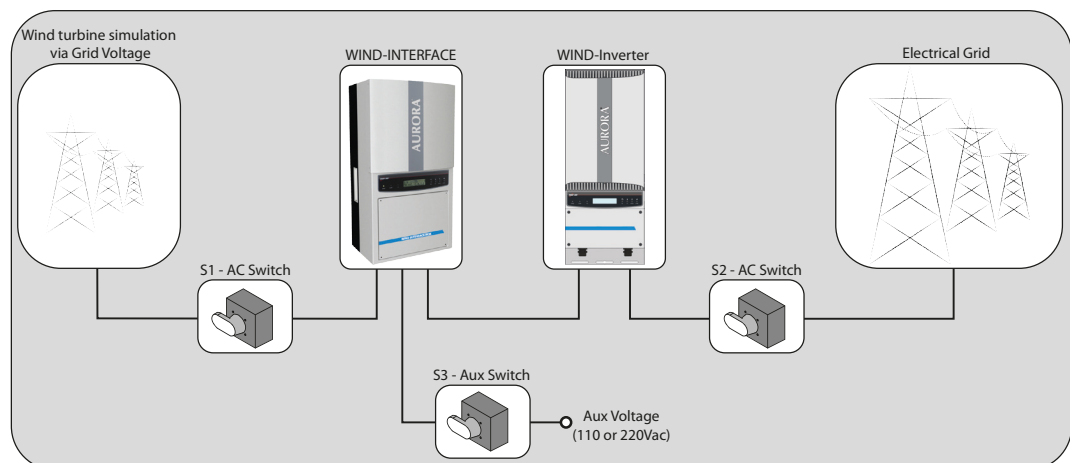
- Set up the system with the AURORA WindBoxCVI software
- Test the system, then put it into service (described below).

Chapter 5 describes how to do the connections, how to get the inverter recognized by the AURORA WindBoxCVI software, and how to upload the wind turbine power curve.

The installation and setup will be confirmed with the turbine off-line by using two phases of the grid voltage (and grid parameter 51 set to 1 = service, described below) to simulate the turbine input. This allows confirmation of the setup under controlled conditions, and in the absence of wind.



As shown in the figure below, the system must have a disconnect upstream from the AURORA WIND Interface (S1), a disconnect downstream from the inverters (S2), and a switch for the auxiliary voltage (S3). For sizing circuit breaker S2, consult the user's manual for the inverters.



In the setup phase, the inverters must not be connected to the grid. Circuit breaker S2 must be open and locked/tagged out to avoid damage to the inverters.

Before carrying out any operation, confirm that the turbine is stopped, in safety mode, and all the switches are open and locked/tagged out.



Read this section and following sections through before starting the step-by-step procedure. Any operation not described in the manual may damage the equipment and create hazardous conditions for personnel.

NOTE. Install AuroraWindBoxCVI software on a Microsoft Windows PC before starting the following procedure.

Testing the system connections

In this section, grid voltage will be connected to the AURORA WIND Interface in place of the turbine. This is done in “service” mode, and still feeds the downstream inverters, to confirm the system connections. Directions for each step are found in Chapter 5.

1. Remove the front panel of the AURORA WIND Interface by removing the screws on the front panel with the TORX T20 key provided in the hardware kit.
2. Connect the auxiliary power cables to the AURORA WIND Interface (refer to the paragraph “Connecting the Auxiliary Voltage”).



Remember to leave circuit breaker S3 open and locked/tagged out.

3. Connect the DC output of the AURORA WIND Interface to the inputs of the inverter (refer to the paragraph “Connections for Service mode,” page 32).
4. Connect the cable for recognition of the inverter to the input of the AURORA WIND Interface (page 32).



Remember to keep S1 switch OPEN and locked/tagged out.

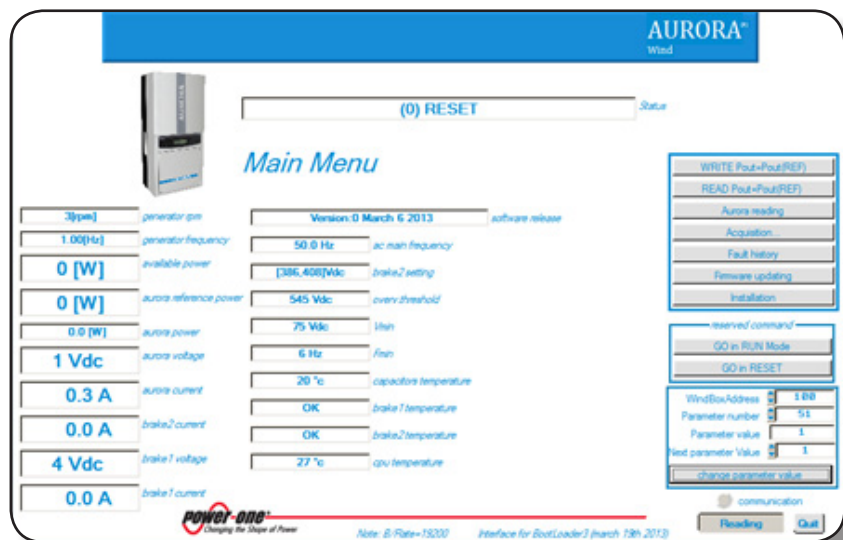
5. Connect the auxiliary RS-485 serial bus from the AURORA WIND Interface to the RS-485/USB converter at the PC.
6. Close switch S3 (auxiliary power to the AURORA WIND Interface) so the AURORA WIND Interface can power up.
7. Open the AuroraWindboxCVI software and click “Start Reading.” Variables and the system status will be displayed.



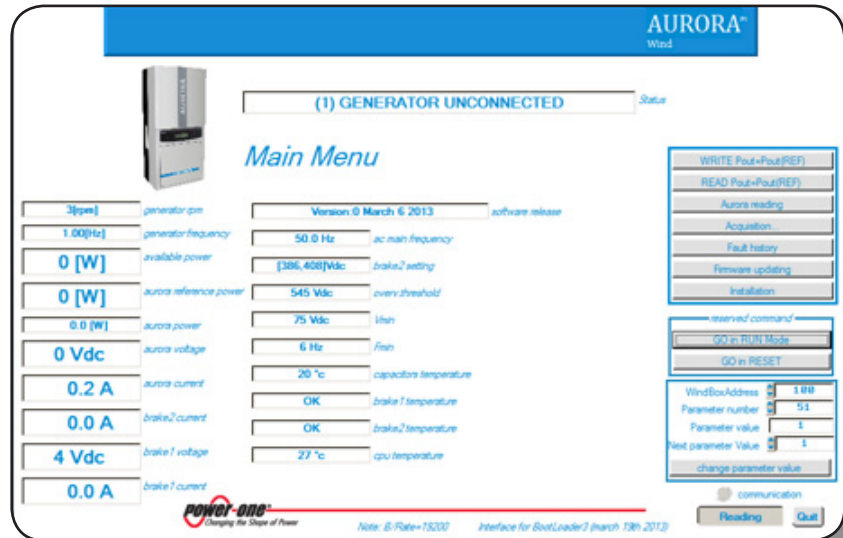
8. Click "Go in RESET"
Insert "470" for the password
Click "CONTINUE".
9. In "Parameter number," insert "51"
In "Next parameter Value" insert "1"
Click "change parameter value".



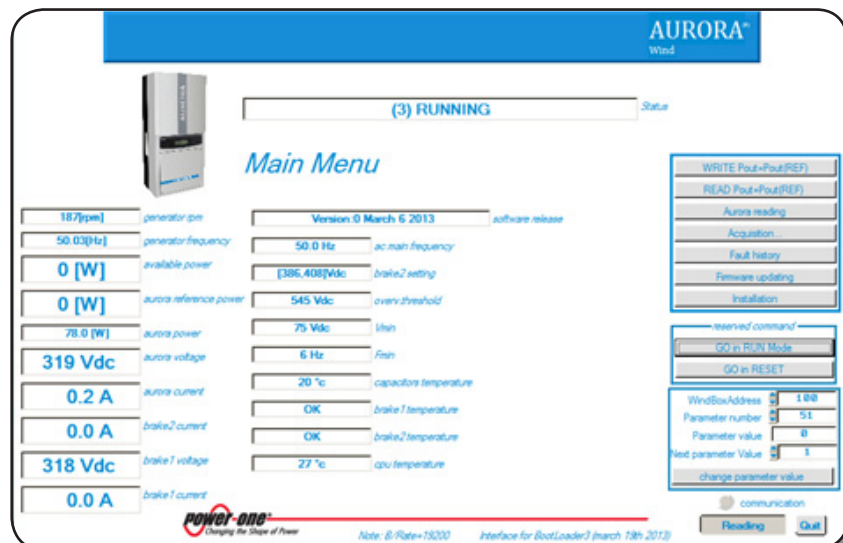
The "Parameter value" will change to "1".



10. Click "GO in RUN Mode".
On the following screen, insert "470" for the password and click "CONTINUE".
The main menu will show the state "(1) GENERATOR UNCONNECTED".



11. Close circuit breaker S1 to simulate the wind turbine using the electrical grid. The AURORA WindBox CVI software state will change to "(2)SOFT START" and then to "(3) RUNNING".



All inverters will turn themselves on.

12. Modify the RS-485 address of each inverter if needed, so that each has a distinct address (refer to the inverter manual for instructions).

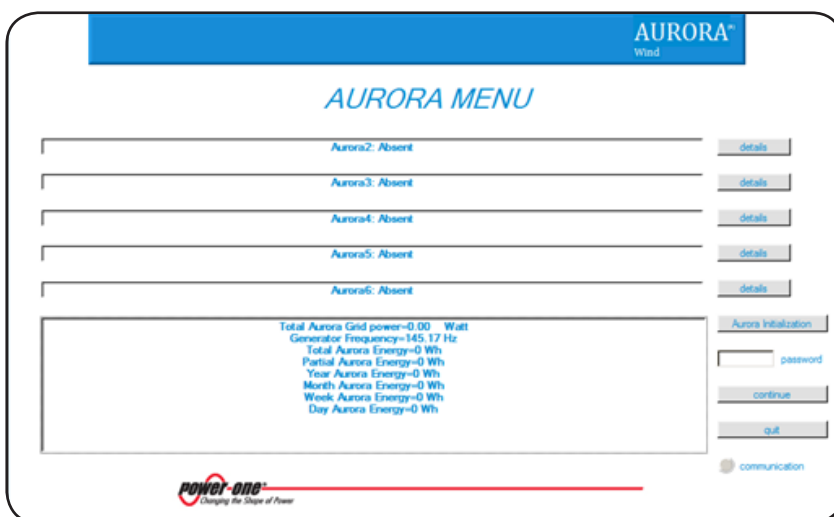


If an inverter shows a "Warning! Empty Table W009" message, it's not in a state where its RS-485 address may be changed. It will be necessary to upload an example wind turbine power curve into the inverter to block the W009 warning. Follow the procedure described in the inverter manual for uploading the wind turbine power curve.

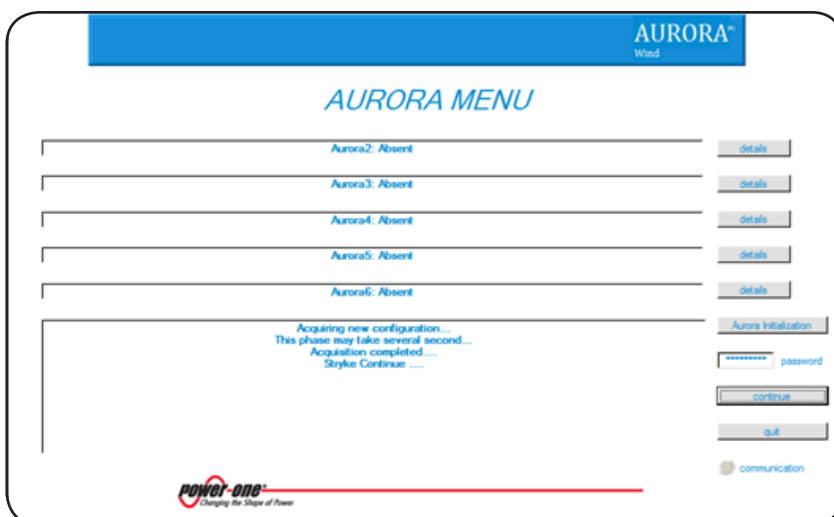


Multiple-inverter systems with a single wind turbine require that the isolation resistance measurement(s) be disabled on the inverters running off isolation transformers.

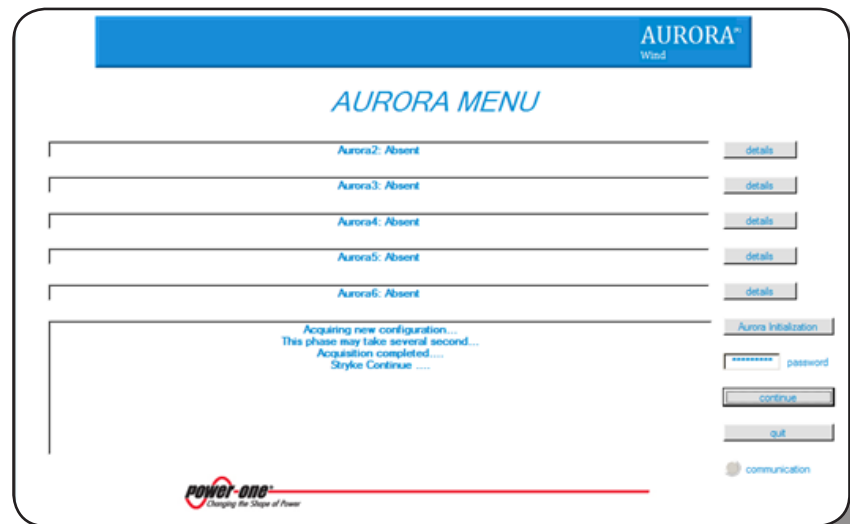
13. Open switches S1 and S3, and wait for the inverters and the AURORA WIND Interface to turn themselves off.
14. Connect the the frequency command cables to the AURORA WIND Interface and to the inverters (refer to the paragraph “Inverter Frequency Command Signals”).
15. Connect the internal RS-485 bus to the AURORA WIND Interface and to the inverters (Refer to the paragraph, “Instructions for connecting the internal RS-485 lines”).
16. Repeat steps 6-11 to reset variable 51 = 1 (in Step 13, it would have defaulted to a value of zero) so the inverter(s) will once again run from the AURORA WIND Interface and the grid. Then continue with Step 17.
17. In the main menu of the AURORA WindBoxCVI software, click “Aurora Reading.” The following menu will appear:



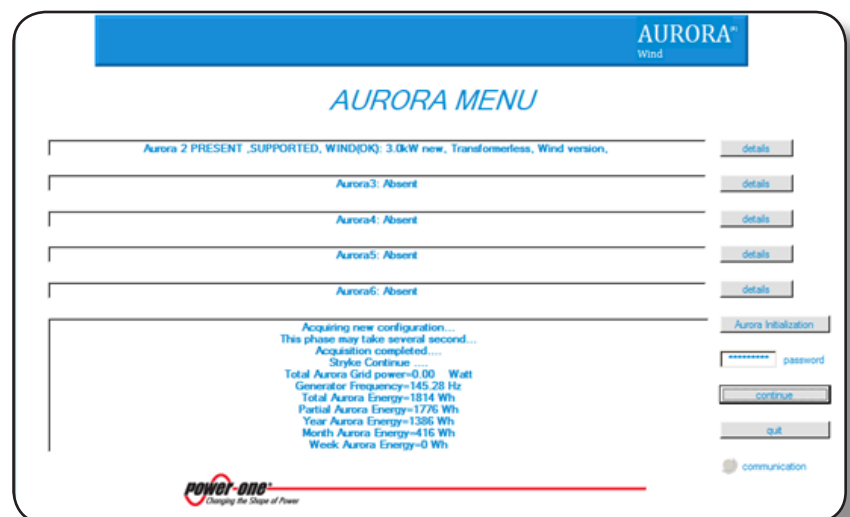
18. Click “Aurora Initialization,” insert “470” for the password, and click “Continue” (screenshot below):



When the procedure is finished, the software displays the following screen:



19. Click “Continue” to display the inverters recognized by the software



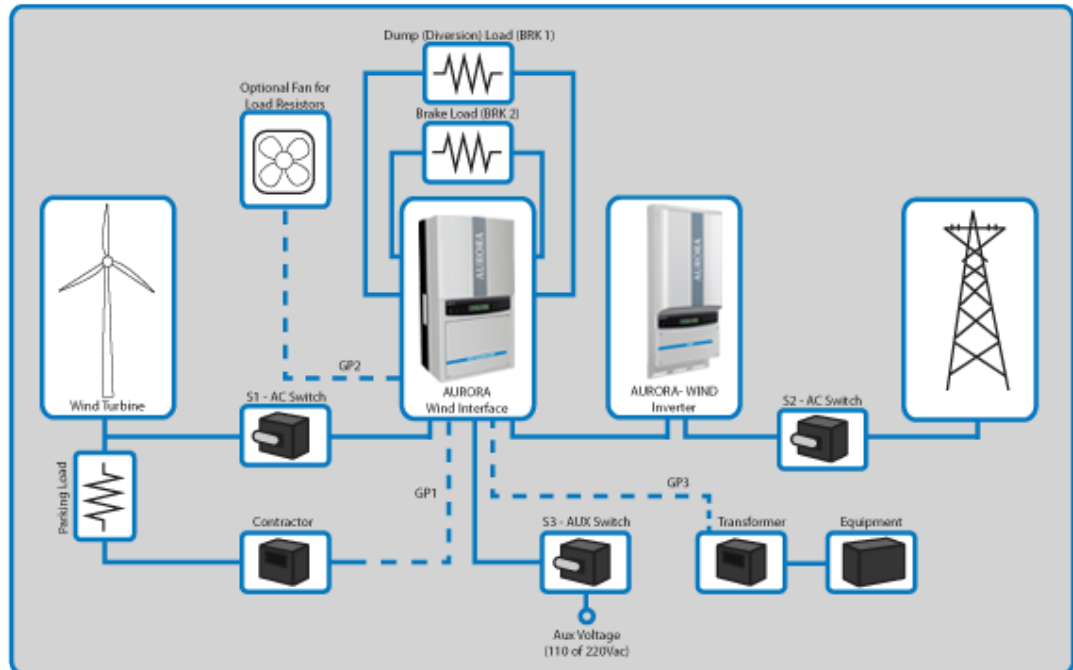
20. Click “Quit” to return to the main menu.
21. Open switch S1 so that only the AURORA WIND Interface remains powered up.
22. Modify the parameters (page 42) as needed, and enter the wind turbine power curve (page 48).
23. Open switch S3 (see the paragraph on S3).

Putting the system into service

Connect the wind turbine to the AURORA WIND Interface, connect the auxiliary braking system, and launch the system into service.



As shown in the figure below, the wind turbine system must have a disconnect upstream from the AURORA WIND Interface (S1), a disconnect downstream from the inverters (S2), and a switch for the auxiliary voltage (S3). For sizing circuit breaker S2, consult the user's manual for the inverters.



Carefully read this section and following sections through completely before starting the procedure. Any operation not described in the manual may damage the equipment and create hazardous conditions for personnel.



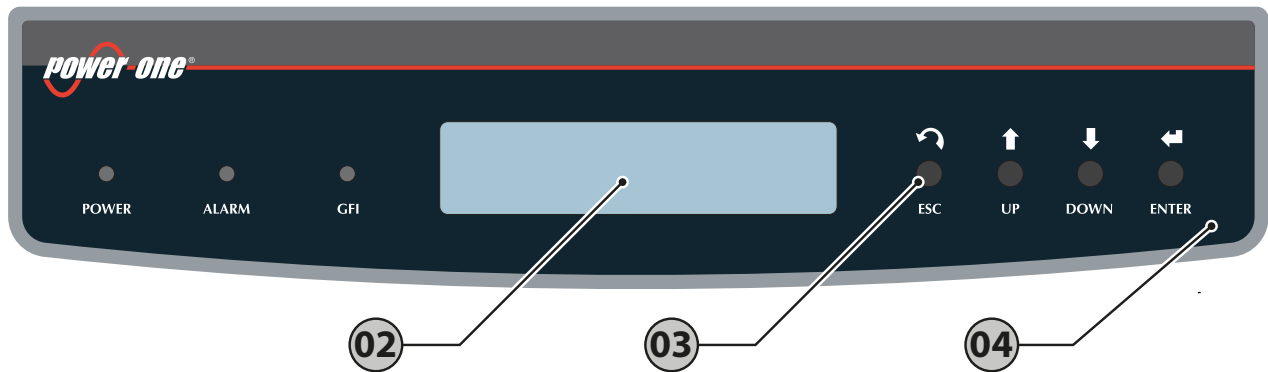
Confirm that the turbine is stopped and in safety mode.

24. Connect the AURORA WIND Interface to the turbine's 3-phase output (Refer to the paragraph "Connection to the Wind turbine (Wind Interface AC side)" in Chapter 5.
25. Connect the inverters to the distribution grid through circuit breaker S2 (Refer to the inverters' manuals for details).
26. Close switches S3, S2 and S1, in that order.

Menus

Navigate through the menus of the LCD **02** using the keypad on panel **04**. The display has two 16-character lines and is used for:

- Displaying the AURORA WIND Interface operating state and statistics;
- Displaying service messages for the operator;
- Displaying alarm and error messages.



The UP and DOWN keys on panel **04** change the location within the menus, and increment or decrement values being input.

The ESC key:

- Accesses three principal submenus, STATISTICS, SETTINGS and INFORMATION.
- Returns, during navigation, to the previous submenu and enters settings.

The ENTER key, during navigation, enters the selected submenu.

Statistics Menu

The STATISTICS menu provides access to:

1. Grid Power (W)

Instantaneous power exported to the grid.

2. Daily Energy (kWh)

Daily energy production.

3. Weekly Energy Production (kWh)

Energy produced during the last 7 days.

4. Monthly Energy (kWh)

Energy produced during the previous 30 days.

5. Annual Energy (kWh)

Energy produced during the last 365 days.

6. Total Energy (kWh)

Total energy produced since the initial power up of the product.

7. Period Energy (kWh)

Energy produced during the selected period.

8. Reset Period (kWh)

Zero the value for the Period Energy selection.

Settings Menu

When selecting SETTINGS, a password is required for entering the submenus.

The default password to access this menu is "0740." [On the display, use all 4 digits]

The ENTER key will scroll from one icon to the next, from left to right

ESC returns to the main menu

DOWN progresses down from 9 to 0

UP progresses up from 0 to 9.

After entering the password, press ENTER to get to the various submenus through which parameters for the AURORA WIND Interface can be changed

1. Language

Chooses the desired menu language.

2. Reset Software

Enables/disables setting of system parameters.

"0": blocks modification of system parameters.

"1": modification of system parameters is permitted.

3. Minimum Voltage

Defines the minimum voltage at which the wind turbine generates enough power for the inverters to be turned on.

4. Vno soft start

Minimum voltage for the automatic soft start or braking of the turbine during startup. Details are in the Operating Modes paragraph.

5. Generator Fmin

Minimum frequency (in Hz) at which the wind turbine has enough energy to feed the inverters. For rotation frequencies below GenFmin, the semicontrolled bridge is held "OFF".

6. Initial Aurora

Initiates the automatic recognition of the inverters connected downstream from the AURORA WIND Interface.

7. Generator pole pairs

Enter the number of pole pairs for permanent magnet wind turbine generators.

8. Max.Bulk.Aurora

The DC voltage at which the Wind Interface box disconnects from the inverters to avoid overvoltage damage to the inverters.

9. Start Voltage Brake 2

The voltage at which Brake 2 (dump load) begins to operate.

10. End Voltage Brake 2

The voltage at which Brake 2 (dump load) reaches its maximum braking function.

11. Brake 1 present

Input "1" if Brake 1 (the Brake resistor, BRK1) is present,
Input "0" if Brake1 is not present.

12. Fan Time

The time (in seconds) that relay GP2 remains energized after Brake 1 and/or Brake 2 are turned off. GP2 can be used to feed a cooling fan for the brake resistors.

13. Enable Emergency

A "1" value enables reading of the state of the plant's Emergency Stop (optional, and external to the AURORA WIND INTERFACE), so the system fault log will have a record of any use of the E-stop.
A value of "0" disables reading of the state of the E-stop.

14. Contrast

Sets the contrast for the display (on a scale from 400 to 900).

15. Backlight

Regulates the brightness of the display (on a scale from 13000 to 19999).

16. Ext RS-485 address

Sets the AURORA WIND Interface RS-485 address. Values can run from 100 to 107. Use the UP and DOWN keys to scroll through the numbers.

17. Service

This simulates the wind turbine by connecting the grid to two phases of the AURORA WIND Interface input. This procedure permits powering of the inverters in the absence of wind, so the system setup can be tested.

Information Menu

The information menu shows data on the AURORA WIND Interface and the inverters.

1. Wind-Box

• Part/Number

Displays the part number for the AURORA WIND Interface.

- **Serial/Number**

Displays the serial number for the AURORA WIND Interface.

- **Soft.Release**

Displays the AURORA WIND Interface software revision level.

- **Executed Restart**

The number of RESETs done to the AURORA WIND Interface.

- **Status**

- **CPU Temperature**

Temperature measured at the CPU.

- **Cap Temperature**

Temperature measured at the bulk capacitors.

2. Aurora #x

“x” is the number of the inverter for which to display information (where inverter 1 = RS-485 address 2, etc).

- **Part/Number**

Displays the part number for inverter “x”.

- **Serial/Number**

Displays the serial number for inverter “x”.

- **Alarms**

Displays any alarms (errors or warnings) posted by inverter “x”.

- **State**

Displays the alarm status of inverter “x.” Value = 0 is no alarm.

3. Brake #1

- **Status**

Status of brake #1 (dump load resistor).

- **Restart done**

- **Resistance**

Value in ohms calculated from reading the internal voltage and current sensors.

- **Temperatura 0/1**

Temperature of the brake circuit's IGBTs.

4. Brake #2

- **Status** Status of brake #2 (dump load resistor).

- **Restart done**

- **Resistance** Value in ohms calculated from reading the internal voltage and current sensors.

- **Temperature 0/1** Temperature of the brake circuit's IGBTs.

5. Generator

- **RPM**

- **Voltage**

- **Power**

8 - Maintenance

General conditions

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



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



For cleaning, DO NOT use rags made of filamentary material or corrosive products that may corrode parts of the equipment or generate electrostatic charges.

Avoid temporary repairs. All repairs should be carried out using only genuine spare parts.

The maintenance technician is under an obligation to promptly report any anomalies.

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



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

Routine Maintenance

Routine Maintenance operations are not considered mandatory, but are certainly recommended to keep the plant operating efficiently.



Maintenance operations must be carried out only by qualified personnel, or by Power-One Field Service Engineers. Contact Power-One Customer Service regarding maintenance contracts.

Maintenance frequency will vary depending on environmental conditions at the site.

Table: Annual Maintenance

Visual examinations:	• Confirm the AURORA WIND Interface is functioning normally, without alarms • Confirm all labels and safety warning and clean and visible • Check the integrity of all cables, connectors, cables, cable glands outside the AURORA WIND Interface box • Confirm that environmental and site conditions haven't changed considerably since installation
Annual preventative maintenance activities	• Check the tightness and torque of the cable glands and screws on the terminal blocks • Check the tightness and seal of the front cover • If a real-time monitoring system is not in use, check the alarm and error history, using the instructions in applications notes, to check for any recent malfunctions and their possible causes
Annual cleaning	• Clean the AURORA WIND Interface, in particular the back heatsink

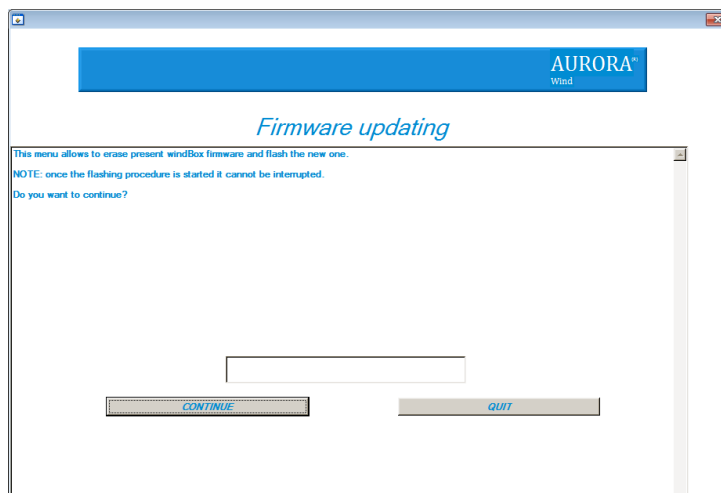
Firmware Updates

Firmware updates reset all parameters to their default factory values. Before starting, record any parameters which may need to be re-entered later. When a AURORA WIND Interface firmware update is required, follow this procedure, step by step:

- Download the file Windbox_CC.hex, where “CC” is the latest version of the firmware, from the site <https://registration.power-one>.
- Copy the file Windbox_CC.hex to the folder where the AURORA WindBoxCVI software is installed (example; C:\Program Files\Dsp8025CVI).
- Rename the file from Windbox_Cc.hex to Windbox.hex

If the file Windbox.hex already exists, erase it and proceed with the renaming.

- Power AURORA WIND Interface by closing switch S3. Open, or leave open, the upstream switch S1 and downstream switch S2.
- Open the AURORA WindBoxCVI software, click on the “Reading” button and then on “Firmware upgrading.” The following screen will appear:



- Click the “continue” button, insert the password “2323,” and click “continue” again.
- The firmware upgrade will start. When complete, the status on the AURORA WIND Interface display will read “Run Mode Turbine Stopped.”



After the firmware update, all the parameters will be reset to their factory default values. Go to the “Installation” menu to reset them as required for any given wind system.



Before reactivating the wind plant, close switches S1 and S3, and confirm that all AURORA WIND Interface settings and parameters have been correctly re-entered.

Storage and dismantling

Storage of the equipment or prolonged stop

If the equipment is not used immediately or is stored for long periods, check that it is correctly packed and contact **Power-One** for storage instructions.

The equipment must be stored in well-ventilated indoor areas that do not have characteristics that might damage the components of the equipment.

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

Dismantling, decommissioning and disposal

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

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

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

Table: disposal of components

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