NOVASTAR

INVERTER FOR GRID FEEDING

OPERATION & INSTALLATION MANUAL

MODELS: SEAG-110-2K5
SEAG-110-4K0

SERIAL NO: _____

MODEL NO: _____

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General Information

Thank you for choosing to purchase another quality inverter from Solar Energy Australia. This product has been developed to provide you with many years of trouble free operation. Your SEA NovaStar Grid Feed Inverter demonstrates the latest technology, and draws from experiences as a pioneer in the application of this technology.

It is important to us that you get the best out of your NovaStar, so please take a few minutes to read this manual carefully; it could save you from frustration. If you have any comments regarding our products and / or service, please do not hesitate to contact us to discuss your thoughts.

Remember: As soon as your Solar Energy Australia Inverter has been installed please complete and return your warranty card and/or warranty extension card. This will enable us to efficiently handle any service enquiries you may have and keep you updated with any relevant information

Features Include:

- Simple to install.
- No Battery Bank required.
- High Efficiency.
- Extremely robust design.
- Liquid Crystal Display provides system information
- Efficient Maxiumum Power Point Tracking
- Designed for harsh climatic conditions
- Conservative ratings
- DC & AC EMC attenuation

IMPORTANT: YOU MUST REGISTER YOUR WARRANTY

SOLAR ENERGY AUSTRALIA WARRANTY Terms and Conditions

Solar Energy Australia considers reliability of your power system/inverter as absolutely critical. We would rather avoid any potential inconvenience by being proactive. Many external influences can effect the reliability of an inverter, none of which are under the control of Solar Energy Australia. For these reasons we request that you register your warranty within 60 days of purchase. Warranties which are not registered receive a 6 month warranty.

These terms and conditions do not exclude your rights under the statutory or implied warranty within your state or territory.

Solar Energy Australia warrant this product against defects in material or workmanship, to the original purchaser only for an initial period of 6 months from date of purchase, when in normal use and service. The warranty period will be extended to a total of two (2) years when you register your warranty within 60 days of purchase (max. 3 years after date of manufacture). No warranty will be provided on units which have not been paid for in full.

This warranty does not extend to products which have been opened, altered or repaired by persons other than authorised by Solar Energy Australia or to products which become defective due to acts of God, fire, sabotage, vandalism, contaminated fluids, negligence or failure to operate, house and maintain the product in accordance with instructions provided in this manual.

It is extremely important that all installation and operating instructions contained within this manual are strictly adhered to. Failure to do so will void your warranty. Units which are to be permanently installed/used within 1km of the coast should use the marine version of our product, this will help to avoid corrosion problems which are not covered under the terms of this warranty..

Solar Energy Australia will use the information you supply to carry out a system check, to attempt to avoid any problems before they occur. Solar Energy Australia will repair or replace the defective product in accordance with its best judgement. For service under warranty, the buyer or installer must contact Solar Energy Australia to obtain appropriate paper work and shipping instructions before returning the unit. To make a warranty claim you must produce proof of purchase when returning the unit. Units returned without prior authorisation or warranty registration will be delayed. The buyer will pay all charges incurred in returning the product to the factory including, installers time. Solar Energy Australia will pay return freight charges, if the product is found to be defective, within the terms of the warranty. Repair or replacement of any unit does not extend the original warranty terms in any way.

This warranty does not cover repairs made necessary due to the product coming in contact with dirt, abrasives, moisture, rust, corrosion, varnish or other similar, insufficient system maintenance, failure due to poor quality or poor condition batteries, failure to use the appropriate AC transfer switch or wiring carried out by inappropriately qualified personnel.
Solar Energy Australia will in no way be held responsible for any losses incurred due to the malfunctioning or failure of a product.
Suitably qualified personnel must carry out all AC & DC permanent wiring . Failure to do so will void warranty.

To register your warranty you must do the following:

- ❖ Return your completed warranty registration card within 60 days of purchase.
- ❖ Fixed installations must provide a picture of the installation from a distance of 1 metre, household installations must supply a second picture showing the structure housing the inverter.
- ❖ Circuit diagram of installation. This can be obtained from your installer.

If the above items are not received, they may be requested before work can commence on any faulty units. Solar Energy Australia is here to help.

These measures are put in place to ensure you have years of trouble free service from your Solar Energy Australia inverter. If you have any questions about this warranty please do not hesitate to contact us.

ALL Installations must be carried out by suitably qualified personnel. All work must adhere to relevant standards and local utilities requirements. AS4509 & AS3000 are recommended

INSTALLATION

Before beginning to install your NovaStar, it is important you have correctly matched your solar modules to the input of the NovaStar.

A grid feeding inverter is rather different from a traditional Stand Alone or battery inverter.
Your NovaStar must NEVER be connected to a battery bank, instead solar modules are connected directly to the input of the NovaStar.
Solar modules are wired in series to match the input voltage of the inverter, here is guide on how to do this.

Most crystalline solar modules will not produce their rated output for long periods, normally dropping back to around 85-90% of their rating, this is more likely when the solar cell temperature exceeds 25 C. Keep in mind that a solar cell works at approximately 15° C above the ambient temperature. Therefore based on the rating of this style of module it is possible to connect a slightly greater amount of module power to the inverter.

Eg, If you connected 2500watts of crystalline solar modules to the SEAG-110-2K5, you will most likely be putting in around 2250watts most of the time. By adding an additional 250watts of crystalline solar modules (2750watts total) the input figure will more likely be 2500watts. If the input is too great for the inverter, the inverter will simply limit the amount of input power by shifting the maximum power point.

MPPT Maximum Power Point Tracking
Any solar module has a point where its output voltage and output current are at their maximum, this is called the Maximum Power Point. Volts x Current = Power. This is usually stated on the back of the module as MPP, or may be shown on a graph in the instruction manual, please note that the maximum power point will vary with temperature.

Your SEA Novastar will extract the maximum amount of power from your solar modules by constantly varying its input voltage to match the MPP voltage of your solar modules. This method extracts the greatest possible power from the solar modules.

Solar Module Configuration
Modules In Series (Series string)
Solar modules are connected in series to make up the necessary input voltage, this will normally be 6 in series. The important parameters are the MPP voltage of the series string does not exceed 115vDC and the open circuit voltage of the series string does not exceed 140vDC. It is recommended that the MPP voltage of the series string at 25°C be at least 25% above the minimum MPP voltage of the inverter.

Modules in Parallel
Once you have created a series string, you can add Parallel strings to increase the power. The number of parallel strings allowed is determined by the maximum input current and maximum power of the inverter, which ever comes first.

MODULE	BP 380
NOMINAL PEAK POWER	80 Watts
PEAK POWER VOLTAGE	17.6V
PEAK POWER CURRENT	4.55A
SHORT CIRCUIT CURRENT	4.8A
OPEN CIRCUIT VOLTAGE	21.1V

Parameter	SEAG-110-2K5	SEAG-110-4K0
Maximum Open Circuit voltage of Solar Array	140v DC @ the minimum ambient day temperature.	
MPP(Max Power Point) Voltage of series modules	72v-115v DC	
Nominal Working Voltage	96v DC	
Maximum Solar Array Power Rating*	2750watts	4400watts
Maximum DC Input Power Continuous @ 40°C	2500watt	4000watts
Maximum total DC current from Solar Array	33A DC	52A DC

Above are the ratings for a BP 80watt module. Given these specifications we can work out the required configuration for the SEAG-110-2k5.

No of Modules in series.
Inverter Maximum Open Circuit Voltage divided by Module Open Circuit
= 140V/22.1V= 6.3 modules in series.
Use 6 modules in series. String MPP voltage = 6 series modules x 17.6V = 105.6V this is less than 115V (maximum MPP) and 47% greater than 72V (minimum MPP)

No of Modules in parallel.
Each series string of six modules will have 6 x 80 = 480 watts @ 4.55Amps.
Maximum size of array divided by power of each series string = 2750w/480w = 5.7 = 5 parallel strings.
5 parallel strings will produce 5 x 4.8 Amps = 24A, this is less than 33A (maximum current).
In this example a maximum of 30 x BP380 watt modules can be connected.

The minimum number of solar modules that can be connected is 6 x 40 watts.

Solar Module Wiring

It is very important that you are aware of the requirements of the local electricity authority, requirements may vary between authorities.

Careful attention should be paid to the cable used to wire solar modules to the Inverter, when choosing a cable ensure that:
The cable is rated for operating voltage of the system (110v DC)
The cable allows no more than 5% voltage drop of both conductors.
The cable can accommodate any future expansion of the system.

NovaStar with Wind Generators.

It is possible to use the NovaStar using a wind generator as an input. It is Critical that the wind generator will NEVER exceed 140v DC, not even for a very short duration. This situation is most likely when the NovaStar disconnects from the AC grid whilst significant DC power is being fed from the wind generator. Voltages in excess of 140v DC will damage the inverter and can be detected by the repairer. You must consult your wind generator supplier to confirm suitability with the NovaStar.

If using a wind generator, you will need to disable the maximum power point tracking, thus is done by removing the link from J1 see elsewhere in this manual for location of J1

Lightning Protection for Grid Inverters

To protect any grid-feeding inverter from lightning transients, it is recommended that an analysis of the severity and frequency of lightning strikes be done on each installation and the appropriate suppression measures be taken. AS1768:1991 is the best reference document for this analysis. Depending upon the degree of protection which a particular client requires, some or all of the following may be required:

1. Protection of the AC feed into the inverter: The inverter is shipped with lightning protection to AS1768-1991, category B on the AC feed. This suppression is suitable for inverters which are mounted inside buildings and are fed via short or long feeds from the main switchboard.
If the inverter is installed in a building right at the AC service drop from the pole, if it is installed close to the solar array, or if it is mounted anywhere outside, it is recommended that additional suppression to AS1768-1991, category C be installed on the inverter grid connections. Varistors should be connected between line and neutral, between line and earth and between neutral and earth as close as possible to the input to the inverter.

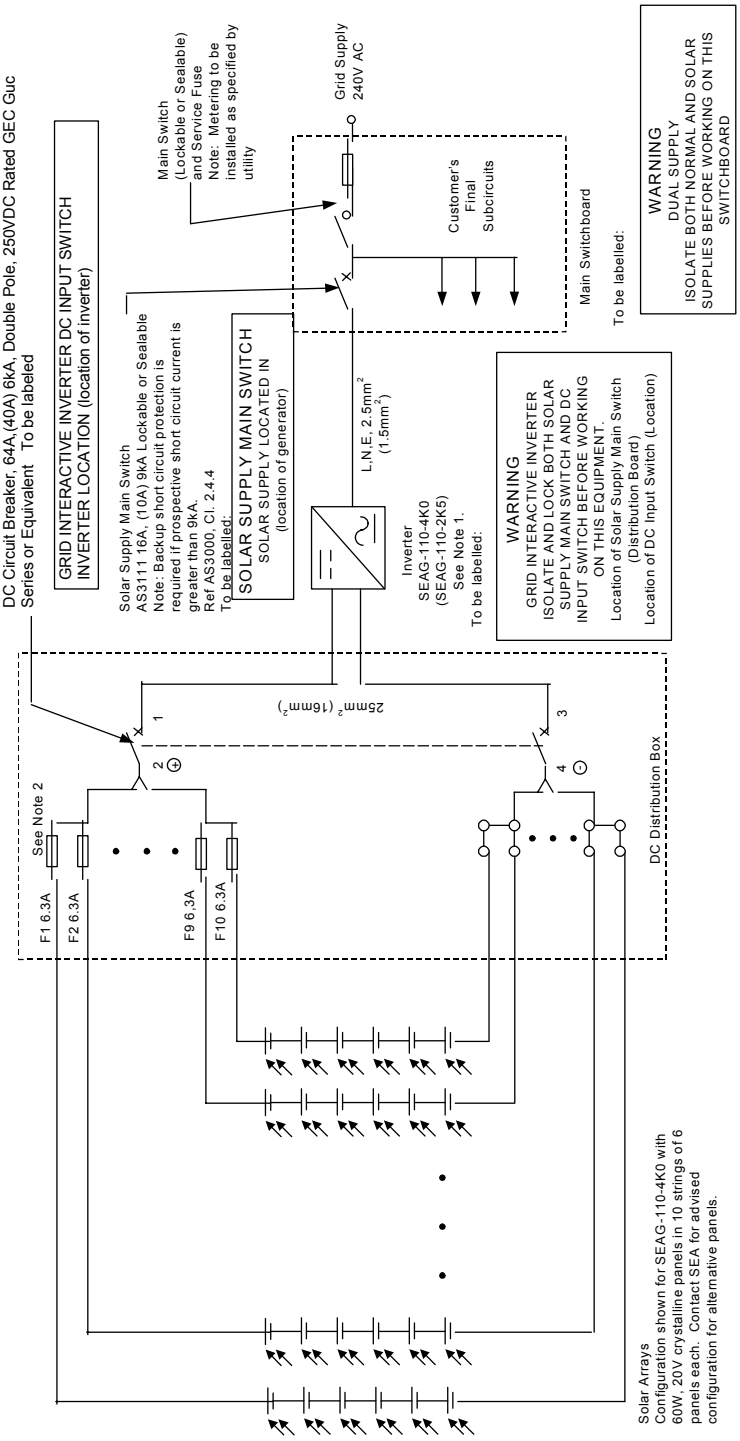
It is critical that the leads of these varistors be as short as possible and that the chassis connections be bonded to the frame of the inverter. Total lead length (sum of both varistor leads) of greater than 200mm negates their installation.
Suggested varistors are Iskra pn V275E40 which is available from Fastron Technologies Pty. Ltd, 14 Dingley Avenue Dandenong 3175 p: (03)9794-5566.

2. Earthing of the frame of the solar array: The design of any solar array must be done in light of the requirements of AS1768:1991, in particular, clauses 4.10 to 4.13. These clauses cover the earthing of the frame to ensure that the current from a lightning strike to the frame will flow directly to the bulk of the earth and not via the DC input leads to the inverter. An earthing conductor complying with this design must be used on all solar arrays.

3. Protection of the DC input: As for the AC connections, the inverter is shipped with lightning protection to AS1768:1991, category B on the DC input. This suppression is suitable for inverters which are mounted inside buildings and are fed via long DC leads or if the solar array or the building is not highly exposed to lightning.
If the solar array is in an exposed location, such as a free-standing array at ground level, or an array on the top of an exposed building, additional suppression to AS1768:1991, category C is recommended. Additional varistors should be connected between DC+ and earth and between DC- and earth as close as possible to the input to the inverter. As for the AC suppression discussed above, it is critical that the total lead lengths for these parts be less than 200 mm. Iskra pn. V275E40 is acceptable for use in this location.

4. Protection of the AC grid feed at the main switchboard which feeds the grid inverter: Surge protection in accordance with AS4070-1992 can be installed at this switchboard to reduce the peak impulse voltages due to lightning strikes on the AC grid to less than 2500V. This can be achieved through the connection of 320V transient suppressors to AS1307.2:1996 between active and neutral at this switchboard. Approved parts to AS1307.2 are available from;
Haycolec Switchgear Pty. Ltd.. 88 Redfern St., Wetherill Park, NSW, 2164, p: (02) 9609-3344, part number LN32BB-10.
This modification is recommended where the AC grid is very highly exposed such as in long rural feeds.

Typical configuration of SEAG-110-4k0 or SEAG-110-2K5 Grid Feeding Inverters Using Solar Arrays
(Inverter Connected Directly to Main Switchboard)



Configuration shown for SEAG-110-4K0 WITH 60W, 20V

Notes:

1. Values shown are for SEAG-110-4K0. Values in ( ) are for SEAG-110-2K5. Active frequency drift anti-islanding, grid over/under voltage, grid over/under frequency, grid isolating contractor (L&N), and DC/AC galvanic isolation are all provided by the SEAG-110-2K5 and SEAG-110-4K0 inverters.
2. F1-F10 to be 250Vdc rated, fast blow.
3. If the inverter is connected to a distribution board the solar supply main switch is to be located in this distribution board. An additional lockable switch must be installed in the subcircuit of the main distribution board which controls the distribution board. Additional labelling is required. Refer to Australian Guidelines for Grid Connection of Energy Systems Via Inverters.
4. If the inverter is supplied from a fixed voltage source such as a wind generator a hydro generator, an overvoltage protection device must be installed in the DC supply to limit the maximum continuous input voltage to 115Vdc

Mounting the Inverter

Now you must choose a suitable spot to mount the Inverter. The Inverter should be placed in a position which minimises DC cable lengths, it is better to run AC cable over a distance than the DC cable. **Choose a site which is dry, free of salt or moisture laden air, free of dust and free of access to rodents.**

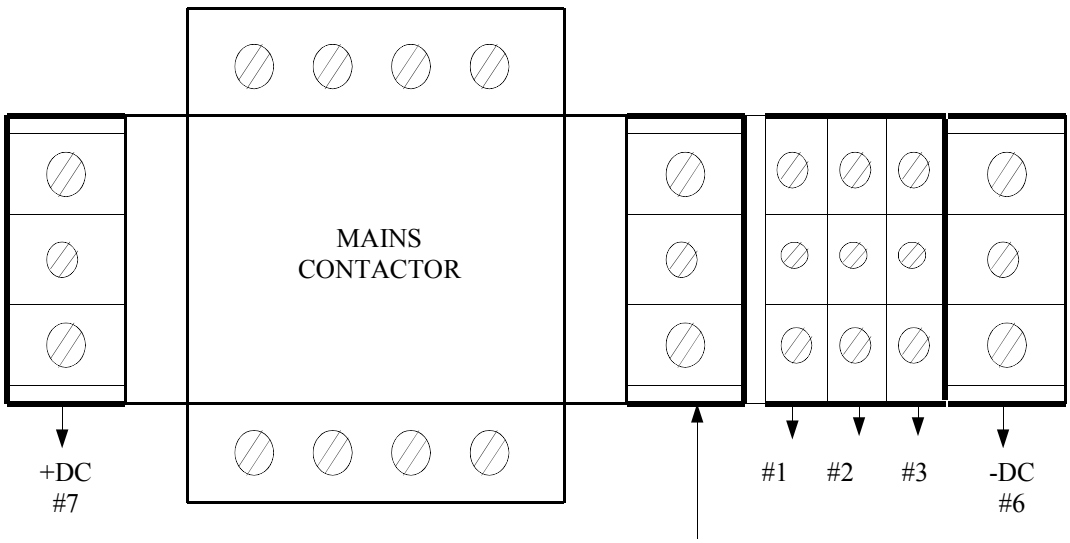
The unit is intended for wall mounting, inspection and operation is more convenient when the unit is approximately head high. There is also reduced probability of flood damage (depending on the site).

- We recommend your NovaStar is mounted in a location such as a garage or in a weatherproof box outside under an eave. on a suitably solid vertical wall. A cooling space of at least 200mm all around the inverter should be allowed., placing the inverter in a cupboard or small enclosure may reduce the available output power. The installation site should not be susceptible to temperatures in excess of 60^0C or humidity greater than 95% non condensing.
- We DO NOT recommend the NovaStar is mounted inside the home near sleeping quarters as it is normal for the unit to emit some noise, this noise may increase at first and last light.

Wiring the Inverter

Before attempting to connect any DC wiring to the Inverter you must check the polarity, if sufficient sunlight is available it is also wise to carry out a short circuit test on the solar modules to ensure they are working correctly.

To access the wiring terminals of the NovaStar, remove the lid from the inverter by loosening six pozidrive screws down the side of the inverter, remove the four pozidrive screws on the front of the inverter. Now gently remove the lid, you will also have to disconnect the earth strap from the base of the chassis.
Wiring the NovaStar is straight forward, connect the DC from the DC isolation switch to the terminals on the internal din rail. Now connect the Active, Neutral and Earth AC connections to the appropriate terminals on the Din rail.



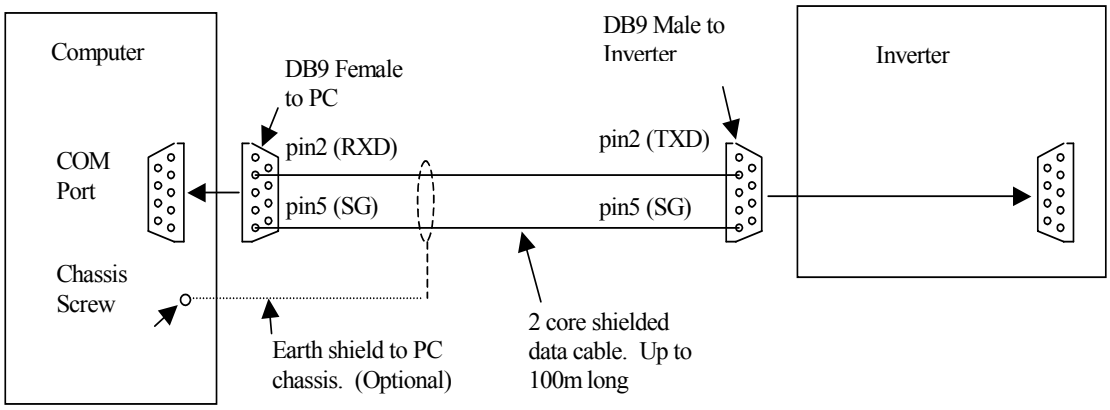
CONNECTING BLOCK DIAGRAM
1. Phase (A1)
2. Neutral
3. Earth
6. Negative "-" of solar array
7. Positive "+" of solar array

Alarm Contacts

A set of alarm contacts are provided with the NovaStar as standard. These relay contacts are located on the right hand side of the PCB and are green in color. The alarm contacts will close if either the grid or the inverter fails. Maximum switching capacity is 1amp @30v.

Fitting the optional RS232 Interface

If your NovaStar has been supplied with the optional RS232 interface, it should be installed now. Remove the small blanking plate from the bottom right hand corner of the chassis and replace with the RS232 interface card. Plug the 3 wire loom (yellow, red, white) which hangs loosely from the Din rail, into the white connector on the RS232 card, do not force this connection.



Once the RS232 interface board is installed, it is possible to view the raw data from the inverter using Hyperterminal. Settings are as follows: 19200 baud, 8 data bits, no parity, 1 stop bit. For further information you will have to install the optional MS2002 software. See elsewhere in this manual for details.

More Power

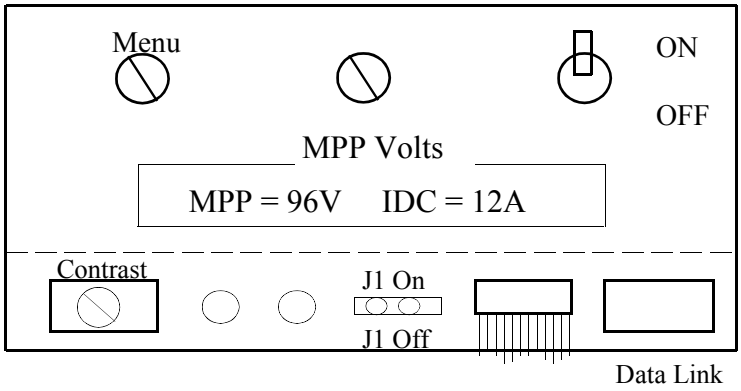
To increase the system size, any number of NovaStar inverters can be paralleled on the AC side. If the AC supply is three phase, ensure equal wattage is distributed across the phases, one inverter per phase. Inverters cannot be paralleled on the DC side due to Maximum Power Point tracking (MPPT).

Completing the installation

Re fit the lid of the inverter, ensuring firm connection of the earth strap. Do not over tighten the screws down the side of the inverter, these should just be firm.

Before turning the Inverter ON, check all connections thoroughly, use a multimeter to check the DC voltage is no higher than 160vDC and polarity is correct.

It is now safe to turn on your DC isolation switch, now turn the front mounted toggle switch to the ON position (up). If there is sufficient DC input voltage, the LCD display will now be lit. Now turn ON the AC connection, if all is well, a clicking sound will be heard and a periodic buzzing. This is normal and will continue for approximately 60-90 seconds, during this time the NovaStar is confirming the parameters of the incoming AC. After approximately 60-90 seconds a larger click will be heard and the NovaStar is now On Line



** *Parts underneath the dotted line are only visible when the cover is removed. Contrast is factory calibrated and must not be tampered with*

USING YOUR NOVASTAR

Your NovaStar requires a minimum input of 25watts to start operation, once this occurs the screen will display the following.

The menus below will appear when the unit is operating during daylight hours. Use the Menu dial to change menus. Start with the dial fully anti-clockwise

```
MPP = 96vDC
IDC  = 2A
```

MPP = Voltage from the Solar modules. This will continually change as the NovaStar constantly tracks the most efficient voltage point
IDC = Current being extracted from the solar modules. As air temperatures increases, the above figures will generally decrease, this is normal

```
VAC = 240 Vac
PAC=0000W invert
```

VAC = voltage of the incoming electricity supply
PAC = the real power being produced at the moment.

```
0.76hrs
04.5KWH
```

0.76Hrs = hours of sufficient sunlight today
04.5kwh = the power produced today.
Both of the above counters will reset if power from solar is insufficient or turned OFF

```
TOTAL  578KWH
```

The total power produced by the system since it was first installed

```
-01  12h3  06.9KWH
```

When you first turn to this menu it will show the hours of sufficient sunlight yesterday and the power produced yesterday .
12h3 = 12.3 hours (12hours 18minutes)
If you remain in this menu, the NovaStar will automatically scroll through the previous 30 days. This allows you to compare data from day to day.

The figures supplied in the menus may not be the same as external metering in your home, if this is the case please consult your installer.

System Expectations

How much power should I produce?

This will depend on how many solar panels you have installed and your location. Ask your designer for further information. Presuming your solar panels are on a shade free North facing roof, with an ambient temperature of 20°C, the following can be used as a guide to the amount of power you can produce.

Total wattage of solar modules (see your system documentation or ask your supplier)
Less system losses (normally around 20%, this will vary between solar modules and temperature)
Multiplied by the average no of peak sun hours in the day (varies from 2.6 in Hobart to 5.5 in Northern Aust)
= kilo watt hours (kwh) per day average.

Example. Presume a 1000watt system in Melbourne

=1000w minus 20% = 800watts x 3 peak sun hrs p/day (Melb average) =2400watt hours. This would also be written as 2.4kwh.
Some days will not produce this amount of power, but other days it will be exceeded.

Getting the most from your investment

As with any investment, it is critical that you achieve the greatest possible return. In the example above we are producing an average of 2.4kwh per day. If you look at your electricity bill, you should be able to find out how many kwh per day you are using. An average suburban household will use between 10-25kwh per day. Most suburban homes are very inefficient, the less power you use, the greater the percentage contribution from your Solar Energy Australia grid feeding solar system. Here are some ideas on how to potentially reduce your electricity use.

Ensure maximum light and sun can penetrate any North facing windows, this lets more light in, and can reduce heating requirements during the day.

Shade west facing windows during summer months, this will reduce cooling requirements.

Turn ALL appliances OFF at the power point, stereos, TVs, clocks, VCR's, microwave ovens, battery chargers, computers all use power when they are not in use. None of them use much instantaneous power but they are on 24 hours a day. This can waste a huge amount of power.

Turn lights OFF if not in the room.

In rooms where lights are ON for more than 10 minutes, replace the light globes with good quality compact fluorescent. This can save up to 80% of your electricity.

If you do not have a 5star rated fridge, consider changing to one. These can save considerable electricity, the fridge is one of the biggest users of electricity in the home.

Move your fridge to the coolest part of the kitchen.

The above measures will not reduce your bill to zero, but you might surprised what they do save you.

Maintaining your NovaStar

Your NovaStar requires very little maintenance. Every 3 months you should check that the black heatsink fins on top of the unit are clear of any debris, such as mud wasps or spiders. Blockage of these will reduce the performance of the NovaStar; clear any obstructions.

APPLICATION FOR EXTENDED WARRANTY

I would like to extend the warranty of my Solar Energy Australia Inverter:

MODEL NO:	
SERIAL NO:	
DATE PURCHASED:	
FOR A PERIOD OF:	

I confirm that my unit will be used in a land based fixed installation and the installation meets all installation criteria as set out in the instruction manual and any relevant Australian standards.

NAME:	
ADDRESS:	
CITY/STATE/POSTCODE:	
PHONE/FAX/EMAIL:	
DATE:	

INSTALLER / RETAILER: I confirm that all conditions of this warranty have been met.

NAME:	
SIGNATURE:	
COMPANY:	

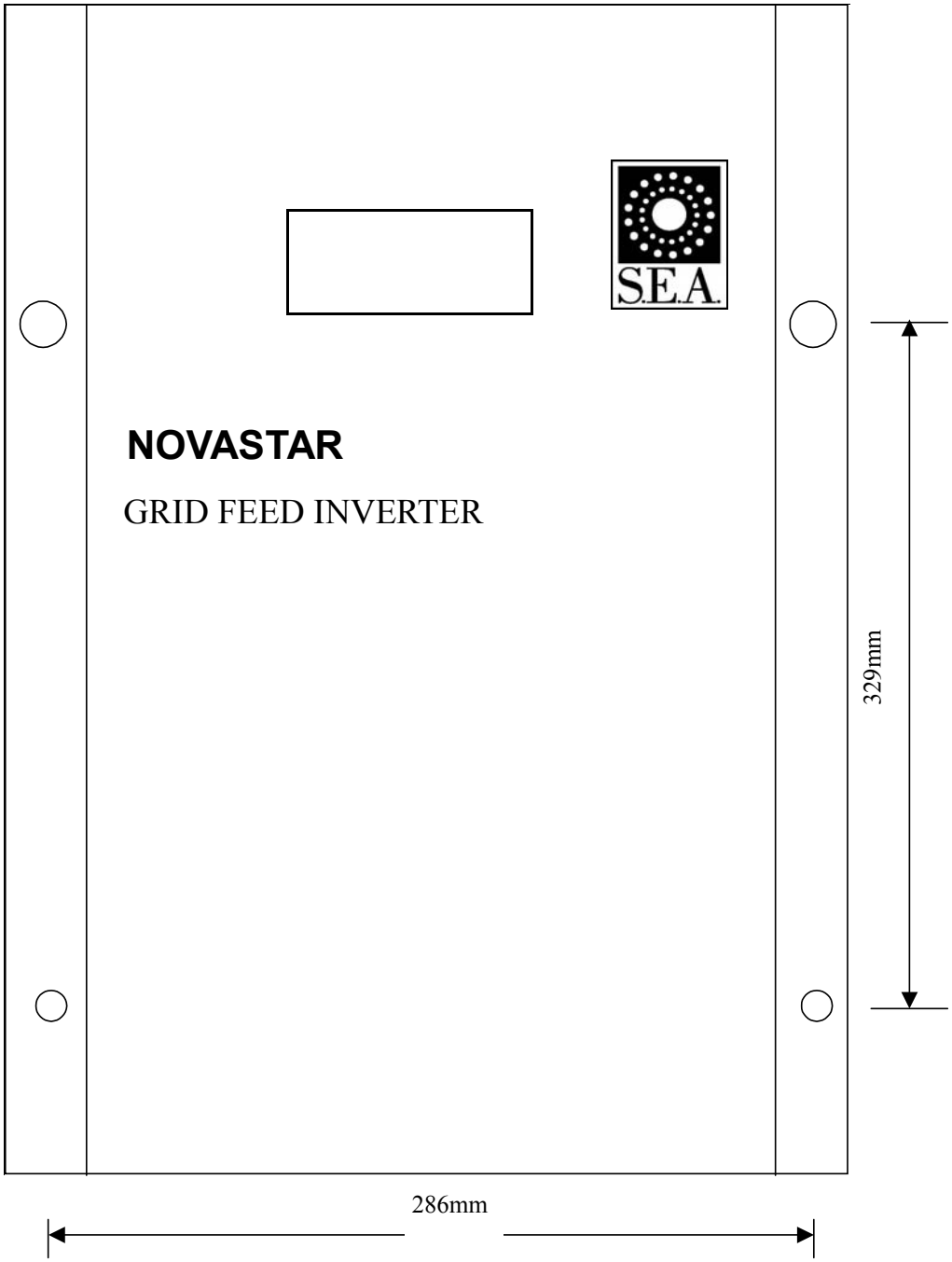
CHARGES FOR EXTENDED WARRANTIES

	"EVEREST" WARRANTY EXT. PRICE INCL. GST	
	AUS$ INCL GST	NZ$ INCL GST
ADDITIONAL 1 YEAR (3 years total)	$150	$200
ADDITIONAL 2 YEARS (4 years total)	$200	$250
ADDITIONAL 3 YEARS (5 years total)	$250	$300

TECHNICAL SPECIFICATIONS

	SEAG-110-2K5	SEAG-110-4K0
Specifications		
Maximum recommended Solar Array	2750watts	4400watts
Max DC Input Power	2500watts	4000watts
Max DC Input Current	33 Amps	52 Amps
Max Solar Array O/C voltage	140v DC	
Solar Array operating voltage MPP	72-115v DC	
12v Solar modules in series	6	
Power draw from Solar array	15watts (day) 0watts (night)	
Operation starts from	20watts	25watts
Max AC power output (electronically limited)	2300watts @ 40°C	3700watts @ 40°C
Max AC output current	10Amps AC	16Amps AC
AC Voltage operating range	210-260v AC	
AC Frequency operating range	49-51Hz	
Efficiency @ 10% rated output	91%	90%
@ 30% rated output	92%	92%
@ 60% rated output	94%	94%
@ 100% rated output	92%	91%
Input to Output Isolation	3kv AC RMS 1 minute	
Power factor to Grid	Typically 1	
Display type	2 line LCD	
Memory	Daily kwh produced each day for previous 30 days	
Alarm Contacts	Closed in case of Grid or Inverter Failure. Maximum 1A 30v	
ESAA Approved	Yes	
Certificate of suitability	Yes	
C Tick Approved	Yes	
Enclosure rating	IP20	
Operating Range	-20C to +50C	
Dimensions in mm HxWxD	510x300x243	
Weight	22kg	28kg

Mounting dimensions

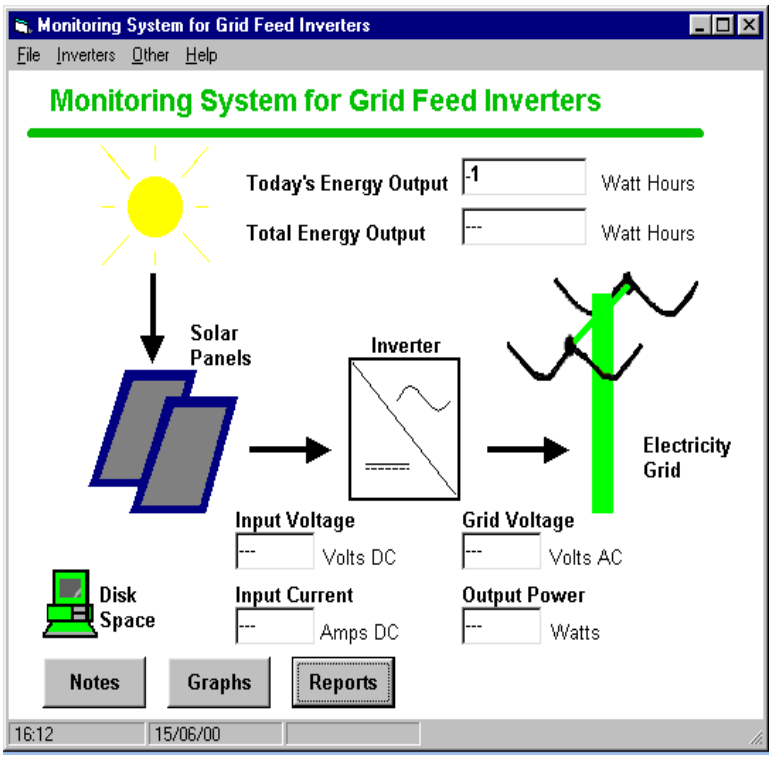


MS2002 INVERTER MONITORING SYSTEM

Version 1.1

Monitoring Program for a single Grid Feed Inverter

Operating and Installation Instructions



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INTRODUCTION

The MS2002 Monitoring system is a software package designed to monitor the output of a single grid feed inverter model SEAG-110-4K0 and SEAG-110-2K5. The system provides both on site monitoring and data logging of the inverter output.

The output from the inverters is connected to the electrical distribution system. The MS2002 monitoring system interfaces with a single inverter using a fibre optic link that is converted into an RS232 signal and then fed into the computer serial port.

The MS2002 system monitors the inverter for availability of communications and displays the status of the inverters on the screen.

Data is logged every 15 minutes. Logged data is stored in a standard text file and may be easily opened using a spreadsheet program or word processing program. A daily report is generated every morning to summarise the total power output from each inverter in the previous day.

The MS2002 is a reliable and user friendly system that is designed to monitor and log data for long periods of time extending into several years.

PROGRAM INSTALLATION INSTRUCTIONS

Minimum PC Requirements:

Computer	IBM-PC compatible
CPU	486/50MHz
RAM	8 MB
Graphics	VGA 14-inch monitor with any Windows 95 supported video board.
Floppy Disk	3.5 inch, 1.44 MB
Hard Disk	200 MB 10 MB free space
RS232	One spare COM port for connection to inverter. Usually two COM ports are required: one for a mouse and one for the inverter
Pointing Device	Any - Mouse, trackball, etc.
Operating System	Windows 95

Installation Files:

The files which are required for installation are as follows:
setup.exe, setup.lst, ms20021.cab, ms20022.cab and flpgrfrt.exe.

To install from a hard disk:

1. Copy all of the above files to any temporary directory on the hard disk.
2. Click Start>Run>C:\{temporary directory}\setup.exe. This will start the installation program. If the computer is missing any system files or if any of these files are out of date, you will be asked to restart the computer halfway through the setup. After the computer restarts, it is necessary to run setup again to complete the installation.
3. **Click Start>Run>C:\{temporary directory}\flpgrfrt.exe. This installs the graphing routines.**

To install from floppy disks:
Three 3.5" high density floppy disks are required. These contain the following files.

MS2002 Ver 1.0 Setup Disk 1 of 2.	Files: setup.exe, setup.lst, ms20021.cab
MS2002 Ver 1.0 Setup Disk 2 of 2 (Disk 22).	Files: ms20022.cab, readme.txt
MS2002 Ver 1.0 Graph Utility Disk 1 of 1.	File: flpgrfrt.exe

1. Put Setup Disk 1 of 2 in the floppy drive and click Start>Run>{floppy drive}:\setup.exe. This starts the installation program which will use both setup disks. If the computer is missing any system files or if any of these files are out of date, you will be asked to restart the computer halfway through the setup. After the computer restarts, it is necessary to run setup from disk 1 again to complete the installation.

2. Put Graph Utility Disk 1 into the floppy drive and click Start>Run>{floppy drive}:flpgrfrt.exe. This installs the graphing routines.

The Main Screen

The main screen of the MS2002 shows one inverter icon. This icon is green in colour when there is a communications signal from the inverter. If there is no communications signal from the inverter the icon turns red in colour. If the inverter is not installed, which is done by setting the serial port number in the systems setting screen to 0, then the icon color will be white. Next the electricity grid icon displays the status of the electricity grid. Under normal circumstances this icon is green. The icon turns red if there is a grid failure. The last icon is the disk space icon. This icon is normally green and turns red to signify a low free disk space level.

Real time data is displayed on the main screen at the rate it is sampled from the inverter. This is typically updated once every few seconds. If the inverter is not installed or is not communicating with the computer, then – is displayed.

Below the inverter are four labels which indicate input voltage and current being supplied to the inverter by the solar panels, the electricity grid voltage, and the amount of power being supplied to the grid by the inverter.

Above the electricity grid icon are two labels which show the energy supplied to the grid today and the total energy which has been supplied to the grid since the inverter was commissioned. Both of these figures are displayed in Watt Hours.

Three command buttons are provided at the bottom of the screen. Clicking on the Notes button opens a standard notepad text file which can be used for storing information about the system. Serial numbers, installation dates and other commissioning and maintenance information can be stored in this file. Clicking on the Graphs command button opens the graphs specifications form. Clicking on the Reports command button opens the graph specification form.

System Settings

The systems settings form is used to set various parameters that affect the way the program works. To reach the system settings form choose system settings from the Other menu. An explanation of the various system setting parameters follows:

Inverter Alarm Inhibit: This check box is provided to inhibit the system from checking for lack of communications for the inverter.

Inverter Serial Port: This box is used to specify the serial port number to which the inverter is connected. Allowed values are between and 1 and 10. The serial port settings will only take effect when the program is restarted.

Photovoltaic Power Station Name: A name for the PV power station can be entered in this box. This will be displayed at the top of the main screen.

Grid fail Timer: This text box specifies the number of hours to elapse before assuming a grid fail condition. The default value is 24 hours.

Inhibit Grid Fail Alarm: This check box is provided to inhibit the system from checking for grid failure.

Disk Space Alarm Limit: This text box specifies the size of free disk space below which there will be an alarm condition. The default value is 500MB.

Inhibit disk space alarm: This check box is provided to inhibit the system from checking for the disk space alarm condition.

System Alarms

There are three types of alarms in the system. These alarms are as follows:

Inverter Alarm: During every polling cycle, which occurs every minute, the system checks the communications for the inverter, provided the alarm is not inhibited. If there are no communications from the inverter then that inverter is assumed to be under alarm condition. Communications will only be received from the inverter if it is supplying power to the grid. At night, the inverter shuts down and stops communicating. An inverter alarm will be shown at this time.

Grid Fail Alarm: if there is no output from the inverter then it is possible that there is no sun radiation or there is a grid failure problem. The grid fail timer text box specifies the amount of time to wait before concluding that it is a grid fail situation

Disk Space Alarm: All data is stored on the computer's main hard disk. If the amount of free disk space left falls below the value specified in the disk space alarm text box then a disk space alarm is raised.

System Daily Reports

Every day between midnight and 15 minutes past midnight the system generates a report that shows the total watt-hours that the inverter supplied during the past 24 hours. A sample printout of the report is shown below:

Daily Report for the past 24 hours
Generated At Tuesday, January 05, 1999
File Name Stored In Computer = C:\Program files\MS2002\MS2002\Daily Report Files\Report-4-1-1999.txt

Inverter Number	Total WH
1	500
Total	500 WH

This report is automatic and there is no way of stopping the system from generating it.

All daily report files are stored in the daily reports folder, with the file name Report-dd-mm-yyyy.txt

For details of all folders used in the system refer to the system folders and files section.

User Generated Reports

This system allows the generation of a report which shows the daily output watt-hours for the inverter as well as the total watt-hours of the system. This report may cover a period up to 61 days.
The report specification form is used to specify the period over which the report is needed. This form is opened when clicking on the reports command button from the main screen.

In this form enter the start date and end date of the report. In the Excel file name index text box enter a number with up to five digits. This index will become part of the excel file name that is generated and contains the report. All user-generated reports are stored in the user reports folder with the name: reportxxxxx.csv where xxxxx is the index. For details of all folders used in the system refer to the system folders and files section.

A sample user generated report is shown below:

User Report for the period Sunday, January 03, 1999 To, Friday, January 08, 1999
File Name Stored In Computer = C:\Program Files\MS2002\MS2002\User Report Files\Report1.csv

Date	, Inverter 1,	Daily Total
03-01-2000	500	500
04-01-2000	600	500
:		
:		
:		
07-01-2000		

Total for the whole station = 15000

User Generated Graphs

Graphs of any of the logged data can be generated by clicking on the graphs button from the main screen. The graph specification form is shown below:

In this form enter the start date and end date for the graph. Next enter the parameters that you wish to be plotted on the graph. You may enter up to 4 parameters. If you wish to export the graph data to an excel file then click on the generate excel file check box and enter a file index number in the text box. This is a five digit number that becomes part of the file name. All user generated reports are stored in the User Graph Files folder with the name: graphxxxxx.csv where xxxxx is the index number of the graph. For details of all folders used in the system refer to the system folders section.

The excel file is composed of several columns. The first column represents a string value of the date. The second column is a numeric value of the date expressed as number of days since a reference date which is set to December 30, 1899. This numeric value is useful when plotting the data.

To start the processing and display of the graph and generation of the excel file click on the plot graph button. The system gives the message that it is processing and then plots the graph and generates the excel file if the check box is checked.

As there may be periods of time chosen where there is no data stored, the system generates a -5 value for these dates, so as to be able to distinguish those periods from other periods where the system was logging data, but there was no output from the inverter, which would result in the storage of a 0 value.

System Folders and Files

All the system folders are stored in the applications file folder. In a default installation, this file folder is called MS2002 and is located in the Program Files directory.

There are two main folders named “MS2002” and “Usr”. The “Usr” folder contains many subfolders that contain the data files and event files that are updated as the system is running.
Every Day at the start of the morning all the data files and event files are copied from the “Usr” folder to the “MS2002” folder. It is recommended that the user access the files in the “MS2002” folder and not the “Usr” folder as accessing the files in the “Usr” folder may cause some data not to be logged.

The main subfolders in the “MS2002” folder are as follows:

Daily Report Files: This folder contains all the daily reports that are generated by the system.
Inverter Notes: This folder contains the notepad documents that contain the user inverter notes.
User Data Files: This folder contains a copy of the data files for the user to access. The data files are copied to this folder once every morning at the same time as the daily report is generated.
User Events Files: This folder contains a copy of the events log files for the user to access. The events log files are copied to this folder once every morning at the same time as the daily report is generated.
User Graph Files: This folder contains the Excel-readable graph files that are generated by the user.
User Report Files: This folder contains the Excel-readable report files that are generated by the user.

The software relies totally on ASCII files for storage and retrieval of all data and system information. The use of ASCII files makes it very reliable and easy to use. Data is logged into the data files and events are logged into the events files. The method of logging is based on devising the year into four quarters:

Q1=Jan,February,March
Q2=April,May,June
Q3=July,August,Spetember
Q4=October,Novermber,December

Data is logged into the appropriate quarter file for that particular year.

The main files used in the system are the following

Report-dd-mm-yyyy.txt: Daily report file for the day dd-mm-yyyy. These files are found in the "Daily Report Files" folder.
Data-Qx-yyyy.txt: Data file containing all the logged data for the x quarter of the year yyyy. These files are found in the "User Data Files" folder.
Events-Qx-yyyy.txt: Events file containing all logged events for the x quarter of the year yyyy. These files are found in the "User Events Files" folder.
Graphxxxxx.csv: An Excel-readable graph file generated by the user with a user specified index number of xxxxx. These files are found in the "User Graph Files" folder.
Notes For Inverter 1.txt: Notepad text file for the notes for the inverter. This file is found in the "Inverter Notes" folder.
Reportxxxxx.csv: An Excel-readable report file generated by the user with a user specified index of xxxxx. These files are found in the "User Report Files" folder.

The data files are stored in ASCII format as a CSV file. These files may be easily opened with a spreadsheet program such as Excel. The file structure is as follows:

Column 1:	Contains a Start string to identify the beginning of the row
Column 2:	Contains a String specifying the date and time of recording of the row
Column 3:	Contains a numeric value of the date expressed as number of days since a reference date which is set to December 30, 1899. This numeric value is useful when plotting the data.
Column 4:	Output AC Voltage stored as Volts AC
Column 5:	Input DC Voltage stored as Volts DC
Column 6:	Input DC Current stored as Amps DC
Column 7:	Output AC Power stored as Watts
Column 8:	Total output WH stored as Watt Hour
Column 9:	Communications status for Inverter. Three values may be stored as follows: 1 = Good Communications, -1 = Bad or No Communications, -2 = Inverter not assigned a serial port
Column10:	This is an end number of value -99 to identify the end of the row.