JSM POWER CONVERTION CC

REG NO. 2004/119440/23

For the development and production of power electronic products

User Manual
6 kVA, 48Vdc – 230Vac Inverter/Charger

The **Inverter/Charger** can be used in 3 different modes (applications).

- **Offline UPS:** Where you have an unstable grid connection or where load shedding is used, you will use the Inverter/Charger as a backup power source. While the grid is available, the Charger will keep the batteries (not included) fully charged and the load will run from the grid. When the grid falls away, the Inverter will supply your load. This happens automatically with a seamless changeover time of less than 12 milliseconds. The backup time depends on the size of your battery bank and the size of the load.
- **Generator Assisted Inverter:** Where there is no grid connection and the batteries are charged from Solar Panels and/or wind generators, the load will run permanently from the Inverter. Sometimes when the alternative power is not enough it is necessary to run a diesel or petrol generator. Then the Inverter/Charger will switch the load over to the generator and charge the batteries. When charging is finished, the load will be switched back to the Inverter. This all happens automatically and the changeover is seamless. There is also a generator start relay to start and stop the generator.
- **Grid Assisted Inverter:** When you have a grid connection, but want to use alternative energy, like Solar Panels, you will run your load permanently from the Inverter, which runs from the batteries. If the alternative power is not enough the Inverter/Charger will change the load over to the grid and charge the batteries. When charging is finished the load will be switched back to the Inverter. This all happens automatically and the changeover is seamless.

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Inverter Specifications

Nominal Battery Voltage	**:**	48 Vdc
Input Voltage Range	**:**	30 – 75 Vdc
Operating Voltage Range	**:**	40 – 66 Vdc
Output Voltage	**:**	220 – 230 Vac Settable, 50 Hz
Waveform	**:**	Pure Sine Wave
Total Harmonic Distortion	**:**	< 3%
Continuous Power @25°C	**:**	6000 VA
Maximum Output Power	**:**	18 kVA for 5 s
Efficiency	**:**	>92%
Power Consumption – idle	**:**	39W

Charger Specifications

Input Voltage	**:**	180Vac – 270Vac
Input Frequency	**:**	45Hz – 55Hz
Input Current	**:**	17.5 Amps ac
Charging Current	**:**	60 Amps
Charging type	**:**	3 Stage

General Specifications

Enclosure	**:**	Powder coated mild steel
Dimensions (w x h x d)	**:**	630mm x 320mm x 350mm
Feet	**:**	Rubber
Weight	**:**	55 kg

Protection Features

Over Load Protection	**:**	Electronic
	:	DC Circuit Breaker
	:	AC Input Circuit Breaker
	:	AC Output Circuit Breaker
Over Voltage Protection	**:**	66 V
Under Voltage Protection	**:**	Settable (40.0V – 46.0V)
Short Circuit Protection	**:**	100 A
Over Temperature Protection	**:**	>85°C

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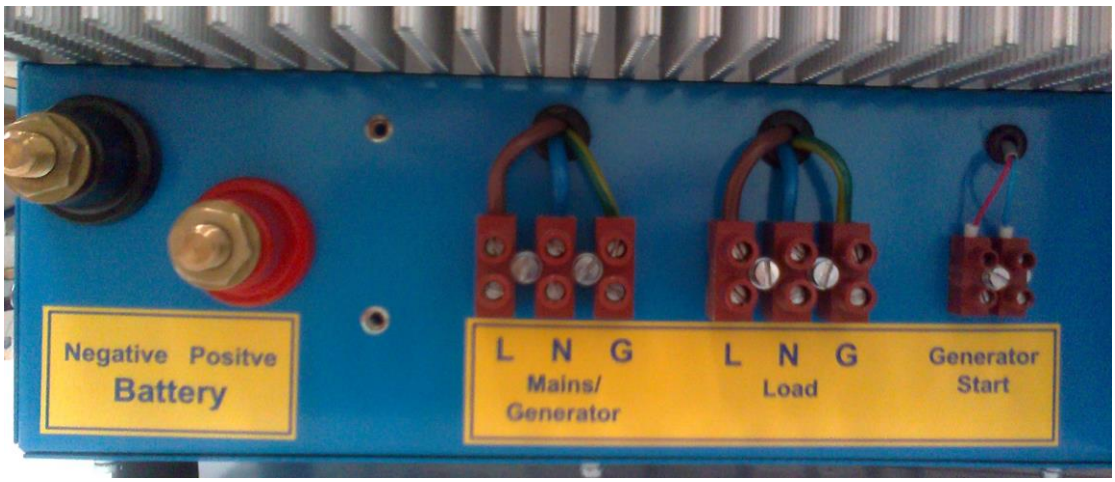
Other features

Zero spark connection	**:**	Charge DC Bus with resistor
Cooling	**:**	Natural Cooling (no fan)
Battery Connection	**:**	M10 Brass Studs at the back
AC Output Connection (Load)	**:**	Connector block at the back
AC Input Connection (Grid/Gen)	**:**	Connector block at the back
Generator Start Relay Output	**:**	Connector Block at the back
Comprehensive LED Display	**:**	On front panel
Keypad and LCD Display	**:**	**Optional** and mounts on front panel

Installation

It is recommended that the Inverter/Charger is installed by a qualified person.

All the connection points are located at the back of the Inverter/Charger as seen in the picture below.



Battery Connection. Before connecting the battery cables, make sure the **DC Input circuit Breaker** on the front of the Inverter/Charger **is switched off** (handle pushed down). For cables less than 1 meter long, at least 50mm^2 cables need to be used, with 50 x 10 crimping lugs. For cables longer than 1 meter long, at least 70 mm^2 cables need to be used, with 70 x 10 crimping lugs. There is a positive and negative terminal that is clearly marked. Connect the negative battery cable to the black terminal on the upper left hand side. Connect the positive battery cable to the red terminal on the lower right hand side. Do not over tighten.

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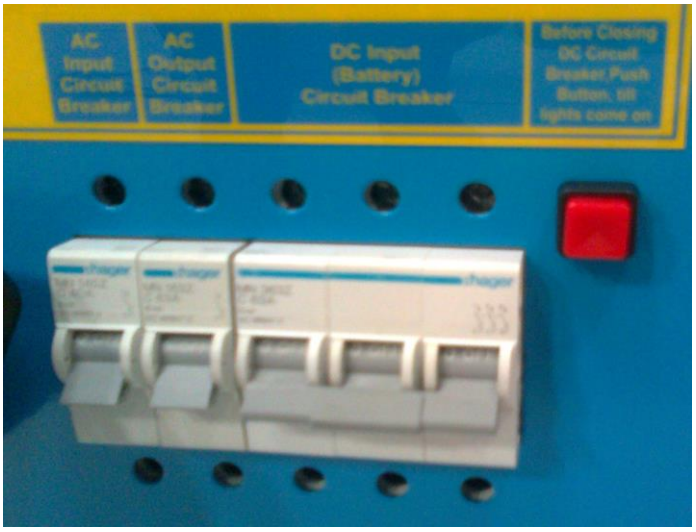
Load Connection. It is the right hand side, 3 way connector block. The load, for example your household supply cable, should be connected here. Use at least 4mm^2 wires. **Live** must be connected to the left hand side connector, **Neutral** to the middle connector, and **Ground** to the right hand side connector.

Mains/Generator Connection. It is the left hand side, 3 way connector block. The Mains from the national grid (Eskom) or your Generator Output, should be connected here. Use at least 4mm^2 wires. **Live** must be connected to the left hand side connector, **Neutral** to the middle connector, and **Ground** to the right hand side connector.

Generator Start. This is the 2 way connector block. It is connected to a 1 Amp relay. This contact is open when the generator must be off, and will close if the generator must run. If your generator has an automatic start switch, you can use this relay to start and stop the generator.

Switching on

After everything is connected the Inverter/Charger should be started up in the following sequence. All the circuit breakers are located at the front of the Inverter/Charger, as seen in the picture below.



1. Push the red button for 5 seconds and check if some of the LEDs (little lights) on the front panel come on. If not, **do not** switch the DC Input Circuit Breaker on. Check that the polarity of the battery cables is correct. If the LEDs come on, switch the DC Input Circuit Breaker on, **while holding the red button in**.
2. Switch on the AC Input Circuit Breaker. **Do not switch off while generator is running.** Switch Circuit Breaker off, before starting the generator, if you don`t want to charge the batteries from the generator.
3. Switch on the AC Output Circuit Breaker.

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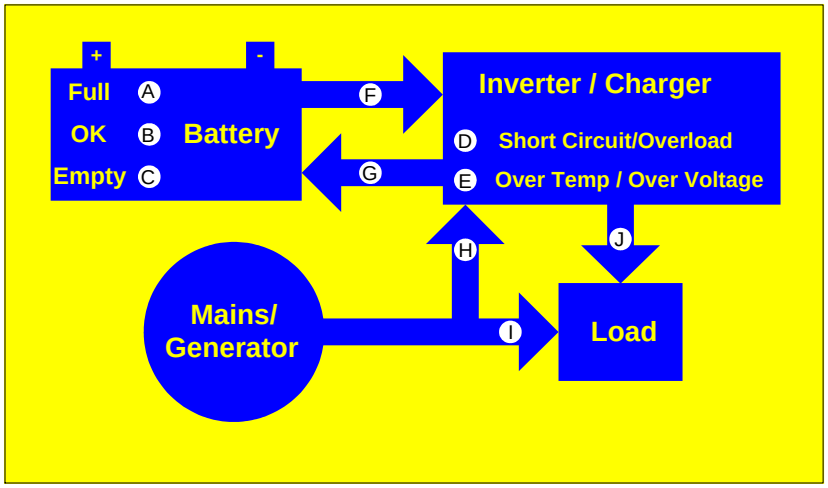
Comprehensive LED Display and Buzzer

On the front panel is a LED display that shows the Battery Status (indication of Battery Voltage), the Flow of Power and the Inverter Errors, as seen below.
To be ignored while LCD display is active.



(A) will be on if the Battery Voltage is above 50.0V.

(**B**) will be on if the Battery Voltage is above 46.0V, but below 50.0V.

(**C**) and **Buzzer**. This LED will start flashing if the Battery Voltage goes below 46.0V. At "**Battery Low Voltage**" + 0.5V, for example if "Battery Low Voltage" is set at 44.0V, then at 44.5V, the buzzer will start giving a "peep" every 20 seconds. When the "Battery Low Voltage" is reached the buzzer will buzz continuously till the Inverter switches off, after the "Battery Low Time" run out. The Inverter is now in a "Battery Low" state and the "**Empty**" LED will stay on. This LED will only be cleared after the "Battery Reconnect Voltage" has been reached, and the Battery Status LEDs will show the Battery Voltage again.

(**D**). If a Short Circuit (load bigger than 100Amps) is applied to the output of the Inverter, the Inverter will switch off and this LED will stay on. Remove the Short Circuit and Reset the Inverter by pressing the Reset button (if you have a display), or switch the DC Input Circuit Breaker off. Wait 5 seconds. Push the red button for 5 seconds and then switch the DC Input Circuit Breaker on while holding the red button in.

(**D-flashing**). If a load bigger than 6kVA is applied to the output of the Inverter, for longer than the time shown in the graph below (next page), the Inverter will switch off and this LED will flash. Decrease the load and Reset the Inverter by pressing the Reset button (if you have a display), or switch the DC Input Circuit Breaker off. Wait 5 seconds. Push the red button for 5 seconds and then switch the DC Input Circuit Breaker on while holding the red button in.

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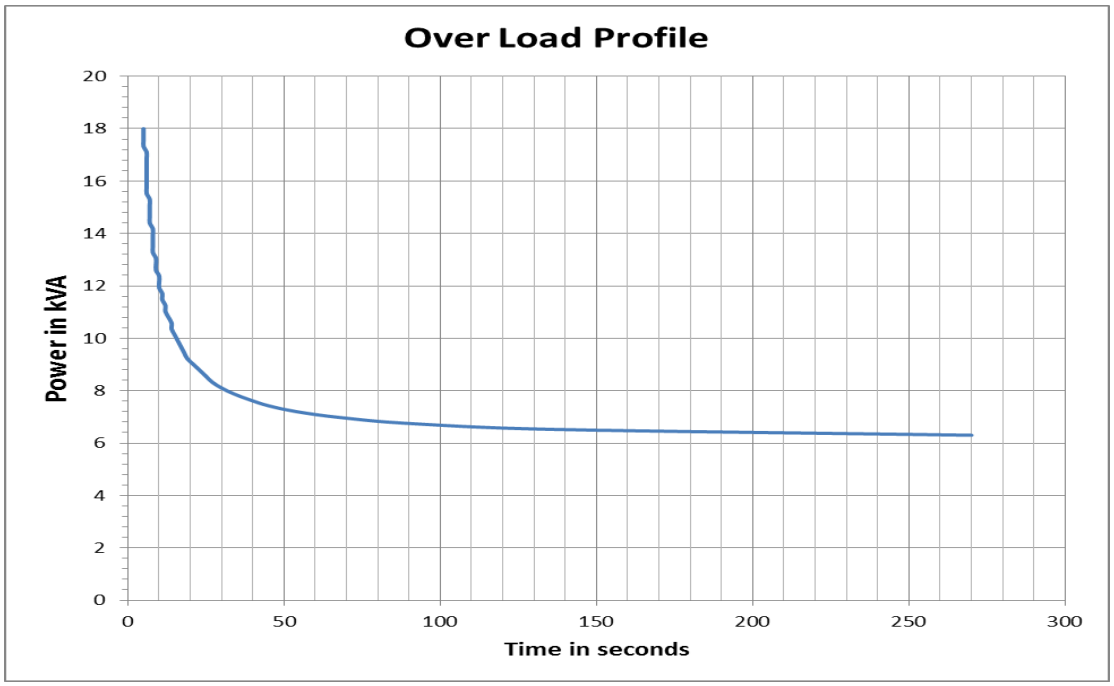

Note: If operated in **Grid Assisted Mode** and the grid is available, the Inverter will switch the load over to the grid before it overloads. If the load is less than 6kVA for more than 5 minutes, the load will switch back to the output of the Inverter.

(**E**). If the temperature of the Inverter/Charger`s heatsink rise above 85°C, the Inverter/Charger will switch of and this LED will stay on. Make sure nothing is restricting the airflow over the heatsink (Aluminium block with fins at the back, on the right hand side of the Inverter/Charger). Reset the Inverter by pressing the Reset button (if you have a display) or switch the DC Input Circuit Breaker off. Wait 5 seconds. Push the red button for 5 seconds and then switch the DC Input Circuit Breaker on while holding the red button in.

(**E-flashing**). If the input Voltage of the Inverter rises above 66V, the Inverter will switch off and this LED will flash. Check the battery connections and make sure the input Voltage is less than 66V. Reset the Inverter by pressing the Reset button (if you have a display), or switch the DC Input Circuit Breaker off. Wait 5 seconds. Push the red button for 5 seconds and then switch the DC Input Circuit Breaker on while holding the red button in.

(**F**). This LED will be on when power is flowing from the batteries into the Inverter/Charger (in Inverter mode). When the Inverter is switched on and the battery voltage is above "**Battery Reconnect Voltage**", this LED will flash till the "**Battery Reconnect Time**" has run out. This LED will then stay on and the Inverter`s output will switch on. See "**Battery Reconnect Time**".

(**G**). This LED will be on when power is flowing from the Inverter/Charger (in Charging mode) into the batteries.

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(**H**). This LED will be on when power is flowing from the Mains or Generator into the Inverter/Charger (in Charging mode).

(**I**). This LED will be on when power is flowing from the Mains or Generator into the Load.

(**J**). This LED will be on when power is flowing from the Inverter/Charger (in Inverter mode) to the Load.

Note: If operated in **Grid Assisted Mode** and the grid is available, the Inverter will switch the load over to the grid if any of the above **fault conditions** occur.

Keypad and LCD Display

On the front panel is a DB15 connector, where an optional User Interface can be connected for viewing parameters and to change the settable parameters. The display can be mounted onto the Inverter/Charger. **It is recommended that the display cable is disconnected (pulled out at one end) when not used, since LCD displays are sensitive for lightning.**

Viewable parameters

There are 4 Viewing windows. They show the following parameters as seen below. To view these windows, press "**Menu/Enter**" to activate the display. Then press "**up**" or "**down**" to change between the different windows. If no buttons are pushed for more than 5 minutes, the display will switch off.

Battery Voltage and Current. A positive current means the battery is being charged, while a negative current means current is drawn out of the battery.

```
    BATTERY
 028A      50.1V
```

AC Input Voltage, Current and Power. The AC Input can either be from the National Grid (Eskom) or from a Generator. The Power is shown in VAs, since generators are rated at VAs.

```
GRID/GEN:    230V
3360VA       14.6A
```


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Inverter Voltage, Current and Power. The Power is shown in Watts, since it is the real power that drains your batteries, and not the VAs. For equipment that does not run at unity power factor, like motors, your real power is less than your VAs. In the example below, if you have a motor that runs at 13.2A, at 220V with a power factor of 0.8, your VAs will be 2900VA, but your real power will only be 2320Watts.

I	N	V	E	R	T	E	R	:			2	2	0	V	
2	3	2	0	W						1	3	.	2	A	

Load Voltage, Current and Power. The Power is shown in VAs, since the inverter is rated in VAs.

L	O	A	D	:							2	2	0	V	
2	9	0	0	V	A					1	3	.	2	A	

Equalize Cycle

An occasional Equalize Charge helps to equalize the voltage of the different cells of the battery, for longer working life. The Equalize Voltage, and Equalize Time is settable in the Settable Parameters Menu. To start an Equalize Cycle you need to press the "**Menu/Enter**" button to activate the display. Press the "**Menu/Enter**" button again to show the following screen.

	S	t	a	r	t		E	q	u	a	l	i	z	e	
	C	y	c	l	e				N						

Then press "**Up**" or "**Down**" to activate the Equalize Cycle. If the AC Input Source is a generator, the Inverter/Charger will close its Generator Start Relay to start the generator, and then start the Equalize Cycle. If the AC Input Source is the Grid the Equalize Cycle will start immediately. **An Equalize Cycle should be supervised until completed**. The Generator Start Relay will open after the Equalize Cycle is completed, to stop the generator.

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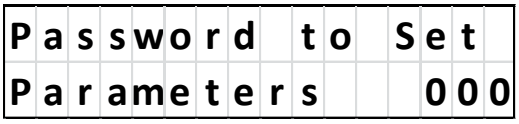
Settable Parameter

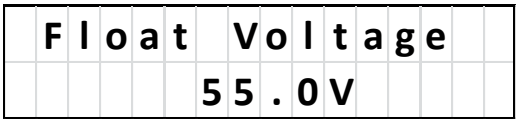
There are several parameters that are settable. To access these parameters you need to activate the display by pressing "**Menu/Enter**". Press the "**Menu/Enter**" button another 2 times till the following screen appears.



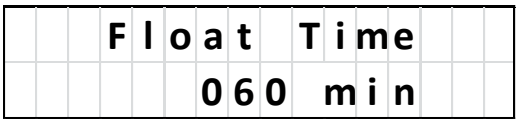
Press the "**Up**" or "**Down**" buttons (can be held in for quick counting) till the Password is **234,** and then press "**Menu/Enter**". The different settable parameters will appear. The values can be changed by using the "**Up**" and "**Down**" buttons and then press the "**Menu/Enter**" button to go to the next screen. You need to go through all the screens till you get the following screen,

and then press "**Reset**" before the parameters will be updated. The screens will appear in the following sequence.

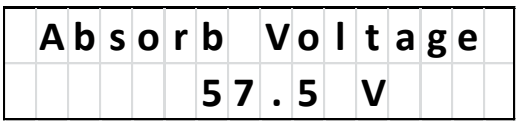
Float Voltage: Settable from 48V to 60V. (default, 55.0V)



Float Time: Settable from 0 minutes to 600 minutes. (default, 60min)



Absorb Voltage: Settable from 52V to 64V. (default, 57.5V)



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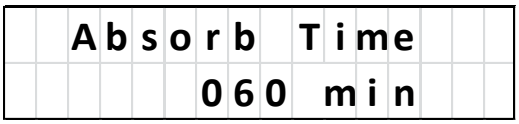
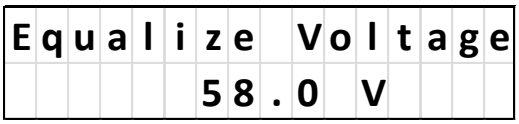
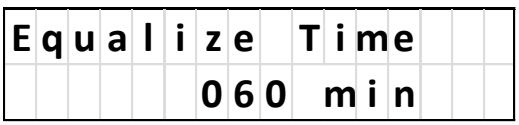
Absorb Time: Settable from 0 minutes to 600 minutes. (default, 60min)



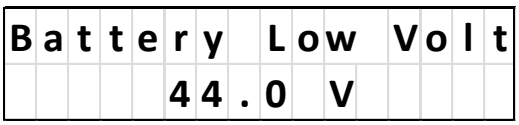
Equalize Voltage: Settable from 56V to648V. (default, 58.0V)



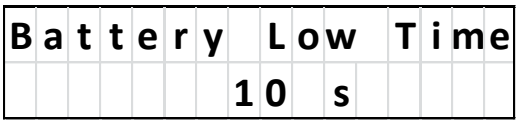
Equalize Time: Settable from 0 minutes to 600 minutes. (default, 60min)



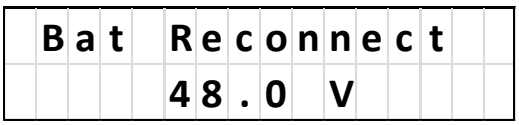
Battery Low Voltage: If the battery Voltage goes below this value for longer than the "Battery Low Time", the Inverter will switch off and stay off till the batteries reaches the "Battery Reconnect Voltage". Settable from 40V to 46V. (default, 44.0V)



Battery Low Time: See "Battery Low Voltage" above. Settable from 1second to 20 seconds. (default, 10 sec)



Battery Reconnect Voltage: If the Inverter is off due to a "Battery Low" state, the Inverter will automatically start up if the battery Voltage rises above this value and the "Battery Reconnect Time" has ran out, since the Inverter switched off. Settable from 40V to 56V. (default, 48.0V)



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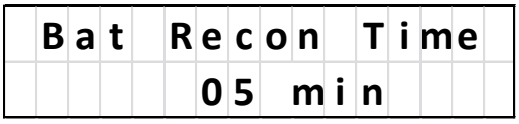
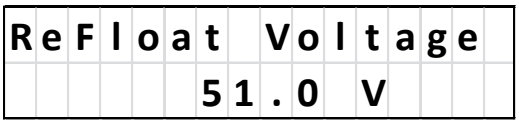
Battery Reconnect Time: If you connect a big load onto your Inverter when the batteries are fairly discharged, it can pull the Battery Voltage below the "Battery Low Voltage" and cause the Inverter to switch off. The Battery Voltage can then jump up to above the "Battery Reconnect Voltage". This will cause the Inverter to start up again, while your fridges motor is still under pressure, which is not good for you fridge's motor. To prevent this from happening, the Inverter will wait for the "Battery Reconnect Time" to run out, before it will start up again. Settable from 0 minutes to 10 minutes. (default, 5 minutes)

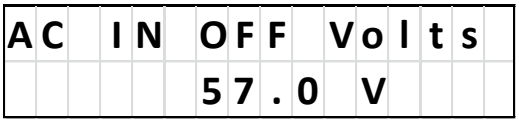


Refloat Voltage: Settable from 44.0V to 52.0V. (default, 51.0V)



Generator Mode: At the back of the Inverter/Charger is a generator start terminal. It is connected to a 1 Amp relay. This contact is open when the generator must be off, and will close if the generator must run. If your generator has an automatic start switch, you can use this relay to start and stop the generator. OFF will be selected if you don't want the generator to be started, for example, the generator ran out of fuel. ON will be selected if you manually want to start the generator. Then you need to switch it OFF manually as well, or switch it back to AUTO. In AUTO the generator will be started and switched of as needed. See AC IN ON Voltage, AC IN ON Delay, AC IN OFF Voltage and AC IN OFF Delay.

AC IN OFF Voltage: This is the Battery Voltage at which the Inverter/Charger will switch off the generator or stop charging when used in Generator Assisted or Grid Assisted mode. Settable from 48.0V to 64.0V. (default, 57.0V)



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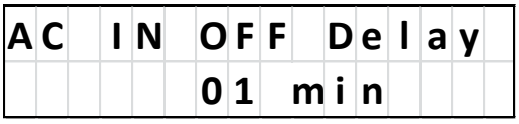
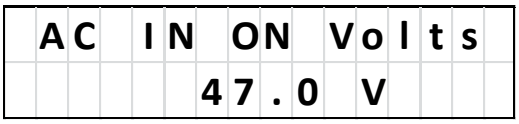
AC IN OFF Delay: This is the time it will keep the batteries at "AC IN OFF Voltage" before stop charging, when used in Generator Assisted or Grid Assisted mode. Settable from 1 minute to 99 minutes. (default, 1 minutes)

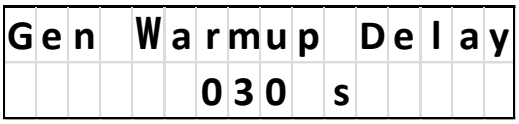


AC IN ON Voltage: This is the Battery Voltage at which the Inverter/Charger will start the generator or start charging when used in Generator Assisted or Grid Assisted mode. Settable from 40.0V to 56.0V. (default, 47.0V)

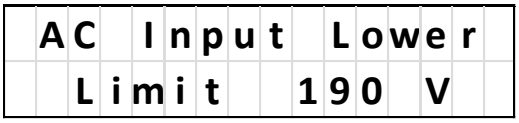


AC IN ON Delay: This is the time that the batteries will have to stay below the "AC IN ON Voltage" before the Inverter/Charger will start the generator or start charging, when used in Generator Assisted or Grid Assisted mode. Settable from 1 minute to 99 minutes. (default, 1 minutes)

Generator Warmup Delay: This is the time the Inverter/Charger will give the generator to warm up, after starting it, before it will connect to it. Settable from 0 seconds to 600 seconds. (default, 30 sec)



AC Input Lower Limit: If the AC Input Voltage drops below this value, the Inverter/Charger will disconnect from it and the load will be switched over to the Inverter. Settable from 180V to 220V. (default, 190V)



AC Input Upper Limit: If the AC Input Voltage goes above this value, the Inverter/Charger will disconnect from it and the load will be switched over to the Inverter. Settable from 250V to 270V. (default, 260V)

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AC Input Upper
Limit 260 V

AC Input Maximum Current: This is the maximum current the Inverter/Charger will draw from the Generator (to protect the generator) or Grid, unless the load is more than this current. For example: If you have a 6kVA generator at 230V. The maximum output current of the generator is then 26Amps. If your load is 15Amps, the Inverter/Charger will then draw a maximum of 11Amps from the generator to charge the batteries, so that your generator is not overloaded. If your load is more than 26 Amps, there is nothing the Inverter/Charger can do about it. This value will be set according to your generator. Settable from 0 Amps to 50 Amps. (default, 15 Amps)

AC IN Maximum
Current 15.0A

AC INPUT Source?: This is used to select in which mode the Inverter/Charger is being used. As an Grid-Offline UPS, as a Generator Assisted Inverter or as a Grid Assisted Inverter. See page 1 for more details of the different mode.
(default, Generator Assisted)

AC INPUT Source?
GEN Assisted

Maximum Charging AC Current: This is the maximum current on the AC side that will be used for charging the batteries. The average Battery current over the whole voltage range will more or less be 3.4 times the AC current. For example, if you want to set the maximum Battery Charging Current to 60Amp, then you set the **Maximum Charging AC Current** to ***60/3.4 = 17.6Amps***. Settable from 0 Amps to 17.5 Amps. (default, 17.5 Amps)

Maximum Charging
AC Current 17.5A

Password to Set Calibration: This is for factory use only. Do not attempt to enter it.

Password to Set
Calibration 000

"The End"

Enjoy your High Quality, South African Developed and Manufactured product.

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