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

The **Inverter/Charger** can be used for the following applications:

- **Offline UPS** (Uninterrupted Power Supply)**:** Where you have an unstable Grid Connection or in cases of Load Shedding, 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. The inverter has **two AC Inputs**. Where Grid failures are longer than a few hours, a Generator can be connected to the seconds AC Input. If the Generator has an Automatic Start Unit, the Inverter will automatically start the generator when the Grid is off and the battery drops below a settable value (SOC or Battery Voltage). Otherwise, the Generator can be started manually.
- **AC Assisted Mode:** In this mode the Inverter is used in conjunction with an alternative energy source like Solar Panels. The Inverter will primarily run on the batteries, which is charged by the solar panels or another sources. If the alternative energy is not enough the inverter will switch the load to the AC source. The two AC Inputs make it possible to connect the inverter to either to the Grid, a Generator, or both.

Table of Contents

Inverter Specifications

Nominal Battery Voltage	**:**	48 Vdc
Input Voltage Range	**:**	40 – 66Vdc
Input Current	**:**	200A
Output Voltage	**:**	220 – 230 Vac Settable, 50 Hz
Output Current	**:**	35A
Waveform	**:**	Pure Sine Wave (THD < 3%)
Continuous Output Power @25°C	**:**	8000 VA
Continuous Output Power @25°C	**:**	6500 W
Continuous Output Power @40°C	**:**	5500 W
Maximum Output Power	**:**	18 000 VA for 5 s
Maximum Efficiency	**:**	>92%
Power Consumption – No Load	**:**	39W

Charger Specifications

Input Voltage (Grid & Generator)	**:**	180Vac – 270Vac
Input Frequency	**:**	45Hz – 60Hz
Input Current	**:**	30 Amp AC
Charging Current	**:**	100 Amp DC
Charge Voltage	:	48 – 64Vdc
Charging type	**:**	3 Stage (Bulk, Absorb, Float) & Equalize

General Specifications

Enclosure	**:**	Powder coated mild steel
Dimensions (h x w x d)	**:**	610mm x 330mm x 250mm
Mounting	**:**	Wall Mount
Weight	**:**	53 kg

Protection Features

Over Load Protection	**:**	Electronic
	:	DC Circuit Breaker
Over Voltage Protection	**:**	66 V
Under Voltage Protection	**:**	Settable (40.0V – 50.0V)
Short Circuit Protection	**:**	100 Amp AC
Over Temperature Protection	**:**	>75°C

Other Features

Zero spark connection	**:**	Charge DC Bus with resistor
Cooling	**:**	Fan Cooled
Battery Connection	**:**	M8 Stud on Copper Busbar
230V AC Connection	**:**	Screw Terminals 10mm^2
Generator Start/Auxiliary Relay	**:**	1 Amp, Screw Terminal

1. Mounting

First mount the wall mount bracket level onto the wall, with the Lip to the top, as in Picture 1 below. Use the supplied (8 x 60) Coach Screws, or (8 x 65) nail-in fasteners. Mount the 2 handles onto the sides of the inverter, as in Picture 2. Lift the inverter and hook it onto the wall mount bracket.

Picture 1

Picture 2

Remove the 2 handles and mount it onto the bottom of the inverter as shown in Picture 3 below. These 2 brackets can now be used to secure the inverter to the wall using the supplied (6x45) nail-in fasteners.

Picture 3

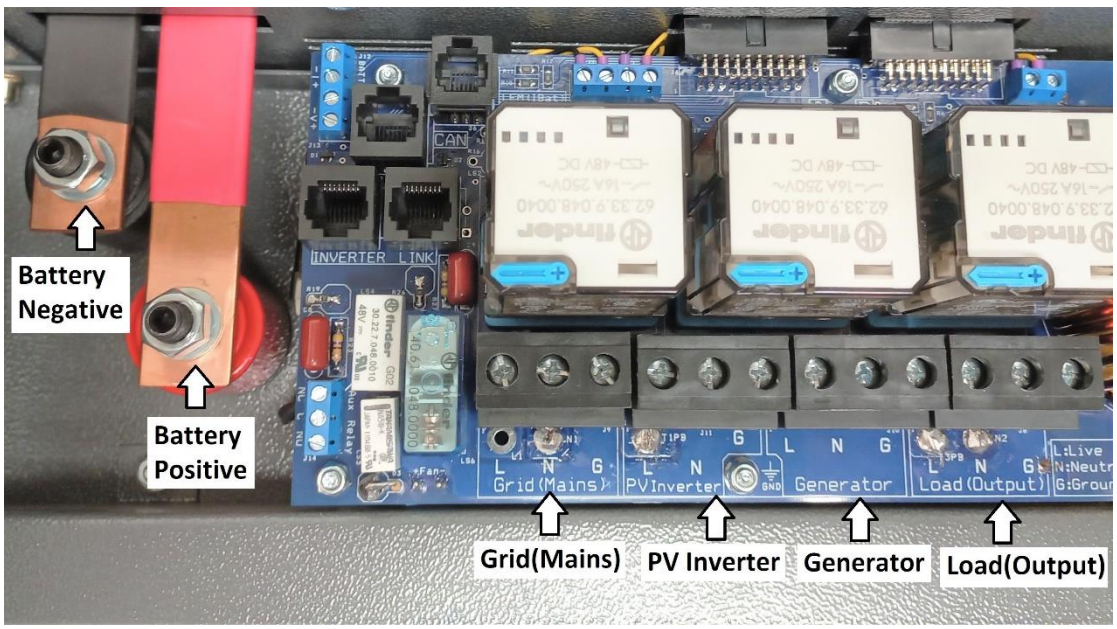
2. Installation

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

Remove the Terminal Cover Plate as seen in Picture 4 below. There are 4 screws on the front and 2 screws at the bottom.

Picture 4

- **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 8 crimping lugs. For cables longer than 1 meter, at least 70 mm^2 cables need to be used, with 70 x 8 crimping lugs. The Positive Busbar is RED. The Negative Busbar is Black. Connect the Negative battery cable to the Black Busbar on the upper left-hand side. Connect the Positive battery cable to the Red Busbar on the lower right-hand side. See Picture 5 below.



Picture 5

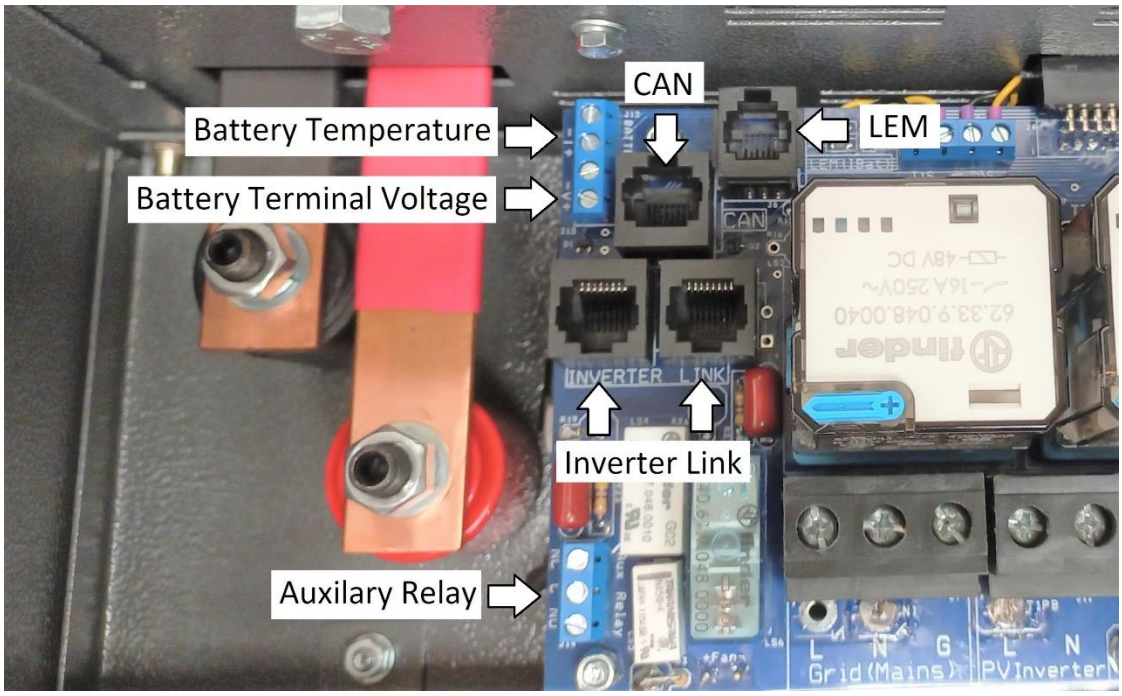
- **AC Connections.** The Grid, PV Inverter, Generator and Load must be connected accordingly as clearly indicated on the PCB. See Picture 5 above.
  At least **6 mm²** wire must be used. A **40Amp** Circuit Breaker must be installed on the Grid, PV Inverter and Generator Inputs, as well as on the Load(Output).

- **Auxiliary Relay.** See Picture 6 below. This is a dry contact that can be used as a Generator Start Relay or a Programmable Relay to switch on or off at Battery Voltages or Battery SOC (State of Charge) levels. The Relay is rated at 1Amp at 230VAC . Programming the relay is explained in Section 6.3.48. You must connect to the Common(C) and to the Normally Open(NO) or Normally Closed(NC) terminals of the 3 pin screw connector.

- **Battery Temperature.** See Picture 6 below. A temperature sensor (optional) can be connected to the 2 pin screw connector for measuring battery temperature. Connect the Red wire to the Positive(**+**) and the Blue wire to the Negative(**-**).

- **Battery Terminal Voltage.** See Picture 6 below. For an accurate Battery Voltage Measurement, the Battery Terminal Voltage can be measured by connecting wires between the 2 pin screw connector and the battery terminals. Connect the Battery Positive wire to the Positive (**+**) and the Battery Negative wire to the Negative (**-**).

- **LEM(IBat).** See Picture 6 below. If the inverter is used with Lead Acid batteries, a LEM module (optional) can be used to measure the Battery Current. The SOC (State of Charge) of the batteries can also then be calculated. A one to one, 6 way(3 pair) cable is used to connect between the RJ12 sockets of the Inverter and the LEM module.



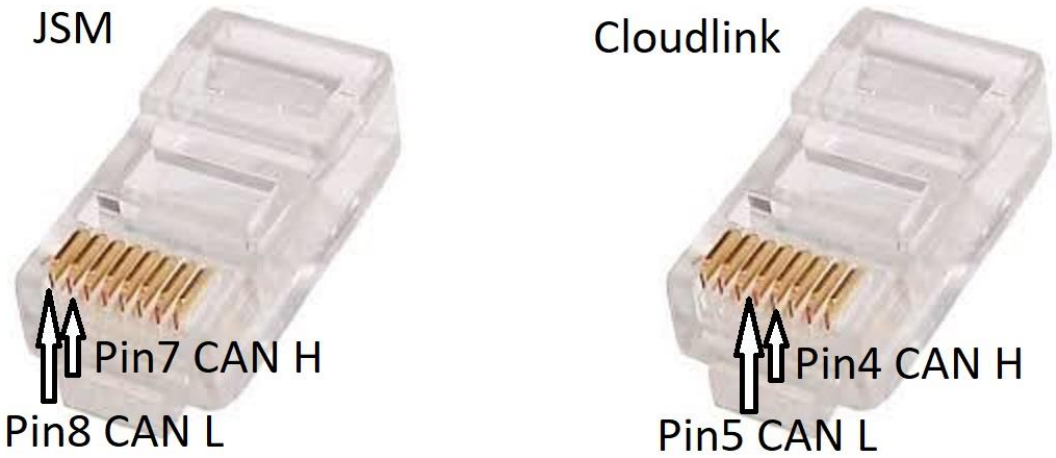
Picture 6

- **Inverter Link (must always be terminated).** See Picture 6 above and Picture 7 below. This is a RJ45 (8 poles, 8 connected) connector that is used for communication between Inverters, connected in parallel or in three-phase. The cable is made one to one.

Picture 7

If only one inverter is used, use one termination on any of the 2 **Inverter Link** sockets. If more than one inverter is used, the cables are daisy-chained between the Inverters. Make sure to terminate (120Ω between **pin1** and **pin2**) on both ends of the CAN bus.

- **CAN.** See Picture 6 above and Picture 8 below. This is a RJ45 (8 poles, 8 connected) connector that is used for communication with MPPT's, Lithium-Ion Batteries and the Riot Cloud Link. There is a **built-in 120Ω termination** in the Inverter, so no termination is needed on CAN, on the Inverter side. It needs to be terminated at the last device connected to this CAN bus.



Picture 8

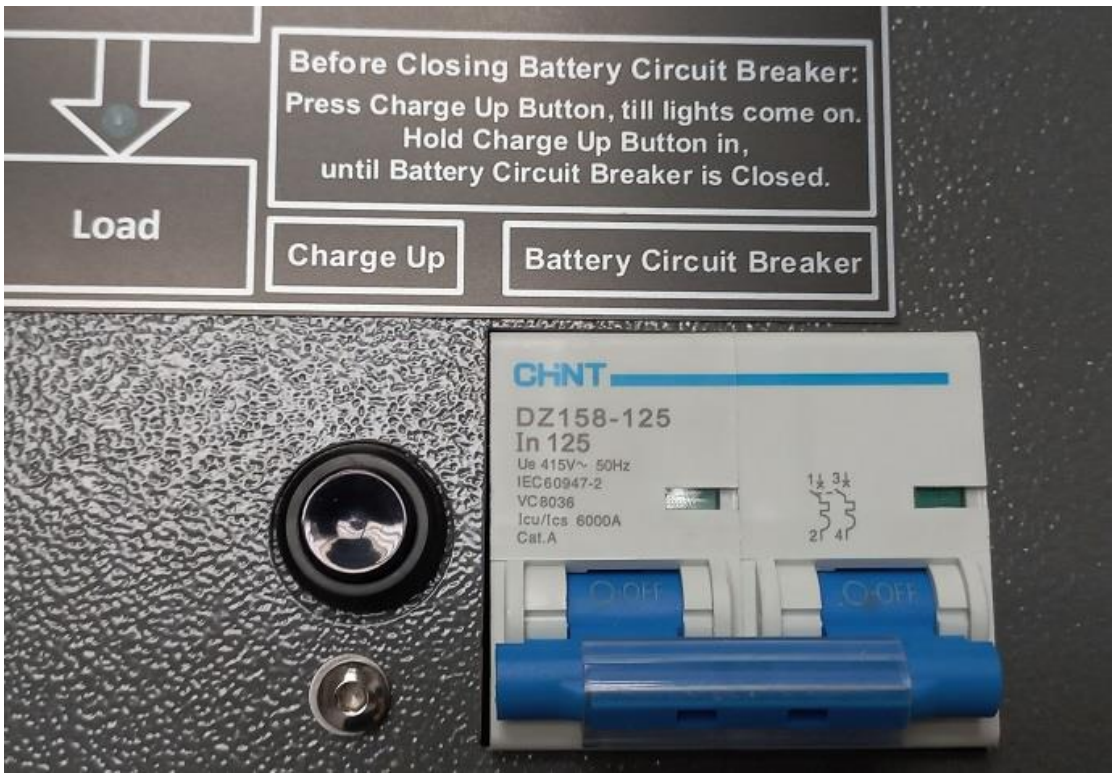
Please refer to Lithium-Ion Battery manual for CAN bus pinouts.

3. Switching on

See Picture 9 below. Push the Charge Up button, next to the Battery Circuit Breaker for 5 seconds and check if some of the LEDs on the front panel come on. If not, **do not** switch the Battery Circuit Breaker on. Check that the polarity of the battery cables is correct. If the LEDs come on, switch the Battery Circuit Breaker on, **while holding the push button in**. Now go to the Setup System Menu and Set Parameters Menu to set the Inverter up, according to your application, see section 6.

For systems with **more than one inverter,** it is recommended that the Master Inverter is switched on first. Finish the System Setup on the Master Inverter and set the number of Inverters. Then switch on the Slaves one by one. Set them as Slaves and allocate the right Inverter number to them in the System Setup.

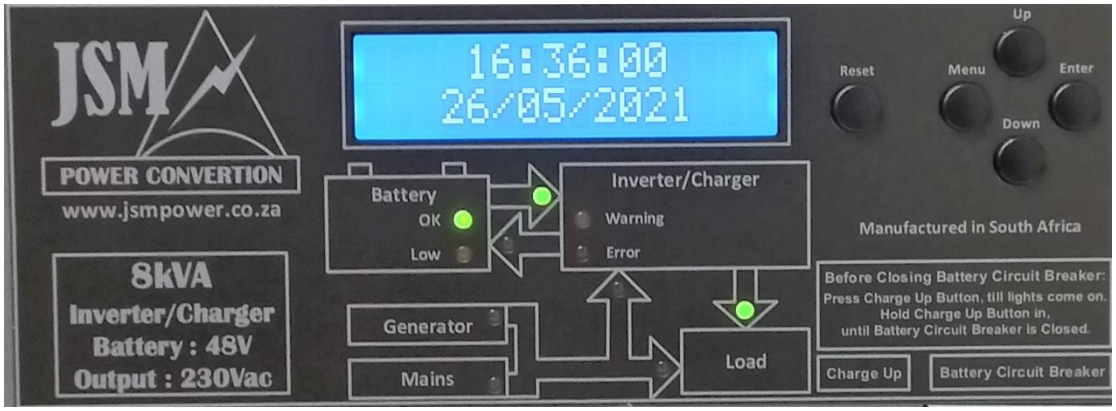
Setting up a System with MPPTs and Inverters is explained in Appendix A on page 23.



Picture 9

4. LED Display

On the front panel there is a LED display that shows the Flow of Power and Errors and Warnings as seen in Picture 10 below.



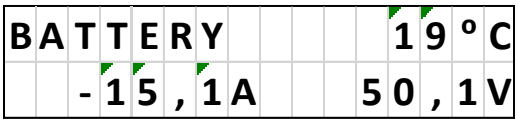
Picture 10

The illuminated LEDs in the specific arrows will be an indication of the power flow.

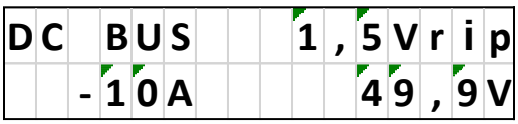
- **Battery Low LED.** This LED will start to flash if the Battery Voltage goes below *"Battery Low Voltage"* +1V, or the SOC goes below *"Battery Low SOC"* +0,5%. When the *"Battery Low Voltage"* is reached the buzzer will buzz continuously for 30s and then the Inverter will switch off. If the SOC goes below *"Battery Low SOC"* the inverter will also switch off. The Inverter is now in a *"Battery Low State"* and the Battery Low LED will stay on. This LED will only be cleared after the *"Battery Reconnect Voltage"* has been reached and the inverter will start up again.
- **Battery OK LED.** This LED will be on if the battery voltage is higher than *"Battery Low Voltage"* +1V, and the Inverter is not in *"Battery Low State"*.
- **Warning LED.** If this LED is on use the Up or Down buttons on the keypad to go to the "Warning Window" to see what Warnings is active. See Warning Window on page 13.
- **Error LED.** Use the Up or Down buttons on the keypad to go to the "Error Window" to see what Errors is active. See Error Window on page 12.

5. Keypad and LCD Display

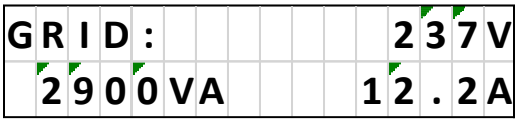
The Keypad and LCD Display is used to Setup the System, Set Working Parameters or View Variables like Battery Voltage etc.
There are 13 Viewing windows. They show the following variables as seen below. Press the "**Up**" or "**Down**" buttons to change between the different windows.



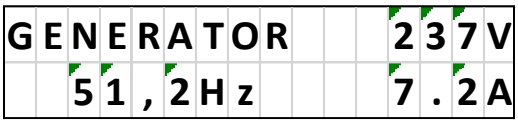
- **Battery Temperature, Current and Terminal Voltage.** This window is only displayed if the SOC Meter is enabled. If a Lithium battery is connected these variables is the values from the battery's BMS. A Positive current means the battery is being charged, while a Negative current means current is drawn out of the battery.



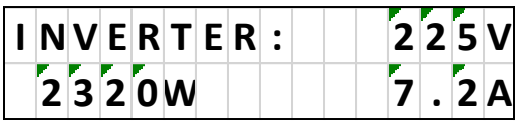
- **DC Bus Voltage, Current and Voltage Ripple.** These variables are the Voltage and Current on the DC bus bars inside the inverter. The Voltage Ripple is an indication of the health of the batteries. A Negative Current means current is drawn from the battery by the inverter.



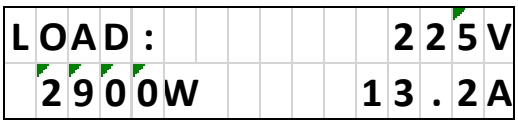
- **Grid Voltage, VA's and Current.**



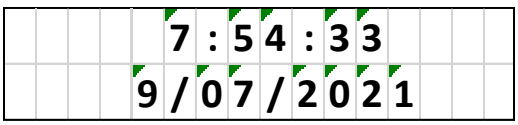
- **Generator Voltage, Frequency and Current.**



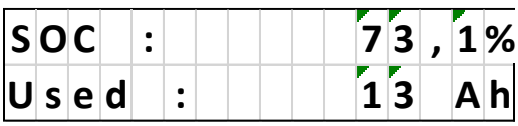
- **Inverter Voltage, Current and Power.**



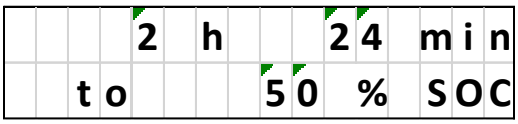
- **Load Voltage, Current and Power.**



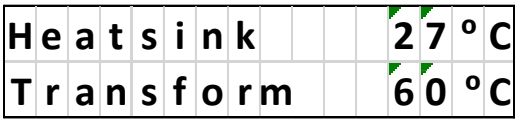
- **Date and Time**



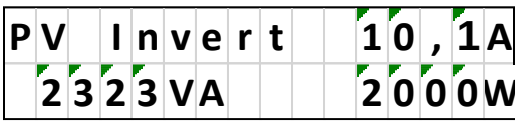
- **Battery State of Charge and Amp Hours used.**



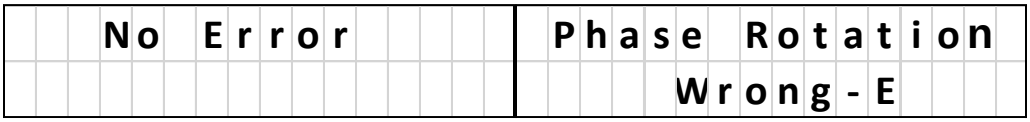
- **Time to Go.** This is the time that the batteries will take to reach the settable floor SOC at the current power drawn from the batteries.



- **Heatsink and Transformer Temperature.**



- **PV Inverter's Current, VA and Power.**



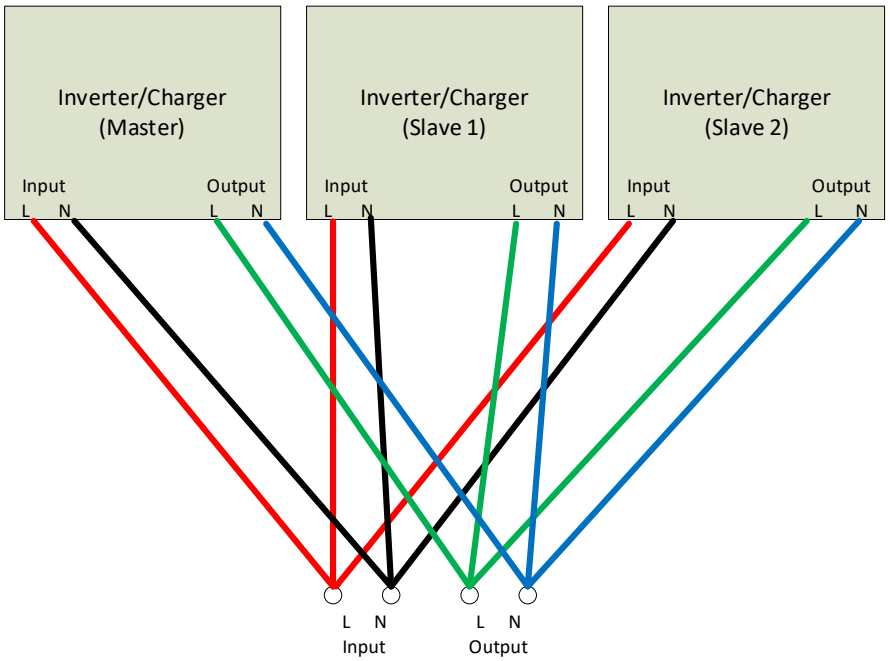
- **Error Window.** If there are multiple Errors, this window will scroll through the Errors. All the possible Errors are listed below. The (-E) at the end of the message indicates that it is an Error and not a Warning. See example above.
    1. **Phase Rotation Wrong** – This Error will occur if the system is configured as a Three Phase System, and the Inverters try to switch over to the Grid, but Phase B and Phase C needs to be swapped.
    2. **More Than One Master Detected** – There can only be one Master Inverter. All other Inverters on the CAN Bus need to be changed to Slaves.
    3. **Sync Pulse Lost** – The Master Inverter is sending Sync Pulses to the Slave Inverters. If any of the Slaves is not receiving this Pulses it will show this message. Check the CAN Bus cables between the Master and Slaves.
    4. **Feedback Signal Lost** – The measurement of the Inverter's Output is lost, and the Inverter needs to switch off to make sure that a too High Voltage is not supplied to the Load.
    5. **Over Load** – This Error will occur if the transformer temperature is too high, the inverter will switch off and stay off until you Reset it. In Grid Assisted Mode the Inverter will switch the load over to the Grid (if available) if the transformer temperature gets too high. It will switch the load back to the Inverter if the transformer has cooled down enough.
    6. **Over Temperature** – The inverter will switch off if the Heatsink temperature gets above 75ºC. The Inverter needs to be Reset to clear this error.
    7. **Short Circuit** – If more than 18kVA is drawn from the inverter it will switch off to protect the MOSFETs(Transistors). The Buzzer will also buzz in this condition. Reset the Inverter to clear this Error.
    8. **Over Voltage** – If the DC bus for some reason goes above 66V the inverter will switch off. Reset the inverter to clear this error.
    9. **Battery Low** – If the battery Voltage goes under the *"Battery Low Voltage"* for more than 30s or the SOC goes under *"Battery Low SOC"* the inverter will switch off. It will switch on if the battery Voltage reaches the *"Bat Reconnect Voltage".*
    10. **Error received from Inverter –** If an Inverter receives an Error from another Inverter on the same CAN Bus, it will switch off. The inverter will switch on again if the Error is cleared by the other Inverter.
    11. **Incorrect setup or comms lost –** The Master Inverter will check to see if the number of Inverters, it was setup for, is actually on the CAN bus. If not, this message will be displayed and the Inverters will switch off. This message can also be displayed if the CAN bus communication cables is not connected.

No Warning

Comms Lost MPPT West -W

- **Warning Window.** If there are multiple Warnings, this window will scroll through the Warnings. All the possible warnings are listed below. The (-W) at the end of the message indicates that it is a Warning and not an Error. See example above.
    1. **Comms Lost MPPT West.**
    2. **Comms Lost MPPT North.**
    3. **Comms Lost MPPT East.**
    4. **Comms Lost Wind Turbine.**
    5. **Comms Lost Water Turbine.**

    The Master Inverter will check to see if the number of MPPTs and turbine specified in the Setup System is actually communicating on the CAN Bus, if not, it will display one of the warning messages above.
    6. **AC Input Current Fault –** This warning will occur if the Grid or Generator input relay is not working or the AC input wire is damaged.
    7. **AC Wire Length not the same –** For inverters in parallel the AC input wires and AC output wires, to and from each inverter should be the same. This is illustrated in Picture 11 below. The wires with the **same color need to be the same lengths**.

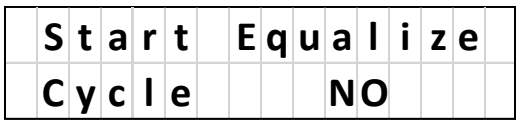


Picture 11

6. Setting Up the Inverters

Press the "**Menu**" button to enter the Menus and then use the "**Up**" or "**Down**" buttons to scroll thought the different Menus as listed below.

6.1 Equalize Cycle.

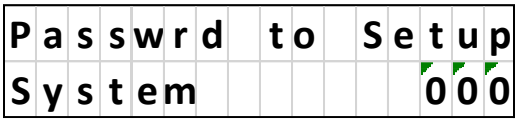


On Lead Acid Batteries, an occasional Equalize Charge helps to Equalize the Voltages of the different cells of the battery, to prolong battery life. The Equalize Voltage, and Equalize Time is settable in the Settable Parameters Menu. If the following screen is displayed, press "**Enter**" and the "**NO**" will start flashing. Use the "**Up**" or "**Down**" to change the "**NO**" to "**YES**", press "**Enter**" and the flashing will stop. 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. See (6.3.15) & (6.3.48) as well. 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.

If the "**Menu**" button is pressed again, the Viewable Variable Windows will be displayed.

6.2 Setup System.

When this screen is displayed, press "Enter" and the digits **"000"** will flash. Use **"Up"** or **"Down"** to go to **"123"** and press **"Enter"**.



The Setup System Menu is used to specify the Operating Mode of the PV system. It can be setup as an UPS or an AC Assisted System. You also select if it is a Single or Three Phase System. You also give each inverter an unique number and specify whether it's the Master or a Slave.

6.2.1 **Master or Slave**: You need to select one of the Inverters as the Master and set the rest all as Slaves. All the Setup System Options and Setup Parameter are only set on the Master Inverter and sent to the Slaves.

6.2.2 **Inverter Phase and Number**: The Master Inverter is automatically Phase A1. On the Slave Inverters you need to give each Inverter a unique number. The options are Phase A2, Phase A3, Phase B1, Phase B2, Phase B3, Phase C1, Phase C2, Phase C3.

6.2.3 **Single or Three Phase**: On the Master you need to specify whether it a Single or Three Phase system.

6.2.4 **Total Number of Inverters in the System**: This is the total number of inverters in the system, including the Master.

6.2.5 **Total Number of MPPT's facing West**:

6.2.6 **Total Number of MPPT's facing North**:

6.2.7 Total Number of MPPT's facing East:

6.2.8 Total Number of Wind Turbines:

6.2.9 Total Number of Water Turbines:

6.2.10 Operating as UPS: If there are no Alternative energy sources in the system and the system consists only of batteries and Inverter/Chargers, select **"YES".** If any alternative energy sources, like PV panels, wind turbines, water turbines etc. is connected to the system select **"NO".**

6.2.11 SOC Meter Enabled or Disabled: An Optional LEM module is used to measure the battery current. This module can measure up to 300Amp positive or negative. On a 48V system you can measure up to 15kW. If the system runs frequently more than 15kW or 300Amp, extra LEM modules can be added to the Slave Inverters. You need to enable the SOC Meter on these Slave Inverters as well.

6.3 Set Parameters.

Password to Set
Parameters 000

When this screen is displayed, press **"Enter"** and the digits **"000"** will flash. Use **"Up"** or **"Down"** to go to **"234"** and press **"Enter".** The Parameters listed below can now be changed. Use the **"Up"** or **"Down"** buttons to scroll through the different parameters and press **"Enter"** if the parameter needs to change. If the value flash, use the **"Up"** or **"Down"** to change the value, and press **"Enter"** when the correct value is reached. The parameters can only be set on the Master Inverter and the Master will send these values to all the Slaves. If the Slave display **"Press UP to Save Master Settings"** it means that they received new parameters from the Master Inverter and they will save these setting if "**UP"** is pressed. Please note that not all these parameters will be accessible, but only those that is applicable for the application. For example, no Generator parameters will be displayed if the **"AC Input Source"** is set to **"Only Grid".**

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

6.3.2 Float Time (Minutes): Settable from 1 minutes to 600 minutes. (default, 60min)

6.3.3 Absorb Voltage: Settable from 48V to 64V. (default, 57.5V)

6.3.4 Absorb Time (Minutes): Settable from 6 minutes to 600 minutes. (default, 60min)

6.3.5 Equalize Voltage: Settable from 48V to 64V. (default, 57.5V)

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

6.3.7 Battery Low Voltage: If the battery Voltage goes below this value for longer than 30s, the Inverter will switch off and stays off until **Battery Reconnect Voltage** is reached. Settable from 40V to 50V. (default, 44.0V)

6.3.8 Battery Low SOC (%): If the SOC Meter is Enabled or the SOC is received from a Lithium-Ion Battery and the SOC goes below this value, the Inverter will switch off due to a Battery Low condition. Settable from 0% to 100%. (default, 50%)

6.3.9 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. Settable from **"Battery Low" +1V** to 56V. (default, 48.0V)

6.3.10 Temperature Compensation Voltage (mV/ºC/Cell): If lead acid batteries are used, a temperature sensor can be connected to the inverter to measure battery temperature and this value will be used to bring down the Charge Voltage if the battery temperature gets too high. (Settable from 0 – 10 mV)

6.3.11 Maximum Charging Current (A): This is the Maximum Battery Charging Current that the batteries will be charged with by **each** Inverter. If, for example there are 3 Inverters in parallel, each inverter will limit its charging current to this value, so that means that the total charging current into the batteries is 3 times this value. (Settable from 0 A – 100A). Please note that the Charging current in **Grid Assisted Mode** is **0A** if the Inverter/Charger connects to the Grid.

6.3.12 Inverter Output Voltage: This value is settable from 220V to 240V. (default, 225V)

6.3.13 Refloat Voltage: Settable from **"Battery Low" +1V** to 60.0V. (default, 51.0V)

6.3.14 AC Input Source: The Inverter/Charger have two AC inputs. This parameter is used to select what AC source is used, either Grid or Generator or Both.

6.3.15 Generator Mode: The Inverter/Charger's Auxiliary Relay (see 6.3.48) can be used as a Generator Start Stop 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 unit, 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 off as needed.

6.3.16 Generator ON Voltage: If the battery Voltage drops below this Voltage for more than the **"Generator ON Delay"** the Inverter will start the Generator, lock to the Generator output and switch the load over to the Generator. The Inverter/Charger will start to charge the batteries. Settable from 40V to 64V. (default, 47V)

6.3.17 Generator ON Delay (Minutes): See above. Settable from 1 minute to 60 minutes. (default, 1 minute)

6.3.18 Generator ON SOC (%): If the SOC meter is Enabled or a Lithium-Ion Battery is connected, the Generator can also be started and stopped on SOC conditions of the battery. The Inverter/Charger will **start** the Generator if the Battery Voltage goes below **"Generator ON Voltage"** **OR** the SOC goes below **"Generator ON SOC".** Settable from 0% to 100%.

6.3.19 Generator OFF Voltage: If the battery Voltage rises above this V oltage for more than the **"Generator OFF Delay"** the Inverter/Charger will stop the Generator and switch the load over to the Inverter's output.
Settable from **"Generator ON Voltage" + 1V** to 64V. (default, 57V)

6.3.20 Generator OFF Delay (Minutes): See above. Settable from 1 minute to 60 minutes. (default, 1 minute)

6.3.21 Generator OFF SOC (%): The Inverter/Charger will **Stop** the Generator if the Battery Voltage goes above **"Generator OFF Voltage"** **AND** the SOC goes above **"Generator OFF SOC".** Settable from 0% to 100%.

6.3.22 Generator Warmup Delay (Seconds): 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 1 second to 600 seconds. (default, 30 sec)

6.3.23 Gen Volts Lower Limit: If the Generator 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 230V. (default, 190V)

6.3.24 Gen Volts Upper Limit: If the Generator 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 240V to 270V. (default, 260V)

6.3.25 Generator Max Current (A): This is the maximum current the Inverter/Charger will draw from the Generator (to protect it), unless the load draws 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. Settable from 0 Amps to 50 Amps. (default, 10 Amps)

6.3.26 Grid ON Voltage: If the battery Voltage drops below this value for more than the **"Grid ON Delay"** the inverter will lock to the Grid and switch the load over to the Grid. In Grid Assisted Mode the battery **will not be charged** from the Grid, it will give priority to the Alternative Energy source (like PV panels) to charge the battery. Settable from 40V to 64V. (default, 48V)

6.3.27 Grid ON Delay (Minutes): See above. Settable from 1 minute to 60 minutes. (default, 1 minute)

6.3.28 Grid ON SOC (%): If the SOC meter is Enabled or a Lithium-Ion Battery is connected, the Inverter/Charger will **switch** the load over to the Grid if the Battery Voltage goes below **"Grid ON Voltage" OR** the SOC of the battery goes below **"Grid ON SOC".** Settable from 0% to 100%.

6.3.29 Grid On if Load Bigger as (Watts): The Grid can also be switch on and off, on Load conditions. If the Load gets bigger than this value for 30s, the load will be switched over to the Grid, but the battery will **not be charged** by the Grid. The Load will be switched back to the Inverter if the load power drops below **"Grid Off if Load less than".** Settable from 0W to 8000 W. (default, 8000W)

6.3.30 Grid OFF Voltage: If the Battery Voltage rises above this Voltage for more than the **"Grid OFF Delay"** the Inverter/Charger will switch the load over to the Inverter's output. Settable from **"Grid ON Voltage" + 1V** to 64V. (default, 57V)

6.3.31 Grid OFF Delay (Minutes): See above. Settable from 1 minute to 60 minutes. (default, 1 minute)

6.3.32 Grid OFF SOC (%): The Inverter/Charger will switch the load over to the Inverter's output if the Battery Voltage goes above **"Grid OFF Voltage" AND** the SOC goes above **"Grid OFF SOC".** Settable from 0% to 100%.

6.3.33 Grid Off if Load less than (Watts): See section 6.3.29. Settable from 0W to **"Grid on if Load Bigger as" - 500W.**

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

6.3.35 Grid Volts Upper Limit: If the Grid Input Voltage goes above this value, the Inverter/Charger will disconnect from the Grid and the load will be switched over to the Inverter. Settable from 240V to 270V. (default, 260V)

6.3.36 Grid Maximum Current: This is the maximum current the Inverter/Charger will draw from the Grid (to protect the circuit breaker feeding the inverter), unless the load is more than this current. For example: if you have a 32A circuit breaker and your load is 15Amps, the Inverter/Charger will then draw a maximum of 17 Amps from the Grid to charge the batteries, so that the breaker is not overloaded. If your load is more than 32 Amps, there is nothing the Inverter/Charger can do about it. Settable from 0 Amps to 50 Amps. (default, 10 Amps)

6.3.37 PV Inverter On Output: If this option is enabled, the Inverter/Charger will start to drift its output frequency in order for the Grid Tied Inverters to reduce their Output Power to prevent the battery from overcharging. The following 3 parameters (6.3.38 – 6.3.40) need to be set according to the Grid Tied Inverter.

6.3.38 Start Frequency Drift at (Hertz): See Grid tied inverter's Datasheet

6.3.39 Reduce Power to zero at (Hertz): See Grid tied inverter's Datasheet

6.3.40 Disconnect PV Inverter @ (Hertz): See Grid tied inverter's Datasheet

6.3.41 Chrge Efficiency (%): When a battery is charged, not all the energy is stored in the plates, some energy is lost due to heating of the battery and gassing, therefore the Charge Efficiency is less than 100%. (default, 96%)

6.3.42 Peukert Constant: When a battery is discharged at high currents the capacity of the battery will depend on the current. Peukert Constant is a parameter of the battery that takes this effect into account when SOC and Time to Go is calculated. If this parameter is unknown use 1.25 for a lead acid battery or go to www.planetcalc.com/2268/. (default, 1.2)

6.3.43 Battery Capacity (Ah): Battery size given in AmpHour.

6.3.44 Tail Voltage: This parameter is used with the tail current to synchronize the State of Charge Meter. This value should be just below (say 0.5V) the Absorb Voltage.

6.3.45 Tail Current: This value must be smaller than 4% of the Battery Capacity. If the Battery Voltage is more than the Tail Voltage and the current drops below the Tail Current for 5 minutes the State of Charge Meter will Synchronize. This means SOC = 100% and Ah Used = 0, so the battery is fully charged.

6.3.46 Discharge Floor (%): When the Time To Go is calculated the Inverter will displays the time the battery will last at the current load, till it will reach this SOC.

6.3.47 Set SOC to (%): If you Reset the Inverter, it will lose the SOC (State of Charge) of the battery, so this parameter can be used to set the SOC to any value.

6.3.48 Auxiliary Relay: This parameter can be set on the Master and on the Slave Inverters. This relay can be programmed to switch on or off at selected Voltage Levels or SOC (State of Charge) Levels, or it can be set as a Generator Start Stop Relay (see 6.3.15), in which case it will use the Generator ON Voltage, OFF Voltage and SOC's to switch the Relay on and off.
Options: **"Disabled"**, **"Enabled-Voltage", "Enabled-SOC" and "Gen Start Relay"**

6.3.49 Aux Relay On Voltage: See Graph 1 & 2 below.

6.3.50 Aux Relay On Delay (Minutes): The Relay will switch on if **Aux Relay On Voltage** is reached and is this time has run out.

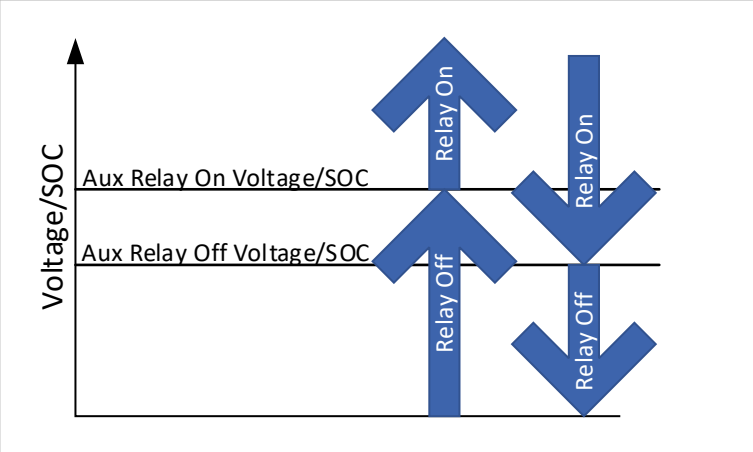
6.3.51 Aux Relay On SOC (%): See Graph 1 & 2 below.

6.3.52 Aux Relay Off Voltage: See Graph 1 & 2 below.

6.3.53 Aux Relay Off Delay (Minutes): The Relay will switch off if **Aux Relay Off Voltage** is reached and is this time has run out.

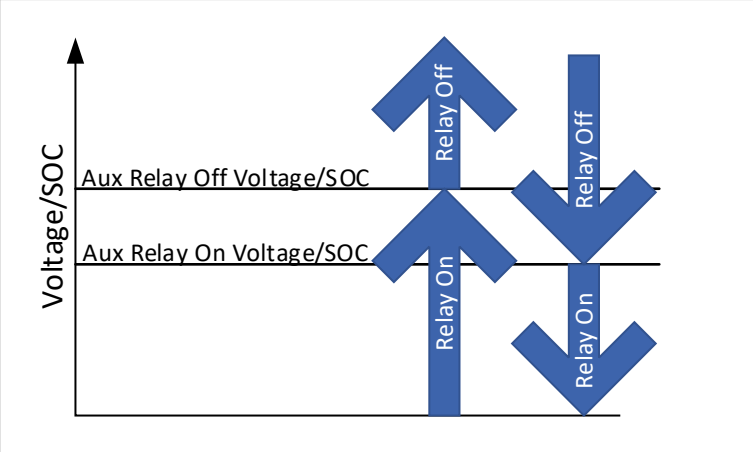
6.3.54 Aux Relay Off SOC (%): See Graph 1 & 2 below.

Graphs 1 show the Relay States for scenario's where the ON Voltage/SOC is bigger than the OFF Voltage/SOC.



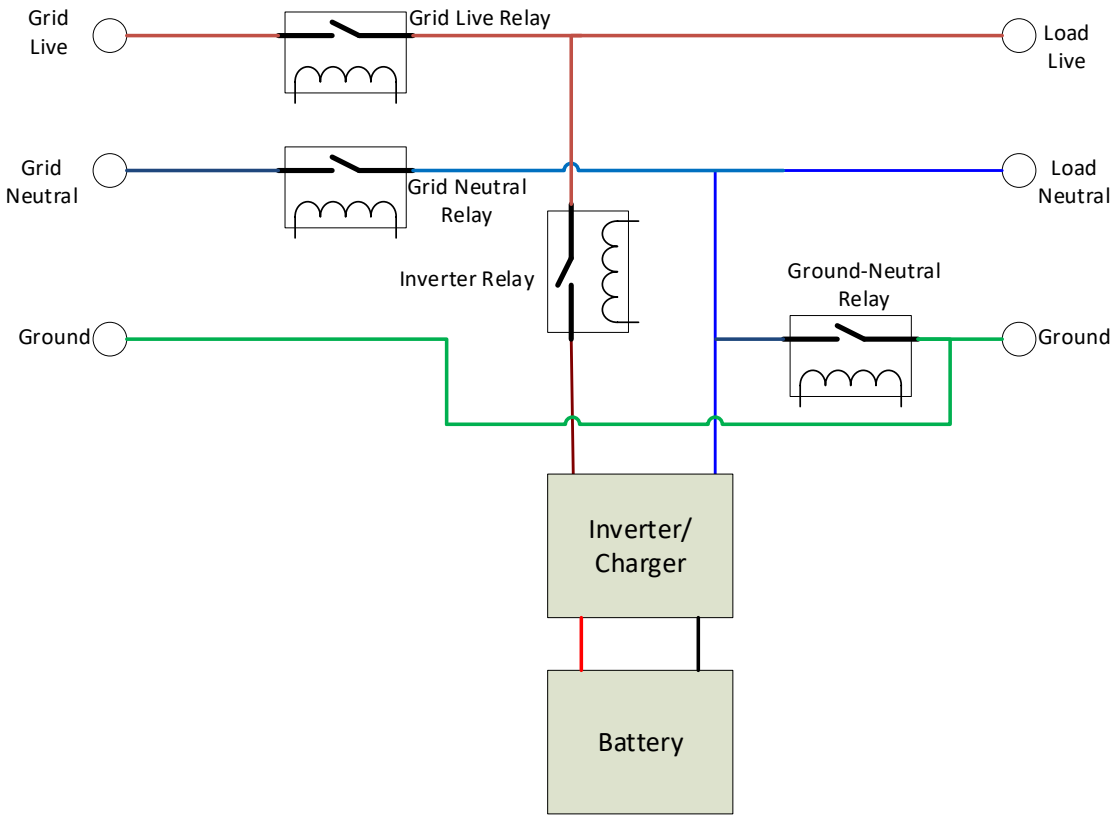
Graph 1

Graphs 2 show the Relay States for scenario's where the OFF Voltage/SOC is bigger than the ON Voltage/SOC.



Graph 2

6.3.55 Ground-Neutral Relay: The Wiring diagram below explains the working of the Inverter/Charger. If the Grid Live and Grid Neutral Relays are closed, the load is connected directly to the Grid. The Inverter/Charger will look like a Rectifier Load to the Grid and will charge the battery. The Inverter/Charger DON'T have the ability to feed power into the Grid. Before the Inverter/Charger runs as an Inverter, it will firstly open the Grid Relays to totally isolate the Grid Live and Grid Neutral from the Inverter/Charger. When both Relays are open, it will start running as an Inverter to supply a sinusoidal output to the Load. If the **"Ground-Neutral Relay"** is **"Enabled"** this Relay will close if the Inverter/Charger is running as an Inverter.



Wiring Diagram of
Inverter/Charger

6.3.56 Switch Over Time: The normal switch Over time for when the Grid falls away is 12ms. If this parameter is set to **"Slow"** the switch over time will be more than 20ms.

6.4 Set Calibration.

For Factory Use Only

Password to Set
Calibration 000

6.5 Set Time.

Set Time
No

If this window is seen and "Enter" is pressed, the "No" will flash. Use the "Up" or "Down" buttons to change to "Yes" and press "Enter".

The Time will be displayed as in the example below. First the hour field will flash, in this example the 12. Use the **"Up"** and **"Down"** buttons to change and then press **"Enter".** The next field will flash and can be changed. If all the fields are set, the **"Save"** will flash. Press **"Enter"** and the time is set.

				1	2	:	1	5	:	3	4	S	a	v	e				
			1	5	/	0	5	/	2	0	2	1							

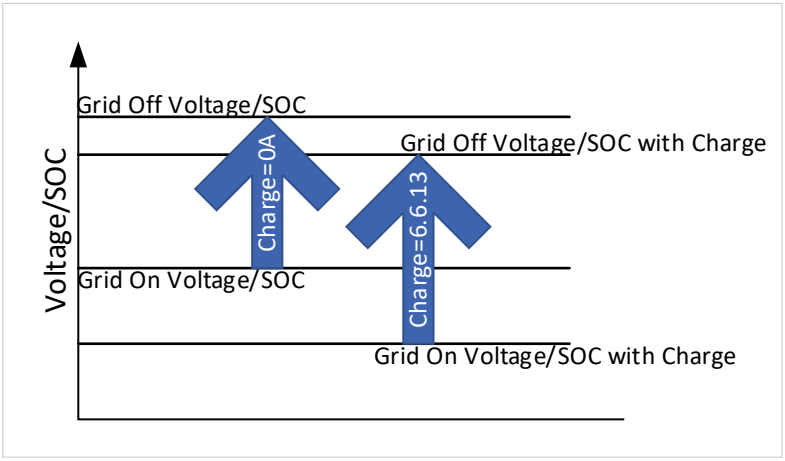
6.6 Battery Save Mode.

If you want to switch **Load Shedding Mode** on or if it is necessary to **Top Up Charging** the batteries if not fully charged.

P	a	s	s	w	o	r	d	-	B	a	t	t	e	r	y				
S	a	v	e		M	o	d	e						0	0	0			

When this screen is displayed, press **"Enter"** and the digits **"000"** will flash. Use **"Up"** or **"Down"** to go to **"345"** and press **"Enter".**

6.6.1 **Load Shedding Mode**: **On/Off**. If Load shedding Mode is switched off the **"Grid On Voltage"** and **"Grid Off Voltage"** settings as set in Parameters is used to switch over to the Grid in Grid Assisted Mode. If Load Shedding Mode is switched On, a new set of parameters (6.6.2 – 6.6.11) is used to decide when to switch over to the Grid and when to switch back. If the "Grid On Voltage/SOC" is reached, and the Gird is not available, the inverter cannot switch over to the grid. If the battery is drained further and reach the "Grid On Voltage/SOC with Charge" the Inverter will charge the battery with the current specified in parameter 6.6.13, as soon as the Grid is available again. It will go back to Inverting if the "Grid Off Voltage/SOC with Charge" is reached. See Graph 3 below.



Graph 3

6.6.2 **Grid On Voltage**: Settable from 40V to 64V. (default, 48V)
6.6.3 **Grid On Voltage with Charging**: Settable from 40V to **"Grid On Voltage" – 0,2V**. (default, 48V)
6.6.4 **Grid On Delay Charging (Minutes)**: Settable from **"Grid On Delay" + 1min** to 60
6.6.5 **Grid On SOC(%)**: Settable from 0% to 100%
6.6.6 **Grid On SOC with Charging**: Settable from 0% to **"Grid On SOC"**
6.6.7 **Grid Off Voltage**: Settable from **"Grid On Voltage" + 0,2V** to 64V.
6.6.8 **Grid Off Voltage with Charging**: Settable from **"Grid On Voltage"** to 64V.
6.6.9 **Grid Off Delay Charging (Minutes)**: Settable from **"Grid Off Delay" +** 1min to 60min
6.6.10 **Grid Off SOC(%)**: Settable from **"Grid On SOC"** + 0,1% to 100%
6.6.11 **Grid Off SOC with Charging**: Settable from **"Grid On SOC"** + 0,1% to 100%

6.6.12 Days Before Top-up Needed: To Disable this function press the **"Down"** button until **"OFF"** is displayed. If the Master Inverter see that the Batteries did not reach Float, it knows that it was not fully charged. If this happens for consecutive days, equals to the value specified here, the Inverter will do a **Top-up Charge**. It will switch the Load over to the Grid and Charge the Battery, with the current specified in 6.6.13, till the Battery is fully charged. Settable from 1 to 30 days.

6.6.13 Maximum Charging Current: This is the Charging Current that will be used if the Battery Levels **"with charge"** or **"Days Before Top-up Needed"** is reached.

Appendix A - Setting up a System with MPPTs and Inverters.

To setup a system that consists of multiple Inverters and MPPTs, it does not really matter which is switched on first. Switch OFF the Loads on the output of the Inverters and Switch OFF the Grid Input to the Inverters, before the System is Switch ON and Configured.

1. It is however recommended to switch the Master Inverter on first, go to the **"Setup System"(Password=123)** menu and setup the Master Inverter according to the application.

2. Now switch on the Slaves Inverters, one by one, go to their **"Setup System"(Password=123)** menu, set them up as Slaves and give each inverter a unique number (A1 is the Master, A2, A3, B1, B2, B3, C1, C2, C3).

3. If the Inverters switch on and they do not display any errors like **"Sync Pulse Lost"** or **" Incorrect setup"** or **"comms lost"**, you know that the communication between the inverters is working properly.

4. Set the Time on Master Inverter.

5. "**Set Parameters"(Password=234)** on Master Inverter, especially the battery changing parameters.

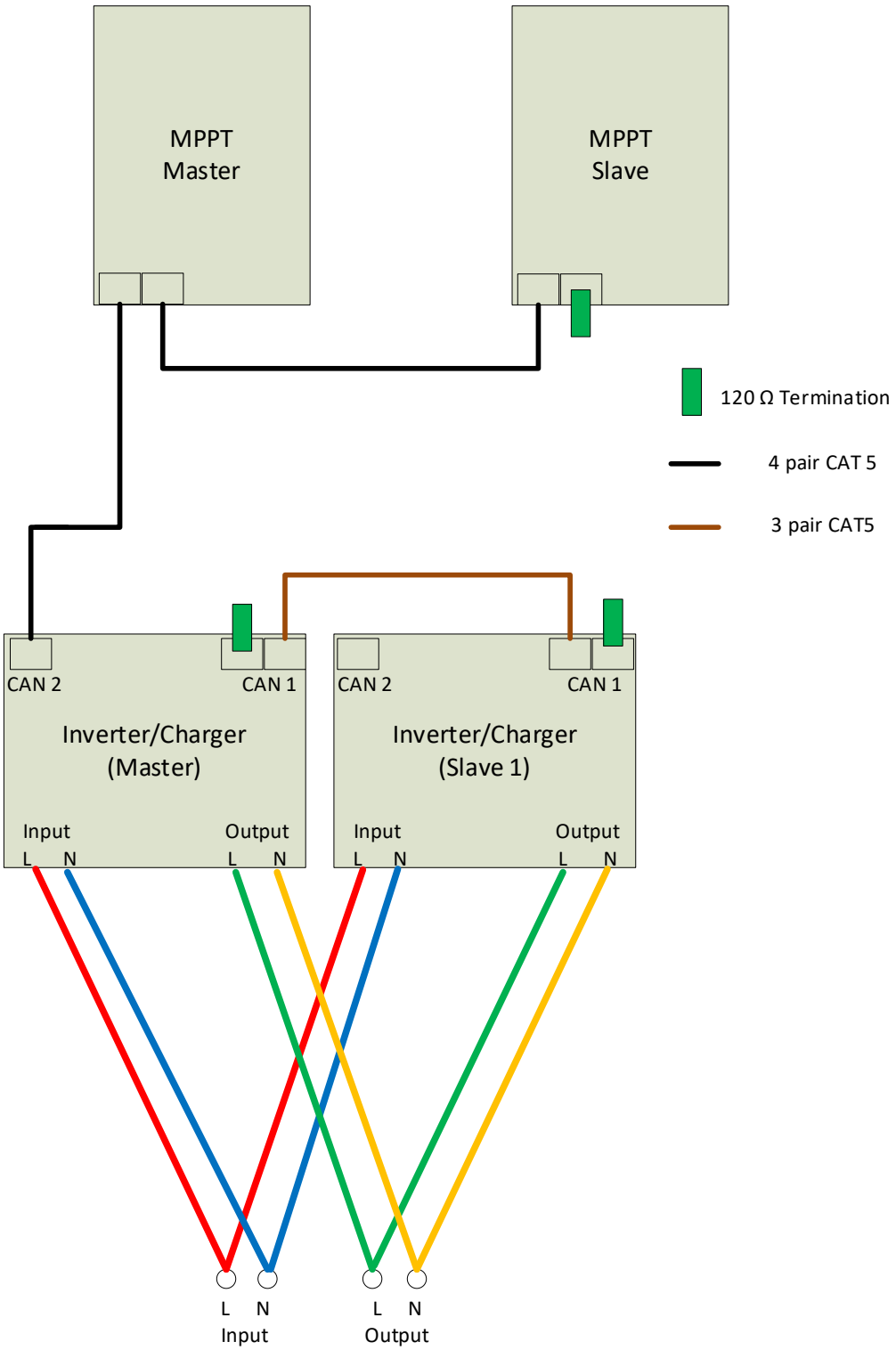
6. Now switch on the Battery Breaker on the MPPTs, one by one. Go to the **"Setup System"(Password=123)** menu of each MPPT. Choose any one to be the Master, the rest are Slaves. Give each MPPT a unique number and Direction (North1 - North10, West1 – West10, East1 – East10.

7. If you have specified the correct number of MPPTs in the system and the Master Inverter don't display any warnings, you know the communication between the MPPT's and Master Inverter is working properly.

8. Switch on the Solar Breakers of each MPPT.

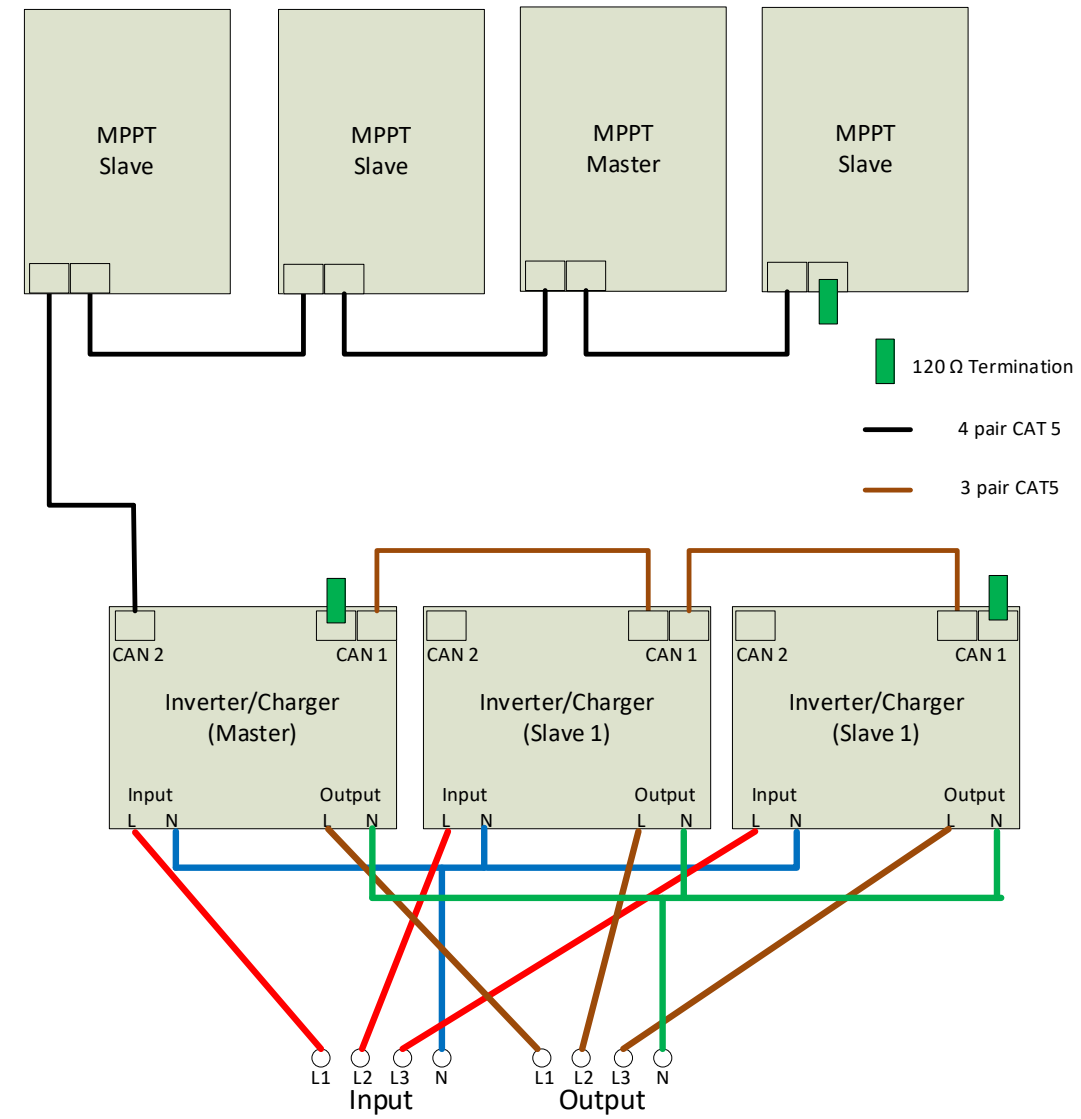
9. See Picture A1 on page 22 for an example of a Single phase system with 2 inverters in parallel and 2 MPPTs.

10. See Picture A2 on page 23 for an example of a Three phase system with 3 inverters and 4 MPPTs.



Picture A1

Note : The 2 red wires have same length
The 2 blue wires have same length
The 2 green wires have same length
The 2 yellow wires have same length



Picture A2

Note : The AC Input and AC Output wires don't have to be the same lengths because these inverters are not in parallel but in three phase. If however a second inverter is added on a phase the **AC input and Output wires of that phase need to be the same length** (see picture of example 6)

"The End"

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