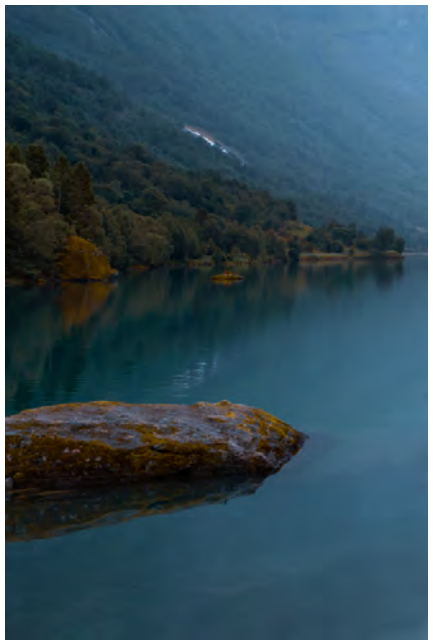
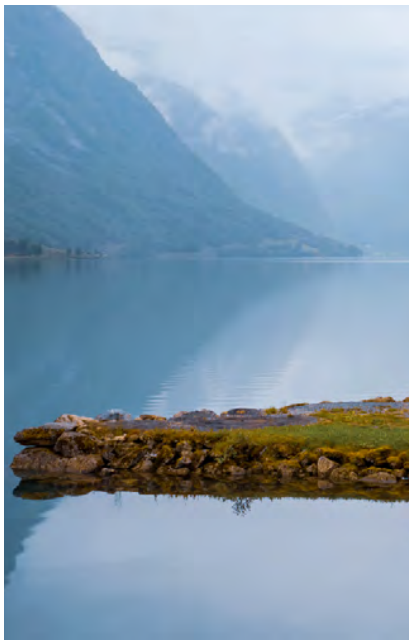
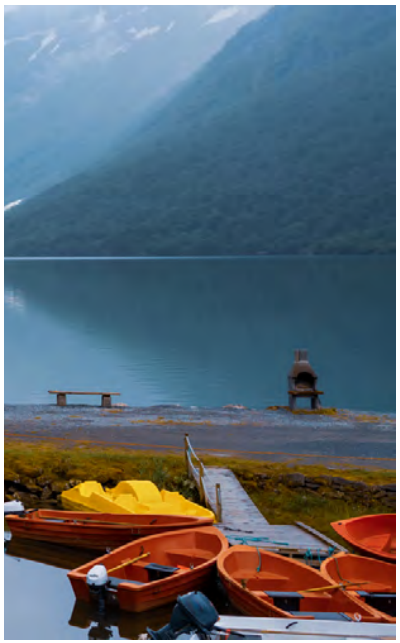
Installer's Guide

MODULE WITH EXTERNAL BMS INSTALLATION KIT

VICTRON 3000 WATT



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Safety Information

This manual is intended to be used by qualified installers. Although it is detailed, it is meant only as an overall guide to the installation and not to replace the manuals supplied by the relevant equipment manufacturers.

All electrical work should be performed in accordance with local and national electrical codes. Assume that voltage is present at the battery terminals; use insulated tools and gloves while working on the system. Always turn off equipment connected to the battery in addition to turning OFF the Power switch on the BMS to isolate it from other electrical circuits before performing any repairs or maintenance on the system.

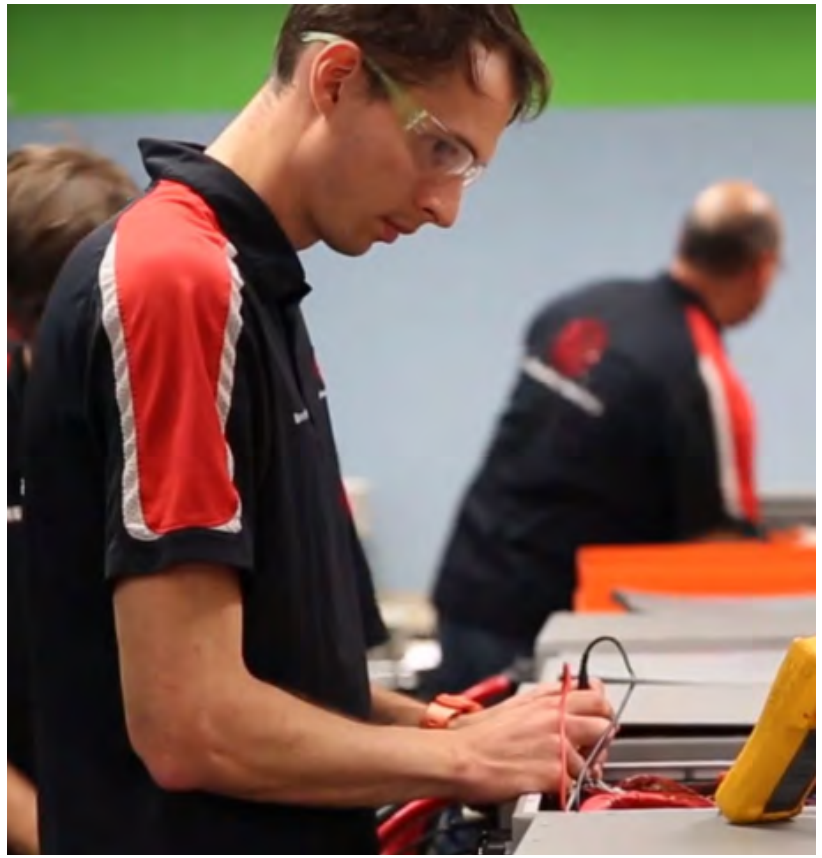
Always use proper wire sizes to connect the system to inverters, chargers or other equipment. Always use crimped connections to connect to the battery terminals.

Read and follow the inverter, charger or other equipment manufacturer's safety precautions prior to connecting the battery to that equipment. Always use charging equipment compatible with Lithium Iron Phosphate battery chemistry.

Links to the installation manuals relevant to this kit are listed at the back of this manual.

Introduction

The Lithionics Module and **External BMS** kit is based on a large format **GT** or **GTX** series lithium ion battery module and a **Victron MultiPlus** 3000 watt inverter. This combination is capable of providing enough power to run your AC loads for extended periods of time. The inverter features true sine wave grid quality power, adaptive charging, power assist, and many system integration features.



Wiring Diagrams

- Main Diagram
- Inverter Diagram
- Sterling Diagram
- Solar Diagram
- BMS/IonGage Diagram

Main Diagram

The main diagram depicts the general layout of the system. The main 4/0 positive cable is connected to the main positive distribution buss via a 400A class T fuse and an isolation switch.

The inverter is connected to the positive distribution buss via two 175A class T fuses and an isolation switch. The fuse blocks should be mounted as close as possible to the positive distribution buss. The isolation switch allows you to isolate the inverter in case of a malfunction as well as disabling the inverter if you need to work on the AC system. The chassis DC grounding conductor (green) should be sized not less than one size smaller than the DC positive conductor and have a capacity such that the DC positive fuse has an amperage rating not greater than 135% of the current rating of this ground wire.

If the positive cable suppling the inverter shorts to ground internally, then the chassis ground cable needs to be able to carry enough current to blow the fuse without melting and possibly causing a fire.

Main Diagram

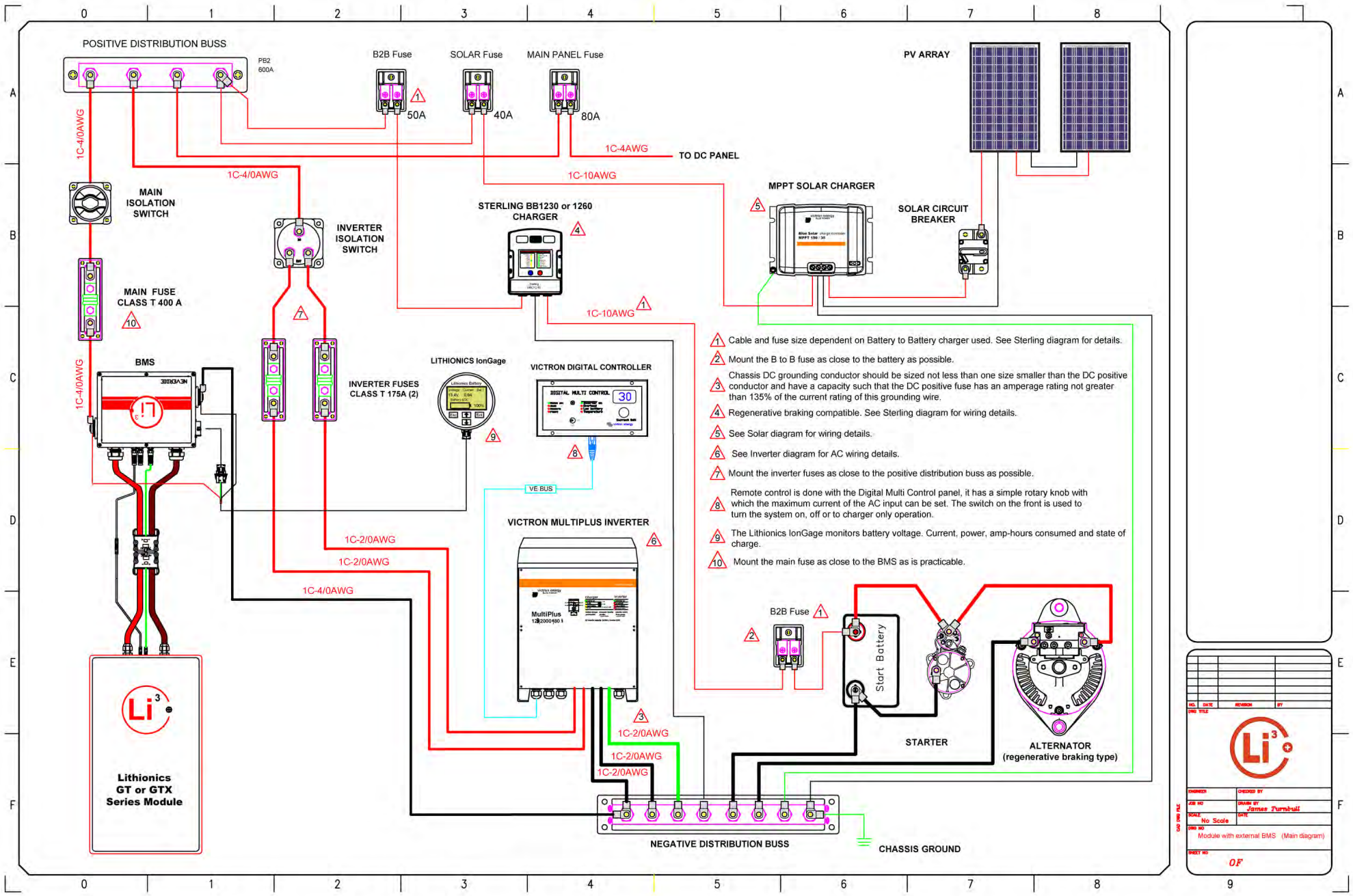
The inverter is controlled by the **Digital Multi Control Panel.** The front mounted switch is used to turn the system on, off or to charger only operation. The shore current limit is set by the control knob. Turning the knob to the right or left sets the desired value. The current limit is shown on the 7-segment display.

The **Lithionics IonGage** monitors battery voltage, current, power, amp-hours consumed and state of charge.

The **Solar MPPT** charger is connected to the positive distribution buss via a 40A Maxi fuse. The PV solar array is connected to the MPPT charger via a circuit breaker. The specified circuit breaker is only rated at 48VDC; if your PV solar array has an open circuit voltage that is higher, then another circuit breaker with a higher voltage rating must be substituted. The fuse and wire sizes are based on the Victron MPPT 100/30 charge controller, if a larger controller is used then the fuse and wire sizes should be increased as required.

The **Sterling battery to battery charger** is connected to the positive distribution buss via a 50A Maxi fuse (80A for the Sterling BB1260 charger). It also has a fuse at the starter battery, this fuse must be installed as close to the battery as possible.

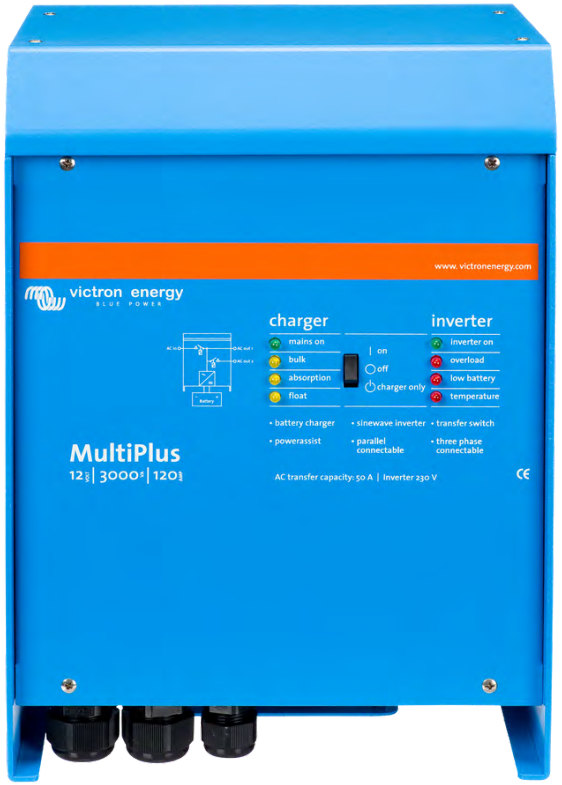
MAIN DIAGRAM



Inverter Diagram

The inverter diagram depicts a typical AC installation. The main panel has an output breaker for the non-inverter loads. It is used to power the high power loads that are beyond the inverters capacity such as a water heater or an electric stove. The AC input must be protected by a magnetic circuit breaker rated at 50A or less, and the cable cross-section must be sized accordingly. Make all connections using proper crimp-on connectors (do not use twist on connectors).

The inverter has a power assist feature and when enabled can add up to 2kVA (that is 2000 / 120 = 17A) to the output during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 67A (50+17).



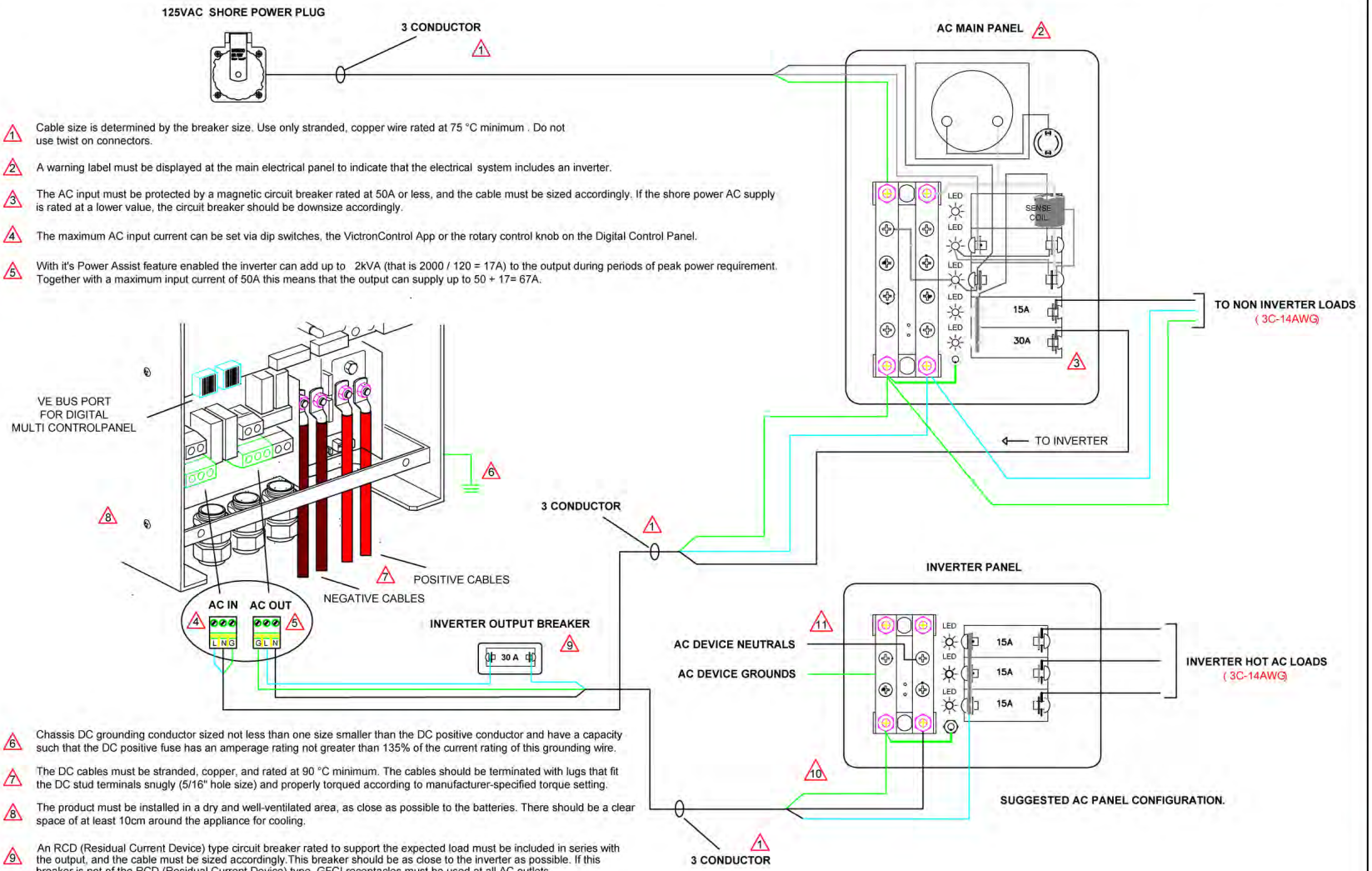
Inverter Diagram

An RCD (Residual Current Device) type circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. This breaker should be as close to the inverter as possible. If this breaker is not of the RCD (Residual Current Device) type, GFCI receptacles must be used at all AC outlets.

The Inverter is provided with a ground relay that automatically connects the neutral output to the chassis ground if no external AC supply is available. In an RV installation, the inverter chassis must be connected the vehicle chassis ground (via the negative distribution buss). The chassis grounding conductor must be sized not less than one size smaller than the DC positive conductor and have a capacity such that the DC positive fuse has an amperage rating not greater than 135% of the current rating of this grounding wire. **When using an inverter sub panel, the inverter neutrals must return to the inverter sub panel and not the main AC panel.**

A warning label should be installed at the main AC panel to indicate that there is an inverter in the system.

INVERTER DIAGRAM



SUGGESTED AC PANEL CONFIGURATION.

1. Cable size is determined by the breaker size. Use only stranded, copper wire rated at 75 °C minimum . Do not use twist on connectors.
2. A warning label must be displayed at the main electrical panel to indicate that the electrical system includes an inverter.
3. The AC input must be protected by a magnetic circuit breaker rated at 50A or less, and the cable must be sized accordingly. If the shore power AC supply is rated at a lower value, the circuit breaker should be downsize accordingly.
4. The maximum AC input current can be set via dip switches, the VictronControl App or the rotary control knob on the Digital Control Panel.
5. With it's Power Assist feature enabled the inverter can add up to 2kVA (that is 2000 / 120 = 17A) to the output during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 50 + 17= 67A.
6. Chassis DC grounding conductor sized not less than one size smaller than the DC positive conductor and have a capacity such that the DC positive fuse has an amperage rating not greater than 135% of the current rating of this grounding wire.
7. The DC cables must be stranded, copper, and rated at 90 °C minimum. The cables should be terminated with lugs that fit the DC stud terminals snugly (5/16" hole size) and properly torqued according to manufacturer-specified torque setting.
8. The product must be installed in a dry and well-ventilated area, as close as possible to the batteries. There should be a clear space of at least 10cm around the appliance for cooling.
9. An RCD (Residual Current Device) type circuit breaker rated to support the expected load must be included in series with the output, and the cable must be sized accordingly.This breaker should be as close to the inverter as possible. If this breaker is not of the RCD (Residual Current Device) type, GFCI receptacles must be used at all AC outlets.
10. AC Output Neutral Bonding
The neutral conductor of the Victron Multi plus 2000's AC output circuit is automatically connected to the safety ground during inverter operation. When AC utility power is present this connection is not present, so that the utility neutral is only connected to utility ground at your source.This ensures the correct operation of an earth leakage circuit breaker that is connected to the output.
11. Inverter neutrals must return to the inverter AC sub panel and not the main AC panel.

Module with external BMS (Inverter diagram)

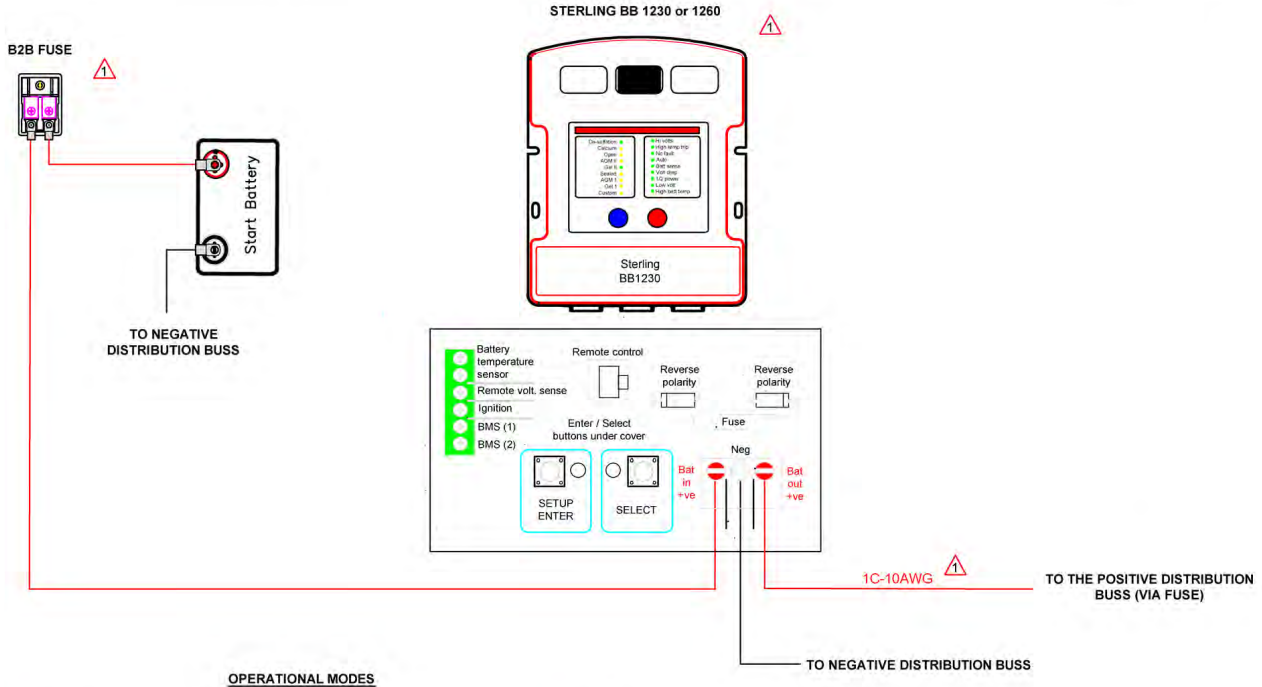
Sterling Diagram

The **Sterling Battery to Battery charger** charges the house battery via the vehicle's alternator. This system uses either the Sterling BB1230 charger (Mercedes recommendation), or the BB1260 charger depending on the size of the alternator. The charger should be programmed to charge the battery using a Lithium battery profile. The charger can also be configured to work with vehicles using regenerative braking.

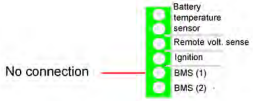
Sterling Power Battery to Battery Charger 12V input to 12V output up to 60amps.

Sterling Power Battery to Battery Charger 12V input to 12V output 30amps

STERLING DIAGRAM



OPERATIONAL MODES



MODE 1 - IGNITION TERMINAL DISCONNECTED

Automatic activation (default setting). The most common mode, used in 50% of all installations including vehicles with some EURO 6 / Regen. braking systems (depending on application). This means that the unit is voltage sensitive (no ignition feed required unless Euro 6 vehicles are being used in a stationary application - at idle at the side of the road). When the input voltage exceeds 13.2V-19.0V (x2 for 24V) then the unit will simply start charging. If the voltage drops below 13.0V the unit shall turn off.

However, if the input voltage has exceeded 13.2V (2x for 24V) for 5 seconds the regenbraking timer is prepped and shall become active if the input voltage drops down to 12.0V-13.3V. This timer is 240s (default - can be changed) and allows the charger to continue charging at these lower input voltages. If the voltage drops below 11.9V the charger goes to sleep irrespective of the timer. If the input voltage remains between 11.9V-13.0V for over 240s the charger also goes to sleep. To wake the charger, the input voltage needs to rise above 13.2V - this shall also reset the regen braking timer.

MODE - 2 IGNITION FEED MODE

Apply an ignition feed cable to the 'Ignition' terminal on the connect block.
As soon as there is a signal (> 4V) on this connector, the unit will wake up (can take up to 60 seconds) and will start to charge the output battery. The only limit is the input voltage. It will charge down to 10V on the input side. When ignition is turned off (0-4V) the BB shall continue charging at 'mode 1' charging parameters. WARNING: If ignition on the vehicle is left on and the engine is off, you shall deplete your starter battery down to 10V. Also, if your alternator is less than 60A or can not produce 60A at idle revs you may discharge your starter battery.

WARNING: the BB shall start up by mode 1 voltage parameters if there is a line feeding the ignition at <4V. We have done this to allow users to put solar or an AC to DC charger onto the starter to enable the BB to charge the leisure / aux battery without running an additional ignition supply.

Euro 6 vehicle (which to choose).
If your usage of the vehicle includes situation applications where the vehicle engine is being run for long periods at idle and stationary. I.e. you are simply switching the engine on to charge the auxiliary battery system but not driving, then you must use the ignition feed mode, Mode 2.

Recommended cable and fuse size for the different models

BB1230 / 30A						Fuse size for input & output
Distance	10ft	15ft	22ft	25ft	30ft	50A
AWG	10	10	10	10	8	
BB1260 / 60A						
Distance	10ft	15ft	22ft	25ft	30ft	80A
AWG	6	6	6	6	4	

NO.	DATE	REVISION BY
DWG TITLE		
ENGINEER		CHECKED BY
JOB NO		DRAWN BY James Turnbull
SCALE	No Scale	DATE
DWG NO	Module with external BMS (Sterling diagram)	
SHEET NO	OF	

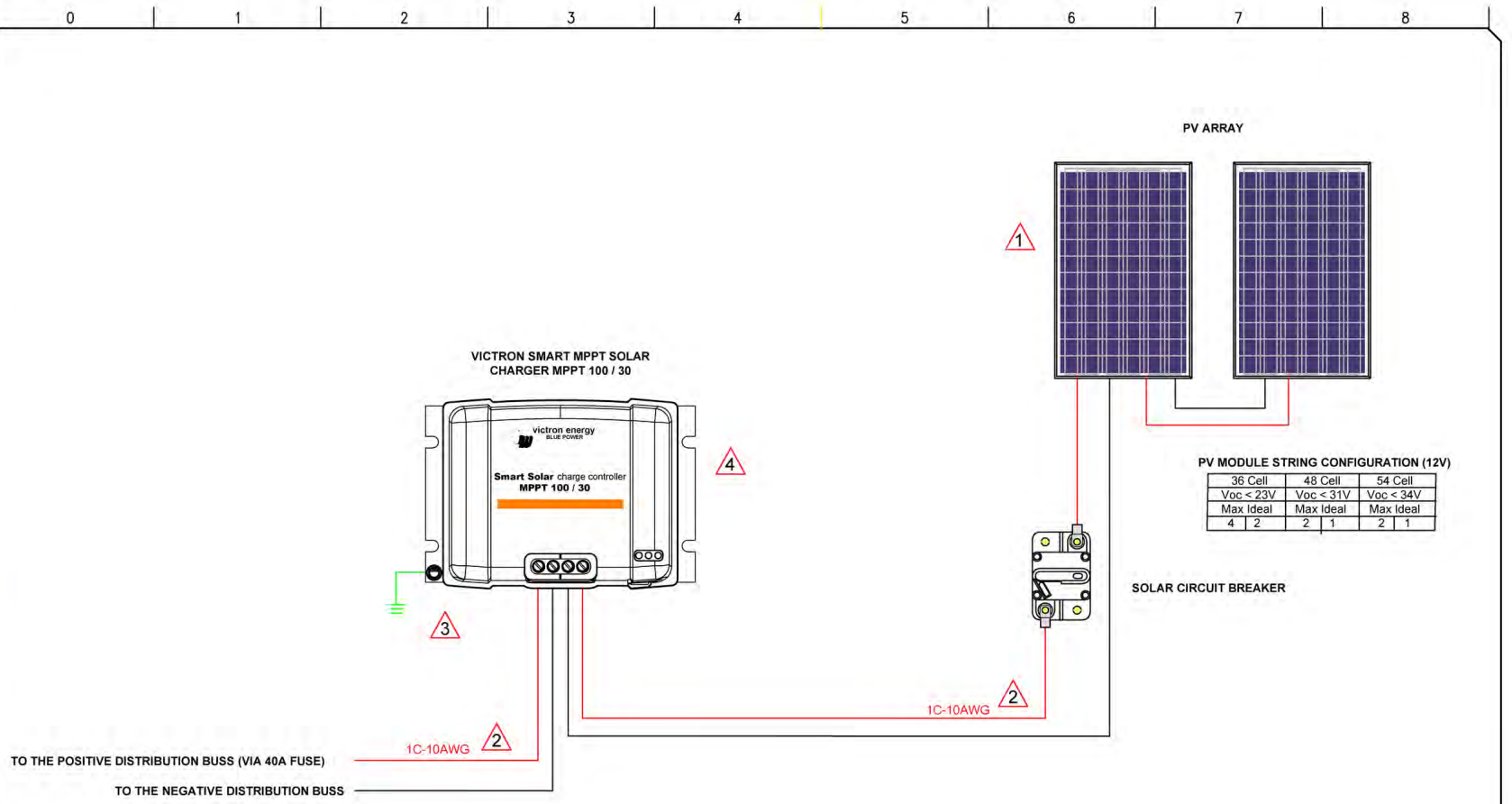
Solar Diagram

The **Victron Smart MPPT** solar charge controller uses maximum power point tracking that optimizes the match between the solar array and the battery bank. It converts the higher voltage DC output from the solar panels down to the lower voltage needed to charge the batteries. The PV solar array is connected to the MPPT charger with a circuit breaker (not supplied). The specified circuit breaker is only rated at 48VDC; if your PV solar array has an open circuit voltage that is higher, then another circuit breaker with a higher voltage rating must be substituted.

The charger is connected to the positive distribution buss via a 40A fuse. The fuse and wire sizes are based on the **Victron MPPT** 100/30 charge controller, if a larger controller is used then the fuse and wire sizes should be increased as required.

Using the **VictronConnect** App on your smartphone, you can connect via blue tooth and remotely control and monitor the **Smart solar MPPT** charger.

SOLAR DIAGRAM



PV MODULE STRING CONFIGURATION (12V)

36 Cell		48 Cell		54 Cell	
Voc < 23V		Voc < 31V		Voc < 34V	
Max Ideal		Max Ideal		Max Ideal	
4	2	2	1	2	1

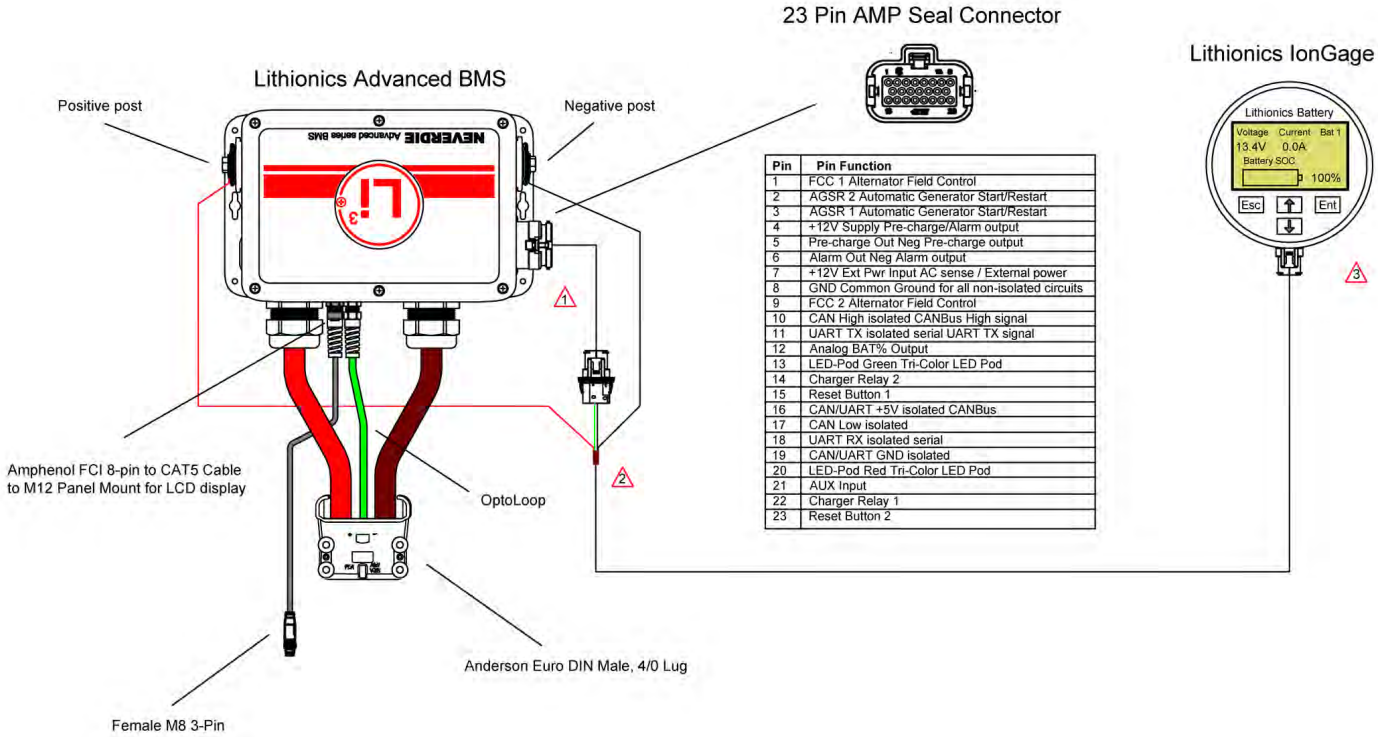
1. Total open circuit voltage (Voc) of the PV array multiplied by 1.25 (a 25% safety factor) must not exceed the charge controller's maximum PV voltage rating of 100V.
2. Output power from the PV array varies depending on PV module size, connection method, and sunlight angle. The minimum wire size may be calculated using the short circuit current rating (Isc3) of the PV array. Refer to the value of Isc in the manufacturer's PV module data specification sheet (minimum wire size is 10 AWG and the max wire size is 6 AWG for this MPPT charger).
3. The size of the chassis grounding cable should not be less than 10 AWG and should be connected to the negative distribution buss.
4. Remote control and monitoring of the Smart solar MPPT charger can be done via bluetooth by pairing it with your smartphone or other device via the VictronConnect App. The App is available for iOS & Android devices; as well as macOS and Windows computers.

NO.	DATE	REVISION	BY
DWG TITLE			
ENGINEER		CHECKED BY	
JOB NO		DRAWN BY	James Turnbull
SCALE	No Scale	DATE	
DWG NO	Module with external BMS (Solar diagram)		
SHEET NO	OF		

BMS/IonGage Diagram

The Advanced Series BMS includes an integrated SOC Gauge, designed to track battery state of charge (percent of usable energy left in the battery) as well as other useful data parameters. Tracking state of charge is accomplished by a Coulomb counter, based on an internal, high sensitivity hall-effect sensor. The SOC Gauge data will only be correct if the configuration parameters are set correctly, which are pre-set initially by Lithionics Battery, but are user adjustable with supporting hardware. The SOC Gauge will also track and display live amperage (A), live wattage (W), battery voltage (V), temperature (F/C), amp hours (Ah), watt hours (Wh), time remaining (d/h), etc. The meter will be most accurate if the battery is fully charged on a regular basis. If the battery is always partially charged, then the SOC meter reading may drift in the long term and will become less accurate. When the most accurate measurements are required it is recommended to perform a full charge at least weekly.

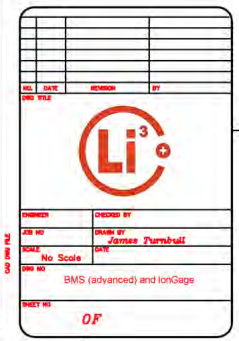
BMS/IONGAGE DIAGRAM



23 Pin AMP Seal Connector

Pin	Pin Function
1	FCC 1 Alternator Field Control
2	AGSR 2 Automatic Generator Start/Restart
3	AGSR 1 Automatic Generator Start/Restart
4	+12V Supply Pre-charge/Alarm output
5	Pre-charge Out Neg Pre-charge output
6	Alarm Out Neg Alarm output
7	+12V Ext Pwr Input AC sense / External power
8	GND Common Ground for all non-isolated circuits
9	FCC 2 Alternator Field Control
10	CAN High isolated CANBus High signal
11	UART TX isolated serial UART TX signal
12	Analog BAT% Output
13	LED-Pod Green Tri-Color LED Pod
14	Charger Relay 2
15	Reset Button 1
16	CAN/UART +5V isolated CANBus
17	CAN Low isolated
18	UART RX isolated serial
19	CAN/UART GND isolated
20	LED-Pod Red Tri-Color LED Pod
21	AUX Input
22	Charger Relay 1
23	Reset Button 2

Lithionics IonGage



Parts List

QTY	PART NUMBER	DESCRIPTION	COMMENTS
1	BSS-2104	PowerBar 600A BusBar - Four 3/8"-16 Studs	Blue Sea Systems
1	BSS-2107	PowerBar 600A BusBar - Eight 3/8"-16 Studs	Blue Sea Systems
4	BSS-5006100	MAXI Fuse Block	Blue Sea Systems
2	BSS-5140	MAXI Fuse - 50 Amp	80A for Sterling BB1260
1	BSS-5139	MAXI Fuse - 40 Amp	Blue Sea Systems
1	BSS-5143	MAXI Fuse - 80 Amp	Blue Sea Systems
1	BSS-5502100	Class T Fuse Block with Insulating Cover - 225 to 400A	Blue Sea Systems
1	BSS-5121	Class T Fuse - 400 Amp	Blue Sea Systems
2	BSS-5007100	Class T Fuse Block with Insulating Cover - 110 to 200A	Blue Sea Systems
2	BSS-5115	Class T Fuse - 175 Amp	Blue Sea Systems
1	BSS-3000	HD-Series Heavy Duty On-Off Battery Switch	Blue Sea Systems
1	BSS-9003e	e-Series On Off Battery Switch	Blue Sea Systems
1	BSS-7138	187-Series Circuit Breaker - Surface Mount 40A	Blue Sea Systems, 48V max voltage
1	BB1230 12to12 30A	Sterling BB1230 12 to 12 30A	Optional BB1260 (60A)
1		Victron Multiplus Compact inverter/charger 12-3000-120	Victron
1		Victron Multi Controller GX	Victron
1		Victron Smart Solat MPPT 100/30	Victron
1	51-160	Lithionics IonGage	Lithionics Battery
1	75-521-288	IonGage Harness	Lithionics Battery
1		CORPORATE/CONSUMER AMPSEAL	Lithionics Battery

Battery Installation

Battery Module and NeverDie BMS Unit Environment and Mounting orientation

The Battery Module and BMS Unit should be mounted in an environment that does not receive direct sunlight, pressurized water or road debris. To avoid power interruption, your installation may need to consider controlling the ambient operating temperature. Mount the Battery Module in an upright position, i.e. black lid faces up. Other orientations are NOT permitted and will void the warranty. The BMS Unit can be mounted in any orientation as long as all its features are accessible. Ensure that the BMS Unit is located in close proximity to the Battery Module so that all connectors can be mounted securely.

Temperature Sensor Connector

The temperature sensor cable and connector exiting the battery module must be connected to the BMS. Connect the two M8 circular connectors together by first aligning their pins and pressing them together, and then rotate the securing nuts until they stop snugly. Do not use the temperature probe from the inverter-charger manufacturer.

Battery Installation

Main Power Connector

The battery module has a large black female main power connector that must be inserted into the BMS male main power connector. This is the connector with the large 4/0 red and black wires and single small gauge gray cable. Align the connectors and insert them together. Use 2 zip ties to bind the connectors together so that they do not separate during use.

NeverDie BMS Unit Power Terminals

Connect the BMS Unit Power Terminals to your DC bus, both Positive (Red) and negative (Black). Use correctly sized wire conductors for the application. Torque to 80 INCH pounds. Never stack ring terminals. Never place the stainless-steel washer between the Power Terminal and ring terminal lug.

Pressure Vent

It is recommended to install a ventilation hose onto the pressure vent barb when the Battery Module is in a location with poor ventilation. The hose shall direct the gases to the atmosphere.

Battery Installation

BMS Unit I/O Connector

Some systems have a rectangular I/O connector to extend the BMS Unit features remotely such as remote Power/Reset switch, LED indicator, or serial data logging. Be sure to connect the I/O connector if so equipped.

Initial Charge Cycle

Initially the system must be FULLY charged once to calibrate the BMS Unit to the Battery Module.

DO NOT attempt to disassemble the battery, as it could lead to permanent battery damage and voids your battery warranty!!!

A link to the battery installation manual is listed at the back of this manual

System Operation

Powering the System On

Short-press the Power switch for 1 second. The switch will illuminate once power is enabled. You may notice an audible “thunk” noise of the internal contactor switching on. Check that there is voltage at the Power Terminals with a voltmeter.

Powering the System Off

Long-press the Power switch for 3 seconds. The switch will cease to illuminate once power is disabled. You may notice an audible “thunk” noise of the internal contactor switching off. Check that there is 0V at the output terminals with a voltmeter.

Charging

The charging device(s) connected to the Lithium Battery System must be programmed to the correct parameters for the battery. Charging may be performed at any time the system is powered ON.

NOTE – The Lithium Battery System will disconnect power if the voltage, amperage, or temperature limits are exceeded during charging. Only use a Lithionics Battery approved charging source. Please contact Lithionics Battery for charger approval.

System Operation

Initial Charging Cycle

The initial charging cycle is required as it calibrates the NeverDie BMS to the Battery Module for accurate State of Charge percentage monitoring. During the initial charging cycle, the system must reach a voltage level that is equal to the Standard Full Charging Voltage indicated. Enable the charging device(s) so that they may complete a charge cycle. It is recommended to not have any discharge loads active during the initial charging cycle, especially towards the end of charging.

Discharging

Discharging may be performed at any time the system is powered On.

NOTE - The Lithium Battery System will disconnect power if the voltage, amperage, or temperature limits are exceeded during discharging. The NeverDie feature allows the system to have a "reserve" amount of energy left in the battery. Once the system is discharged to 12.0V or 10% State of Charge, whichever comes first, power will be disabled to leave a "reserve" amount of energy still left in the battery. To enable the remaining reserve energy of the system, short-press the Power switch for 1 second.

NOTE - Once the reserve range is enabled the battery should be charged as soon as possible.

WARNING - If the reserve energy is used and the battery module is left in a deeply discharged state without immediate charging, the battery module will become permanently damaged.

Equipment Manuals

Please see below the web links for the manufacturer equipment manuals.

Lithionics Battery ***Victron Inverter*** ***Sterling Charger*** ***Victron MPPT Solar Charger***