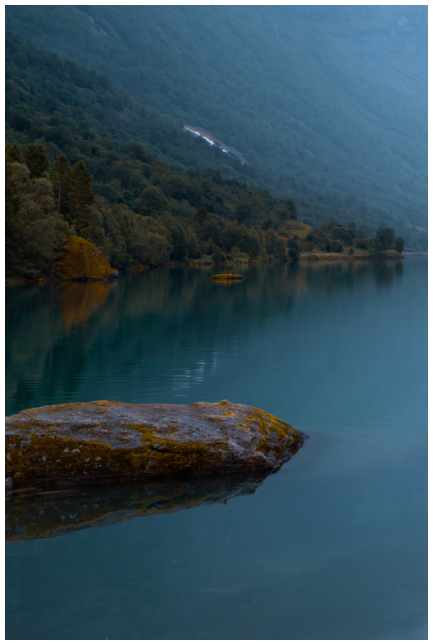
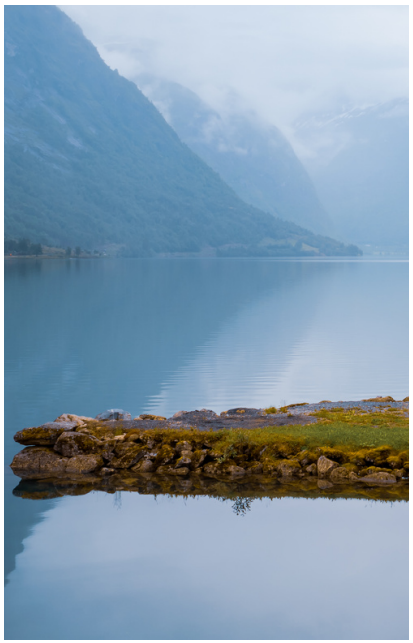
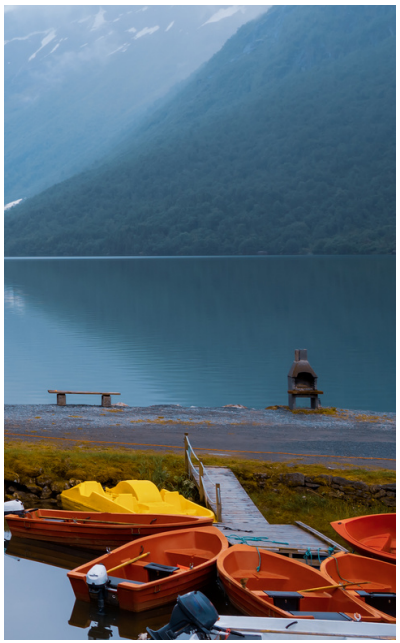
Installer's Guide

GTX12V315A-E2107-CS200 INSTALLATION KIT

VICTRON MULTIPLUS II 3000 WATT (DUAL BATTERY)



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Safety Information

This manual is intended to be used by qualified installers. Although it is quite 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 battery to isolate it from other electrical circuits before performing any repairs or maintenance on the system.

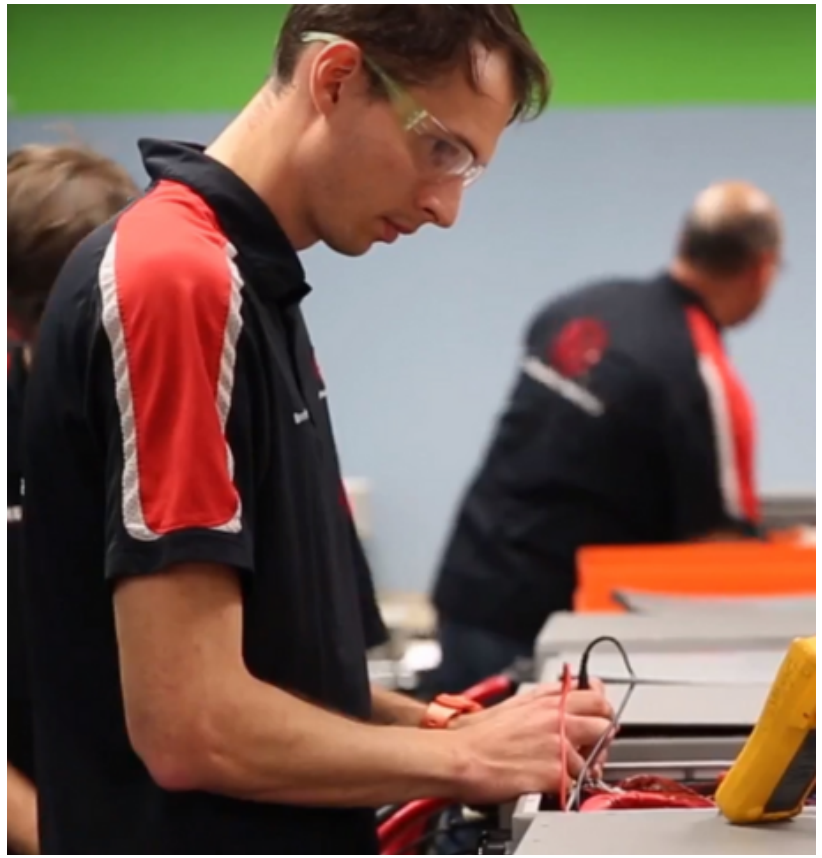
Always use proper wire sizes to connect the system to inverters, chargers or other equipment. Always use crimped connections to connect to the battery terminals.

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 **GTX12V315A-E2107-CS200 Victron** kit is based on two **GTX12V315A-E2107-CS200** batteries (630 amp hours) and a **Victron MultiPlus II** 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
- Power Flow Diagrams
- Sterling Diagram
- Solar Diagram
- Battery/IonGage Diagram

Main Diagram

The main diagram depicts the general layout of the system. The 2/0 AWG battery positive cable is connected to the main positive distribution bus via a 400A class T fuse (a mega fuse may be substituted) and an isolation switch.

The inverter is connected to the positive distribution bus via a 350A class T fuse and an isolation switch. The class T fuse block should be mounted as close as possible to the positive distribution bus. The inverter switch is required for inverter isolation and inrush management when first turning on the system.

The chassis DC grounding cable (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 supplying the inverter shorts to ground internally, then the chassis ground cable needs to be able to carry enough current to blow the inverter 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.

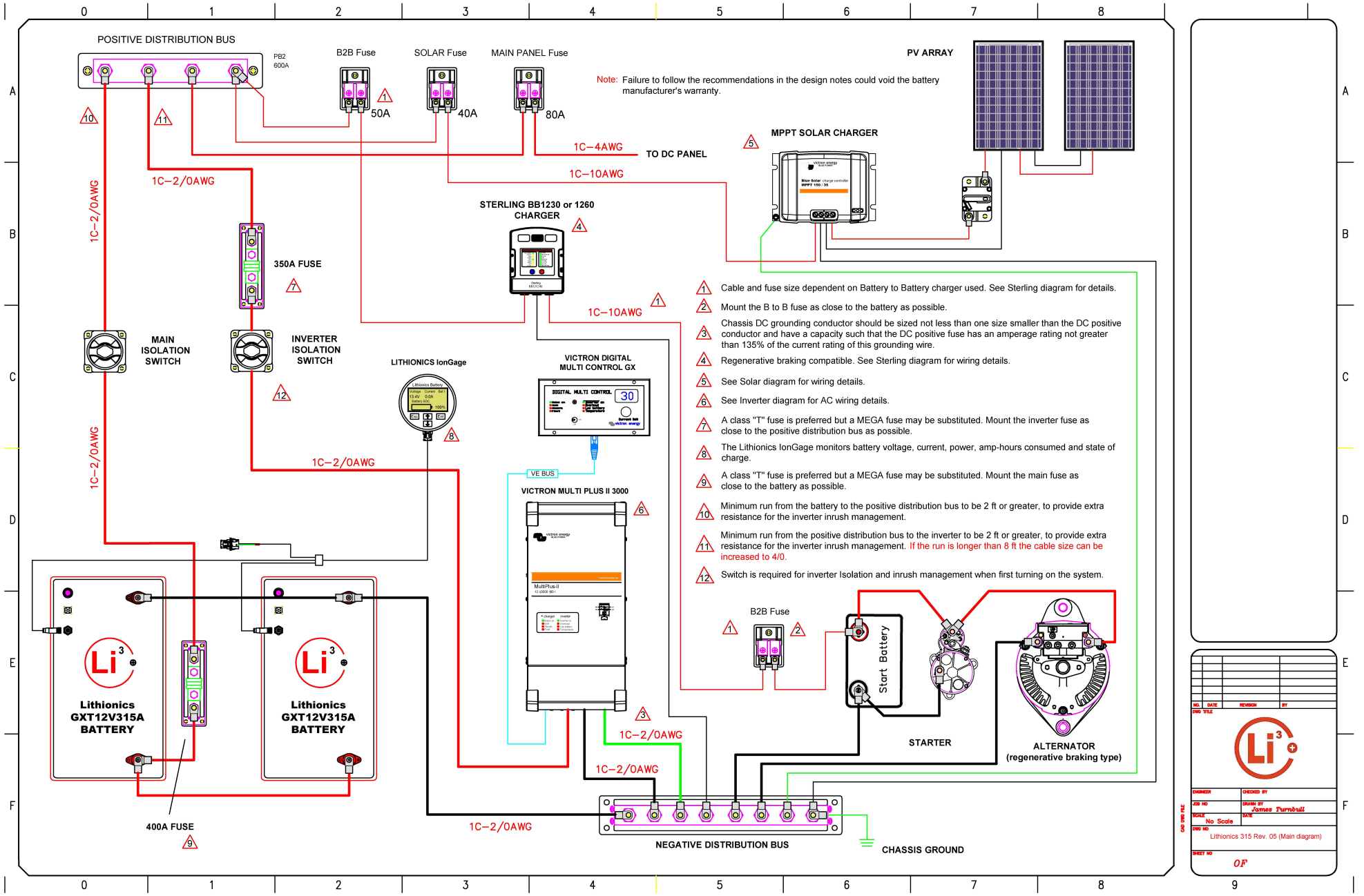
The **Lithionics IonGage** monitors battery voltage, current, power, amp-hours consumed and state of charge.

The **Victron Smart Solar** MPPT charger is connected to the positive distribution bus 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 Smart Solar** 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 bus 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.

Wiring note:
A total DC power circuit resistance between a single Lithionics battery and a 3000W inverter can be as low as 5 mOhm (0.005 Ohm), when using short wires to connect the battery to the inverter. With a typical battery voltage of 13.5V, this can result in an inrush peak current of 2,700 Amps (!!!) from the battery to the inverter capacitors. This surge only lasts around 1 millisecond but could be enough to damage the Battery Management System (BMS) or even damage the inverter. The minimum required wire size and length stated in the wiring diagram are provided to ensure minimum circuit resistance of at least 5.6 mOhm to reduce the inrush under 2,400A. For more information refer to Lithionics Support page, FAQ Section at this link https://lithionicsbattery.com/support/

MAIN DIAGRAM



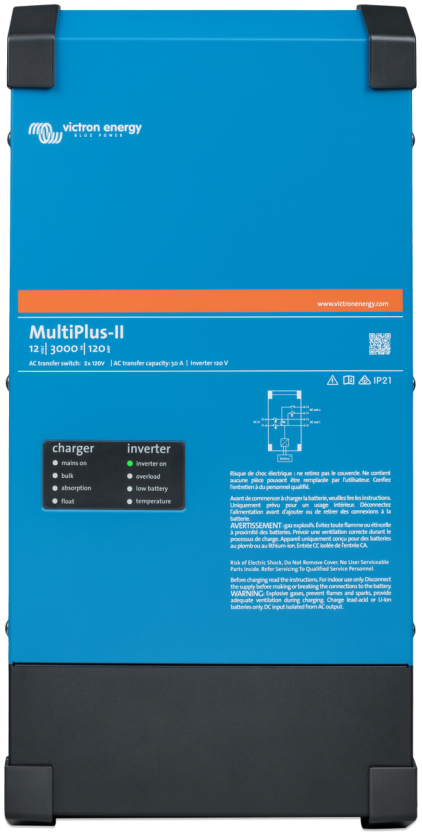
Inverter Diagram

The inverter diagram depicts the **Victron Multiplus II** configured with a 120/240 VAC split/phase shore power input. The MultiPlus II can also be configured for single/phase 120VAC input. When an AC source is available, the MultiPlus II will feed through the AC to its output. The output will therefore mirror the AC input.

When the MultiPlus II is in inverter mode the output is 120V single phase only. In inverter mode, the MultiPlus II connects both output lines (L1 and L2) together to provide 120VAC to loads on either line.

Any 240V loads will only be supplied when the MultiPlus II is supplied by a splitphase AC source. This prevents heavy loads such as water heaters or 240V air conditioners from discharging the battery.

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).



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

Inverter Diagram

The MultiPlus II has two AC outputs **AC-1** and **AC-2.**

AC-1
The MultiPlus II provides power to the AC-1 output (120V only) when the shore power is disconnected. With its PowerAssist feature the MultiPlus II can add up to 3kVA to the AC-1 output during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 75 A. An earth leakage circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. The maximum rating of the circuit breaker is 75A.

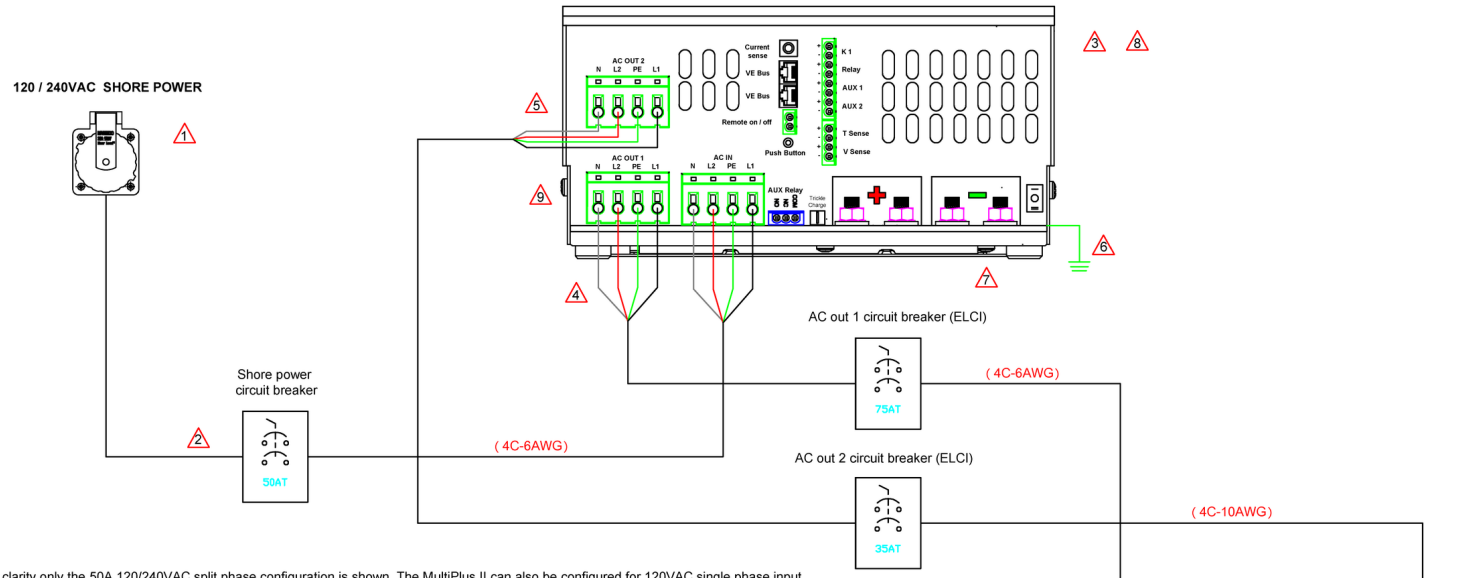
AC-2
The auxiliary (AC-2) output is live only when AC is available on the input of the MultiPlus II. Heavy loads that would discharge the battery can be connected to this output. The maximum rating of the circuit breaker is 35A.

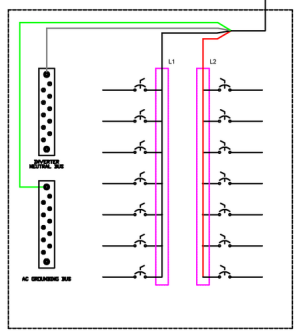
The inverter is provided with a ground relay that automatically connects the neutral output to the chassis ground if no external AC supply is available. In an RV installation, the inverter chassis must be connected to the vehicle chassis ground (via the negative distribution bus). The chassis grounding 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.

For a graphical view of the power flow please see the power flow diagrams included in this manual.

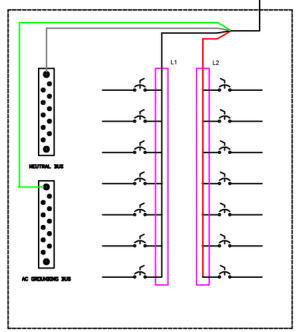
INVERTER DIAGRAM

120 / 240VAC split phase configuration





120 / 240 VAC 60 Hz
INVERTER PANEL



120 / 240 VAC 60 Hz
NON INVERTER PANEL

1. For clarity only the 50A 120/240VAC split phase configuration is shown. The MultiPlus II can also be configured for 120VAC single phase input.

2. 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.

3. A warning label must be displayed at the main electrical panel to indicate that the electrical system includes an inverter.

4. **AC-out-1**
With its PowerAssist feature the Multi can add up to 3kVA (that is 3000 / 120 = 25A) to the output L1 during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 50 + 25 = 75 A. An earth leakage circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. The maximum rating of the circuit breaker is 75A.

5. **AC-out-2**
AC-out-2 is an auxiliary output that disconnects from the load in the event of battery operation. Equipment that is connected to this output will only operate if AC voltage is available on the AC input. When AC power becomes available on the AC input, the load on AC-out-2 will be reconnected with a delay of approximately 2 minutes. This is to allow a genset to stabilize. The rated current on this output is limited at 35 A. Recommend circuit breaker 35 A. Minimum wire gauge AWG 10.

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. **AC Output Neutral Bonding**
The neutral conductor of the Victron Multi plus II 3000'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.

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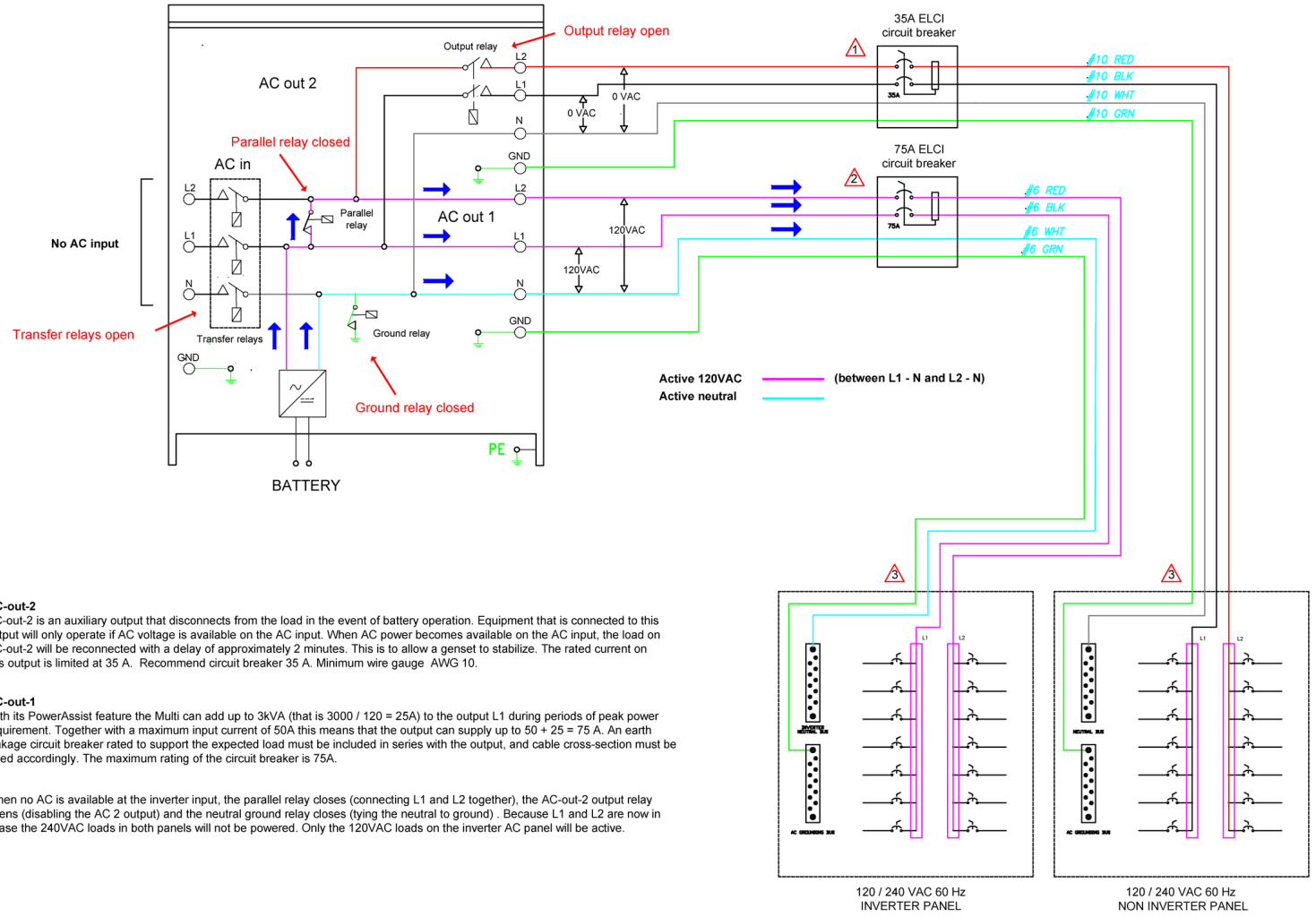
POWER FLOW DIAGRAM 1

Power Flow when in Inverter Mode



AC-out-2

1 AC-out-2 is an auxiliary output that disconnects from the load in the event of battery operation. Equipment that is connected to this output will only operate if AC voltage is available on the AC input. When AC power becomes available on the AC input, the load on AC-out-2 will be reconnected with a delay of approximately 2 minutes. This is to allow a genset to stabilize. The rated current on this output is limited at 35 A. Recommend circuit breaker 35 A. Minimum wire gauge AWG 10.

AC-out-1

2 With its PowerAssist feature the Multi can add up to 3kVA (that is 3000 / 120 = 25A) to the output L1 during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 50 + 25 = 75 A. An earth leakage circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. The maximum rating of the circuit breaker is 75A.

3 When no AC is available at the inverter input, the parallel relay closes (connecting L1 and L2 together), the AC-out-2 output relay opens (disabling the AC 2 output) and the neutral ground relay closes (tying the neutral to ground) . Because L1 and L2 are now in phase the 240VAC loads in both panels will not be powered. Only the 120VAC loads on the inverter AC panel will be active.

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Inverter mode power flow diagram

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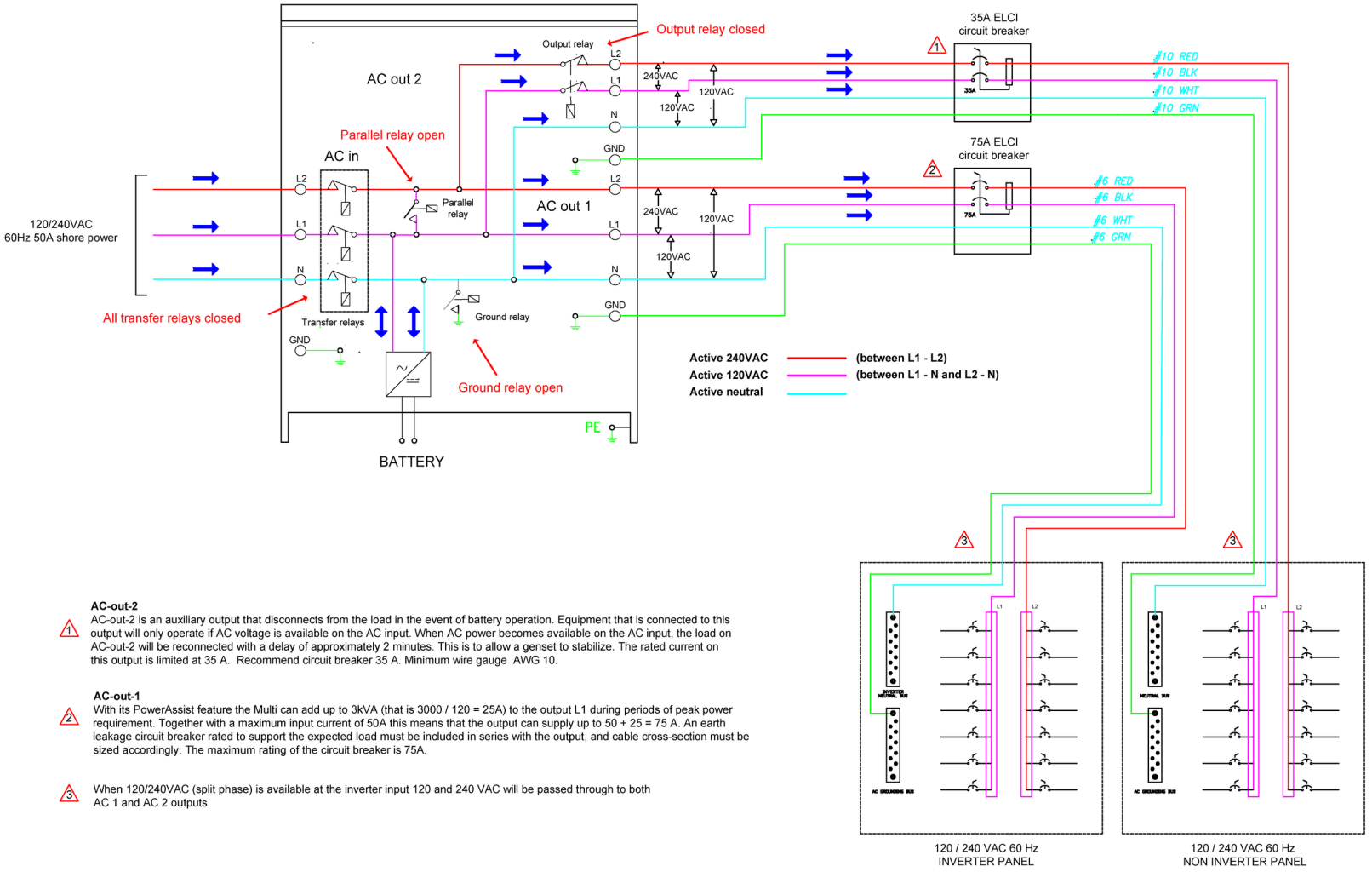
POWER FLOW DIAGRAM 2

Power Flow when connected to Split Phase 120/240VAC 60Hz



AC-out-2

1 AC-out-2 is an auxiliary output that disconnects from the load in the event of battery operation. Equipment that is connected to this output will only operate if AC voltage is available on the AC input. When AC power becomes available on the AC input, the load on AC-out-2 will be reconnected with a delay of approximately 2 minutes. This is to allow a genset to stabilize. The rated current on this output is limited at 35 A. Recommend circuit breaker 35 A. Minimum wire gauge AWG 10.

AC-out-1

2 With its PowerAssist feature the Multi can add up to 3kVA (that is 3000 / 120 = 25A) to the output L1 during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 50 + 25 = 75 A. An earth leakage circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. The maximum rating of the circuit breaker is 75A.

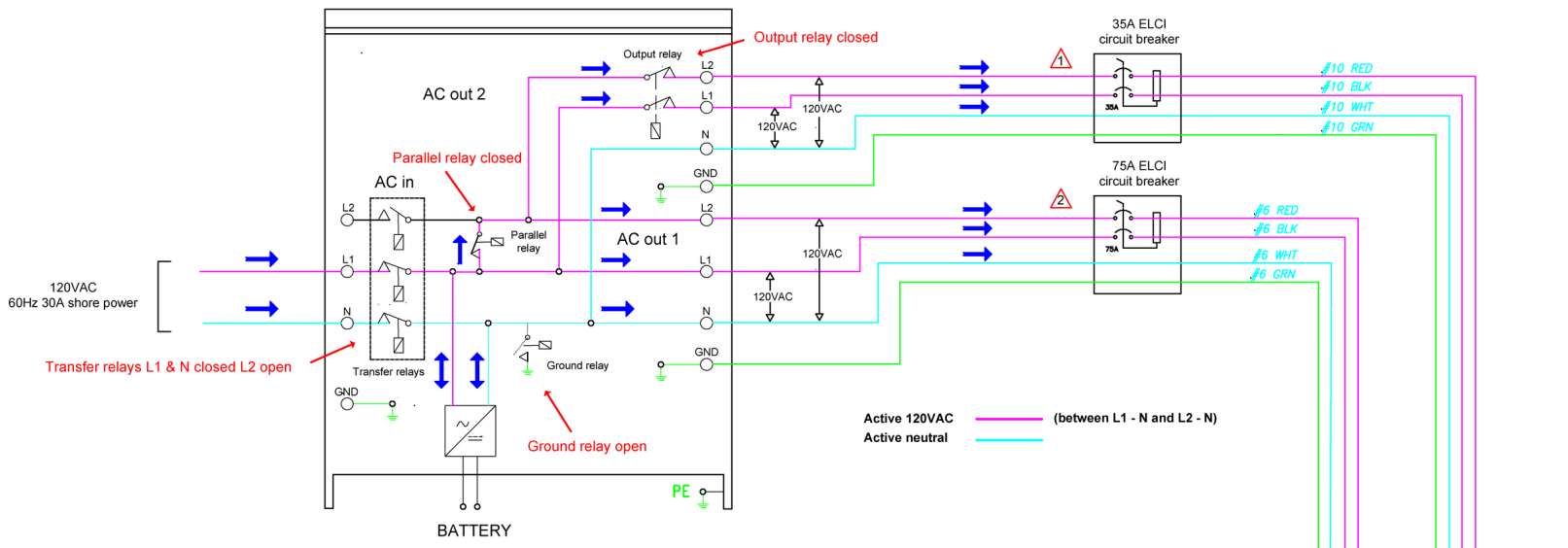
3 When 120/240VAC (split phase) is available at the inverter input 120 and 240 VAC will be passed through to both AC 1 and AC 2 outputs.

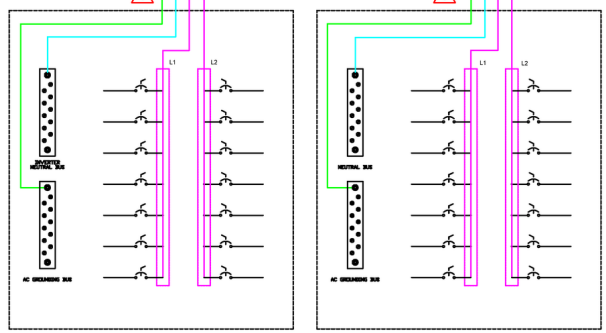
Power flow when connected to split phase

OF

POWER FLOW DIAGRAM 3

Power Flow when connected to Single Phase 120VAC 60Hz





AC-out-2

1 AC-out-2 is an auxiliary output that disconnects from the load in the event of battery operation. Equipment that is connected to this output will only operate if AC voltage is available on the AC input. When AC power becomes available on the AC input, the load on AC-out-2 will be reconnected with a delay of approximately 2 minutes. This is to allow a genset to stabilize. The rated current on this output is limited at 35 A. Recommend circuit breaker 35 A. Minimum wire gauge AWG 10.

AC-out-1

2 With its PowerAssist feature the Multi can add up to 3kVA (that is 3000 / 120 = 25A) to the output L1 during periods of peak power requirement. Together with a maximum input current of 50A this means that the output can supply up to 50 + 25 = 75 A. An earth leakage circuit breaker rated to support the expected load must be included in series with the output, and cable cross-section must be sized accordingly. The maximum rating of the circuit breaker is 75A.

3 When only single phase 120VAC is available at the inverter input, the parallel relay closes connecting L1 and L2 together. Because L1 and L2 are now in phase the 240VAC loads in both panels will not be energized. The 120VAC loads in both panels will be active.

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Power flow when connected to single phase		
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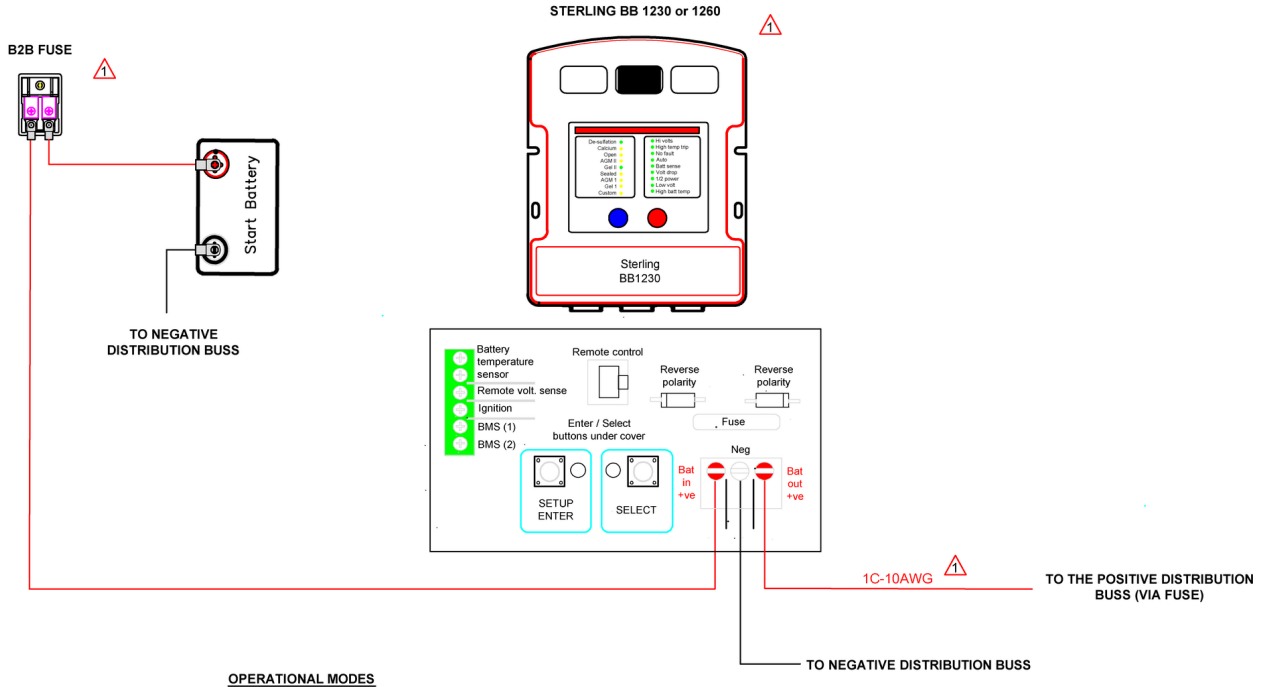
Sterling Diagram

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.

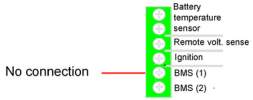
Sterling Power Battery to Battery Charger 12V input to 12V output up to 60amps.

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.

1 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	

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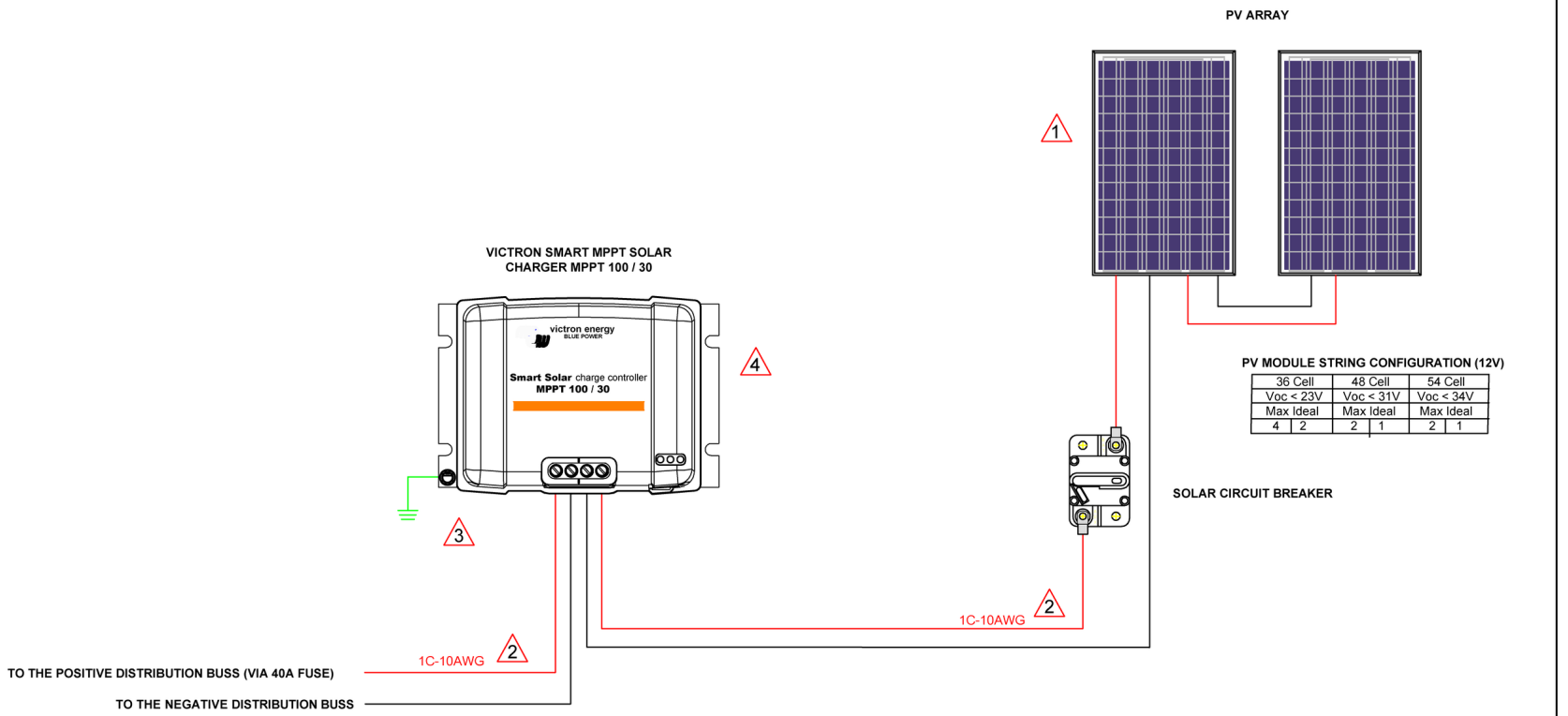
Solar Diagram

The **Victron Smart Solar** 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 bus 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.

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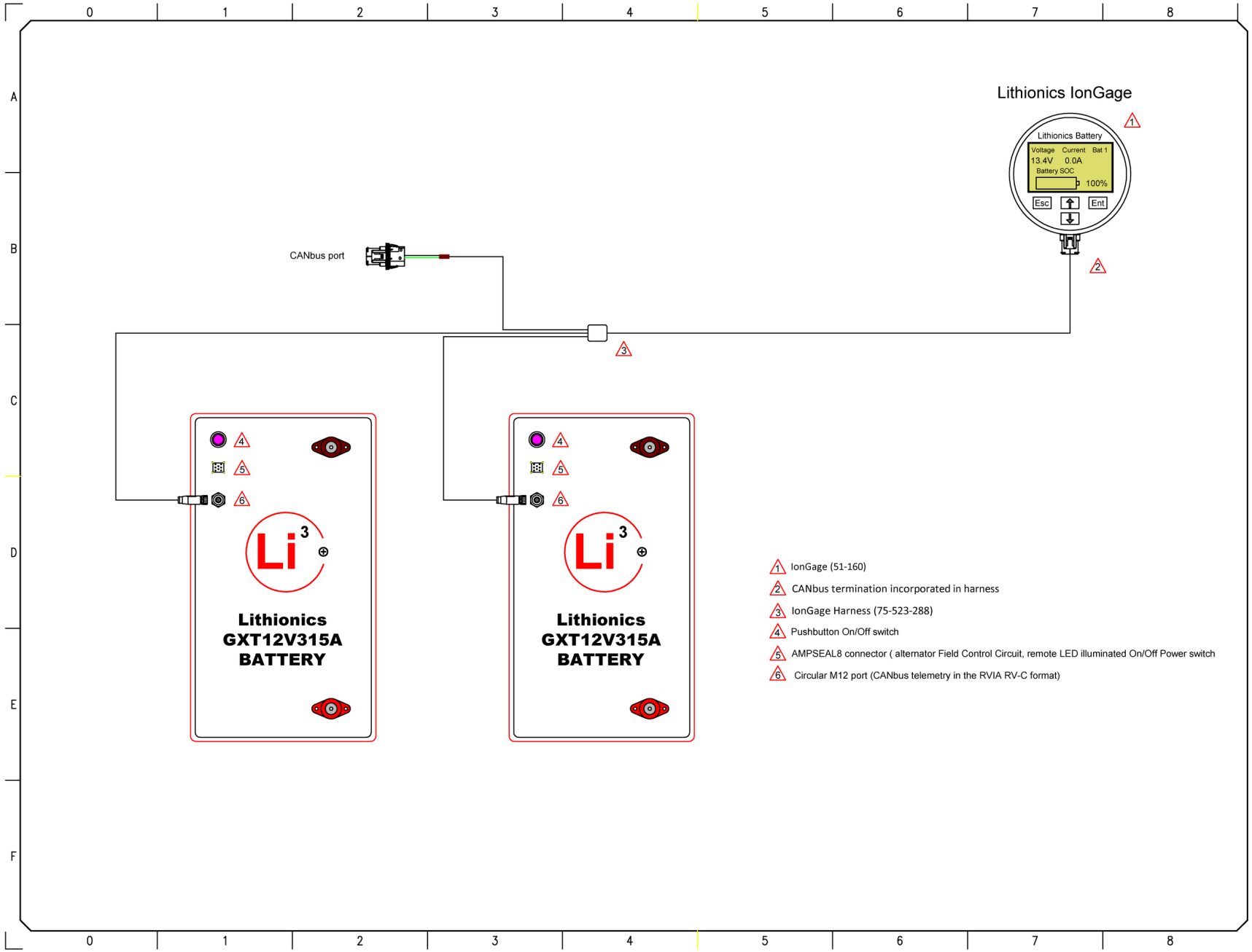
Battery/IonGage Diagram

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.

BATTERY/IONGAGE DIAGRAM



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
2	BSS-5502100	Class T Fuse Block with Insulating Cover - 225 to 400A	Blue Sea Systems
1	BSS-5121	Class T Fuse - 350 Amp	a mega fuse may be sustituted
1	BSS-5190	Class T Fuse - 400 Amp	a mega fuse may be sustituted
2	BSS-3000	HD-Series Heavy Duty 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 12 to12 30A	Sterling BB1230 12 to 12 30A	Optional BB1260 (60A)
1		Victron Multiplus II 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	75-523-288	IonGage Harness	Lithionics Battery

Battery Installation

Check the battery for visible damage including cracks, dents, deformation and other visible abnormalities. The top surface of the battery and terminal connections should be clean, free of dirt and corrosion, and dry.

Battery power should be turned off prior to the installation and for storage. Check the LED integrated into the Power button to make sure it is completely off. If the LED is on or blinking, press and hold the Power button for 3 seconds until LED turns off.

Lithium batteries do not release gas during normal use. There are no specific ventilation requirements for battery installation, although enough airflow should be provided to prevent excessive heat build-up.

The battery should be stored and installed in a clean, cool and dry place, keeping water, oil, and dirt away from the battery. If any of these materials can accumulate on the top surface of the battery, current leakage can occur, resulting in self-discharge and possible short circuits.

Battery Installation

The battery is equipped with two flat threaded terminals designed for a 5/16” or M8 size ring terminal lug and secured by included M8 bolts, flat washers and lock washers. When using flat washers, it is critical to place the ring terminal lug in direct contact with the top surface of the power terminal and then place the washers on top of the lug.

Connect the positive and negative battery cables with correct polarity and double check the polarity of battery circuit to avoid potential equipment and battery damage.

DO NOT place any washers between the battery power terminal and the ring terminal lug, as this could create a high resistance path and cause excessive heating of the connection which could then lead to permanent battery damage or fire. If you must attach more than one lug to each terminal, make sure at least 1/4” or 6mm of thread is available to secure the connection. Additionally, the ring terminal lugs need to be “clocked” in such a way that they do not interfere with their flat conducting surfaces. Acquire and use longer M8x1.25mm bolts if necessary.

Tighten both M8 power terminal bolts to a maximum of 108in-lbs/12.2Nm to ensure there is good contact with the ring terminal lug. Over tightening terminal connections can cause terminal breakage and loose connections can result in power terminal meltdown or fire.

Battery Installation

The battery cables should be sized to handle the expected load. Refer to NEC Table 310.15(B)16 for the maximum amperage based on the cable gauge size. Cable lengths in excess of 6 feet may require heavier gauge wire to avoid unacceptable voltage drop.

For more information refer to the National Electrical Code for correct cable size, which can be located at www.nfpa.org The battery circuit must be properly fused to handle the expected load and not to exceed the battery specifications.

After installation is complete, turn on the battery power by a short-press of the Power button. The LED indicator should come on to confirm the battery's state.

DO NOT connect multiple batteries in series to get higher voltage as it will damage the internal BMS.

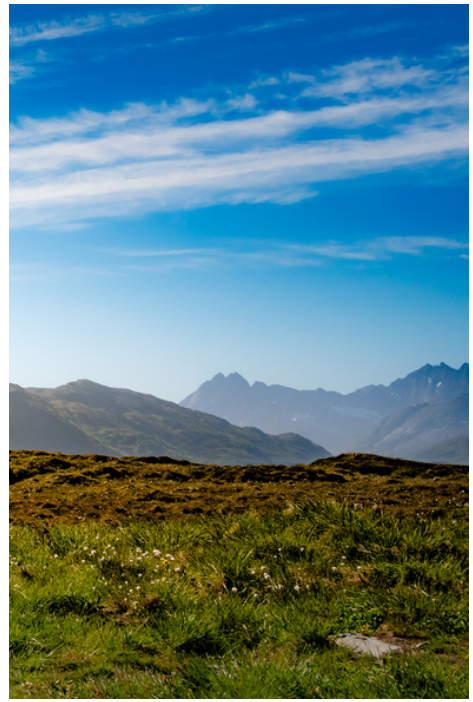
DO NOT attempt to disassemble the battery, as it could lead to permanent battery damage and voids your battery warranty!!!

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

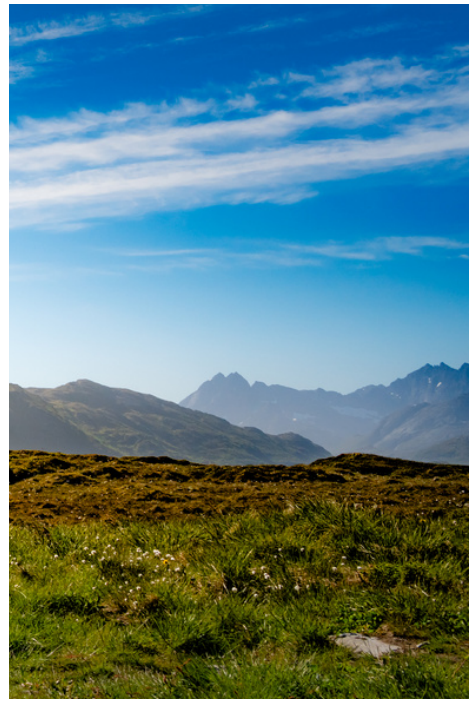
Equipment Manuals

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

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



Equipment Manuals

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

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