Lithium Upgrade Manual

Note: this document is in development and will be occasionally improved. The online version can always be found by visiting https://stg.net. To make suggestions, comments, or add questions, please type into the document directly or select a section to add comments to.

Note: this manual is intended for those who have had a combination of Lithium Batteries and Victron 3000 inverter installed by STG.NET. Some instructions may not match other installations.

System Usage Cheat Sheet **1**
- Starting an adventure 1
- Plugging into shore power less than 20 1
- End of adventure - park in the Sun 1
- End of adventure but parking without Sun 1

Inverter Modes **2**

Quick reference for Inverter Control Panel **3**
- Mode Switch 3
- Current Limit Setting 4
- LED Status Indicators 5

Cerbo GX & Touch 70 quick reference **6**
- Touchscreen controls 6
- Wifi Connection 6
- Remote Console 6
- VRM Portal 7

Arrival Checklist **7**
- Campground - 30A 7
- Campground - 50A 7
- Garage - 20A - only 10 gauge cables 7
- Garage - 15A - only 10 gauge cables 7
- Garage - 15A - thinner/longer extension cables 7
- Garage - 15A - shared circuit 7

Generator - manual (auto gen start not installed) **7**

Generator - manual (with auto gen start installed) **8**

Generator - automatic (if auto gen start installed) **8**

Departure/Drive/Boondock/Service Checklist **9**
- Keeping AC power on via Inverter 10
- Conserve Battery - NO AC power (saves 2-3 Amp/hour) 10
- Extreme Power Conservation (saves extra 1 Amp/hour) 10
- Getting service work done 10

Storage Checklist **11**
Storing with shore power 11
Storing with only Solar power 12
Storing without shore or solar power 13
Quick Reference for Victron 3000 Inverter **13**
Resetting the Victron 3000 Inverter 13
Battery and Inverter Settings **14**
Quick Reference for BMV-712 or SmartShunt Battery Monitor **15**
Default Battery Settings 16
Quick Reference for Auto Generator Start **16**
Auto Generator Start Switch **17**
Quick Reference for Epoch 300 Batteries **18**
Installation options **19**

System Usage Cheat Sheet

Most of the time while you are enjoying a trip leave the inverter set ON and current at 20.

Starting an adventure

- Turn COACH BATTERY SWITCH to ON
- Turn Inverter to ON
- Set current limit to 20

Plugging into shore power less than 20

- Entire 15 amp breaker to yourself? Set current limit to 15, then plug in
- Unsure, something else may be on the same circuit? Set to 8, then plug in

Camping (not driving) for several days in a row

- To save battery power and avoid needing to run chassis or generator you can set the Inverter to OFF when 120vac appliances & outlets are not needed

End of adventure - park in the Sun

- Set Inverter to OFF
- Turn COACH BATTERY SWITCH to OFF
- Empty fridge
- Winterize when needed
- Solar panels will keep all batteries charged, you are ready to go again anytime

End of adventure but parking without Sun

- Set inverter to CHARGE ONLY (avoids draining battery if power drops)
- Set current limit to 15 or less if necessary
- Plug into shore power, using 15-30 adapter if needed
- Turn COACH BATTERY SWITCH to OFF
- Empty fridge
- Winterize when needed
- Shore power will keep all batteries charged, you are ready to go again anytime

Inverter Modes

Shore Power	Need AC Power	Not actively using (parked/stored)	Set the Inverter Switch to:
✔	✔		ON
✔			ON
	✔		ON
			OFF (to save battery)
✔	✔	✔	Charge Only (in case of power loss)
✔		✔	Charge Only
		✔	OFF

Shore plugged into	With cable	Set the Current Limit to:
	“Thick” 10 gauge RV cable only (and dogbone for 50)	30* *recommend setting to 20 instead to avoid accidentally tripping generator breaker
20 	Thick cable and dogbone	20
15 	Thick cable and dogbone	15
 or 	“Thin” 12 or 14 gauge conventional extension cord	10 (to avoid heating up cable or connectors)
Any outlet that may have other appliances on same breaker	Any	8 (to avoid tripping breaker)
 Generator	(internal)	22* *using 20 instead is convenient

Quick reference for Inverter Control Panel

The Victron Digital Multi Control panel for the inverter has a 3 position mode switch, and a knob for adjusting the current limit. Note: If your installation does not include this control panel, you can adjust these same settings in the Victron Connect app or the GX controller (Color or Cerbo), see below.

Mode Switch

Charger Only	The inverter will not consume power from the batteries (except for about 1 amp per hour to keep operating), but will charge the batteries from generator or shore power when present. Generator or shore power will be passed through the inverter to the 120vac appliances and outlets.
OFF	The inverter consumes no power, will not charge, and will not pass generator or shore power through to the appliances and outlets.
ON	The inverter is allowed to operate as needed to provide 120vac power, and also assist when power consumption is above the current limit. It will also consume approximately 2-3 amps per hour just to keep operating and supplying 120vac power with no real loads.

Most commonly, the inverter should be left in ON position unless boondocking and 120vac power is not required, in which case turning the inverter to Charge Only or even fully to OFF to reduce battery drain. Note that the inverter mode switch setting does not affect the chassis alternator or solar power charging the batteries.

Current Limit Setting

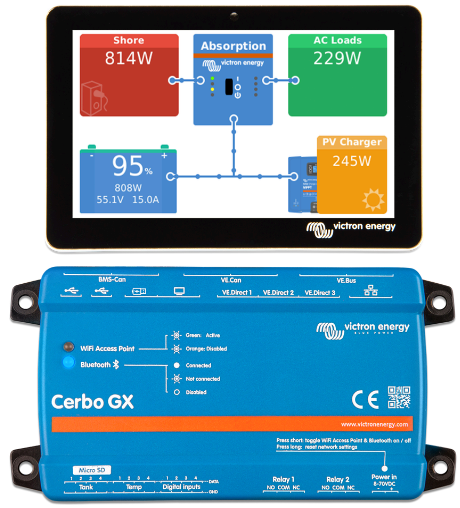
The current limit sets the maximum amount of 120vac amps that the inverter will allow to be drawn from shore or generator power. Any power usage above the current limit, when the inverter is in ON, will be generated using the inverter from battery power to avoid overloading the power source. Generally, this is set to the value of the breaker protecting the circuit that is being plugged into. However, use of thinner or longer cables and/or extensions may also require a further reduction in the maximum current in order to avoid melting of the cable or connections.

To set the current limit, rotate the knob to adjust the displayed current limit up or down. A few seconds after the value has been changed, the updated setting will be sent to the inverter. Turning the current limit down to a lower value may trigger the inverter assist mode, depending on power usage. Turning the current limit up may allow the inverter assist mode to shut down. The current limit can be set between 8 amps (120vac) up to 50 amps (120vac) but should not ever be set above 30 amps, because the shore power connections and cabling are rated for only 30 amps.

LED Status Indicators

MAINS ON (blue or green light)	The inverter has detected shore or generator power that is within acceptable voltage and frequency values. This will come on somewhat after the ATS "clunks" when shore power or generator power is then available.
BULK ABORPTION FLOAT	Any one of these three yellow lights will be on when the inverter is charging the batteries from the shore power. Note that the charge function only works from 120vac shore or generator power, and does not indicate solar or alternator charging, as those operate completely separately from the inverter and directly into the battery.
INVERTER ON (blue or green light)	The inverter is currently actively providing 120vac power, either without shore or generator power, or when mains light is also on, it is assisting the shore or generator power. Note that the inverter mode switch can be set to ON, but this light will not come on when on shore power until the inverter is actually needed and is actively producing power.
OVERLOAD LOW BATTERY TEMPERATURE	Any one of these three red lights indicates that the inverter has shut down due to excessive load, low battery voltage, or overheating. Once the conditions change, the inverter should reset and attempt to provide power again.

Cerbo GX & Touch 70 quick reference



The Cerbo GX duplicates everything that the Color GX does, except that it adds additional connections and built-in WiFi and Bluetooth. It also has a separate HDMI/USB touchscreen display option that can be more easily installed on a control panel wall.

Touchscreen controls

Because the screen doesn't include any keys and is touch only, the method of operating menus differs slightly from the Color GX. Tap on the screen to get the Menu button to pop up from the bottom. Then press the Menu button to access the menus. Once in the menus, tapping on a line once will highlight it, and a second time will select/open it (like double-clicking). Buttons to manipulate values will appear as necessary, and for some functions a keyboard is also displayed for text entry.

Wifi Connection

The Cerbo GX supports both being an Access Point (where a local network is not available) and a Wifi Client (to connect to a local network and to the Internet). Use the Menu, Settings, Wifi to select the Wifi network or to enable the access point.

Remote Console

The remote console allows you to view and operate the same display on another device over an IP connection. The Victron Connect app on a cell phone will discover the Cerbo GX when on the same network, and offer a convenient button to connect to the remote console. The remote console can also be directly using the IP address of the Cerbo GX from any web browser. The current IP address is available in the Wifi settings menu when connected.

VRM Portal

When an internet connection is available, the GX controller can be connected to the VRM Portal, which then allows remote viewing of the status on a web browser logged into the portal, and optionally also access to the remote console.

Arrival Checklist

Note: a surge suppressor is not shown in these examples. Always use one. A lower cost one with only led indicators is sufficient.

Campground - 30A


OPTIONAL


1. Set current limit to **30** (or 20 for safety)
2. Set inverter to **ON**
3. Plug cable into outlet, optionally using 30 amp extension if needed

Campground - 50A



OPTIONAL


1. Set current limit to **30** (or 20 for safety)
2. Set inverter to **ON**
3. Plug cable into outlet, using 50-30 dogbone and optionally an extension

Garage - 20A - only 10 gauge cables

1. Set current limit to **20**
2. Set inverter to **ON**
3. Plug cable into outlet using 15-30 dogbone and optionally a 30 amp extension

Garage - 15A - only 10 gauge cables

1. Set current limit to **15**
2. Set inverter to **ON**
3. Plug cable into outlet using 15-30 dogbone and optionally a 30 amp extension

Garage - 15A - thinner/longer extension cables

1. Set current limit to **10** (instead of 15 to reduce power through thin/long cable)
2. Set inverter to **ON**
3. Plug cable into outlet using a 15-30 dogbone and conventional extension cord
4. Monitor extension cord plug and socket for heat - mildly warm is okay but if burning hot turn down current limit to **8** or replace extension cord.

Garage - 15A - shared circuit

1. Set current limit to **10** or even **8**
2. Set inverter to **ON**
3. Plug cable into outlet using 15-30 dogbone and optionally a conventional extension cord. Monitor extension cord for hot spots and replace if necessary.

Generator - manual (auto gen start not installed)

1. Set current limit to **22** (or less where needed)
2. Set inverter to **ON**
3. Start and stop generator manually on control panel

Generator - manual (with auto gen start installed)

1. Set current limit to **22** (or less where needed)
2. Set inverter to **ON**
3. Disable automatic generator through BMV-712 relay or GX module
4. Start and stop generator manually on control panel

Generator - automatic (if auto gen start installed)

Caution: do NOT enable auto gen start when parked in an enclosed space such as a garage.

1. Set current limit to **22** (or less where needed)
2. Set inverter to **ON**
3. Enable automatic generator through BMV-712 relay SoC (or voltage) or GX module
4. When conditions are met, generator will be started and stopped automatically.

Departure/Drive/Boondock/Service Checklist

Keeping AC power on via Inverter

1. Unplug shore cables
2. Set Current Limit to **20** in case of later generator use
3. Set (or keep) Inverter to **ON**

Conserve Battery - NO AC power (saves 2-3 Amp/hour)

1. Unplug shore cables
2. Set Current Limit to **20** in case of later generator use
3. Set Inverter to **Charge Only**

Extreme Power Conservation (saves extra 1 Amp/hour)

1. Unplug shore cables
2. Set Current Limit to **20** in case of later generator use
3. Set Inverter to **OFF**
4. Note: Must set back to Charge Only or ON for generator power

Getting service work done

1. Unplug shore cables
2. Set Current Limit to **20** in case of generator testing
3. **Disable** auto generator start if present
4. Set Inverter to **Charge Only** as this will prevent confusion by techs when checking shore power or generator power – which will not appear to work when inverter is in OFF mode.
5. Turn coach power switch to **OFF** to avoid draining batteries

Note: When a generator is not present (Such as in a Solis P), ignore the instructions above to set the current limit for the generator and instead simply develop the habit to set the current limit appropriately before plugging into shore power.

Storage Checklist

Storing with shore power

1. Set current limit according to connection type from one of the above scenarios
    a. However, do not set above **22** in case of auto generator use.
2. Set Inverter to **Charge Only**
3. Plug into shore power
4. Leave COACH BATTERY switch in ON position
    a. If heated batteries are installed, this leaves the heater enabled and the batteries will be kept warm and able to be charged.
5. If installed with battery selector, select Both or 1 as appropriate for your system
    a. If both 1 and 2 battery banks are Lithium, leave in Both
    b. If bank 2 is an AGM, and charge systems are set for lithium, leave on 1 only
6. If installed with auto generator start, disable it if storing in a building to avoid fumes.
7. If an LI-BIM-225 or AMP-L-START is installed, the chassis starter battery will also be kept charged.

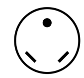
Storing with only Solar power

1. Set Inverter to **OFF** to eliminate battery drain from inverter (do this first).
2. Set COACH BATTERY switch to **OFF** to eliminate other battery drain (empty fridge!)
    a. If heated batteries are installed, this disables the heater and the batteries will not charge from solar if the temperature is too low, but since all power consumption is disabled, this should not result in the battery charge being lost.
3. If installed with battery selector, select Both or 1 as appropriate for your system
    a. If both 1 and 2 battery banks are Lithium, leave in Both
    b. If bank 2 is an AGM, and charge systems are set for lithium, leave on 1 only
4. If installed with auto generator start, disable the auto start
5. If an LI-BIM-225 or AMP-L-START is installed, the chassis starter battery will also be kept charged.

Storing without shore or solar power

1. Set Inverter to **OFF** to eliminate battery drain from inverter (do this first)
2. Set COACH BATTERY switch to **OFF** to eliminate other battery drain (empty fridge!)
    a. If heated batteries are installed, this disables the heater.
3. If installed with battery selector, select OFF to disconnect all batteries
4. If installed with auto generator start, disable the auto start

Quick Reference for Victron 3000 Inverter

Current Limit		
15.0 or less	22.0	30.0
3 prong outlet 	Generator 	RV 30 or 50 

IMPORTANT: Always set current limit <u>BEFORE</u> plugging into shore or starting generator!

Note: the current limit can be set lower to reduce the possibility of overloading a shared circuit or to put less load on the generator (and thus less noise). The lowest it can be set to is about 8. Although it can be set above 30 (the Victron 3000 supports 50 amps maximum), do not set it above the value of the breaker supplying power in order to avoid tripping the breaker.

	Inverter/Charger Functions		
Switch set to:	**Charge Only**	**OFF**	**ON**
Inverter is:	Disabled	Disabled	Enabled
Charger is:	Enabled	Disabled	Enabled
AC Power:	From Shore*	No power	***Assist Mode***

	Assist Mode		
Shore Usage:	**Below Limit**	**Above Limit**	**No Shore**
Inverter is:	Disabled	Providing additional power above current limit (assisting)	Providing power
Charger is:	Enabled up to limit	Disabled	Disabled
AC Power:	100% from Shore*	Shore* + Inverter	100% from Inverter

* or generator

Resetting the Victron 3000 Inverter

If the inverter becomes confused due to a low voltage condition, it may stop responding to commands to set the on/off/charge mode and current limit. Usually in such a situation it will be stuck in an error state that switching between off and on modes through the victron app or control panel will not resolve. To reset the inverter, open up access to the inverter itself (usually under a bed or bench seat but may be accessed through a vent cover) and locate the single black mode switch in the center of the face of the inverter (between two rows of LEDs). Flip the switch to the center position for 10 seconds, then back to the up/on position. The inverter should then return to normal operation. Alternatively, if installed with a battery selector or battery disconnect switch, turn the disconnect switch to off for 10 seconds to reset the inverter.

Battery and Inverter Settings

	House/Coach Battery Switch & Inverter			
When:	Camping (shore power or generator)	Boondocking	Storing (shore power or solar)	Storing (no power)
Coach Batt:	ON	ON	OFF	OFF
Inverter:	ON	Charge only†	Charge only	OFF
~~Battery Selector:~~ ~~(if installed)~~	~~BOTH~~ ~~(unless reasons)~~	~~BOTH~~ ~~(unless reasons)~~	~~BOTH~~ ~~(unless reasons)~~	~~OFF~~ ~~(or AGM only if charging is AGM)~~

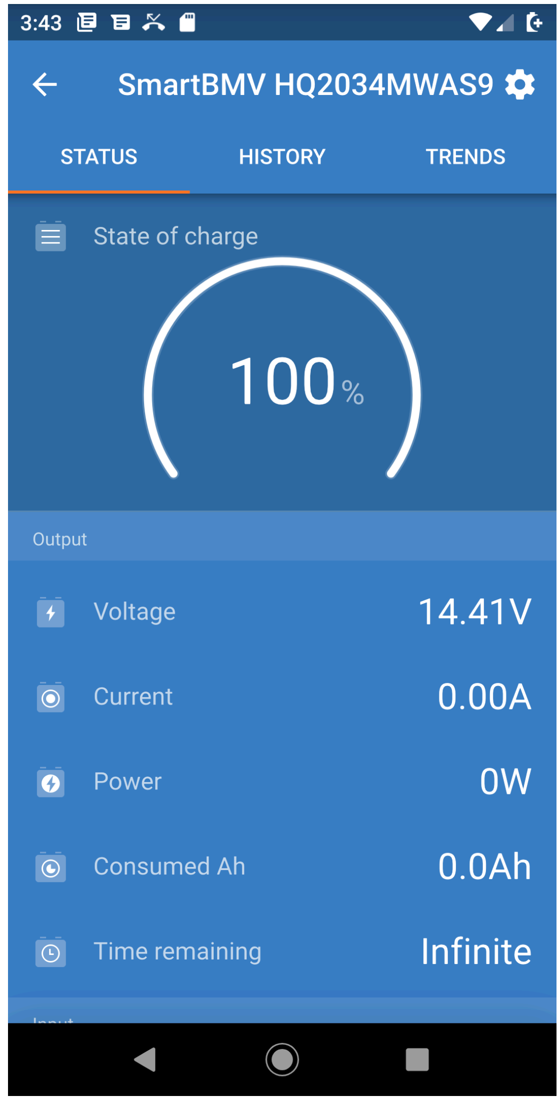
NOTE: The coach battery switch still turns off battery power to all 12 volt devices including fridge, lights, propane solenoid, and all control panels except solar and inverter control. The inverter is connected directly to the batteries and is not shut off by the Coach switch. The inverter can also be set to OFF, which disables all AC power even if shore power is present.

† When AC power is needed, turn the inverter ON. Leaving the inverter ON when AC power is not needed will drain the batteries slightly faster than leaving it in Charge Only or OFF.

~~If installed with Battery selector and:~~

- ~~Both 1 and 2 are Lithium, leave in BOTH unless storing (OFF)~~
- ~~Bank 2 is AGM and charge systems set to AGM, leave in BOTH unless storing (2 only)~~
- ~~Bank 2 is AGM and charge systems are set to Lithium, leave in 1 unless storing (OFF)~~

Quick Reference for BMV-712 or SmartShunt Battery Monitor



Use VictronConnect app (iOS or Android) to view and control the battery monitor. The default bluetooth pin code to connect to it the first time is **000000** but this may have been changed.

The display shows the current status of the battery including charge percent (State of charge or SoC) and battery voltage.

The current and power values show how much is being used from the battery (negative numbers) or charged to the battery (positive). Consumed Ah gives the amount of power that has been used so far, bringing the SoC below 100% full charge. The consumed power combined with average current is used to calculate the Time remaining, which is hours and minutes of use left at present average load on the battery.

If the state of charge shows -- instead of a number, that means that the battery monitor lost power and does not know what the charge level is. Charging the battery until full will reset the value to 100% so that it can track accurately again. Each time the battery charge current drops to zero, the state of charge is reset back to 100% to reduce slight tracking errors that may otherwise build up.

If the battery monitor has been used with Battleborn heated model batteries with the heat mode enabled (and it has been cold enough to need heat), the State of charge will read high (due to power consumed by the heater in the battery not being tracked). Once the heater is no longer in use, and the battery has been recharged to 100%, the State of charge will read accurately again.

During normal use, none of the settings (using the gear icon in the upper right corner) will need to be adjusted, except possibly enabling the relay if used in conjunction with an automatic generator start circuit. Note that the Victron Connect app will occasionally want to upgrade the firmware on the Victron devices it connects to. This is normal and you are encouraged to do so each time it requests.

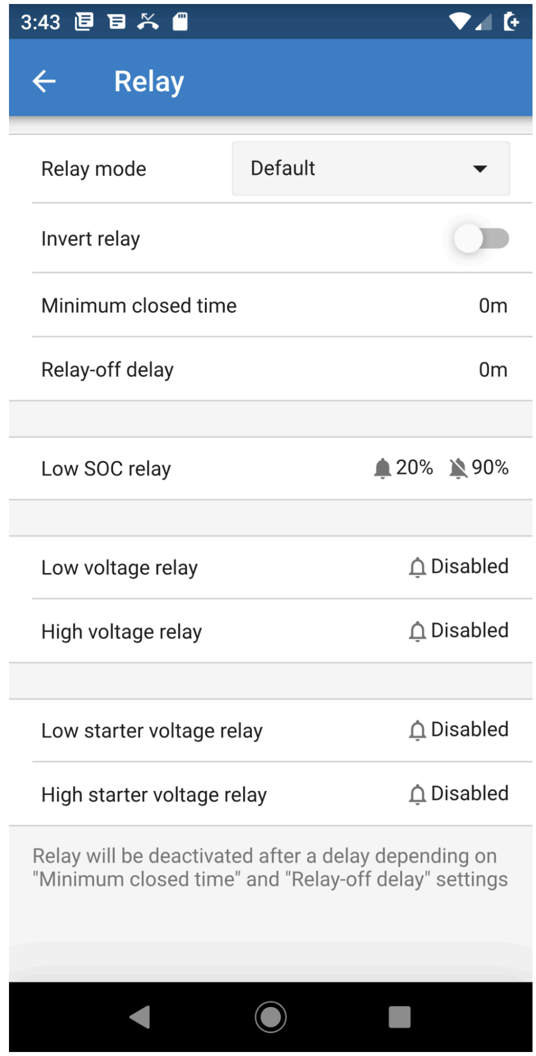
Default Battery Settings

The battery monitor comes from the factory with AGM battery settings, however, the correct battery settings for Battle Born Lithium batteries have already been configured during installation. If any value is lost or replacement of the battery monitor is necessary, the settings shown here are the correct values for all BattleBorn lithium batteries. Set the Battery Capacity to the correct Ah for the number and type of batteries installed in your system, and all of the remaining values to match the values shown.

Battery settings

Battery capacity	270Ah
Charged voltage	14.2V
Discharge floor	0%
Tail current	0.50%
Charged detection time	5m
Peukert exponent	1.05
Charge efficiency factor	98%
Current threshold	0.00A
Time-to-go averaging period	1m
Battery starts synchronized Battery SOC after a reset will be 100%	

Quick Reference for Auto Generator Start



If installed with an STG.NET Auto Generator Start circuit attached to the BMV-712 relay, the generator can be run to automatically recharge the batteries when low. To test that the Auto Generator Start is working properly, toggle the **Invert relay** option on. Leave this off for normal operation.

To enable the generator auto start, select **Low SOC relay**, enable it using the blue toggle button above the set value, and put in the start (**set**) and stop (**clear**) values of SOC (charge %). To minimize generator run time and allow solar to assist, a start (set) value of 25 and stop (clear) value of 50 are recommended as a starting point. The values for start and stop can also be changed at any point while enabled.

To disable auto start, select **Low SOC relay** and turn off the blue toggle button above the set value.

The generator auto start can also be triggered from low voltage condition, instead of or in addition to the SOC value. This may be necessary if SOC tracking is unreliable, such as when using a heated battery mode that draws power (rather than charging the battery) through the BMV-712 shunt.

Note: when Auto Generator Start (Low SOC Relay) is enabled, make sure to also set the Current Limit on the inverter to **22.0** amps to prevent tripping the breaker inside the generator.

Auto Generator Start Switch

If installed (if not contact us for a free upgrade) there will be an ON/OFF switch labeled “AUTO GEN” on the control panel wall, usually adjacent to the BMV-712 or Touchscreen controls. This switch allows convenient control of the auto generator start feature without needing to go through menus on the smartphone app or touchscreen. When switched to OFF, the generator will not be auto started, even when the SoC battery charge % goes below the trigger point (usually 10%). Turn the switch off when parked in a garage, or in cases where generator operation is not allowed. The switch can also be used to stop the generator if it has been triggered to run automatically (note that pressing STOP on the Oneplace will only temporarily stop the generator). Otherwise, where auto generator function is desired, leave the switch in the ON position. This switch does not affect the ability to manually start or stop the generator using the Oneplace controls.

Quick Reference for Epoch 300 Batteries

Epoch batteries can be monitored directly (without a BMV-712 or Smartshunt) using the **Epoch LI-ION** smartphone app found in both iPhone and Android app stores. When the app is started, it will show a list of all Bluetooth devices (even ones that are not an Epoch battery). Typically during install, the batteries are renamed with a prefix of E300 that identifies their location, such as **E300 BED** or **E300 DRVR**. Switch each of your batteries to ON to view them together as a group, then select the second button across the bottom (dashboard) to view the total SoC (charge %) and current in (positive) or out (negative) of the battery. The SoC and Amps are the two values that provide useful information for you to understand how much charge is left, and what the charge or discharge speed is currently. For the most part the other information can be ignored.

Lithium Upgrade Details

Note: the manual portion of this document is now available at https://stg.net as "Lithium Upgrade User Manual (Post-Installation)". This document shows your upgrades.

Installation options

Each installation may vary in number of batteries and options and this document attempts to cover the common features and provide assistance with understanding how usage of your Travato has changed. Please fill in ☑ below what applies to your installation if this has not been done already:

Date Installation Completed: __—-__ / _–_ / _–_ At: ___________________

☐ Battle Born Batteries, 100AH each: Qty underneath: ___ Qty inside: ___

☐ Battle Born Batteries Heated Model, 100AH each: Qty under: ___ Inside: ____

Heat Enable connected to: ☐ DC Fuse # ____ ☐ Coach power switch

☐ Epoch 300ah Batteries: Qty underneath: ___ Qty inside: ___

☐ BMV or Smartshunt Battery Monitor -- starter voltage: ☐none ☐ chassis ☐ agm

☐ Victron 3000 Multiplus Inverter/Charger

☐ PD9245C Converter removed or ☐ just disabled

☐ PCS (Power Control System) disabled

☐ 1000 Watt inverter removed or ☐ just disabled

☐ VE.Net Smart Bluetooth Adapter for inverter

☐ Victron Cerbo, Color Control, or other GX controller

☐ Victron Digital Multi Control

☐ Changed ZAMP charge setting to LiFePo4

☐ Victron MPPT Solar controller

☐ Replaced isolation solenoid (old one failed)

☐ LI-BIM-225 (in place of isolation solenoid)

☐ Boost switch changed to ground LR when pressed

☐ STGNET Auto Generator Start connected to: ☐ BMV-712 ☐ GX controller

☐ ________________________

☐ ________________________

☐ ________________________

☐ ________________________

☐ ________________________

☐ ________________________