Victron & Freedom Won LiFePO4 batteries - Freedom Lite

Introduction

Freedom Won (www.freedomwon.co.za) produces two ranges of LiFePO4 batteries for 48V systems:

- Freedom Lite Home and Business: Eight models available ranging from the smallest 5kWh model (Freedom Lite Home 5/4) up to the 80kWh model (Freedom Lite Business 80/56)
- Freedom Lite Commercial: Ten models available ranging from the 100kWh model (Freedom Lite Commercial 100/70) up to the 700kWh model (Freedom Lite Commercial 700/490).

Note: Refer to Freedom Won website for detailed specification sheets covering all models

These Freedom Lite batteries are fully compatible with the Victron Multiplus, MultiPlus II, Multiplus GX, and Quattro inverter/chargers, Solar charge controllers (Ve Direct and Ve CAN), and system controllers (Color Control GX, Venus GX, and Octo GX).

The Freedom Lite batteries contain an advanced battery management system (BMS) that communicates, using a CAN Bus protocol, with the Victron Venus device, which in turn communicates as required to the other Victron devices on the system.

All Freedom Lite models can be connected in parallel with other models of the same capacity, where one Lite (Master) communicates with the Venus device as well as all the other Lite's in the system (Slaves). The Victron and Freedom Won integration has been extensively developed and tested and is certified and supported by both companies.

The system is suitable for all applications, namely:

- Grid Connected with solar and storage including continued operation in grid outage (ESS or self-consumption mode)
- Backup storage or UPS mode
- Off Grid plant with storage and solar

Figure 1 Typical Installation: Freedom Lite 60/42 with Victron 15kVA Quattro and 3x Ve Direct MPPT's

Figure 2 Typical Installation: 7 x Freedom Lite Commercial 200/140 with Victron 12 x 15kVA Quattro and 10 x Ve Direct MPPT's and 6 x Fronius ECO 27kW

This Manual

This manual is intended to offer Victron specific guidance when designing, installing, and commissioning a Victron – Freedom Lite system. For further details pertaining to the setup of the Victron equipment not pertaining directly to the Freedom Lite interface please refer to the various manuals available on the Victron Energy website eg. Color Control GX manual. Likewise, for further information pertaining to the Freedom Lite batteries, please refer to the Freedom Lite installation manual available from Freedom Won (support@freedomwon.co.za).

Product Compatibility

All new Victron equipment as follows is compatible with Freedom Lite: • MultiPlus • MultiPlus II • MultiPlus GX • Quattro • Blue Solar and Smart Solar Ve Direct MPPT's • Ve Can MPPT's • Color Control GX • Venus GX • Octo GX

***Note**: Certain older Multiplus and Quattro models containing the smaller microprocessor chip (numbered 19 and 20) are not able to accept the version XXXX4XX firmware and hence are not compatible with the CAN Bus communication from the Freedom Lite battery.*

***Note**: If a system includes one or more Ve CAN MPPT's it is necessary to request that Freedom Won dispatches the Lite from the factory with a profile accommodating 250kbps BAUD rate for the CAN Bus (the standard is 500kbps). This change can also be made remotely by Freedom Won with a local PC connected to the battery. Please contact support@freedomwon.co.za for assistance.*

Venus Device Required eg Color Control GX (CCGX), Venus GX (VGX), or Octo GX (OGX)

In all cases a Venus device is required to receive, process, and transmit the commands and information communicated by the battery to the Victron system.

Firmware

In all cases the latest available firmware should be installed on the Victron devices. The Freedom Lite may also benefit from a firmware update if the Victron firmware is being updated on an existing installation. Contact support@freedomwon.co.za for assistance with updating firmware on your Freedom Lite.

Battery Sizing

The Freedom Lite models are rated for specific maximum power discharge and charge levels. It is important to refer to the applicable Freedom Lite specification sheet for the maximum inverter power that may be connected to each specific Lite model. Do not exceed the maximum kVA values provided

in the specification sheet for each respective model. For multiple units in parallel, the kVA rating for every Lite in the system may be summed to provide the total allowable inverter installed power.

Further to above, the Lite should be sized so as to provide adequate energy capacity in kWh to meet the load demands of the system and to receive most of the excess solar generation each day (for self-consumption installations).

***Note**: It is not permissible to install an inverter larger than stated in the Lite specification sheet regardless of whether the "Limit DC Discharge Power" ESS feature in the Venus device is used. For instances where the grid is not available this power limiting feature will not operate and the battery could thus be overloaded, causing it to trip. The Lite will also not be able to limit discharge power in the absence of a grid connection. Lastly, the Lite contains a protection circuit breaker that is only rated to handle the power-up inrush current of the inverter for up to the capacity stated in the specification sheet.*

Operating Philosophy

The Freedom Lite transmits, amongst others, the following messages to the Venus device:

1. Adaptive Maximum Charge Voltage Setpoint – the value transmitted varies from 54.1V to 55.8V depending on the state of balancing on the particulate Lite. Typically a well-balanced Lite battery will request a maximum charge voltage of between 55.0V and 55.8V. This advanced feature is only available from Freedom Won and allows superior system control and optimal battery management. The Venus device uses this setpoint to control the real time operating or target voltage of the inverter/charger devices and the MPPT's.
2. Charge Current Limit (CCL) – this is the maximum current that the battery will accept at any given time stated in Amps. This is a secondary control feature behind the more effective maximum charge voltage control method. This value reduces as the battery approaches 100% State of Charge (SoC). The Venus controller uses this value to ensure that the combined Victron system of inverter/chargers and MPPT's does not exceed the CCL of the Lite. If the CCL drops to zero, the Victron system within a few seconds will ensure that there is no net current flow into the Lite.
3. Discharge Current Limit (DCL) – this is the maximum discharge current that the battery is prepared to accept at any given time. This value typically decreases as the battery drops below 10% SoC. The Victron inverter cannot enforce a variable DCL unless in ESS mode were an AC input source can be used to supplement the power to the loads. If there is no AC input source the inverter will stop supplying power to the loads as soon as the DCL drops to zero.
4. Battery Temperature
5. Minimum Battery Voltage
6. Battery State of Charge
7. Battery State of Health
8. Battery Voltage
9. Battery Current
10. Battery Name

All of the above information can be viewed in the Freedom Lite device sub menus on the Venus device. Specific setup of the Venus device and the Multi/Quattro is required to ensure the required control is implemented.

If the CAN bus cable is removed or damaged the Victron inverters will shut down within 5 minutes. This prevents continued operation in the absence of communication from the battery. Likewise, the MPPT's will stop producing power to the DC bus.

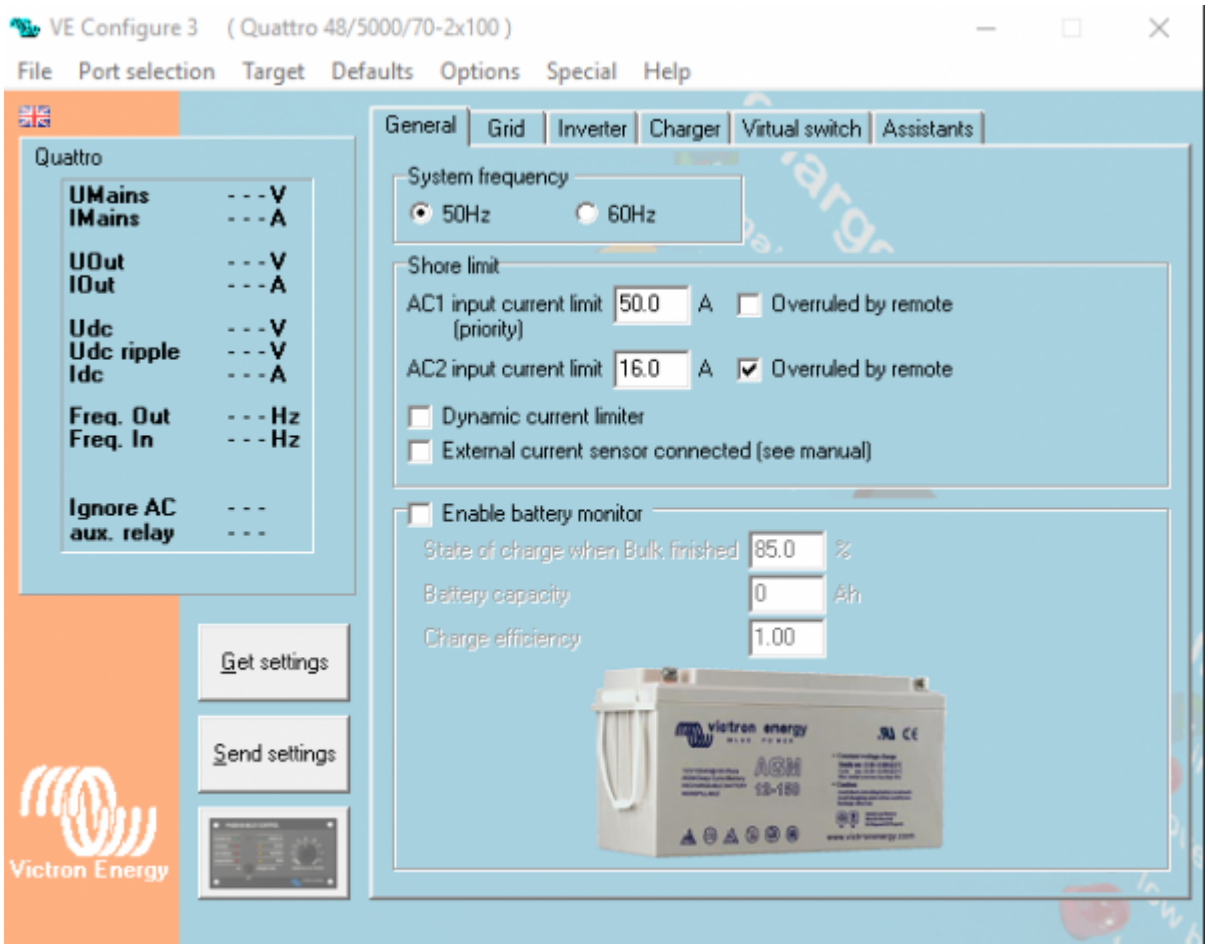
CAN Bus Wiring

The connection of the Lite to the Venus device is extremely simple. A standard **straight through** CAT5e Ethernet cable is required of the desired length, with one end plugged into one of the RJ45 sockets on the Lite and the other end plugged into one of the CAN sockets on the Venus device. Note that the second RJ45 socket in each case must be fitted with an end of line 120Ω resistor. Two are supplied with each Venus device. If multiple batteries are installed in parallel the second RJ45 socket is used to link the next battery in the line onto the CAN Bus network. The termination resistor is installed in the last battery in the CAN Bus line. Refer to Lite installation manual for further information. Correct CAN Bus communication can be verified by observing whether the Freedom Lite battery is presented in the Venus device list under the name "Freedom Lite".

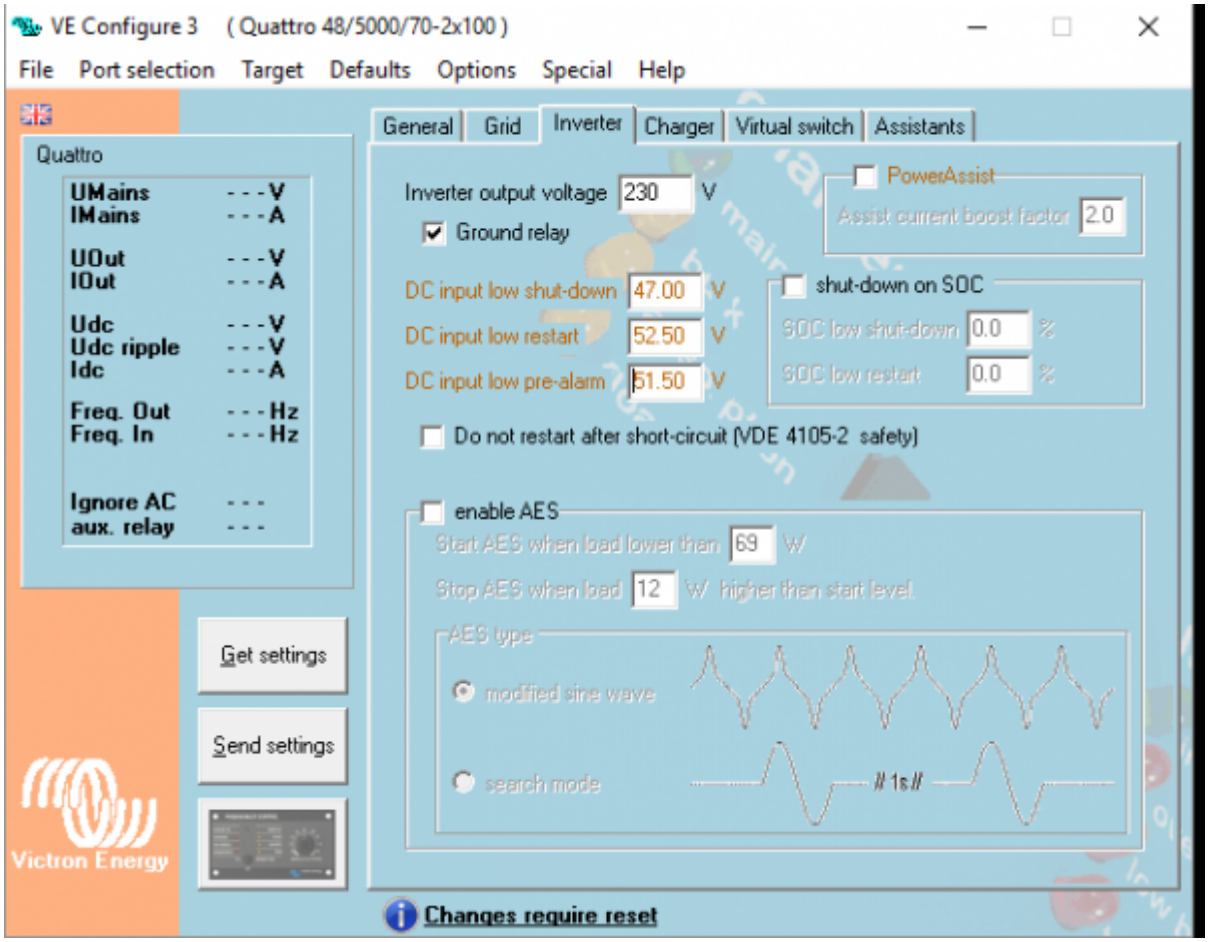
Ve Configure Settings

The Multi or Quattro devices must be set for operation with the Freedom Lite as follows (note that settings not directly related to the Lite are not mentioned here and must be referenced in the VE Config manual):

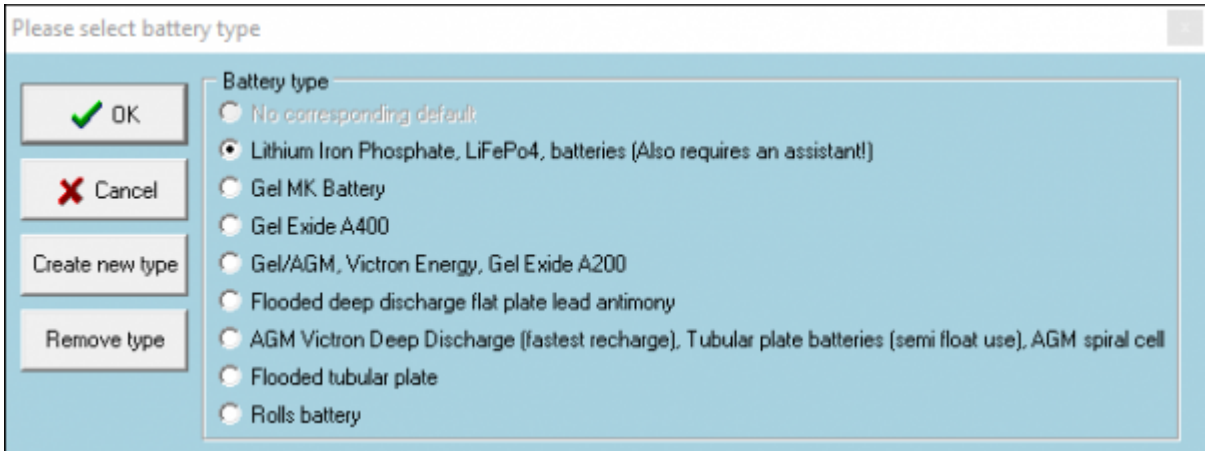
☛Disable Battery Monitor (the Ve Bus battery monitor is not required with a CAN Bus Lithium battery)



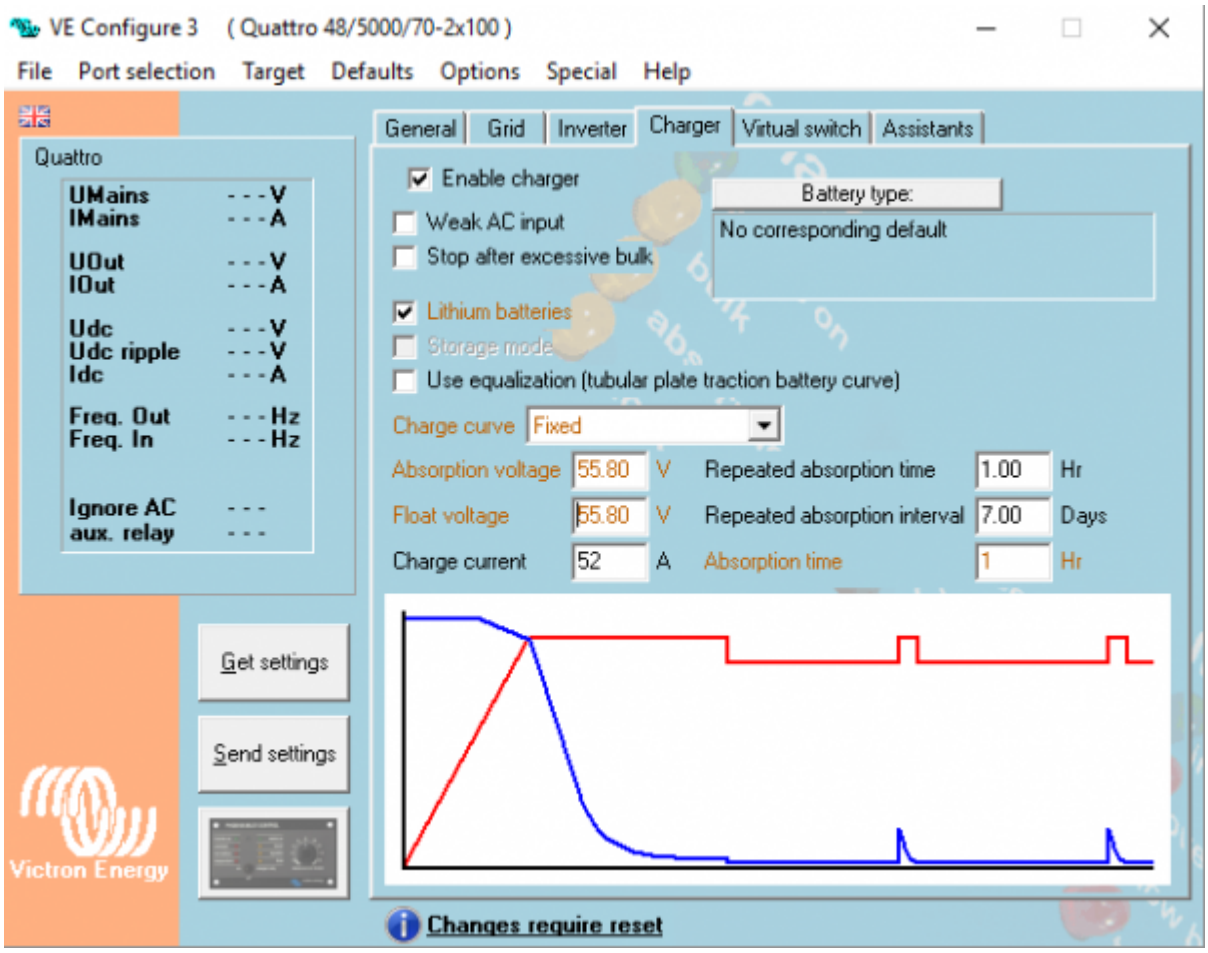
☛Set the Shut-Down, Low Restart, and pre-alarm voltages (the pre alarm only activates the low battery LED on the inverter and serves no other purpose in this setup. The Shut Down and Low Restart voltage settings are usually overridden by the commands from the Lite but offer redundancy in instances of loss of communication and therefore should still be set correctly)



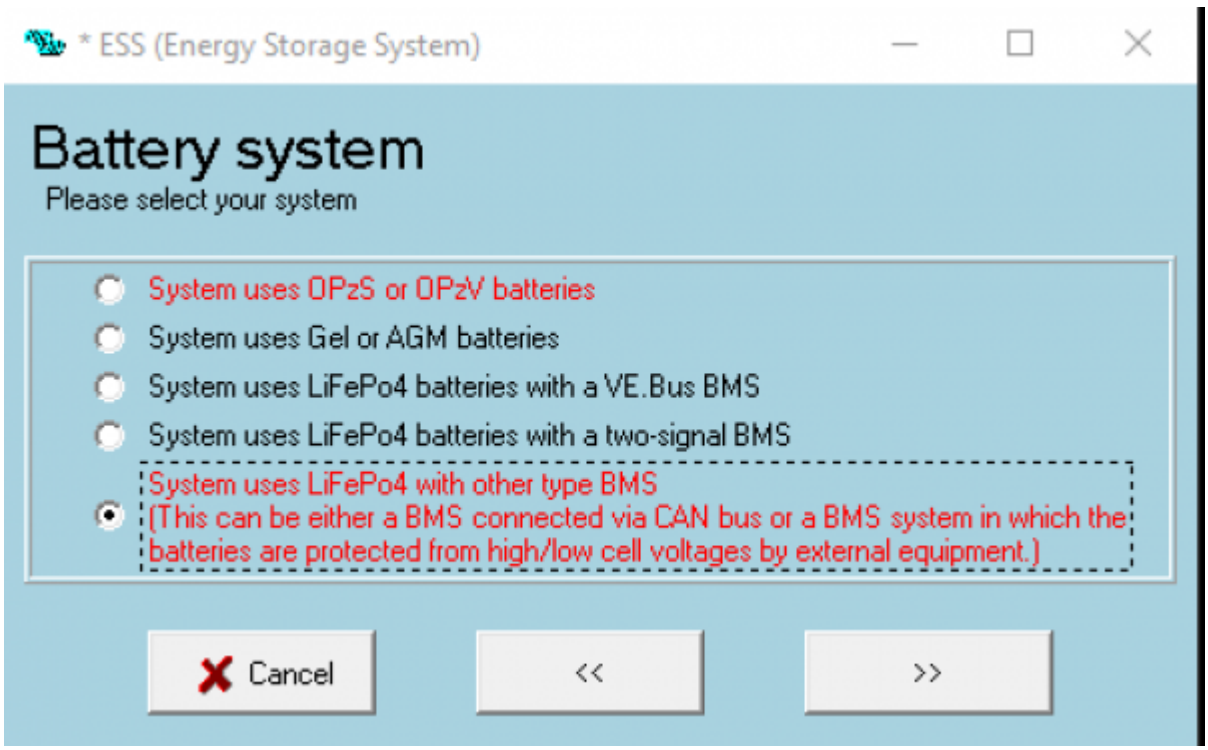
☛Charger Settings (set Battery Type as Lithium Iron Phosphate after selecting Lithium Batteries).

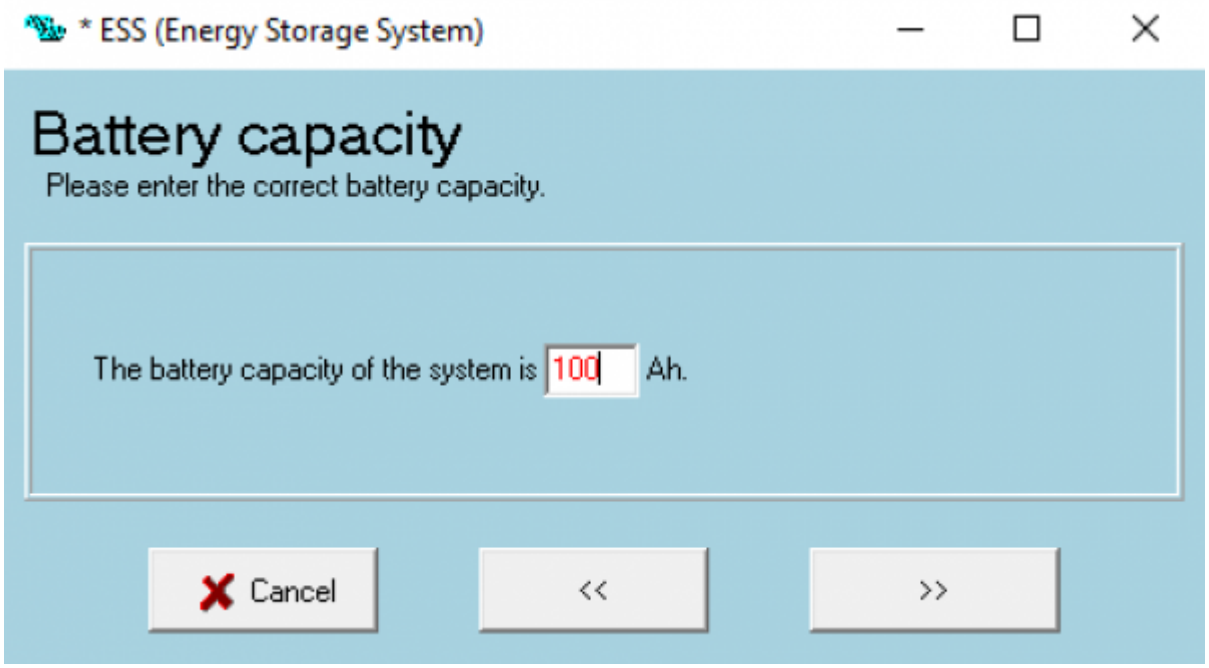


☛Set Charger Settings as below (the charge voltage values are overridden by the Lite but should be set correctly regardless for redundancy. The charge current should be set according to the user's requirements while ensuring that this value combined with all other charge sources cannot exceed the charge limit of the battery – it is possible to select "Limit Charge Current" on the Venus device as an additional measure to prevent the total system charge current from exceeding the charge capacity of the Lite) Note: only adjust these values AFTER selecting Lithium battery as the incorrect values are entered by Ve Config when selecting the Lithium battery type.

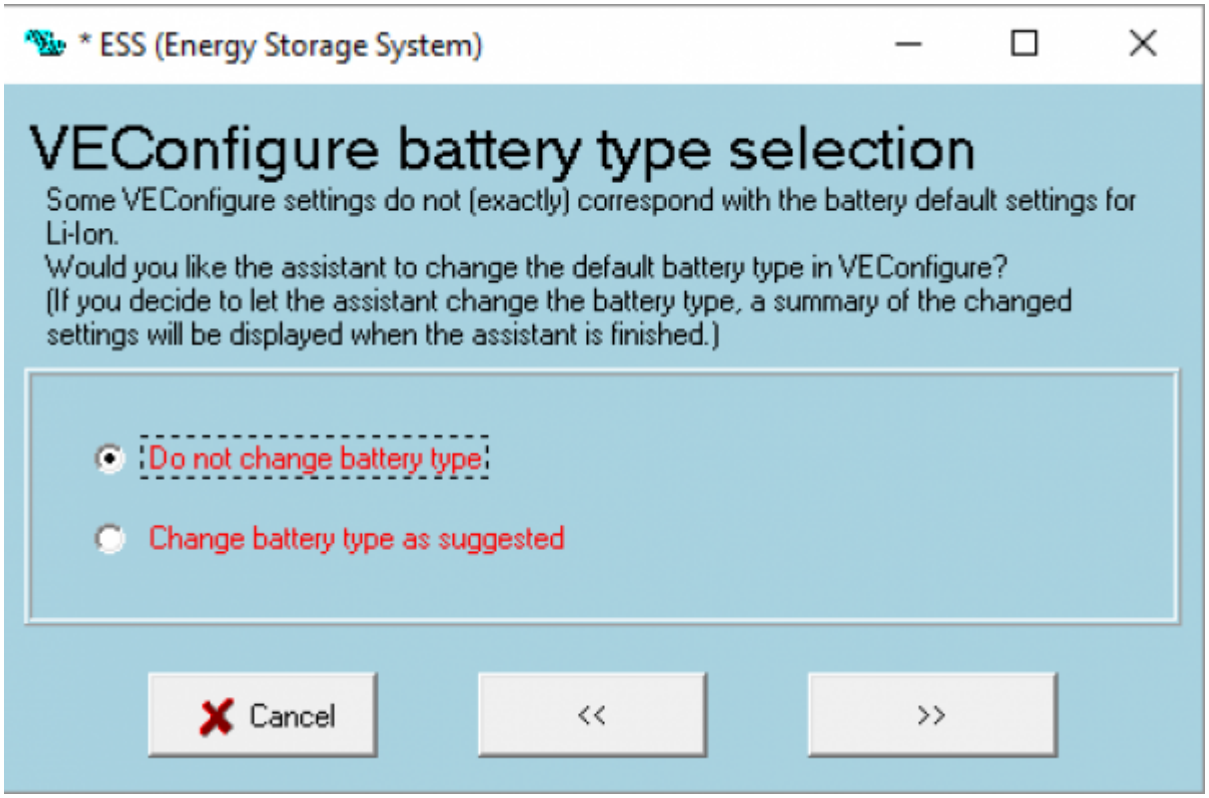


☛When setting up the ESS Assistant select LiFePO4 battery and enter the Ah value for the Lite (or the combination of Lite's for a parallel battery system) as per the Ah rating provided in the Lite specification sheet eg. Lite 5/4 = 100Ah.

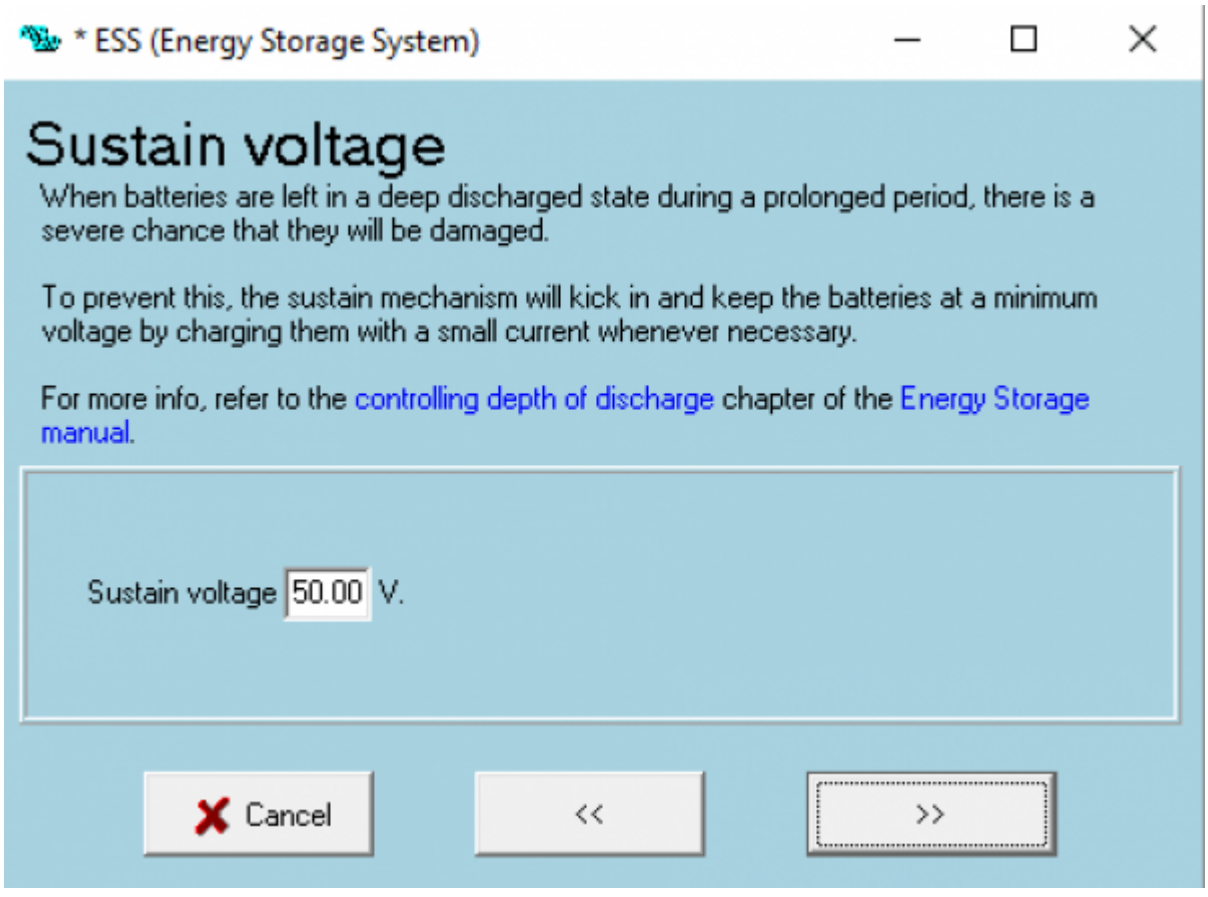




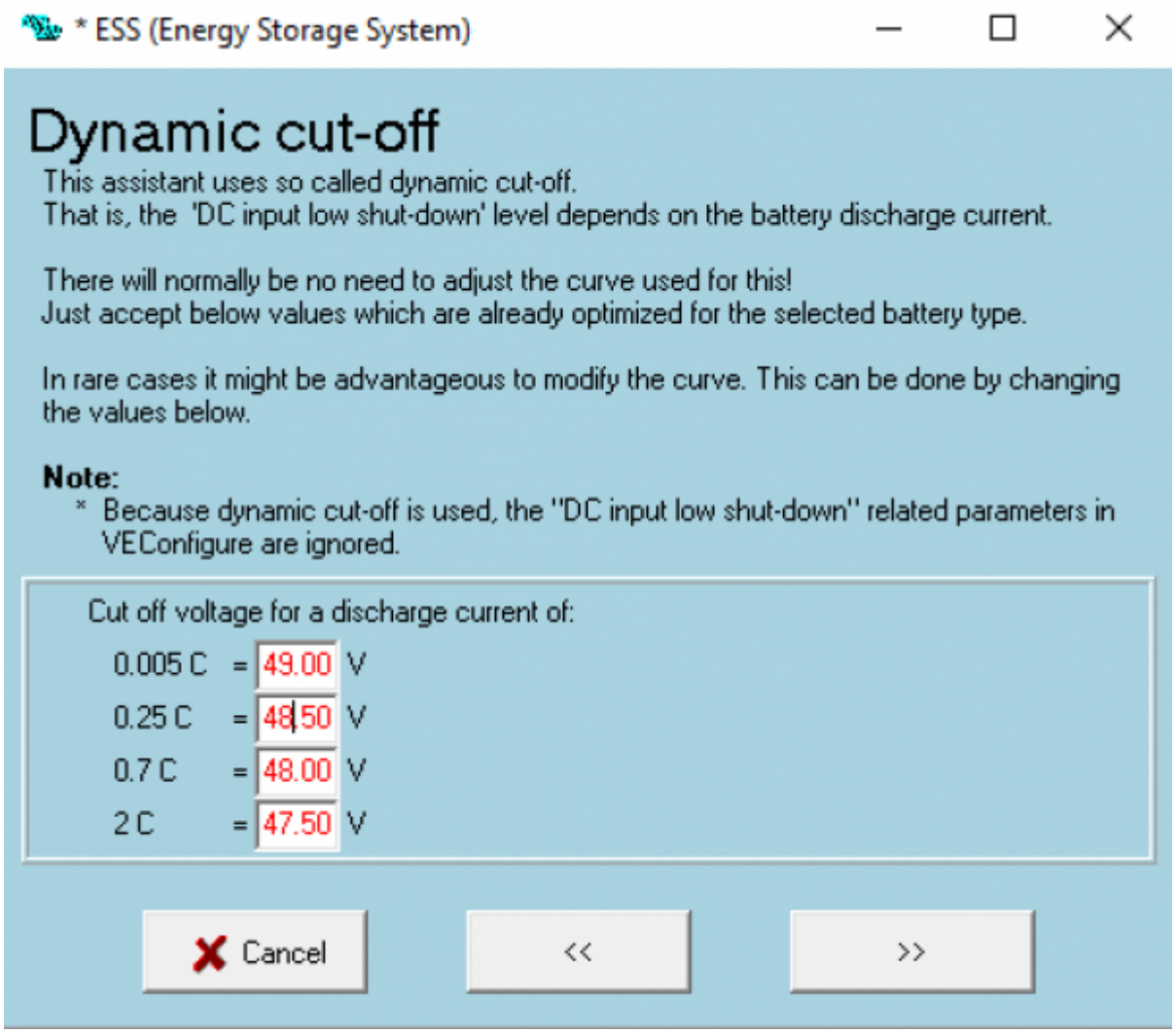
☛Select – Do not change battery type



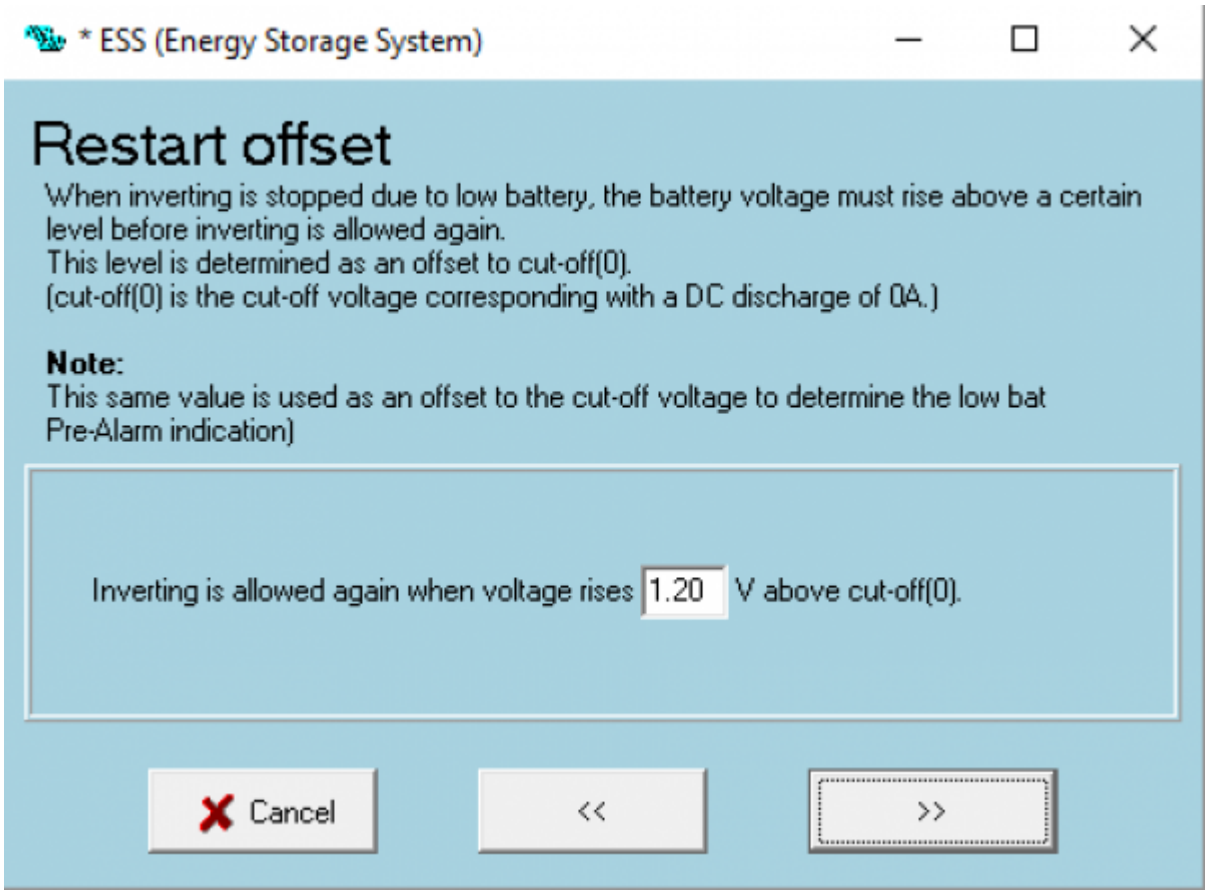
☛Sustain Voltage = 50V



☛Enter Dynamic Cut-off values as below (usually the Lite will override these values, however they should be entered correctly for redundancy)



☛Restart Offset = 1,2V



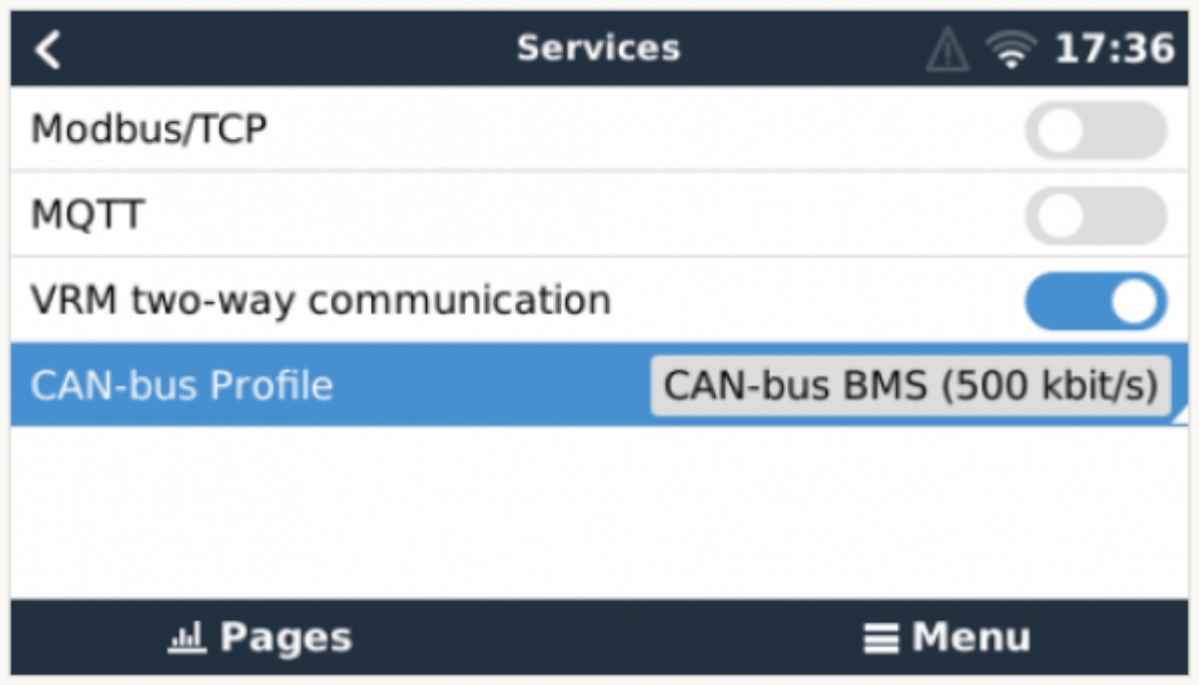
☛Go back to General and disable battery monitor again.

Venus Device Configuration

It is very important that the following settings are entered correctly for proper functioning of the Lite communication interface:

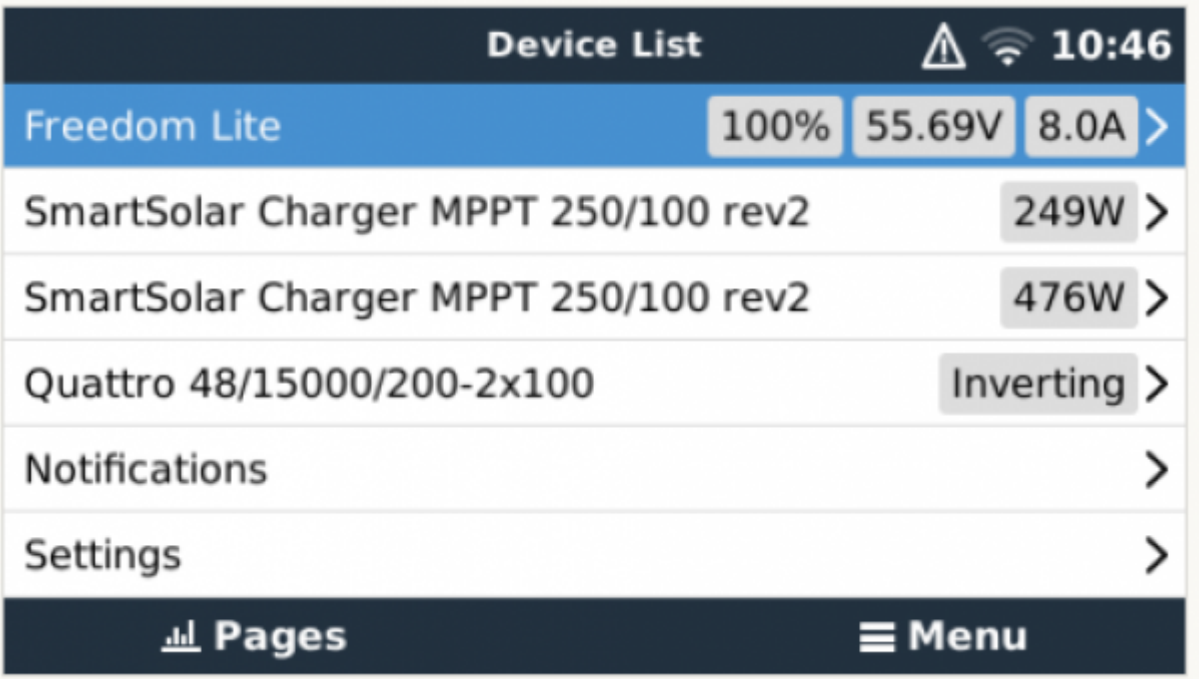
☛Settings → Services → CAN-bus Profile → CAN-bus BMS (500kbit/s)

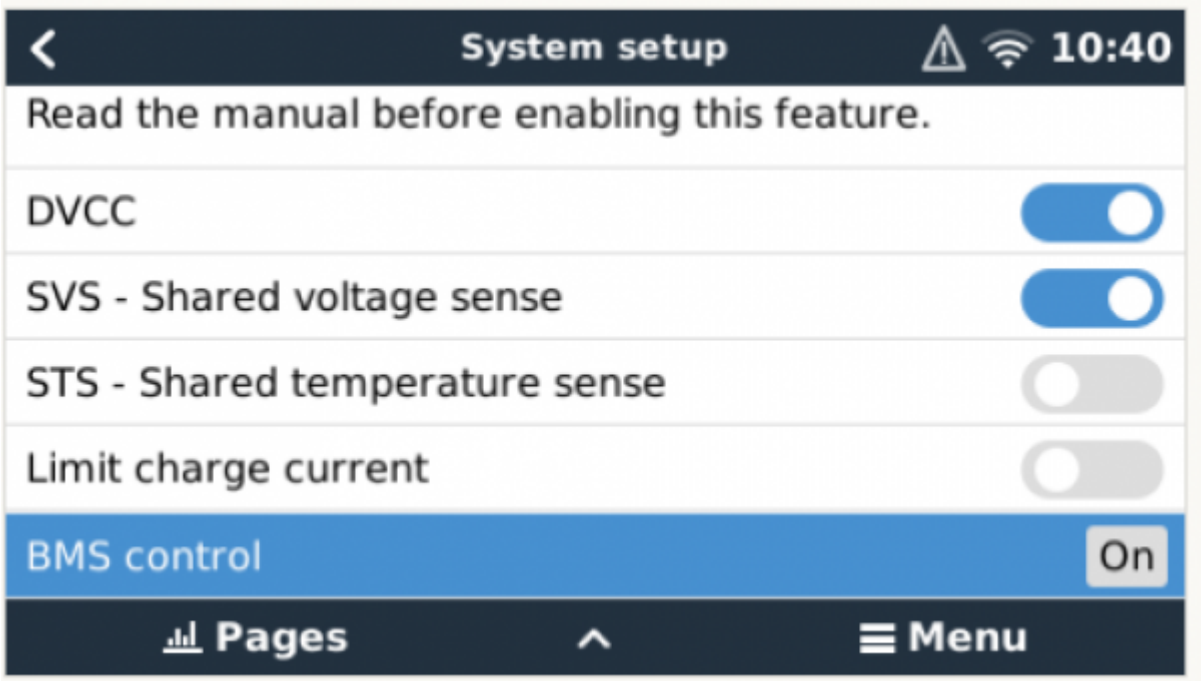
***Note**: For systems with VE Can MPPT's, select 250kbit/s and ensure Lite profile is also set for 250kbit/s (check with Freedom Won or your Freedom Won distributor).*



☛Confirm that the Freedom Lite is showing in the device list as per below

☛Settings → System Setup → Switch on DVCC and SVS, check that BMS Control is “On”





☛Freedom Lite (device list) → Parameters → Confirm that the Charge Current Limit and Discharge Current Limit are as per the Lite specifications (Note: if the battery is fully charged the CCL may be reduced. Check that the voltage target is within the range 54,1V to 55,8V (Note: below about 95% SoC the value reflected should be 55,7 or 55,8V. For a fully charged battery this value should range from 55,0V to 55,8V depending on the state of balancing of the cells in the Lite.

MPPT Configuration

The voltage setpoints on the MPPT's must be set to 55,8V for bulk and float with equalization disabled. In order to do this on the Ve CAN MPPT's select the User Defined option 8 battery type as this allows adjustment of the charge voltage setpoints.

Adjust the maximum current on the MPPT's to ensure that the combined total charge power cannot exceed the maximum rated charge current for the Lite or Lite's in the system.

Troubleshooting

Should any difficulties arise with the Freedom Lite to Victron interface please contact support@freedomwon.co.za for assistance.

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