THUNDERSTRUCK MOTORS BMS VC1 Master Control Unit Instructions

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THUNDERSTRUCK MOTORS BMS VC1 Master Control Unit

Introduction

The Thunderstruck BMS VC1 is a microprocessor-controlled device that reads cell voltages from one or more Valence™ battery modules and selects an action based on a comparison between reported cell information and BMS configured limits. Action options include opening circuits in response to out-of-limit cell voltages or temperatures, making it possible to control both charge and load circuits in a battery-powered system. The BMS automatically initiates module-level cell balancing, but not inter-module balancing (between modules). This feature is being investigated for a future release.
The BMS provides a simple user interface for setting voltage limits and for listing connected modules and module cell voltages. Data connectors between modules in the pack are chained together without concern for parallel/series orientation. The BMS connects to one end of the chain, and the provided termination plug connects to the other end.

BMS Setup

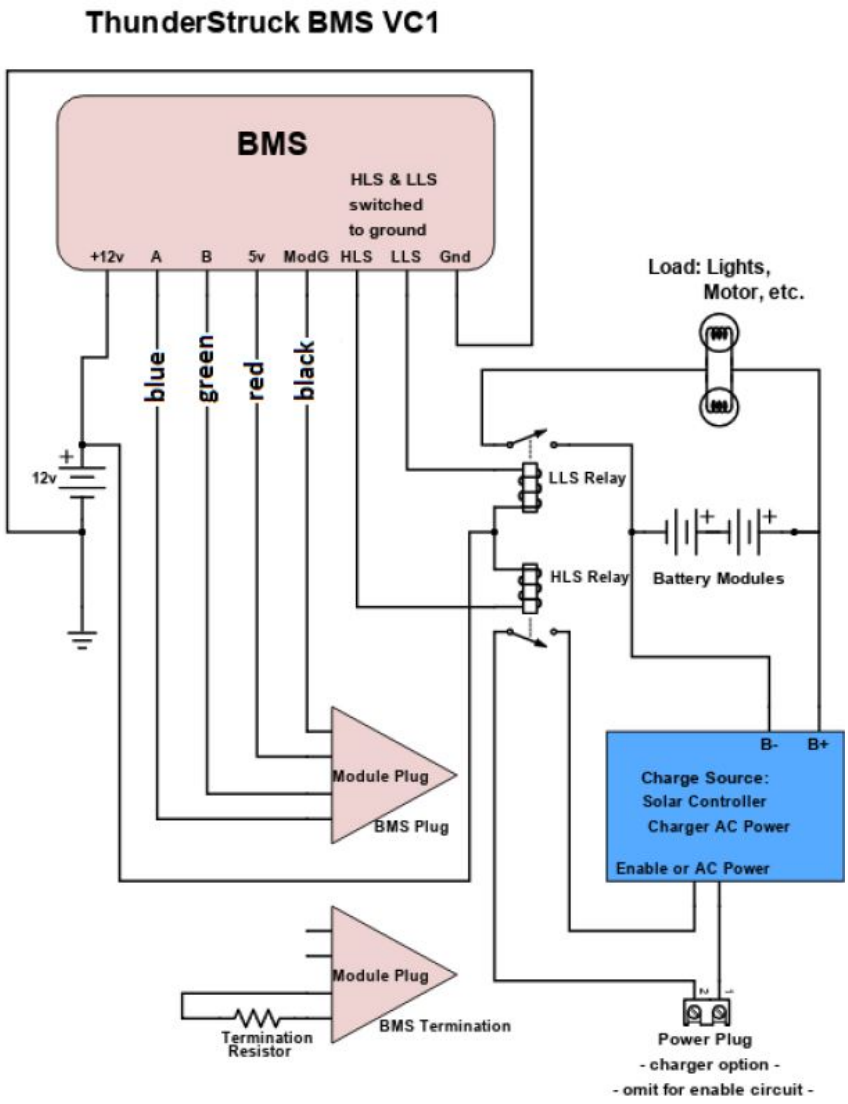
PC/Mac Software

To communicate with the BMS, connect it to your computer using the provided micro USB cable. The BMS will be recognized as a serial device with an assigned COM port. You can use any serial terminal software to communicate with the BMS, however, we suggest using a free open source program like Putty (Windows) or Coolterm (Mac).
The assigned COM port number can be found using the Windows Device Manager and then entered into Putty. Cool term provides a dropdown to select available ports on the Mac. See the following document for applicable information about these two options.
http://www.thunderstruck-ev.com/images/companies/1/DD_SerialPortUtilities_v1.2.pdf

Android Software

To communicate with the BMS using an Android device you will need to install a serial terminal app such as this, from Google Play:
https://play.google.com/store/apps/details?id=de.kai_morich.serial_usb_terminal
Connect the BMS to the Android device with an OTG micro USB serial cable. Make sure that the host end of the cable is connected to the Android. For correct text alignment, set up the app to use a monospace font.

Wiring Instructions



Build up the pack, attach power interconnects and verify power output, then connect module plugs between modules until all but the end plugs are connected. Connect the BMS Termination and BMS Plug (see below) to the end module connectors. Next, refer to the diagram below and complete the BMS wiring per the actual system requirements.
Charge and load enable circuits are controlled by relays. If controlling power circuits, use power contactors rated for charge and load voltage and current. A DCDC converter from the pack is required if a 12 volt battery or supply is not available.

Configuration

After the wiring is complete and you are communicating with the BMS, you can configure the BMS to work with your group of battery modules. If you purchased your modules along with the BMS, the configuration should be already completed and locked. If not, then take the following steps to configure your system.
Start by entering the “update” command to show all the modules connected to the BMS. If all the modules in your system are not shown in the list, then plug each module individually into the BMS and “update” again. Label each module using the listed ID. Use the “set mode” command (see “Commands” below) to change the ID of one module with any duplicate ID. Plug in all the modules again and enter update” to verify all are present.
Once the modules are verified, enter the “lock” command to save that set of module IDs. After this step, the HLS and LLS limit switches will be active.
To change the HVC and LVC values, use the “set” command. If changed, also set the HVCC and LVCC values. Set the HVCC approximately 0.1 volt below the HVC value, and set the LVCC value 0.1 volt above the LVC value.

High & Low Limit Switches

The BMS has two limit switches that can be used to control other devices. Both the HLS (High Limit Switch) and the LLS (Low Limit Switch) are open collector outputs found on many electronic devices. They behave like a normally open switch that is connected to the ground when activated.
The method for controlling a specific external device depends on features supported by that device. Many devices have a control/enable input that can be activated directly by a limit switch from the BMS. If no such options are available, you can also use a limit switch to trigger a large relay or contactor, indirectly disconnecting the other device from its power. In most cases the HLS would be used to control a charger or charge controller and the LLS would be used to control whatever you are trying to power, such as a motor controller, AC inverter, LEDs, buzzer, etc.

Commands

The following commands are available in the VC1 – these are not case-sensitive.

- “update” displays a list of connected modules and their ID values
- “show cells” lists the connected set of modules along with module cell voltages
- “show config” shows the list of configuration setting
- “debug” shows a list of errors useful for troubleshooting
- “lock” saves the current pack ID list (required for operation)
- “set” sets parameter values, using “set (parameter) (value)” – Example: “set hvc 3.55”
- “set mod” used to change a module ID. Example: change 3 to 9, enter: “set mod 3 9”
- “enabled” sets LS output logic. Default is closed when enabled. Example: to set HLS open when enabled: “set HLS enabled open” (“HLS” is case sensitive on early versions)
- “help” lists the command options available to the user

Parameters

- “hvc” (high voltage cutoff) is the high voltage limit at which the BMS will open the HLS
- “lvc” (low voltage cutoff) is the low voltage limit at which the BMS will open the LLS
- “hvcc” (high voltage cutoff clear) is used to buffer cycling of the High limit switch. If a cell reaches HVC during charge, the BMS will shut off the charger, and the cell voltage drops slightly. The charger will turn back on below HVC, and the cycle repeats. Setting the HVCC below the HVC creates a delay to eliminate rapid cycling. The charger turns back on only after the highest cell voltage drops below HVCC.
- “lvcc” (low voltage cutoff clear) works the same as HVCC, but responds to the low end of the cell voltage range. This allows for turning the load back on only after the lowest cell voltage rises above LVCC.
- “tmax” maximum temperature in Centigrade for charge or discharge
- “tmin” minimum temperature in Centigrade for charge or discharge

Terms

- **BMS** – Battery Management System
- **HLS** – High Limit Switch
- **LLS** – Low Limit Switch
- **DCDC** – DC to DC converter, typically providing 12v power from main pack voltage
- **OTG** – On The Go (type of USB cable)
- **Relay** – an electromechanical switch allowing a low power source to control a high power source

- **Contactor** – a relay used to control high current circuits

Default Settings

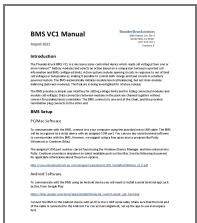
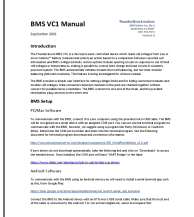
The following example shows default voltage configuration settings programmed into the BMS before shipping. These can be changed as needed for specific applications.

- hvc: 3.600
- hvcc: 3.500
- lvc: 3.00
- lvcc: 3.100
- tmax: 50.00c
- tmin: 5.00c
- HLS Enabled State: CLOSED LLS
- Enabled State: CLOSED

Product Variations and Known Issues

Feature variation may be found in different product versions. Please contact ThunderStruck Motors with any questions about product features.
Customer reports suggest that the VC1 may power cycle LLS and HLS switches when closing the computer interface during system operation. Testing shows variable results depending on the specific computer system and interface software being used. We recommend testing your system for this behavior, and to avoid user interface operations as indicated to avoid damage to external power devices. **connect@thunderstruck-ev.com**

Documents / Resources

	**THUNDERSTRUCK MOTORS BMS VC1 Master Control Unit** [pdf] Instructions BMS VC1 Master Control Unit, BMS VC1, Master Control Unit
	**THUNDERSTRUCK MOTORS BMS VC1 Master Control Unit** [pdf] Instructions BMS VC1 Master Control Unit, BMS VC1, Master Control Unit

References

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- connect@thunderstruck-ev.com
- Serial USB Terminal - Apps on Google Play
- CP210x USB to UART Bridge VCP Drivers - Silicon Labs