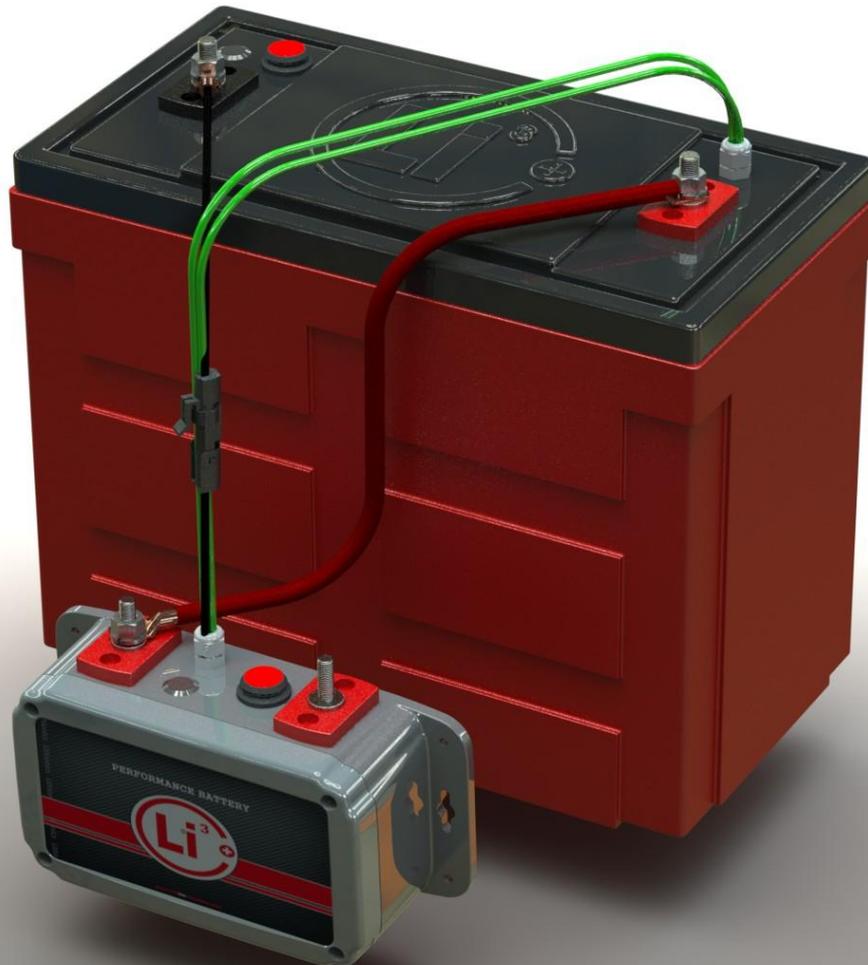




LITHIONICS BATTERY

External NeverDie® Troubleshooting Guide

Example of a 12 Volt Module with an External BMS



Overview: Common Problems Easy to Fix

- Most battery ‘problems’ reported result from improper charging habits and not issues related to manufacturing defects.
- Examples: extreme cold or hot storage conditions, or, batteries that were put into storage in a depleted condition. All batteries have ‘natural self discharge’ characteristics, so, if the BMS is not functioning, then, it is likely that the energy levels in the lithium cores is too low to power-up the BMS for safety reasons.
- On the matter of safety, do not assume the battery has a defect, thus, avoid attempts to force-charge a battery. Never use an un-authorized charger. The BMS may fail to power-up the battery because it IS possible that 1 cell in series has failed and the BMS is simply doing its job...protecting the battery and the user from thermal run-away.
- Most battery issues tend to focus on the connection points. Therefore, the first step is ALWAYS to re-check your connectors. Examples:
 - A. Cell Loop Connectors: the process of pulling them apart results in pulling the wire out of the internal crimp, creating a break in continuity.
 - B. Voltage Reference Wire not connected: in the example on the previous page, the BMS will not function unless it ‘sees’ or registers NEGATIVE pack voltage to the BMS. Check the integrity of the PACK MINUS voltage reference wire.

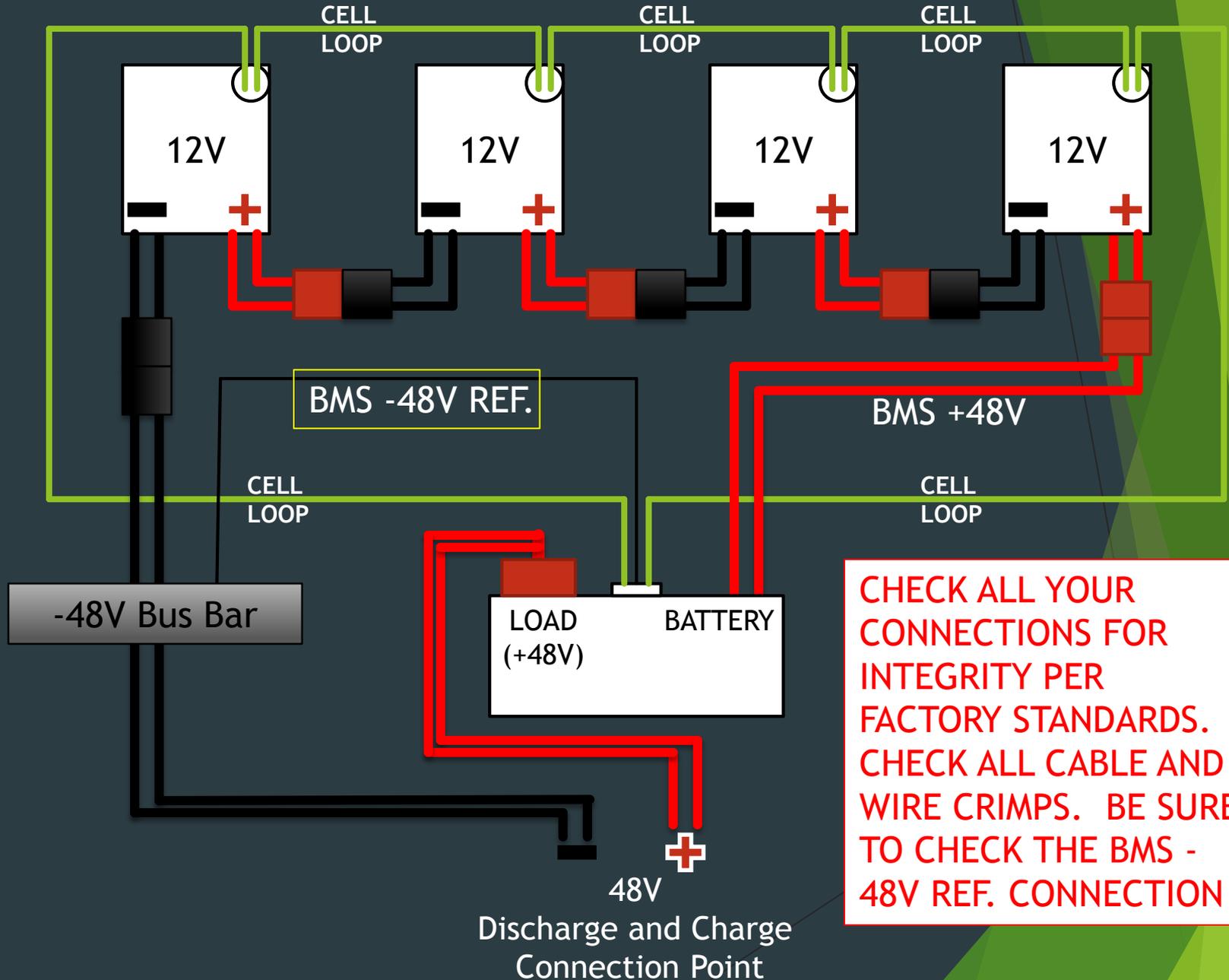
Overview: Common Problems Easy to Fix

- Check to be sure that you have no washers of any kind in between the terminal posts on the battery and the connection cable lug or ring terminal....be sure that it is copper-to-copper. Users often insert a stainless steel washer between the terminal connection points, causing a voltage drop and temperature rise.
- Check your torque settings on the terminal bolts! Do not over or under tighten. Know your torque settings for bolt-down terminals.

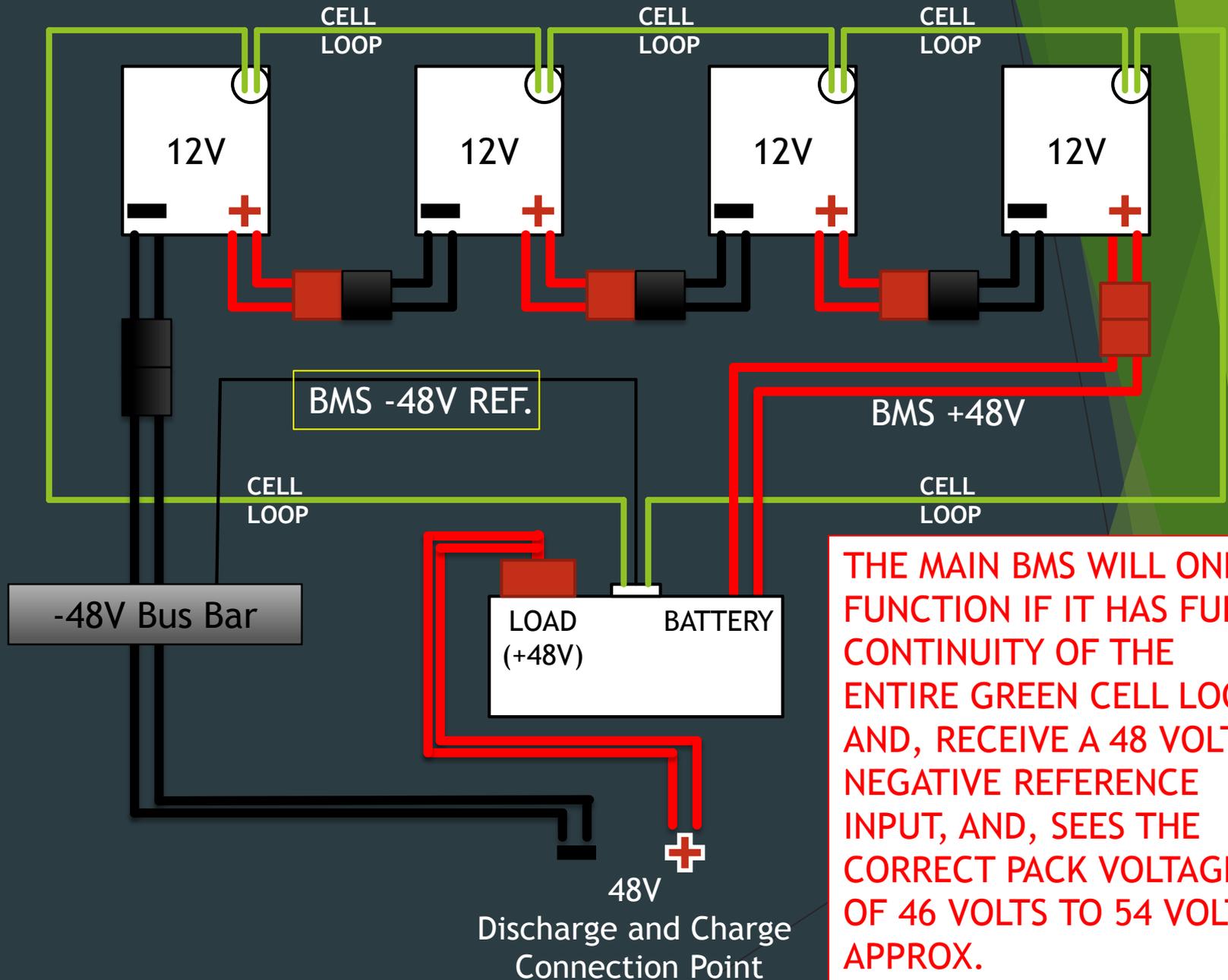
All Battery Issues Fall Under One of These Categories: the objective to simple first ISOLATE where the problem is at:

1. Cell or Lithium Core HEALTH: always measuring by a simple volt-meter
2. Cell Computer Health: always measuring by a simple continuity meter (the type that BEEPS if you have continuity)
3. Module-to-Module Voltage BALANCE: modules left uncharged for long periods of time will 'drift apart' on state-of-charge and will show different overall voltages. Module-to-module balance must exist for the system to function properly.
4. External NeverDie® HEALTH: diagnostics of the external NeverDie® is possible, but, never repairable by the end-user.

Example 48V System



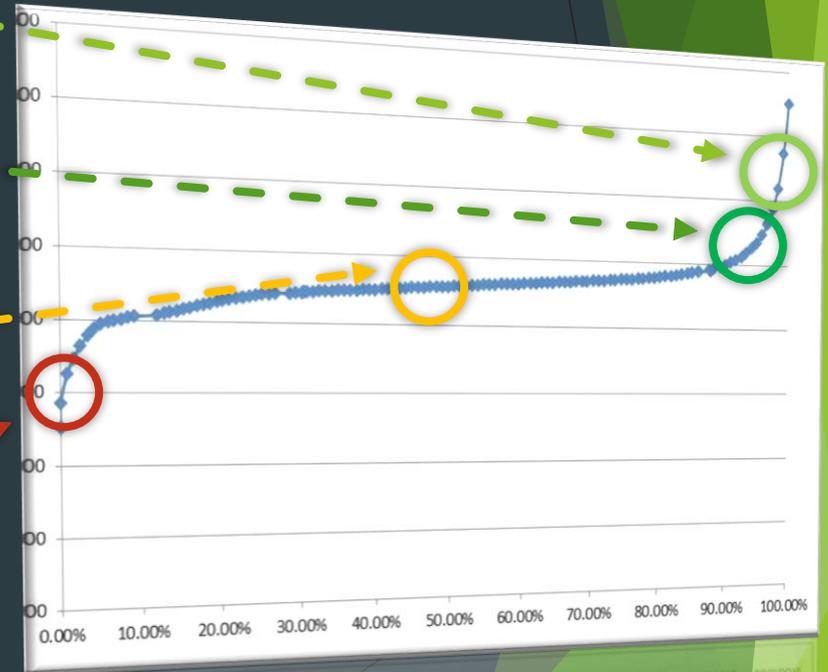
Example 48V System



THE MAIN BMS WILL ONLY FUNCTION IF IT HAS FULL CONTINUITY OF THE ENTIRE GREEN CELL LOOP, AND, RECEIVE A 48 VOLT NEGATIVE REFERENCE INPUT, AND, SEES THE CORRECT PACK VOLTAGE OF 46 VOLTS TO 54 VOLTS APPROX.

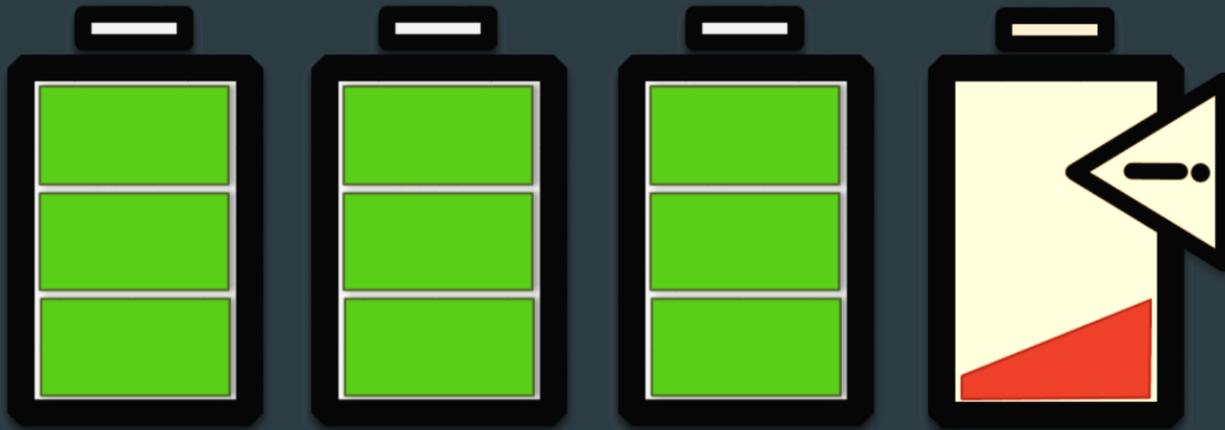
Lithionics Battery Basics

- ▶ Each 12V battery module has:
 - Charging voltage of 14.0-14.6V (depends on type of charger used)
 - CHARGED (rest of 1 hour after completing charge) voltage of 13.3-13.6V
 - Nominal voltage of 12.8V (average operating voltage)
 - Discharged voltage of 11.2-12.0 volts

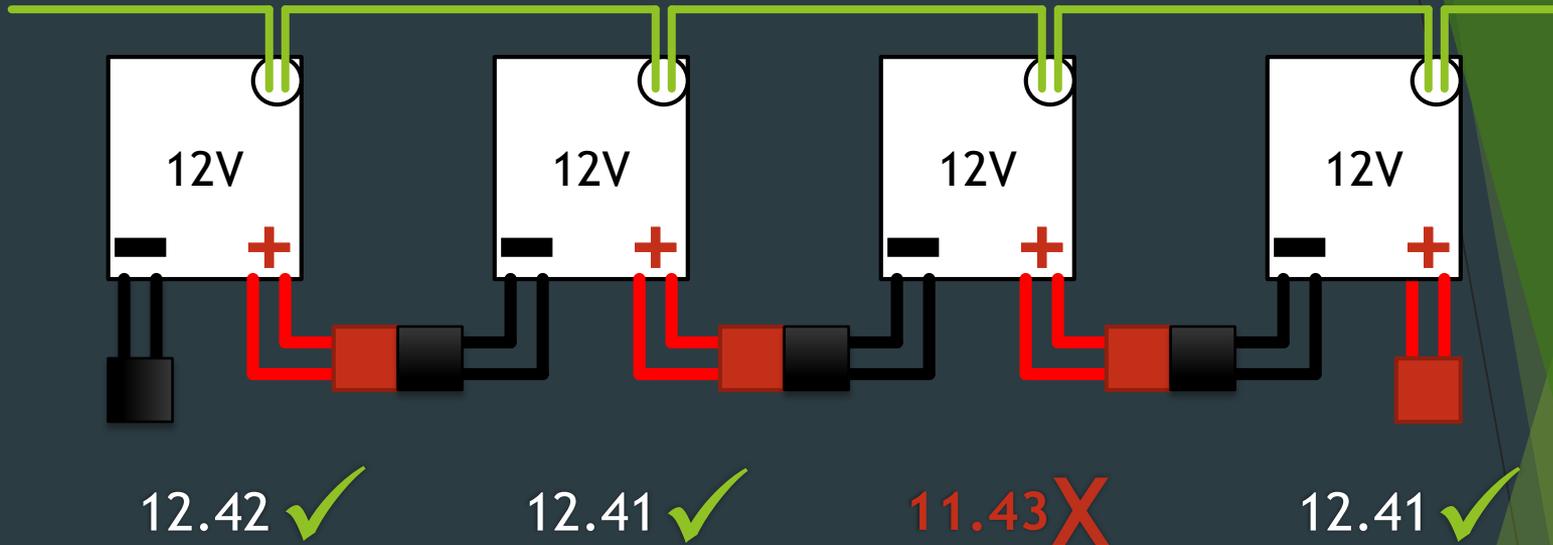


Lithionics Battery Basics

- All 12V battery modules in series must be at an equal state of charge and voltage to function properly as a system. Your are only as strong as your weakest battery!

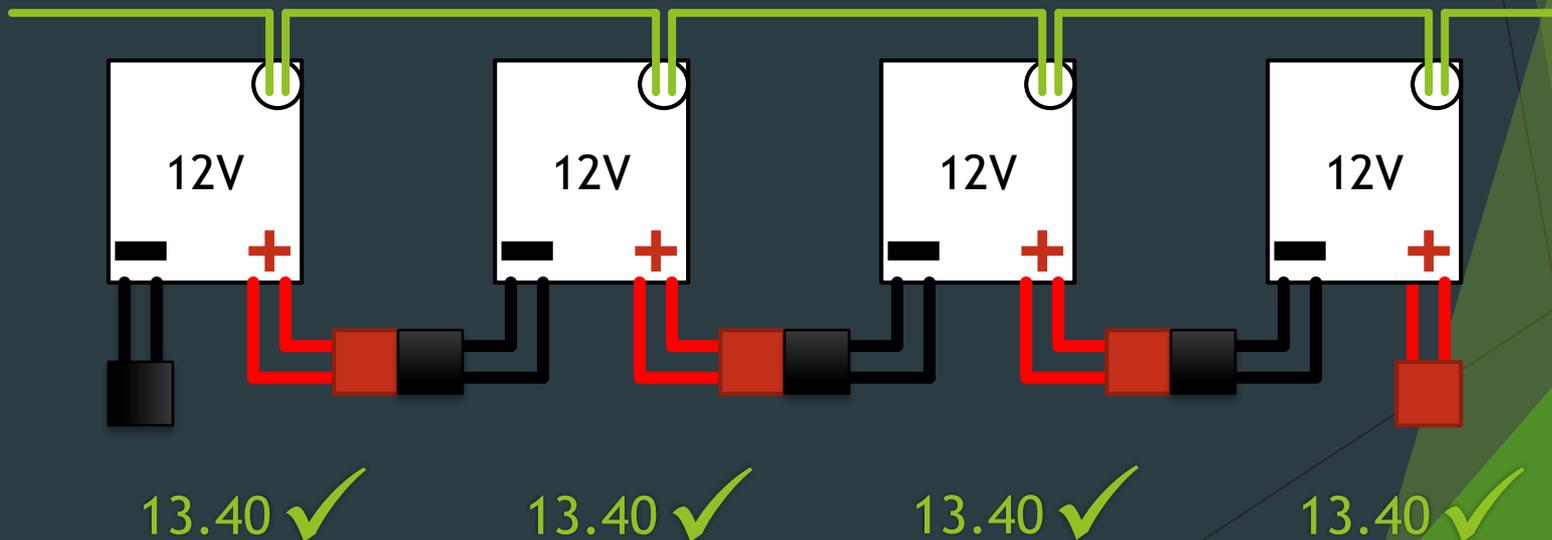


1. Measure each battery's voltage with a multimeter/voltmeter and write it down.

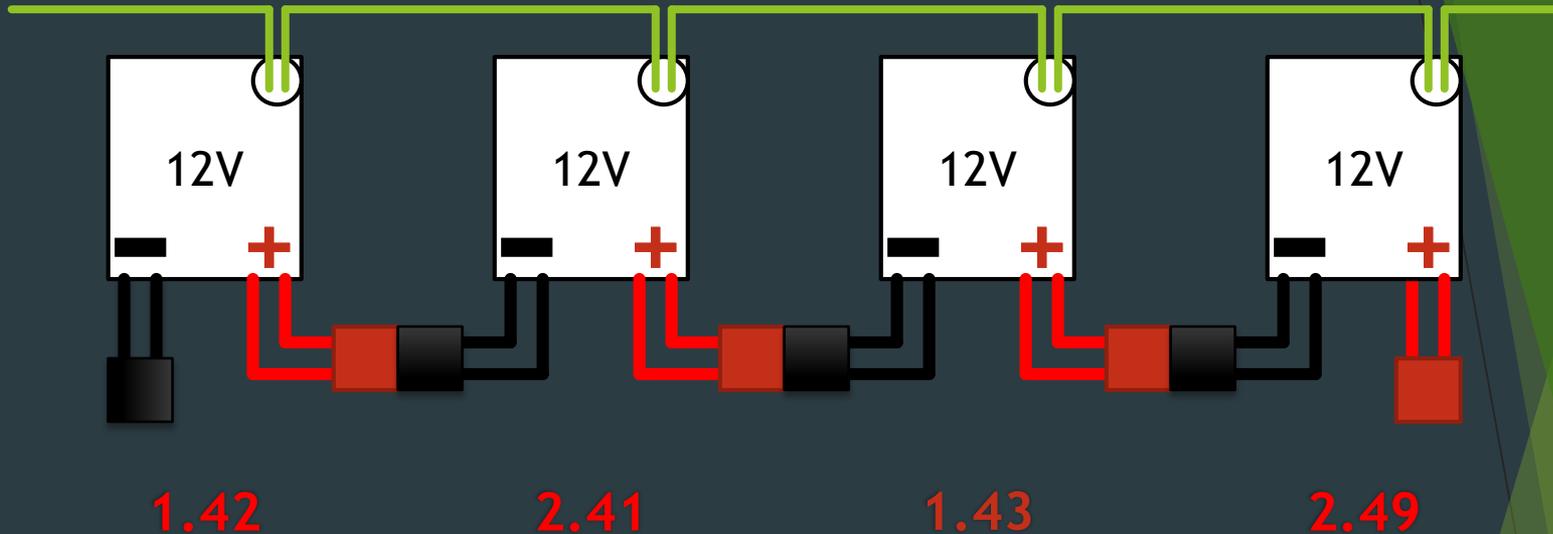


- We can tell from our battery voltages that the third battery in series has a much lower voltage than the other 3.
- This indicates that the battery is out of balance from the rest.

1. First, disconnect each battery in series and then disconnect the external NeverDie® BMS. CONTACT Lithionics Battery to obtain a special charger that matches the voltage of your module, normally a 12 Volt charger to match your 12 volt ‘module’.
2. FULLY charge each module until you are sure the charger has completed its cycle.
3. After resting for 1 hour each battery’s voltage should be between 13.33–13.80V.
4. Re-connect the modules in series, connect the NeverDie® master BMS

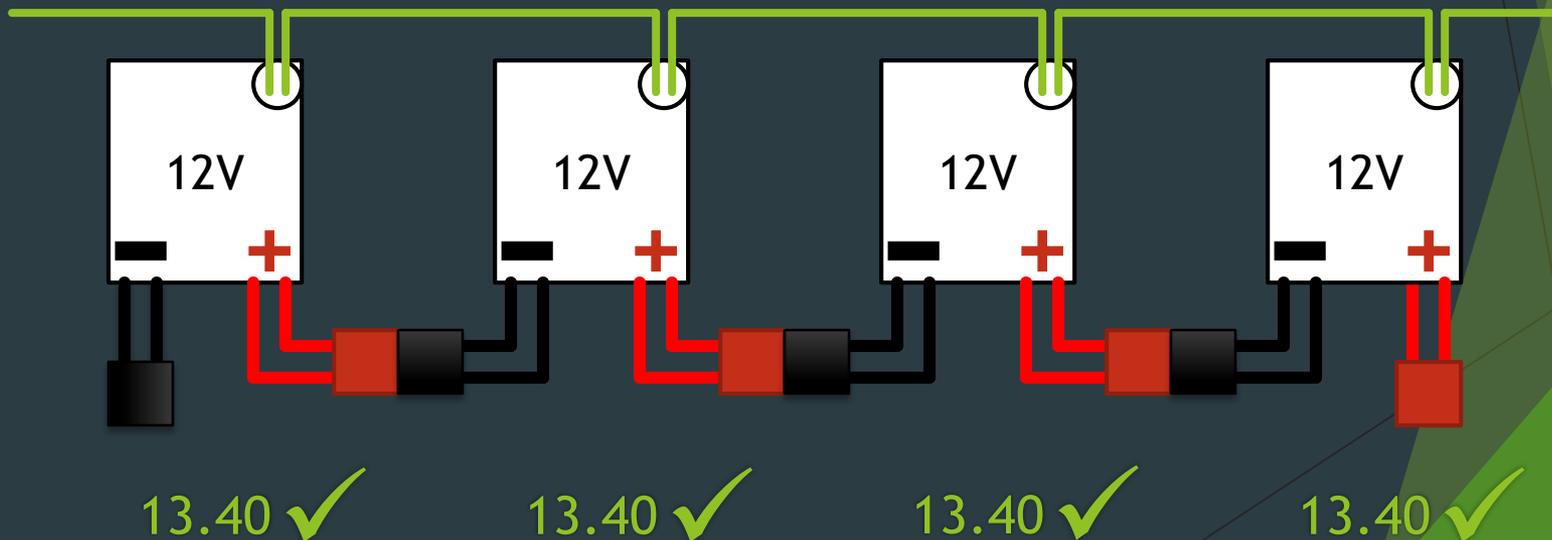


In this example, the batteries were stored incorrectly and now the modules are measuring very low voltage. DO NOT attempt to recharge the modules before contacting Lithionics Battery.



In the example above, a possible safety or hazard condition exists that can occur during recharging. A Lithionics Battery 'Rescue Charger' is needed to gently begin charging the batteries at a special low voltage using a special algorithm. Purchase a Rescue Charger from Lithionics Battery only.

1. In the event that you restored all batteries to equal voltage, and after connecting the master NeverDie® BMS, the system does not function, the possibility exists that an internal cell computer or sensor has tripped.
2. The next step is to check the CONDITION of the cell computers inside each module via the green Cell Loop communication, and, to check the integrity of the entire Cell Loop connection system.



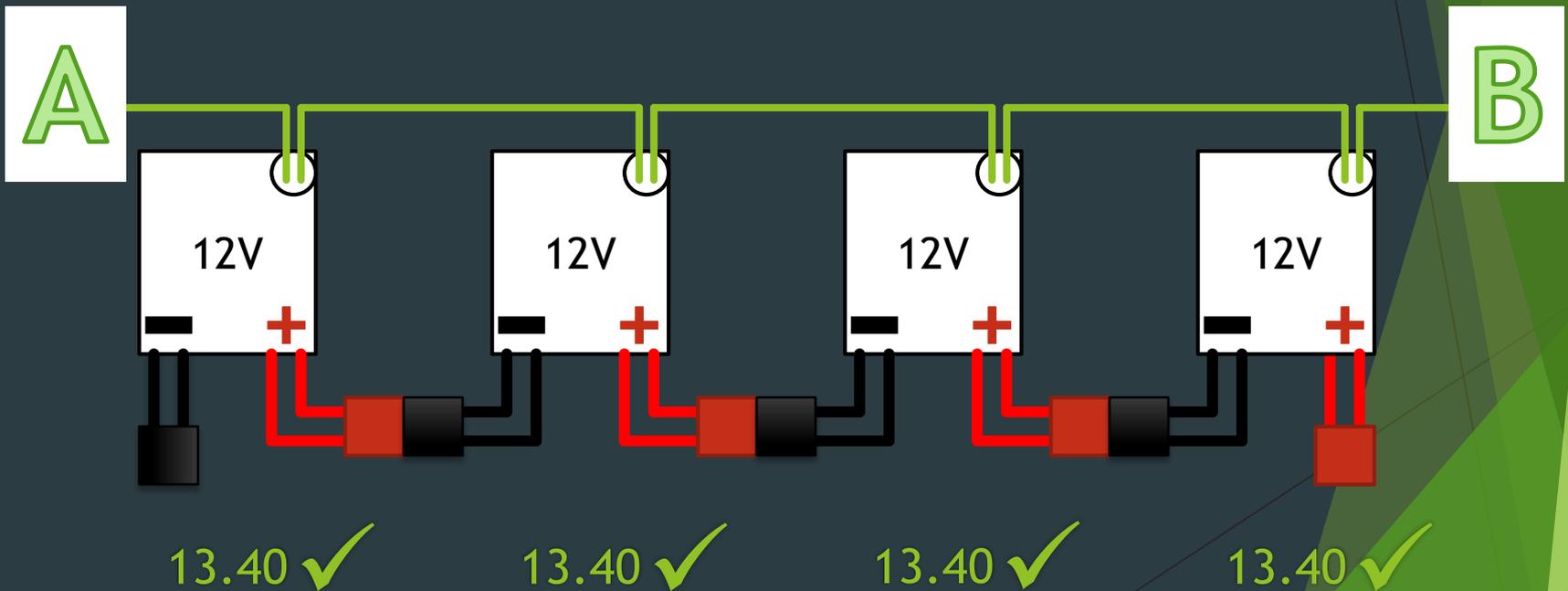
Lithionics Battery Basics

- **Cell Loop**

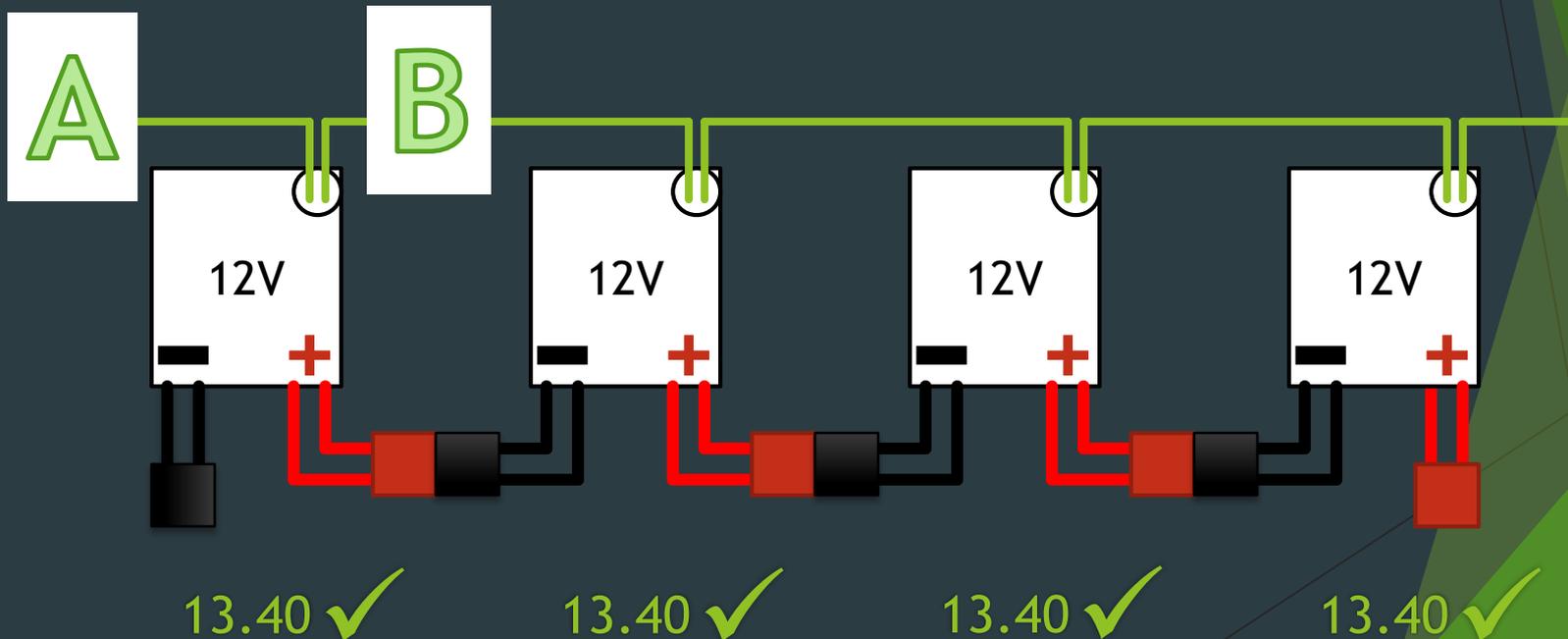
- Each 12V battery module has a normally closed (N.C.) logic Cell Loop (CL) output composed of 2 light green colored 16 gauge wires. These wires are “daisy-chained” from one battery module to the next.
- The Cell Loop starts and ends at the NeverDIE BMS unit.
- If there is ever a fault in any battery module then its cell loop will go to open circuit condition which communicates the fault to the NeverDIE BMS.
- This simple open/closed circuit fault makes diagnosing a battery system very easy!



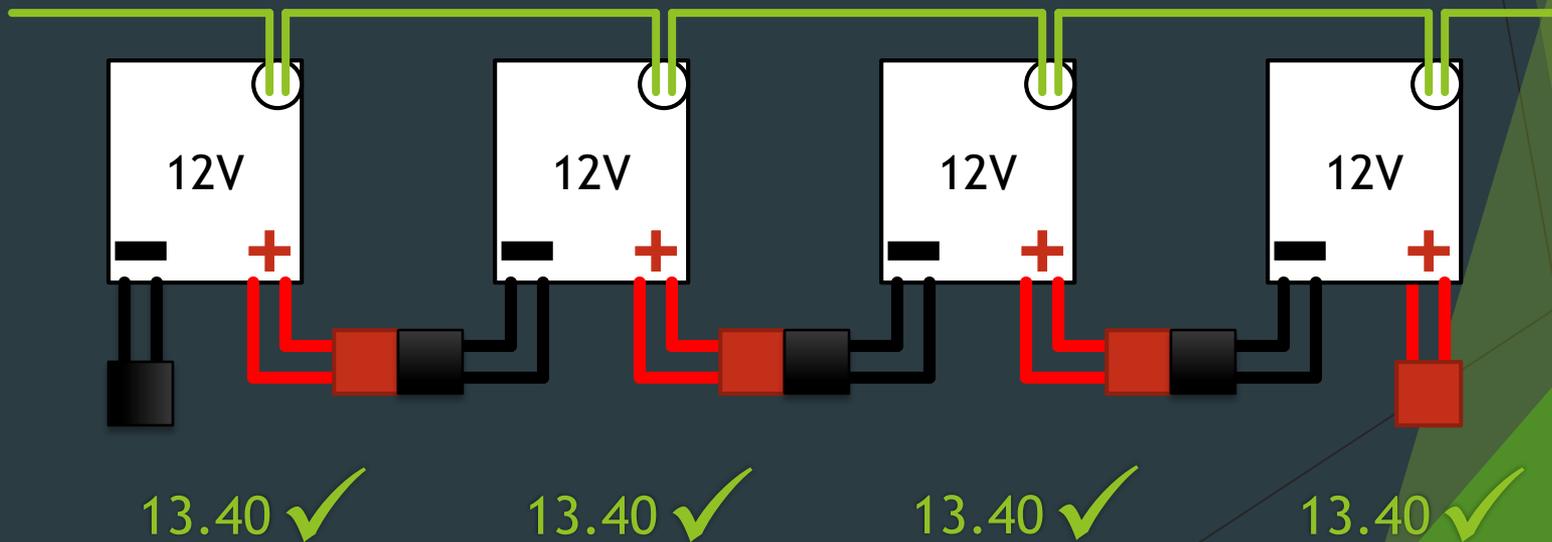
1. Step 1: using a common multimeter with a beeping continuity tester, probe points A and B.
2. If continuity is found, then, the entire cell loop is good and you have determined that there are no connection issues INSIDE the modules or from module to module.
3. If your system still does not function at this point, then, there may be an issue in the external master NeverDie® box.



1. Step 2: using a common multimeter with a beeping continuity tester, probe points A and B ON EACH MODULE and record your findings.
2. Contact Lithionics Battery if no-continuity is found on any given module. First, however, be sure to check continuity of the WIRE excluding the Delphi Weatherpack (black) connector by shaving away some green insulation at two points: on the wire going INTO the module and the wire coming OUT of the module. You may have a bad Delphi crimp.



1. If you now have module-to-module compatible voltages and voltage-balance, and, you have continuity, HOWEVER, the master NeverDie® BMS will not power-up, contact Lithionics Battery for support on how to field-diagnose the master BMS.



If you now have module-to-module compatible voltages and voltage-balance, and, you have continuity, **HOWEVER**, the master NeverDie® BMS will not power-up, contact Lithionics Battery for support on how to field-diagnose the master BMS.

