LITHIONICS BATTERY

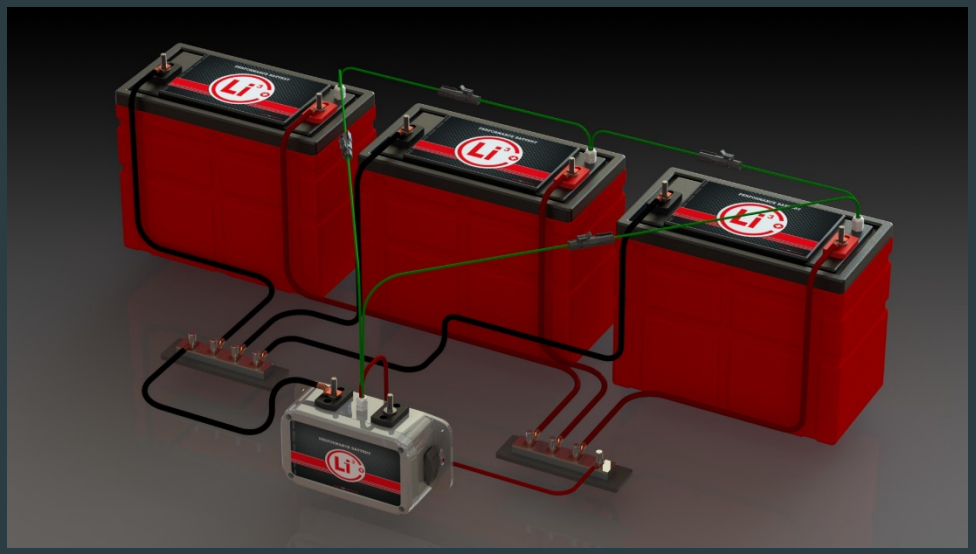
External NeverDIE Field Service Guide

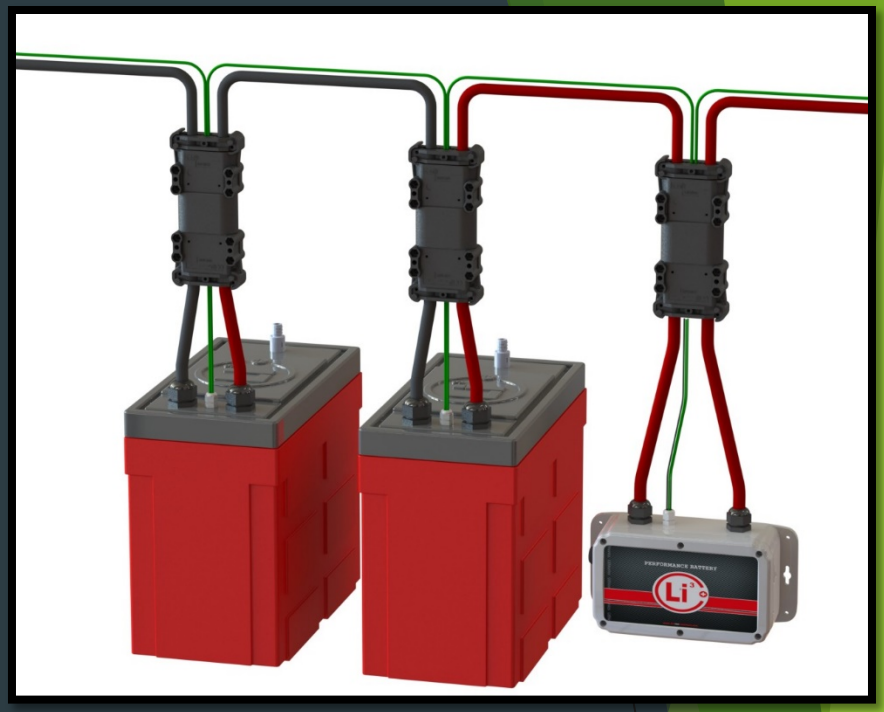
A Modular System, Plug-and-Play, Using a Single-Wire Opto-Electric Battery-to-Battery Communication System…..

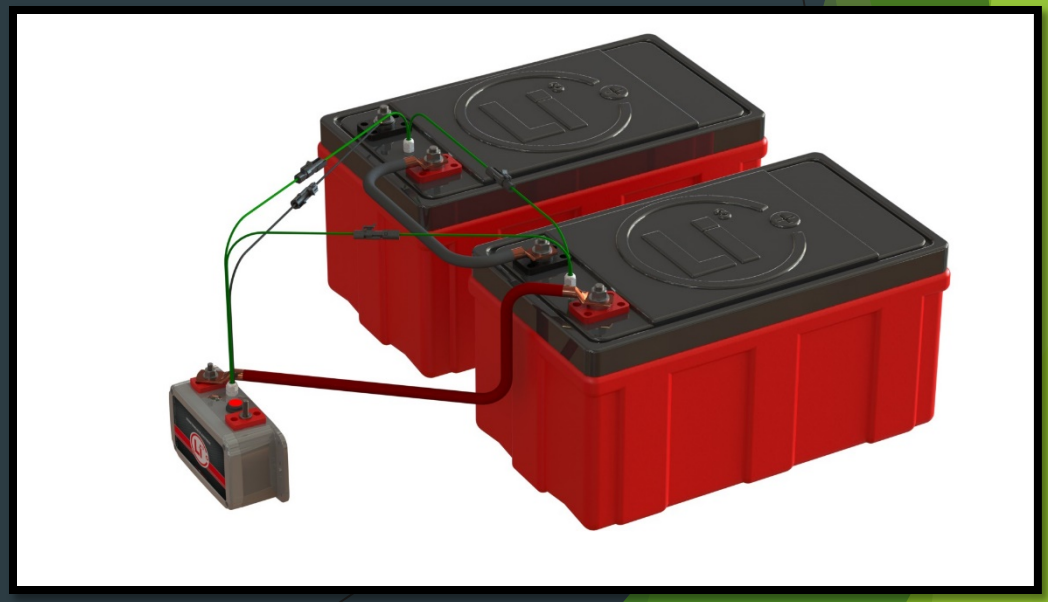
Advantages

- ✓ Ability to diagnose with a $25.00 multimeter
- ✓ Field service issues relating to cell health are diagnosed with a volt meter
- ✓ Field service issues relating to BMS/Electronic issues are diagnosed with a simple continuity tester
- ✓ Modules are air-shippable and replaced in minutes
- ✓ External NeverDie® BMS is replaced in minutes
- ✓ The NeverDie® external BMS is the world's ONLY 'firmware' based BMS, able to be re-flashed with improvements, new features and upgrades
- ✓ The NeverDie® BMS system assures the lowest downtime in the industry today
- ✓ Batteries are safely wired in series and in parallel connection up to 1000 volts and up to thousands of amp hours with no voltage drops or BMS communication issues to our proprietary optical communication systems

System Installation and Layout Examples…..

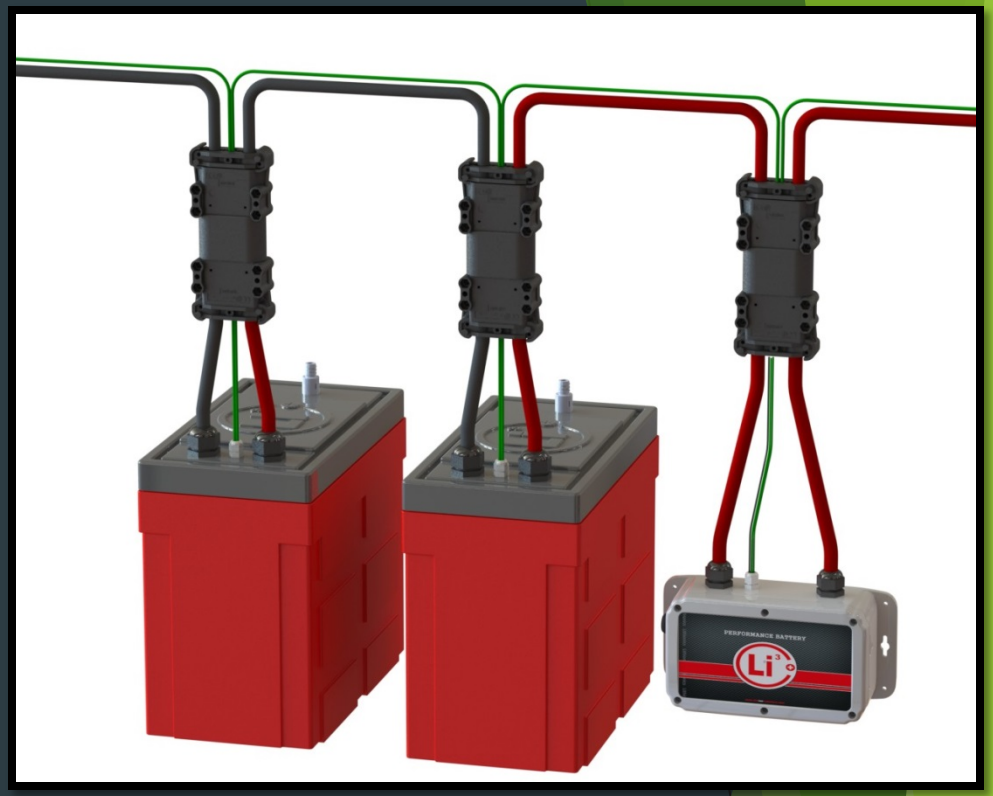






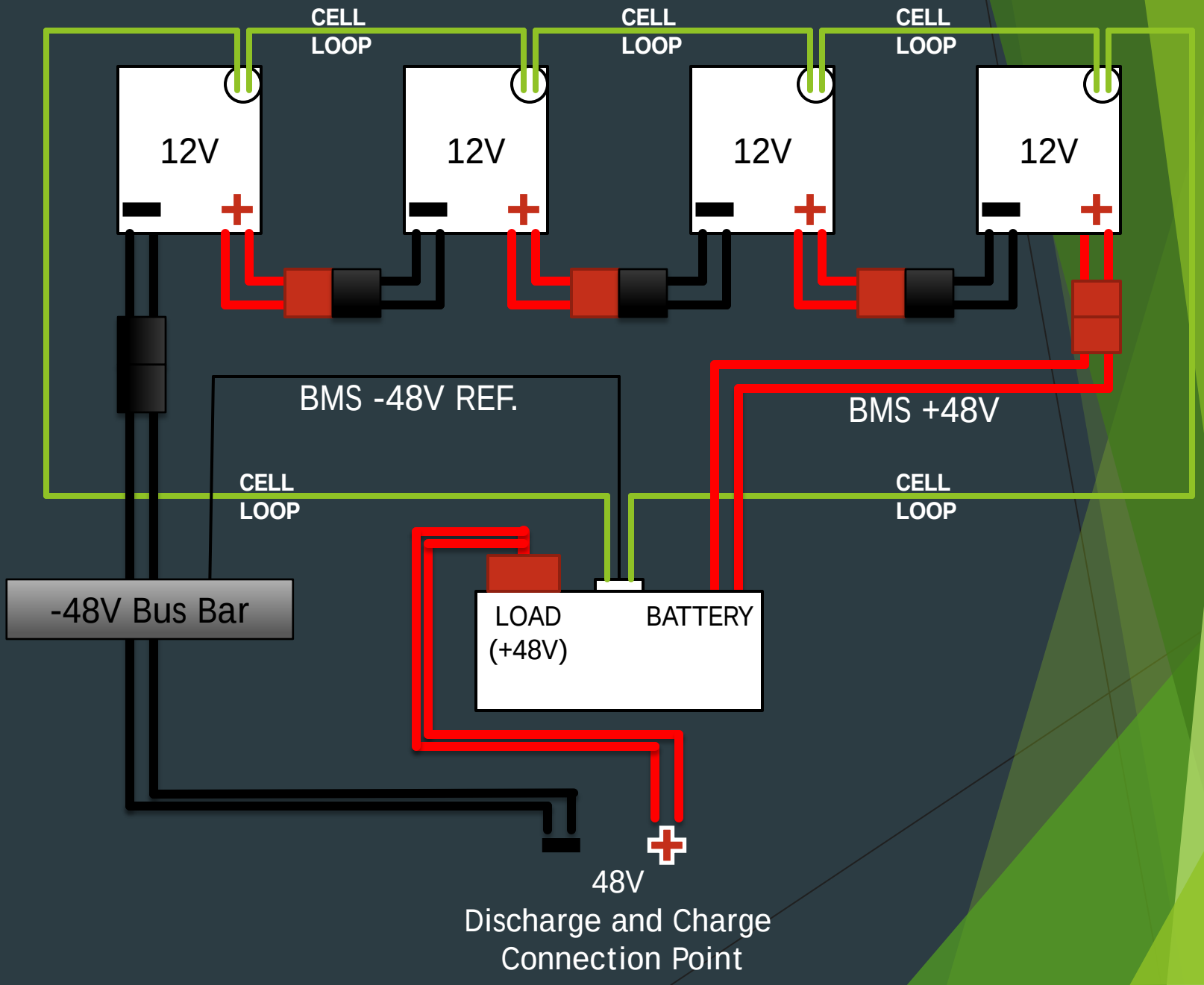
Benefits and Advantages of the External NeverDie® BMS…

1. We have reached Six-Sigma quality levels on our lithium cells.
2. Field service issues or requirements now tend to be focused on the Battery Management System.
3. The logistics of returning/replacing/upgrading a 5 pound BMS case is significantly easier than returning HazMat Batteries.
4. The majority of field service issues tend to focus on changing the behavior pattern of BMS trigger points, i.e., the FIRMWARE installed in the BMS or other hardware upgrades.



5. The modules allow the customer to rapidly increase battery capacity in the event more power is needed. We are able to air-ship new modules at 12 volts as they are far lighter than batteries built in a single box.
6. It truly is a PLUG-AND-PLAY System

Example 48V System



Lithionics Battery Basics

- Failure Mode Analysis

At the Module Level Goal: Prevent HazMat Shipping!

- Level 1: Cell-Level Computer Failures (Rare)
- Level 2: Cell Failures (Rare)

At the Main NeverDie® BMS Level

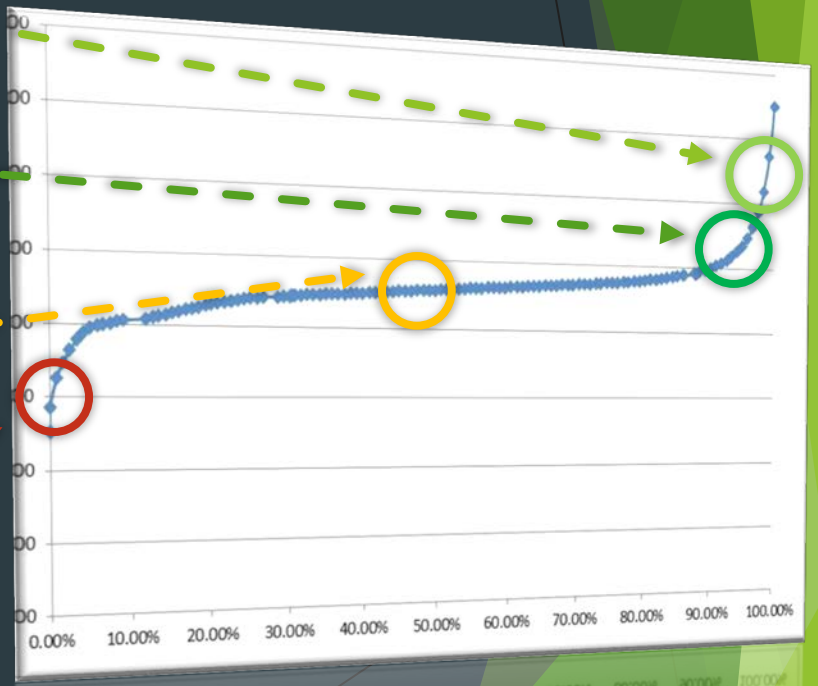
- Level 3: Pack Level (Main Computer) Failures
- Failures Are Rare, However, Firmware (Trigger Point and Feature

Changes are Common)

EASY TO DIAGNOSE, EASY TO REPAIR/REPLACE/UPGRADE

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

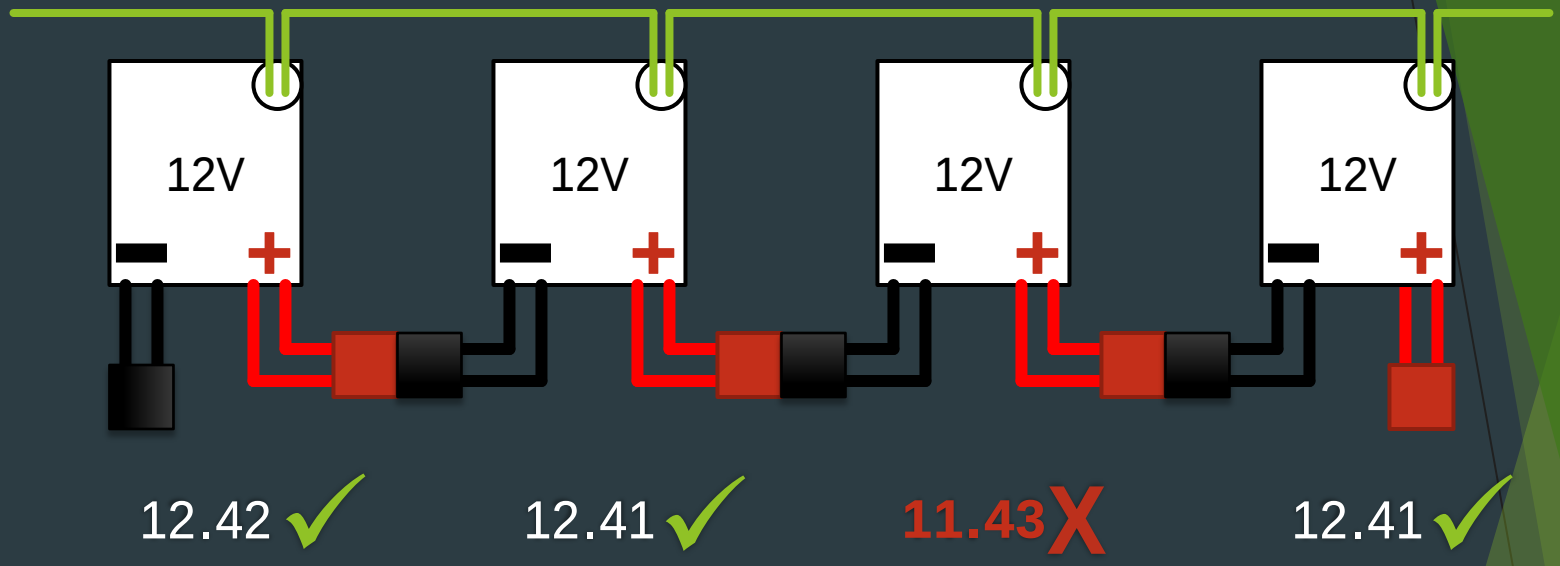


Lithionics Battery Basics

- Step 1: Check for Cell (lithium core) Issues
- 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!

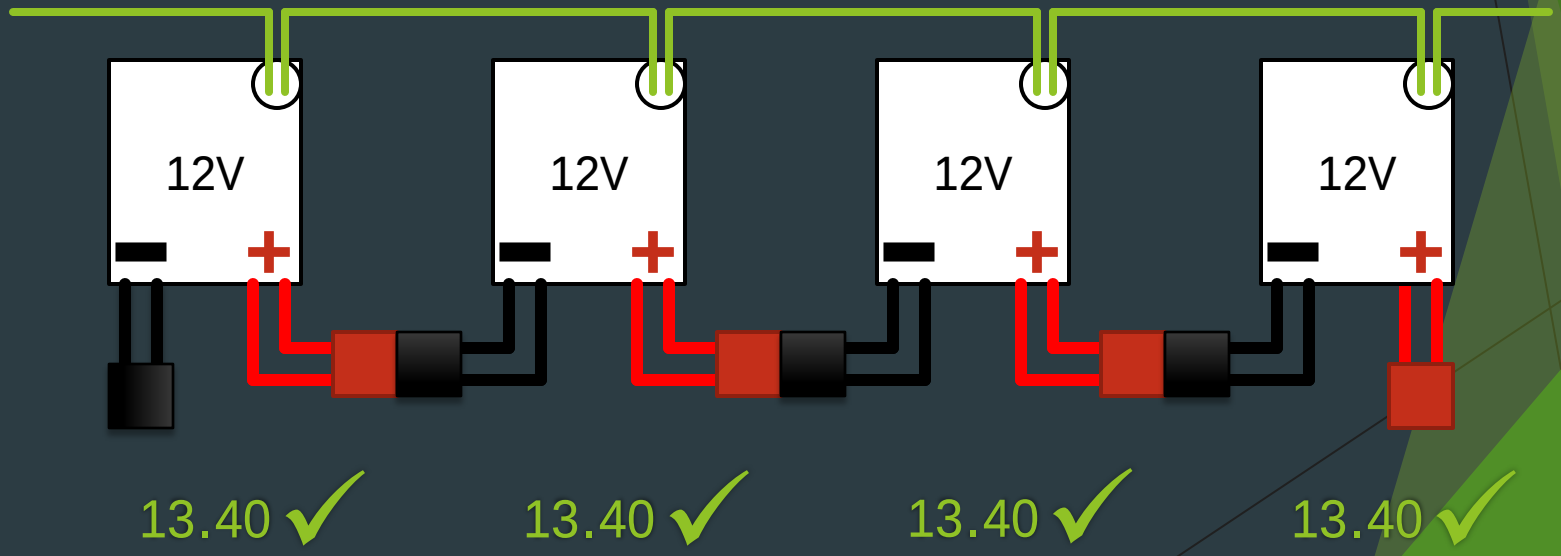
- Use a Simple Volt Meter to Isolate Cell Issues or Cell Imbalance

1. Measure each battery's voltage with a multimeter 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.

- To correct this imbalance charge the 4 batteries in series with the 48V charger.
- Once charging completes top-off each battery with a 12V charger.
- Once all 4 are individually charged, re-connect them in series.
- After resting for 1 hour each battery's voltage should be between 13.33—13.80V.



Lithionics Battery Basics

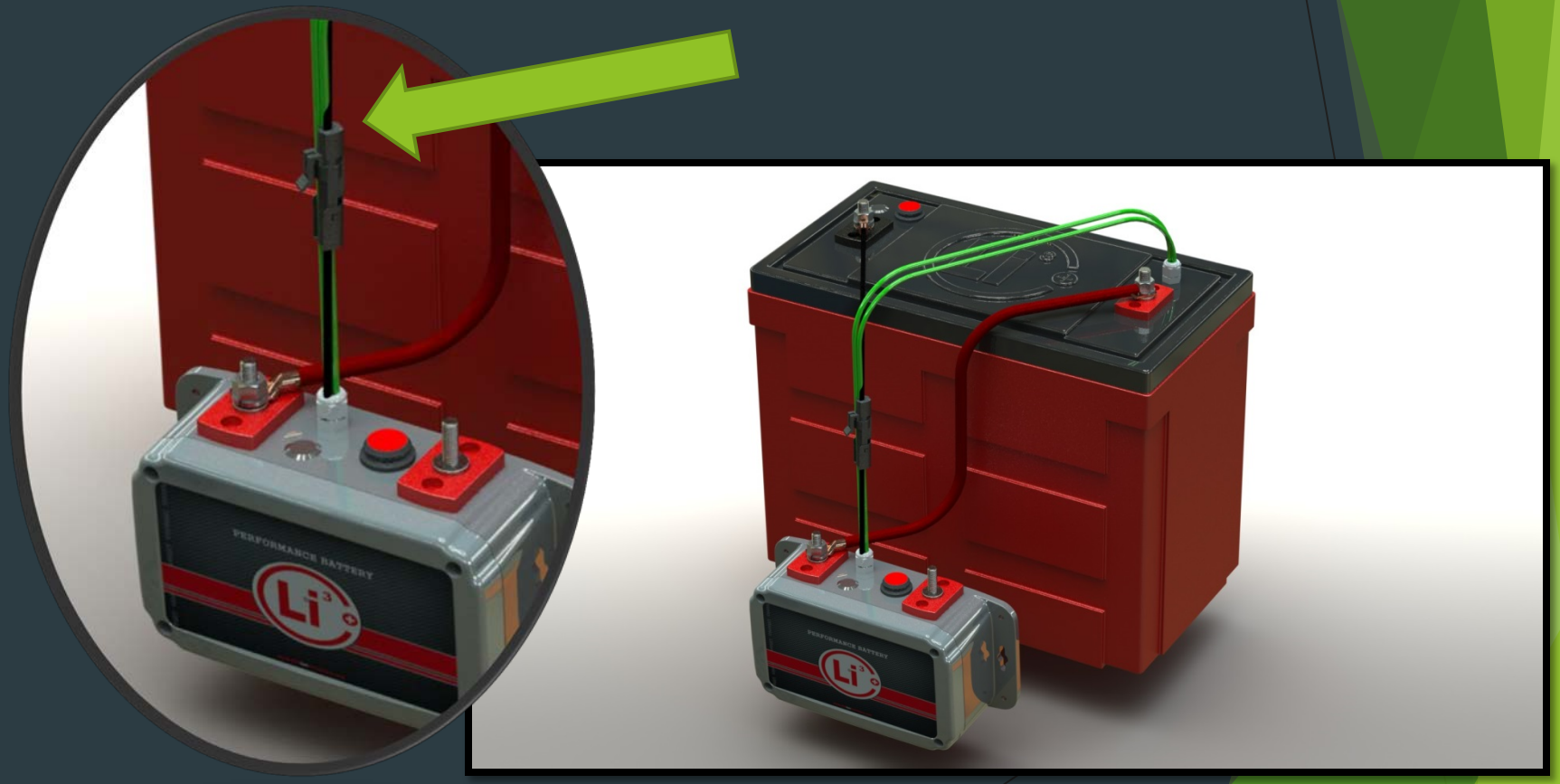
Step 2: Isolate Cell Computer Issues

- **Cell Loop**

- **Each 12V battery module has a normally closed 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!**

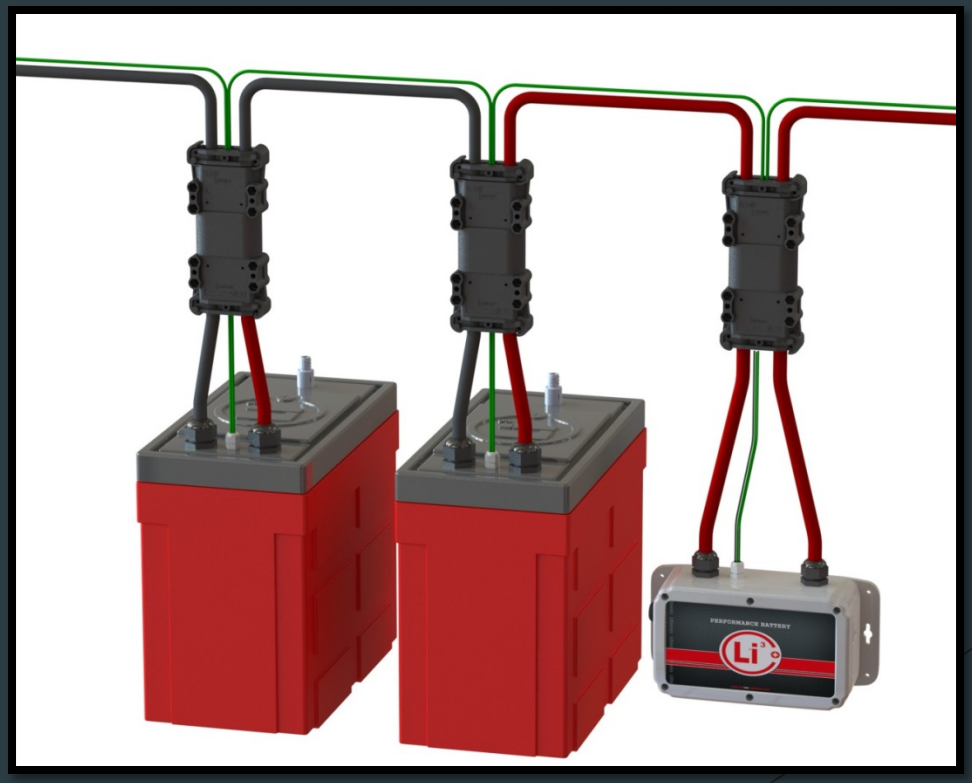
Step 3: Isolate the NeverDie® Master Computer Functionality

- To isolate and identify a Master Computer problem, simply short-circuit connect the green cell-loop connection at the NeverDie® box to provide a false systems-good condition, and check for BMS functionality….



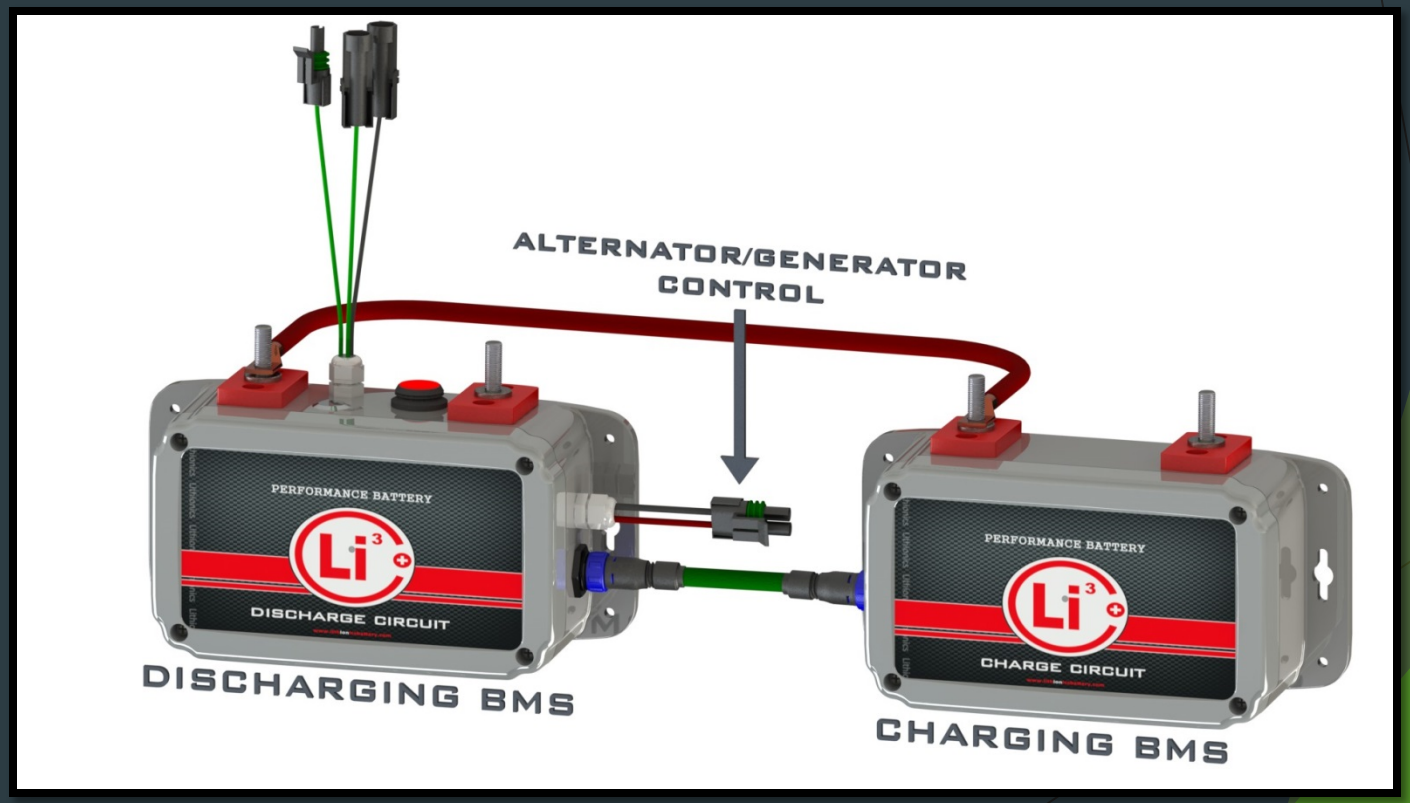
Summary:

1. Total Diagnosis Time: 15 Minutes
2. Time to Replace a 12V Module: 1 Minute
3. Time to Replace a Master NeverDie® BMS: 1 Minute



Lithionics Proprietary Optical BMS Communication Cell Loop Offers Infinite Connectivity and Large Scale Power Systems with:

- No voltage drops or imbalances
- Islanded-Independent Parallel SAFE String Connections
- A Dual-Channel© BMS to segregate HVC (Charge) from LVC (Discharge Events)



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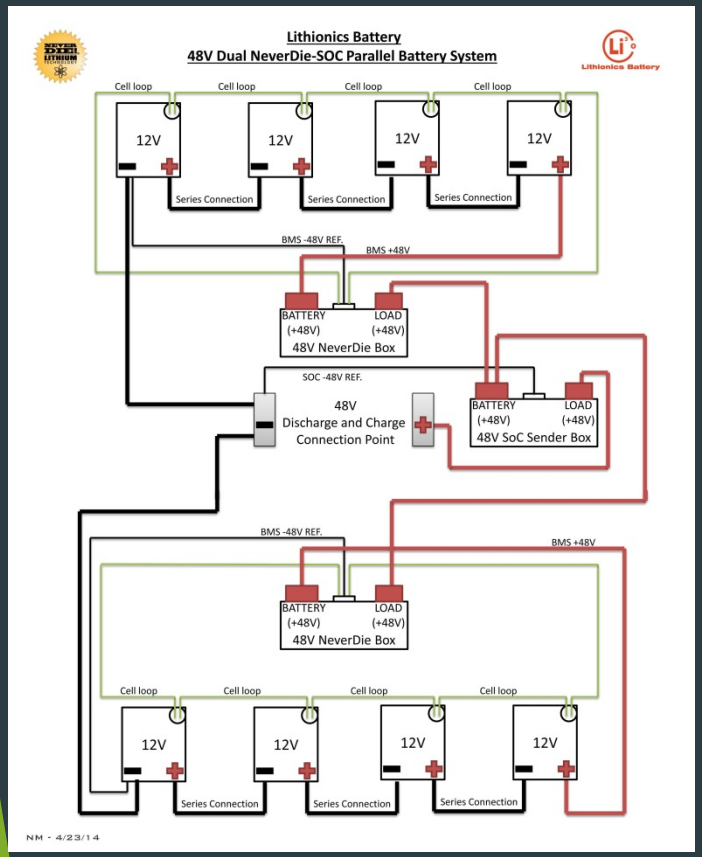

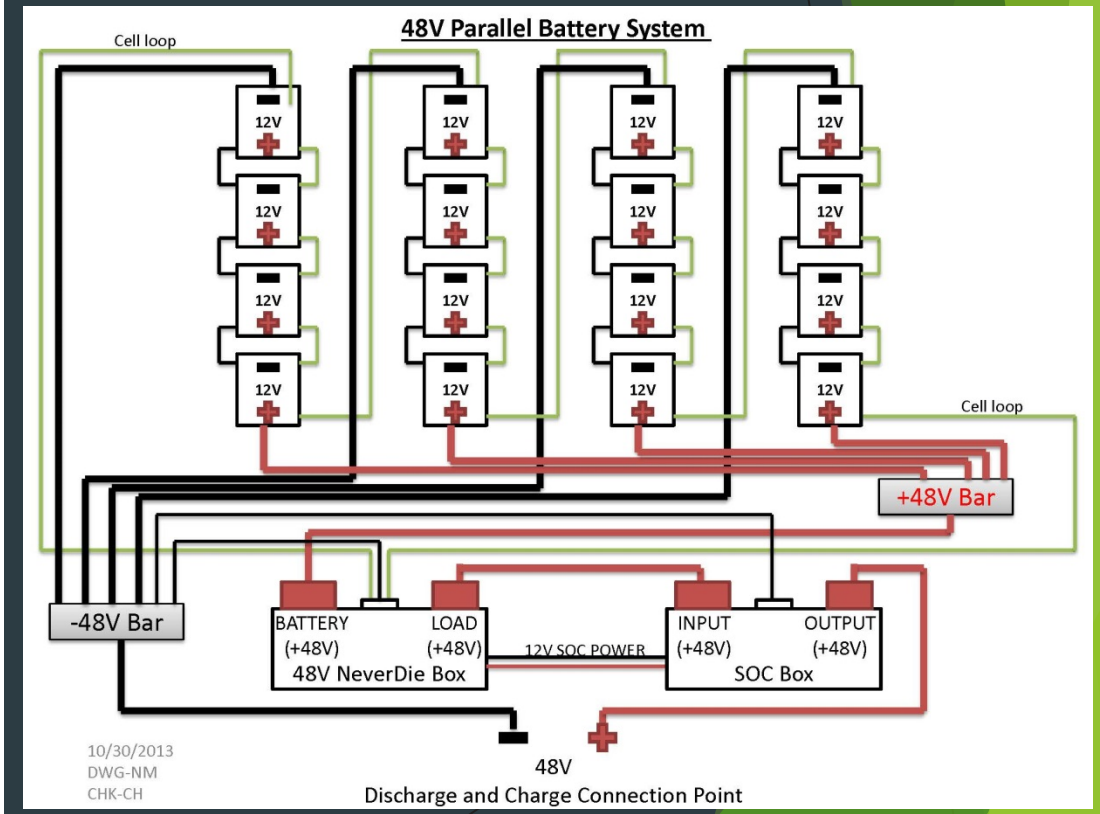

World's First and Only State-of-Charge Command and Control BMS Takes Charge of Inverter, Solar Charge Control, and Automatic Generator Start-Run-Stop Systems….