PHEV Balancer/BMS Installation, FAQ, and Troubleshooting Guide

Overview

The system consists of a relay box that turns the charger and converter off if the batteries are over-charged or over-discharged and two balancer boards that monitor the cells and pass the cell status on to the relay box.

The CellLogs provide the logic to turn off the charger and converter. CellLogs also give the voltage read-out and (if you have the 8s version) the CellLogs can collect and download data.

The boards have shunt resistors for each cell that provide the balancing capability of 350mA. This shunting is only done when a cell gets above 3.6v. So any cell that goes high at the end of charge gets drained automatically a little. This balancing is independent of the CellLogs. Several cells can be shunting at once.

The BMS works on getting the pack better balanced every time it charges. The BMS will eventually bring the pack fully into balance and once it has it in balance it should stay that way.

Leave the AC Power to the charger on overnight, as that is the only way to balance. Don't unplug the system when the first cell reaches the high voltage limit, or it will actually hinder the ability of the balancer to balance out the whole pack. The system is designed to let the balancer cycle the charger on/off on its own until things get balanced out.

The balancer is 8 power resistors with zener diodes, to top balance, plus a CellLog8s. The alarms from the CellLogs go to the control unit and it turns off the converter and charger.

The Pacific EV BMS system will cut off when any cell goes below 2.7V. Rarely will the converter shut off due to its own low-voltage detection circuit.

During charging, the new Pacific EV BMS cuts off the charger at HVC by opening the AC power to the charger. Balancing begins at 3.6v per cell, HVC voltage is set in the cell log at 3.9V HVC cut-off. The resistors on balancing cells are warm (even hot to the touch). There is a fairly wide tolerance on the balance voltage; as well it turns on balancing gradually. If individual cells are getting to 3.8V+ without getting warm, then the balance circuit is broken. Otherwise, they are just fine.

2-year warranty against defects in manufacturing.

Credit for much of the above writeup goes to Kim Small, thanks for your assistance!

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INSTALLATION STEPS:

I. Mount Relay Box:
1. Remove rear tool storage bin and upholstery around the rear driver side tail light.
2. Carefully position the interface box with the phone jacks facing toward the box.
3. Secure in place with (4) #10 x ½" self-drilling sheet metal screws.
4. Leave cover of relay box off.

II. Disconnect Components:
1. Turn switch on dash to kit off.
2. Turn breaker switch next to the charger off.
3. Unplug the telephone cable from the converter.
4. Unplug the IEC power cable from the charger.
5. Remove old balancer units (2) from the mounting plate. No need to keep any of the hardware as your new BMS comes with all the hardware you will need to install.

III. Mount new BMS:
1. Place one nylon spacer between the mounting surface and the PCB (printed circuit board). Insert screw through top of board, through the nylon spacer and into the threaded holes in the mounting surface and tighten. (Note: Over tightening may damage the PCB and cause the system to fail)

IV. Connect Components:
1. Insert rubber grommet in side of kit on the side facing the newly mounted relay box.
2. Attach yellow/white wire to new balancer, run through the newly placed grommet and out to the relay board. Connect to the blue connector as shown in figure 1 below. Repeat with the second balancer.
3. Run the wires from the charger and converter through grommet and attach the wires from the charger to relay board and plug in wire from converter per figure 1.
4. On the relay box board, the wall power input and charger output are labeled along with the letters "G", "L", and "N", which are "Ground", "Line", and "Neutral", respectively. Ground is typically green, Line is typically black, and Neutral is typically white. If you need to check against the inlet on the bumper, the wider blade is Neutral and the round prong is Ground.
5. Attach wires from bumper plug to relay board per figure 1.
6. Plug in wire from switch to the relay board per figure 1.
7. Attach cover to relay box.
8. Attach connector from battery pack to each balancer unit per figure 1. (If your battery packs are ThunderSky or MottCell and configured for 4 balancers, you will need to rewire the batteries to be buddy-paired or buy two sets of balancers).

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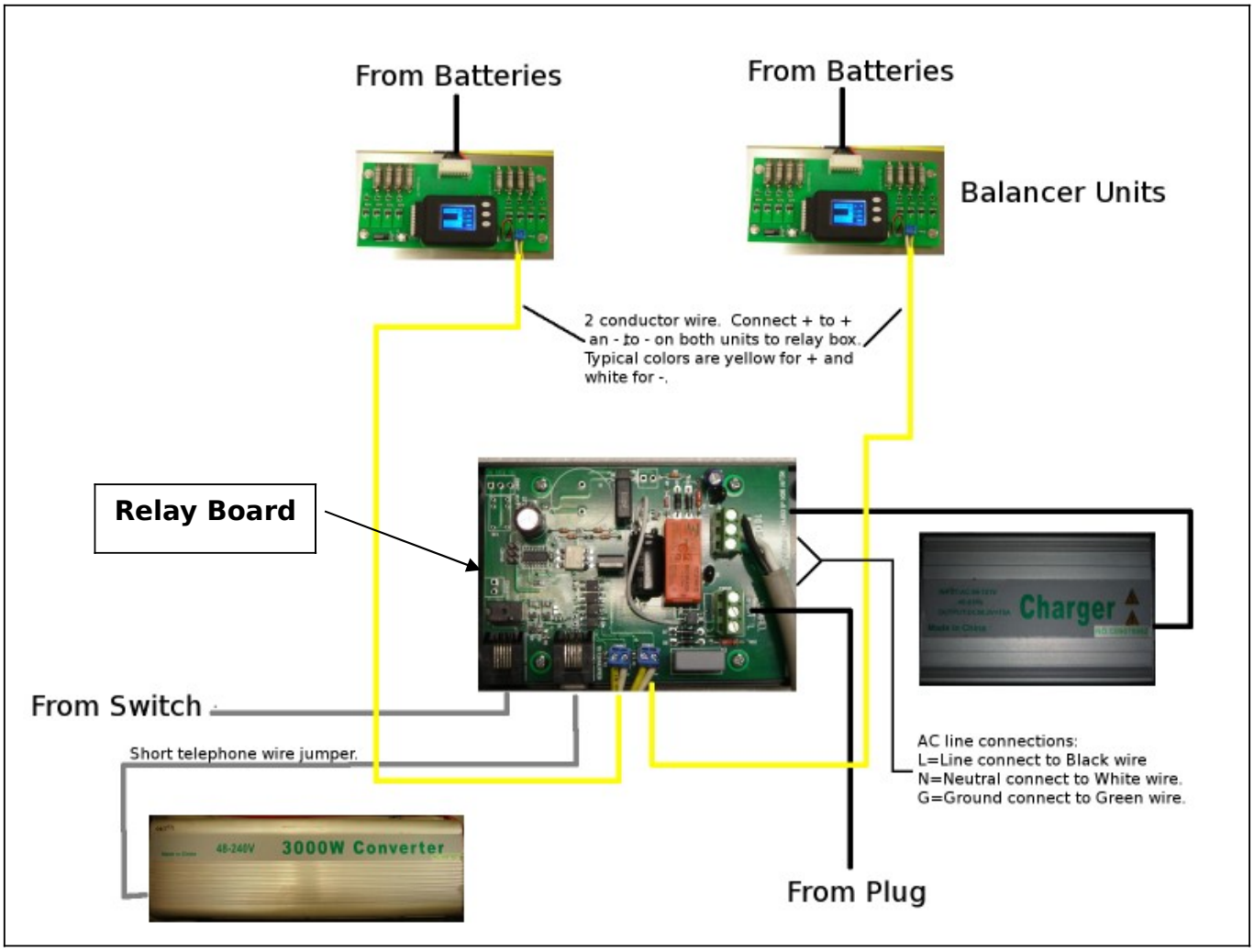

Figure 1

V. Test:
   1. Turn breaker switch on.
   2. Turn on dash switch.
   3. Check condition of cells:
      a) Press any key on the balancer on the left to light up the display.
      b) If any cells read less than 2V, go to Troubleshooting Guide section I.
      c) Check the balancer on the right as well.

VI. If all cells read between 2.5V and 3.3V, congratulations! Close and secure the lid of the kit and plug it in to fully charge.

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Frequently Asked Questions

Q: Is the normal 'catch-up' balancing cycle for more and more cells go above 3.6v and be balanced by the BMS?

A: Yes, that's just right.

Q: Should 'normal' operation be to leave the AC be left on overnight and let the balancer cycle the charger?

A: Yes, this is the only way for it to balance.

Q: When are the cells actually 'balanced' (is that when the green light goes on on the charger, AND none of the cells cause a HVC)?

A: When you get 4kwh out of the pack, then you are balanced. Or about 4.5-4.8kwh measured via kill-a-watt meter during charging. Usually this coincides with the green light and no HVC cut-off.

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TROUBLESHOOTING GUIDE:

I. Cell Readout is out of Range:
   1. If one or just a few of the cells are below 1V or above 3.5V, this is an indication that the cell is bad and needs to be replaced. For a Real Force battery the entire pack needs to be replaced, whereas a single ThuderSky or MottCell can be replaced. Even if you get the pack running again, you will have diminished capacity because of just the bad cell(s) while the rest of the pack goes mostly unused.

II. Pack won't charge: What to do is dependent on the severity of the over discharge (OD) event
   1. The first level is one of the cell-log's is in the alarm state. This is characterized by the cell-log's still power up and display individual cell voltages. Most celllog's will be emitting a beep to alert the operator there is something wrong. The cell voltages are all above about 1.5 volts. When you plug in the charger, it will charge for at least 30 seconds. If the batteries are still too low, it will stop charging after 30 seconds. If that happens, unplug, wait 15 seconds, then plug in again. The charger will start charging again. If it cuts off again, repeat the previous process until the charger runs for at least 2 minutes. Only do this if the battery voltages are low; if you do this when the cells are full they will be damaged!

   2. The worst OD event is when the cell-log's will no longer power up. Depending on how long the batteries have been in this state will determine of the batteries can be saved. Most of the cells are well below 1 volt. Any cell below 1 volt is highly damaged.

      The kit's internal charger will not operate. An external charger will have to be connected and slow rate of charge must be applied. In a pinch you can use an ordinary 12 volt automotive charger. But you have to be proficient with circuits and wiring to be able to isolate the individual 12 volt blocks. Charge each 12 volt block until all 4 of the cells in that block go above 2.7 volts. It should be noted that the cell voltages will fall slightly when the charger is disconnected. You will have to run the charger until all the cells hold above 2.5V long enough for the cell logs to come on and the main charger to work.

      After a cell over-discharge event like above, some cells are probably damaged. They are found by fully charging, then driving the kit until empty. At this point you look at the voltages, then wait a day without charging and with the kit off. If any cells drop in voltage more than about 100mV, they are dead and need to be replaced.