

# CasaDelGato Systems



## Battery Monitor II

### User Guide

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Copyright 2010, John Lussmyer  
<http://www.CasaDelGato.Com>  
Email: General@CasaDelGato.Com

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## Battery Monitor

One of the most frequent problems with an Electric Vehicle is having a battery get over-discharged. This can permanently damage the battery. Most 1<sup>st</sup> time EV owners wear out their first battery pack prematurely since they haven't learned exactly what kind of range they can expect of their vehicle. That's where the Battery Monitor system can help.



Figure 1: Battery Monitor

The main purpose of a Battery Monitor is to detect when one or more batteries in a pack are being discharged too far. It then warns the user of this condition so that they may take appropriate action. (Most likely – take your foot off the accelerator pedal!)

The basic BattMon II unit can only inform you that something may be wrong. It displays approximate battery voltages, and indicates by color/flashing if a battery is too high or low.

There is an optional Relay output board available so that you can cause other things to happen when a battery goes too hi or low. The Relay unit has 4 relays, Battery Low, Battery Very Low, Battery High, Battery Very High.

## **Theory of Operation**

The Battery Monitor simply monitors the voltage of each battery. Since it is only watching for extreme voltage levels, and there is a LOT of electrical noise in an Electric Vehicle, it doesn't try for highly accurate voltage measurements. Instead, it samples the voltage frequently (about 700 times/second) and maintains an average of the voltage readings. This helps smooth out the noise, and allows it to ignore little dips in voltage caused by things like sudden acceleration. It only warns the user when the batteries average voltage is too low (or hi) for a significant amount of time. (1 sec, 5 sec, or 12 sec, depending on averaging time set for display.)

BattMon II was specifically designed for smaller EV packs. It can monitor up to 8 batteries.

## **Operation**

In general, you just turn it on! The display has 3 buttons to change what is being displayed.

Top Button – cycles through the possible display modes. Voltage Graph, Voltage Text, Differential Graph.

Middle Button –Used to reset the Min/Max voltages.

Bottom Button – Averaging length. ½ second, 5 seconds, 12 seconds, Minimums since last reset, Maximums since last reset.

## Display Modes

### Voltage Graph

This is a simple bar graph of the voltage of each battery, and the total pack voltage. The pack voltage is the horizontal bar on the top, low to the left, hi to the right. Then there are up to 8 vertical battery bars below that.

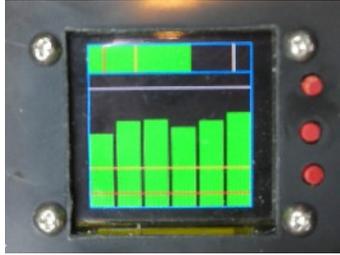


Figure 2: Mode: Voltage Graph

There are lines across each bar showing where the Low, Very Low, Hi, and Very Hi levels are. Whenever a batteries voltage drops below the Low level, the bar turns yellow. If it goes below the Very Low level, it becomes Red, if it's below 80% of the Very Low Level, it starts flashing. Above the Hi level it goes White, above the Very Hi level it starts flashing.

### Voltage Text

This just displays the approximate voltages for the Pack and each Battery. Colors will change similar to the Voltage Graph mode.



Figure 3: Mode: Voltage Text

## Differential Graph

This is meant to highlight the differences between batteries. The center line of the graph is the average battery voltage, and each battery is then shown as above or below this average. The range of the graph defaults to 2v above/below the average.

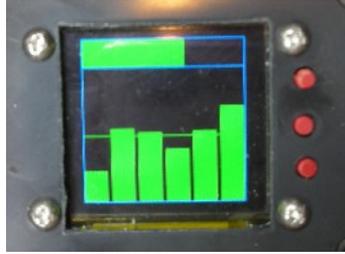


Figure 4: Mode: Differential Graph

## Configuration

The various voltage levels used to indicate hi/lo can all be set via the Configuration screen.

You get to this screen by pressing and holding the top button for 10 seconds.



Figure 5: Configuration Screen

Use the Top/Bottom buttons to scroll up/down the list. Press the middle button to select a value to be changed. The value will then be highlighted, then you can use the top/bottom buttons to increment or decrement the value. Press the middle button when you are done.

After making changes, you scroll down to the “Save Changes” line and press the middle button to save your settings. This will also cause the monitor to check for the number of batteries attached and update the display accordingly.

So, if you just want to change the number of batteries displayed, just bring up this screen, scroll down to the Save line, and press the middle button.

## **Installation**

### **Pack Isolation**

The first thing to consider during installation is if your pack is isolated from the 12v system or not.

#### Not Isolated, common Ground

This case has the simplest wiring. Connect the Red supply wire to a 12v supply that is always on, and the Yellow supply wire to a 12v supply that is switched (probably via your "ignition" switch).

#### Isolated, or not a common Ground

In this case, you can't connect the power lines to your vehicle 12v system, so you must provide 12v power some other way. This is usually done by tapping the pack to get a 12v supply, then using a relay to switch this on/off for the yellow wire. The relay coil is connected to the vehicles 12v system. If you ordered the unit with this option, the relay is provided and pre-wired to the BattMon wiring harness. You just connect the Red wire to the 12v tap on your pack, the Yellow wire to a switched 12v line from the ignition switch, and the Black wire to the 12v system ground (NOT the pack ground.)

### **Battery Connections**

The sense lines are pins 1 to 9 for a 8 battery configuration. Pin 1 goes to the most negative post, pin 2 to the next, etc....

Note that each of the sense lines has a hi-value resistor in it right at the ring terminal. Handle them with care, if they break the monitor won't work. One of the reasons to have them right at the battery is so that if a wire gets shorted to some other wire, only a tiny current can flow, preventing shock and fire hazards.

## Split Battery Pack Handling

Sometimes it is necessary for a Monitor to be connected to batteries that aren't all in the same pack. This can cause the 1<sup>st</sup> battery in the 2<sup>nd</sup> pack to incorrectly show a low voltage. This is due to the voltage drop in the longer cable, and/or connections between the packs. (Contactors, Fuses, Connectors, etc...)

If you need to do this, and you are connecting to less than 8 batteries, the Monitor can be configured to ignore the voltage drop caused by the inter-pack connection.

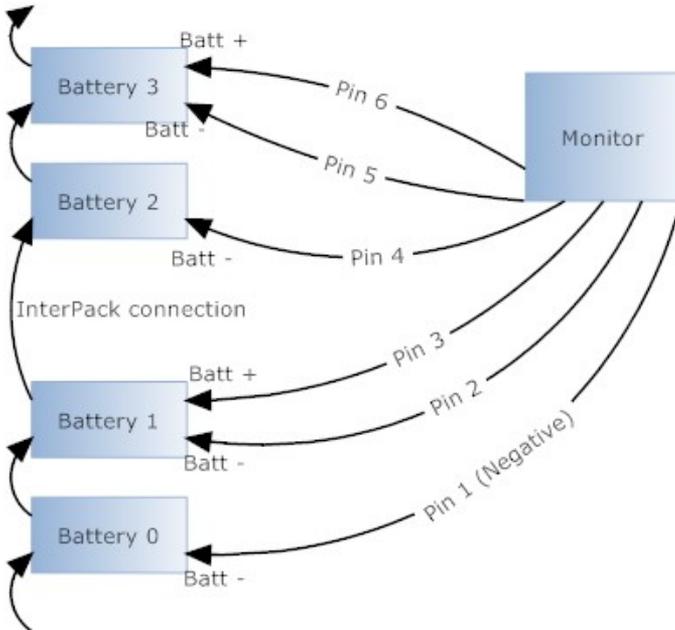


Figure 6 - Split Pack Wiring

What you need to do is to connect the Battery Monitor as if the inter-pack connection were a battery. In the example in Figure 7, this is done by connecting Pin 3 to the positive of battery 1, instead of the negative of battery 2, then

continuing the normal pattern of connections after that. This will allow the Monitor to measure the voltage drop across the connection, and ignore it.

If you do connect the monitor in this fashion, you **MUST** perform the Configuration to Change the Number of Batteries being monitored. Even if the display shows the correct number, you will need to request a battery count update. This is how it detects that a inter-pack connection is to be ignored.