

Battery Monitor

by Del Tapparo

A friend of mine had a slick little battery monitor gadget that someone made, and he wanted to know if I could make him another.

Assembly

It consists of a 3 Digit LED voltmeter that can be purchased from either Amazon.com or Banggood.com, a mating connector that matches the ones you use on your battery packs, and some clear heat shrink tubing.

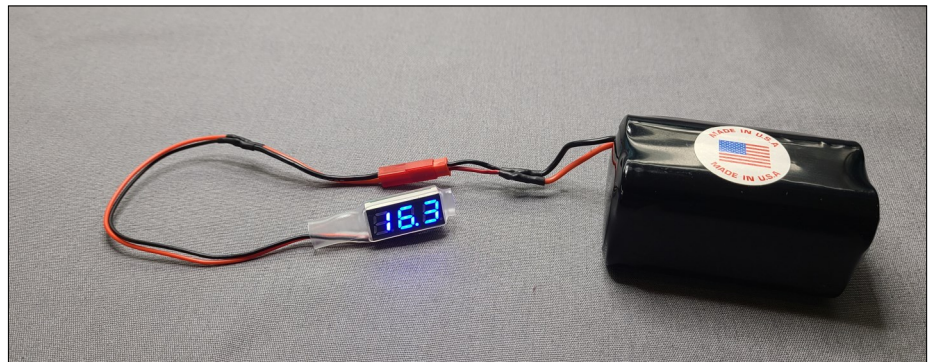
These voltmeters are available on Amazon in quantities of 5 for \$10 to \$12. I got the "variety pack" with Red, Blue, Yellow, Green, and White digits. The Red and Blue are highly visible, the others not so much. They also come in packs of 5 Blue or 5 Red, which would be a better choice. Bangood.com offers Red, Blue, or Green in single quantities for \$3 free shipping; best choice.

They are available in 2-wire (red/blk) or 3-wire (red/blk/wht) configuration. For the 3-wire, you just combine the red/wht together.

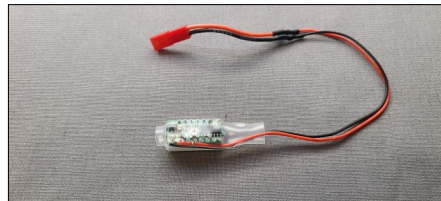
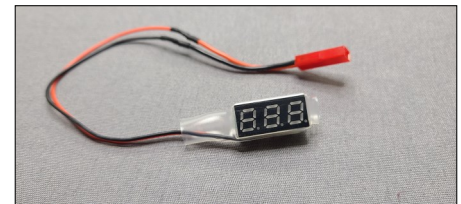
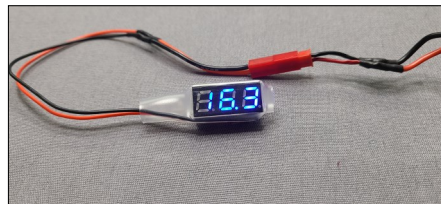
1/2" dia. Clear heat shrink tubing around the entire display protects the exposed electronics on the back and still allows you to see the display. You could also just cover the back with Silicone Adhesive.

Use

Lithium Ion Battery packs are assembled using cells that are rated for a nominal voltage of 3.6-3.7V. Cells are connected in series to achieve the desired voltage; e.g. 4 cells in series (noted as 4S) produce $3.6 \times 4 = 14.4\text{V}$. Cells in parallel increase the current capability. E.g. 4S2P indicates 4 cells in series, and 2 sets of those in parallel. Still 14.4V, but twice the capacity measured in mah (milliamp hours). Battery packs include a little circuit board (PCB) that



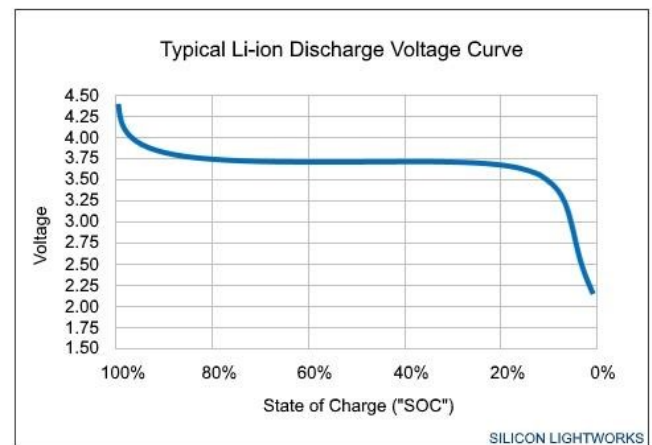
Simply connect it to the battery pack you want to test, and get an instant voltage reading.



protects the pack from overcharging or over discharge. When protection kicks in, voltage goes to zero.

The voltage drops as the battery discharges. A rather quick drop at first, then relatively flat for most of the charge, then a dramatic drop at the end, as shown in the chart. A voltage reading of anything less than nominal voltage would indicate the need for charging.

While this monitor is handy for checking batteries of unknown charge state, best practice, in my opinion, is to always charge your battery packs at the end of running. This way, they are always ready to go for the next operating session. Li-Ion batteries have a very low self discharge rate.



Volts/Cell	4 Cells (4S)	5 Cells (5S)	State
4.25V	17.0V	21.25	PCB Overcharge Protection
4.2V	16.8V	21.0V	Full Charge
3.6V	14.4V	18.0V	Nominal Voltage
3.0V	12.0V	15.0V	Full Discharge
2.5V	10.0V	12.5V	PCB Discharge Protection