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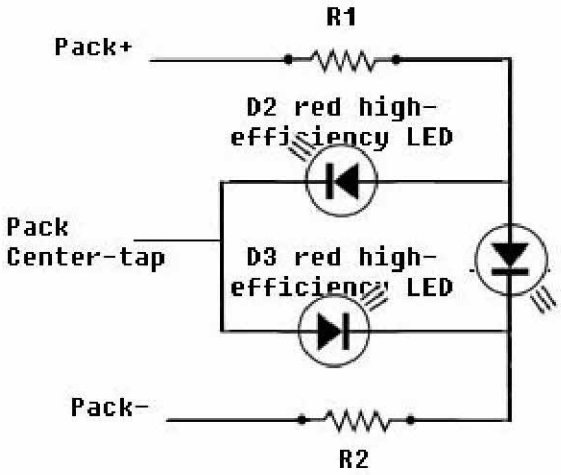
Lee Hart's Batt-Bridge Battery Balance Alarm

Batt-Bridge Out-of-Balance Battery Detector



The Batt-Bridge is about as simple as you can get; that's why it is so inexpensive. If all you want is an 'idiot' light to say, "Stop driving, your batteries are dead," I can't imagine anything any simpler. You really don't need dozens of ICs and hundreds of components just to light a light.

The Batt-Bridge divides the pack in half, and compares the voltage of each half. It lights an LED when one of them is 1v less than the other.

If a cell dies somewhere in the pack, it typically causes a 2 volt change. So the Batt-Bridge warns you that a cell went dead. There are two LEDs, so they indicate which half-pack contains the bad cell.

R1 and R2 are chosen to draw about 10-20ma from the pack. For example, if you have a 120v pack, R1 and R2 each have about 60v across them. At 15ma, they would be R = 60v / 0.015a = 4k ohms. They need to be identical values (1% or hand picked or trimmed). And they must be power resistors; 60v x 0.015a = 0.9 watts, so use at least a 2 watt resistor.

Use an ordinary low brightness green LED. Its purpose is just to indicate that power is on, and to act as a low-voltage 2.4v "zener" diode. However, the red LEDs should be high brightness types -- the brighter the better, so you can see them even in daylight.

Here's how it works. All voltages are relative to the pack center tap. If +pack == -(-pack), then the green LED lights. The green LED's anode is at +1.2v, and its cathode is at -1.4v. The red LEDs don't light because they only have 1.2 volts across them (they need over 1.5v to light).

Now, suppose you have a dead cell in the upper half of the pack. Then +pack is 2v less than -pack. R1 and R2 form a voltage divider, so both ends of the green LED are 1v more negative; its anode is at +0.2v, and its cathode is at -2.4v. This means there is now 2.4v across the lower red LED; so it lights! Likewise, if the dead cell is in the lower half, then the upper red LED lights.

The total resistance of R1 and R2 sets the sensitivity, and the ratio of these resistors sets the desired center-tap voltage of the pack. If both LEDs light, then the resistors are too low a value; increase the resistance of both of them proportionately. Ten milliamps through the resistors is low sensitivity (over 2v difference to light an LED); 20ma is normal sensitivity; 40ma gives you high sensitivity (less than 1v difference to light an LED).

If one LED lights when the half-pack voltages are correct, then adjust the value of one of the resistors. This is also how you deal with packs with an odd number of batteries, where the "center tap" is off by one.

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