A Battery-Voltage Indicator

Here's a quick and inexpensive project that allows you to keep tabs on your battery's condition.

The Circuit

Refer to Figure 1. Only four components are required for the indicator: a Maxim 8211 IC (U1), two resistors and an LED (DS1). R1 and R2 form a voltage divider for the THRESH (threshold) input of U1. DS1 illuminates when the battery's low-voltage point is reached. U1's sink current is limited, allowing direct connection of the LED without need for a current-limiting resistor.

Construction

Although the components can be assembled on a perfboard, a PC board is available.1 I used a 1-MΩ multiturn trimmer pot at R2. A multiturn pot allows for easy adjustment. The pot is wired so that clockwise turning of the adjustment screw increases the low-voltage indication level. This may seem unimportant, but it is in keeping with design practice that increases a value (as it appears to the user) with a clockwise direction of adjustment. The LED's cathode (the side with the flat spot) connects to U1 pin 4 (OUT).

Before connecting R2, ensure that a resistance of approximately 500 kΩ exists between R2's wiper and the terminal that connects to pin 3 of U1. This guarantees that the voltage divider can develop a voltage at pin 3. Or, as shown in Figure 2, insert a fixed-value 510 kΩ resistor in series between R1 and R2 and replace the 1-MΩ pot with a 500 kΩ unit (R2A). Then, connect pin 3 of U1 to the junction of R1 and the 510 kΩ resistor (R2B). With this arrangement, a voltage will always appear at U1 pin 3, even if the pot is at its minimum resistance position.

Adjustment

Circuit setup is straightforward. If you have access to a variable-voltage power supply, use this approach: With the battery disconnected, connect the power supply's positive terminal to the circuit's positive terminal and connect the supply's negative terminal to ground. Set the supply to the low-voltage point at which you want the low-battery indicator to trigger. Adjust R2 until DS1 just lights. Slowly increase the supply voltage; DS1 should extinguish. Slowly decrease the supply voltage again and DS1 should illuminate at the low-voltage point. For example, a 13.6 V battery low-battery indication could be set anywhere from 11.5 to 12.5 V, but still allows the equipment to perform without exceeding its minimum operating-voltage requirements.

If you do not have access to an adjust-

1A PC board for this project is available from FAR Circuits, 18N640 Field Ct, Dundee, IL 60118-9269, tel 847-836-9148 (voice and fax). Price: $3.50 plus $1.50 shipping for up to four boards. Visa and MasterCard are accepted with a $3 service charge.
able power supply, here’s an alternative method to set the low-battery indication. Monitor the battery voltage with a voltmeter. When the battery voltage reaches the point at which you want the indicator to trigger, adjust R2 until DS1 just comes on.

Additions

As shown in Figure 2, adding two components provides an audible alarm. S1 allows selection of the LED or LS1, the audible alarm, to indicate the low battery/voltage condition. The Sonalert alarm I use has a working voltage range of 6 to 28 V dc and a current drain of 3 to 14 mA. The device has two connection terminals, a positive terminal to which the positive voltage is applied and a negative terminal that connects to S1. This alarm is quite loud!

The quiescent current of this circuit is approximately 20 μA. When DS1 is illuminated, the current drain is about 14 mA; with LS1 activated, current drain is approximately 5 mA.

Summary

This approach provides flexibility and reliability when monitoring battery voltage levels. It can be used in a variety of applications where low voltage detection and indication are desired. It’s an inexpensive project, too.

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The Maxim 8211

The Maxim 8211 is a voltage monitor with programmable voltage detection. Most often, it is used in computers to warn the microprocessor of a power failure. In a typical operating circuit, the 8211’s output connects to a microprocessor’s NMI (nonmaskable interrupt) pin. Other Maxim-defined applications for the 8211 include undervoltage detection, back-up battery switching, power-supply fault monitoring and low battery voltage detection.

Because it is a CMOS device, the 8211 operates under a wide range of supply voltages. Typically, its quiescent current is approximately 5 μA. The device is easily programmable allowing for simple adjustment to the voltage level being monitored. Maxim spec’s the MAX8211 to 16.5 V dc. This wide range of supply voltages allows the IC to easily handle voltage monitoring in the 12 to 13.6 V dc range. The MAX8211 is a plug-in replacement for the bipolar ICL8211, which was made by Intersil.—Donald G. Varner, WB3CEH

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