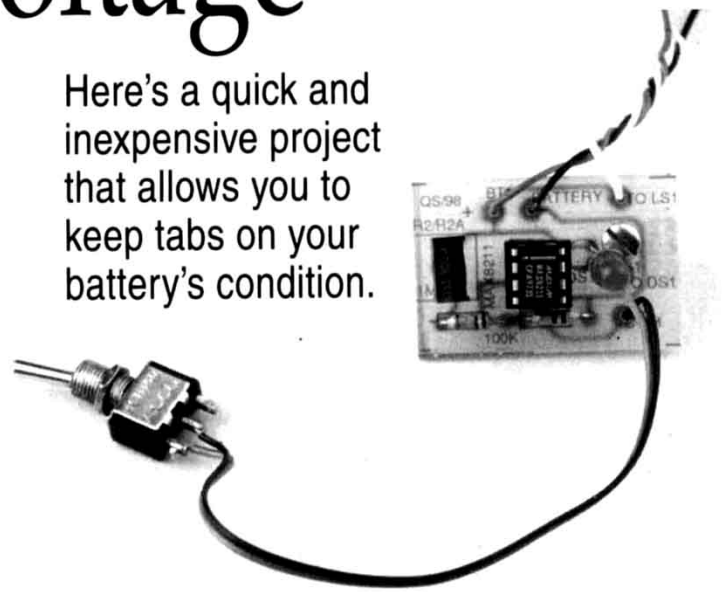
By Donald G. Varner, WB3CEH

A Battery-Voltage Indicator

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



I use a rather large-capacity (31 Ah) gel cell battery to power a VHF transceiver and, at times, use a hand-held transceiver at a fixed location. After many operating sessions, I never knew the condition of the gel cell and often charged it unnecessarily—or charged it too late after discovering that the battery voltage was extremely low. Not wanting to leave my voltmeter permanently connected to the battery, I frequently found myself dragging out the voltmeter to measure the battery's voltage. After awhile, I decided I needed a simple means of continually monitoring the battery's voltage. I also wanted an indicator that would inform me when charging was necessary. After a brief search, I found the Maxim MAX8211 IC would suit my needs: It's an 8-pin DIP CMOS device, with a maximum supply voltage of 18 V that makes it quite suitable for monitoring voltages in the 13.6 V dc range. (See the sidebar for more information about the MAX8211.)

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-

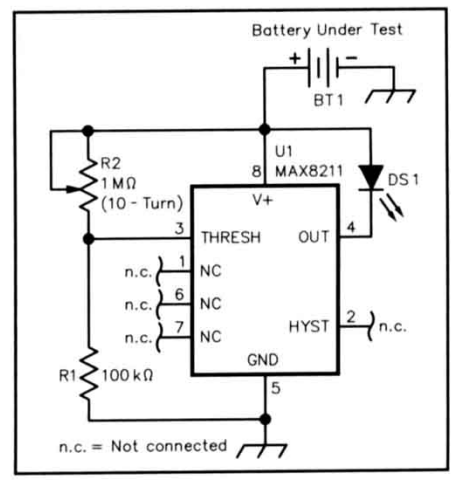


Figure 1—Schematic of the low-voltage-indicator circuit. Unless otherwise specified, resistors are 1/4 W, 5% tolerance carbon-composition or film units. Equivalent parts can be substituted; n.c. indicates no connection. Parts identified with DK numbers are available from Digi-Key Corp, 701 Brooks Ave S, Thief River Falls, MN 56701-0677; tel 800-344-4539, 218-681-6674; fax 218-681-3380; **http://www.digikey.com**, Mouser Electronics, 2401 Hwy 287 N, Mansfield, TX 76062; tel 800-346-6873, 817-483-4422; fax 817-483-0931; e-mail **sales@ mouser.com**; **http://www.mouser.com** and other sources. PC boards are available from FAR Circuits; see Note 1.

DS1—Red LED
R1—100 kΩ, 1/4 W
R2—1 MΩ multiturn trimmer pot (DK 3266W-105; DK 3266X-105)
S1—SPDT toggle switch
U1—Maxim 8211 programmable voltage detector (DK MAX8211CPA-2)

[1]A 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.

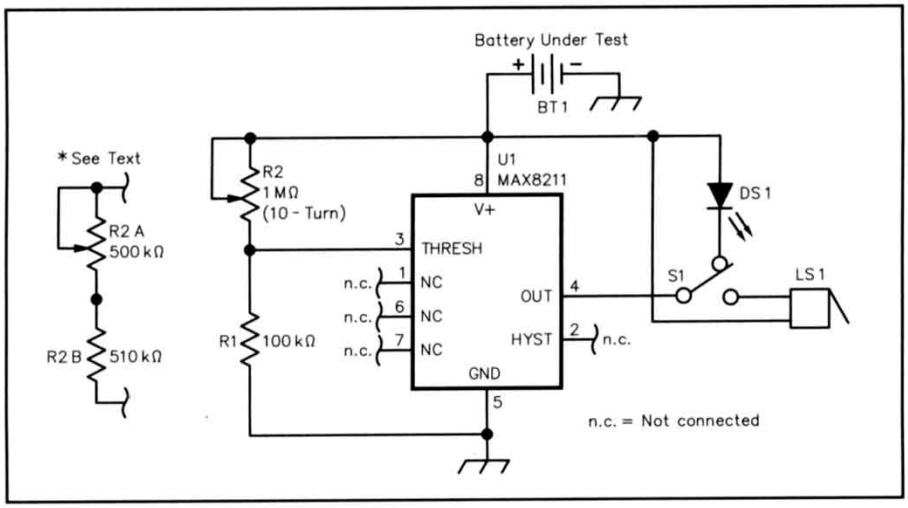


Figure 2—Adding two components to the circuit of Figure 1 allows selection of a visual or aural alarm.
LS1—Mallory Sonalert SC628 used here (Mouser 539-SC628AD)
S1—SPDT toggle switch

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.

Donald Varner, WB3CEH, attended St Vincent College and received a degree in psychology. He also has done graduate studies in the field of psychology. Don also has a diploma in Electronics Technology from Cleveland Institute of Electronics and is a member of the International Society of Certified Electronics Technicians. Don has been a licensed amateur for over 20 years and also holds a commercial FCC General Radiotelephone Operator License. His Amateur Radio activities have included 2-meter SSB weak-signal work, packet radio, 2 meter nets, 440 MHz and 10 meter SSB. Don's other interests are computers and the Internet. Previously, Don was employed by Cook Pacemaker Corporation in the engineering department as Senior Electronics Engineering Technician. He currently works for the Federal Aviation Administration as an airway transportation systems specialist. You can contact Don at 1125 Sebring Rd, Beaver, PA 15009; e-mail **varpenns@usaor.net**. QST

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 specs 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*

New Products

CW CONTEST INTERFACES FROM W1WEF

◊ Compatible with popular computer contest logging programs such as *CT*, *NA* and *N6TR LOG*, W1WEF's newest CW interfaces are now available in three models. The standard LPT model keys any solid-state rig. The PTT model keys your rig's PTT line before the first Morse code character is sent, eliminating "first dit cutoff." The paddle model does everything listed above and lets you connect your keyer paddle to your computer, eliminating the need to use an external keyer (when using software that supports direct paddle inputs). All models connect to your IBM-compatible PC's LPT port and key only solid-state rigs.

Prices: LPT model, $20; PTT model, $35; paddle model, $49 (plus $3 S&H). For more information, contact Jack Schuster, W1WEF, 408 Thompson St, Glastonbury, CT 06033; e-mail **w1wef@snet.net**.

HAND-HELD TRANSCEIVERS FROM ADI

◊ ADI's new line of hand-held transceivers has been designed to incorporate luxury features at no-nonsense prices. Single and dual-band hand-held and mobile models feature wide-range receivers, built-in DTMF and CTCSS functions, and ease of use.

For more information on ADI's entire line, see your favorite Amateur Radio products dealer or contact Premier Communications, 20277 Valley Blvd, #J, Walnut, CA 91789; tel 909-869-5711; fax 909-869-5710; **http://www.adi-radio.com**. QST