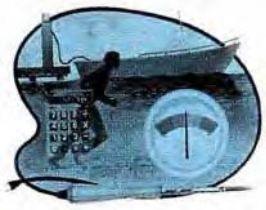


Low-cost Projects continued...

2. Vehicle low-fuel indicator

Alarm sounds when level in vehicle fuel tank drops to a predetermined level

By Bradley Albing

RUNNING out of gas can be an exasperating experience. The low-fuel indicator described here can help you avoid this situation. It will sound an alarm when the fuel level in your gas tank reaches a predetermined minimum. This level can be preset by a simple potentiometer adjustment.

Circuit Operation. In most vehicles, the fuel-level sensor is a float-controlled potentiometer (sender) wired in series with the dashboard-mounted fuel gauge (meter) and connected between the chassis and + 12-volt line as shown in Fig. 1. As the fuel level changes, the resistance changes, making the meter indication change.

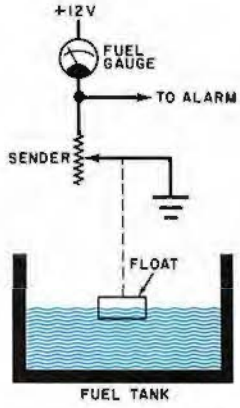


Fig. 1. Typical fuel-gauge circuit.

The voltage level thus generated across the fuel-level sensor can be tapped off (at the meter) and, as shown in Fig. 2, applied through a low-pass filter *R8-C4* so that the voltage across *C4* is the average across the sender. This low-pass filter also eliminates any rapid voltage fluctuations due to gasoline sloshing and a bouncing sensor float, or voltage transients generated by the switching voltage regulator as used in some vehicles.

The *C4* voltage is applied to the noninverting (+) input of comparator *IC1*, and rises with decreasing fuel in the tank. When this voltage exceeds the *R4* preset voltage on the inverting (-) input, the output of *IC1* (pin 6) goes high.

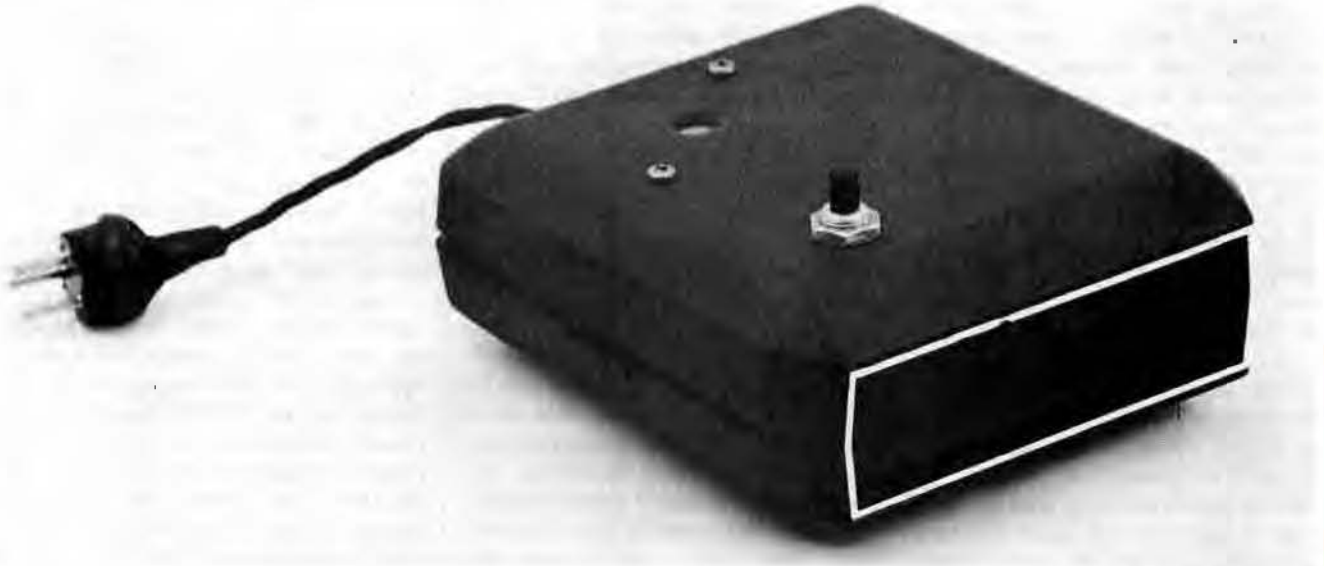
This voltage (approximately 9 volts) is high enough to cause zener diode *D6* to conduct and turn on transistor *Q1*. When turned on, this transistor draws current through audible alarm *A1*, and turns on optional indicator *LED1*.

As long as the fuel level is low, the output of *IC1* remains high. To silence the alarm until the tank is filled, CANCEL switch *S1* is depressed to trigger *SCR1*. When triggered, the SCR brings the junction of *R5-D6* (the input to *Q1*) down to approximately 2.2 volts, which is not high enough to cause *D6* to conduct and activate the alarm circuit. Since the SCR is powered by dc, it will remain turned on as long as the *IC1* output is high (the fuel level is low).

As long as *SCR1* is conducting, there will be about 1.2 volts (two diode drops) across *D7* and *D8*, enough to turn on *Q2* and cause *LED2* to operate. This LED is a special type that incorporates a built-in flasher circuit that makes the LED flash at a 2.5-Hz rate as long as the LED is

(Continued on page 40)

Cable on author's prototype has connector for +12 volts, ground and tank sender unit.



PARTS LIST

A1—Sonalert, buzzer or other 12-volt alarm (Radio Shack 273-060 or similar)
C1,C2—100-μF, 25-V aluminum electrolytic
C3,C5—0.1-μF, 25-V disc or Mylar
C4—300-μF, 15-V tantalum electrolytic
D1,D7,D8—1N914
D2—1N5742, 18-V, 400-mW zener
D3,D4,D9—1N751A, 5.1-V, 400-mW zener
D5—1N4001
D6—1N5732, 6.8-V, 400-mW zener
IC1—3140E op amp
LED1—red LED
LED2—Litronix FRL-4403 flashing LED (Radio Shack 276-036)
Q1—2N3053 or similar
Q2—2N3904 or similar
The following are ¼-watt, 10% tol. resistors.
R1,R11—100 ohms
R2—33 ohms
R3,R5,R12—470 ohms
R6—10 megohms
R7—470,000 ohms
R8—33,000 ohms
R9—330 ohms
R10—10,000 ohms
R13—820 ohms
R14—200 ohms
R4—25,000 ohm potentiometer
SCR1—2N5062
S1—normally open pushbutton switch
Misc.—Suitable enclosure (Radio Shack 270-285 or similar), interconnecting leads, mounting hardware
Note: The pc board (LF-2) is available for $4.50 plus $1 postage/handling from BFA Electronics, P.O.Box 212, Northfield, OH 44067. Ohio residents please add sales tax.

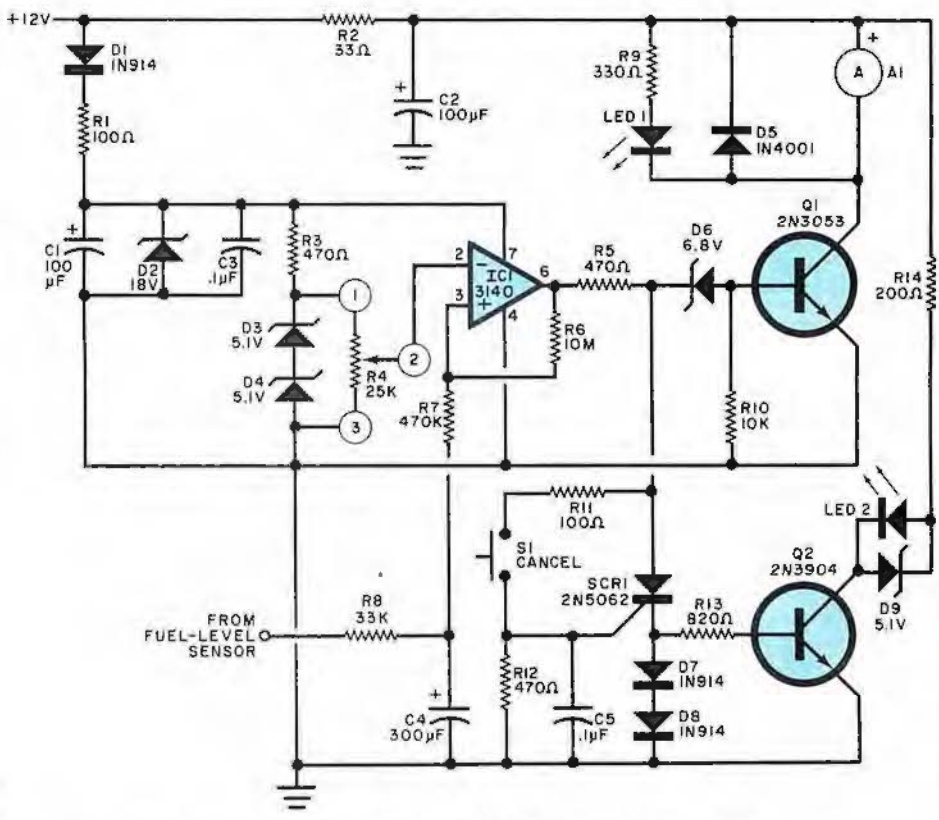
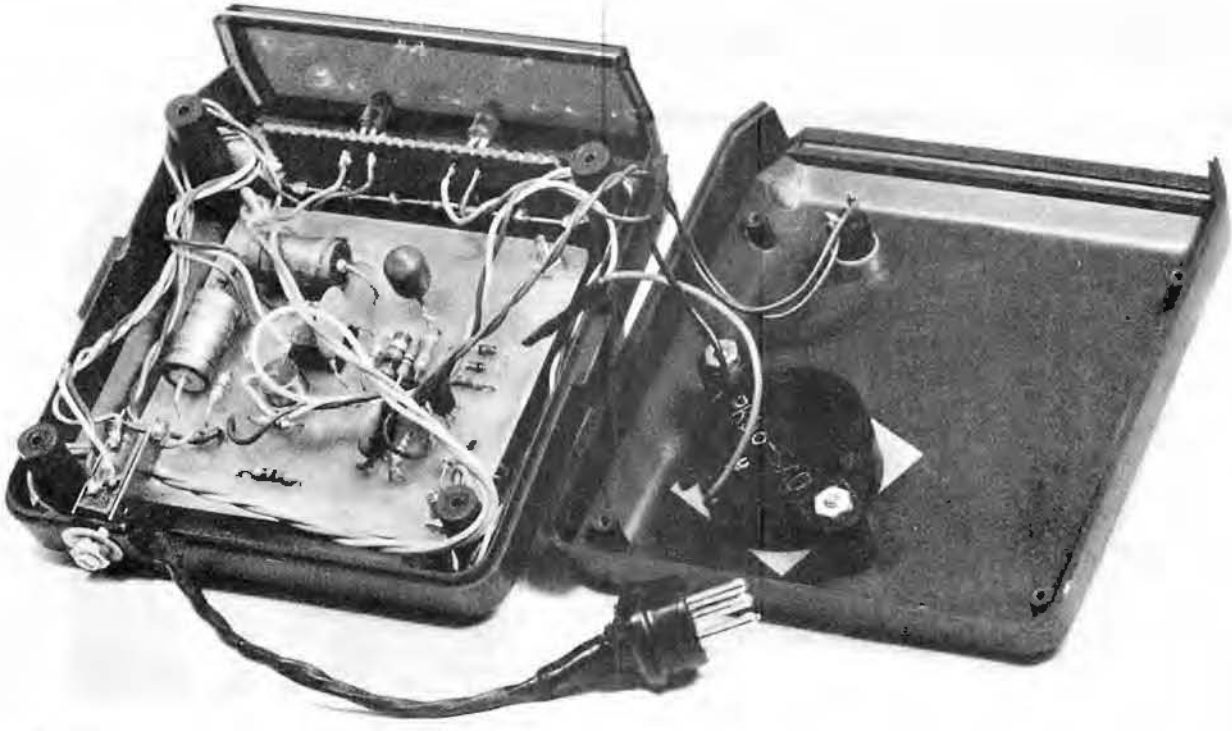
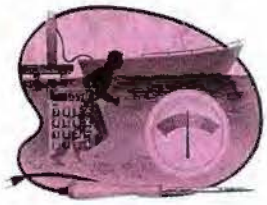


Fig. 2. Comparator IC1 turns on when fuel drops below some predetermined level, and sounds the alarm. The SCR circuit energizes a flashing LED during the Cancel mode.

Printed circuit board mounted in prototype with alarm and CANCEL switch on top.





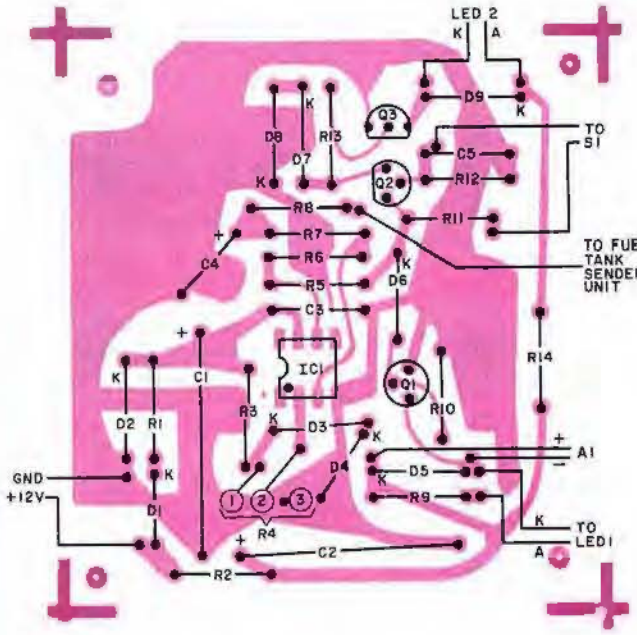


Fig. 3. Actual-size etching and drilling guide is shown at left. Component placement guide is above.

powered. The maximum voltage permitted across this special LED is 6 volts, hence the presence of 5.1-volt zener diode *D9*.

The incoming dc power line is noise decoupled by *R1*, *C1* and *C3*. Zener diode *D2* clamps any transients to a maximum of 18 volts while diode *D1* makes sure that the correct polarity is supplied to *IC1*. Filter *R2-C2* decouples the power line to the alarm and indicator circuit. Diode *D5* clamps any voltage spikes that may occur if an inductive load, such as a buzzer, is used as the alarm. Resistor *R6*, connected between the output of *IC1* (pin 6) and the noninverting (+) input, adds a small amount of positive feedback to give the comparator a little hysteresis and speed up the transition from low to high. This also reduces the likelihood of comparator oscillation.

Construction. The circuit may be constructed on perf board, Wire-Wrapped, or on a pc board such as that shown in Fig. 3 along with the component installation.

The two LED indicators, CANCEL switch *S1*, level-select potentiometer *R4*, and the selected audible alarm are not mounted on the pc board.

The finished pc board can be mounted within a selected enclosure that will also mount the off-board components. Power can be derived from any +12-volt source that becomes active when the vehicle ignition key is operated. The ground can be any convenient metal element that is solidly connected to the vehicle chassis.

You will have to locate the dashboard end of the fuel sensor lead. Test this lead by measuring the voltage across it with various levels of fuel. Usually, the lower the fuel level, the higher the voltage. It is possible for this voltage to vary due to the action of the vehicle switching voltage regulator (if your vehicle uses one) so this must be considered.

If you have any doubt as to the type and wiring of the fuel-level sensor in your vehicle, consult the vehicle repair manual.

Calibration. There are two ways to calibrate the system. The first is to wait until the fuel level is down to the selected low level, then adjust *R4* until the alarm sounds off.

The second approach is to disconnect the fuel gauge from its feed line to the fuel sender but leave the lead connected to the low-fuel alarm, then connect a resistor-substitution box between the fuel gauge and ground (as a substitute for the fuel sender). Adjust the value of the resistor until the fuel gauge indicates the desired level. Adjust *R4* to sound the alarm at that point. Disconnect the resistor box and replace the fuel sender line.

Once the fuel-level turn-on point has been determined, depress *S1* to silence the alarm. After the tank is filled, the alarm will be reset until the fuel level drops below the predetermined point. ◇