A WIRELESS IDLE TACHOMETER FOR AUTO TUNE-UPS

Eliminate risk of damage to electronic ignition systems

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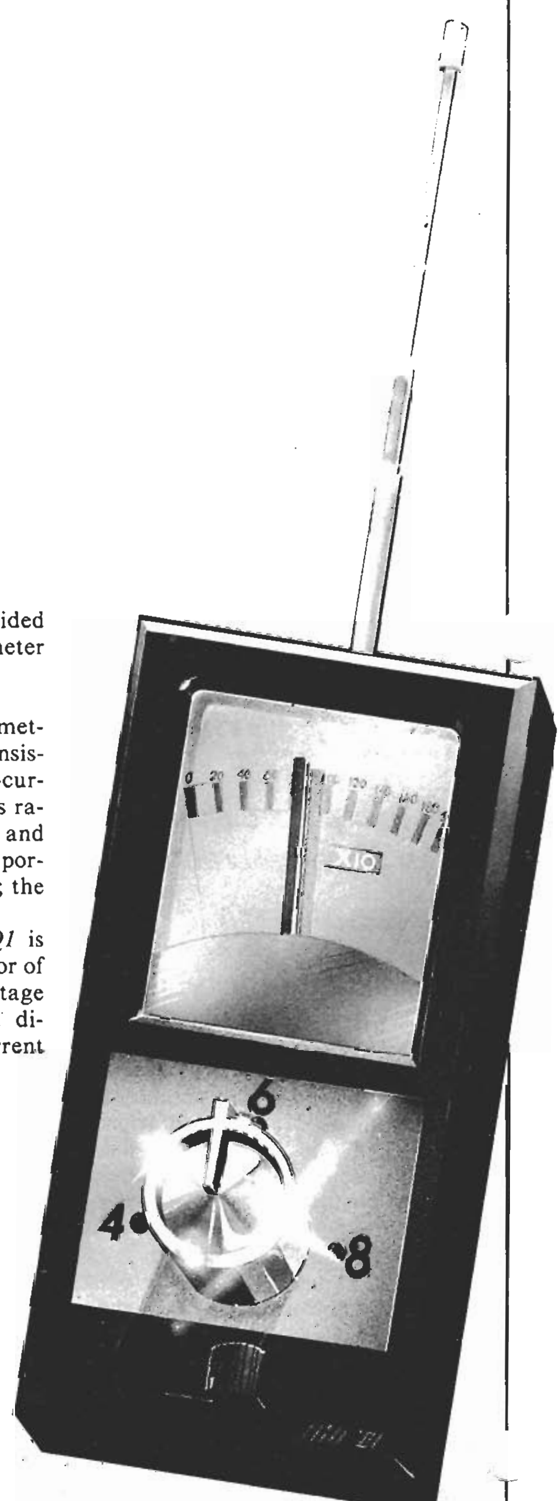
PERFORMING your own automobile tune-ups can be a source of personal satisfaction as well as a way to save money, but if you own a late-model car with electronic ignition, you'll find that the process is not what it used to be. Many modern ignition systems are magnetically triggered and have no points to adjust, thus relegating dwell meters to museums. However, the anti-pollution devices on modern engines have made idle speed considerably more critical than it once was, so an idle tachometer is still required. Since some of these systems can be severely damaged by momentarily grounding the tachometer tie-in point, the problem is where and how to connect the tach without damaging the ignition module.

The best way would be to avoid electrical interconnection with the ignition system entirely, and you can achieve this by building the Wireless Idle Tachometer described here. The tachometer is designed to operate with any four-, six- or eight-cylinder, four-cycle engine having spark ignition. It can be used with two-cycle engines, but the meter indications will be twice the actual engine speed.

Idle tachometers generally indicate from 0 to 1000 rpm. However, partly for ease of calibration it was decided to extend the range of the tachometer described here to 2000 rpm.

Circuit Operation. The tachometer circuit (Fig. 1) uses a two-transistor monostable as a frequency-to-current converter. The input signal is radiated from the ignition system and picked up on a small telescoping (portable radio-type) antenna nearby; the output is displayed on a meter.

Under quiescent conditions, *Q1* is off and *Q2* is on. Since the collector of *Q2* is low, there is not enough voltage to forward-bias series-connected diodes *D3* and *D4* and produce a current flow through *R10*, *R11*, and *M1*.



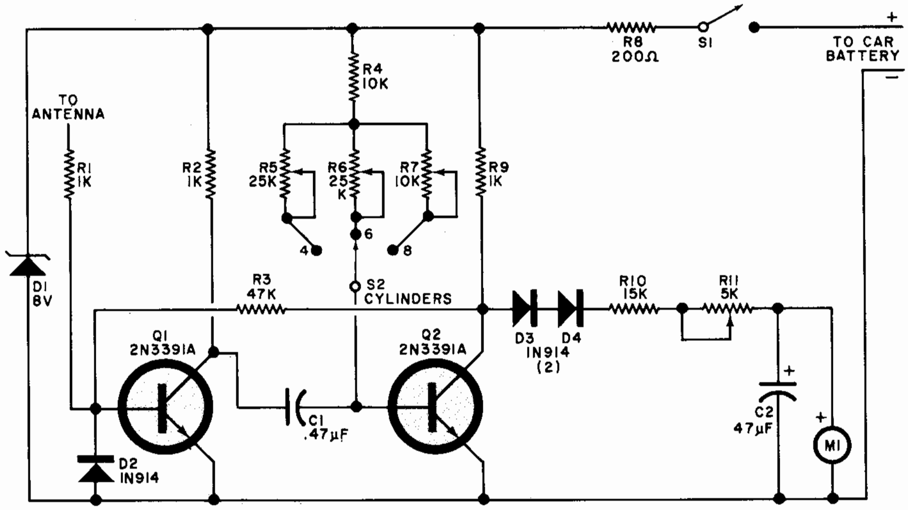


Fig. 1. The tachometer uses a two-transistor monostable circuit as a frequency-to-current converter.

PARTS LIST

C1—0.47-µF capacitor
C2—47-µF electrolytic
D1—8-V, 1-W zener diode
D2,D3,D4—Silicon diode (1N914 or similar)
M1—200-µA meter
Q1,Q2—2N3391A transistor
R1,R2,R9—1-kΩ, 1/2-W resistor
R3—47-kΩ, 1/2-W resistor
R4—10-kΩ, 1/2-W resistor
R5,R6—25-kΩ, mini-pc potentiometer (Radio Shack #271-336 or similar)
R7—10-kΩ mini-pc potentiometer (Radio Shack #271-335 or similar)
R8—200-Ω, 2-W resistor
R10—15-kΩ, 1/2-W resistor
R11—5-kΩ linear-taper potentiometer
S1—Spst toggle switch
S2—Three-position rotary switch
Misc.—Telescoping portable radio antenna, suitable plastic enclosure, two-conductor power cable, battery connector, etc.

When the antenna picks up a positive-going ignition signal, *Q1* turns on and forces *Q2* to turn off for an interval determined by the time-constant of *C1* and the resistance selected by switch *S2*. The choice of time constant sets the tach for 4-, 6-, or 8-cylinder engines.

When turned off, the collector of *Q2* rises to deliver a constant-voltage, constant-duration pulse to the meter network. Meter *M1* will indicate the current flow. When each positive-going ignition pulse finishes, *Q1* returns to its cutoff state, and *Q2* reverts to its conducting state. This stops generation of the meter pulses. As the ignition system rapidly cycles on and off, the two-transistor circuit will follow, and the meter needle will flutter. This is prevented by *C2* which smooths the current pulses.

Potentiometer *R11* provides means to compensate for errors due to ambient temperature variations. For example, if the ambient temperature is 20°F different from the temperature at which the tachometer was calibrated, an error of about 25 rpm will be found. If you are not overly concerned about temperature variations, use a fixed 2,200 ohms for *R11*.

Resistor *R8*, in conjunction with zener diode *D1*, maintains a constant 8 volts for the circuit. Switch *S1* is the on/off switch. Diode *D2* protects *Q1* from negative spikes, while *R3* provides the necessary feedback.

Construction and Calibration. Circuit layout is not critical and the builder may use point-to-point wiring on perf board or the printed circuit board shown in Fig. 2.

Meter *M1*, switches *S1* and *S2*, and control *R11* are mounted on the top panel of the case. Capacitor *C2* is mounted directly on the meter terminals. The two-conductor power cable exits the case where convenient.

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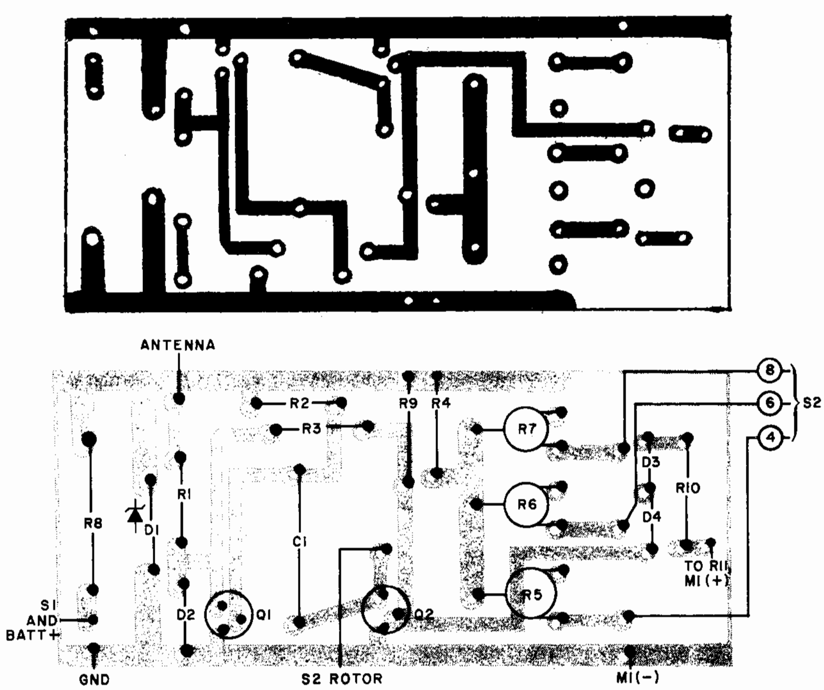

Fig. 2. Etching and drilling guide (top) and component layout diagram for a printed-circuit board for the tachometer.