Bicycle Speedometer

0 — 99 MPH in sixty minutes — that's how long it will take you to build this all electronic, solid-state speedometer.

WITH FUEL getting more expensive, the world's oil supply running out and gas disappearing in a puff of smoke, it can't be long now before pedalpower makes a comeback. We can see it now; CB freaks with cycle mounted rigs and six-foot whips on the back. Of course there will be lots of research into optimum wheel size, cruising speed etc. That's where this dandy little project will come to your aid. Featuring a two-digit readout, bright red LED display with 1 MPH resolution updated every few seconds, it can be built in a trice (ideal if your bike has three wheels) and powered from a single 9 V battery.

Swift And Silent

There have been many bike speedometer designs published over the years but never before has so much been brought to so many with so little. Yes, only Electronics Today can do this for you! No, seriously, before this gets totally over done, we'll explain. Only three ICs are required plus the two displays and a handful of passive conponents. The whole thing is very easy to put together so you can assemble it whichever way you like best. The speedometer works by detecting each revolution of the bike's wheel using magnetically-sensitive reed switches with one or more bar magnets mounted on the wheel. The faster you go, the more pulses are counted and the speed displayed increases. The display blanks out while the counters are advancing to avoid a distracting flicker and the count period is set up by adjustment of a single resistor when the speedometer is mounted on your bike. Okay, so it doesn't tell your weight, but it won't burn a hole in your pocket either!

Construction/Setting Up

Nothing to cause any problems here. As usual we'd recommend you use sockets for the ICs. If you use our PCB design you should have success first time though the circuit is simple enough to

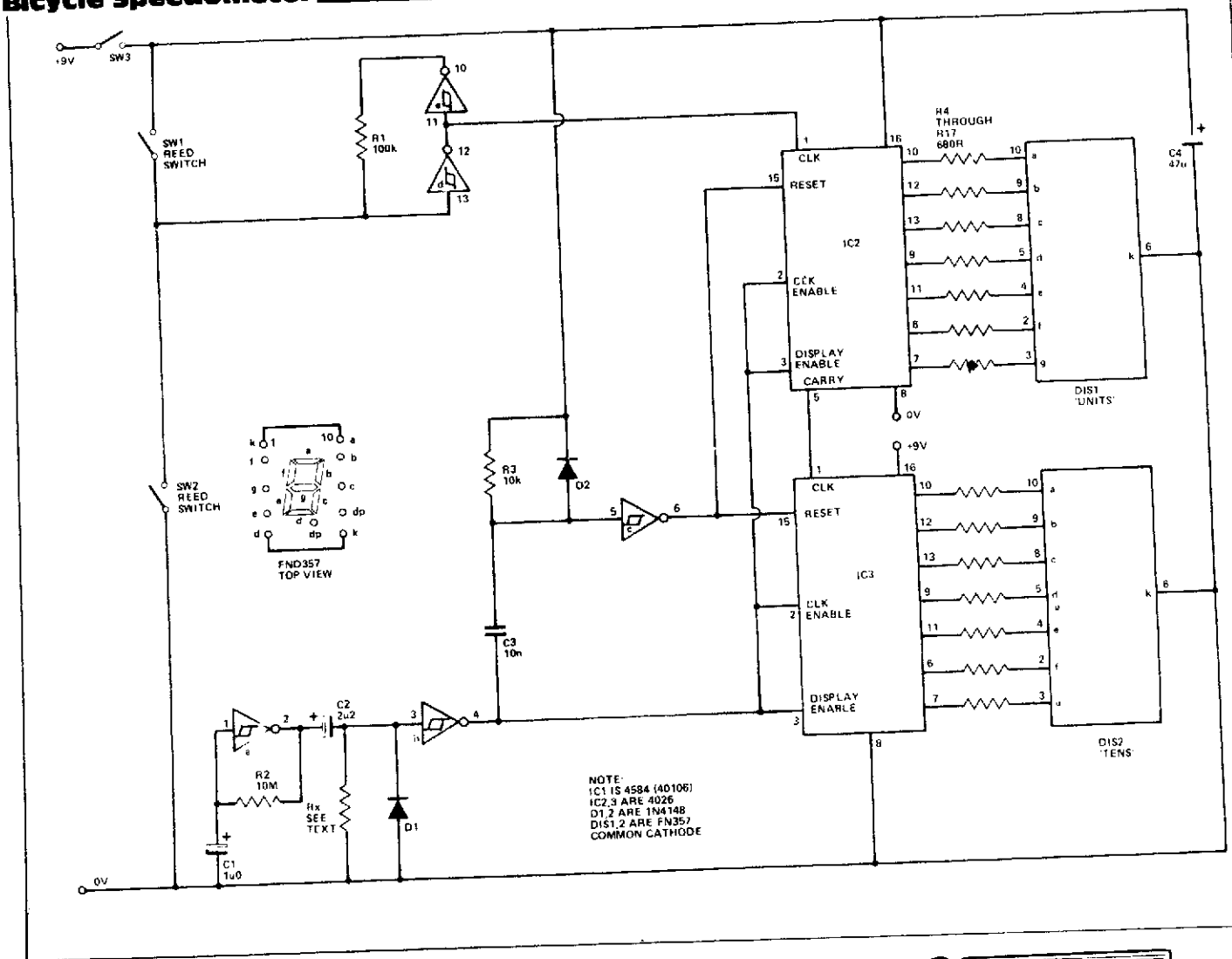


Figure 1. Circuit diagram of the Bicycle Speedometer.

be put together on Veroboard or whatever comes to hand . . . except for the original breadboard which went out of fashion when ICs arrived. (You try knocking nails into a piece of wood the size of a postage stamp . . . and anyway, you would look silly with a breadboard between the handlebars!)

Reed switches come with two main switch actions, either single-pole, double-throw or single-pole, double-throw (changeover). You can use two of the former or simply one of the latter (with its centre contact connected to the common point on the circuit board for the two switches (see **Fig. 2**).

Reed switches are usually supplied as glass tubes with the switch contacts brought out to tags at either end. For better protection against the elements a single pole double throw reed switch is ideal. You can however, do as we did, and get by with two single throw units.

The relationship between wheel diameter, gate period and number of

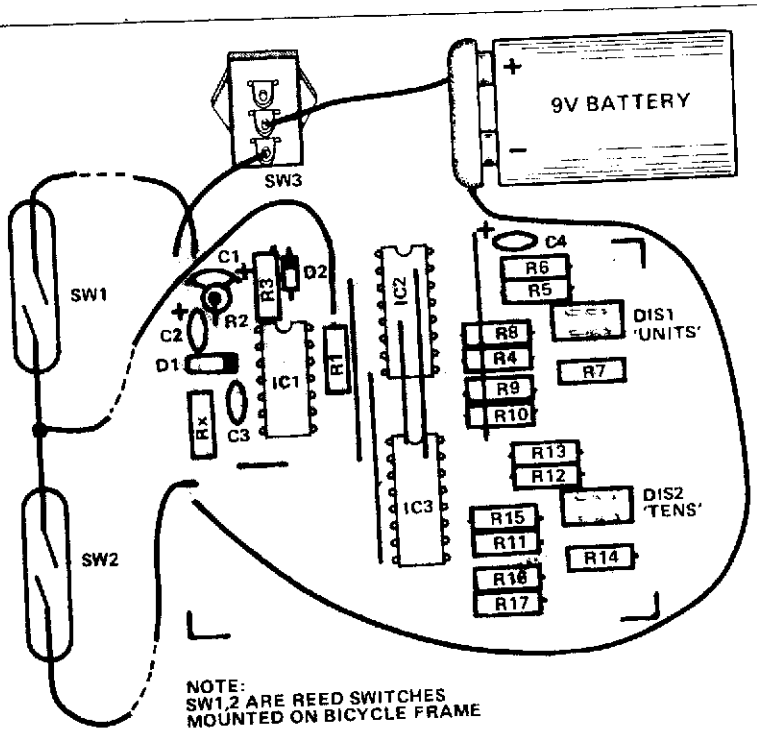
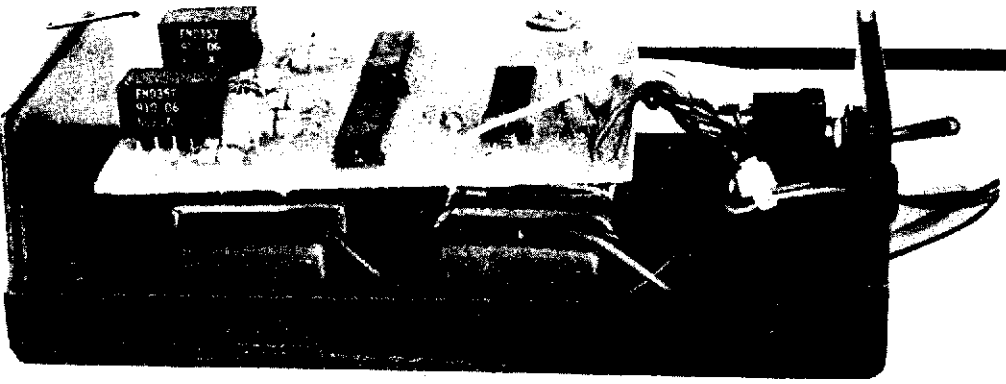
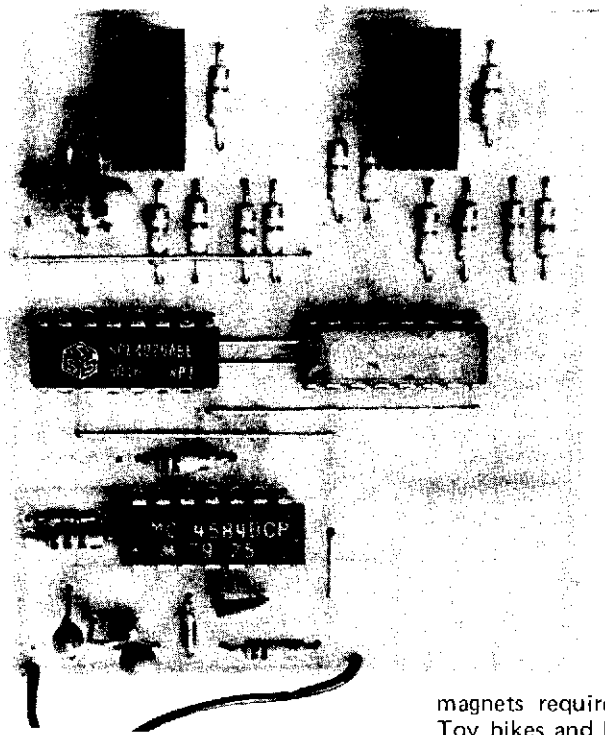


Figure 2. Overlay and connection details. Remember that SW1 and SW2, the reed switches, can be combined as one changeover type reed switch.



Side view of speedometer, showing the two batteries.



Component layout of PCB.

Parts List

RESISTORS	
R1	100k
R2	10M
R3	10k
R4-R17	680R
POTENTIOMETER	
Rx	1M0 linear potentiometer
CAPACITORS	
C1	1u0, 16 V tantalum
C2	2u2, 16 V tantalum
C3	10n ceramic
C4	47u, 16 V tantalum
SEMICONDUCTORS	
IC1	4584 or 40106 hex inverting, Schmitt trigger
IC2,3	4026
D1,2	1N4148 diode
DIS1,2	FND357, common cathode, 7-segment displays
MISCELLANEOUS	
SW1,2	reed switch inserts
SW3	single-pole, double-throw toggle switch
Magnets	
Battery and clip	
Case to suit	

magnets required is not a simple one. Toy bikes and bikes with 'baby' wheels will get away with one or two magnets. To obtain a reasonable gate period with larger wheels you'll need to use more magnets. In practice, fix between five and 10 small magnets (the type usually supplied with reed switches) around the rim of the wheel (the more

How It Works

A low-frequency astable oscillator provides the master clock for the circuit. IC1a, R2, C1 take care of this. Pulses are then differentiated and squared up by IC1b and IC1c to provide clock enable and reset signals. Figure 3 shows this in detail.

Integrated circuits IC2 and IC3 form a two-digit counter and display driver, which needs only correct timing and clock pulses to operate both 7-segment displays. While IC1b's output is low the counters are enabled and clock pulses from IC1d cause the counters to advance. When IC1b goes high the counters are disabled and the count is displayed on the 7-segment displays. The combination of IC1d and IC1e forms a simple but effective debouncing circuit. Some form of signal conditioning circuit like this is nearly always required when mechanical switches are interfaced to digital counters. Resistors R4 through R17 limit the current in the displays and C4 provides overall decoupling.

the merrier). To stop them falling off it's best to glue them in place or secure them with pads of double-sided tape. Once fixed, a dab of paint or varnish will prevent them from getting rusty.

Connect a 1M0 potentiometer or preset at the Rx position, get on your bike and adjust the pot until you get the right speed reading. Now, measure its value and make it up from fixed value resistors or just fasten the pot or preset onto the board — there's plenty of room.

If you use separate reed switches,

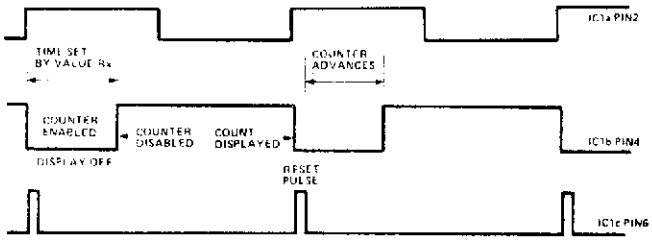
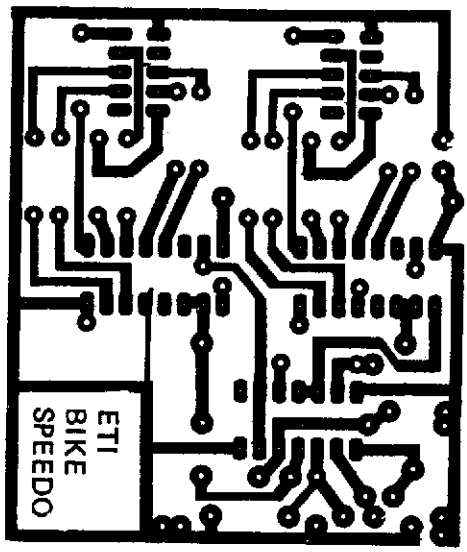


Figure 3. Waveforms within the circuit not to scale.



make sure that both are never on at once or the battery will be short — circuited through them. To safeguard against this you can connect 10k resistors in series with the wires from the battery.

Ideally you'll need a box with a clear lid so you can see the display without having to cut holes in the box, which would let in water. It's best to mount the box centrally on the bars so that, if the bike takes a tumble no damage will be done. Lacquer the back of the board so that if any condensation appears in the box no shorts will result. The circuit takes about 40 mA of current when running so two batteries in parallel are advisable and there's just enough room under the PCB to put them.

Alternatively, you might like to make a proper facia panel to hold a whole set of instruments (oil pressure, ammeter, etc!?) Watch this space! •