Project 557

Reaction Timer

Check your reflexes with this simple project.

AT OUR LAST Synergistic Beer Drinking night, one of our readers brought along a reaction timer to prove that reactions *do* slow down during one of these nights! We were impressed with the timer and decided to publish it as a project.

While we have published reaction timers before, the feature which made this unit unique is that it gives a random time interval between tests. This prevents anticipation causing a shorter than actual reaction time. As the prototype was built on veroboard and used 9 TTL packages plus two of the nice (and expensive) HP displays (which have the decoder on board), we decided that at least one pc board was required.

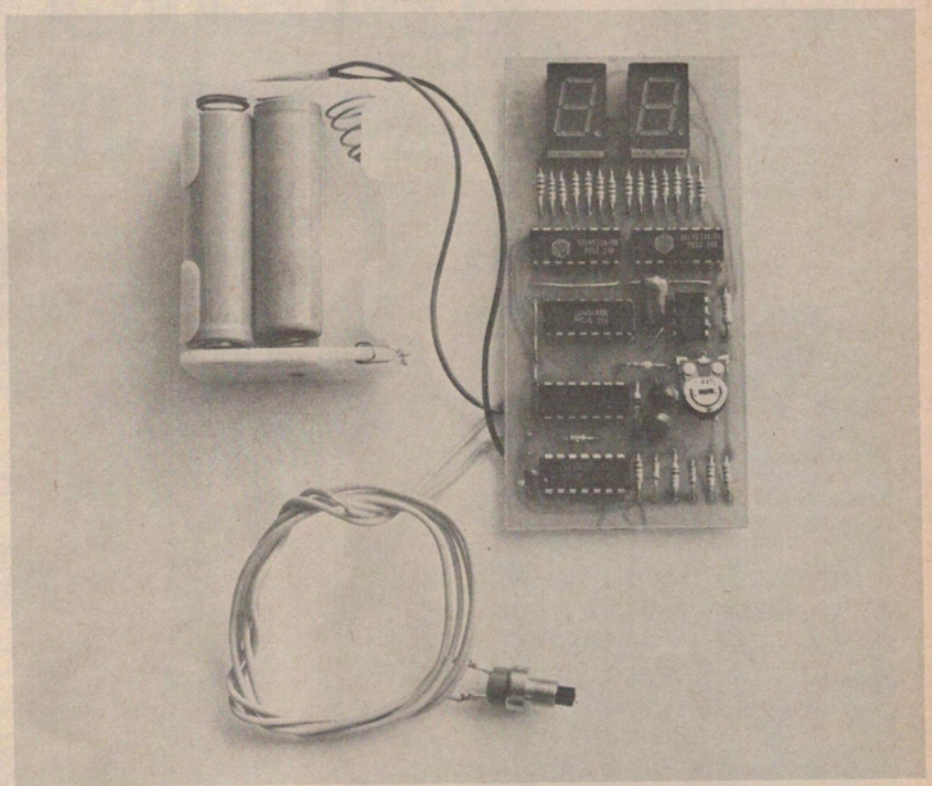
On looking at the logic involved, we saw it could be simplified without any change in operation and with the use of CMOS the power supply is less critical than with TTL.

Operation

If the unit has not been used for more than 30 seconds the display will blank. Pressing the button and releasing it will initiate operation. When the display comes on again it will start counting from zero until the button is pressed. It should be held depressed while the time (in hundredths of seconds) is read. Releasing the button blanks the display for a random time before it comes on again, counting from zero for a second test. If the button is not pressed the display will blank after about 30 seconds to conserve power – no on/off switch is required.

Construction

We will describe only the electrical side of the project, leaving the mechanical side to the individual constructor.



SPECIFICATION - ETI 557

Reaction time	0 to 0.99 seconds
Delay between tests	½ to 10 seconds (random)
Power requirements	4 to 12 volts dc @ 50 mA (display on) @ 1.9 mA (display off)

Project 557

Assemble the pc board with the aid of the overlay in fig. 1. Start assembly with the resistors, diodes and the four links. The 555 IC should now be fitted and soldered, followed by the other ICs. These are all CMOS and their pins should not be handled more than is necessary. As an added precaution, solder the power rails first (pins 7 and 14 on ICs 8 and 16) using an earthed soldering iron. The rest of the components can now be assembled.

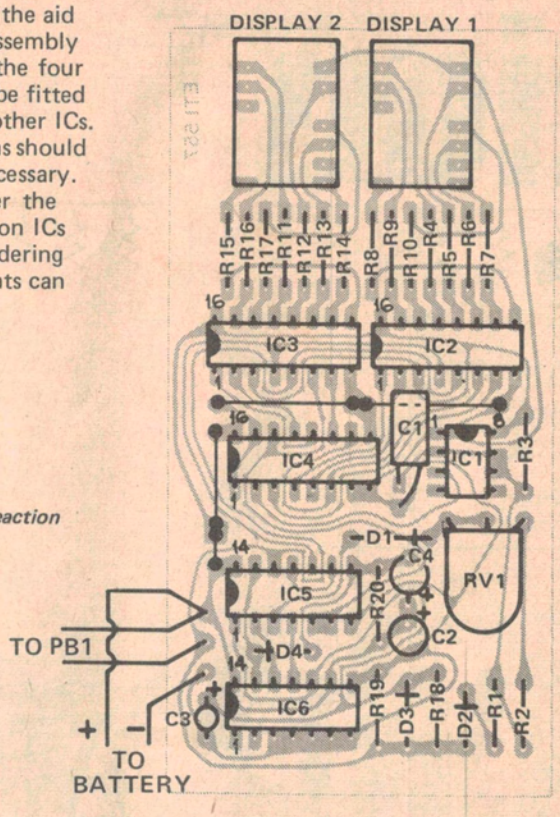


Fig. 1. Component overlay of the reaction tester.

PARTS LIST - ETI 557

Resistors all ¼ W, 5%
R1 . . . . . 1k
R2 . . . . . 330k
R3 . . . . . 4M7
R4-R17. . . . . 1k
R18. . . . . 1M
R19. . . . . 10k
R20. . . . . 1M

Potentiometers
RV1 . . . . . 500k trim

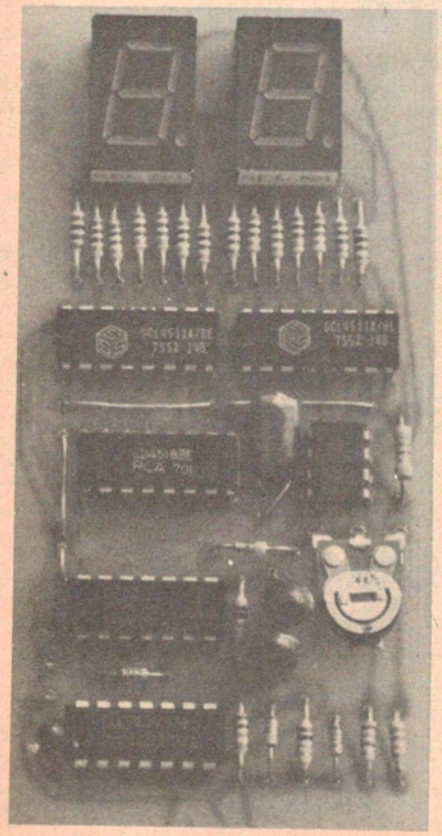
Capacitors
C1. . . . . 22n Greencap
C2. . . . . 33µ 16V tantalum
C3. . . . . 1µ 16V tantalum
C4. . . . . 33µ 16V tantalum

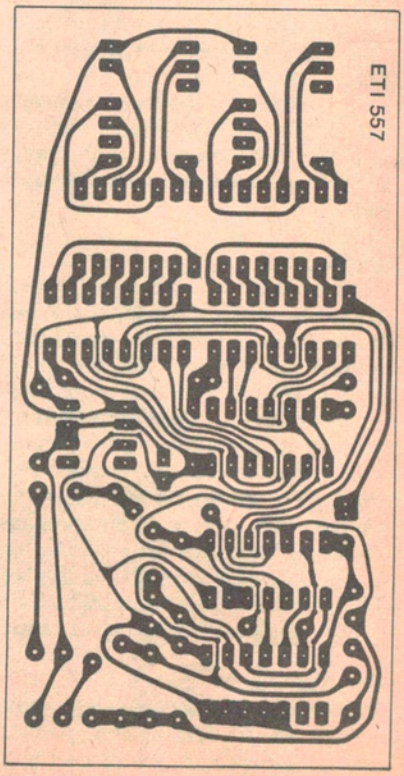
Semiconductors
IC1 . . . . . 555 or 7555
IC2, 3. 4511
IC4 4513
IC5 4001
IC6 4013

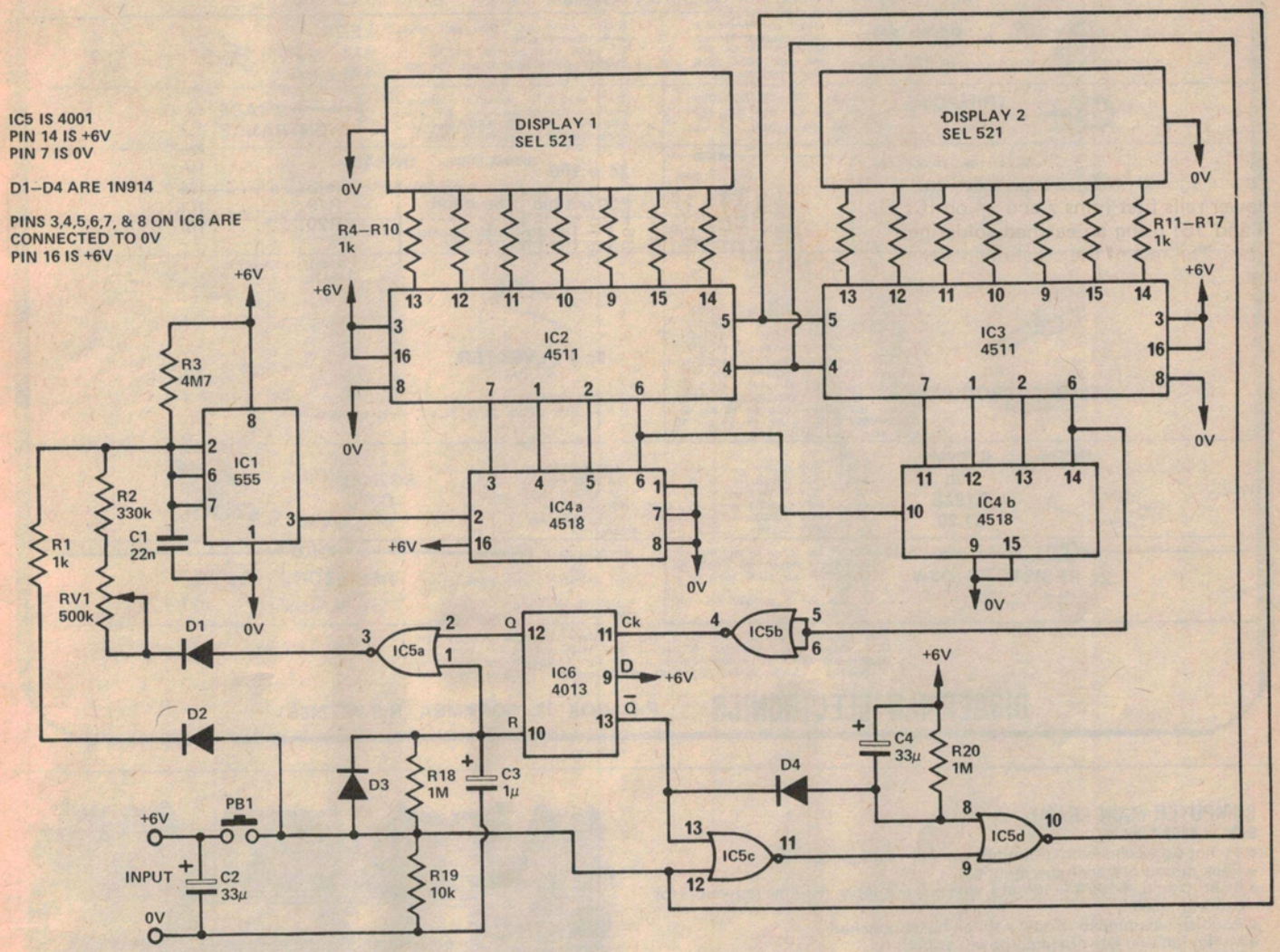
D1-D3 . . . . . 1N914

Display 1, 2 . . SEL 521

Miscellaneous
pc board ETI 557
push-button
6V battery







HOW IT WORKS - ETI 557

The unit is basically an oscillator, IC1, clocking two decade counters (i.e. ÷ 100), with their outputs being decoded by IC2 and IC3 and displayed on the LED displays. Control of the oscillator and displays is done by IC5 and IC6.

When the push-button is activated, IC6 is reset so that pin 13 is "0" and pin 12 is "1". Also, a "1" is applied to the latches in the decoders (IC2, 3) so that the number presented to the decoders at that instant is stored. It also applies a "1" to pin 12 of IC5/3, forcing its output low. As there is a "0" on pin 13 of IC6, the diode D3 brings the voltage on pin 8 of IC5/4 low. Two "lows" on these gates (NOR) make the output go high. As the output of this gate controls blanking ("0" = dark), the display will be on.

The push-button also (yes, it does a *lot*) causes the 555 oscillator to run at about 50 kHz. The oscillator clocks the counter ICs – they are completely cycled 500 times per second.

When the button is released, the oscillator frequency drops to about 10 Hz. The display blanks as IC5/3 now has both zeros on its input, a "1" on its output and hence a "0" on the output of IC5/4. The latches in the decoder ICs also open, although counting cannot be seen as the display is blanked.

After about ½ sec the voltage on the reset input of IC13 (pin 10) falls below the threshold level, allowing it to be toggled by the clock input (pin 11). As when the push-button was released, the counters (IC4) could have started at any count, the time until the voltage on pin 14 of IC4 goes low is random. The delay on the reset line going low is to prevent IC6 from being toggled too soon.

When IC6 is toggled (after ½ sec to 10 sec), pin 13 goes high and pin 12 low. IC5/1 now has two lows on its input, giving a "1" on its output. This raises the oscillator frequency to 100 Hz. The "1" now on pin 13 of IC5/3 gives a "0" on pin 9 of IC5/4 and a "1" on pin 10. This brings the display back on. As IC6 can only be toggled on the overflow of IC4, the display comes on at the zero count.

The display continues counting up at 100 Hz until the button is pressed, freezing the display to indicate reaction time. The whole thing is then repeated.

If the button is not pressed for more than 30 sec the voltage on pin 8 of IC5/4 will go above the high threshold, forcing the output low and thus blanking the display.