BY HAL LEFKOWITZ

Build a
FAIL-SAFE
TIMER

*Easy-to-construct circuit
lets you know
if a timer should fail.*

ONE OF THE integrated circuits most commonly used by electronics enthusiasts is the 555 timer. A typical application for this ubiquitous chip is as an elapsed time indicator. Here, the 555 functions in the monostable mode and drives either a beeper or LED to indicate the end of a time period. Unfortunately, such a circuit usually has no way of alerting the user when the timer is not working properly. This problem is circumvented by the use of the Fail-Safe Timer. A simple project, the timer will not only notify you when the specified period has elapsed, but will also tell you at a glance if it is still "ticking."

About the Circuit. As shown in the diagram, two 555 IC timers (or a 556 dual timer) form the heart of the circuit. The first (*IC1*) operates in the monostable mode. When triggered by S2, the one-shot output goes high and *LED1* glows to indicate the timing cycle. When the timing interval is over, the output of *IC1* goes low, darkening the LED and grounding pin 1 of *IC2* and the lower plate of timing capacitor C5. The second timer is an astable multibrator whose output is capacitively coupled to a small 8-ohm speaker. When pin 1 of the IC and the lower plate of C5 are grounded, *IC2* generates a 1300-Hz tone.
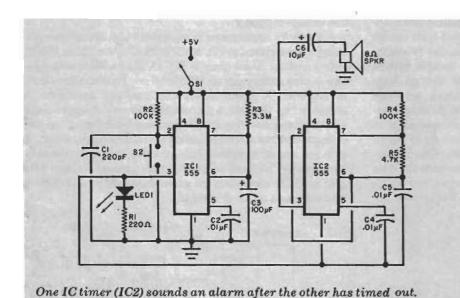
If for any reason the one-shot (*IC1*) output goes low *before* the timing cycle is finished, the LED will darken to alert you. Of course, you can use a LED or relay at the output of *IC2* if you prefer a visual indication of elapsed time. Connect a diode in parallel with the relay coil (cathode to pin 3 of the IC, anode to ground) to protect the chip's output transistor from voltage spikes.

As mentioned earlier, the Fail Safe Timer is triggered by closing S2. This switch can be replaced with a touch switch. Simply connect a length of hook-up wire to pin 2 of *IC1* and another wire to ground. Remove ½" (1.3 cm) of the insulation from the free ends of the wires, and fasten them to a flat, nonconducting surface. The wires should be spaced about ¼" (6.4 mm) apart, parallel to each other but not in electrical contact. The lightest touch of your finger across the exposed conductors will initiate the timing interval.

Uses and Modifications. The circuit as shown is used by the author as a callsign identifier alarm during his conversations via amateur radio. Of course, you can adapt the timer for many other applications.

The length of the timing period can be changed by varying the values of *C3* and *R3* according to the equation $T = 1.1(R3)(C3)$, where T is the timing interval in seconds, $R3$ is in ohms and $C3$ is in farads. Note, however, that the tolerance of many electrolytic capacitors is −50%, +100%. Unless you use a close-tolerance tantalum capacitor, you might end up with a timing interval anywhere from one half to twice the calculated duration.

The pitch of the warning tone can be raised by increasing the value of *R4* or *C5*, or both. Similarly, it can be reduced by using a smaller value of resistance or capacitance. ◇

One IC timer (IC2) sounds an alarm after the other has timed out.

PARTS LIST

C1—220-pF disc ceramic capacitor
C2,C4,C5—0.01-μF disc ceramic
C3—100-μF, 16-V tantalum
C6—10-μF, 16-V electrolytic
IC1,IC2—NE555V timer (or 556 dual timer)
LED1—TIL-32 light emitting diode
The following are ¼-watt, 10% tolerance carbon composition resistors.
R1—220 ohms

R2,R4—100,000 ohms
R3—3.3 megohms
R5—4700 ohms
S1—Spst switch
S2—Normally open, momentary contact pushbutton switch
SPKR—8-ohm dynamic speaker
Misc.—Printed circuit or perforated board, suitable enclosure, hook-up wire, machine hardware, etc.