Universal timer

Need a two-stage timer that can be latched on? That can be set for continuous operation? That can be used for a time-delayed alarm operated by a hidden photocell? If so, try this nifty timer/alarm that can do it all.

by Jeff Sandler
Contributing Editor

About half the letters addressed to Clinic ask about timers and alarms. So here's a universal timer/alarm circuit that can be customized to meet just about any need. The circuit is built around a single 4011 quad NAND gate. A quick look at the circuit will show you that it consists of two almost identical flip-flops, each driving an NPN transistor, which powers a buzzer or alarm relay.

The timer/alarm can be triggered by any device that drops input A on the 4011 to ground from a normally high state. Magnetic door switches, pressure sensitive mats or even a panic switch can be used. If your detector has a positive going output, you can use a single-transistor inverter.

A 2N3904, or other small signal NPN, makes an excellent inverter, as shown in the lower left corner of the schematic diagram. The output of your detector connects to input B of the inverter, the output of which connects to input A of the 4011.

The timer/alarm can also be triggered using a photocell, as shown in the upper left corner of the schematic. The photocell can be connected on either the hot side or the ground side of the input of the 4011. A variable resistor is used to set the light threshold for triggering the timer/alarm.

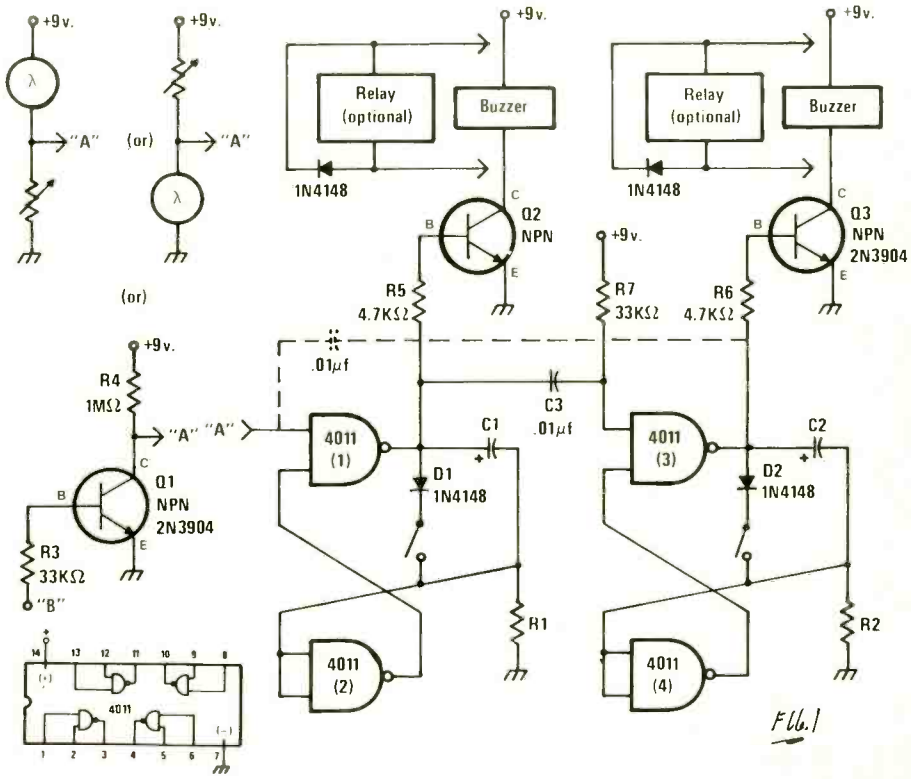
The universal timer/alarm operation is straightforward. In its resting state, the output of the first timer is low, which keeps its output transistor, Q2, off. When you trigger the circuit, the output goes high, turning on Q2, and its associated buzzer or alarm relay. The number of seconds the alarm stays on is approximately equal to 0.7 multiplied by the value of R1 in ohms multiplied by the value of C1 in farads.

After the time period has passed, the first timer will turn off, and in so doing, trigger the second timer. The second timer then turns on its associated transistor, Q3, and its buzzer or alarm relay. The number of seconds this alarm stays on is determined by the value of R2 and C2 in the same way as R1 and C1 did in the first timer.

If you wish, you can feed back the output of the second timer to the input of the first timer, as shown in dashed line, with a .01 mfd capacitor. This arrangement will turn on the first timer when the second goes off. The result will be continuous operation, with one alarm turning on for a period of time, then the other alarm, and so on.

You can build your universal timer/alarm with only the second transistor output circuit, using only Q3 and its associated buzzer or alarm relay. Doing this will give you a delayed alarm, letting you turn it off between the time it's triggered and when the alarm would sound.

The schematic shows each timer with a latching option consisting of a diode—D1 and D2—and a single pole, single throw switch. With the switch left open, the timer works as described. But, with the switch closed the timer once trig-



gered will remain on until the switch is opened.

If the latching option is going to be used, it would most likely be done on the second timer. Latching the first timer on would effectively lock out the second timer. However, there may be situations where you want instantaneous turn-on with a latch on, so provisions for it have been made in the circuit.

In building your timer/alarm, you can wire only those parts of the circuit you need for your specific application. For example, you might build a single-stage timer with an LED substituted for the transistor output. If you use only two of the gates in the 4011, however, make sure to tie the input lines of the unused gates to the positive supply voltage. This will prevent unwanted self-oscillation in the unused gates, with its resulting erratic timer operation.

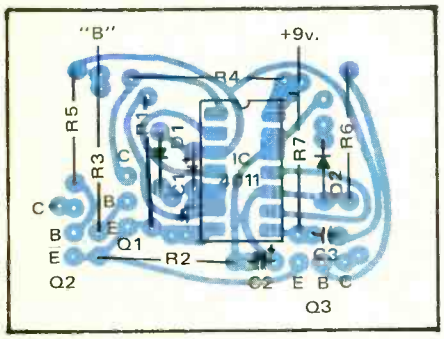
Another approach is to build several fully equipped universal timer/alarms and keep them on hand as junk box items. Then, when you need a timer or alarm, just connect those portions of the pre-wired circuit you need to do the job.

Although you will be tying up a small inventory of parts, your junk box will be considerably enriched with ready-to-use, do-everything boards. And, using parts already in your junk box, and buying in quantity, the total investment per board should be quite low.

Construction

Building the universal timer/alarm is relatively easy. The parts layout isn't critical. The circuit is simple enough that it can be built on perfboard. However, it is ideally suited to printed circuit board construction, and a typical layout is provided.

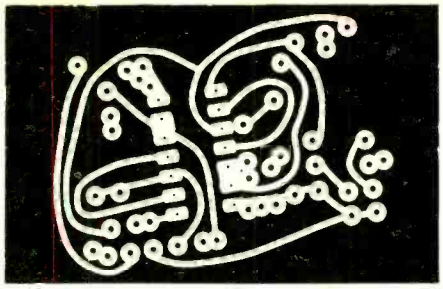
There's nothing to prevent you from etching several alarm circuits on one large size board for use as a master



The close clearances of the PC layout make parts density higher than you may like. However, power consumption is very low, so there's little chance of overheating.

control station. If you'd like, you can cascade the timers to form a multi-delay timer. This multi-delay timer can be used for a wide variety of projects ranging from a sequencing controller to a rather elaborate do-nothing box.

The kind of device used to signal the



The universal timer/alarm is ideally suited to printed circuit construction. You can use this template, or create your own multi-stage timer/alarms.

alarm can be just about anything you have handy. Low current nine-volt buzzers can be driven directly from the output transistor. Other devices will have to be connected to their power sources through relay contacts. Remember to include a protection diode across the relay coil as shown in the schematic.

The prototype alarm used a new self-contained alarm manufactured by Citizen America Corporation, 1710 22nd Street, Santa Monica, CA 90404. The alarm is called a Microbuzzer and comes with 3, 6, 12 and 24 volt electronics. These units can, according to Citizen, produce an alarm with a level of 70 dB at 20 cm, which should be loud enough for your timer/alarm.

The Microbuzzers are now going into general distribution, but you may have a little trouble tracking them down in your area. Citizen American really doesn't like to deal in mail order, but if you can use ten or more of them, you can get them direct by mail. Check with them for price and delivery information.