Build the Mailbox Sentry

LED and tone indicators announce mail arrival at remote location

By Les Svoboda

A RURAL mailbox is often located a good distance from the house, which makes it difficult to tell when mail has arrived. The "Mailbox Sentry" helps solve this problem by sounding a tone and lighting a LED in the house when the mailbox door is opened. The tone stops after approximately 20 seconds, but the LED remains on until it is manually cancelled by operating a pushbutton.

Circuit Operation. As shown in the schematic, Fig. 1, a CMOS 4001 chip, *IC1*, is set up as a dual set-reset latch. Each latch is triggered by the leading edge of a positive-going pulse provided by switch *S1* at the mailbox. The pulse remains high as long as the mailbox door is open (switch is closed). During this time a reset is not possible. In fact, if your mailbox is left open, you'll know about it because you won't be able to perform a reset.

When the mailbox is opened, pin 11 of *IC1* goes high and turns on transistor *Q1*. This activates the alarm circuit, which consists of 555 timer *IC2* (operating in the astable mode) driving an 8-ohm speaker *SPKR1*. The alarm times out in about 20 seconds due to the RC time constant of the 10-μF capacitor *C1* and 2.2-megohm resistor *R8*. A normally open pushbutton switch, *S3*, is placed across the capacitor so the alarm can be prematurely silenced, if desired.

Pin 4 of *IC1* also goes high when the mailbox is opened, and turns on
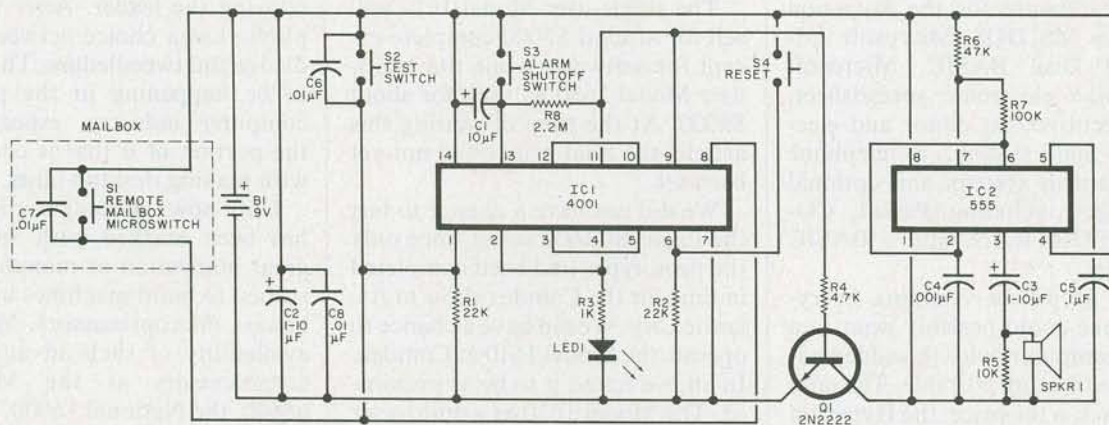

Fig. 1. Heart of the circuit is the 4001 chip set up as a dual set-reset latch.

PARTS LIST

B1—9-V battery
C1—10-μF, 25-V electrolytic
C2,C3—1-10-μF, 25-V electrolytic
C4—0.001μF, 25-V ceramic disc capacitor
C5—01.-μF, 25-V ceramic disc capacitor
C6,C7,C8—0.01-μF, 25-V ceramic disc capacitor
IC1—4001 quad NOR gate
IC2—555 timer
LED1—Red or green light-emitting diode

Q1—2N2222 npn silicon transistor (or similar)
The following are ¼-W, 10% resistors:
R1,R2—22 kilohms
R3—1 kilohm
R4—4.7 kilohms
R5—10 kilohms
R6—47 kilohms
R7—100 kilohms
R8—2.2 megohms

S1—Normally open microswitch, magnetic reed switch, or mercury switch
S2 through S4—Normally open pushbutton switch, panel mount
SPKR1—8-ohm, 2″ or 2½″ speaker
Misc—14-pin DIP socket, 8-pin DIP socket, battery clip, Veroboard™ or perf board, # 8451 Belden audio wire, hookup wire, case, mounting hardware, construction adhesive, etc.
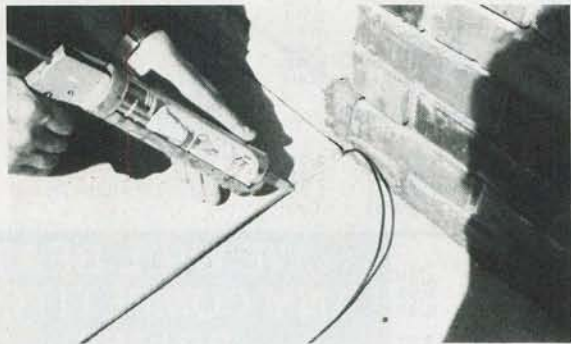
Fig. 2. Cement the wire into a groove in the sidewalk using some sort of construction adhesive.

visual indicator *LED1*. A normally open pushbutton switch, *S4*, provides for a reset to turn the LED off.

A normally open pushbutton switch, *S2*, is used as a "test" switch. It bridges the switch located at the mailbox and provides a check of the system. A single 9-V alkaline battery, such as that used in transistor radios, is used to operate the unit.

Construction. The circuit is simple enough to be constructed on Veroboard™ or perf board. DIP sockets are recommended for the ICs.

After the unit's case has been drilled for switch openings and sound emission, the speaker can be mounted on the inside front of the case using a few dabs of silicon sealant.

Installation. A microswitch is mounted under the mailbox where it can close when the door is opened, and open again when the door is closed. (A magnetic reed switch or mercury switch can be used if desired.)

A shielded cable such as Belden's #8451 shielded audio pair is run from the switch to the house. This type of wire was chosen because it has a heavy and durable plastic covering that will last a long time buried underground. It is also of a fairly small diameter so that it fits nicely within the breakaway grooves of a sidewalk. With a caulking gun, place a bead of construction adhesive such as Liquid Nails (trademark of Macco Adhesives—SCM Corp.) within the groove, imbedding the wire into the bead. Place another bead over the wire and smooth it with your finger. This makes a permanent installation below the surface of the sidewalk in a few minutes (Fig. 2).

The rest of the cable is then conveniently routed into and through the house, and connected to the "Mailbox Sentry" unit. The shield can be connected to a convenient ground if desired. The unit should be mounted where it can be easily seen or heard, and where it can be reset after the mail is picked up. ◇