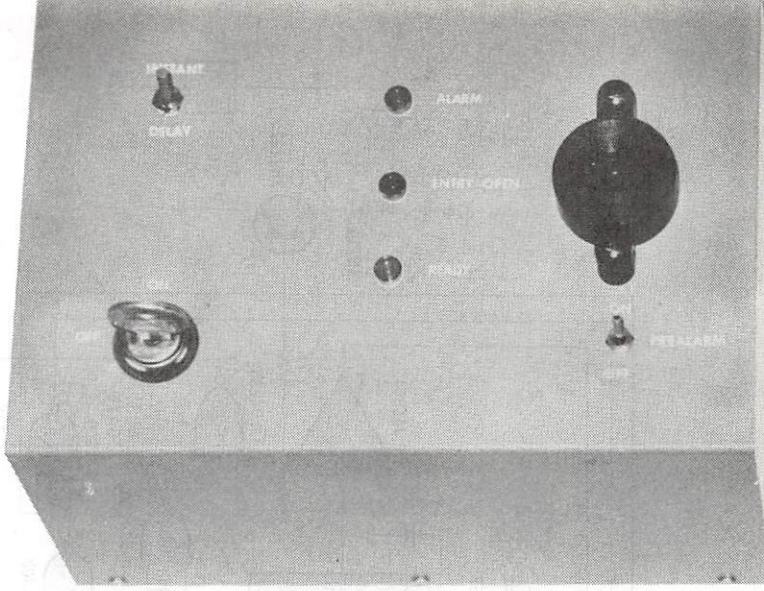
BUDGET BURGLAR ALARM



This home-protection system does everything the big, fancy, expensive systems do. And it costs a lot less!

By John Cooper

I FOUND OUT THAT INSTALLING A BURGLAR-ALARM SYSTEM can save money. How? An added discount on my insurance premium! Deadbolt locks, fire extinguishers, and smoke alarms, all contribute to such savings, so check with your insurance agent. I had long wanted a security system, and that added incentive started me shopping. I made a list of the features I wanted: A key switch to arm/disarm; an instant/delay switch; an alarm memory; entry open and ready LED indicators; a pre-alarm sounder with on/off switch; auxilliary dry contacts for a light; a trickle charge for rechargeable battery backup, and an automatic alarm reset and power-on reset.

I checked the local stores. With the features I wanted, the prices were exorbitant. I decided to design my own.

How the System Works

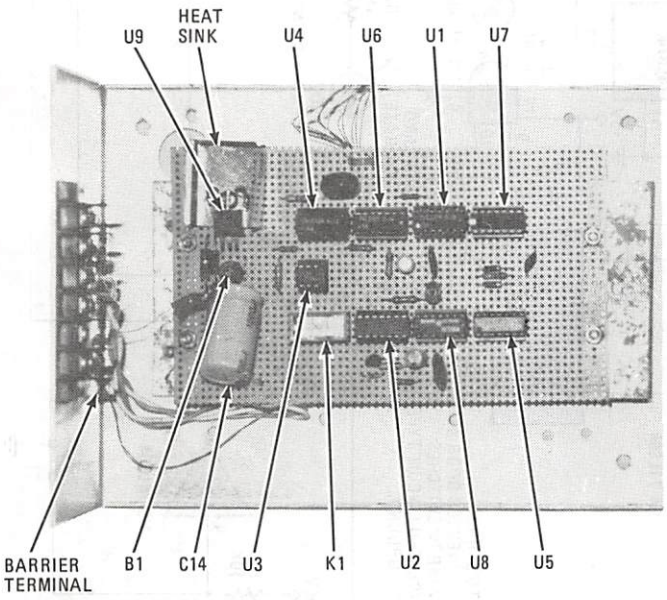
The schematic diagram for the Budget Burglar Alarm (Fig. 1) shows that the closed-loop switches place a ground on optocoupler U3, pin 2. As long as the doors and windows remain closed, U3, pin 5 stays low. That low blocks the clock, U4A and U4B, the NOR gates, through U2A, an AND gate, holds flip-flop U5A clear and turns off LED 2, ENTRY OPEN. That LED comes in handy for setting the alarm.

The system is off and the logic is reset when key switch S1 is in the off (open) position. With S1 on and all entries closed, U2C, an AND gate, pin 8 goes high and turns on READY indicator, LED3.

In the INSTANT mode of operation, as determined by switch S2, INSTANT/DELAY, if an entry is opened, the clock is gated through U1A, a NAND gate, and fires U8B, a dual timer. At that time, relay K1 operates and grounds the siren causing it to sound. U8B is one half the 556 dual timer whose on time is set by R9 and C11. When U8B fires, U5A and U5B both set. U5A blocks the alarm until the entry is closed and U5B turns on ALARM MEMORY indicator LED1. That indicator remains on until the key switch, S1, is operated.

With S2 in the DELAY position, leaving home opens the loop and the clock fires U8A. That sets U7B, a flip-flop, and the system is armed. The next time an entry opens, U8A fires again, turning on the pre-alarm sounder and setting U7A. After a delay (determined by R8 and C10 unless S1 is off) U8B fires and the siren sounds. Note that U7B remains set and U7A is cleared. Therefore, after an attempted break-in, if the entries are closed, the system is reset to respond to the next violation.

Hex inverters U6B and U6C form a power-up reset to condition the logic if the AC power fails and a battery backup is not used. Resistor R13 and diode D2 are optional components to provide a trickle charge to a 12-volt battery and can provide that added security.



Parts placement is not critical to the operation of the circuit, and while author used perfboard and wirewrap techniques, an etched circuit board could just as easily be used.

Building the Unit

The author wired the Budget Burglar Alarm control unit on a 3½ × 6-inch perfboard using wire-wrap sockets for the relay and integrated circuits. The parts layout is not critical, and a Photo shows the layout used by the author. Naturally, should you opt to do so, the circuit could be etched on a printed-circuit board.

There is a wide tolerance on the C10, C11 electrolytic capacitors used in the 556 timing circuits. Use clip leads to test U8A and U8B for the correct on time before wiring those capacitors in place. Many cities have regulations regarding

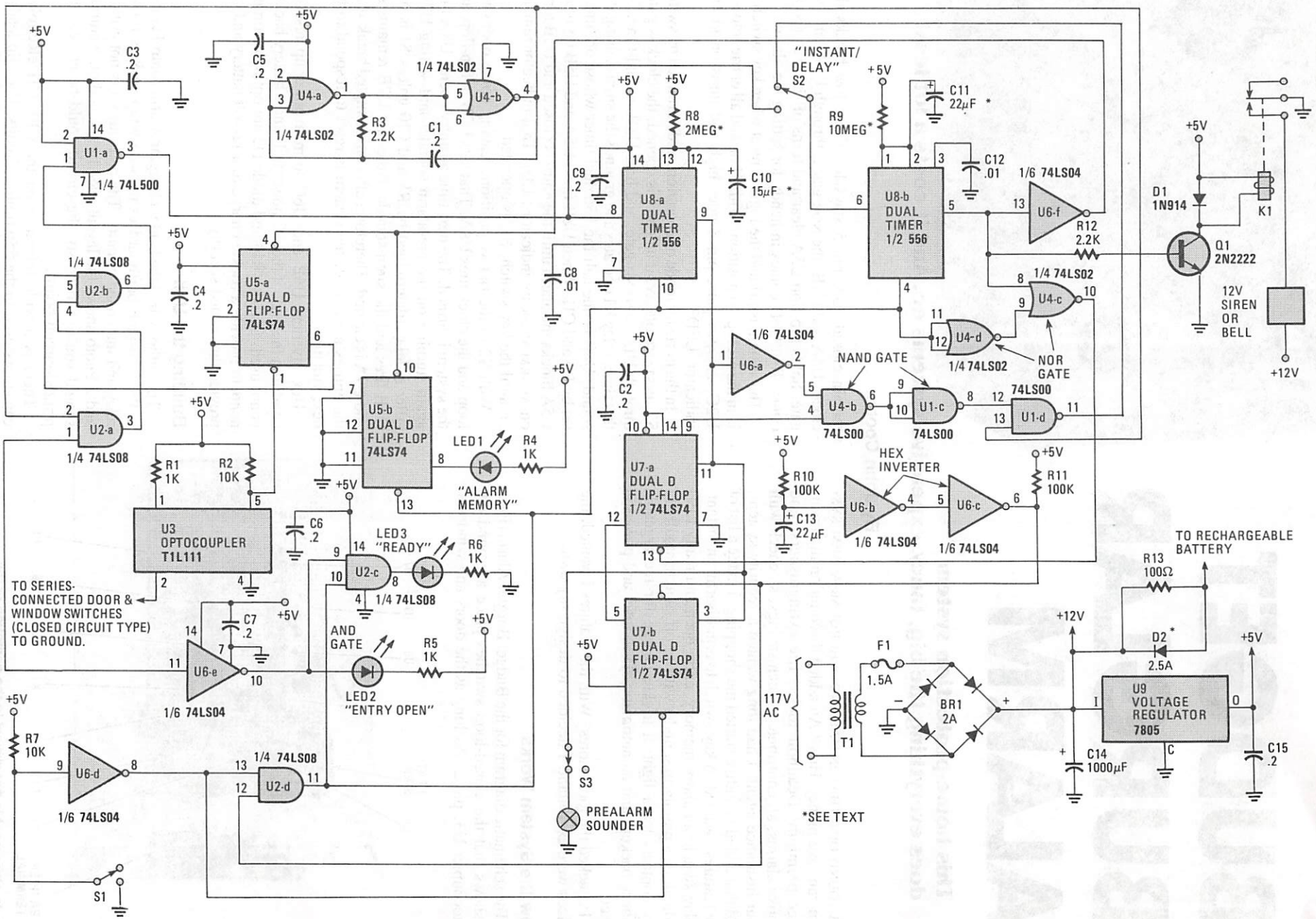


Fig. 1—Schematic diagram for the Budget Burglar Alarm. Resistor R13 and diode D2 are required only if a trickle charge is needed for battery backup, and can be included or not at builder's option.

PARTS LIST FOR THE BUDGET BURGLAR ALARM

SEMICONDUCTORS

BR1—2-A bridge rectifier or 4-1N4001 diodes in bridge circuit
D1—1N914 silicon, small-signal diode
D2—2.5-A diode (optional—see text)
LED1–LED2—Light-emitting diode, red
LED3—Light-emitting diode, green
Q1—2N5223 or 2N2222 transistor
U1—74LS00 quad NAND gate
U2—74LS08 quad AND gate
U3—TIL111 optocoupler (Radio Shack 276-132)
U4—74LS02 quad NOR gate
U5, U7—74LS74 dual-D flip-flop
U6—74LS04 hex inverter
U8—556 dual timer
U9—7805 voltage regulator +5VDC

RESISTORS

(All resistors are ¼-watt, 10% units unless otherwise noted)
R1, R4, R5, R6—1000-ohm
R2, R7—10,000-ohm
R3, R12—2200-ohm
R8—2-Megohm (see text)
R9—10-Megohm (see text)
R10, R11—100,000-ohm
R13—100-ohm, ½ watt

CAPACITORS

C1, C7, C9, C15—.2-μF, mylar or ceramic disc
C8, C12—.01-μF, ceramic disc
C10—15-μF, electrolytic (see text)
C11—22-μF, electrolytic (see text)
C13—22-μF, electrolytic
C14—1000-μF, electrolytic

ADDITIONAL PARTS AND MATERIALS

BZ1—5-volt DC piezoelectric buzzer (Radio Shack 273-060 or equivalent)
F1—1.5-A fuse and holder
K1—DPDT relay: 100-mA, 5-volt DC solenoid; 125-VAC, 1-A contacts (Radio Shack 275-215 or equivalent)
S1—SPST key-operated switch
S2—SPDT miniature toggle switch
S3—SPST miniature toggle switch
T1—Transformer: AC-line, step-down, power; 12.6-volt, 2-A, secondary winding
Cabinet, siren, 12-V, ¾-A, circuit board, wire-wrap IC sockets, barrier strip, hardware, wire, solder, etc.

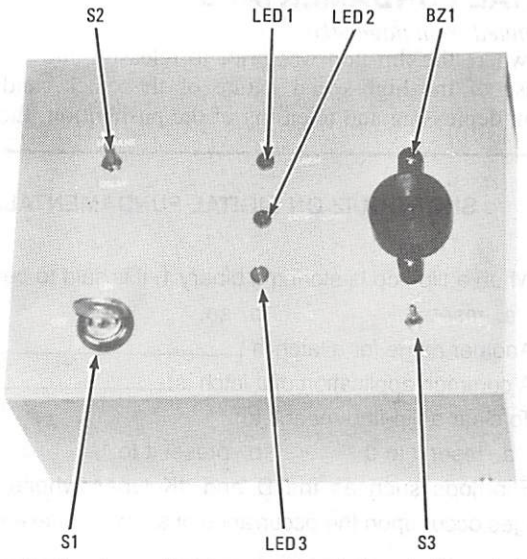
the maximum time that an alarm may sound.

A six-terminal barrier strip was used to connect the siren, 12-VAC, and protective loop to the control board. A plug-in transformer is used for T1 so that low-voltage AC could be provided for the control unit. The unit draws about 1 ampere with the siren on, so use sufficiently large wire and provide a fuse at the transformer.

The author selected a cabinet measuring 8 inches long, 6 inches wide and 4½ inches deep. While the pre-alarm sounder could have been mounted inside the cabinet, we installed it on the outer surface for better volume. If the siren is connected during testing, take proper precautions. It is very loud.

Testing

To test the control unit board, turn S1 off (open), put S2 on INSTANT and close S3. Place a clip lead from U3 pin 2 to



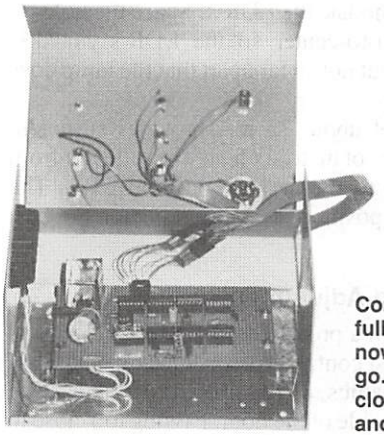
The unit's front panel is clean and uncluttered with only two toggle switches, a key switch and three LED indicators, in addition to the piezoelectric pre-alarm sounder. The sounder could just as well have been placed inside the aluminum chassis-box, but external mounting provides additional volume.

ground, which simulates a closed loop. Apply 12 VAC to the board. The three LED indicators should be off. Closing S1 should cause LED3 READY to turn on. Remove the clip lead from U3 and several things should happen: LED1, ALARM MEMORY, and LED2, ENTRY OPEN, should come on, LED3 READY, should go off. Relay K1 should energize until U8B times out, then it should de-energize. Note that the pre-alarm sounds though it is not used in the INSTANT mode. Using the same R/C values as the author should provide about 30 seconds of pre-alarm and about 3½ minutes for the siren. That concludes the INSTANT test.

To test DELAY operation, turn off S1 and reconnect the ground jumper to U3. Put S2 on DELAY, turn S1 on and simulate leaving home by breaking the jumper to ground momentarily. Wait until the pre-alarm has timed out, then again remove the ground jumper to simulate an entry. This time, after the pre-alarm times out, relay K1 should energize.

Using the Budget Burglar Alarm system is simple. Turn S1 off. If you're going out, set S2 to DELAY. If the ENTRY OPEN indicator is on, locate and close the open window or door. Turn on S1.

The chances are that, like me, you'll save money with this unit, but even if you don't, you'll surely sleep a lot better. ■



Completely wired, carefully checked, the unit is now assembled and ready to go. All that remains is to close the protective cover and put in the screws.