BUILD A TELEPHONE STATUS MONITOR

Automatically turns on indicator lamps at extensions when a phone on the line is in use

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IF YOU have phone extensions in your home, chances are you've interrupted a conversation or been interrupted yourself on occasion. The phone-line status monitor described in this article indicates that the phone line is in use by turning on indicator lamps at all phone extensions whenever one phone is off its hook. At the same time, it can automatically cut off sound from nearby stereo or television sets.

Circuit Operation. In Fig. 1, the terminals marked R and T (ring and tip) connect directly across the telephone line and monitor the line voltage. When the phone is "on-hook" (not in use), the line voltage is about 48 to 50 V dc. When the phone is "off-hook" (in use), the line voltage drops to about 6 to 10 V dc. This voltage drop occurs because of the IR loss along the lines between the central office and the phone. Also, central-office relays that monitor phone-line status add to this loss.

Regardless of line polarity, a positive voltage appears at the cathode of *D7*. If the phone is on-hook, the voltage will be high enough to cause *D7* to conduct. When *D7* conducts, an LED lights and turns on the phototransistor in *IC1*. Optoisolator *IC1* isolates all the status monitor circuitry from the phone line and prevents any imbalance in the line current. (An imbalance could introduce ac hum into the line or otherwise degrade performance of the phone.)

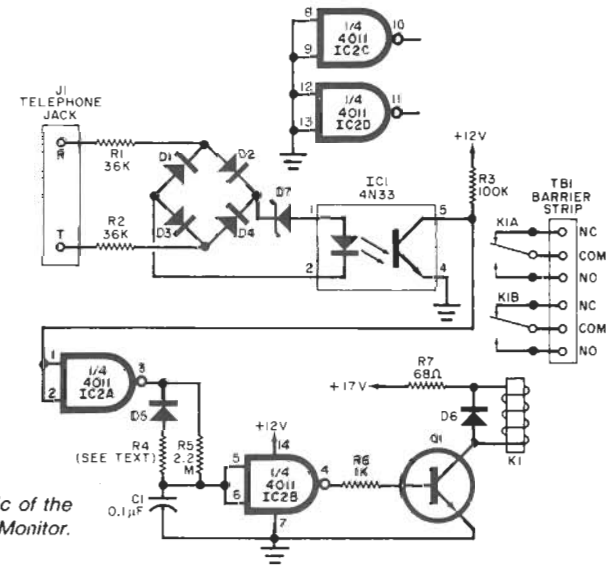

Fig. 1. Schematic of the Telephone Status Monitor.

PARTS LIST

C1—0.1-μF disc capacitor
C2—1000-μF, 25-V dc aluminum electrolytic
C3—100-μF, 25-V dc aluminum electrolytic
D1 through D6—1N914 diode
D7—1N5252, 24-V, 1/2-W zener diode
D8 through D10—1N4001, 1N4002, or 1N4003, 1-A rectifier
D11—1N759, 12-V, 400-mW zener diode
F1—3AG, 1/2-A fuse
IC1—4N32 or 4N33 optoisolator
IC2—CD4011B, quad dual-input CMOS NAND gate
J1—Modular telephone jack
K1—Dpdt relay; coil: 12 V dc; contacts: rated 3 A or more (Magnecraft W67PCX-2 or equivalent)
Q1—TIP29A power transistor

The following are 1/4-W resistors, except where noted:
R1, R2—36 kΩ
R3—100 kΩ
R4—100 kΩ or 1 MΩ; see text
R5—2.2 MΩ
R6—1 kΩ
R7—68-Ω, 1/2-W
R8—270 Ω
T1—24-V ac, ct, 600-mA transformer
TB1—6-terminal barrier block

Note: The following is available from BFA Electronics, P.O. Box 212, Northfield, OH 44067: complete kit (LSM) of parts including metal enclosure (which is *not* machined) at $30, postage and handling included. Also available separately from the same source is the pc board (LSM board) at $6 including handling and postage. Allow 6 weeks delivery.

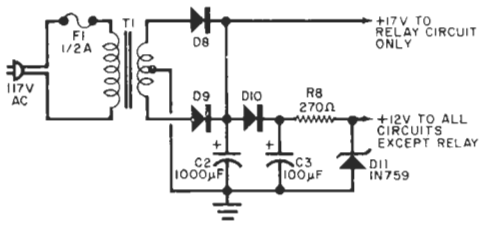

Fig. 2. Schematic diagram of a simple power supply for operating the circuitry of Fig. 1.

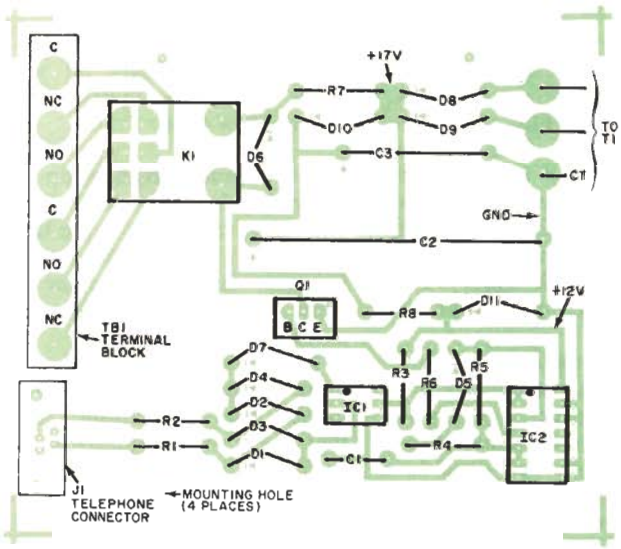

Fig. 3. Component placement guide for the Telephone Status Monitor's printed-circuit board.

With the phototransistor on, pins 1 and 2 of NAND gate *IC2A* are low and pin 3 is high. Ignoring for the moment the time delay of the *R4*, *R5*, *D5*, *C1* network, pins 5 and 6 are high and pin 4 is low, *Q1* is off and the relay is disengaged. These conditions reverse when the phone is off-hook.

Because rotary-dialing pulses momentarily open the circuit, they could appear as a series of quick on-hook conditions. These pulses would then cause the relay to chatter. To prevent this chattering, the delay network formed by *R4*, *R5*, *D5*, *C1* introduces a short delay for the signal going to pins 5 and 6 of NAND gate *IC2B*.

The selected value for *R4* also determines the conditions(s) that energize the relay. If *R4* is 100 kΩ, the relay will engage when the phone rings as well as when the phone is off-hook. If *R4* is 1 MΩ, the relay will energize only for off-hook conditions (ring-up conditions are ignored).

The normally–open contacts of *K1* can be wired to turn on indicator lamps placed by each phone to show whether or not the line is in use. Also, the normally closed contacts can be used to disconnect stereo or TV speakers whenever the phone is in use.

Figure 2 shows a simple power supply for operating the circuitry of Fig. 1. The parts layout diagram for this project is given in Fig. 3, while the foil pattern is shown in Fig. 4. ◇

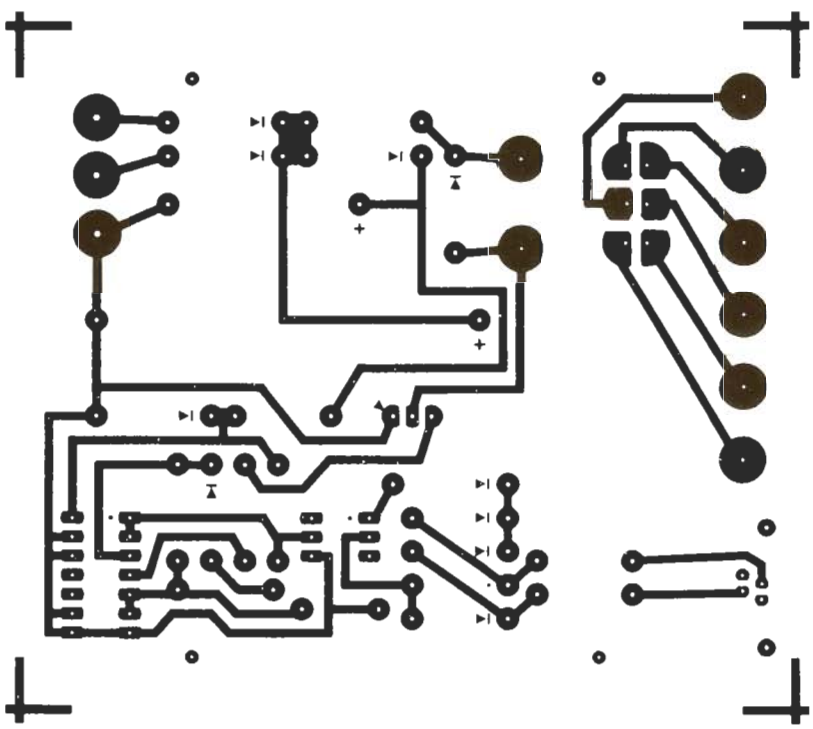

Fig. 4. Full-size etching and drilling guide for the project.