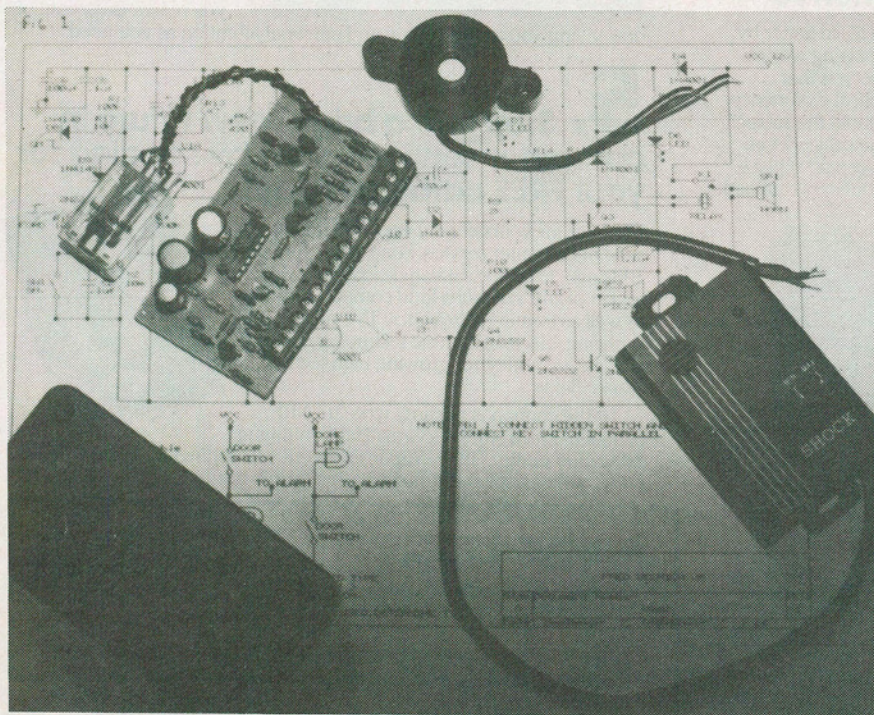


Professional Car Alarm

Protecting Your Car
With Multiple Sensors

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Imagine, an alarm system that has all kinds of professional features which you can build at home. This article contains all the plans and details to permit even the novice electronic enthusiast the opportunity to build and install his or her own pro-alarm system. The idea behind the system is to warn the potential criminal before he actually commits the crime on your vehicle that the car is well protected. At this point he makes his decision whether to proceed or not once the alarm has activated. The amateur criminal (which often cause the most damage) will definitely be scared off. As for the pro, if he wants what is yours, even if you had two pitbulls, your mother-in-law and a \$2,000 alarm system in your vehicle, he will probably take what he wants and with my luck leave my mother-in-law behind. I personally have had my car's window smashed and dash ripped apart on three occasions. Not once did I have an alarm system. Now I install an alarm system on my vehicle before it even leaves the dealer's show room.

How It Works

This project was intended for people who own jeeps, convertibles or vehicles with T-tops. It is fairly sophisticated, simple to build and easy to install. A similar commercial unit, installed, would set you back at least \$500.00. This system can be put together for under \$120.00 installed and working. The project comprises of several sections; a control panel comprising of 4 LEDs, 2 electronic shock detectors and a key switch. The control panel which handles all information, monitors the 2 shock detectors and sends related information to the 4 LEDs. There is also a tone which is heard to warn you that the system is in the process of being armed. It also monitors the key switch, all timing signals and controls the siren. The LED panel is very simple, it has one LED to monitor power, one LED to monitor shock detectors, one blinking LED to advise you that the system is armed and ready to be triggered, the fourth LED is used as a memory to warn you that the alarm was triggered. The key switch is mounted on the outside of the vehicle to allow you time to get in and disarm the alarm system. Disarming is done by flipping a hidden switch. The shock detectors are fully electronic. They have a LED mounted in each unit and a pot control to adjust the sensitivity. They can be adjusted to detect a fly landing on the hood. The shock detectors work on a simple principle. There is a small magnet which is rubber mounted. It is placed in

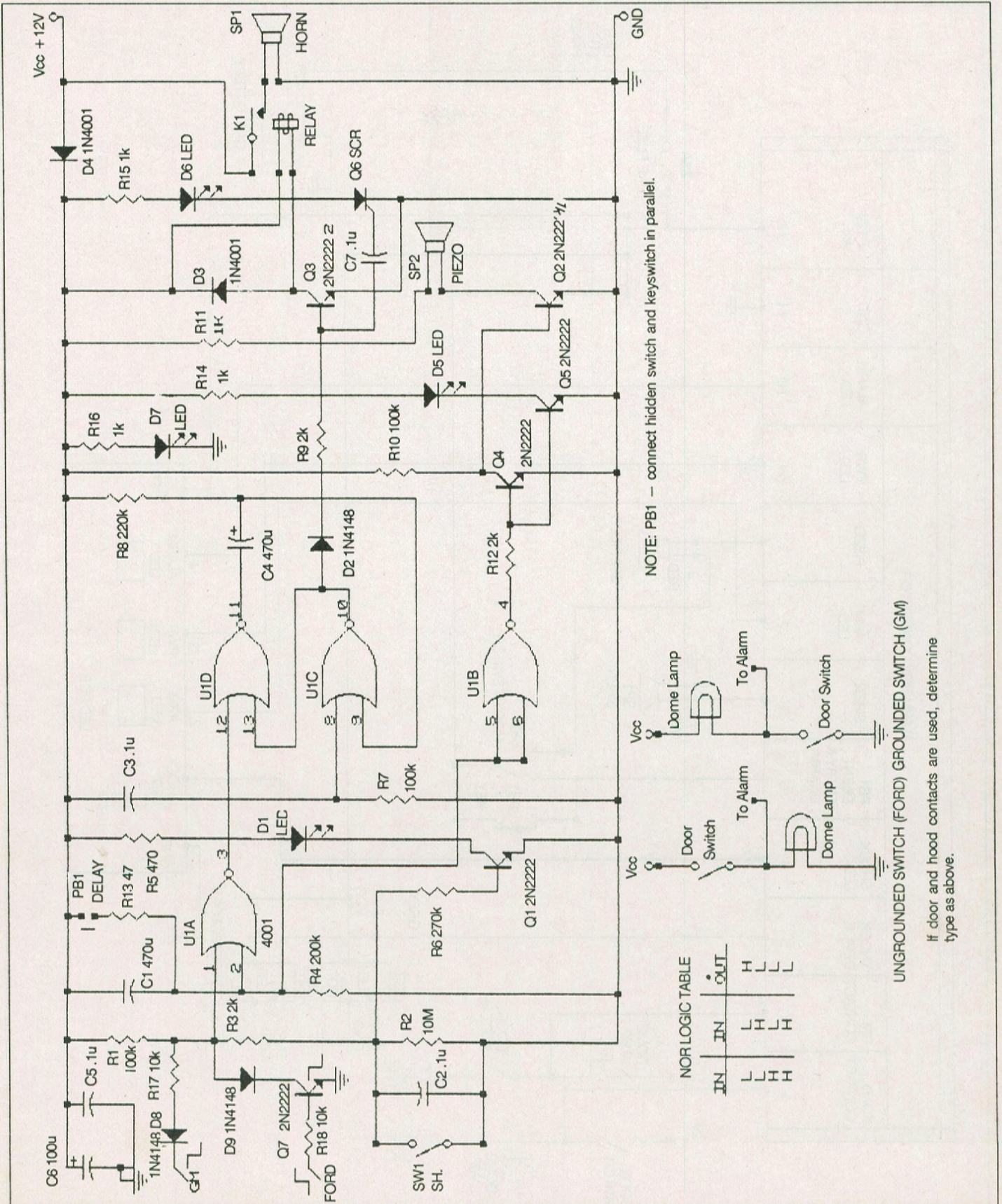


Figure 1. The schematic of the car alarm.

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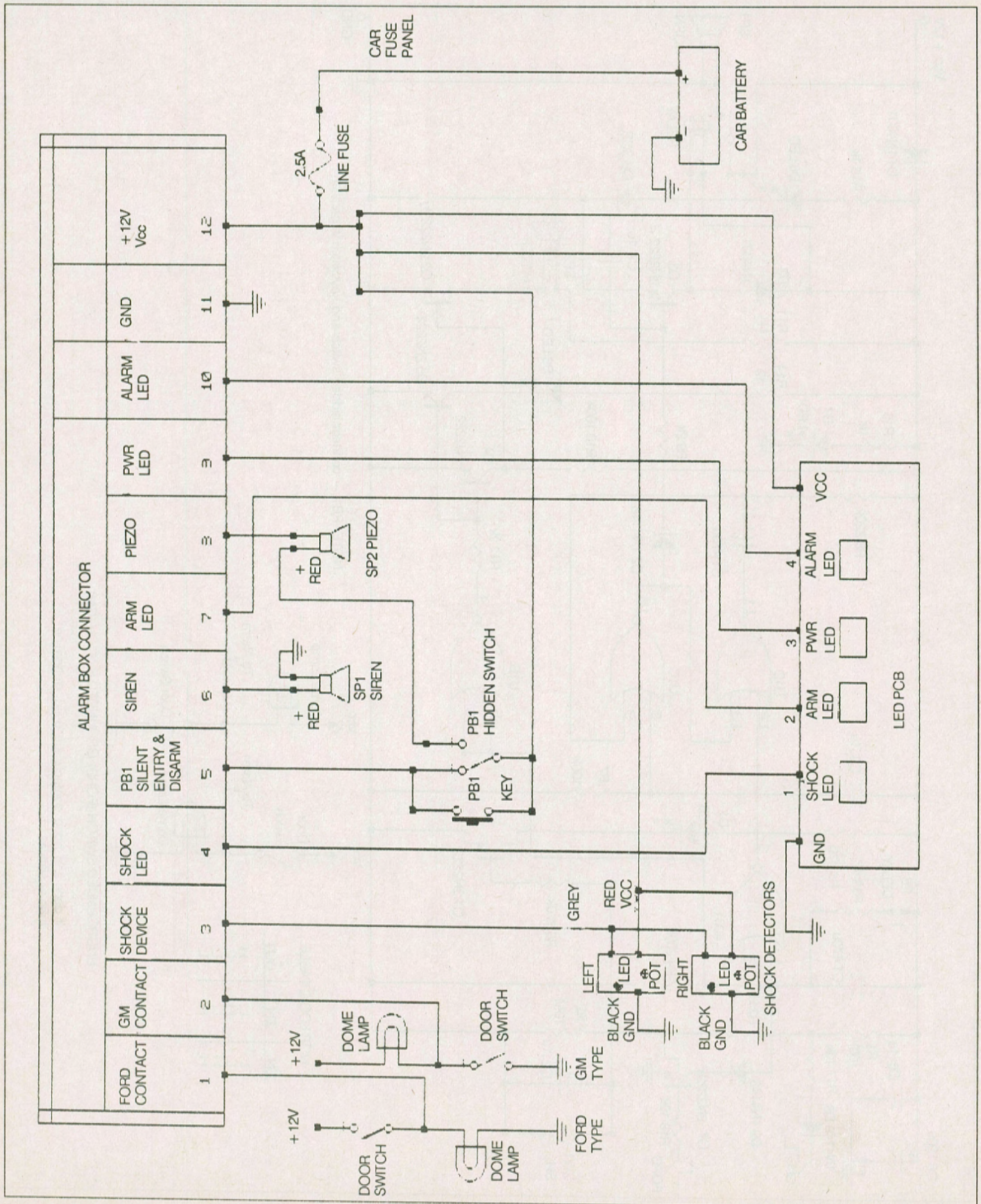


Figure 2. The wiring diagram for the car alarm.

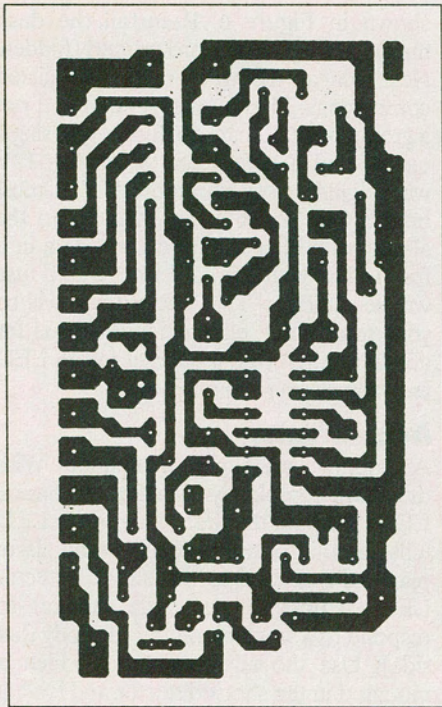


Figure 3. Main PCB.

front of a coil. When a vibration reaches the unit, the magnet vibrates and acts as a generator with the coil. The small voltage produced by the coil is sent to a voltage comparator whose threshold is adjusted to light up an LED and cause its output to go low.

The Working System

Suppose you are about to leave your vehicle, there will be 2 LEDs lit. The first LED tells you the power is OK. The second LED indicates the two shock detectors are stable. Tapping the dash would extinguish the LED momentarily to advise you it detected your presence (a vibration). At the same time, the LED on either or both shock detectors will light up and extinguish. If both LEDs on the dash are lit you can leave the vehicle. You flip the concealed switch and hear the tone coming from the piezo warning you the alarm is in the arming process. You exit the vehicle at this point. The time you have is determined by construction. The tone stops after the selected time and the third LED starts flashing rapidly. This indicates the alarm is armed. When you return to your vehicle the three LEDs should still be lit up. If the fourth LED is lit, someone has tampered with it. To enter the vehicle, simply insert the key in the momentary contact switch and enter. Observe the red blinking LED has stopped flashing and the piezo is active. Flip the concealed switch and the tone stops. There should be only 2 LEDs lit up; power and shock detector. If the fourth LED is on, the siren rang for a time determined upon construction, then the siren reset and re-armed itself ready for the next trigger.

Construction

Construction of the main control panel should pose no particular problems. Observe Figure 4. The relay is mounted off the board. There are 12 wires going to a connector mounted on outside of alarm box (this facilitates connections and gives you the chance to waterproof the alarm box with silicone). Apply bathtub silicone on inside lid to form tight seal. Drill one hole as shown 1/4 inch in order to pass 14 wires to connector. Spray lacquer may be used on PCB to give long lasting durability, especially if the alarm is being installed in a jeep. Double face tape is used to hold relay, circuit board and connector to alarm box. The next step is to mount the 4 LEDs on to the desired circuit board. See PCBs. Two styles were given depending upon the dash space in which these LEDs are to be mounted. LED sockets were used to hold the board in place in the dash. Cosmetics will not allow you to fasten PCB to dash with screws, so a dab of silicone is also used to secure the back of the PCB to the dash. This is done in order to stop LEDs from being pushed in when washing the dash, etc.

Installation

Installation of the whole system should take about 4 hours. You will need a drill and 2 bits. One bit to drill the hole for the con-

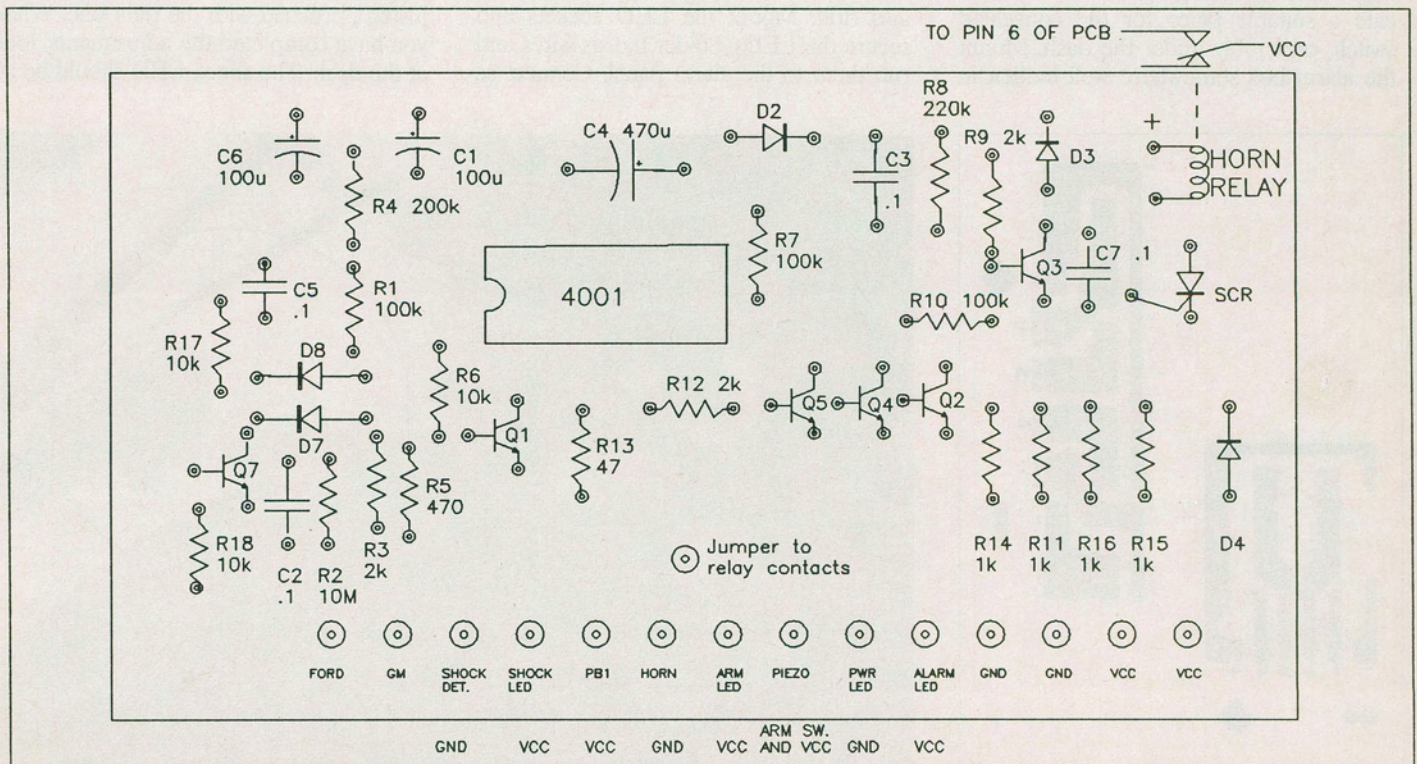
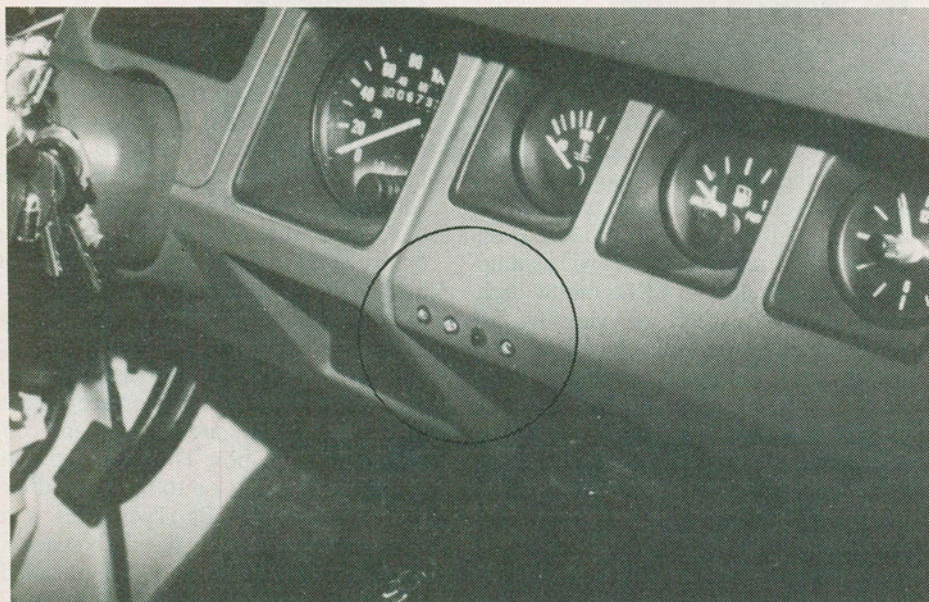


Figure 4. Component overlay for main PCB (not to scale).

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The four LEDs are shown located on the dash.

cealed switch and siren, the other for the keyswitch on the fender. Examine Figure 2 carefully for wiring diagram. Start by drilling the hole in the fender, make it somewhere easy to get to and wire up. Next, drill two holes in the engine compartment for the siren. Mount the siren facing towards the firewall and down towards the ground. This will prevent water and snow from getting in and remaining inside the siren. Locate a suitable place for the concealed switch, preferably under the dash. Mount the alarm box somewhere well hidden in

the car compartment. Try not to install it under the hood, it may get damaged by heat. Fasten it down with 2 face tape. Proceed to mount the shock detectors directly on to side panels, one on each side. Shock detectors work best if mounted near the doors on side panels but screwed into the body, directly on to steel. Remove the section of the dash where you wish to install LEDs. Mark off 4 holes of 1/4 inch and drill. Mount the LED sockets and secure the LEDs. Solder the six wires and run them to the alarm panel. Connect as

shown in Figure 6. Reinstall the dash making sure the wires are properly hidden. Next, run all the wires to the associated components. Find a good ground and run a ground wire. Locate the fuse box. Using a meter, find a connection which has 12V when ignition key is removed. You must have a live 12v at all times going to the alarm panel. For safety reasons, wire in a fuse in line with this 12V lead; a 2.5a fuse will be sufficient. This line and fuse will be your reset point, eliminating the need for another switch (use it to reset fourth LED and stop alarm from ringing)..

Adjustments

Adjustments are kept to a minimum. With the alarm completely installed, you have 2 LEDs lit up on the dash. The power LED tells you that power is reaching the alarm panel, the second is the shock detector LED. Adjust the left side shocker to respond to a small hit on the car body (left side). Use the adjustment pot which is mounted in the shock detector and look at the LED on the shock detector. The LED should light up. If not, turn adjustment clockwise to increase sensitivity. You will probably tend to adjust shocker too sensitive. Be lenient or else a car parking next to yours might be all that's needed to trigger the alarm. Trial and error with readjustments will eventually lead you to the desired sensitivity. Once the left side is adjusted, proceed with the right one. When you have completed the adjustments, look at the dash. The shock LED should be lit.

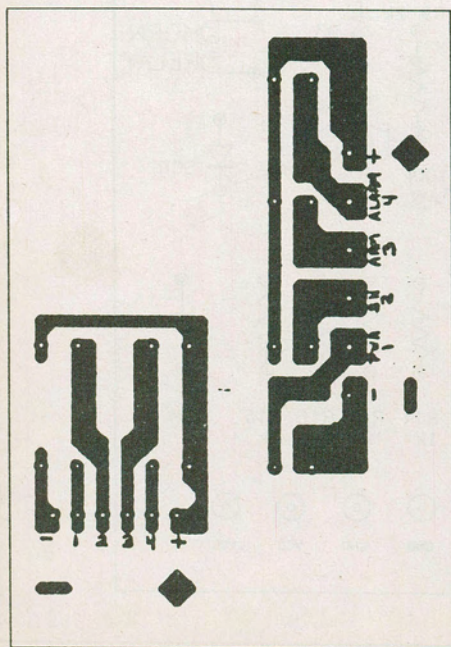
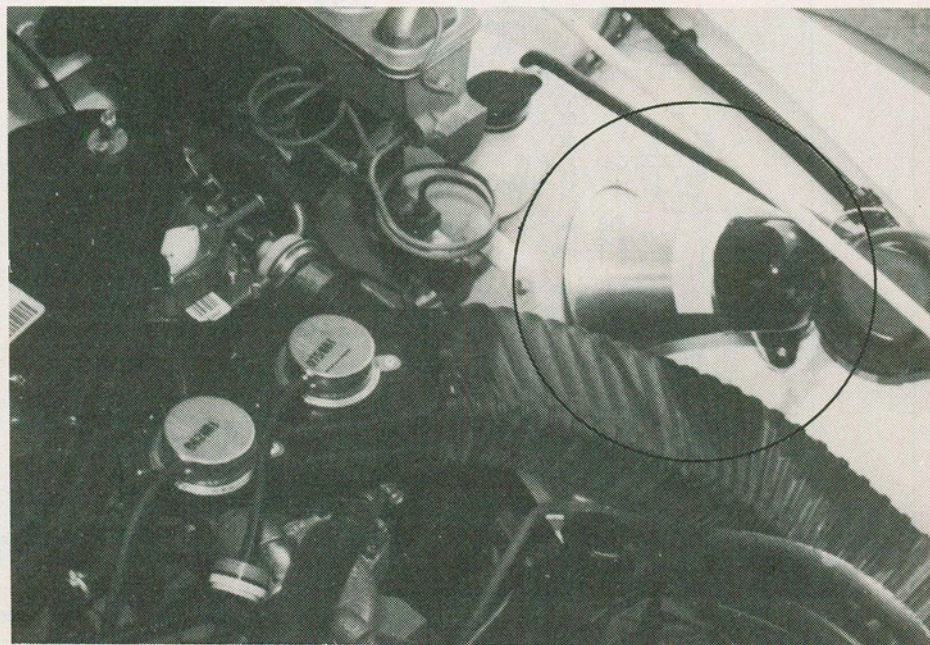


Figure 5. Use either LED printed circuit.



Note the siren mounted towards the firewall and pointing to the ground.

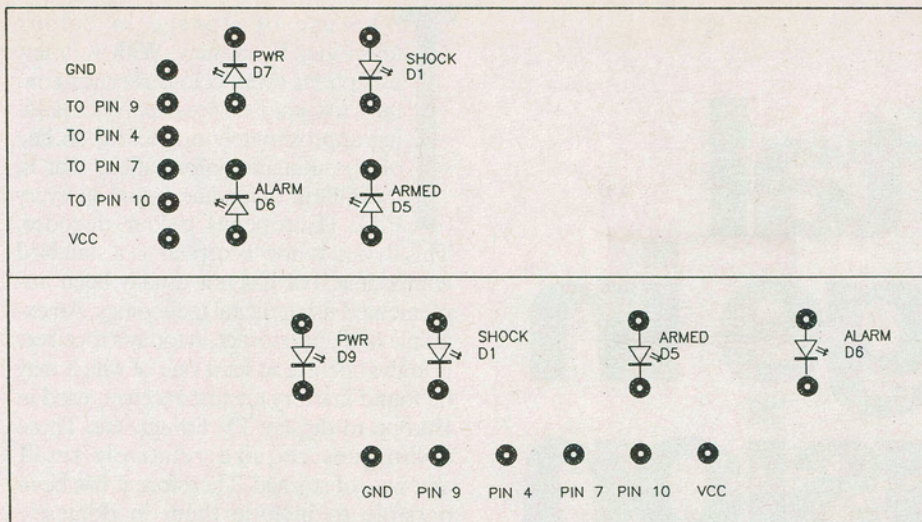


Figure 6. Either of these LED PCB overlays may be used. The upper one is for LEDs in a square, the lower for LEDs in a row.

Hit any part of the vehicle. The LED should extinguish momentarily. The alarm should now be functioning properly. Try it out a couple of times. Time the delays to make sure you have sufficient time to enter and leave the vehicle. Let the alarm signal ring once to make sure it turns on. It should turn off after a time delay. Remember, an alarm is only a means to scare off the average thief.

Technical Description

There are three separate inputs. U1A forms the basis of the input stage. Pin 2 is connected to C1 and R4; these form a timing circuit. The time it takes to charge C1 is approx. $(C1 \times R4) \times 1.1$. At this point pin 2 will go low. C1 value may be changed to increase or decrease enter and exit time. R13 is connected across C1 through the key switch and hidden switch (PB1) to pull pin 2 of UA1 high, also discharging C1. R1, R2, R3 form a voltage divider keeping pin 1 of UA1. R3 keeps pin 1 of UA1 slightly above GND potential if SW1 (shock detector) is activated. C2 prevents any spikes from occurring on line which could destroy IC. Door and hood contacts could be connected if desired. D8 and R17 wait for a low input and prevent a permanent high from being fed to 1A pin 1. Vehicles such as GM use this arrangement; 12V going to the dome lamp waiting for the door switch to close. This sends a low to U1A upon closing of the door switch. D8, Q7, R18 form an inverter. Ford uses the arrangement of a low waiting a high. C6 and C5 filter any noise on the power line. Q1 follows the input of U1A pin 1. Q1 is switched on grounding LED D1 through the current limiting

resistor R5. If a low input is present at 1A pin 1, Q1 is turned off, opening the path between D1 and the ground. U1B inverts the signal present on U1A pin 2. It also follows the charging circuit of C1 and R4. Initially the output of U1B is low. The output of U1B goes to inverter Q4, the output of Q4 is taking from the collector an fed to the base of Q2. Q2 is switched on and SP2 will ring. When C1 is charged, 1B's output will go high and Q4 is switched on. The collector of Q4 goes low and this causes Q2 collector to go high, in turn, shuts off SP2. The base of Q5 is connected to the output of U1B. When U1B's output is low Q5 is switched off. The collector being high will turn off LED D5. Once the output of U1B goes high, Q5 will turn on and the collector will go low allowing LED D5 to turn on. R14 and R11 limit the current which LED D5 and SP2 will receive to about 20ma. U1C and U1D form a flip flop. C3 and R7 allow the flip flop to reset upon power up. R8 and C4 give the "on" time of the flip flop. To determine the different timings use the formula $(C3 \times R7) \times 1.1$. The output is fed to the blocking diode D2 and biasing resistor R9. During the on time of flip flop, Q3 is switched on, causing it's collector to go low. This activates the relay and horn SP1. D3 is used to shunt out the current when the relay coil collapses (power is removed). C7 lets a pulse from the flip flop pass causing SCR Q6 to latch up. Current will flow from the SCR to LED D6 and the limiting resistor R15, causing the LED to light up. In order to reset the SCR, power must be removed entire circuit. D4 is used to ensure proper polarity. Limiting resistor R18 and D7 monitor power. ■

PARTS LIST

Resistors

R2	10m
R3,9,12	2k
R4	200k
R5	470ohm
R6	270k
R7,10	100k
R8	220k
R11,14,,15,16	1k
R13	47ohm
R17,18	10k

Capacitors

C1,4	470uf 16V
C2,3,5,7	.1uf
C6	100uf 16V

Semiconductors

U1	4001 Quad NOR gate
D1,7	LED high intensity green
D5	LED blinking (Radio Shack 276-036)
D6	LED high intensity red
D2,8,9	14148
D3,4	1N4001
Q1,2,3,4,5,7 2	N2222 or 2N3904
Q6	SCR (Radio Shack 276-1662)

Miscellaneous

SW1 Model A-180 available at : Addison Electronics, 20th Ave., Montreal, Quebec H1Z 3S7
 SP1..... Horn (siren 12V 0.5 amp).
 SP2..... PIEZO (Radio Shack 273-060).
 K1..... Relay 12V single contacts 3amp.
 PB1-A Momentary Key Switch (Radio Shack 49-523).
 PB1-B DPDT Switch (Radio Shack 275-626).
 Utility box approx. 2" x 4" x 1 1/2 (Radio Shack 270-222).
 Terminal strip 12 position (Radio Shack 274-679).
 Fuse holder inline and fuse 2 1/2 amp (Radio Shack 270-1238).
 Double face tape.
 Screws to mount horn, shock detectors.
 PCB main alarm PCB and LED PCBs predrilled available through: F.R.E.D. 5387 Moreau, Chomedey, Laval, Quebec H7W 9Z7
 \$16.00 main PCB, \$8.00 LED PCBs, add \$2.00 postage and handling.
 All resistors are 1/4 watt.