Designer's casebook

Auto intrusion alarm uses C-MOS circuits

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A sophisticated alarm circuit that uses the horn of the car and incorporates multiple time delays has been designed around two C-MOS packages—a natural choice for use in automobile intrusion alarm systems because of their extremely low power consumption.

The circuit, which is armed by a hidden switch located inside the car, has a short delay period after it is enabled, to permit the driver to leave the car without tripping the alarm. Thereafter, opening a door or trunk lid will trigger the alarm and, following another short interval (to permit the driver to enter the car and disable the alarm) the horn is pulsed approximately 60 times per minute, so as not to sound stuck. After several minutes, the alarm circuitry resets itself, ready for another intrusion. All of the time delays can be adjusted by changing resistor values.

The figure shows the schematic of the alarm circuit using a CD4001 quad NOR gate and a CD4013 D-type flip-flop. The input to the circuit is taken from the door switches that control the dome light and short to ground when any door is opened. The alarm's input signal is normally 12 volts and also goes to ground when the doors are opened. The driver enables the alarm by a hidden spdt switch connecting 12 v to the circuitry.

Resistor-capacitor combination R1C1 develops a reset command signal to the intrusion memory when the alarm is enabled. This time delay permits the driver and passengers to leave the automobile prior to the arming of the flip-flop. Once the reset time delay expires, the flip-flop is ready to detect a switch closure to ground at the input. When a closure to ground occurs, a positivegoing signal clocks the D-type flip-flop. Capacitors C2 and C₃ were initially charged to 12 v during the reset interval, and they begin to discharge. R2C2 discharges below the NOR gate input threshold first, causing the 1hertz astable oscillator to turn on. This astable is used to drive a small relay or transistor that turns the horn relay in the car on and off. If C1 equalled C2, the voltage on the reset of the CD4013 at turn-on would be half of the supply voltage, which is not a valid state. Therefore C1 is made twice C₂, giving a reset voltage of two thirds the supply voltage. R₃C₃ discharges below the NOR gate input at a much later time, generating a reset command to the intrusion memory. Thus, the complete process can repeat itself if another intrusion is detected.

When the driver enters the car, the alarm is turned off but will be initialized instantly if turned on again. In



Smart alarm. C-MOS intrusion detector for an automobile uses only two ICs, yet provides a high degree of flexibility. Delay times are provided to aid in the arming and disarming of the alarm. Once the pulsating-horn alarm is sounded, it resets automatically after several minutes.

practice, a time delay of 30 seconds was chosen for the R_1C_1 time constant. R_2C_2 was chosen to be 15 seconds. and R₃C₃ is 300 seconds. Either a relay or an npn transistor may be used to trigger the horn relay in the car. depending on how much current must be controlled:

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both these alternative output circuits are shown in the diagram. Since only two C-MOS ICs are used, the circuit fits easily on a small circuit board and mounts under the dash. If the trunk or hood switch is paralleled with the door switches, then it too will trip the alarm.