SUPER SIREN ALARM

An alarm system is useful only if its warning is noted. With the distinctive sounds that this siren can produce, that's no problem.

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THIS ELECTRONIC SIREN ALARM IS THE perfect complement to your custom-designed security system. Whether you want to protect the belongings in your home, the belongings in your car, or alert your family to a fire, this low-cost but powerful alarm generates a variety of attention-getting sounds and provides 10 watts of output power to the speaker.

How the alarm is triggered is totally up to you. Indeed, a successful security system often depends upon a novel scheme that is unfamiliar to the intruder. Regardless of the detection device used—trip switches, ultrasonic detectors, fire and smoke detectors, etc.—the interface to the alarm is a simple switch or relay. Wire the alarm to an existing power source and detector, add a suitable speaker, and your system is all set to operate.

How it works

The siren alarm circuit is shown in Fig. 1. Timer IC1-a, half of a 556 (see Fig. 2), is connected as a low-frequency astable multivibrator (LFM). In that configuration, the squarewave output at pin 5 remains fixed at approximately 50 percent of the duty cycle as its frequency is varied by timing-resistor R1. With the exception of the TWO-TONE and PULSE modes, the LFM's squarewave output is integrated by R-C integrators R2 and C4, producing a triangle wave at pin 11 of IC1-b. Timer IC1-b is configured as an audio-frequency voltage-controlled multivibrator (AFM). Its frequency is controlled by the voltage on control-voltage input pin 11 and by timing resistor R3. The triangular waveform at this pin frequency-modulates (FM's) the AFM so that the squarewave output at pin 9 rises and falls in frequency to duplicate the familiar wail of a siren.

The TWO-TONE mode uses the same squarewave output from the LFM except that it is not integrated before it is used to FM the AFM. The squarewave, attenuated by R2, causes the AFM to shift frequency abruptly at the rate determined by the LFM. The resulting sound is a distinctive "twee-dell" similar to that of a European police-car siren.

The PULSE mode also uses the LFM's squarewave output, but not to FM the AFM. In this mode, the squarewave is routed to the RESET input (pin 10) of the AFM. As long as this pin is held high, the AFM will operate normally but when it is brought low, the AFM will stop running. The squarewave, alternately high and low, will gate the AFM on and off at the frequency of the LFM. The pitch of the sound will be constant since the frequency of the AFM is determined only by the value of timing resistor R3.

The YOWL mode is a combination of the SIREN and PULSE modes. The squarewave from the LFM is both routed to the RESET input of the AFM and integrated by C4 and R2 at the control-voltage input of the AFM. The AFM is gated on and off as in the PULSE mode; but every time it is gated on, it sees the rising half of the triangle wave

TABLE 1

MODE	R1 (ohms)	R2 (ohms)	R3 (ohms)	C4	J1	J2
Mechanical siren	5.6 MEG	1K	150K	1000 μF	X	—
Electronic siren	470K	10K	120K	100 μF	X	—
Warble	100K	100K	100K	10 μF	X	—
Two-tone	560K	10K	150K	—	X	—
Pulse	680K	—	150K	—	—	X
Yowl	2.2MEG	1K	100K	500 μF	—	X

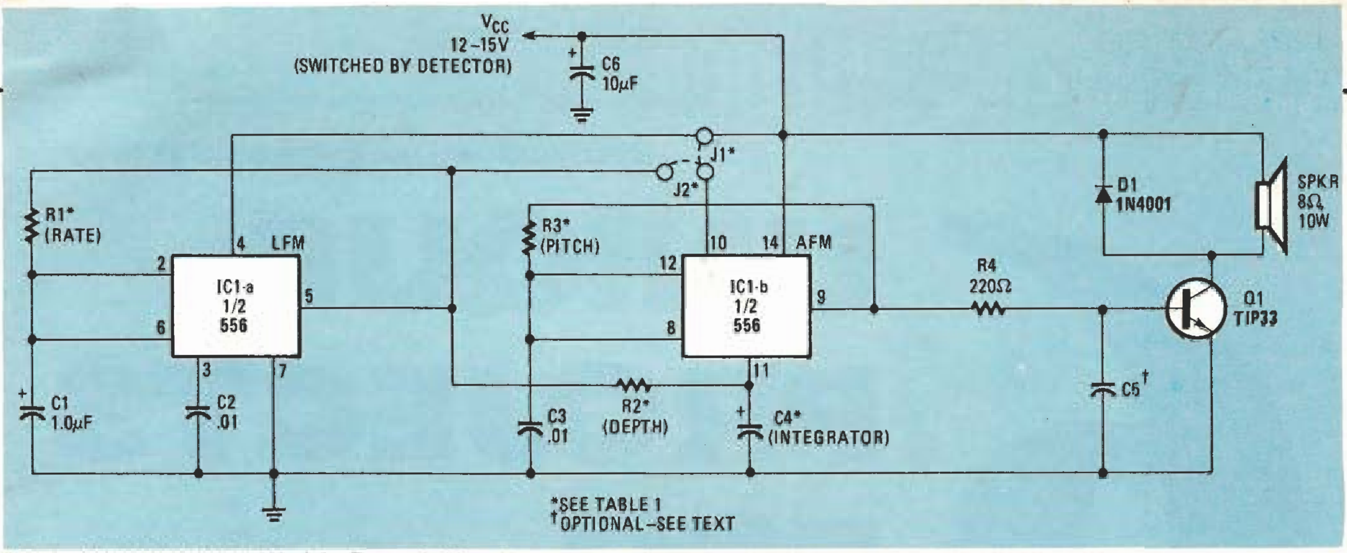

FIG. 1—SCHEMATIC DIAGRAM of the Electronic Siren Alarm. Typical values for R1-R3 and C4 are listed in Table 1.

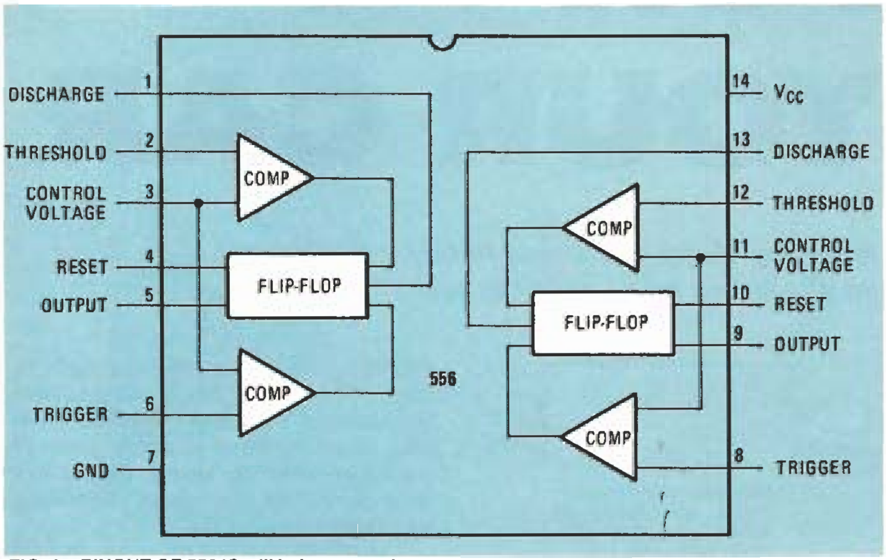

FIG. 2—PINOUT OF 556 IC will help you see how control- and signal-voltages are developed.

PARTS LIST

Resistors ¼ watt, 5% unless otherwise noted
R1-R3—See Table 1
R4—220 ohms, ½ watt
Capacitors
C1—1 µF, 35 volts, tantalum
C2, C3—0.01 µF, 50 volts, ceramic disc
C4—See Table 1, 25 volts, electrolytic
C5—0.1-1.0 µF, 50 volts, ceramic disc (see text)
C6—10 µF, 25 volts, electrolytic
Semiconductors
D1—1N4001, 1-amp, 50 PIV
Q1—TIP33 power transistor or equivalent
IC1—556 dual 555 timer
J1, J2—jumpers (see table 1)
SPKR1—8-ohm, 10-watt speaker (Radio Shack 40-1269 or similar)
Miscellaneous: Construction-or-PC board, wire, solder, etc.

at its control-voltage input. Consequently, the pitch of the sound is no longer constant during the on intervals but falls in frequency until the off interval begins.

Switching amplifier Q1 boosts the output to an attention-getting peak power of over 10 watts. If V_{CC} is increased to 15 volts from the normal 12 volts, the power output will be even greater. The squarewave output may sound harsh at some frequencies. The addition of filter capacitor C5 (from 0.1 to 1.0µF) will mellow the tone somewhat. Capacitor C5 and resistor R4 form a lowpass filter to remove some of the high-frequency components from the squarewave.

Construction

Since the alarm is meant to be part of a bigger system, no circuit layout or power-supply design is shown. The alarm may be built on the same construction- or PC-board as the detection circuitry. The circuit layout is not at all critical. Power-transistor Q1 need not be heat-sinked unless it is used in ambient temperatures greater than about 90°F. The siren draws less than 1.5 amps at 12 volts when run at its rated power output.

Operation

The sounds that can be produced are almost limitless. Table 1 gives some typical component values for different sounds as a guide to start you off. You are free to vary those values until you create a sound you like. In any case, final tweaking may be necessary, since the type of speaker and enclosure used will have an affect on the tone of the sound.

The rate at which the sound varies is determined by the value of LFM timing-resistor R1; increasing its value will decrease the rate and vice-versa. The pitch of the output is determined by both the amplitude of the modulating control voltage and the value of AFM timing resistor, R3. As the control voltage increases in amplitude, and/or the value of R3 is increased, the pitch decreases and vice-versa.

The range of modulation, i.e., the difference between the high and low frequencies of the AFM, is set by the value of R2. A small value of R2 permits a large range while a large value restricts it. About 1000-ohms is the practical minimum value for R2 as well as for R1 and R3.

The range is also controlled by the size of integrating capacitor C4. The product of the capacitor's value and that of R2 is the time constant of the integrator. The time constant establishes the linearity of each half of the triangle wave and also limits the amplitude that the triangle wave can rise to during the on time of the LFM. Because of that frequency dependency, there will be some interactions among R1, R2, and C4 as the range is set.

The alarm is best activated by switching the V_{CC} line. Not only is that a simple method, but the standby current is reduced to zero. The switching may be done directly by the detection device although that method is not suitable if the detection device cannot supply enough current. In that event, a relay or electronic switching, actuated by the detector, is recommended. R-E