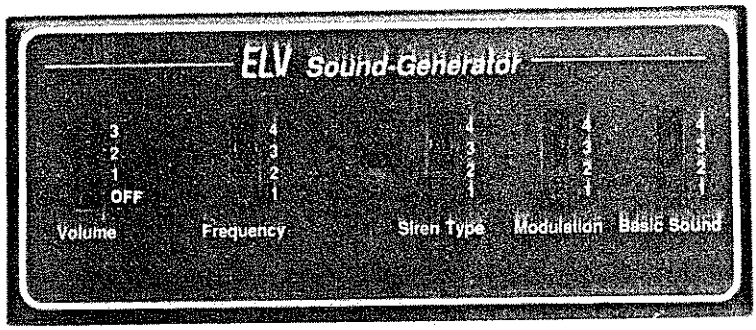
SOUND GENERATOR



The sound generator described here, designed and marketed as a kit by ELV, is capable of producing up 256 different siren-like sounds, including the popular Kojak-, FBI-, and Hawaii-Five-0 types. Compact, easy-to-build and suitable for use in conjunction with alarm systems in and on premises as well as on vehicles, the unit is complete with an on-board 20-watt amplifier.

The type of sound is selected with four slide switches on the front panel of the sound generator. Since each slide switch has four positions, a total number of 256 (4×4×4×4) different sounds are available. An output stage is included in the circuit to provide a solid 20 watts of audio power at a supply voltage of 12 V to 15 V. The slide switch at the extreme left on the front panel functions as a three-level volume control and as an on/off control.

Circuit description

Circuit IC1, a Type NE556, contains two multivibrators. One of these, IC1b, generates the basic siren sound. Switch S4 allows four different basic sounds to be generated by selecting one of four timing capacitors C7–C10. The output of IC1b, pin 9, drives the power output transistor, T1, direct via resistor R14. Depending on the position of volume switch S5, the loudspeaker is either disconnected ('off'), connected direct to the collector of T1 (volume level 3), or connected via series resistors R15 or R16 (volume levels 2 and 1).

Evidently, a single oscillator does not make a siren, let alone one capable of producing up to 256 different sounds. Circuit IC1b, is, therefore, frequency-modulated by applying a signal to its control voltage input, pin 11. This modulation signal is supplied by a second oscillator, formed by the parts to the left in the circuit diagram.

The second multivibrator in the circuit, IC1a, operates at a much lower frequency than IC1b. The oscillation frequency is determined by one of four capacitors C1–C4 connected to IC1a via the 'frequency' switch, S1. The other frequency-determining parts are R1 and R2, which set the charge and discharge periods respectively.

When S2 is set to the position shown in the circuit diagram, R3 is connected in parallel with R2, so that the input of buffer opamp IC2 receives a sawtooth signal. In the other extreme position, i.e., when S2 is set to the top position, R3 is not connected so that a triangular waveform is produced. The two centre positions of the switch produce a rectangular waveform and a combined rectangular/logarithmic waveform (as shown inset in Fig. 1). The latter is obtained with the aid of components C6, R7 and R3.

Opamp IC2 forms a buffer between the modulation waveform generator, IC1a, and the tone generator, IC1b. The level of the modulation signal fed to IC1b is determined by the position of switch S3, which connects one of four series resistors R8–R11 between the output of IC2a and pin 11 of IC1b. Switch S3 thus determines the modulation intensity.

Summarizing the above, the functions of the slide switches in the circuit are as follows (front panel marks in brackets):

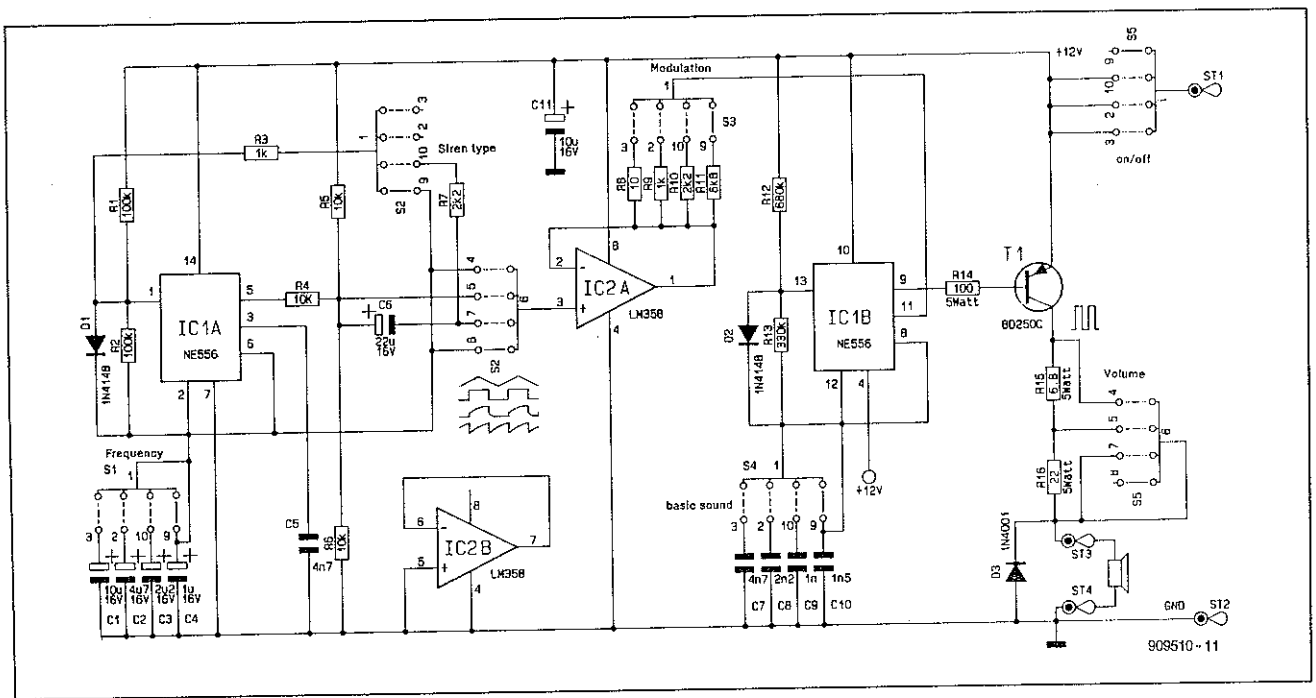


Fig. 1 Circuit diagram of the sound generator.

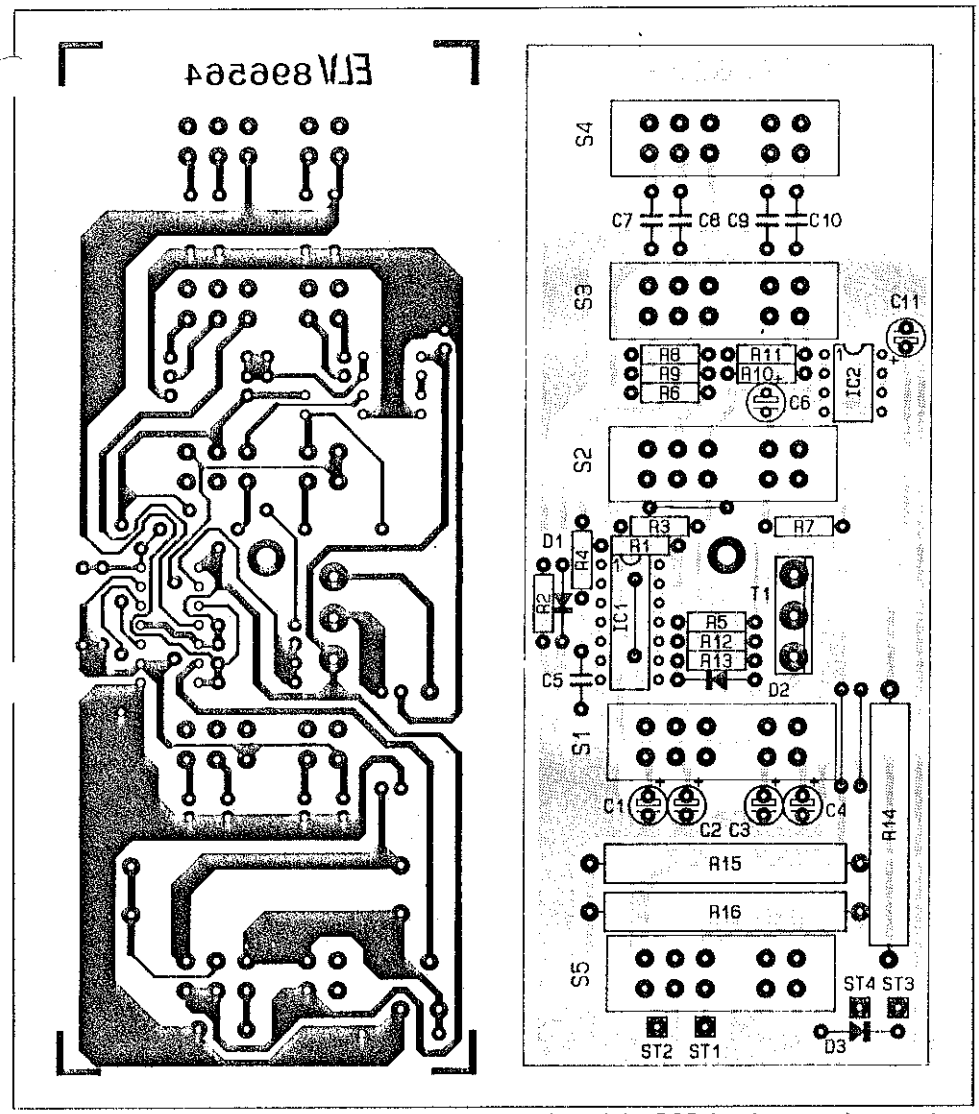


Fig. 2. Track lay-out and component mounting plan of the PCB for the sound generator.

- S1 (frequency): modulation frequency
- S2 (siren type): modulation waveform
- S3 (modulation): modulation intensity
- S4 (basic sound): fundamental siren frequency
- S5 (volume): sound level and on/off control

The four switches S1–S4 allow 4^4=256 different sounds to be generated at three volume levels.

For the highest possible sound level (particularly in alarm systems), it is recommended to use a pressure-chamber type loudspeaker with a sufficiently high power rating (≥20 W). For other applications, standard loudspeakers may be used with good results. The minimum loudspeaker impedance is 4 Ω.

Construction

The sound generator is a relatively simple circuit which should not present difficulties in assembling. Moreover, the unit is supplied in kit form, which obviates problems with obtaining certain components.

Start the construction by fitting and soldering the low-profile parts, followed by the higher parts, on the single-sided printed circuit board shown in Fig. 2. The overlay printed on the component side of the board indicates the position of the parts mentioned in the parts list.

To assist in their cooling, the 5-W power resistors are mounted at a small distance above the printed-circuit board.

The use of a relatively flat enclosure makes it necessary to bend the power transistor, T1, towards the PCB surface as shown in the photograph of the completed board. By virtue of its low internal resistance, and the fact that it is driven at a fairly high level, T1 dissipates relatively little heat, even at full output power. Consequently, the transistor does not require a heat-sink.

After a careful visual check of the completed board, this may be fitted into the enclosure supplied with the kit. Connect the supply voltage to PCB terminals ST1 (+12 V to +15 V) and ST2 (ground). Connect the loudspeaker to terminals ST3 and ST4. Drill holes in the enclosure to pass the supply wires and the loudspeaker wires. Make knots in the wires at the inside of the enclosure to provide strain reliefs. Finally, fit the top half of the enclosure and secure it with the screws supplied.

Practical use

When a 4-Ω loudspeaker is used, the unit draws a peak current of up to 4 A. When used in a switched circuit, e.g., as a horn, the sound generator may be powered via a push-button or a relay with a suitable contact current rating. Use as a horn is possible because the siren starts to sound the moment is it powered. It should be noted, however, that in many countries the use of a siren as a sound actuator device in or on vehicles, and in some cases in or on premises as well, is restricted to emergency services. The use of a siren in general may also be subject to special licenses, rules or regulations as regards on-time, sound type and sound level. ■

COMPONENTS LIST

content of kit supplied by ELV France

Resistors:

1	6.8Ω 5W	R15
1	10Ω	R8
1	22Ω 5W	R16
1	100Ω 5W	R14
2	1k	R3;R9
2	2k2	R7;R10
1	6k8	R11
1	9k1	R4
3	10k	R4;R5;R6
2	100k	R1;R2
1	330k	R13
1	680k	R12

Capacitors:

1	1nF	C9
1	1n5	C10
1	2n2	C8
2	4n7	C5;C7
1	22nF	C11
1	1µF 16V	C4
1	2µ2 16V	C3
1	4µ7 16V	C2
1	10µF 16V	C1
1	22µF 16V	C6

Semiconductors:

1	NE556	IC1
1	TLC271	IC2
1	BD250C	T1
1	1N4001	D3
2	1N4148	D1;D2

Miscellaneous:

5	2-pole 4-way slide switch	S1–S5
4	solder pin	
1	printed-circuit board	
1	enclosure	

A complete kit of parts for the sound generator is available from the designers' exclusive worldwide distributors:

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