

BUILD A Speaker Protection Circuit

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AFTER LONG periods of listening to reproduced music played at a high volume level, it's not uncommon for one's hearing to become insensitive to average loud sounds. As a result, the listener often turns up the gain to compensate for this diminished sensory perception.

The best way to protect our hearing ability—and do a good turn for our speaker systems—is to put an upper limit on the decibel level our sound systems can generate. This is precisely what the automatic audio-overload/speaker-protection circuit described here does.

There are, of course, many circuits that use zener diodes and SCRs to shunt power to dummy loads. Most act too fast, however. This causes important dynamics such as drum rolls, cymbal crashes, and trumpet blasts to get "crunched." A slow-acting threshold sensor that has built-in hysteresis and a comparator circuit would be excellent for providing automatic level limiting, but it requires a power supply. The speaker-protection system here, on the other hand, is far simpler in circuitry, self-powered, automatic in action, and connects directly between the power amplifier and the speaker system it is to protect. It is also inexpensive to build.

About the Circuit. The output from the power amplifier to the speaker-protection circuit is shown in Fig. 1. (The rectifier diodes should have a forward resistance of approximately 600 ohms to introduce minimal signal distortion.) The signal then goes to the normally-closed relay contacts and out to the speaker system.

At high signal levels, the charging circuit consisting of $R1$ and $C1$ generates sufficient voltage levels to energize $K1$ and open its contacts. When $K1$ energizes, $R2$ is connected in series with the speaker system to drop the sound level. Then, when the input signal level drops, $K1$ de-energizes

and its contacts automatically close, removing $R2$ from the circuit.

Construction. The simplicity of the protection circuit lends itself to just about any method of construction desired. For those who wish to use printed-circuit construction, an actual-size etching-and-drilling guide and components-placement diagram are given in Fig. 2. Once wired, this compact pc assembly can be permanently mounted inside the speaker system's enclosure or connected directly to the speaker terminals.

Relay $K1$ should have a dc coil resistance of about 100 ohms and a dc pull-in rating of at least 2 volts less

than the required rms voltage cutout point of the speaker system. This allows for the voltage drop across the rectifier circuit. The diodes and capacitors should have twice the peak voltage rating of the signal passing through them. The components specified in Fig. 1 are for a 4- and an 8-watt unit and will protect a speaker system rated at 5 to 10 watts with a 20% derating factor for safety.

Resistor $R1$ can be bypassed to move the operating point of $K1$ down to 4 watts.

Adjustment. Make certain that the common of each amplifier output circuit is connected to the common of the speaker protector and observe proper speaker phasing when connecting the device into your audio system. With a relay whose coil resistance is about 100 ohms, the circuit shown in Fig. 1 will cut out at 4, 8, or 12 watts if the value of $R1$ is 0, 50, or 100 ohms, respectively. Since the circuit is basically a voltage divider, doubling the value of $R1$, shifts the rms point 50% higher. You can also experiment with the value of $R2$ to obtain the low level desired. \diamond

PARTS LIST

- C1—100- μ F, 50-volt electrolytic
 - D1 thru D4—Silicon rectifier diode (see text)
 - K1—Spst relay with 100-ohm dc-resistance coil (American Zetler No. A 535-11-2 or similar) (see text)
 - R1—Value depends on power protection level: 0 ohms for 4 watts; 50 ohms for 8 watts; 100 ohms for 12 watts
 - R2—50-ohm, 1/2-watt resistor
- Note: The following items are available from Micro Sound, 1012 Disston St., Philadelphia, PA 19111; Pc board for \$3.00; board and all components (state R1 wattage) for \$10.00 postpaid.

Fig. 1. The self-powered circuit, left, automatically reduces speaker level when peaks occur.

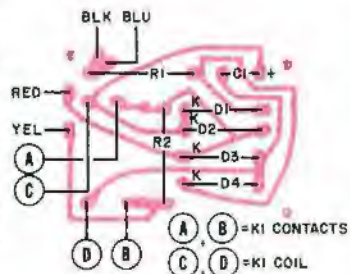
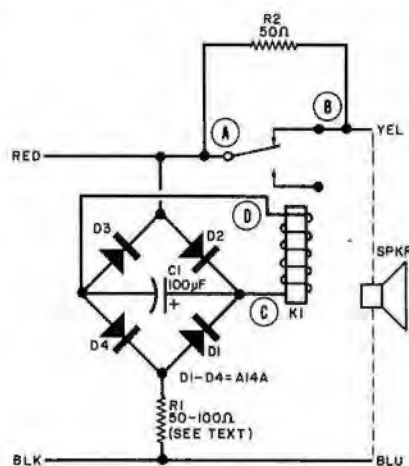


Fig. 2. Actual-size etching and drilling guide, right; component placement above.

