

# The Scanner Companion

*This simple project can make using your scanner more enjoyable by eliminating the annoying hiss between messages.*

If you like to listen to your scanner, but the constant hissing sound between messages bothers you, then the *Scanner Companion*, described in this article may be just what you've been looking for. The *Scanner Companion* is basically an amplified extension speaker with voice-deactivated muting. When no speech is present, the speaker is disconnected, thereby eliminating the hiss normally heard between messages. And for added convenience, there's also a volume control on the *Scanner Companion* to allow the scanner to be placed out of the way—maybe in another room—and still have control of its volume.

The unit can be built into an existing communications extension speaker. All it requires to operate is a single supply of between 6 and 12 volts DC. Best of all, no modifications to the scanner are necessary. It simply plugs into the ear-phone jack on the scanner itself.

**How It Works.** A schematic diagram of the *Scanner Companion*—which consists of two LM386 low-power audio amplifiers, an LM741 op-amp, a couple of transistors, and a few additional components—is shown in Fig. 1.

When the incoming signal is applied to the circuit, it travels along two paths: one path leads to an audio muting circuit (consisting of U1, U2, Q1, and a few other parts); the other path leads to the audio-amplifier section of the circuit. Let's look at the muting circuit first.

In the muting circuit, the audio signal is fed through coupling capacitor C1 to U1, which is configured (in the non-in-

verting mode) for a voltage gain of 20. After amplification, the signal is applied to a voltage-doubler circuit, consisting of C2, C3, D1, and D2, which changes the audio signal into a DC control voltage. That voltage is then used to turn on transistor Q1.

When power is applied to the circuit, C4 charges toward the supply voltage via R1. Capacitor C4, along with resistor R1 and op-amp U3, form a retriggerable monostable multivibrator. A voltage-divider network comprised of R2 and R4 sets the reference at pin 3 (the non-inverting input) of U3 at half the supply voltage. When a positive voltage is applied to the base of Q1, it turns on, allowing C4 to discharge. As C4 discharges, pin 2 (U3's inverting input) is pulled to rear ground potential. When the voltage at pin 2 of U3 goes lower than that at pin 3, the output of U3 is forced high.

Once discharged, C4 again slowly charges through R1. When the charge on C4 exceeds the voltage at pin 3 of U3, the op-amp's output again goes low (around 2 volts), resulting in a "squelch tail" of approximately two seconds. Most of that voltage is dropped across D3 and LED1, allowing Q2 to fully turn off.

When speech is detected, the voltage produced at pin 6 of U3 is sufficient to overcome the 2-volt drop across D3 and LED1. That causes Q2 to turn fully on, thereby feeding clear and undistorted audio to the speaker. When activated, LED1 lights, showing that the unit is working. Once speech stops, there should be a two-second delay

before LED1 extinguishes, and the speaker is again muted; that slight delay is provided to prevent choppy audio and is similar to the squelch delay used on scanners.

The audio amplifier section of the circuit consists of a second LM386 low-power audio amplifier (U2), two capacitors, and an audio-taper potentiometer (R3). Audio is fed through C5 and R3 (the volume control) to the non-inverting input of U2, which provides a gain of 20. After amplification, the signal is fed to the speaker. But, as you already know, no audio will be heard unless transistor Q2 is turned on, connecting the minus terminal of the speaker to ground. The effect of this is that the speaker is inoperative unless a signal is being received, thereby eliminating the hissing sound that is normally heard between messages. Capacitor C7 is included to filter the supply.

Now that we know how the *Scanner Companion* works, it's time to build your own. Let's do that now.

**Assembly** There is nothing particularly critical about the construction of the *Scanner Companion*; so use the construction technique that you are most comfortable with. The author's prototype unit was built on a small piece of perfboard, measuring 1- x 2¼-inches, with the interconnections between components handled through point-to-point wiring.

Although the author did not socket the IC's in his prototype, it's a good idea for you to do so. Aside from making troubleshooting and repair a lot easier,



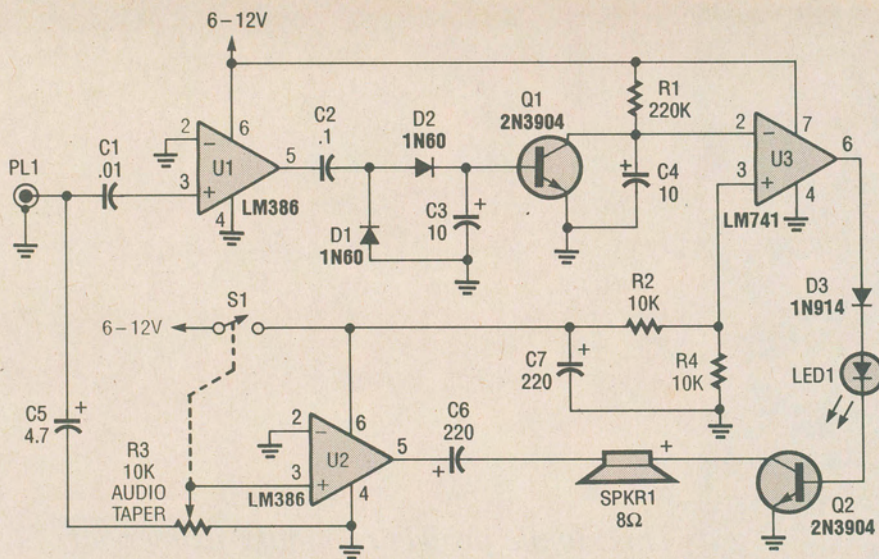


Fig. 1. The Scanner Companion consists of two LM386 low-power audio amplifiers, an LM741 op-amp, a couple of transistors, and a few additional components.

the use of sockets makes assembly a bit easier because you need not worry about overheating the IC terminals, thereby destroying the relatively expensive IC's.

You might also consider mounting the passive components and diodes in an IC socket, giving the circuit board a much neater appearance. In addition, that technique has the advantage of making replacement of those components a lot easier.

Note from the schematic diagram that S1 is piggy-backed to the volume control, R3; however, a separate switch and potentiometer can be used instead.

The author's unit was housed in a 4- x 4- x 2½-inch plastic, mini-CB, extension-speaker enclosure, which is avail-

able for \$6.95 from an after-market automotive parts supplier, J.C. Whitney & Co. (1917-19 Archer Ave., P.O. Box 8410, Chicago, IL 60680; Tel. 312-431-6102). That speaker, and most other speakers of that type, have sufficient room inside for the additional circuitry, and the speaker in the case can be used as the project speaker.

If you also choose to take that approach, you'll only have to drill one hole in the enclosure for the volume control, R3. The circuit board and battery holder can be mounted to the inside walls of the enclosure with double-sided tape, eliminating the need to drill additional holes for mounting, etc.

**Using the Unit.** To use the Scanner Companion, turn the unit on and insert

## PARTS LIST FOR THE SCANNER COMPANION

### SEMICONDUCTORS

U1, U2—LM386 low-voltage, audio amplifier, integrated circuit  
 U3—LM741 general-purpose op-amp, integrated circuit  
 Q1, Q2—2N3904 general-purpose NPN silicon switching transistor  
 D1, D2—1N60 small-signal germanium diode  
 D3—1N914 general-purpose silicon diode  
 LED1—Jumbo red light-emitting diode

### RESISTORS

(All fixed resistors are ¼-watt, 5% units unless otherwise noted)  
 R1—220,000-ohm  
 R2, R4—10,000-ohm  
 R3—10,000-ohm, audio-taper potentiometer with SPST switch

### CAPACITORS

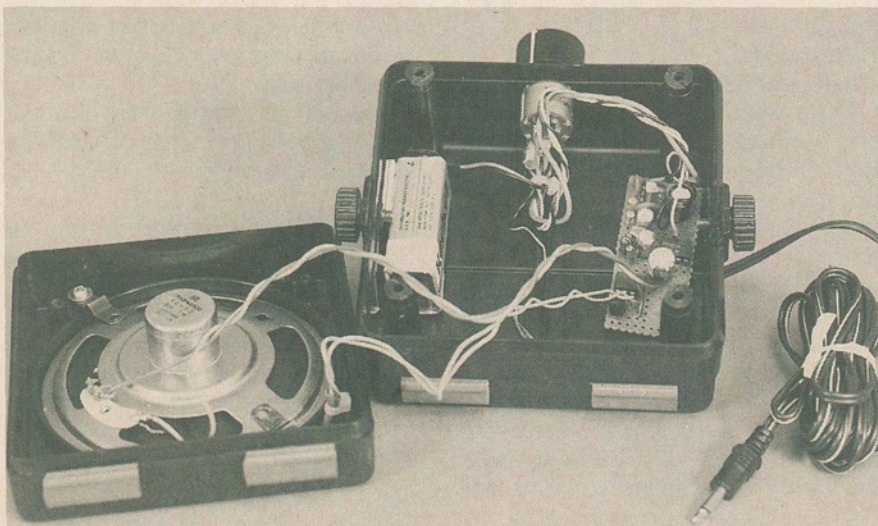
C1—0.01-μF, ceramic-disc  
 C2—0.1-μF, ceramic-disc  
 C3, C4—10-μF, 16-WVDC, electrolytic  
 C5—4.7-μF, 16-WVDC, electrolytic  
 C6, C7—220-μF, 16-WVDC, electrolytic

### ADDITIONAL PARTS AND MATERIALS

SPKR1—8-ohm, 4-inch speaker (see text)  
 PL1—Phono plug to fit scanner earphone jack  
 S1—Part of R3 (see text)  
 Perfboard materials, enclosure (see text), 9-volt transistor-radio battery, battery holder and connector, LED bezel, speaker wire, hook-up wire, control knob, IC sockets, solder, hardware, etc.

PL1 into the earphone jack on the scanner to be used. Note that since C4 has discharged, LED1 will glow for the delay period when first turned on. With potentiometer R3 (the Scanner Companion's volume control) at the halfway point, turn on your scanner with the volume low, then squelch the scanner until noise is present. Then increase the setting of the volume control on the unit until LED1 glows and audio is heard through the Scanner Companion's speaker.

Adjust the squelch control on the scanner for silence. LED1 should glow for approximately two seconds and then extinguish, muting the sound from the speaker. If the LED doesn't extinguish, lower the volume on the scanner and try again. That's all there is to it! Set the volume of the Scanner Companion to a comfortable level and then relax and enjoy.



Here is an inside view of the author's prototype of the Scanner Companion. Note that even with the added circuitry and battery with holder, there is still plenty of room left within the speaker housing.