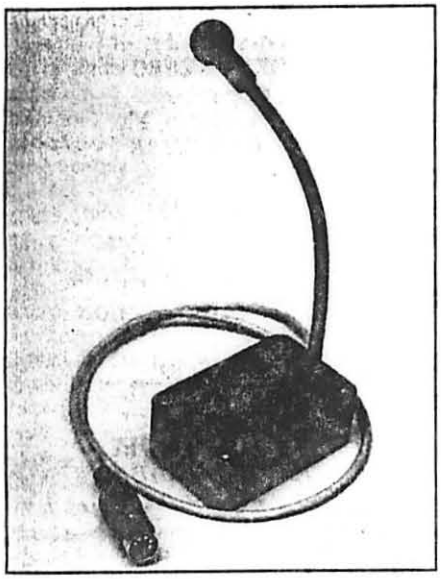
With Artwork

How To Build A Desktop Microphone

Here's an interesting project that's easy to build, fun to use, and speaks right to the issue.

BY RICK LITTLEFIELD*, K1BQT



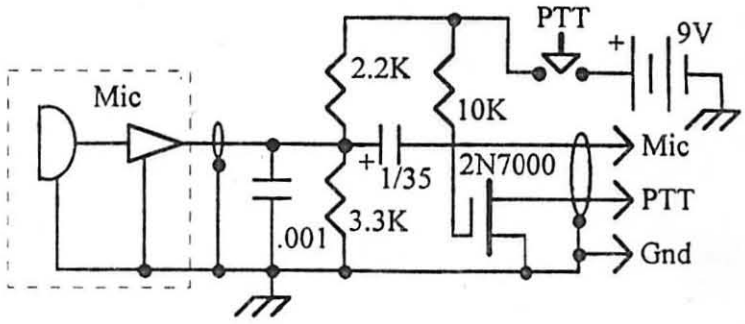
The completed electret microphone has simple lines and fits in well with contemporary radio gear.

Good desk microphones are always in demand, but the price tag on some brand-name models may leave you with sticker shock—especially if you own several radios. I solved this problem by building my own! A short trip to Radio Shack and the local hobby shop yielded most of the parts I needed, and a couple of evenings spent on light assembly produced a microphone that sounds great for a fraction of the price.

Circuit Description

The heart of this project is an inexpensive electret condenser microphone element available from Radio Shack (part No. 270-090). Don't be fooled by the low price, as speech quality is outstanding! Like most low-cost electret elements, the 270-090 has a built-in FET preamp that requires external DC power (see fig. 1). Some transceivers, especially those with 8-pin jacks, provide operating voltage for an electret element at the microphone jack. However, many other radios do not, making a self-powered design more universally useful. For stand-alone power I used a 9 volt flat-pack battery and voltage divider R1, R2 as a power source. At 6 volts the microphone element draws around 2 mA.

*109A McDaniel Shore Drive, Barrington, NH 03825



Parts List

1—Radio Shack PC-mount condenser microphone element, RS270-090.
1—Radio Shack 3 1/4" × 2 1/8" × 1 1/8" molded project box, RS270-230
1—Radio Shack "soft-feel" SPST momentary push-button switch, RS275-1566
1—Power clip for 9-volt rectangular battery, RS270-324
1—9-volt rectangular alkaline battery, RS23-553
1—Radio Shack windscreen for tie-clip microphone, RS33-4006 (pkg of 4)
1—microphone plug (RS270-025 for ICOM, Yaesu, Kenwood HF radios; RS274-003 for MFJ)
1—length of two-conductor microphone cable, RS278-514
1—10 inch length mini-shielded cable, RG-174 (remove plastic covering)
1—7 1/2 inch length K&S ST-6-3/16 inch square plastic stock
1—1 inch length K&S TB-12-3/8 inch round plastic stock
1—PC board, or perfboard with pre-drilled pads, RS276-148
1—2.2 K resistor
1—3.3 K resistor
1—10 K resistor
1—VN-10 or 2N7000 IG-FET
1—.01 µF disc
1—1 µF electrolytic

Fig. 1– Schematic diagram of power supply and switching circuit.

By powering the microphone element only when PTT switch SW1 is depressed, service life of the battery is stretched to approximate shelf life. The only tradeoff is loss of VOX capability; the microphone goes dead whenever the PTT switch is open, and speech signals cannot activate the radio's VOX circuitry. In addition to supplying Vcc to the electret element, PTT switch SW1 supplies turn-on bias to Q1 through R3. This causes Q1 to conduct, providing a low-resistance ground path for the transmitter PTT line. Q1 replaces the second set of contacts usually found on PTT-type "leaf" switches, and permits the use of an inexpensive SPST soft-touch switch.

While it is relatively easy to make a microphone that *sounds* good, making one that *looks* good from readily available materials can be a bit of a challenge. To avoid the Chez plumbing-parts "white plastique" motif, I chose small, lightweight materials to complement the diminutive size of the element (see fig. 2). These items included model-builder's square-plastic tubing and a small molded project box for the base enclosure. To bring unity of form to a multicolored collection of parts, I sprayed the box lid and neck materials with semi-flat black paint (Krylon 1613). This non-glare surface resists marking, provides a close match to the plastic project box, and also blends in well with most contemporary transceivers.

Construction

I constructed the microphone's power and switching circuitry on a small PC board (see figs.

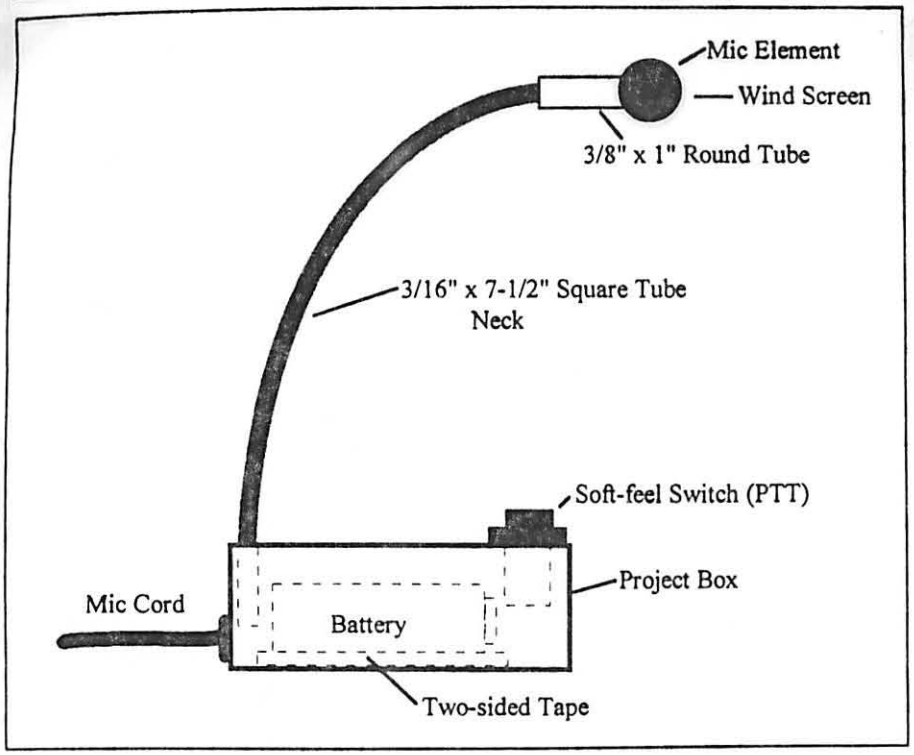


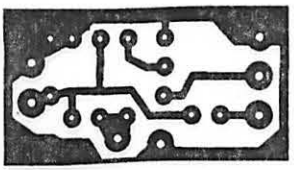
Fig. 2– Microphone uses readily available materials from Radio Shack and a hobby store.

3[A] and [B]). If you don't have PC-board materials handy, a small piece of pre-drilled mini-board—such as Radio Shack 276-148—will work fine. Note that all tracks and solder connections are placed on the *top-side* (or component side) of the board. This provides a flat surface on the bottom that permits easy mounting to the projects box with two-sided tape or contact cement. Be sure to install the mic cable, element line, and battery wiring on the board before gluing the module inside the box.

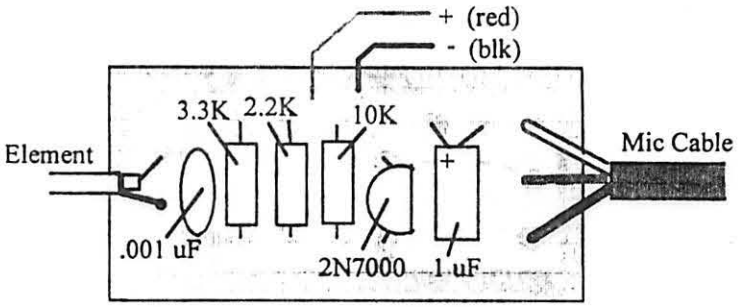
K&S 3/16 inch square tubing used for the neck normally comes in 15 inch lengths. Cut one of these in half (7 1/2 inches), and you'll have two pieces of the correct length. Next cut a 1 inch length of the 3/8 inch round plastic tube. The outside matches the diameter of the microphone element and the inside friction-fits over the square tubing. To bend a curve into the neck, I used a 4 inch diameter tin can as a form. No heat was needed. I simply bent the tubing until it retained the final shape I wanted. Once the curve is formed, slip the 1 inch transition in place, pushing it about 1/4 inch over the neck. Spray-paint both pieces.

Next remove the aluminum plate from the project box and cut as shown in fig. 4. To prepare for painting, I roughed the surface with fine sandpaper and sprayed on a liberal coat of Heavy-Duty Eazy-Off™ oven cleaner (however, you may omit this step if you *are* uncomfortable working with caustic materials). Be sure to observe all precautions, as Heavy-Duty Eazy-Off contains lye, which serves as a powerful etchant to skin as well as aluminum. After allowing the lid to etch for about 20 minutes, rinse and dry thoroughly before painting. To prepare the molded portion of the box, drill a single 1/4 inch hole in the lower left-hand rear panel and install a small grommet for the microphone cable.

To begin final assembly, locate the PC board, neck assembly, and microphone element. Install the microphone cable through the grom-



A



B

Figs. 3(A) & (B)– PC board artwork and parts layout for microphone electronics. Note that parts will be mounted on the foil or solder-side of the PC board.

met at the rear of the project box. Next find the 12 inch length of RG-174 element cable and measure 3 inches from the PC-board termination. Remove the outer insulation from this point to expose the shielding braid. Removing this allows the RG-174 to fit inside the square K&S neck stock. Thread the shielded line through the neck until it exits the transition piece. Clip both microphone element terminals to about 1/4 inch, and solder a line lead to each, connecting the shielded side to the case terminal. Make sure the terminals are separated and don't short circuit when installed inside the transition.

To secure the element to the neck, coat the joining surfaces with a thick layer of contact cement and set aside to dry. When dry, align the element with the neck and gently tug on the PC-board end of the shielded line to pull the cartridge snugly to the neck. Press firmly to form a bond. To mount the neck onto the project box, coat the mating surfaces with contact cement and allow to dry. Then clamp the neck and box firmly together. Finally, secure the circuit board to the left side of the box using contact cement and the same mounting technique.

To complete the assembly, install SW1 in the box lid. Now cut the red battery-clip lead about midway and solder each end to a terminal of the PTT switch. To secure the 9-volt battery in place, install strips of two-sided tape on the bottom of the box. Plug the battery into its snap connector and position it on the tape. Make sure the battery clears the switch body when the lid is installed. To finish off your microphone, install the foam windscreen on the element. This may take a bit of stretching, but it will fit.

Operation

When installing the transceiver microphone connector, be sure to consult your operating manual for the jack pinout. Also, check the radio's specification sheet or schematic to confirm that the PTT switching circuit uses a low-current ground path for activation. Some radios may employ load-sensing on the microphone element line, or may hot-switch +12 volts directly to the radio's T/R relay. These circuits will not activate with your microphone, and the latter type may damage the switching transistor in your microphone. Most modern SSB and FM-mobile transceivers are compatible with the microphone and will work fine.

This particular microphone is categorized as an *omnidirectional electret* device, and exhibits some characteristics that are different from *unidirectional dynamic* microphones such as the popular Kenwood MC-60. To get top performance, you'll want to be aware of what those differences are. For one thing, the omnidirectional pattern may pick up more off-axis sounds—things such as amplifier blower noise, screeching kids, etc. On the other hand, the element has less acoustical coupling to its enclosure, so you can expect fewer problems with low-frequency hollowness and desktop thumps. Also, because the element is electrostatic rather than electromagnetic, you may pick up less interference from magnetic fields generated by power-supply transformers and computer monitor fly-backs. You may even notice less *proximity effect*—a tendency for a microphone to sound progressively bassier as you speak closer to it. On the cautionary side, "close-talkers" should back off a bit, as it is somewhat easier to overdrive electret elements than dynamic cartridges. For best results, position your mouth 2–3 inches from the element and talk past the windscreen at about a 45-degree angle. This technique is used by broadcasters and professional narrators to obtain the best speech intonation and signal-to-noise ratio when recording or transmitting.

On-the-air reports with this microphone have been excellent. I now have three of them which I regularly use on the MFJ Travel Radios, Kenwood TS-440, and VHF-FM rig. RF immunity appears good, and speech quality remains unaffected when I kick on amplifiers. The first prototype has been in service for over a year on its original battery and still is going strong. Why not give one a try? ■

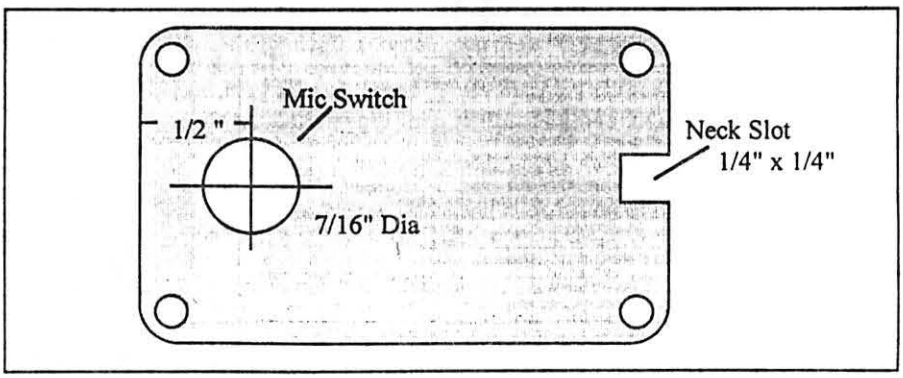


Fig. 4– Pattern for preparing the project box cover.