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The Beeper

-- NASA-type beeping

For some time now, we have considered using the "begin/end" beep which NASA traditionally uses for all voice space communications. Its potential use in amateur radio, whether on the low bands, the two meter repeater band, or, for that matter, any phone band, seemed obvious. Perhaps the main concern with high noise QSOs, be it QRM, QRN, or simple wind noise when mobile, is trying to identify when the mike on the other end has been keyed or dropped. A device similar to this one has been incorporated into some repeaters, but usually only as an "out" indicator.

The specifications we desired for such a device were clear. It would:

1. Automatically initiate a beep when the mike is keyed either on or off.
2. Produce a different frequency beep for each status. We preferred to use a high tone going in and a low tone coming out.
3. Produce the tone for only about one half of a second and hold the transmitter in while it was being produced in the "out" state.
4. Be totally solid state with no use of relays or electro-mechanical devices.
5. Be inexpensive and easy to build, with readily available parts.

The final version was designed specifically for the Kenwood TS-520 transceiver, but a relay option was added to allow use with any transceiver or transmitter. The unit operates conveniently from a 6 V dc power cord used for calculators, tape recorders, etc. In this sense, no power supply was needed. The power cord we used was bought from a clearance supply of calculator power cords, for which there was no longer a calculator made. They are available new for about $4.99, but most surplus houses have them for half that. We found that a few power cords we tried would not work properly, causing the unit to switch back and forth between tones. This was traced to a poorly regulated supply which caused the unit to

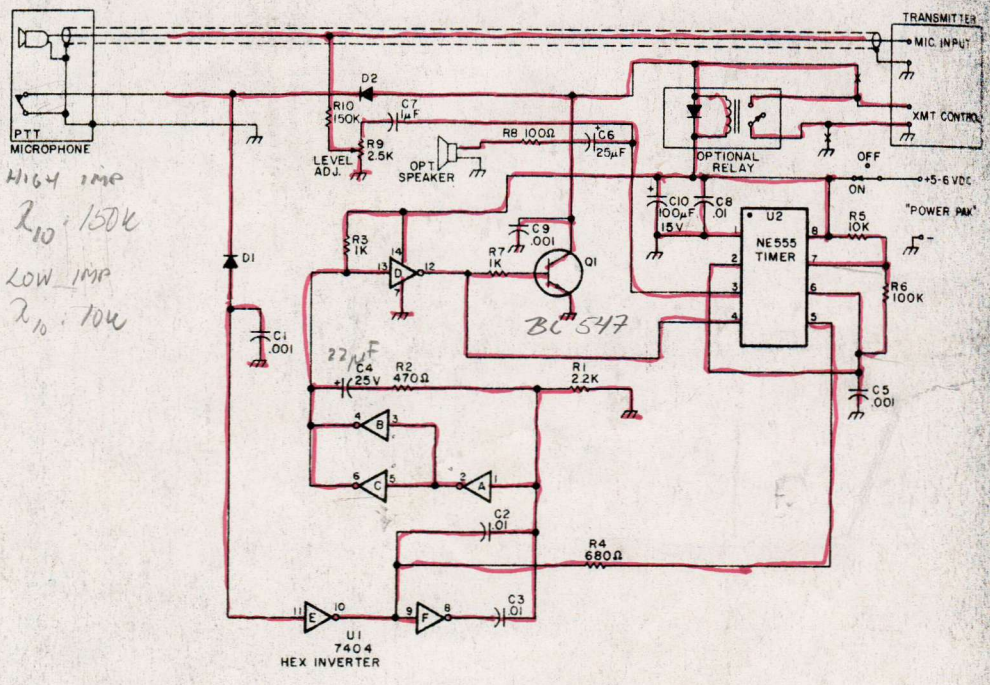
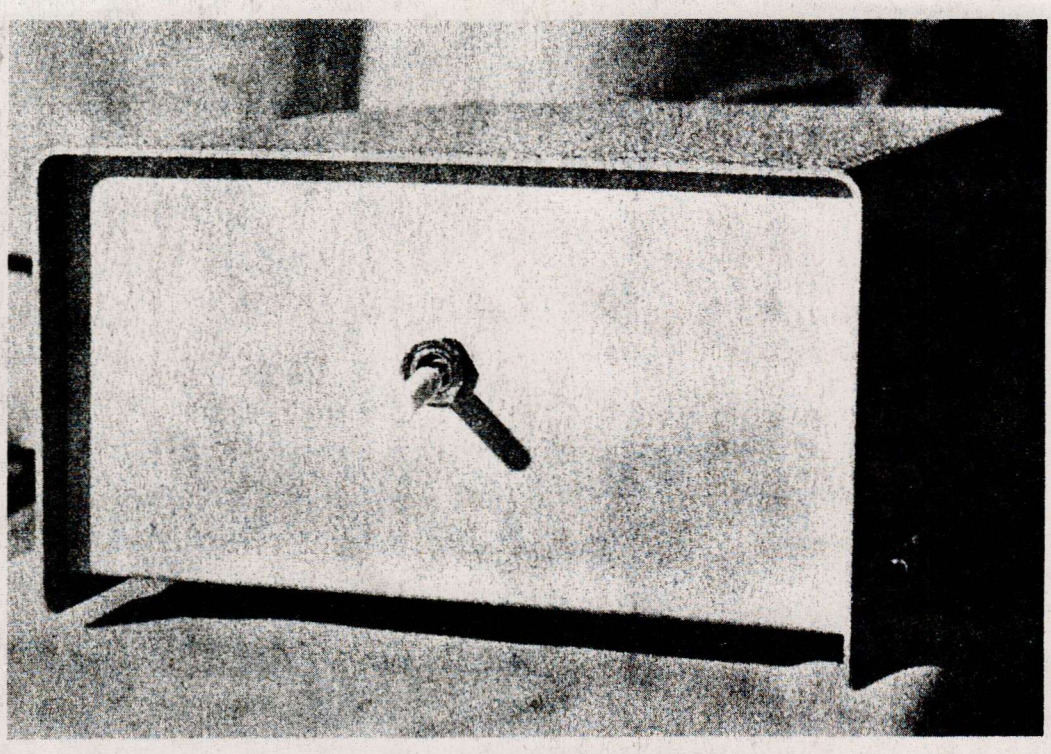


Fig. 1.

switch on and off. The unit, of course, works fine on batteries, so this method can be considered for portable operation. Also, our final version incorporated a speaker so that the operator could be assured that the unit was functioning properly. This audio feedback adds less than $1.00 to the cost, and can be disregarded if not desired. (However, this option is an attention-getter.) Finally, the beeper does not interfere with normal transceiver operation when turned off. No disconnection need be made at any time.

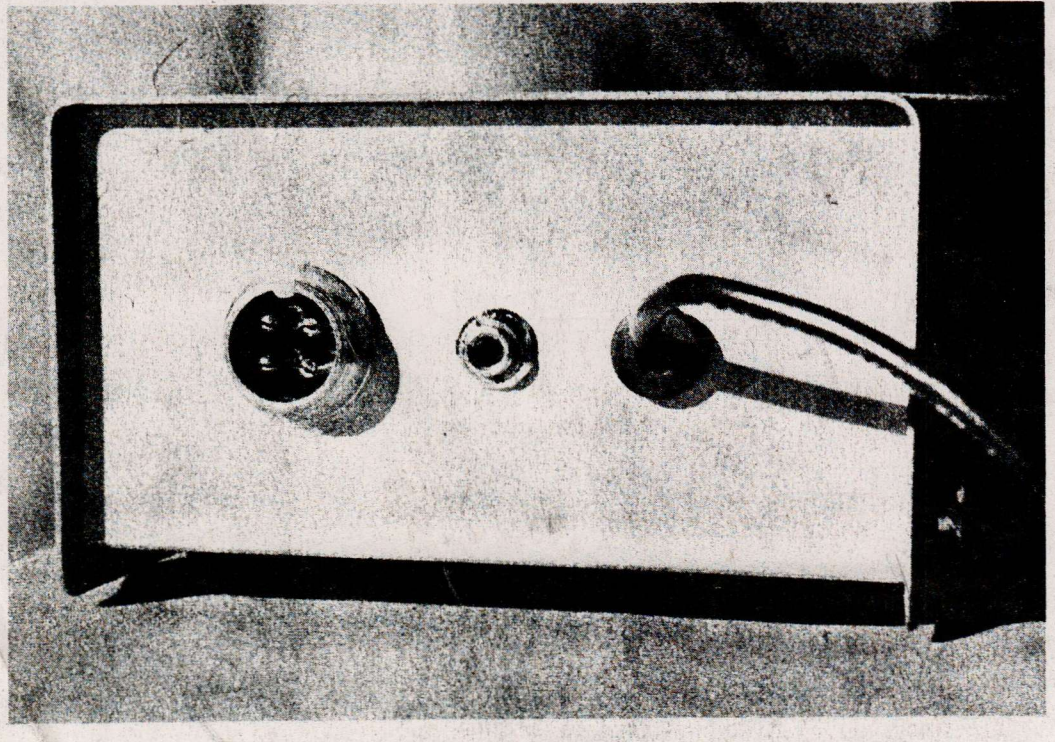
Basically, the "NASA Type Beeper" uses a 555 IC as a tone generator because of its ability to directly drive a speaker, be turned on and off by a TTL control signal, and vary the frequency of the tone by using the "modulator input" pin. A 7404 hex inverter provides buffering functions and a monostable multivibrator with a one half second time duration. Inverter sections A, B, and C form the monostable multivibrator. When depressed, the PTT microphone switch supplies a ground through isolation diode D1 to inverter section E. Its output goes high, sending a positive pulse through capacitor C2 and causing inverter F's output to go low. This sends a negative pulse through capacitor C3. Capacitors C2 and C3 are connected together and drive inverter A, the first stage of the monostable timer. It would appear that the opposing pulses through C2 and C3 would cancel, but the output stage of each inverter section is far better able to produce negative pulses than positive ones. A good scope shows a healthy negative pulse at the input to inverter A whenever the mike button is closed or opened. Thus the one half second time period is initiated at the beginning and end of each transmission. During this time period, the output of inverter D goes high, enabling the 555 timer and turning on transistor Q1,



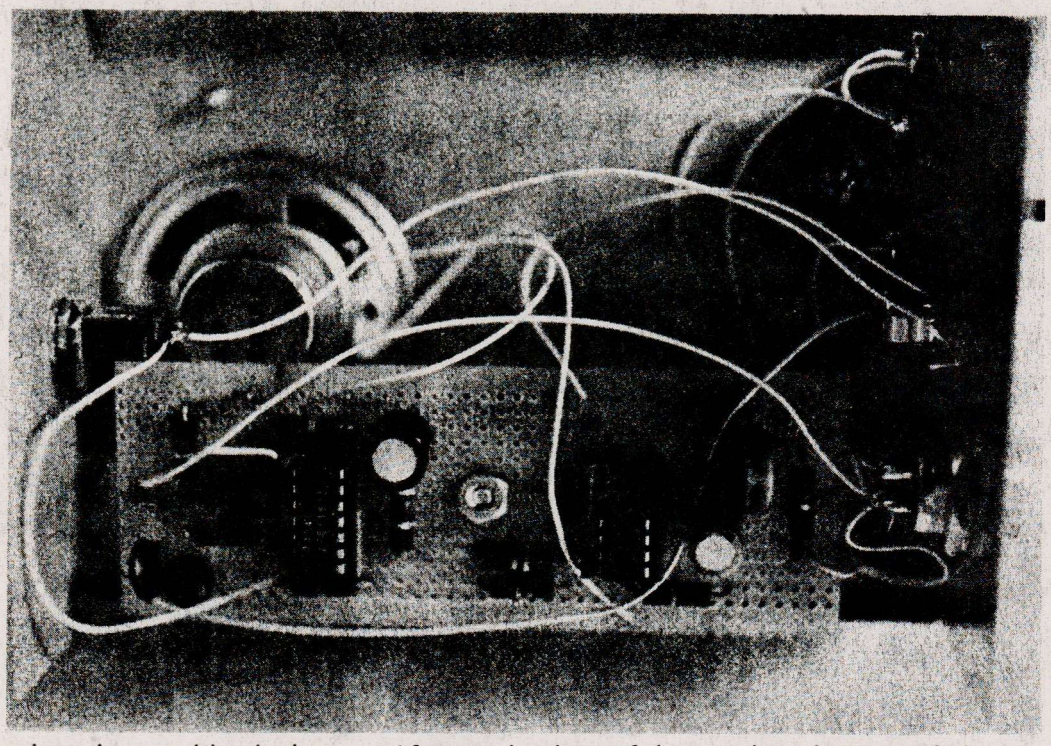
which is used to hold the transmitter on during the "out" status. The transmitter thereby "waits" for the "out" beep, even though the PTT switch has been turned off. The "modulation" pin of the 555 is connected through resistor R4 to the output of inverter E, so that, depending on whether the PTT switch is open or closed, a different frequency tone is produced. The tone is fed into the high impedance mike line through trimmer R9 and resistor R10. R10 should be a 10k for a low impedance microphone. The trimmer allows the tones' level to be controlled.

If the transmitter you construct this unit for requires the completion of a voltage higher than 30 volts, a negative voltage, or a system other than the grounding of 12 V dc as in the Kenwood TS-520, then the relay option should be used. The relay should operate on 6 volts at low current to reduce power consumption. Radio Shack offers an SPST 6 volt low current relay that is ideal (see Parts List).

Construction hints: The unit fits most conveniently in a 6" by 4" by 2" minibox, which allows extra room should you want to incorporate the relay. Point-to-point wiring was used on our



Photos by John Farquhar



unit, as it seemed less bother than making a printed circuit board. The ICs were mounted in sockets to allow quicker servicing or troubleshooting, but this is an "extra" and the ICs could be soldered into the circuit. One single stand-off was positioned in the center of the board, using a single screw and a few nuts. All interfacing connections were placed at the rear for cosmetic reasons and only the power switch was placed on the front panel. A few holes were drilled in the bottom of the case and a small 8 Ohm speaker was epoxied to the case. One note of caution: Shielded cable should be used between the transceiver and the beeper to prevent rf pickup.

After continual use of the unit for a month or so, we found the beeper to be a novel and useful addition to the station. We have experienced no confusion in QRM situations as to when we have switched back to the other station. In fact, operating the transceiver without the beeper on leaves quite a void now and something [illegible] seems missing. Happy beeping! ■

Parts List

R1	2.2k
R2	470 Ohm
R3	1k
R4	680 Ohm
R5	10k
R6	100k
R7	1k
R8	100 Ohm
R9	2.2k trimmer
R10	150k
U1	7404 hex inverter
U2	555 timer
C1	.001
C2	.01
C3	.01
C4	25 uF
C5	.001
C6	25 uF
C7	1 mF
C8	.01
C9	.001
C10	100 uF @ 15 V

Q1 – General purpose NPN
D1, D2 – General purpose silicon diodes
Relay (optional) – Radio Shack 275-004
Miscellaneous: SPST switch, connectors, shielded cable, power cord, speaker, mini-box

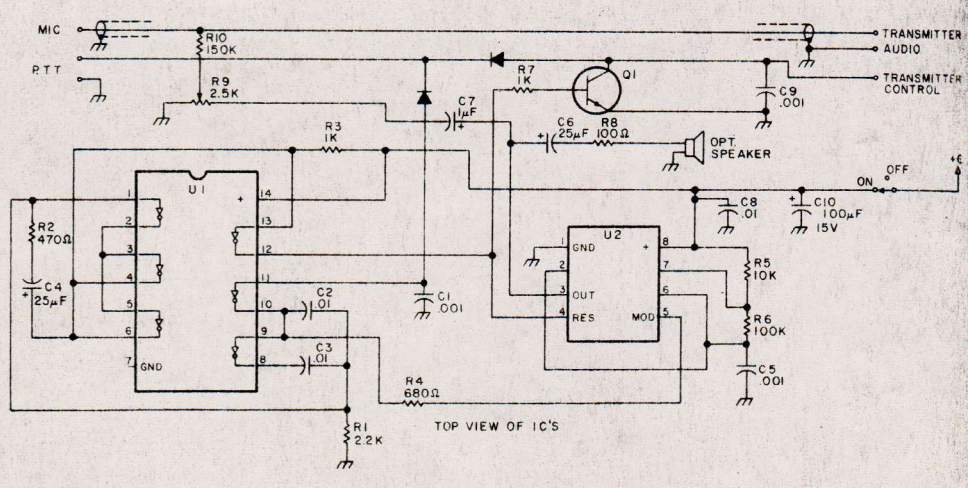


Fig. 2. Pin diagram.