A Tone BEEP Keyer for Repeaters

Obtain an Audible Indication of Off-Frequency Operation

BY ART GENTRY,* W6MEP

Some repeater users, in their haste to operate a newly acquired mobile rig, simply hook it to a power source and an antenna, then key up the local machine. If they get a response, they assume that all is well. The need to adjust the transmitter frequency does not attract their attention until they are in an area of poor coverage, or if some fellow user informs them that the audio "doesn't sound right." Now a problem appears. Frequency checking at vhf is beyond the capabilities of many amateur stations, and it may be weeks or months until the local club has a frequency-netting session. Here is a device that will help the communicators stay "in the groove." One word of caution: Extensive keying of the machine to "walk" the frequency in can be very annoying to the monitors and other users. It would be considerate to ask permission, or wait until a slack time to do your tweaking.

THIS SIMPLE telemetry[1] circuit is the latest of a series of modifications to the WR6ABN repeater. Earlier uses of tones and tone bursts reminded users to allow time for breaking stations, and to indicate that the time-out timer had been reset. This latter indication was by means of transmitting two tones simultaneously.

The designers of the telemetry system decided to inhibit one of the two tones, selectively, and allow either the high or low tone to indicate the position of the user's carrier in the receiver passband. Since installation of this feature, it has been an unqualified success.

The sensors were adjusted to trip the relays at 1 kHz above or below the center frequency; this appears to be a practical value for narrow-band receivers. Thus, the "on-channel" slot is 2-kHz wide, centered about the receiver input frequency.

This system makes use of such nonexotic equipment as relays to perform the switching. Those readers who are well versed in solid-state logic systems will find it easy to apply the principles to their favorite machine.

Technical Description

The 741 op amp is set for a dc gain of 1000. The ac gain of the circuit is very low, as set by the 1 μF bypass capacitor across the 1-MΩ resistor in the feedback loop, and the 1 μF across the 50-kΩ control in the input circuit. The output of the 741 feeds two transistors and a zero-center meter.

The steering diodes, CR1 and CR2, allow the op amp to drive Q1 or Q2 into conduction and to charge C1 or C2 to the value of the op-amp output voltage. R1 and R2 allow capacitors C1 and C2 to charge above the base voltage of the transistors and to cause them to conduct for about 5 seconds after the drive voltage from the op amp is removed. This delay acts as a memory, so the delayed tone beep can indicate the frequency readout after the carrier of the user station goes off.

Note that the poor ac frequency response of the op-amp means that the input to it must remain for approximately 3 seconds in order for it to load C1 or C2 for the readout. This delay was intentional for two reasons: (1) to prevent noise or fluctuating signals from giving false readings, and (2) to prevent unscrupulous users from abusing the device by keying up several short bursts.

Note that the input to the op amp is shorted to ground when a carrier is not present. This prevents noise from loading up the sensor prior to a reading. It also allows the adjustment of the dc offset control, R5. The calibrate potentiometer, R6, is adjusted to a point where signals 1 kHz above or below the center frequency of the receiver will just trip relays K4 or K5. (Note that the receiver should be adjusted so that the discriminator voltage is zero with no signal.) This adjustment of R6 to ±1 kHz determines the slot width. The center frequency is determined by the usual crystal-oscillator adjustments in the receiver.

* 7832 Jellicoe Ave., Northridge, CA 91324.

[1] "Telemetering. Measurement with the aid of intermediate means that permit the measurement to be interpreted at a distance from the primary detector." – *IEEE Standard Dictionary of Electrical and Electronics Terms, 1972.*

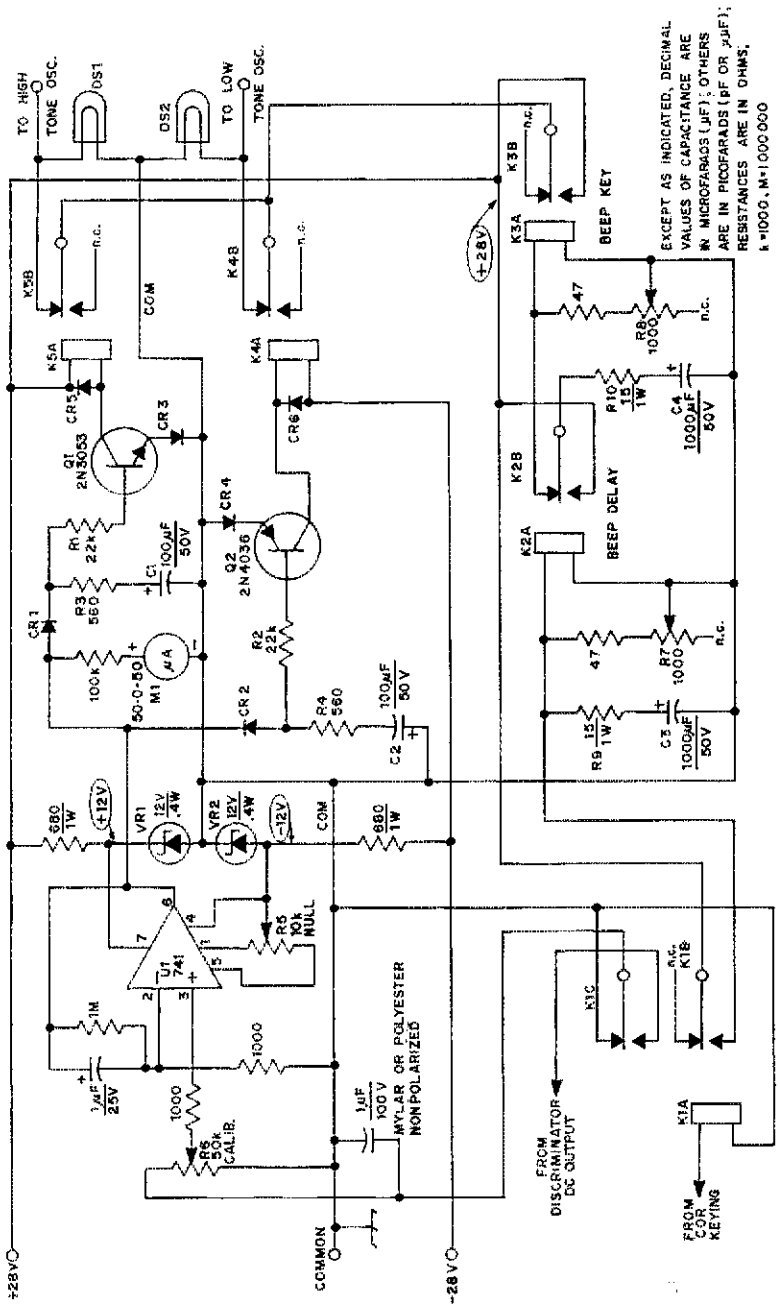

Fig. 1 — The schematic diagram of the tone-beep keyer. A dual 28-V supply is used in this system, but there should be no difficulty in revising values to make use of lower voltages. The charging current of C1 through C4 is limited to a safe value by means of the series resistor in each case. If the meter is omitted, tip jacks should be provided to aid in adjusting the circuit.
CR1-CR6, incl. — Silicon diodes, 1N2069 or equiv.
DS1, DS2 — 28-V pilot lamps. Lower-voltage units or LEDs with suitable dropping resistors may be used.
K1 — Dpdt relay. Coil voltage and current must be compatible with voltages available from receiver COR circuitry.
K2-K5, incl. — Spdt relays, 450- to 700-ohm coil for 24 V dc. Allied Control T154-2C or equiv.
U1 — Operational amplifier IC. Fairchild µA741 (U5B7741312), Signetics µA741T or µA741CV, Motorola MC1741G or MC1741P1 or equiv.

K1 can be the normal COR or a separate relay keyed by the COR. This relay keys both the input to the op amp and the delay relay, K2. Because of the discharge time of C3, K2 will have a delayed release. When K2 releases, it keys K3 for a short period as determined by C4 and R8. The values needed for C3, C4, R7 and R8 will vary, depending upon the characteristics of K2 and K3.

Operational Notes

1) K2 establishes length of delay between end of carrier and keying of tone beep.

2) K3 establishes length of tone beep.

3) K4 or K5 select the desired tone to be keyed.

4) Adjust R5, NULL control, for zero dc volts at the output of the 741 with K1 deenergized.

5) The trip point of K4 or K5 is adjusted by means of R6, the CALIBRATE control. It should be adjusted while monitoring a carrier set to the desired frequency offset value.

Decoding of the telemetry is by means of widely available equipment: the user's ears. QST