PTT Control from Receiver Audio

Here's an easy way to key a transmitter for remote or repeater operation.

by Roland Burgan KB8XI

Does this scenario sound familiar? You needed to key a transmitter when a signal came into your receiver, but there was no way you were going to risk voiding the warranty on your new radio. That very problem has canceled many a project.

Years ago, accessing the COS line (carrier-operated squelch) was fairly easy, allowing simple control of transmitters for repeaters, base extenders, etc. However, recent advances in technology have produced radios that make such tap-offs very difficult, even for the experienced ham. And the possibility of voiding a warranty is no longer something to scoff at.

I needed a way to key a transmitter upon receiving a signal, without invading the insides of my transceiver. Adding a permanent dangling wire was not appealing, and adding another jack was appalling. There are circuits that provide a signal from an audio source, but they all seem to need voice audio to develop a keying signal (VOX). But now there is a reliable alternative.

Various Uses

This circuit will be especially useful for putting together base/mobile/portable repeaters or remote operations. It will allow the use of equipment without your having to get inside and do circuit surgery. Also, this circuit will provide a switching signal for various devices or secondary units which need to operate when a signal (with or without audio) is received.

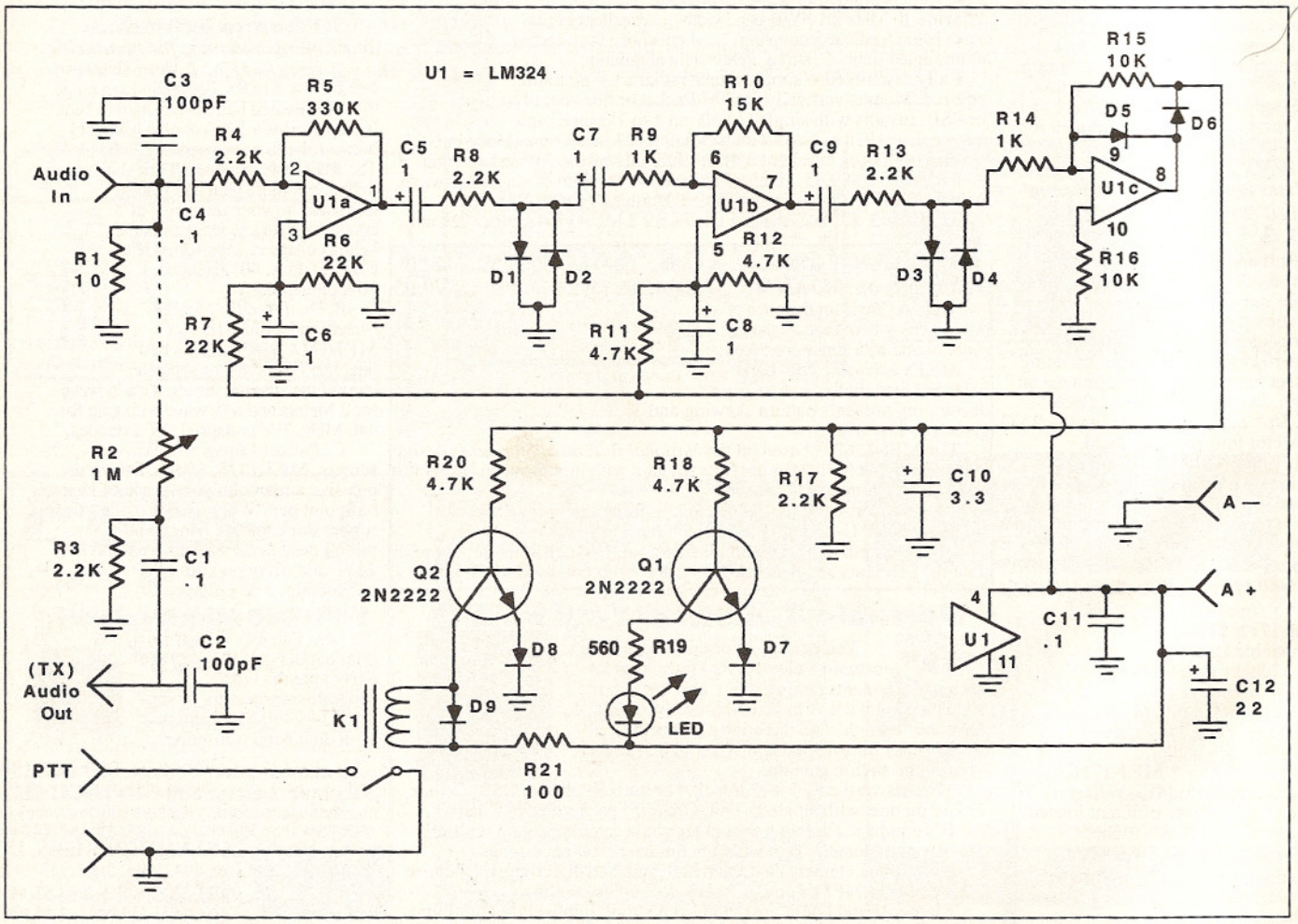

Figure 1. Schematic for PTT control from receiver audio.

Circuit Analysis

The circuit functions on the noise level difference between a full-squelched audio output and the audio noise level present when the squelch opens upon receiving an unmodulated signal. Measurements showed that, on average, there is about a 20 dB difference in levels, and the circuit uses this difference to recreate the COS signal voltage. Op amp U1a (Figure 1) amplifies the audio input, which is then clipped to 0.6V in the first of two clippers. Op amp U1b amplifies the resulting signal, which clips it a second time to 0.6 volts. The result of U1a & U1b is to highly compress and clip the incoming audio noise signal. This signal goes to U1c, which serves in a dual capacity. This op amp first functions as a precision rectifier, producing a DC voltage, and secondly acts as a DC amplifier, raising the DC signal to a TTL level. The TTL level signal voltage then feeds two NPN transistors, one controlling an LED to show status, and the other operating a 5-volt reed relay. A relay was chosen instead of electronic switching to provide reliable device control, especially in repeater/remote base applications. C10 acts as a smoothing filter for the DC signal. The slight time delay this also provides is negligible. Diodes D7 and D8 in the base circuits of the switching transistors will act to prevent false triggering. The LM-324 IC requires only a single supply of from 6 to 18 volts. The audio and A+ line are RF-bypassed. The total circuit gain is 22,500.

Audio Option

For convenience, I have included a transmit audio feed as an option. The variable resister, R2, allows the user to set the receiver volume control to some easily remembered preset point. Then adjust R2 for the required transmit 5 kHz maximum deviation. The 100 pF capacitor acts as RF bypass, while R3 sets level and impedance matching. If your transmitter is designed for high impedance mikes, then delete R3.

Construction

A printed circuit board for this circuit is available for $4.00 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118. Construction may be either on a PCB or point-to-point—there is nothing critical to watch out for. An input sensitivity control was unnecessary because of the heavy signal clipping. However, if your audio source puts out more than 0.5 watt, change the power rating of R1 accordingly. If you intend use this with a transmitter, RF protection requires a metal case. If it becomes necessary to use a higher power supply voltage, changing the relay current limiting resistor (R21) from 100 to 220 ohms and changing the LED resister (R19) to 2.2k will allow operation from 16 to 30 volts (max) power sources. Low current requirements also allow the use of a 9-volt battery. All parts are available from Radio Shack and many other suppliers. 73

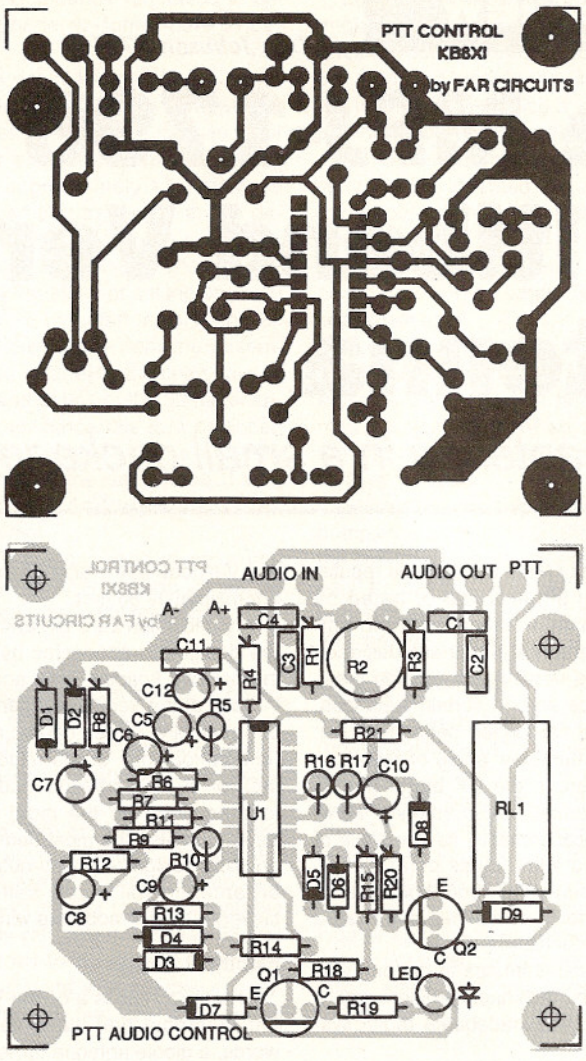

Figure 2. PC board etch pattern and parts placement.

Parts List

C1, C4, C11	0.1 µF, 50V	R/S #272-109
C2, C3	100 pF, 50V	R/S #272-123
C5, C6, C7, C8, C9	1 µF, 35V	R/S #272-1434
C10	3.3 µF, 35V	R/S #272-802
C12	22 µF, 35V	R/S #272-1026
R1	10, 1/2W	R/S #271-001
R2	1 meg. pot, 1/2W	R/S #271-211
R3, R4, R8, R13, R17	2.2k, 1/4W	R/S #271-1325
R5	330k, 1/4W	*R/S #271-1350, 271-1347
R6, R7	22k, 1/4W	R/S #271-1339
R9, R14	1k, 1/4W	R/S #271-1321
R10	15k, 1/4W	R/S #271-1337
R11, R12, R18, R20	4.7k, 1/4W	R/S #271-1330
R15, R16	10k, 1/4W	R/S #271-1335
R19	560, 1/2W	R/S #271-020
R21	100, 1/4W	R/S #271-1311
U1	LM324	R/S #276-1711
Q1, Q2	2N2222	R/S #276-2009
D1-D9	4001 diodes	R/S #276-1653
K1	5 VDC reed relay	R/S #275-232
LED	Any 2V LED	

*Note: Unfortunately, Radio Shack no longer supplies 330k resistors. Wire a 100k and 220k in series.