Control your tape recorder with this

Voice-operated Relay

This versatile voice-operated relay (or VOX) has a variety of applications. It can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. It can be used with any low or high impedance microphone, or a high level source such as a tape recorder.

by COLIN DAWSON

Quite a few uses can be envisaged for this circuit, the most obvious as a VOX control for a transmitter. It avoids the need to use the press-to-talk switch on the microphone every time the operator wishes to speak.

Another use is to control a tape recorder when the material to be recorded is of a short and spasmodic nature. By fitting a VOX, the tape recorder will be activated only when there is something to be recorded. This eliminates tape wastage and ensures that there are no long gaps between recorded segments when the tape is played back.

You can also team the VOX with a stereo tape recorder to control your slide projector. The narration for the slide show is recorded on one channel, while cueing tones to control the VOX are recorded on the other. Each time a cueing tone triggers the VOX, the relay contacts close to activate the slide change mechanism.

Connecting the VOX to your slide projector is not difficult – the normally open relay contacts are simply wired in parallel with the slide change switch.

Circuit description

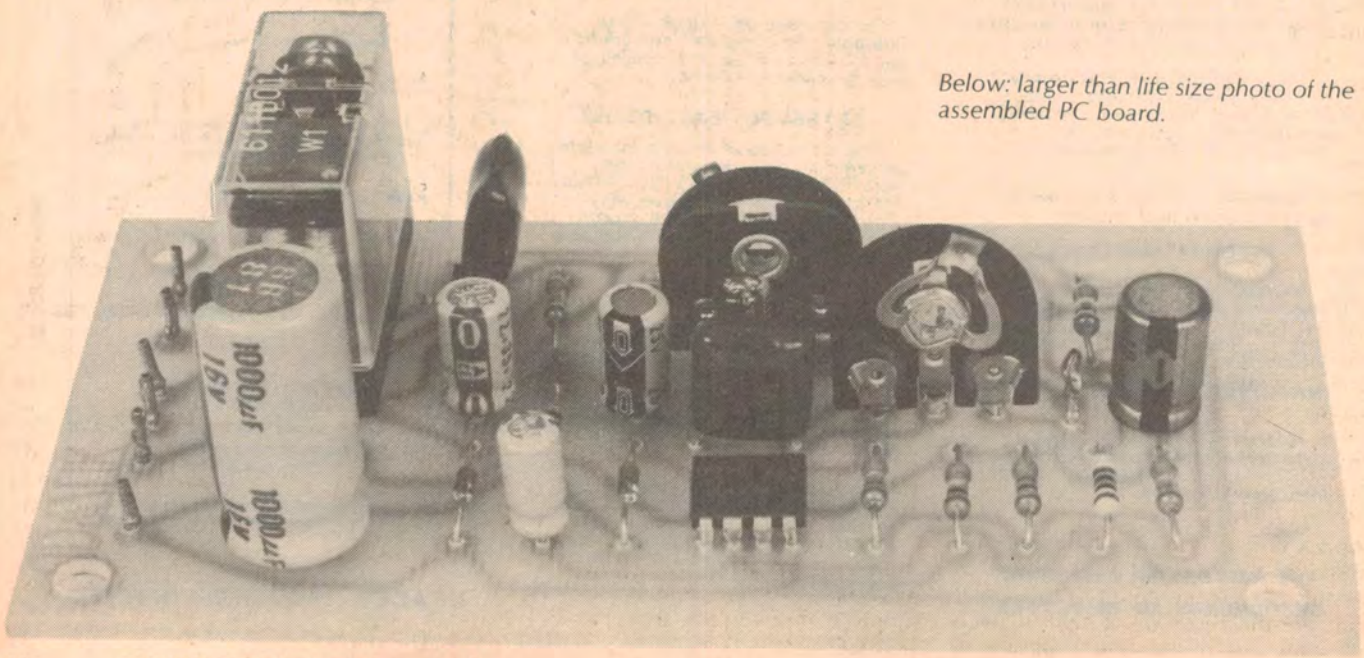
The circuit consists of three parts: a microphone preamplifier, a Schmitt trigger and a relay driver. Input signals to the microphone preamplifier are amplified and fed to a threshold trimpot. When the selected threshold is exceeded, the output of the Schmitt trigger immediately oscillates at almost 9V peak-to-peak. This output is rectified and charges a capacitor to turn the relay driver on and thereby energise the device being controlled.

IC1 functions as the microphone preamplifier and is connected as an inverting amplifier with AC gain variable between 11 and 111 by means of RV1. Frequency roll-off below 20Hz is set by the 10μF electrolytic capacitor, which also sets DC gain at unity.

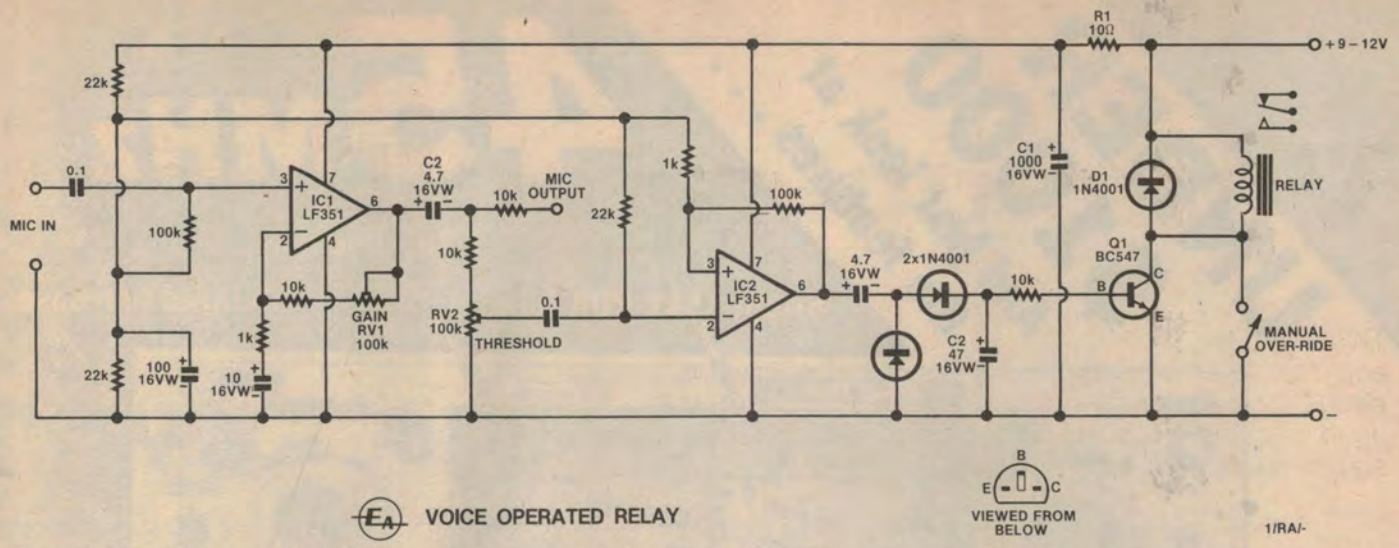
Input signals from the microphone are AC-coupled via a 0.1μF capacitor to the non-inverting input of IC1. A voltage divider consisting of two 22kΩ resistors sets the bias to the non-inverting input of IC1 and to both inputs of IC2 to half supply so that the two op amps can function from a single supply rail. The bias is applied to IC1 via a 100kΩ resistor, while heavy decoupling of the voltage divider is provided by a 100μF capacitor.

The output signal from the preamplifier is coupled by a 4.7μF electrolytic capacitor to a 10kΩ resistor and a 100kΩ trimpot (RV2) which feeds the op amp Schmitt trigger. In addition, the microphone output signal is made available by an additional 10kΩ isolating resistor, to drive a high level input on a tape recorder or transmitter etc.

Signals from the trimpot are coupled via a 0.1μF capacitor to the inverting input of the Schmitt trigger (IC2). Notice



Below: larger than life size photo of the assembled PC board.



VOICE OPERATED RELAY

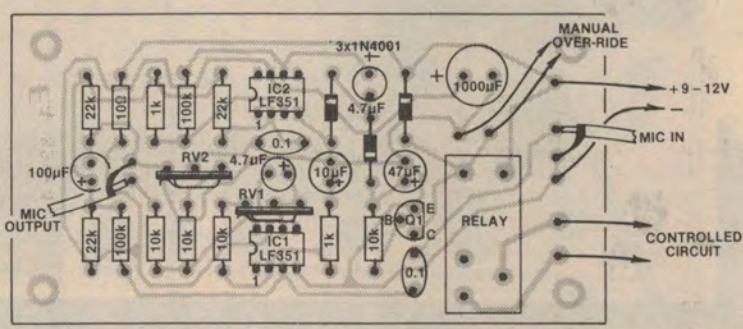
1/RA/-

The circuit suits 600Ω and 50kΩ microphones and may be operated from signals of 100mV RMS or more by omitting the preamp.

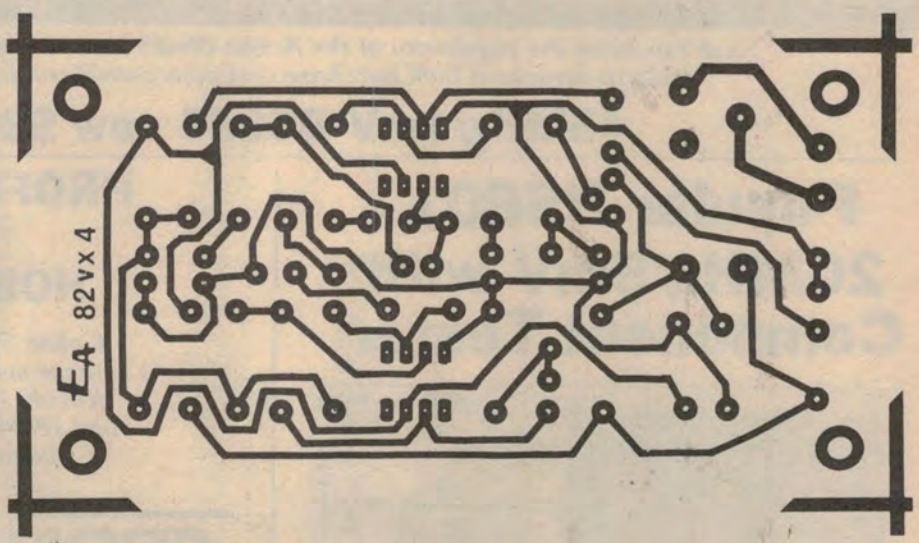
We estimate that the cost of parts for this project is approximately

$15.00

This includes sales tax



Follow this wiring diagram carefully and use shielded cable for the microphone input and output connections. Below is the PC board artwork.



that there is no negative feedback to the inverting input. Instead, there is positive feedback via a 100kΩ resistor to the non-inverting input, and this sets the hysteresis of the Schmitt trigger. For small signals to the inverting input there is no AC output and pin 6 will remain either high or low.

When the signal to the inverting input rises above about 65mV peak-to-peak (which is 23mV RMS for a sine wave), the output of the Schmitt trigger suddenly jumps to the limiting condition which is a square wave at the input frequency with amplitude just a little less than the full supply voltage, ie about 9V peak-to-peak.

So op amp IC2 suddenly changes from a zero gain condition to the limiting condition. This contributes to the fast attack time of the circuit.

Output from the Schmitt trigger is fed to a half-wave voltage doubler rectifier which charges a 47μF capacitor. This capacitor (when charged) provides base bias to relay driver transistor Q1 to enable it to energise the relay. A diode across the relay coil protects the driver transistor against inductive kickback from the relay.

Attack time of the circuit is inherently limited by the closing time of the relay and this is typically about 10ms. Delay time after the cessation of input signal is set by the size of the 47μF capacitor to about three seconds, which should be ample for most purposes. Optional manual override is provided by a SPDT switch wired in parallel with the relay driver transistor.

Power for the circuit can be derived from any plug pack supply capable of delivering 9-12V. Decoupling of the supply is provided by R1 (10Ω) and C1 (1000μF).

Construction

All components, except the override switch, are accommodated on a printed circuit board (PCB) coded 82vx4 and measuring 113 x 60mm. Begin construction by installing and soldering the PC pins, followed by the resistors and diodes. The remaining components can then be fitted, and the board carefully checked for errors.

In particular, check the polarity of the ICs, transistor, diodes and electrolytic capacitors.

If the circuit is to be controlled by signals with an amplitude of 100mV or more, the microphone preamplifier stage may be omitted. Just omit all the components to the left of C2 except for the two 22kΩ resistors and the 100μF bypass capacitor, and substitute a wire link for the 10kΩ resistor connected to the threshold trimpot. The input signal is then coupled in via C2.

The source impedance of the signal to drive C2 in this way must be less than 5kΩ. The outputs of many cassette and tape decks are quite suitable for this purpose.

The threshold trimpot may be replaced with a conventional potentiometer as a panel-mounting control, if you so desire.

To test the VOX, connect the microphone and power supply and set the RV2 threshold control to maximum sensitivity. RV1 is then set to provide the required signal level at the microphone output pin, while RV2 is adjusted to provide reliable triggering. If you do not intend to use the microphone output facility, set RV2 midway and adjust RV1 for reliable triggering.

Finally, if the microphone preamplifier is retained, the PCB should be housed in a metal box to keep hum and noise to a minimum. The circuit should be grounded only via the microphone input earth return.

PARTS LIST

2 LF351, TL071 FET-input op amps
1 BC547 NPN transistor
3 1N4001 diodes
1 printed circuit board, code 82vx4, 113 x 60mm
1 12V SPDT 180Ω relay
1 SPDT miniature toggle switch
10 PC stakes

CAPACITORS
1 1000μF 16VW electrolytic
1 100μF 16VW electrolytic
1 47μF 16VW electrolytic
1 10μF 16VW electrolytic
2 4.7μF 16VW electrolytic
2 0.1μF metallised polyester (greencap)

RESISTORS (¼W, 5%)
2 x 100kΩ, 3 x 22kΩ, 4 x 10kΩ, 2 x 1kΩ, 1 x 10kΩ, 2 x 100kΩ large vertical trimpots (see text).

NOTE: Components with higher ratings may be used provided they are physically compatible.