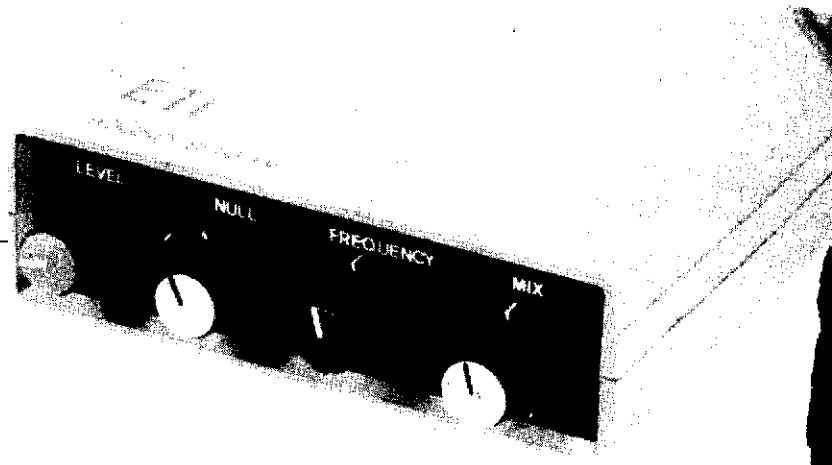
Sound Bender



This neat little ring modulator has a built-in wide-range sine/triangle modulation oscillator and a 'pan pot' output mixer, but can be built (less the case) for under $25.00.

ONE OF THE MOST popular types of cheap sound-effects units is the so-called 'ring modulator' or four-quadrant multiplier. These units have two inputs, one being a voice or music audio signal and the other being a simple sine or triangle oscillator waveform. The output of the unit is equal to the product of the two instantaneous signal amplitudes. In other words, the oscillator effectively amplitude-modulates the voice/music signal, to give some very interesting changes in the apparent signal content of the original voice/music material.

The ETI Sound Bender is a fully self-contained version of the popular ring modulator circuit. Naturally, however, our project has few special features. First, it has a built-in modulation oscillator that can span the frequency range 3 Hz to 5 kHz using a single control pot and which can produce either sine or symmetrical-triangle output waveforms. Second, the actual ring modulator is based on a precision four-quadrant multiplier circuit that is integrated into the oscillator chip; the multiplier balance is externally adjustable, enabling the unit to be used either as a 'sound bender' or as a simple sine/triangle audio generator. Finally, the unit incorporates a two-channel audio mixer in its output stage, which enables the original and modulated audio signals to be mixed in any desired ratio (ranging from 'all original' to 'all modulated') by a single pan-pot type control.

Our unit is designed to operate from nominal audio input signal levels of about 100mV RMS or greater and can simply be interposed between the output of the preamplifier and the input of the main amplifier of an existing audio system. The unit is battery powered by a stack of eight 1V5 cells and typically consumes about 12 mA.

Construction

The ETI Sound Bender is a fairly simple project and construction should present very few problems. Build up the PCB as shown by the overlay, noting the use of 16 Veropins to facilitate the circuit interwiring, then fit the PCB into a suitable case and complete the interwiring to the off-board components, noting that the two halves of RV4 are connected in opposite directions. On our prototype unit the four control pots are fitted on the unit's front panel and the two switches and the input/output terminals are fitted on the rear panel. As you can see from the photographs,

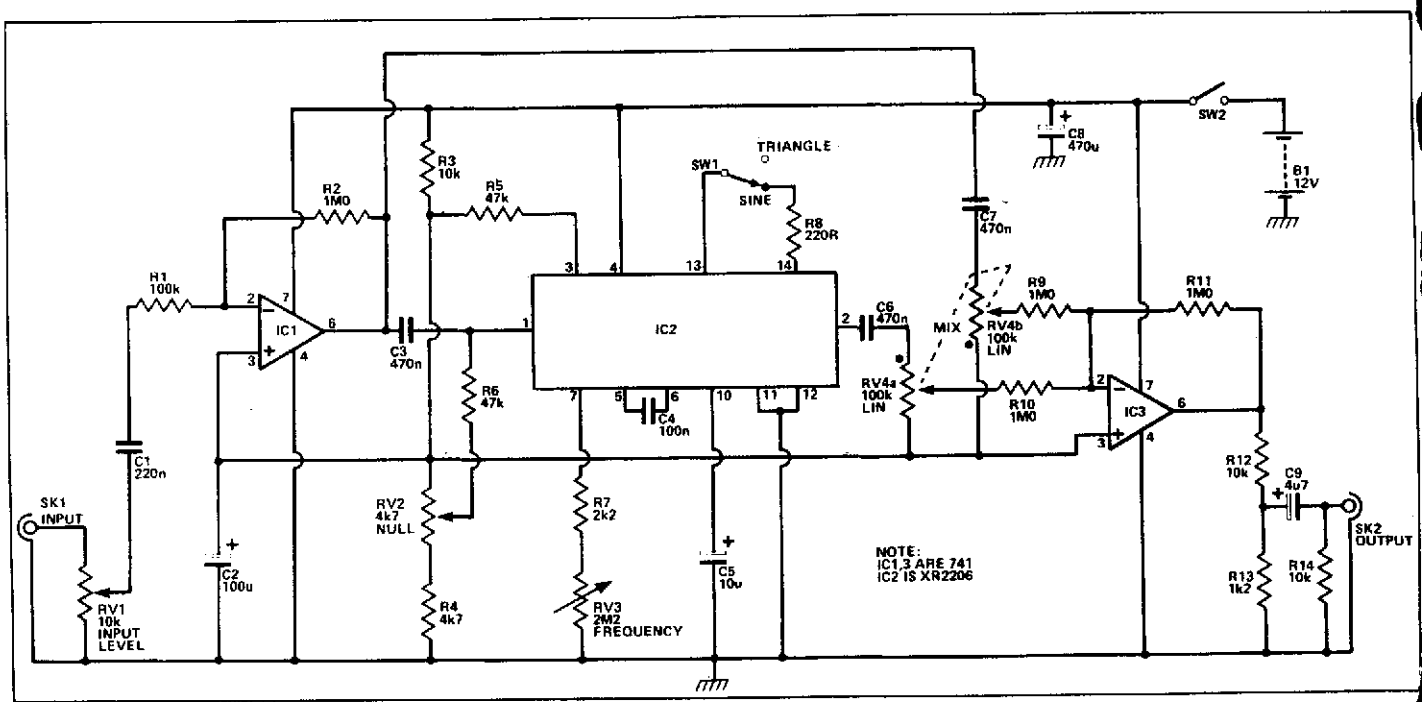
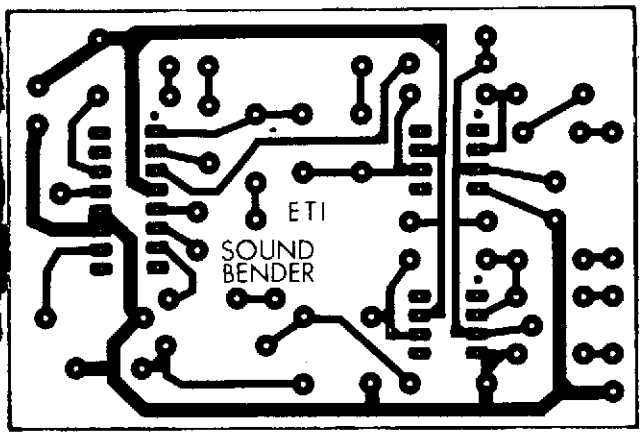


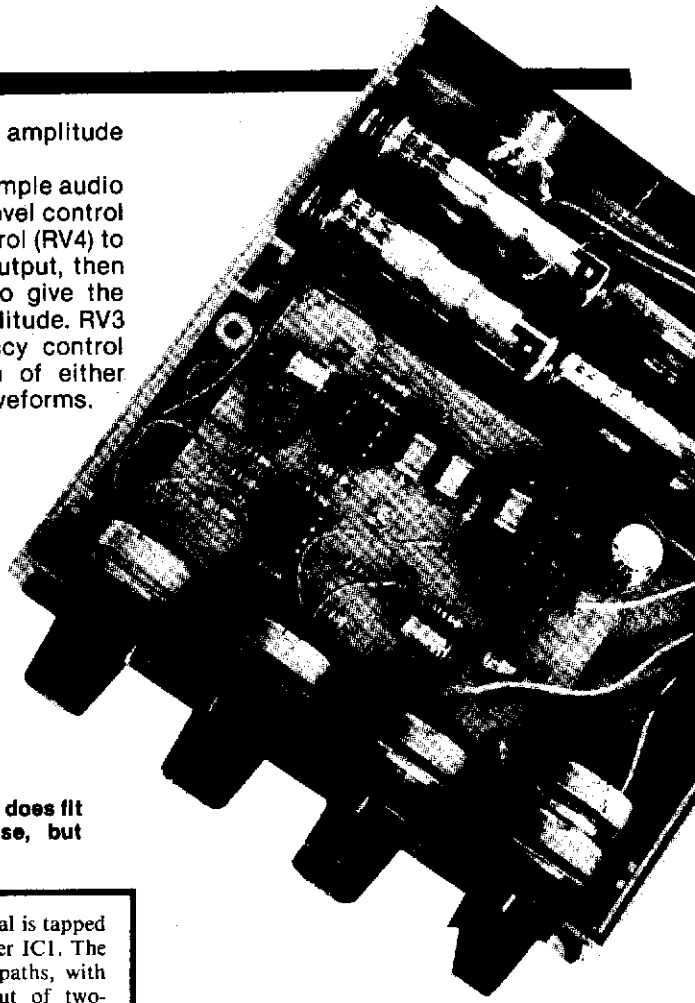
Fig. 1 Complete diagram of the ETI Sound Bender.

the circuitry and battery pack make a fairly tight fit in the case.

The unit is very easy to use. Simply connect the output to an audio power amplifier/speaker combination, adjust RV2 (null) for zero output tone, then connect a voice or music input signal and see how the sound can be 'bent' using the frequency and mix controls. Level control RV1 is simply adjusted to give good sensitivity without amplitude limiting (clipping).

To use the unit as a simple audio generator, turn the input level control down and set the mix control (RV4) to give a 'modulation only' output, then adjust null control RV2 to give the desired output signal amplitude. RV3 then acts as the frequency control and SW1 gives selection of either sine or triangle output waveforms.





Everything does fit in the case, but only just!

How it Works

The heart of this unit is IC2, an XR2206 function generator chip that incorporates a wide-range sine/triangle waveform generator and a precision four-quadrant multiplier within a single package. The output of the waveform generator is internally connected to one input of the multiplier, and the other input of the multiplier is accessible at pin 1: the output is available at pin 2.

In our application, the generator can produce either sine or symmetrical-triangle waveforms, depending on the setting of SW1, and its frequency (determined by C4-R7-RV3) can be varied over the range 3 Hz to 5 kHz via RV3. The pin 1 input of the multiplier is biased by RV2, which is normally adjusted to balance the multiplier so that it produces zero output when zero signal input is applied to pin 1.

The audio input signal is applied across RV1 and a fraction of this signal is tapped off and applied to X10 amplifier IC1. The output of IC1 splits into two paths, with one path passing to one input of two-channel audio mixer IC3 via RV4b, and with the other path passing to the input (pin 1) of IC2, which has its output (pin 2) taken to the other input of the IC3 mixer via RV4a. Note that mix controls RV4a and RV4b are connected in opposite directions so that they control the mixing action in 'pan pot' fashion, giving a final output from IC3 that ranges from 'all original signal' to 'all modulated signal' in the extreme settings of RV4. The output amplitude of IC3 is divided by 10 (by R12-R13), so that the final output signal has an amplitude roughly equal to that of the input signal feeding IC1, thereby giving the Sound Bender a good overall signal-to-noise ratio.

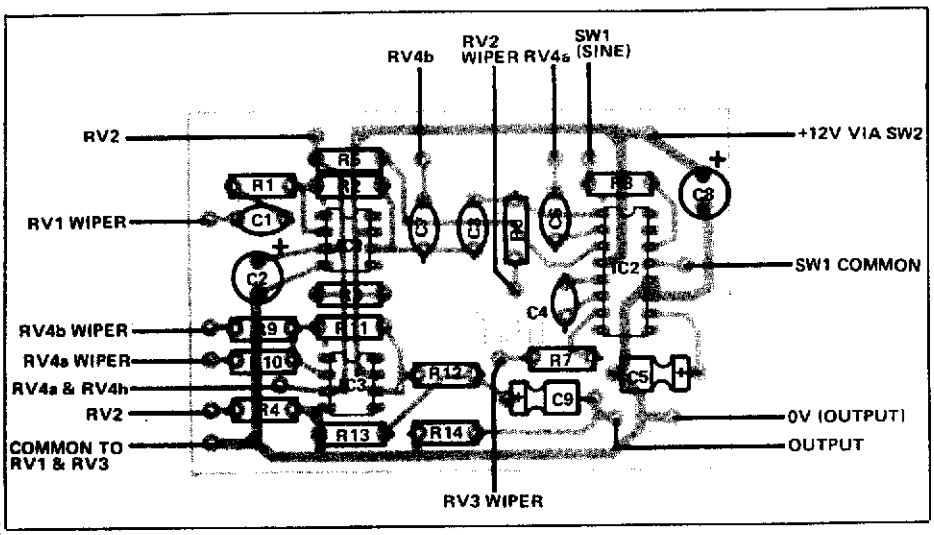


Fig. 2 Component overlay.

Parts List

Resistors
(all ¼W, 5%)

R1	100k
R2,9,10,11	1M0
R3,12,14	10k
R4	4k7
R5,6	47k
R7	2k2
R8	220R

Potentiometers

RV1	10k linear
RV2	4k7 linear
RV3	2M2 linear
RV4	100k dual linear

Capacitors

C1	220n polycarbonate
C2	100u 16V PCB electrolytic
C3,6,7	470n polycarbonate
C4	100n ceramic
C5	10u 25V axial electrolytic
C8	470u 16V PCB electrolytic
C9	4u7 16V axial electrolytic

Semiconductors

IC1,3	741
IC2	XR2206

Miscellaneous

SW1,2	SPDT miniature toggle
SK1,2	phono sockets
PCB	
battery holders (two off).	