



VOCAL EFFECTS/MIXER



Build this vocal effects mixer and get studio-quality sound "reverberations" in your recordings.

TERRY WEEDER

IF YOU ENJOY EXPERIMENTING WITH home recordings, you'll be interested in our vocal effects mixer. With a few evenings' work and a cost of \$50, you'll be able to shape your voice with tone controls and create a "multiple-echo" effect while mixing in audio from a tape, CD, or other stereo source. The effects mixer can also be used with the lead vocal filter (*Radio-Electronics*, September 1990), to mix your own voice with vocal-less music. Let's see how your stereo's channels are mixed together and delayed to produce the reverberation effects.

How it works

The effects mixer takes the line-level output from your stereo's RECORD jacks and applies it to two mixers—one for each channel (left and right). Figure 1 shows a block diagram of how the circuit works. The signal from a

microphone is amplified by a pre-amp and is then sent to an equalization stage where bass and treble levels can be adjusted independently. That signal is fed to an 8-ms delay circuit whose output is remixed with the original to simulate an echo. The delayed signal is attenuated and fed back to the input of the delay circuit, to generate the effects of multiple echoes.

Finally, the vocal signal and its echoes are fed to two mixers, where they combine with the music program being received from the stereo system. The output of those mixers are then fed to the stereo amplifier, via its PLAY input jacks.

Circuitry

The schematic of the effects mixer is shown in Fig. 2. The stereo input signal is coupled via C1 and C2 to the two mixers, IC1-

c and IC1-d. The signal from the microphone is coupled via C13 to IC4-c, which amplifies it 30 times to a line level of approximately 200 mV. The impedance seen by the mike is set by R24, while C14 and R25 filter out frequencies above the voice spectrum.

The output of IC4-c passes through tone controls R28 and R30 (with the associated capacitors) and is applied to the non-inverting input of IC4-b. The gain of IC4 is set by R33 and R34 at 12, which makes up for the loss occurring in the tone-control stage.

The signal then goes through IC1-b to IC2 (an RD5106 256-sample bucket brigade by EG&G Reticon), which delays the signal about 8 milliseconds. An oscillator made up of IC3 and its associated components generates a clock pulse for IC2, which determines the delay time and

can be calculated by

$$512/f_c = \text{total delay,}$$
 where f_c represents the clock frequency. A low-pass filter is formed by IC1-a, which smooths out the sample steps caused by

the delay chip. The output of IC1-a is then fed through FEEDBACK potentiometer R9 back to the input of the delay stage, via mixer IC1-b.

The output of IC1-a is also fed

to mixer IC4-a through EFFECTS-LEVEL potentiometer R15. IC4-a combines that signal with the original signal coming from IC4-b. The volume level is adjusted using R41 together with IC4-d. From there the signal is sent to IC1-c and IC1-d where it mixes with the signal coming from the stereo.

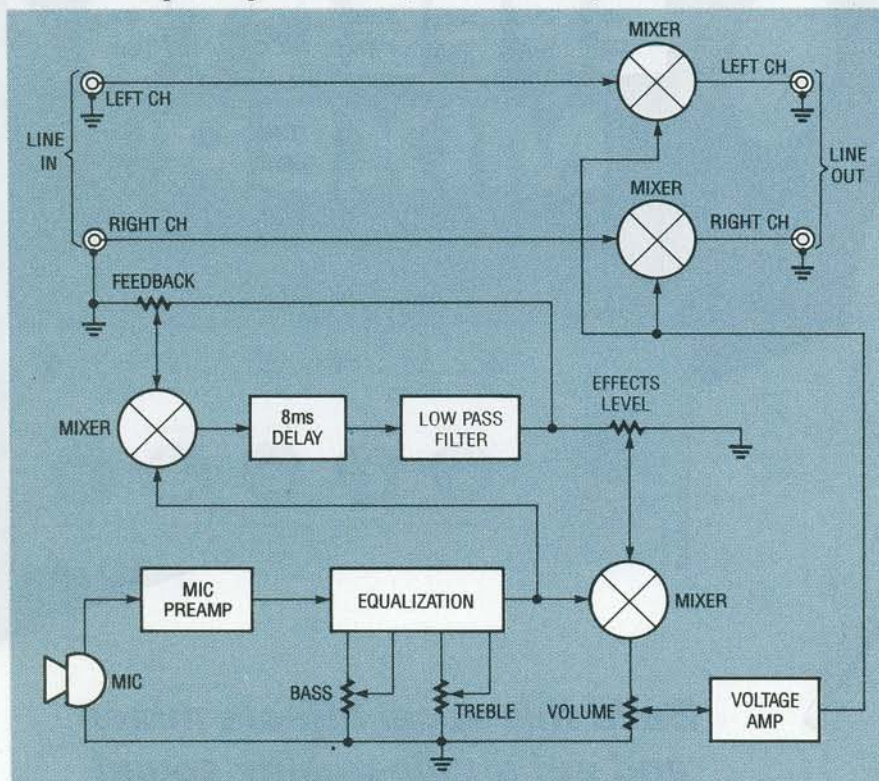


FIG. 1—BLOCK DIAGRAM. The mike signal is adjusted with bass and treble controls. Echo is produced by delaying the signal 8 milliseconds then remixing with the original signal. Feeding the output of the delay circuit to its input causes multiple decaying echoes. The mike signal with echoes are mixed with the stereo signal.

Construction

The author's finished prototype is shown in Fig. 3. The main circuit is mounted on a single-sided PC board, while the power supply (Fig. 4) is wired on a perforated construction board. An etched and drilled PC board is available from the source mentioned in the parts list, or you can build your own using the foil pattern provided. Mount the components according to the parts placement diagram shown in Fig. 5. Note that R24 sets the input impedance at the mike input. The value of that resistor should be 300 ohms when using a low-impedance microphone, or 10K with a high-impedance mike.

A 1/4-inch phone jack can be mounted on the front panel for use with a high-impedance microphone, or an XLR 3-pin jack can be used for a low-impedance mike.

PARTS LIST

All resistors are 1/4-watt.

- R1, R2, R5—150,000 ohms
- R3, R13, R16—R18, R21—R23, R40—47,000 ohms
- R4—100,000 ohms
- R6—1 megohm
- R7, R27—33,000 ohms
- R8—10 ohms
- R9, R15, R28, R30, R41—100,000 ohms, potentiometer
- R10, R12—10,000 ohms
- R11—43,000 ohms
- R14, R19, R20, R37—15,000 ohms
- R24—300 ohms or 10,000 ohms (see text)
- R25, R29—20,000 ohms
- R26—1000 ohms
- R31—3000 ohms
- R32—2200 ohms
- R33—5100 ohms
- R34—56,000 ohms
- R35, R36, R38, R39—39,000 ohms
- R42—130,000 ohms

Capacitors

- C1, C2—2.2 μ F, tantalum
- C3, C5, C6, C19—0.1 μ F, mylar

- C4—1 μ F, tantalum
- C7—0.15 μ F, tantalum
- C8—200 pF, ceramic disc
- C9—0.002 μ F, ceramic disc
- C10—270 pF, ceramic disc
- C11, C12—4.7 μ F, tantalum
- C13—10 μ F, electrolytic
- C14—39 pF, ceramic disc
- C15—0.005 μ F, mylar
- C16—0.033 μ F, mylar
- C17—0.01 μ F, mylar
- C18—0.068 μ F, mylar

Semiconductors

- IC1, IC4—LM324 quad op-amp
- IC2—RD5106 256-sample bucket-brigade analog delay line, EG&G Reticon
- IC3—4011 quad two-input NAND gate

Power-supply parts

- F1—0.5 amp fuse and fuseholder
- T1—24 VAC center-tapped transformer, 100 mA
- BR1—1.5-amp bridge rectifier, 100 PIV
- C1, C2—1000 μ F, 25 volts, electrolytic

- C3, C4—10 μ F, 16 volts, electrolytic
- C5, C6—0.1 μ F, ceramic disc
- D1, D2—12-volt Zener diode
- R1, R2—220 ohms
- R3—1000 ohms

- S1—SPST switch, 1 amp

LED1—light emitting diode, any color
Miscellaneous: PC board, stand-offs, hardware, wire, shielded cable, power-supply cord, strain relief, four RCA jacks, XLR jack or 1/4-inch phone jack, five knobs, and enclosure.

NOTE: The following are available from Weeder Technologies, 14773 Lindsey Rd., Mt. Orab, Ohio 45154: An etched, drilled, and plated through PC board, \$10.00; all board-mounted components, \$19.00; power-supply components (not including the perforated construction board, fuse, fuseholder, and switch), \$12.50. Include \$2.00 for shipping and handling. Ohio residents add 5.5% sales tax.

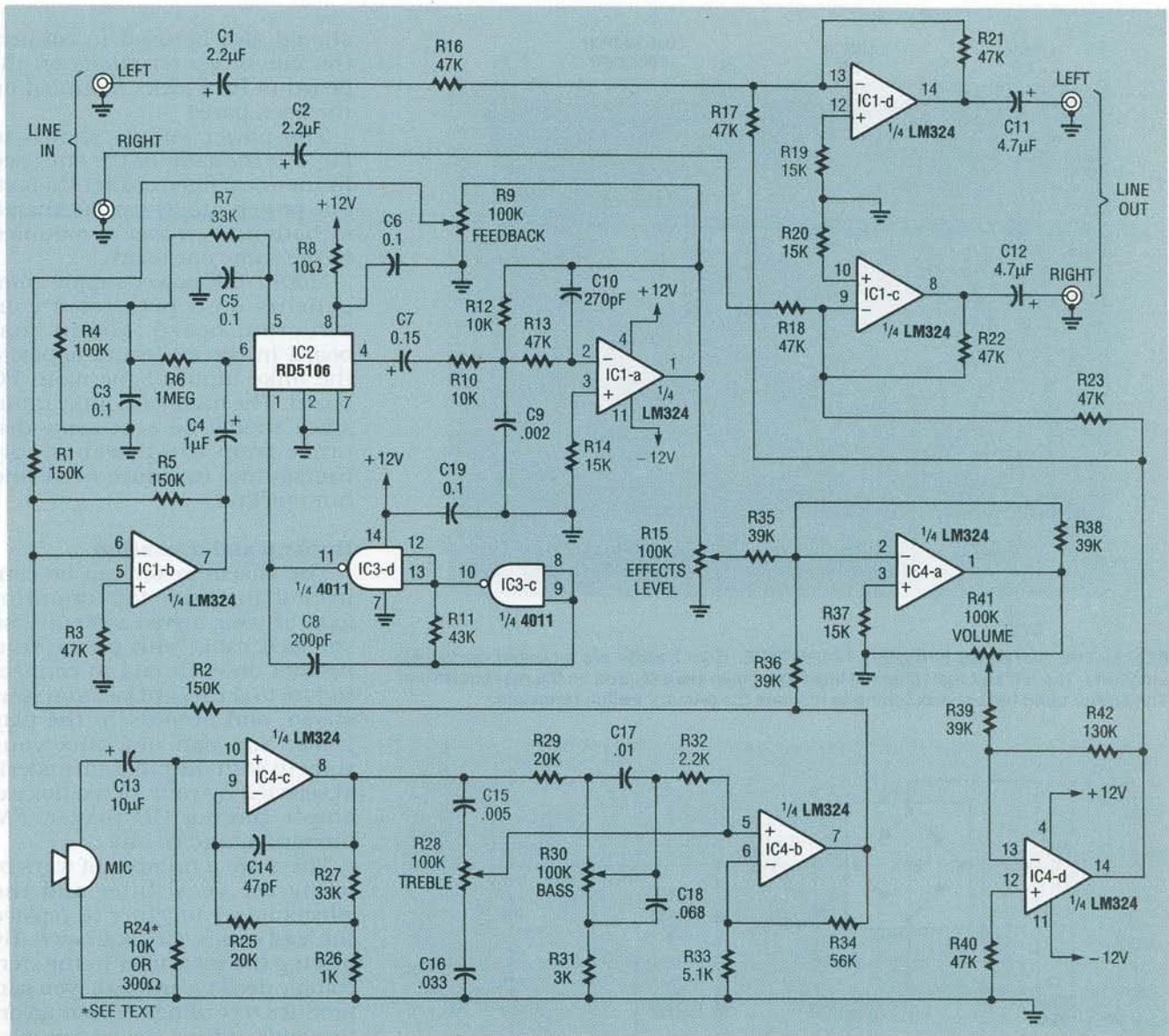
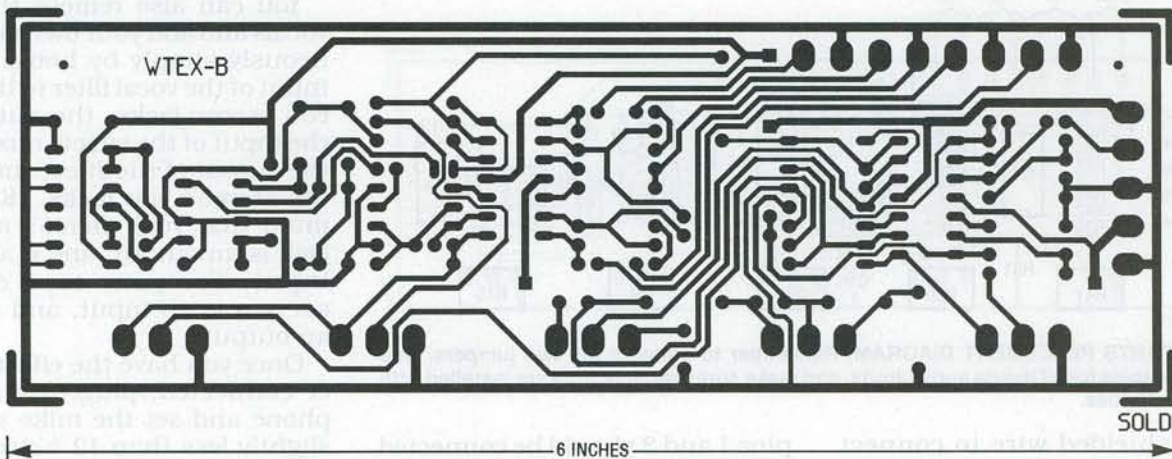


FIG. 2—SCHEMATIC OF THE EFFECTS MIXER. The output from the stereo's RECORD jacks are fed to mixers IC1-c and -d. The mike signal is amplified by preamp IC4-c, IC4-b corrects for signal attenuation in the tone-control stage. IC2 delays the signal 8 milliseconds and IC1-a smooths out the sample steps. The delayed signal combines with the original in the IC1-a mixer, then passes through volume control amp IC4-d to mixers IC1-c and -d where it combines with stereo music. The output is then fed back to stereo via the PLAY jacks.



THIS IS THE SOLDER SIDE of the PC board.

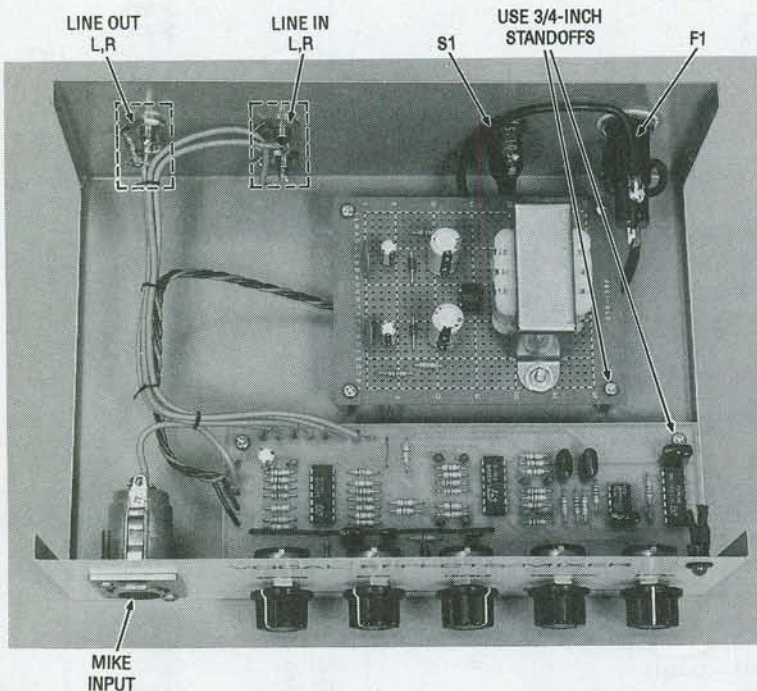


FIG. 3—THE AUTHORS FINISHED PROTOTYPE. Both boards are mounted on 3/4-inch standoffs. The left and right channel line IN/OUT jacks are mounted on the rear enclosure. The author used heat-shrink tubing to insulate the primary switch terminals.

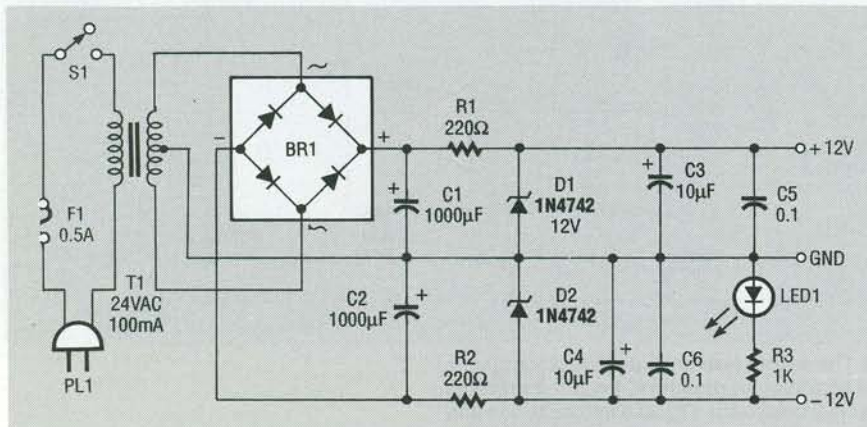


FIG. 4—POWER SUPPLY SCHEMATIC for the effects mixer circuit. Note that this is a dual supply.

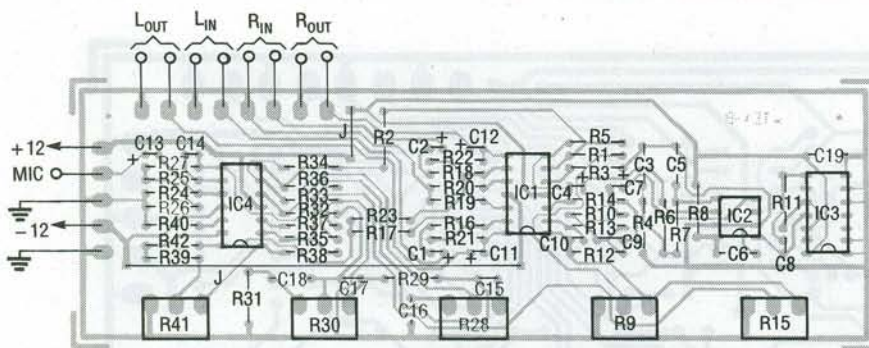


FIG. 5—PARTS PLACEMENT DIAGRAM. Remember to connect the two jumpers. Use shielded cables for all inputs and outputs, and make sure the capacitors are installed with correct polarities.

Use shielded wire to connect the jack to the mike input on the board. When using an XLR jack,

pins 1 and 3 should be connected to the shield and pin 2 to the center conductor. Shielded wire

should also be used to connect the line IN/OUT terminals on the board to RCA jacks mounted on the back panel.

The power supply shown in Fig. 4 is the same as the one used in the vocal filter project. In fact, one power supply can be shared by both units if they're mounted in the same enclosure.

Mount the power-supply components on a perforated construction board. Mount that board in the enclosure opposite the mike input of the main PC board. The high-gain mike input stage should be kept some distance from the power-supply transformer to reduce noise and hum pickup.

Hookup and operation

The effects mixer can be connected into the tape-monitor loop of your stereo system. Use shielded cable with phono connectors on each end to connect inputs to the record jacks on your stereo, and outputs to the play jacks. You can now mix your voice in with the program material selected by your stereo (for example phono, CD player, FM broadcast, and so on).

There are a number of ways of using the vocal filter and the effects mixer together to replace the lead vocals with your own. By placing the vocal filter in the stereo/tape deck record path, you can produce recordings of your favorite songs, minus the lead vocals. Then by placing the effects mixer in the tape deck/stereo playback path, you can dub in your own voice live, or record the music and your voice together with a second tape deck.

You can also remove the lead vocals and add your own simultaneously simply by hooking the input of the vocal filter to the stereo's RECORD jacks, the output to the input of the effects mixer and the output of the effects mixer to the stereo's PLAY jacks. (Keep in mind that your stereo's RECORD jack is an output, and PLAY is an input. For your tape deck, RECORD is an input, and PLAY is an output.)

Once you have the effects mixer connected, plug in a microphone and set the mike volume slightly less than 12 o'clock and the effects controls at their mini-
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imum (counter clockwise) position. Make sure the volume level of your stereo is at its minimum, then turn it on and switch the selector to a source other than the tuner so that you can adjust the mike controls without hearing any music. Now turn up the stereo volume so that your voice can be heard and adjust the BASS and TREBLE controls (R28 and R30) for the desired coloration.

Next, adjust the EFFECTS LEVEL and FEEDBACK controls for the amount of echo desired. The volume of the initial echo is adjusted with the EFFECTS-LEVEL potentiometer (R15), while the amount that each succeeding echo is attenuated is controlled by the FEEDBACK potentiometer (R9).

Now tune in an FM broadcast or put on a record or CD and adjust the mike volume (R41) to match the level of your voice with that of the music. Have fun! **R-E**