

BUILD A STEREO

ROTO-BLENDER

MOST STEREO recordings made in a professional studio begin as a number of "tracks" (usually 16 or more) on tape, which are subsequently mixed down to two channels. During mixing, the apparent location of each instrument and vocalist is fixed in the final left and right channels by its relative loudness. Usually, the listener cannot alter the mix other than by transposing or by blending the two channels to reduce stereo separation. With the "Stereo Roto-Blender," however, he can remix the recording, within certain limitations, to improve the mix and emphasize previously "buried" sounds. It also allows him to blend and transpose the two resulting channels in the conventional manner. The new mix will have roughly the same channel separation as the original program.

The Basic System. The Roto-Blender is made up of two basic parts: a stereo ROTATE control, which is the heart of its remixing capabilities, and a stereo BLEND control (Fig. 1). The ROTATE control "rotates" the performers in a circle around the listener. With the control centered, the mix is unaltered. As it is rotated clockwise, the sounds originating from the left and center shift to the right. The sound originating from the right moves over to the left to complete the rotation.

The above effect is illustrated in Fig. 2. Note that, with the ROTATE control centered (NORMAL), a vocalist is centered between a guitar on the left and a piano on the right. By rotating the control to the left, the vocalist and piano shift one position to the left and the guitar

comes over to the right. Exactly the opposite rotation occurs when the control is rotated in the clockwise direction. The control alters both the sonic directions and relative loudnesses of each sound. Normally, when a sound is shifted to the center, it becomes louder, and when it is shifted away from center, it becomes quieter. This allows the listener to emphasize interesting or previously unnoticed sounds.

The BLEND control allows you to reduce channel separation down to monaural as it is turned from fully clockwise to center. Rotating the control counter-clockwise causes the separation to increase, this time with the left and right channels transposed. This transposition provides additional flexibility in the remixing process.

*Lets you
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About the Circuit. The left- and right-channel inputs to the Roto-Blender in Fig. 1 are buffered by IC1A and IC1B and passed to differential amplifier IC1C whose output is an R - L signal. This signal is similar to the combined left- and right-channel signals minus the center-channel material. NULL ADJ control R13 permits the center-channel material to be precisely cancelled to achieve optimum results.

The R - L signal is inverted by IC1D to produce an L - R signal. The left- and right-channel signals plus the composite signals are applied to ROTATE potentiometer R14. Figure 3 illustrates the signals applied to R14 and indicates how the resulting output signals on each control wiper vary over the range of the potentiometers. An important feature of this arrangement is the cancellation of one channel when the control is at its center of rotation, leaving only the remaining channel, attenuated by one half. In this manner, normal stereo is obtained at center of rotation. The attenuation is counteracted by IC2A and IC2B, whose boosted outputs are added to the R14 outputs through R11 and R12. This does not affect the signal at the extreme positions of the ROTATE control, due to the potentiometer's zero source impedance, but increases in effect as the pot is adjusted to its center position. This results in a nearly constant loudness at all positions of the potentiometer for most stereo signals.

After rotation occurs, the signals are applied to buffer amplifiers IC2C and IC2D. BLEND control R15 mixes the signals in varying proportions to achieve

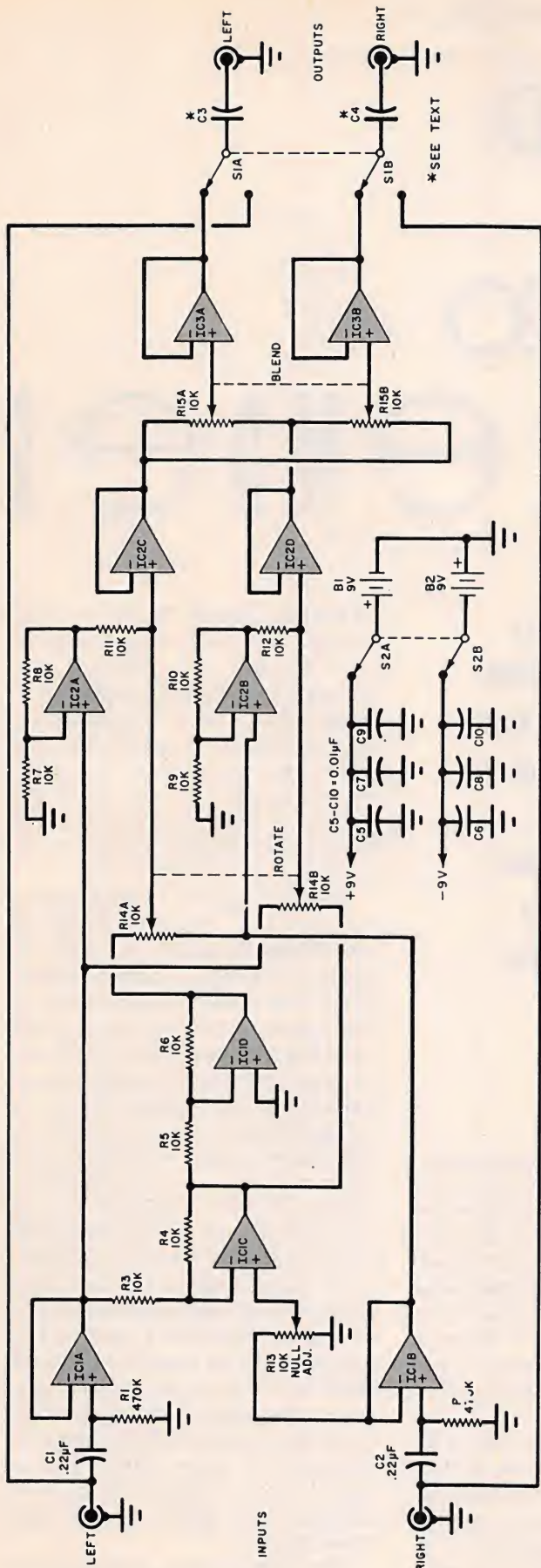


Fig. 1. The left and right stereo signals are buffered in IC1A and IC1B and combined in IC1C. Potentiometer R13 adjusts the null.

PARTS LIST

- B1, B2—9-volt battery
- C1, C2—0.22- μ F disc
- C3, C4—1- μ F nonpolarized (see text)
- C5 through C10—0.01- μ F disc (see text)
- IC1, IC2, IC3—4136 quad op amp (or any other op amp IC—see text)
- J1 through J4—Phono jack
- R1, R2—470,000-ohm, 1/4-watt, 10% resistor
- R3 through R12—10,000-ohm, 1/4-watt, 10% resistor
- R13—10,000-ohm, linear-taper potentiometer
- R14, R15—10,000-ohm, linear-taper dual potentiometer
- S1—Dpdt switch
- S2—Dpst switch

Misc.—Holders for B1 and B2; printed circuit or perforated board; sockets for IC's; control knobs (3); suitable enclosure; lettering kit; machine hardware; hookup wire; solder; etc.

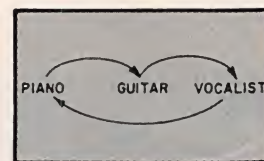
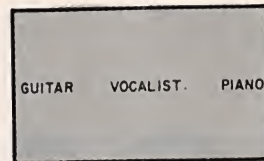
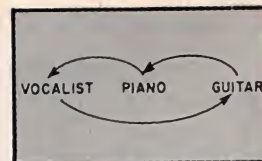


Fig. 2. With R14 centered, as in middle diagram, vocalist is between piano and guitar. With R14 rotated to either extreme, relative positions are changed.

either normal or reversed stereo, mono, or anything in between. These signals are then buffered by IC3A and IC3B, after which they are delivered to the Roto-Blender's outputs. Capacitors C3 and C4 are optional and are required only if the input to the amplifier to which the Roto-Blender is connected does not have similar capacitors. Their values should be chosen to have a low impedance at 20 Hz, compared to the impedance of the amplifier.

The Roto-Blender can be either battery powered as shown in Fig. 1 or driven by a ± 6 -to- ± 15 -volt ac operated supply, which should be decoupled using capacitors C5 through C10 located close to the +V and -V pins of each op amp used. (The op amps used in the author's prototype were 4136 quad types, which required only three IC packages. If you use a different op-amp type, and almost any other type will work in this circuit, you will have to increase the number of 0.01- μ F capacitors so that two capacitors are used for each IC package.)

and boost the bass region using the Parametric. Using a high Q setting, vary the center frequency of the low-band equalizer until you discover the room's fundamental resonant frequency. (That's the one at which the walls start shaking and the furniture moves around the floor.) Now reduce the setting of the BOOST/CUT control for more even-sounding bass. The high-band equalizer can be used to brighten up a room that is too "dead" acoustically or to attenuate treble response in a room that is too "alive."

You will undoubtedly find other uses for this versatile project. Those who listen to music analytically will appreciate the ability to zero in on one particular instrumental (or human) voice. Amateur recording engineers can employ the Parametric to tailor the sounds of a mix. And, of course, anyone whose speakers have response irregularities will be able to smooth them out.

One word of caution—don't blindly apply large amounts of deep bass and extreme treble boost in an attempt to flatten the response of your system at the upper and lower limits of the audible spectrum. Experience has shown that

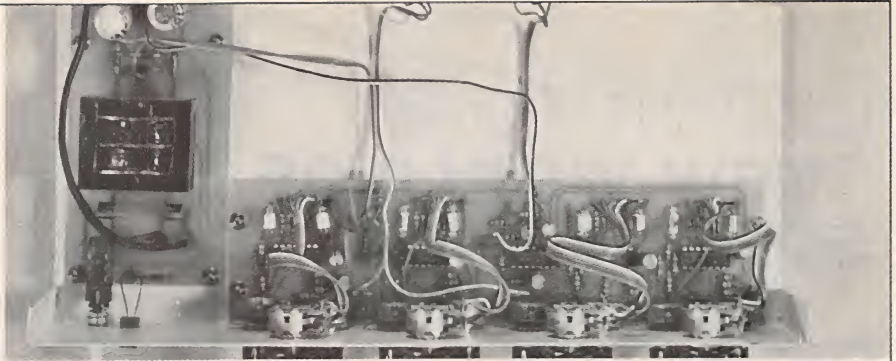


Fig. 13. Interior view of prototype using ac power supply.

room/system combinations are best equalized by first employing acoustic methods, followed by electronic equalization. For example, you should first try repositioning the loudspeakers, modifying the absorption coefficients of the room, and adjusting the speakers' crossover level controls (if any).

Most often, a lack of deep bass and extreme highs is due to the limitations of dynamic drivers. Don't try to force flat response out of your speakers by cranking up the BOOST/CUT controls. The results of such attempts frequently include overloaded amplifiers, excessive distortion, and blown voice coils. Remem-

ber—equalization should be introduced intelligently.

In Conclusion. We have presented a stereo Parametric Equalizer project that is well suited for home, mobile, and portable applications. It provides a high level of performance and the flexibility of control inherent in the parametric design, enough flexibility for most readers. Those who require more bands of equalization per channel can reproduce two or more complete equalizers and connect them in cascade for even greater control over the sounds they record or reproduce. ◇

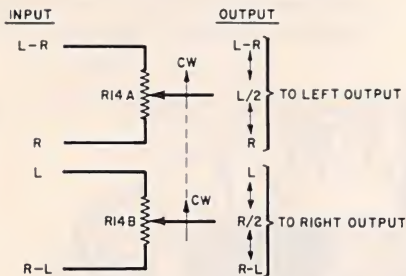


Fig. 3. The left and right signals and the composite are applied to R14 as shown. Note how the resulting output signals on each control wiper vary over potentiometer range.

Construction. The circuit can be assembled on a printed circuit board of your own design or on a perforated board using pencil wiring techniques. In either case, it is a good idea to use sockets for the IC's. Mount the potentiometer controls, input and output jacks, and POWER and IN/OUT switches on the box in which the circuit is housed. Use a dry-transfer lettering kit to label the controls, jacks, and switches according to function and operation.

Application. The Roto-Blender unit should be connected to suitable high-level inputs and outputs for optimum results. You can connect it between a preamplifier and power amplifier or,

lacking this facility, into the tape-monitor loop. It is a good idea to hook it up ahead of the headphone amplifier, since the Roto-Blender is best appreciated using headphones.

For proper operation, the Roto-Blender should be nulled to counteract imbalances in the source material and preceding electronics. This can be done by disconnecting the right channel output of the Roto-Blender and, with the ROTATE and BLEND controls fully clockwise, adjusting the NULL ADJ control to exactly cancel the center sounds of the program source. If a mono source is used, adjust for minimum sound. Excessive distortion heard at this time indicates either a worn record or stylus or

some other deficiency in the source material or amplifier's electronics.

Cancellation of center sounds with some recordings is not possible when the sounds are reproduced differently in each channel, using reverberation techniques. This case should not be confused with the case where distortion prevents nulling with a raspy sound.

Once nulling is accomplished, the right channel can be reconnected and the ROTATE pot should be centered for normal stereo reproduction. If an instrument on the left—a trombone, for example—is to be emphasized, rotate the sound to the right by turning the ROTATE control clockwise. This moves the trombone to the center, where it will be more dominant. At this point, if the BLEND control is rotated fully counterclockwise, the trombone will remain centered while the left and right channels will be effectively transposed.

The effects achieved by the Roto-Blender are a function of the source material and cannot be fully described here. Perhaps the most fascinating aspect of the Roto-Blender is its ability to bring forth sounds that were never noticed before. ◇