OCTAVIZER

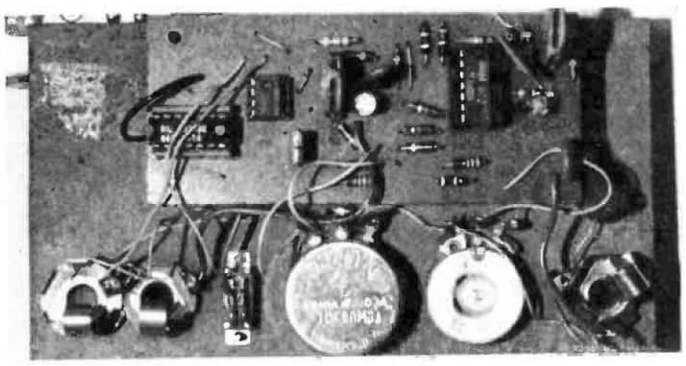
Add a third dimension to the sound of music

CONNECT ANY ELECTRIFIED or electronic musical instrument to OctaVizer and your instrument's single frequency output is expanded threefold. In addition to the single frequency input signal, square waves at fifty-percent of the frequency and one at twenty-five-percent of the frequency are available at OctaVizer's output. All three signals can be mixed in any proportion desired, using the *blend* and *prime* controls. The composite output signal can be used immediately, or further processed using filters or other such devices.

The *blend* control adjusts the relative magnitude of the two square wave signals, while the *prime* control adjusts the amount of input signal which is fed through to the output. The footswitch-operated cancel function disables the square wave outputs when activated.

OctaVizer uses readily available linear and CMOS digital integrated circuits, is powered by a single 9-volt battery, and can be built for less than $15.00.

How It Works. As shown in the schematic diagram, the input signal is AC coupled through C1 and C6 to a low-pass filter and a level control (R23) respectively. R4 and C2 form the low pass filter with a −3 dB point of about 350 Hz, which filters higher order harmonics that might otherwise be detected in later stages and cause false triggering. The filtered signal is amplified in IC1D along with the DC level set by R2. The output of IC1D is further processed in IC1A where it is squared up and clipped. The output of IC1A is AC coupled through C3 and added to the variable DC level set by R12 in the R11, R12, R13 voltage divider. This composite signal is used to trigger a monostable multivibrator (one shot) formed from IC2, R14, R15 and C4. If pin 4 of IC2 is held low by grounding J2, the output remains low regardless of the input. If J2 is not grounded, pin 4 of IC2 is held high by R16 and the pin 3 output is a pulse train of the same frequency as the input signal. This pulse train is used to clock two divide-by-2 flip-flops (IC3B and IC3A) which produce square waves at one-half and one-quarter the frequency of the input pulse train. The two flip-flop outputs are attenuated in the two variable voltage dividers formed by R17, R18 and R19. With R19 set at midrange, two equal voltage dividers are formed which attenuate the 9-volt square wave outputs to about 95-millivolts each (a level similar to that of the input signal). As the wiper is moved toward one side, that divider's signal level is decreased while the other's is increased. Therefore, *blend* control R19 can select either signal alone, or any ratio of the two. The level of the input signal provided to IC1B is selected by the *prime* control (R23). This signal, along with the output of the two voltage dividers, is added in unity gain summer IC1B. Since the output of IC1B has a DC component, it is coupled by C5 to output jack J3.



As you can see from this almost full-scale photograph, the circuit board is rather compact. It would be a relatively easy matter to build it into an existing pre-amp. Any suitable case can be used to house this board, but a "wood-grain" type will match the instrument's finish.

Construction. OctaVizer can be constructed using any standard technique. Standard CMOS handling precautions should be observed when handling IC3. IC sockets may be used if desired. Assemble all components onto the board, being sure to observe polarity for the ICs, D1, and C5. Note that C6 is not mounted on the PC board, but is wired directly between J1 and R23. Interconnect the completed PC board with all jacks and controls. Any suitable case may be used to house the project.

Alignment. If the input to OctaVizer was always a pure, mono-frequency signal, no alignment would be necessary. However, many electrified musical instruments' outputs are generated by a non-linear electromagnetic device (such as a magnetic pickup) and, as such, contain non-sinusoidal and/or harmonically related components. These

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components can be detected and cause false triggering. The alignment procedure outlined below will minimize the effects of these components while maximizing the overall response of the unit.

Begin by setting the wiper of R2 to ground, and the wipers of R12 and R15 to midposition. Connect the input device you will be using, and patch the output to an amplifier. Turn the unit on and rotate the wiper of R12 towards ground until you hear oscillation begin. Now turn the wiper of R12 slightly past the point where the oscillations stop (If a VOM is handy, set the voltage on the wiper to about 3¼-volts). Set R23 (*prime*) to minimum and R19 (*blend*) to high. As you play the instrument, rotate the wiper of R2 until an output is obtained. If the output is not half the frequency of the input (as determined aurally), back off R12 very slightly. You will notice that when the proper frequency output is obtained, its duration may be short. To increase the duration, adjust R2 slightly in the direction that produces oscillation. Next, play the highest note you will intend to play. The output will either be correct, very static sounding, or much lower in frequency than anticipated. If the output is correct, no adjustment is required. If the output is static sounding or lower than anticipated, rotate R15 until the proper output is obtained.

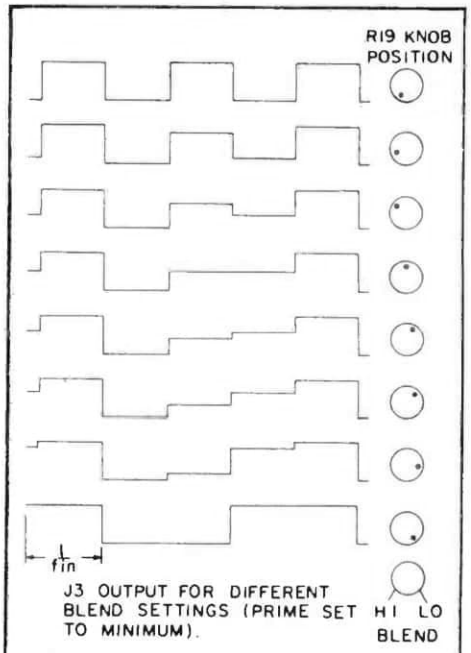
The final step is a fine adjustment which will maximize how long the signal lasts while minimizing false triggering. This adjustment consists of alternately adjusting R12 and R2 until you are satisfied you have obtained maximum duration and minimum (if any) false triggering.

Use. OctaVizer can be used over a 3-octave range. As with any new device, it is best to experiment with all controls to determine the effects that can be obtained. A standard guitar can be used with OctaVizer to create a raspy bass guitar effect by setting *blend* to "Hi" and *prime* to "Min." An interesting effect is created with *blend* to midvalue and *prime* set so both output components are of equal loudness. By striking the strings forcefully, you can create high amplitude harmonics that will false trigger the unit and raise the square wave outputs in frequency by an octave. Thus, by varying your striking force, you can play in different octaves.

When viewed on an oscilloscope, the output signal changes shape as shown in the diagram when the *blend* control is rotated. As you can see, at midsetting of the *blend* control, a step approximation to a ramp wave is generated. This signal can be fitted to produce a realistic reed-type sound.

A standard foot switch can be used for the *cancel control.* If not available, one can be made using a push on-push off SPST switch and a length of audio cable.

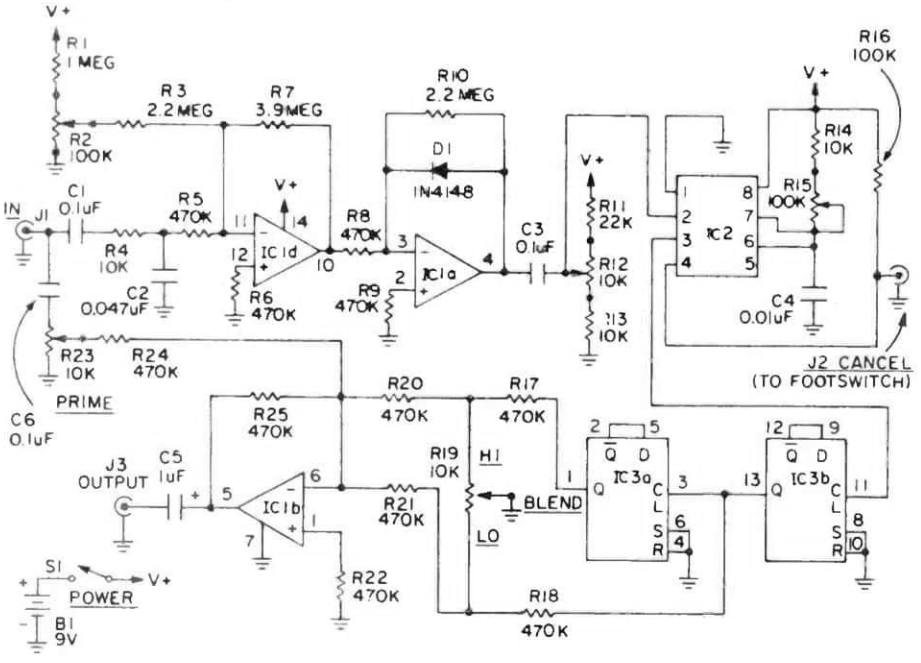
As you familiarize yourself with this new tool, you will find it an interesting and useful special effects device. ■



Here is the chart of the various waveform configurations made possible by varying settings on the "blend" and "prime" controls. Although designed for use through a three-octave range, if used with an electric guitar, false harmonics can be generated by forceful strumming, thus raising the outputs by one full octave automatically.

PARTS LIST FOR OCTAVIZER

B1—9-volt transistor battery
C1, C3, C6—0.1-μF, 25-VDC disc capacitor
C2—0.047-μF, 25-VDC disc capacitor
C4—0.01-μF, 25-VDC disc capacitor
C5—1.0-μF, 16-VDC electrolytic capacitor
D1—1N4148 diode
IC1—LM3900 quad op amp
IC2—555 timer
IC3—CD4013 dual flip-flop
J1, J2, J3—standard 2-conductor phone jack
R1—1,000,000-ohm, ¼-watt resistor
R2, R15—100,000-ohm, ¼-watt vertical-mount trimmer potentiometer
R3, R10—2,200,000-ohm, ¼-watt resistor
R4, R13, R14—10,000-ohm, ¼-watt resistor
R5, R6, R8, R9, R17, R18, R20, R21, R22, R24, R25—470,000-ohm, ¼-watt resistor
R7—3,900,000-ohm, ¼-watt resistor
R11—22,000-ohm, ¼-watt resistor
R12—10,000-ohm, ¼-watt vertical-mount trimmer potentiometer
R19, R23—10,000-ohm, ¼-watt linear-taper potentiometer
S1—SPST slide switch
Misc.—cabinet, hookup wire, knobs, etc.



Note: A complete parts kit is available from BNB Kits, 70 Cooper Ave., West Long Branch, NJ 07764, for $20.95. The PC board alone is $4.00 from BNB also.