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1/2-Octave Real Time Audio Analyzer

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Used with a mike and oscilloscope, it displays system output to permit accurate matching to room acoustics.

PART 1

IT'S COMMON knowledge that an equalizer can shape a sound system's frequency response. But adjusting multiple equalizer bands for flat audio response in a room is a challenge. This project, an audio Real Time Analyzer, provides a solution to the problem. It generates a graphic representation of the system's output with sufficient detail (20 half-octave bands) to allow quick, accurate matching to room acoustics when used with a calibrated microphone and a dc-coupled oscilloscope.

Furthermore, the RTA can be used to check the frequency response of such components as preamps, power amplifiers, etc. The RTA can also function as a sound pressure meter, as a noise analyzer (energy per frequency band), and as an aid in the design of speaker systems and crossovers.

A block diagram of the RTA is shown in Fig. 1. Input signals are selected by *S1* from MIC or AUX sources. Microphone signals are boosted to line level by a preamp with a gain of 200. A buffer amplifier then passes the MIC or AUX signal to twenty half-octave active bandpass filters. Each filter passes only that portion of the input signal within its passband. These filtered ac components are then rectified by diodes (one for each filter) and smoothed by RC combinations. The resulting dc levels, proportional to the amount of energy within each passband, are scanned sequentially by a 24-channel multiplexer. Finally, the multiplexed signal is buffered and presented at the RTA output.

At this point, dc levels can be applied to the vertical amplifier of the oscilloscope. Variations in vertical deflection from one band to the next will *linearly* reflect differences between dc levels, and hence between the energies contained in the filter passbands. However, in audio work, voltage variations are usually expressed in decibels. A logarithmic converter has therefore been incorporated into the RTA, allowing direct readout of signal levels in dB from the CRT trace. The multiplexing and display functions of the RTA are carried on so quickly that all bands are shown simultaneously or in "real time."

Circuit Details. The input stage of the Analyzer is shown schematically in Fig. 2. A balanced differential amplifier, *IC1*, allows the use of long lines and low-impedance microphones due to its good common mode rejection characteristics. This amplifier has a voltage gain of 200, determined by *R2* and *R4*, and boosts microphone input signals to line level. External frequency compensation for the op amp is provided by *R6* and *C1*. Capacitor *C2* prevents any dc level at the output of *IC1* from reaching microphone level control *R7*.

Signals from either the microphone preamp or a source connected to the AUX input are selected by *S1* and applied to buffer amplifier *IC2*. Frequency compensation is provided by *C3*. The low-impedance output of *IC2* drives the parallel inputs of the half-octave filters.

Each active filter employs one IC (*IC3*