WHY AN ELECTRONIC CROSSOVER NETWORK?

No single loudspeaker can adequately handle the whole range of audio frequencies in sound reproduction. Thus to obtain the best possible sound we resort to multiple speaker systems, where each driver is designed to cover one portion of the audio spectrum.

This means that some method must be usedto divide the audio spectrum from the amplifier so that each driver receives only the band of frequencies for which it was designed. This is especially important for midrange and tweeter drivers for they are seldom capable of handling frequencies lower than a specified limit without being damaged.

In simple systems a single capacitor is used to block low frequencies and pass only highs to a tweeter. However, this gives only 6db per octave attenuation, which may not be sufficient to suppress the resonant frequency of the tweeter. Thus the driver could be damaged at high power levels. Also, the presence of non-desired frequencies leads to high levels of intermodulation distortion, and lend a sort of muddiness to the sound.

Hence all good systems use 12db per octave networks in the stop band to control the signalpresented each driver. To keep power losses down, in such networks,the coils must have DC resistances of less than one ohm. This means that heavy wire must be used, making them large & expensive. Also, the high value of capacitance required would normally call for the use of non-polarized electrolytics. The trouble with these is that their tolerance is plus or minus 50%. This means that a crossover using these could easily have deep peaks or holes in its response. All good units use polyester capacitors which are very expensive.

This all leads to the fact that for a multi-way speaker system, the crossover can and should be quite expensive. It can cost almost as much as your bass driver. Many people try to save money by using lighter wire and electrolytics and then wonder why an otherwise expensive system does not sound right. The crossover design is one of the most important features of the whole system. It is better to compromise on a cheaper woofer than crossover

Having established that good conventional crossovers cost money, we may now wonder if that money could be spent in a better way using a completely different approach. There is a better way, using an electronic crossover,after the preamplifier followed by separate power amplifiers for each driver. This is feasible because a power amplifier can now be built at a cost comparable to a quality passive crossover.

Even well-designed crossovers have several serious disadvantages. As we have already said, they are expensive, they waste power and they reduce damping factor(in the crossover region, the damping factor may dropto less than unity) and they perform correctly only into their designed load impedance. Practical drivers exhibit their nominal impedance over only a small portion of their passband and impedance may well increase to several times the nominal value at the high end of their range. Also, it is very difficult to alter the crossover frequency and to trim it for best results.

If we use an electronic crossover, we eliminate most of the problems at a single stroke. The bulky and expensive inductors and the large and expensive capacitors are eliminated. Damping factor is restored(due to seperate amplifiers being used to drive each speaker directly) and it is quite easy to trim the crossover frequency as desired.

Further,as electronic crossovers have gain, it is quite a simple matter to match the various drivers of a system for sensitivity. This can only be done in passive systems by attenuating the more sensitive units down to the level of the least sensitive unit. A practice which is very wasteful of amplifier power.

The catch is that a seperate power amplifier is needed for each type of speaker in your system, which can be expensive. Nevertheless, the technique is now quite feasible and is certainly worthwhile in larger professional sound systems where quality of the sound is of the utmost concern.

It is for these reasons we have developed the ECO-2 three way electronic crossover, with variable crossover frequency and variable level controls for each frequency band. We feel that the use of this unit will greatly improve the quality of any professional sound system.

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VANGUARD ELECTRONICS LTD.

VANGUARD ELECTRONICS LTD. Electronic Crossover-ECO-2 Specification Sheet.

Frequency Response(overall)-DC to 34KHz -1db
Tuning Range:High end of bass channel-165 Hz to 625 Hz. (3db down points)
Low end of mid channel-165 Hz to 625 Hz.
High end of mid channel-1500 Hz to 5000 Hz.
Low end of treble channel-1500 Hz to 5000 Hz.
Voltage Gain: Input A 5 14db
Input B 2.5 8db
If both inputs are used, the voltage gain on both inputs becomes 2.5 with both inputs mixed in a non-interacting circuit.
Input Impedance: Input A 23.5Kohms
Input B 47Kohms
If both inputs are used, input impedance of A becomes 47Kohms.
Minimum Load Impedance per Channel: 600 ohms.
Rolloff Slope of Filters: 12db per Octave.
Type of Filters: Multi-feedback Resistance Tuned Sallen Key Filter.
Distortion: Less than .09%
Case Style: Standard 19" Rack Mounting.
Dimensions: 19"W X 3 5/8" H X 7 1/4" D(6" D excluding handles)
Connectors: $\frac{1}{4}$" Phone Jacks(3 Pin cannons on special order at extra cost)
Power Consumption: Less than 4W
Fuse Size: 1/8A fast blow.
Semiconductors: 126(4 rectifiers, 2 zener diodes and 4 IC's with 30 transistors in each)
Phase Shift-Output WRT Input-180'(Output is 180' out of phase with the input, except near the filter frequencies where phase shift varies with frequency.
Maximum Input signal: 4V RMS
Maximum Output signal: (undistorted) 4V RMS

Description of Circuit.

The circuit consists of an input buffer, a high pass filter, a band pass filter, and a low pass filter with 3 output buffer amplifiers. The input buffer amplifier has two inputs coming together to a virtual earth mixing circuit on the input to the IC. Input A with a gain of 2 and input B with a gain of 1. Connecting into both gives a gain of 1 on both inputs. The filters are completely independent from each other , and have no interaction whatsoever. The output from each filter goes to a level control then to an output buffer amplifier, each with a gain of 2.5. The use of input and output buffer amplifiers means that the filter frequency response and signal level is completely independent of input and output conditions. The output jacks for each channel are in parallel for convenience in connecting two power amplifiers or two amplifier stacks.

Prices

Standard unit with phone jacks and 110V operation-Suggested List Price-$195.00
with cannon connectors(specify male or female and where)-$10.00 per jack extra.
220V option-$20.00 extra.
Cannon option and 220V option are available on special order only and require up to 8 weeks longer, for delivery.

Warranty: Vanguard Electronics Ltd. guarantees that the unit will be free from defects due to faulty parts or workmanship for one year from date of purchase. Unit must be returned to Vanguard for free service on warranty. Warranty does not cover damage due to abuse or improper connection.

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