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Sound System Optimization:

Optimizing Crossovers

(with a Real-Time Analyzer)

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In conventionally-powered systems, the active crossover is a vital part of the system performance and quality; and, unfortunately, is often overlooked during system optimization. Ideally, when the relationship between the crossover and amplifier/loudspeaker components is in order; then little equalization is needed, if any at all. Here's a straight-forward and effective approach to optimizing a crossover with the use of a real-time analyzer (RTA) and a sound-pressure level (SPL) meter.

IMPORTANT: *Provide hearing protection devices (i.e. foam earplugs or the like) to all persons that will be in the room during this process.*

- STEP 1: Optimize the gain structure all the way through to the amplifiers (with the system amplifiers off).
- STEP 2: Set up the measurement microphone in the near field (3 – 10 feet from the loudspeaker), on-axis of the loudspeaker
- STEP 3: Inject full-bandwidth pink noise into the system (be sure to bypass any system equalizer).
- STEP 4: Starting with midrange amplifier, turn up the attenuator on the amplifier until you achieve the desired average performance volume from the loudspeaker (typically 90 – 95 dB SPL A-weighted at the microphone position)
- STEP 5: Adjust the RTA window so that the curve is about 70% of the screen view vertically
- STEP 6: Observing the RTA, turn up the volume of the high-range amplifier until the RTA shows it matching in level of the mid-range.

Pay close attention to the mid/high crossover point. Sometimes a dip is observed at the crossover point. Flip the polarity of the highs and see which position provides the smoothest response at the crossover point.

Repeat the process for the low/mid crossover point.

NOTE: *The low range should typically be set slightly higher in level than the midrange and highs.* Some concert music reinforcement system have the lows set to approx. 6-8dB above the average level of the midrange and highs. This is due largely to the amount of electrical power required for low frequency drivers within a loudspeaker system. If the lows are set to match the midrange/highs in level, then the system could appear "weak" in the low frequency response overall.

Usually, if the crossover/amplifier relationship is optimum, then little (or no) equalization should be necessary. If needed, apply whatever EQ is necessary to achieve the desired response curve. The thing to remember about crossovers is that they introduce phase shift at the crossover point. An RTA will not show you phase information. You'll need a computer-based measurement platform (i.e. Smaart, SIMM, or the like) for this: but an RTA will get you well within the ballpark.

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