Understanding Crossovers

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We are often asked, “What are crossovers and what exactly do they do?”

Interestingly enough, the answer to this question lies within the term itself. “Crossover” comes from the idea of crossing over from one frequency range to the next. A crossover serves as a filter that blocks out unwanted frequencies to a speaker or group of speakers.

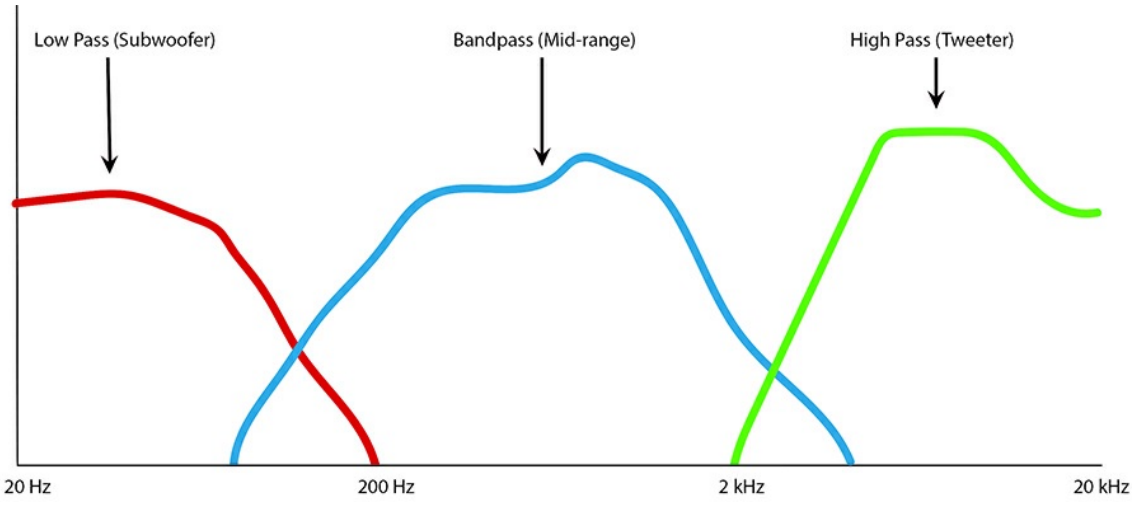
This is extremely useful because it allows us to specifically send each speaker the group of frequencies that it will play most efficiently and effectively. As a result, the sound system’s volume potential and dynamic capability is significantly improved, since each speaker is only responsible for the frequencies that it will do the best job of reproducing.

There are three basic ways to “crossover” or divide frequencies.

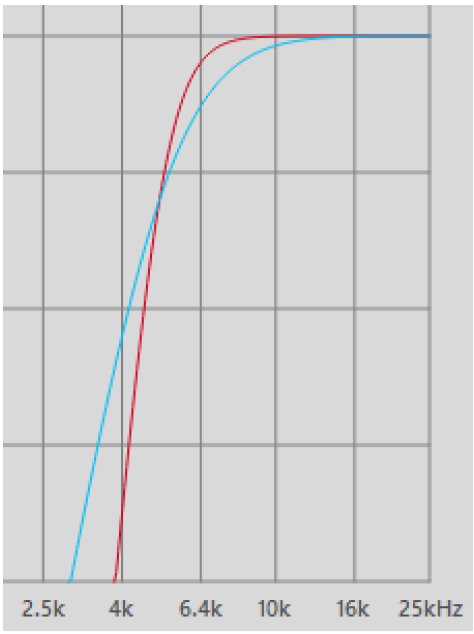
High Pass Crossover: allows frequencies above the chosen cut off frequency to pass through to a speaker or group of speakers.

Low Pass Crossover: allows for frequencies below the chosen cut off frequency to pass through to a speaker or group of speakers.

Band Pass Crossover: uses a combination of a High Pass Crossover and a Low Pass Crossover to allow a range of frequencies above and below two chosen crossover frequencies (one High Pass and one Low Pass) to pass through to a speaker or group of speakers.



Another aspect to crossovers is their slope. The slope is the rate at which the signal rolls off or attenuates past the crossover's frequency. Slopes are set in 6 dB increments with 12 dB, 24 dB and 48 dB slopes being the most common and used in many amplifiers with variable or set crossovers. Higher end DSP tuning processors such as the TwK™ 88 and TwK™ D8 include 6 dB, 18 dB and 36 dB slopes for more advanced tuning. The higher the decibel, the steeper the slope on the crossover. Linkwitz-Reilly is the most commonly used slope, but other types of crossover slopes such as Butterworth can be used with different results. The image at right, shows the difference between a 24 dB L-R (light blue) and 48 dB L-R slope (red) on a High-Pass Filter.



Types of Crossovers

There are two basic types of crossovers: Electronic and Passive.

Electronic Crossover: An electronic crossover uses a DSP chip or Microprocessor to divide frequencies. Many provide added flexibility for a system, since an electronic crossover allows you the ability to choose any number of crossover frequencies and change them as needed. Adjustments to crossover frequencies are instantaneous, so any changes made to the system are heard immediately. Crossovers with advanced DSP's often have many channels of output, allowing you to fine-tune a system with channels of amplification for each individual speaker. Basic electronic crossovers usually offer only High Pass and Low Pass capabilities, with a few exceptions. Electronic Crossovers are typically more expensive than Passive Crossovers.

Passive Crossover: A Passive Crossover uses resistors, capacitors, inductors, or a combination of all three in order to achieve the desired crossover point for a speaker or group of speakers. Passive crossovers can be advantageous, since they are usually less expensive to produce and, in the case of component sets designed by a manufacturer, they offer you a great transition between tweeter and midrange... right out of the box. The disadvantage is that the filters themselves can be large, so they are typically intended for smaller speakers. Subwoofers, on the other hand, would require very large and heavy inductors to handle the necessary power and allow for only the low frequencies to pass through a smaller filter. Passive crossovers are often included with component and high-end coaxial speakers.