Setting Crossovers

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A common question is how to set up the crossovers on an amplifier or source unit. Before the crossovers are set, it's important to understand how they operate. Read the Understanding Crossovers article for the basics of their operation.

Now that the basics of crossovers are understood, lets cover some good starting points for various system configurations. Always consult the speaker's manufacture for more detailed information on their recommended frequency response.

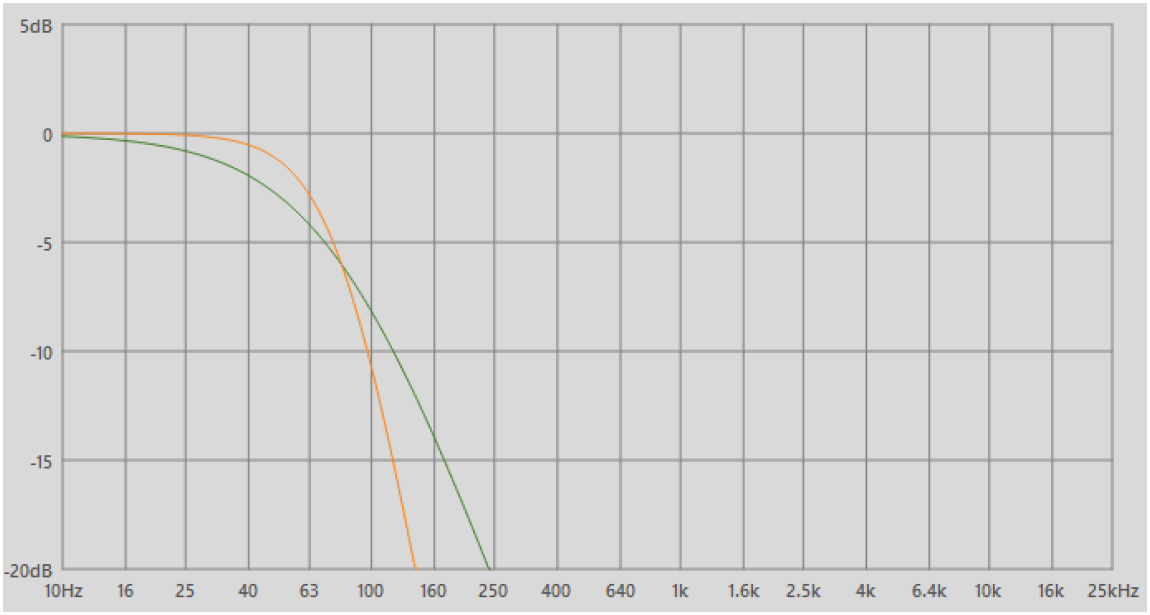
Note: From this point forward unless noted, any mention of crossovers, high-pass or low-pass filters are considered those on an amplifier, source unit or Digital Signal Processor (DSP).

System One - Front Components (passive) & Subwoofer(s)

Since the component set already has passive crossovers that will split the frequencies between the tweeters and midrange drivers, a *High-Pass Filter* should be used. This will block out the lower bass frequencies that the midrange drivers are not designed to effectively play. The passive crossovers will then further divide the frequencies between the tweeter and midrange (or tweeter, midrange and woofer in case of a 3-way component set).

The subwoofer does not have a supplied passive crossover, use a *Low-Pass Filter* to block the high frequencies from being sent to the subwoofer.

The most commonly used slope options found in car audio are 12 dB per octave or 24 dB per octave. If adjustable, try switching the slope and listen for any improvements in sound quality. If you don't like what you hear, simply switch it back.



12 dB per octave slope (green) vs 24 dB per octave slope (orange) on a LPF set at 80 Hz.

A 12 dB per octave slope is a more gradual cut off and is sometimes useful in coupes or sedans that have the subwoofer(s) in the trunk. The rear seat material acts as a filter which can reduce upper bass range amplitude. The more shallow slope of 12 dB per octave will allow a bit more bleed through of frequencies above the crossover point to help counter this.

A 24 dB per octave slope is a more abrupt cut off and is often used in open vehicles such as hatchbacks, wagons and S.U.V's since the bass does not filter through seat material. Also, since a 24 db slope is more abrupt, it can sometimes allow you to use a slightly lower crossover point between the tweeter and midrange while still maintaining safety.

Recommended Starting Points:

- *Front Component Speakers - High-Pass Filter = 80 Hz (12 db or 24 db Slope)*
- *Subwoofer(s) - Low-Pass Filter = 80 Hz (12 db or 24 db Slope)*

System Two - Front Components (w/ passive crossovers), Rear Coaxial Speakers & Subwoofer(s)

The crossover's for the front component speakers and subwoofer(s) are identical to System One. The only difference is we have added rear coaxial speakers. Most coaxial speakers do not come with supplied passive crossovers. Instead they use a basic filter to block low frequencies from being sent to the tweeter. This filter is usually soldered to the back of the speaker. The midrange usually rolls off its frequency response naturally in relation to the tweeter, but a *High-Pass Filter* needs to be applied to block out the lower frequencies. If the coaxial speakers to use a passive crossover network, the crossovers should be set the same as the component speakers mentioned above.

Recommended Starting Points:

- *Front Component Speakers - High-Pass Filter = 80 Hz (12 db or 24 db Slope)*
- *Rear Coaxial Speakers - High-Pass Filter = 80 Hz (12 db or 24 db Slope)*
- *Subwoofer(s) - Low-Pass Filter = 80 Hz (12 db or 24 db Slope)*

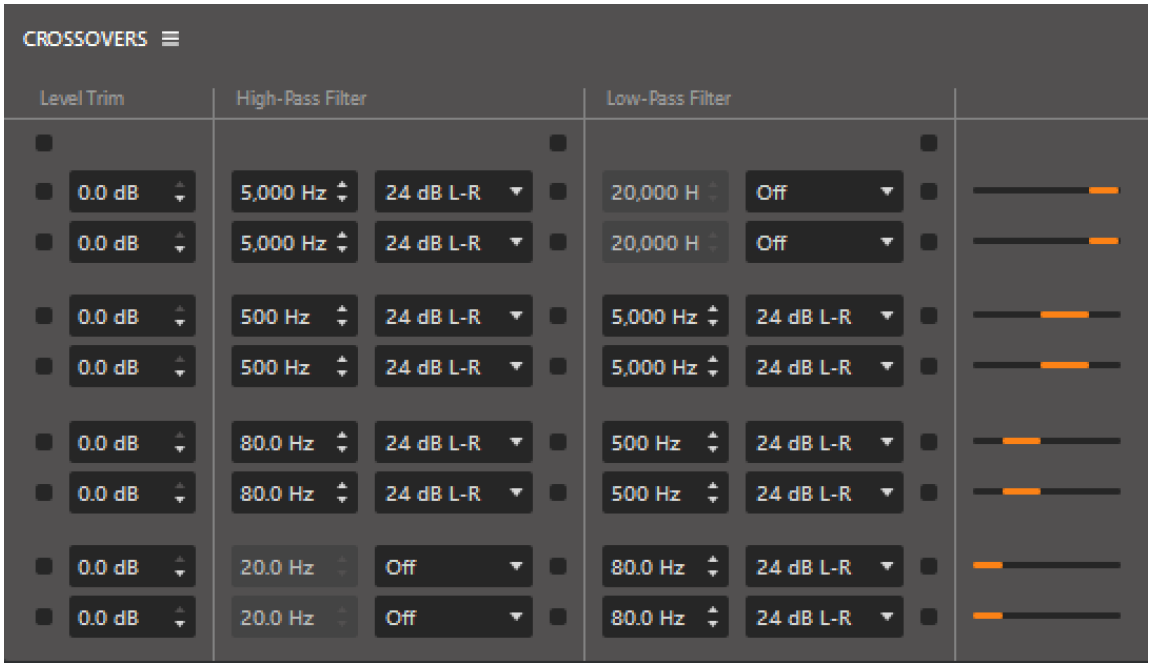
Note: *Both System One and System Two assume the speakers are at least 5.25-inches in diameter or larger. If the speakers are smaller, such as 4-inches, a frequency higher than 80 Hz for the HPF might be required. Start with 300 Hz and work your way down slowly, while listening for any signs of stress from the midrange and then dial the setting up if needed.*

Both System One and System Two represent two of the more popular system configurations used in a car. A more advanced system design is running what is called an Active System. An active system uses electronic crossovers to divide frequencies between the speakers in the system. No passive crossovers will be used. For further understanding of speaker types and their appropriate uses, read the article

on Speaker Types.

With an active system electronic crossovers are needed to establish: high-pass, low-pass or band-pass filters. This allows the appropriate pass-band to be sent along to each individual speaker. The recommended frequency range for a speaker can vary, always consult with the manufacturer before setting your own crossover points. An amplifier with the ability to create the appropriate filters should be used. Our XD700/5v2 and XD1000/5v2 allow the ability to create a bandpass filter for the midrange, allowing an active 3-way system (tweeter, midrange and subwoofer) directly from the amplifier. Read more on the XD700/5v2 and XD 1000/5v2's Bandpass Configuration . You will need enough channels of individual amplification for each speaker, this may require multiple amplifiers or larger six or eight-channel amplifiers such as the XD600/6v2 and XD800/8v2.

Another solution is to use Digital Signal Processor (DSP), such as a TwK™ D8 or TwK™ 88. A DSP will often provide more slopes and more precision when creating crossover points, as well as many other useful tuning features.



The Crossover panel from TüN™ software for the TwK™ 88 and TwK™ D8

The advantage of an active system is that it gives you virtually infinite control over the crossover points and slopes. This allows a more precise level match between each speaker. It also allows each speaker to have it's own independent equalization. This can very well be the difference between a good sounding and a great sounding system.

System Three - Front 2-Way Components (active) & Subwoofer(s)

In this system we are using an electronic crossover to *high-pass* the tweeter, *band-pass* the midrange and *low-pass* the subwoofer(s)

Recommended Starting Points:

- Tweeters - High-Pass Filter = 5,000 Hz (12 db or 24 db Slope)
- Midrange - Band-Pass Filter = 80 Hz HPF & 5,000 Hz LPF (12 db or 24 db Slope)
- Subwoofer(s) - Low-Pass Filter = 80 Hz (12 db or 24 db Slope)

The next system is a variation of System Three, but uses speakers with a passive crossover for rear fill. The front speakers are still considered fully active, but the rear speakers will only need 2 channels of amplification and a High-Pass Filter.

System Four - Front 2-Way Components (active), Rear Speakers (passive) & Subwoofer(s)

Recommended Starting Points:

- *Front Tweeters - High-Pass Filter = 5,000 Hz (12 db or 24 db Slope)*
- *Front Midrange - Band-Pass Filter = 80 Hz HPF & 5,000 Hz LPF (12 db or 24 db Slope)*

- *Rear Speakers (Passive) - High-Pass Filter = 80 Hz (12 db or 24 db Slope)*

System Five - Front 3-Way Components (active) & Subwoofer(s)

This next system uses a 3-way active front stage that utilizes a pair of tweeters, small midrange speakers and larger woofers to create a more even, efficient front stage than the 2-way component set. This setup will require a *high-pass filter* for the tweeters, a *band-pass filter* for the midrange and second *band-pass filter* for the woofers. A *low-pass filter* will be used for the subwoofer(s).

- *Tweeters - High-Pass Filter = 5,000 Hz (12 db or 24 db slope)*
- *Midrange - Band-Pass Fiter = 500 Hz HPF & 5,000 Hz LPF (12 db or 24 db slope)*
- *Woofers - Band-Pass Filter = 80 Hz HPF & 500 Hz LPF (12 db or 24 db slope)*
- *Subwoofer(s) - Low-Pass Filter = 80 Hz (12 db or 24 db slope)*

The final system covered uses a 3-way active front stage and subwoofer (like System Five), but will include a set of passive rear speakers. Again, since the rear speakers are using a passive crossover, only two channels of *high-passed* amplification will be needed.

System Six - Front 3-Way Components (active), Rear Speakers (passive) & Subwoofer(s)

- *High Pass (Front Tweeters) = 5,000 Hz (12 db or 24 db slope)*
- *Band Pass (Front Midranges) = 5,000 Hz low pass - 500 Hz high pass (12 db or 24 db slope)*
- *Band Pass (Front Woofers) = 500 Hz low pass - 80 Hz high pass (12 db or 24 db slope)*
- *Low Pass (Subwoofers) = 80 Hz low pass (12 db or 24 db slope)*

Note: The recommended starting points listed above may vary based on the parameters of the speakers being used as well as listening preferences, but should be looked at as ideal starting points.