Audiofrog UMI-1 Tuning CD Liner Notes

We have chosen and arranged the tracks on this CD to help make tuning your system using common tools and a real time analyzer as straightforward as possible. This document isn't an instruction manual for tuning a car, it's an explanation of what these tracks, why we've made or chosen them and how to use them. For additional tuning instructions, please check out the Tech Tips section of the Forums at www.audiofrog.com.

The tracks on this CD are arranged so that the ones you'll probably use most often are at the beginning and the ones you'll probably use less often are at the end. This is for convenience.

A basic tuning process is for an active stereo (2-channel) system that includes a DSP is:

1. Install all the gear and verify that all of the speakers are playing and that the left speakers play when the balance control is moved to the left and the right speakers play when the balance control is moved to the right. In systems with active crossovers for tweeters, set the tweeter high pass filters at about 3 kHz to start.
2. Use Track 27 (Speaker Polarity Test) with a polarity tester or an oscilloscope to verify that the speakers are connected properly. *Do not try to determine correct polarity using a music track or a mono vocal track. The difference in distance between you and the two front speakers makes this an invalid test. When the polarity is correct according to the polarity test, the speakers are connected properly.*

3. Set system levels. If you use an oscilloscope, you may find tracks 28-37 helpful. We recommend setting the system levels with the -10 dB tracks.

4. Set delays for all of the speakers according to the instructions that came with your DSP. Some processers require you to input the distance to each speaker. Some require that you enter the delay to be applied to each speaker. If the delay is required, those may be entered as distance or time. Be sure you understand what your processor requires. Entering the wrong information will make the rest of the tuning process impossible. Using a tape measure to measure distance is fine. Measure from the center of the speaker to the tip of the microphone.

5. Set your crossovers according to the specifications for your speakers.

6. Equalize the response of ONE side of your car with the subwoofer playing. Start with the left or the right front. Never EQ with both left and right playing.

7. Turn off the side you've just equalized, turn on the other side and the subwoofer and repeat the process. The frequency responses and the levels of both channels should match as closely as possible. If you have a dip in one channel that you cannot remove, *add that dip to the other channel to help ensure proper imaging.*

8. Turn on both channels and listen.

9. Use the technical tracks and the music tracks on this CD to check for imaging and tonal balance. If the imaging tracks don't provide the performance described in the track descriptions, *check to be sure the frequency response of the two channels matches precisely before attempting to adjust time alignment while listening. If images move back and forth across the stage when they should be stationary, it's most likely a frequency response matching problem. If the images are stable but too far to the left or the right, check the channel level match between left and right before readjusting time alignment.*

10. Using track 38 (Zero Bits), check for noise. If you hear a "hissing" sound, turn down your amplifier input sensitivity controls until you have reduced the noise to an acceptable level while allowing the system to play loudly enough to be satisfactory.

For more in-depth discussion of these and other tuning processes, check out the Tech Tips section of the Forums page at www.audiofrog.com.

Tracks 1-5: Frequency Response Testing

Track 1. Mono Pink Noise

This track is pink noise that is exactly the same in the left and the right channels. Use this track when equalizing the left and the right channels. When tuning a stereo system, the objective is to precisely match the frequency response of the left and the right channels. When both channels are matched, this pink noise should appear to come from a point halfway in between the front right and left speakers. Making a frequency response measurement of the system with this track playing shows you the frequency response of your center image. It should be similar to the frequency response you measure with only the left speaker or only the right speaker playing.

Track 2. Mono Pink Noise 20 Hz – 160 Hz

This track can be used after the system is tuned to verify the placement of the bass and lower midbass in the soundstage. All of the pink noise should appear to come from a point halfway in between the front left and front right speakers. If the lowest frequencies seem to come from the location of the subwoofer, check the frequency response between 60 and 160 Hz to be sure there are no abrupt changes in level between frequencies and that the transition is a smooth downward slope. You may also need to adjust the delay setting between the subwoofer and the midbass to improve the phase matching.

Track 3. Mono Pink Noise 80 Hz – 400 Hz

This track can be used to check the match between the left and right speakers in the midbass region. The pink noise should appear to come from a point halfway in between the front left and right speakers. If it doesn't, check the frequency response and level match before checking your delay settings. If you hear ALL of the pink noise as if it comes separately from the left and the right speakers, and there is no center image, your delay settings are incorrect or one speaker is connected in reverse polarity.

Track 4. Mono Pink Noise 400 Hz- 1kHz

This track can be used to check the match between the left and right speakers in the midrange. If you are tuning a 3-way system and the pink noise isn't centered between the left and right speakers, check the frequency and level match between the left and right channels. If, as with the previous track, the pink noise seems to come from both speakers and not from the center, check your delay settings and the polarity of the midrange speakers.

Track 5. Pink Noise 80 Hz-20 kHz

If everything is correct, this pink noise should seem to come from a point in between the front left and right speakers. We have eliminated the subwoofer signal from this track to make it easier to verify that the front speaker system is tuned properly.

Tracks 6-20: Imaging

These tracks have been designed to help you adjust the system so that images that should appear in the left, right and center are correct. In addition to those three locations, tracks with sounds that should appear in between the center and the left or right have been included. The Left of Center and Right of Center tracks have the instrument or the noise recorded at a 6 dB difference. Those sounds should appear to come from a point halfway in between the center and the left or the center and the right.

Track 6: Left Pink Noise

Full range (20 Hz – 20 kHz) pink noise recorded only in the left channel. This pink noise should seem to come from a single point at the location of the left tweeter. If you hear different parts of the pink noise seem to come from the locations of the speakers, (sometimes called "rainbowing"), check the frequency response at the crossovers between the speakers and check your delay and polarity settings.

Track 7: Left of Center Pink Noise

This pink noise is recorded 6dB quieter in the right channel than in the left. It should seem to come from a point halfway in between the center and the left speaker.

Track 8: Center Pink Noise

This is the same mono pink noise that's in Track 1. It should seem to come from a point in between the front left and right speakers. The bass should also seem to come from that point. If it doesn't, check the frequency response match and also check the frequency response shape between 60 Hz and 160 Hz. Also, check the delay and phase between the subwoofer and the front speakers.

Track 9: Right of Center Pink Noise

This pink noise is recorded 6dB quieter in the left channel than in the right. It should seem to come from a point halfway in between the center and the right speaker.

Track 10: Right Pink Noise

Full range (20 Hz – 20 kHz) pink noise recorded only in the right channel. This pink noise should seem to come from a single point at the location of the right tweeter. If you hear different parts of the pink noise seem to come from the locations of the speakers, (sometimes called "rainbowing"), check the frequency response at the crossovers between the speakers and check your delay and polarity settings.

Note: If you listen to these tracks one after the other, the pink noise should seem to move evenly across the sound stage from the location of the left speaker to the location of the right speaker.

Track 11: Left Electric Bass

This is an electric bass guitar recorded only in the left channel. It should seem to come from the location of the left speaker.

Track 12: Left of Center Electric Bass

This is an electric bass guitar recorded 6dB quieter in the right channel than in the left. It should seem to come from a point halfway in between the left speaker and the center.

Track 13: Center Electric Bass

This is the same electric bass recorded in mono. It should seem to come from a point halfway in between the left and right speakers.

Track 14: Right of Center Electric Bass

This is the same electric bass guitar recorded 6dB quieter in the left channel than in the right channel. It should seem to come from a point halfway in between the center and the right speaker.

Track 15: Right Electric Bass

This is the same electric bass guitar recorded only in the right channel. It should seem to come from the right speaker.

If the left of center, center and right of center images aren't correctly placed in the positions described above, check the frequency response match of the left and right channels between 50 Hz and 1 kHz. Also check the delay settings for the mid-bass drivers.

Track 16: Left Piano

This is a piano recorded only in the left channel.

Track 17: Left of Center Piano

This is a piano recoded 6 dB quieter in the right channel than in the left.

Track 18: Center Piano

This is a piano recorded in mono. It should seem to come from a point in between the front right and left channels.

Track 19: Right of Center Piano

This is the same piano recorded 6 dB quieter in the left channel than in the right. It should seem to come from a point halfway in between the center and the right speaker.

Track 20: Right Piano

This is the same piano recorded only in the right channel and should seem to come from the right speaker.

Bass Guitar and Piano Loops from https://www.looperman.com/

Note: Both the bass guitar and the piano are "dry" recordings. That means that there's no room in the recording to give us any clues about placement or room size. These tracks are to check the systems ability to reproduce the effects of panning instruments and vocals across the sound stage. For these tracks, the width and the depth of the soundstage won't and shouldn't extend past the speaker locations.

Note: The piano track is much more difficult because the high frequency reflections from the glass near pillar or dash mounted tweeters will make the image of the piano more diffuse. Trying to eliminate that and to provide precise images even in the range of frequencies reproduced by the tweeters will reduce room size and a sense of spaciousness you'll hear in other tracks designed to check the ability of the system to resolve different spaces later on this disc. Choosing between these two aspects of performance is always a compromise.

Tracks 21-26: Musical Tracks

Track 21: Two Guitars by Admiral Bob

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This track features two guitars, recorded very differently. The first guitar that appears in the track will be difficult to locate. It is mixed this way by placing the guitar in both channels, and delaying it in one channel relative to the other. You'll hear a distinct location left of center for some higher notes but the lower notes will seem to come from an area that spans the left of center and the right of center.

The second guitar is clearly panned to appear just right of center.

Track 22: Winter Walk by spinningmerkaba

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In this track, the trumpet should appear in the center. The piano is mixed so it spans from left to right. The Drum kit should appear behind the trumpet. Pianos are often mixed all the across the stage rather than placed in a single location in relation to other instruments in an arrangement you might hear at a live acoustic concert. We've included this track to highlight this so you'll be able to recognize it in other recordings. Not every recording is designed to provide an illusion of a live concert. This, is one of the those tracks.

Track 23: Don't be Scared by Calling Sister Midnight

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This track features a typical dry studio recording of a quartet of a vocalist, an acoustic bass, a drum kit and a keyboard. The musical part of the recording doesn't include much of a room. There aren't any reflections to give us a sense of the size of the space. The vocal, the bass and the drum kit are all mixed in the center. The level of the singer relative to the bass and the drum kit places her in front. The piano, which appears later in the track is mixed from left to right, as is common.

What makes this track interesting is that at various points, a sample of an interview of the singer, made in a small room at a table is inserted in the mix. The contrast between the studio recording of the singer and the spoken parts which include reflections from nearby surfaces as well as the rest of the room make it easy to hear the difference in the recording spaces.

Track 24: 2 Men Blues by Stefan Kartenberg

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This track is what we expect from a track designed to reproduce the illusion of a live event. The recording includes much more "room" (sounds reflected from the floor, walls and ceiling). The piano isn't mixed across the stage. It's placed left of center. All of the images seem smaller and further away. Compared to the preceding studio tracks, this track should provide a deeper stage and a better sense of a recording space.

Track 25: Sprung by Astroboy

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This electronic track has been included as an example of bass placement and impact that is distinctly front and center with no room reflections and nothing in the mix to spread the impact from left to right. All of the low bass and the midbass impact should come from a point halfway in between the front left and right speakers—from the center. Other sounds will be spread across the front stage from the location of the left speaker to the location of the right speaker.

Track 26: Cripx by CasioP

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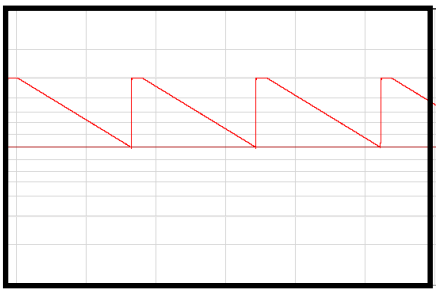
This electronic track features a similar front and center synthesized bass, but without the impact in the preceding track. The other high frequency components of this track are mixed to provide a sense of space that's as wide as your system can reproduce. In systems that include upmixers with side and/or rear speakers, this track may provide a sense of space that extends well past the boundaries of the front speakers.

Track 27: Speaker Polarity

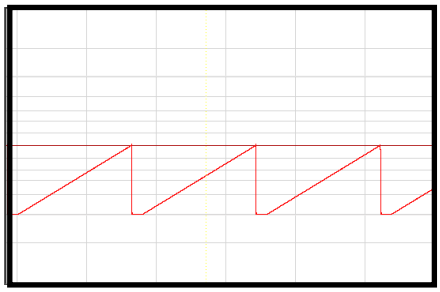
This track can be used with a polarity checker to test that the speakers have been connected properly. It can also be used with a scope (and the microphone) to check polarity. See the images on the following page:

This is the waveform of the polarity pulses. These should provide a "positive" result with a polarity checker if the speakers are connected properly. Viewed on a scope, this is what the waveform will look like for a speaker connected correctly. The wave form will be above zero.



Full Range Correct Polarity

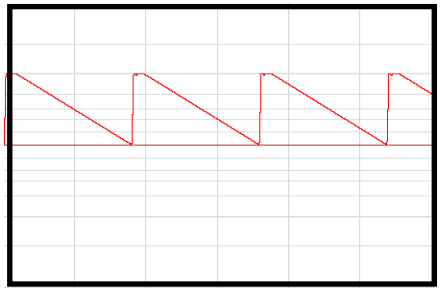
A speaker connected backwards will show the initial vertical line and the waveform below zero.



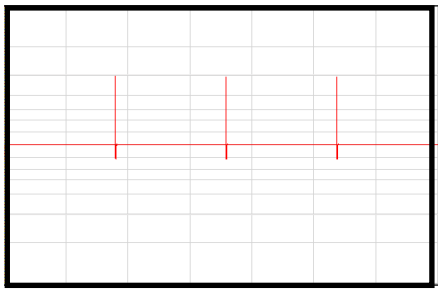
Full Range Reversed Polarity

Finally, high pass and low pass filters will change the shape of the pulses, but not their orientation (up or down). A low pass filter will apply a slight slope to the leading vertical line. A high pass filter will remove the triangular tail from the pulse waveform, but the orientation of the vertical leading edge won't change.

(See diagrams to the right:



Low Pass Correct Polarity



High Pass Correct Polarity

Tracks 28-37 System Gain Setting

Track 28: Sine Wave 50 Hz -10dB 1:00

Track 29: Sine Wave 50 Hz 0 dB 1:00

Track 30: Sine Wave 160 Hz -10 dB 1:00

Track 31: Sine Wave 160Hz 0dB 1:00

Track 32: Sine Wave 400 Hz - 10 dB 1:00

Track 33: Sine Wave 400 Hz 0 dB 1:00

Track 34: Sine Wave 1 kHz -10 dB 1:00

Track 35: Sine Wave 1 kHz 0 dB 1:00

Track 36: Sine Wave 8 kHz -10 dB 1:00

Track 37: Sine Wave 8 kHz 0 dB 1:00

We recommend using the -10dB tracks for gain setting. We have provided sine waves at several frequencies to make it easy to set gains even after crossovers have been applied. Disconnect the speakers before using these tracks to prevent damage!

Track 38: Zero Bits

This is an "empty" track than can be used to check for noise.