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Can You Tune a Theater? 4/2005

by A. Grimani

Calibration...the final frontier: To go boldly where few others have ever been. To make the difference between merely loud surround sound and sublime sonic delight. Obviously, any home theater system needs to be calibrated, but do you really know all the steps involved in this final process?

Most people think that calibration consists of setting the levels of the A/V controller and maybe also the delay times and speaker configuration selections. In fact, there are many, many other steps involved in the full-on tuning of a system. Skip any one of them, and you may be sacrificing performance.

It all starts with understanding the end goal. A properly calibrated home theater audio system will accurately replicate the soundtrack character as intended by the film sound designer and director. It's as simple as that. Dialog levels, effects ratios, music tonalities, soundfield spaciousness, and localization will all match what the film creators heard while they were dialing in the soundtrack back in the studio mixing stage.

Achieving the goal is a long journey through a sequence of operations comprising system configuration, verification and debugging, calibration, equalization, and documentation. Listening tests must accompany each step to verify that what you are measuring actually sounds right and to allow you to develop a "feel" for the system.

The first step is an initial listening test. Pop in a few CDs and DVDs of known material, and get a sense for the overall performance of the system. It probably sounds all wrong at this point since nothing has been configured or tuned, but never mind that. You will commence the process of "connecting" with the system. Note down your impressions on a form, as you will be referring to them along the way.

Configuration of the various devices follows. Of course the A/V controller has many settings you will need to navigate through and configure. On the better products, these are all neatly laid out in a menu, so all you have to do is follow the steps. Even though it's probably against your principles, I do recommend reading the manual, since the

menu screens on most products don't allow enough room for detail. Then remember that DVD players, satellite receivers, gaming consoles, and many other source devices also have multiple configuration settings. A DVD-A/SACD-compatible player will have substantial selections, and I have seen some pretty confusing language used in their menus. Again, read manuals even though the potential for further confusion definitely exists...

Power amps, equalizers, speakers, and subwoofers all potentially have configuration settings, and now is the time to address them. Of course, you should record all the settings on a report form so that you can easily recall them should you have to replace or upgrade a device in the future.

Once everything is configured, it is time to verify that all the devices actually work as they are supposed to. Don't go thinking that a configuration actually took just because you selected it. I have seen defective microprocessor code in A/V controllers result in the wrong outcome despite what the menu choice stated. Of course, I have also seen products that are broken, either because of manufacturing defects or because of shipping abuse. You are the one who has to find all these errors and fix them before going any further. This will take a whole battery of tests performed using electronics, acoustic test equipment, and a very thorough procedure. Performing the tests will also take the better part of a day for a typical high-performance system. Do note that after calibrating about 150 systems, I have yet to work on one that had no defects at all! Just the other day I was up against a system where the speaker wire gauge was way too small due to an error in the specification documents. Despite the fact that the wiring was all concealed in conduits, chases, and plenums, I was able to test for the performance response and detect the mistake. That system would have sounded harsh and had poor bass response; no amount of "tweaking" could have band-aided it. Coincidentally, the same system also had two speakers with internally-reversed polarity. They must have been built up on a Friday evening before a long weekend, and someone wasn't paying attention. Again, you are the last line of defense, and you need to detect the flaws before anyone else does! It took a special polarity pulse-testing device (a \$350 gizmo) to find the internal polarity error, but it saved what would have been hours of head-scratching during the tuning process.

Now that you know every single device is performing as expected and that you have documented the results by recording the response charts and data, you can move on to the basic calibration steps. These consist of setting the individual channel delay times and levels of the A/V controller. For the latter step, I recommend using a good sound level meter and a reputable test DVD. I find that many controllers actually have erroneous internal test tones, so you don't want to rely strictly on them. The *Avia* DVD

and the PMI/Gold Line *5.1 Audio Toolkit* DVD are both good choices. Follow their built-in tutorials and you will be right on the mark.

Part of the tuning process may consist of finding optimized locations for the speakers and subwoofers. Acoustic measurement gear and your ears will come in handy here. If the bass sounds smooth and measures smooth, chances are it really is smooth. One thing that no test gear can measure yet is the quality of the soundstage in 2-channel mode. The phantom center images should be clear, and the wide spatial cues should be well-resolved. Your ear will have to do the work here. If the speaker locations were locked down during design, you're stuck with the results. I do find that baffle-mounting the speakers and setting their locations through computer-calculated optimization can get you darned close to ideal placement, so this is a good solution for engineered systems. Fine-tuning acoustical treatment locations is also a thing you can do if esthetics and interior design allow. Ideally, the acoustic treatment package will have been engineered from the beginning and will take care of the sound reflections that distort the soundfield.

Any room wrapped around any speaker will interact with its sound propagation and alter its tonal balance. There is just no getting around this fact of life! It's about as certain as death and taxes, to quote a popular movie. You must correct for these room spectral effects by using carefully and intelligently dialed-in equalization. I know that many of you are going to scream bloody murder here because you have experienced systems that sounded worse after the equalization process. Don't throw the baby out with the bath water, though. Poorly-performed measurement and EQ do result in terrible sound, but properly executed, the process of correcting for room-induced errors will yield fantastic results. It requires accurate measurement gear that supports averaging of multiple test microphone locations and resolves fine slices of frequencies. It also takes gear that can store and recall measurements as you progress through the correction steps. The equalizer device itself needs to be of sufficient performance quality so that it does not affect the signal path, and it needs sufficient correction resolution to dial right into the problem areas and fix them. Ultimately, it requires time and grade to develop the skills necessary to play the dialing game.

Once you have completed the equalization process, it is time to correct any level changes induced by the equalization, then listen very carefully. Listen for a long time. Listen to many cuts of many musical and film styles. Compare what you hear now with what you noted down during the initial listening test. You may find that you want to fine-tune the levels or the equalization settings. That's just fine because by now you have spent so much time listening to this system that your senses are fully connected to it. You can safely do some small subjective corrections until you are happy with the results.

The calibration process is only really over once you have documented all the results and all the settings. Writing and laying out the report can take the better part of an afternoon, but it will pay off in the long run when you have to service or upgrade something.

By now you have spent two days living with the system, and you desperately want to get out of that room. Go grab some dinner; you certainly owe yourself a good meal!

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