



HPS-4000®

HIGH PERFORMANCE STEREO

Sound IS the Experience !™

**WHY SURROUND SYSTEMS
DON'T WORK**

BY

JOHN F. ALLEN

HIGH PERFORMANCE STEREO™



HPS-4000®

HIGH PERFORMANCE STEREO

FIRST IN DIGITAL STEREO

This article was written by John F. Allen and originally published in BOXOFFICE MAGAZINE. Unauthorized duplication or publication without the written consent of both John F. Allen and BOXOFFICE MAGAZINE is prohibited.

HIGH PERFORMANCE STEREO™

NEWTON, MA 02459 USA • TEL: 1-617-244-1757

HPS® and HPS-4000® are registered trademarks of John F. Allen

WHY SURROUND SYSTEMS DON'T WORK

by
JOHN F. ALLEN

In tackling this subject honestly, I must plead guilty to biting the hand that feeds me. I'm not the first, however, and won't be the last. Consider this grim quote from a speech given by Dolby Lab's loan Allen at the 1981 Show-a-rama. "Some films are now released without any surround tracks, and you have caused that. Theatre operators come to me and ask why were there no surrounds on *Black Stallion*. The reason is that theatre operators are killing surround tracks. Directors and editors go to theatres and consistently hear surrounds played too loud, or played too quiet; and rather than have their surround tracks screwed up, on their next film they won't record a surround track at all. And yet, you can get a simple test film from us (CN-151), which requires no test equipment to use. It takes about three minutes to set the surround levels correct. I would guess again that less than one theatre in ten has correct surround levels. If one film has louder surrounds, or another has quieter ones, it is because the director wants it that way."

Things are now somewhat better now as most stereo films do include surround information. But the reason those directors and editors as well as audiences are even today hearing screwed up surround tracks is that just about everything one can do wrong in building surround arrays, is common practice in most theatres. Terrible speakers totally inadequate to the task are used in insufficient numbers, put in the wrong places (many don't even place any surrounds on the rear wall) and powered by as little as 1/20th of the real power they need.

Perhaps the reasons for this boil down to a lack of understanding of what a surround channel should do and/or a lack of commitment to quality sound. I find it hard to accept budgetary reasons. After all, I run two businesses myself. I have always found that in the long run, the best always costs less and earns more.

The purpose of a surround channel in a movie theatre is twofold: ambience restoration and special effects. We are always surrounded by sound though not always conscious of the effect. We hear sounds first from their source. We then hear the reflections of the sound as it bounces off the walls, ceiling, floor, furniture and everything else. Without these reflections, sound becomes dry and flat.

Films such as "ET", "Annie", "Dragonslayer" and both "Star Treks" have used the surrounds primarily for ambience. The surrounds greatly enriched these presentations

providing an engrossing warmth and dimension. Other films such as “Superman”, “Altered States”, “Apocalypse Now” “The Empire Strikes Back”, “Raiders of the Lost Ark” as well as “Star Trek I and II” provided spectacular effects in addition to ambience. Effects such as spaceships, gun shots and helicopters flying through the theatre are a common feature of these soundtracks. More importantly, these effects require the surround channel to deliver just as much volume as any screen channel. Accomplishing this without overloading both the amplifiers and speakers takes a lot of power and good surround speakers.

Theatres are big rooms, sometimes very big rooms. Unlike concert halls which are designed to sustain reverberation for as much as two seconds, theatres must be relatively dead. This is because the more reverberant the space, the less intelligible dialog will be.

Film makers don’t want the ambience you hear to be that of a theatre. Rather, they want it to be the ambience of the scene. So it is provided artificially. The definition of a surround channel thus becomes an omnipresent sound source, coming at you primarily from the sides and rear. Omni present because the effect is totally destroyed if one can localize it to any one speaker. In fact, most ambience effects are totally ineffective if you are aware of them at all.

A uniform sound field is also capable of providing directional effects. When a film is mixed with that intention, the surround is balanced with the screen channels to accomplish the desired effect. While you may achieve directional effects from an improperly set up surround system, without uniform nondirectional coverage you can never recreate ambience.

Obviously the quality of the surround sound should match the quality of the screen channels or the audience will hear the difference. It’s a sad case but the sound quality of the worst speaker will determine the sound quality of the entire system.

The only way to provide a proper surround effect for the ENTIRE audience, not just those in the center, is to build a distributed system. This consists of a lot of speaker systems placed around the room close enough together so that no one can distinguish any point source.

Two speakers will not do this nor will four or six. Most theatres need ten or twelve. Large theatres need more and, oddly enough, so do small ones. This is because surround speakers in small theatres need to be closer together.

The placement of surround speakers has been largely arbitrary over the years. In 1980, I developed the Allen Surround Array™ formulas proving that reliable formulas providing the exact location of each surround speaker could be derived to solve the problem with as few speakers as possible. Systems built using this technique provide a very even sound field, $\pm 1/2$ dB within the surrounded area, without directional cues.

The surround speakers themselves must be good quality. Those with horn type high frequency sections are the best. Most home systems let alone eight or twelve inch utility speakers aren't nearly good enough. Not only do they not sound very good (an understatement) they are woefully inefficient. There isn't enough power in the world to make these systems play loud enough in a theatre without burning up.

While the sensitivity and power capacity are the key specifications for a surround speaker, one should also require low distortion, flat frequency response and fairly even dispersion. The lower the distortion and the flatter the frequency response, the clearer the sound. Dispersion is another problem. Most speakers used in surround arrays are have coverage angles that are simply too wide.

I believe surround speakers should therefore meet the following criteria:

1 Watt 1 meter sensitivity: 98 dB or greater.

Continuous power capacity: 100 watts or greater.

Continuous program capacity: 200 Watts or greater.

Frequency response: ± 3 dB from 50 to 16000 Hertz.

Beamwidth: within 10° of 120° horizontal and 80° vertical.

When installing surround speakers you should use wire of at least No. 12 or 14 gauge. The speakers should never be wired in series or series parallel combinations. Rather they should used in 70 Volt configurations requiring an excellent transformer, costing about \$70.00, at each speaker. Or, more conveniently and economically, wired all in parallel and, if necessary, connected to the amplifiers through an autotransformer. This would bring the resultant load (impedance) up to 4 ohms or so and keep the amplifier happy. It's best to run a separate pair of wires to each speaker from the booth.

The problem with series wiring is that the damping factor is lost because of the relatively high resistance each speaker sees between itself and the amplifier. The sound becomes less defined particularly in the bass and upper bass. If the speakers in series are not well matched (few are) they will interact with each other and not even sound the same.

John F. Allen is the founder and president of High Performance Stereo in Newton, Mass. He is also the inventor of the HPS-4000® cinema sound system and in 1984 was the first to bring digital sound to the cinema. John Allen can be reached by E-mail at JohnFallen@aol.com.