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# **Why Movies Are Not Too Loud**

**BY**

**JOHN F. ALLEN**

HIGH PERFORMANCE STEREO™



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*FIRST IN DIGITAL STEREO*

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# Why Movies Are Not Too Loud

by  
JOHN F. ALLEN

Since their introduction, digital soundtracks have been noted for many things, mostly good things. The increased separation, wider bandwidth, reduced distortion and greater dynamic range have been welcome improvements. For the first time with every film, digital sound has given producers, exhibitors and audiences alike, the opportunity to experience the kind of sound once only associated with 70 mm magnetic releases.

The one negative comment heard over and over again is that digital movies are too loud. What is the real problem? Why are audiences around the world complaining about loud movies? The answer is actually quite complicated but boils down to four things: One, some films are indeed recorded too loud though most are not. Two, the sound systems in today's theatres are often distorting. Three, many of these sound systems are seriously mis-tuned and mis-calibrated. This third item is bad enough, but it also adds to the problem of distortion. Finally, there is the issue of loud trailers.

Let's deal with the trailers first. Producers have been in a kind of contest to make the loudest trailer. They want THEIR trailer to be the one that gets the audience's attention and be the one the audience remembers. This has caused the soundtracks of digital trailers to be almost uniformly mixed at average levels at least 4 to 5 decibels higher than feature films. The analog soundtracks are typically 2 to 3 dB above the feature levels. If these offending trailers are turned down to a reasonable sound level, the feature will be played so low that the dialog may not be intelligible. This has led to a wide disparity in fader settings. In some theatres, faders are turned down for trailers and left there all the time. Others are not, leaving audiences to suffer - really suffer! The best solution under the circumstances is for faders to be set lower for trailers and restored to their "normal" settings for the features. But this is problematic to say the least.

Fortunately, at least two of the latest cinema processors offer a solution. Dolby's CP-500 can be programmed to run trailers in the same Dolby formats as the feature but at a lower fader setting. The feature format can also be programmed for a specific sound level. Sony's new DFP-3000 processor offers an extremely powerful tool for dealing with trailers and features requiring different fader settings. It's called "Fader Memory". Quite simply,

the processor remembers the fader setting used the last time a film or trailer was played. By recognizing the title encoded in each SDDS soundtrack, the processor automatically returns the fader to the stored level for each trailer and feature during subsequent performances.

Currently a task force is working with the National Association of Theatre Owners to establish an agreement among those responsible for the excessive trailer levels, to stop this ridiculous practice. There is no question that loud trailers are a very serious and totally unnecessary problem.

This then leaves us with the question of loud features. Are digital features too loud? Well, yes and no. For the most part, the average sound level of motion picture soundtracks has not changed since the introduction of Dolby Stereo in the 1970's. However, now that virtually all films can have the dynamic range previously heard with only the relatively few 70 mm releases, more audiences are hearing louder music and effects than they have heard before. In addition, the subwoofer track in digital films has indeed added a greater impact than ever.

While digital soundtrack technology has increased the dynamic range in motion picture sound, it is the sound systems in theatres themselves that are the principle cause of customer complaints about loudness. This is because most of the installed systems currently found in today's movie theatres fall far short of the acoustic power output required to play modern digital soundtracks. This shortfall can be, and often is, as much as 90 percent or more. The lack of speaker and amplifier output in a theatre's sound system is, of course, totally independent of the actual digital format used.

When the speakers and amplifiers of a sound system are too small for their task and are asked to deliver sound levels that are two, ten or twenty times greater than their capability, the resulting distortion can be obnoxious as well as abusive. Distortion not only sounds horrible, but by increasing the density of the sound, it has the added effect of making a film sound considerably louder than really it is. This is very important to keep in mind: Distortion makes sound seem louder!

Each screen channel of a digital soundtrack is recorded to deliver a maximum peak level in the center of a theatre of 105 decibels Sound Pressure Level (SPL). Each surround channel peaks at 102 dB SPL. The subwoofer peaks at 115 dB SPL in the center of a theatre. These levels are the same for each digital format and the same for every theatre. To safely reproduce these levels, or any levels, without distortion, a theatre's sound system must be designed to be capable of delivering greater levels than it will normally be

“asked to”. This so called headroom is necessary ensure that the speakers and amplifiers are never pushed near, let alone beyond, their maximum output. As they near this maximum, distortion is introduced and increases. When the speakers and amplifiers are pushed beyond their capability, the distortion skyrockets. How much headroom one designs into a sound system is optional. That is to say that there can be too little and there can be more than necessary, at least from a practical point of view.

I have always recommended headroom of at least 6 dB in every channel of a sound system, including the subwoofer channel. This brings us to a design goal of 111 dB per screen channel, 108 per surround channel and 121 dB for the subwoofers, as measured in the theatre’s center. This allows for some additional power required for any boosting which may be done in the sound system’s equalization as well as enough to guarantee that the amplifiers will never be over-driven and “clip.” Though subwoofers are not equalized in the ways we see with full range channels, 6 dB of headroom will ensure clean bass. To put it another way, a sound system with 6 dB of headroom will never be asked to deliver more than 25 percent of its output power. This represents good design, assuring that nothing in the sound system will be over-driven or stressed at any time.

Having said that, what are the output capabilities of most of today’s theatre sound systems? Let’s consider at a typical medium sized theatre 80 feet (24.3 m) long. A two-way screen speaker with a one watt / one meter sensitivity of 100 dB, powered by two 300 watt amplifiers will have a maximum capability of about 105 to 106 dB SPL in the middle of the theatre, 40 feet from the screen. (See Figure 1.) This level is even less if the speaker is heavily equalized, which is usually the case. Another way to look at this is to realize the when the system is at 25 percent of its output, the level in the center will be a mere 99 to 100 dB SPL.

The surround channels fare even worse. Let’s say that the theatre is 45 feet (13.7 m) wide. Using the typical surround speakers found in theatres with a one watt / one meter sensitivity of 91 dB and 400 watts per surround channel, each of these two surround channels will crash at 100 dB in the theatre’s center. This is 2 dB below the digital requirement of 102 dB. (See Figure 2.) At 25 percent output, this system delivers only 96 dB per surround channel in the center of a 45 foot wide theatre. Due to the power needed for the equalization often required for these surround speakers, the maximum levels one may actually achieve may be 3 dB lower or more.

Finally, the subwoofers are likely to be the most underpowered. Again the level the soundtrack requires is 115 dB in the center of a theatre. To do this reliably and without distortion, I recommend subwoofer channels be able to deliver at least 121 dB. Looking

once again at a theatre 80 feet long, a subwoofer with a one watt / one meter sensitivity of 95 dB powered by 1200 watts will have a maximum output of 104 decibels at 40 feet from the screen. (See Figure 3.) This is a shortfall of 11 dB, or to put it another way - 92 percent. At 25 percent of this system's output, this system plays at 98 dB, 17 dB (98 percent) below the soundtrack's demand of 115 dB.

To bring the subwoofer channel up to 115 dB in the center of this theatre using the speakers and amplifiers stated, this sound system would need four cabinets and four amplifiers. A capability of 121 dB would require seven subwoofers and seven amplifiers. (See Figure 4.) When one counts the few, if any, theaters equipped with seven subwoofers, it's easy to imagine how widespread this problem is.

Not only is the sound from underpowered sound systems distorted but the speakers are failing at an alarming rate. And while circuits with service contracts may say that such failures don't cost them anything to repair, the number of effected performances as well as disenchanting patrons would seem to be unacceptable to anyone in the entertainment business.

Many theatres larger than 80 feet in length are often equipped with the same speakers and amplifier power outlined above. Obviously, the distortion in such larger theatres will be even worse.

It's easy to see that theatre sound systems are being pushed to, and far beyond their limits. The resulting distortion is one of the most important causes of customer complaints about loud movies. As proof, I offer the following: To eliminate any chance for distortion, all of my sound systems are designed to have at least 6 dB of headroom, or four times the output required for digital motion pictures. This is done with every channel including the subwoofer. Theatres equipped with these sound systems regularly play digital films at their normal levels without complaint. This is an issue I pay very close attention to, often speaking directly with theatre managers and projectionists. When the sound is clear and clean, audiences enjoy and are even thrilled by the dynamic range rather than feeling assaulted by it. Another benefit is reliability. Beyond (three, I think) cases of manufacturing defects, we have never had to replace a speaker driver in our entire 18 year history - not one!

In short, with a few exceptions, movies are not too loud. But they are definitely way too loud for the sound systems in the vast majority of movie theatres.

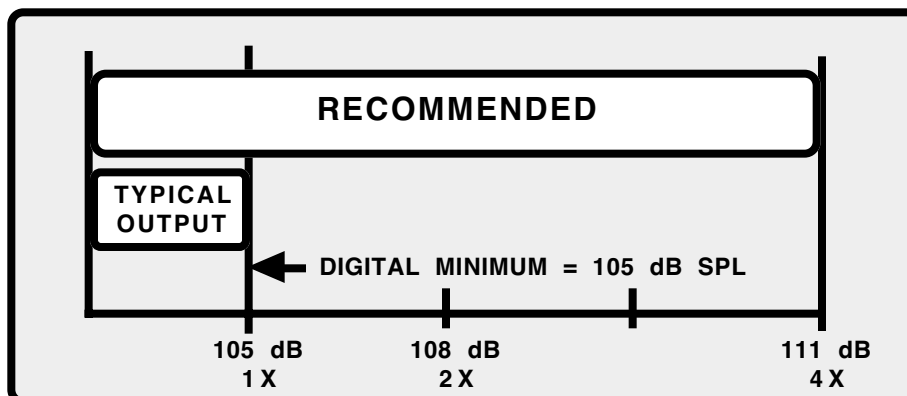
All this, of course, assumes that all the cinema sound systems in the world are properly

tuned, calibrated and are therefore playing films at their normal levels when the fader is set to its normal position. Unfortunately, nothing could be further from the truth. As I described in detail in the November, 1997 and February, 1998 issues of BOXOFFICE, due to common measurement errors, most of the sound systems in today's movie theatres are severely mistuned and mis-calibrated. One of the consequences of this is that auditorium faders cannot be run at their calibration settings (typically "7", or 0.0 for SDDS) without the film sound levels being so high (and distorted) as to drive any sane person from the theatre. Some operators do attempt to keep faders as close to the calibration settings as they can. As a result, some sound systems may in fact be operated too loud.

**If all this sounds like a bad situation, it is!**

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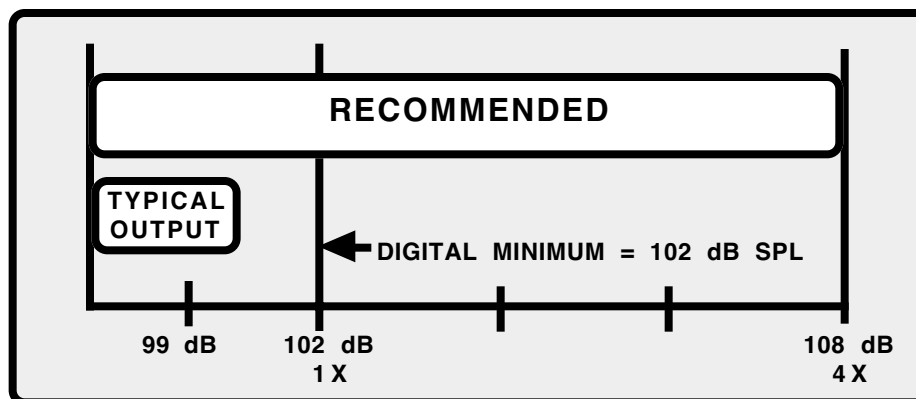


TYPICAL OUTPUT PER SCREEN CHANNEL IN dB SPL  
AT CENTER OF A 24.4 M / 80 FT LONG THEATRE,  
600 WATTS OF BI-AMPLIFIED POWER ASSUMED

## STAGE SPEAKERS

Figure 1.

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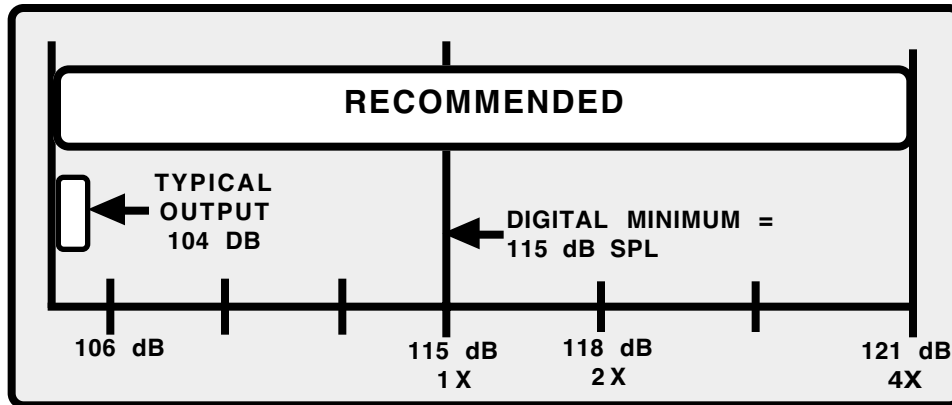


TYPICAL OUTPUT PER SURROUND CHANNEL IN dB SPL  
AT CENTER OF A 13.7 M / 45 FT WIDE THEATRE, 400 WATTS  
OF AMPLIFIER POWER ASSUMED PER CHANNEL

## SURROUND SPEAKERS

Figure 2.



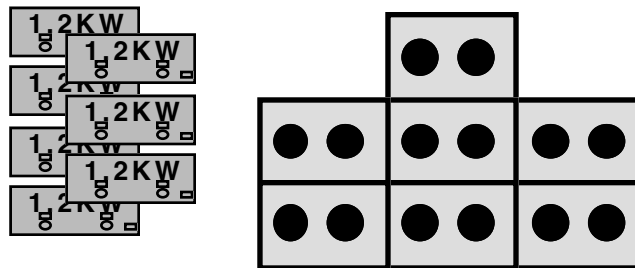


TYPICAL SUBWOOFER OUTPUT IN dB SPL  
AT CENTER OF A 24.4 M / 80 FT LONG THEATRE,  
1200 WATTS OF AMPLIFIER POWER ASSUMED

### SUBWOOFER SYSTEMS

Figure 3.

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RECOMMENDED OUTPUT AT 40 FT / 12.2 M = 121 dB SPL

### SUBWOOFER SYSTEM

Figure 4.