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Get the Picture?
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by A. Grimani

I see it all the time: award-winning home theaters with front projection video systems and light-colored wall surfaces. It really bugs me, too, because the proud owners of these rooms are not experiencing the full potential of the video system. They are being robbed of picture quality by the room.

Light-colored rooms act as reflectors for the light from the screen. It bounces off the walls/floor/ceiling back onto the screen, washing out the dark areas of the picture. In simplest terms, this is a loss of contrast ratio. It is not caused by a *decrease* in peak white level, but by an *increase* in achievable black level. Unfortunately, the human eye is much more sensitive to black resolution than white resolution, so blacks are the worst place to lose contrast. The Imaging Science Foundation (ISF) has long maintained that contrast ratio is the most important element of picture quality. Not color saturation. Not color accuracy. Not even resolution – you should concentrate on good contrast ratio long before worrying about the number of pixels in the picture! The best projector in the world will still lose tons of contrast if it is handed a room with light-colored surfaces. What a terrible thing to do to a \$40,000 projector!

To determine whether or not the contrast ratio of a video system is adequate, you have to measure the actual projector/screen/room combination. There are two ways to do it: the “right” way and the “misleading” way. The misleading way is to measure a full white field followed by a full black field using a spot light meter. What you get is the difference between the brightest white and blackest black the projector and screen can send to a viewer’s eyes. Unfortunately, that’s not what you want, because it doesn’t match typical picture conditions. The right way is to measure the difference between white squares and black squares on a checkerboard test pattern. You get to see what the system can do when 50% of the image is white and 50% is black. This is a much closer match to actual picture content, which is a mix of light and dark areas. The white areas of the checkerboard light up the room surfaces around the screen, which reflect light back to wash out the blacks, simulating the actual contrast ratio with a real picture on the screen.

Here is a real world example. Last month, during an ISF training in Europe, I had the class examine the contrast ratio of a high-end projector from a company that will remain nameless (but likes Tequila toasts). The full white/full black contrast ratio measured an admirable 1,200:1. A good film presentation is about 120:1, and the human eye can only see 800:1. When they switched to a checkerboard pattern in a room with light ceilings and walls, however, the contrast ratio plummeted to a lousy 40:1. Folks, that's worse than VHS, but more importantly, it's worse than the 200:1 contrast ratio possibly with digital video!

Don't get the idea that all home theaters must be flat black, although it would be the ideal color for a viewing environment. Instead of black, you can use neutral tones like dark blue-gray, dark wood, etc. Also, pay particular attention to the area directly above the screen. The common white ceiling is among the most deadly enemies of contrast ratio. Also consider the side walls close to the screen, and even the wall behind the screen. Acoustically transparent perforated or woven fabric screens, which are becoming more and more common, let light through as well as sound. While a light reflection from behind the screen is not quite as serious as a side wall or ceiling reflection, it cannot be ignored. The area behind the screen should be as dark as possible.

What about existing rooms that suffer from poor contrast ratios? It is possible to alleviate some room-related contrast issues by using directional screens (screens with gain) combined with gray screen surfaces, but there are some trade-offs. Increasing the directionality of a screen inevitably reduces uniformity and tends to show off hotspots. The gray surface also absorbs light, which could potentially drop the screen luminance too much. It seems almost inconceivable that modern lamp projectors could lack sufficient light output, but when you're dealing with a very large, acoustically transparent, gray screen, they just might run out of steam.

Next time you look through the listing of candidates for best home theater awards at CEDIA, EHX or some other industry function, pay attention to the colors in the rooms. Remember that darker is always better. Naturally, if you design a high-quality theater, stay away from light colors on the room surfaces.

This article is based on a column published by A. Grimani in Residential Systems magazine July 2006. Chase Walton contributed to this article.