Runco's CSMS™

Cinema Standards Measurement System™

GARY REBER

The CSMS™ Approach

The dateline for this article was November 6, 2002 while on the first annual Home Theater Cruise™ aboard the largest cruise ship in the world, Royal Caribbean's Voyager of the Seas. On board this week-long cruise, November 3 through 10, 2002 to the western Caribbean, were over 250 home theatre enthusiasts who participated in a series of presentations designed to educate the enthusiast end user. The 2nd annual Home Theater Cruise is scheduled for November 1 through 8 aboard Royal Caribbean's Explorer of the Seas. For more information and to book the cruise, visit www.hometheatercrusie.com.

It was the morning of the cruise just prior to docking in Ocho Rios, Jamaica that Sam Runco, Greg Caves, Pat Bradley, and John Bishop of Runco International, and I sat around in the VIP lounge on the ship to have a discussion about projector performance and Runco's new approach to a performance cinema measurement standard. What follows is the essence of the Cinema Standards Measurement System™ (CSMS™) approach instituted by Runco. This is not meant to be a technical description but one that most enthusiast end users will be able to understand. Please keep in mind that the criteria Runco has selected for conducting these tests is intended to provide the consumer with a reference that he or she can hopefully comprehend and use as a basis for "real world" comparison with what they actually experience in a movie theatre.

"Runco's technical description," says Mark Stein, Director of Corporate Communications, "is therefore drafted in a fashion designed to be easier for a novice consumer to grasp and understand, rather than in the highly technical jargon normally associated with a discussion targeting an audience of experts and/or engineers.

"The same can be said of the new specification itself. This specification was developed specifically with the consumer in mind. It has not evolved as an attempt to comply with any existing standards, since no such standard currently exists. Rather, Runco's purpose is to enable consumers (the people who buy our products) to more clearly understand, and therfore compare the performance of our projectors, with the movie theater experience which has *always* been the standard Runco has sought to achieve."

Until now, no video projector manufacturer has had reason to attempt to develop a meaningful criteria for the performance of a projector in an actual home theatre environment. All manufacturers have relied upon the "lumen" and later "ANSI-lumen" specifications to convey the light output capabilities of their products. Stein says that Runco will continue to provide that specification, as well. However, "it is our sincere hope that other manufacturers will see value in our efforts and they too, will adopt this concept."

There is no single "right" or "wrong" way of approaching this issue. Many other variations of this procedure could be considered just as valid. "Runco," says Stein, "views ours to be an initial and evolving effort and is certainly open to thoughtful suggestions and appropriate modifications which might enhance the value of what we are developing. Joe Kane, certainly one of the guiding lights who has contributed greatly to Runco's emergence and success as a leader in our industry, has generously offered his insight and no doubt others will as well. Through such collaborative efforts and understanding Runco is convinced we can contribute effectively to the betterment of our industry and to the benefit of those we are in business to serve."

The complete conversation is available on the *Widescreen Review* Web site at www.WidescreenReview.com. I urge you to read this "On Screen" conversation as it provides greater perception of the intent behind Runco's Cinema Standards Measurement System.

Runco's CSMS

Runco International has replaced the ANSI-lumen specification as the primary measurement standard for its projectors and has adopted the foot-Lambert (fL) measurement procedure for measuring the light output of its projection products.

Runco International is once again striving to enhance and broaden the home theater™ video market by changing the technical specifications of its video displays. Runco is doing this to more realistically reflect the needs of sophisticated consumers concerned with high-fidelity HDTV and digital film reproduction.

The specification standards in use by Runco and others until now, were designed for industrial video displays and by default have been universally used to describe home theatre products throughout the industry.

The objectives for good home theatre video are different than those for industrial presentations. Therefore, the specifications that we currently employ do not convey the proper performance characteristics of what makes a good movie picture or a realistic HDTV image.

Why This Is Necessary

"We feel that the measurement criteria associated with light output for fixed-pixel technology specifications is inappropriate for home theater applications," says Sam Runco, President and founder of Runco International, "The traditional ANSI-lumen method for measuring brightness can be an accurate quantitative measurement but does not describe the quality of an image for home theatre. We have decided to use a measurement system that is a true representation of how bright an image is in reference to something everyone can understand—a movie theatre."

Runco further stated that "By using the foot-Lambert measurement specification we can communicate to the customer that the image in his home theatre might be 1.5x brighter for example, than the image at his local cinema, which is much more meaningful than trying to explain how bright 1,000 ANSI-lumens will appear on an 8-foot-wide screen."

About Foot-Lamberts

The unit of measurement known as foot-Lamberts, is a measurement related to the brightness of a particular image and is equal to 1 lumen per square foot of screen surface.

Specialized equipment is required to perform this measurement. The SMPTE (Society of Motion Picture and Television Engineers) open-gate specification for a film-type movie theatre is a minimum of 16 foot-Lamberts of brightness. Open-gate means the shutter is running but there is no film in the gate.

As research by THX's Theatre Alignment Program has determined, movie theatres sometimes struggle to achieve this brightness specification, even with the high wattage lamps in their film projectors. Since the screen size is generally much smaller for home theater, it is possible to consistently achieve 16 foot-Lamberts and most of the time much higher brightness with Runco lamp-equipped projectors.

How This Affects The Consumer

"The purpose of our change to the more appropriate 'Cinema Standards Measurement System' (CSMS) specification is to make the information on our spec sheets relevant to the consumer, said Runco. "The change to foot-Lamberts will make for an easy comparison between how bright the average movie screen is, relative to our projectors. We will include the color temperature at which our light output was measured, as well as screen gain used. This is critical because increasing color temperature increases brightness as do higher gain screens. Unfortunately an overly exaggerated color temperature ruins color fidelity in the type of pictures necessary for Home Theater."

Runco's changes in video display specifications make it possible for the consumer to easily relate the picture performance of their products to that of a local film cinema.

Home Theater Is Still Evolving

Discussing Runco's departure from the ANSI-lumen method presently in use by the industry, Chuck Turigliatto, Vice President of Sales and Marketing explains, "The home theater industry is still a 'work in progress' and as one of its creators, we at Runco view ourselves as a guardian of this industry. When we feel strongly that something is incorrect or needs a more appropriate direction, we will not hesitate to use Runco as a platform to initiate that change on behalf of the industry. The testing methods that have been used came from an entirely different industry and were applied in home theater more by default than by adoption. Our methods were designed to be an objective measurement that is more appropriate for home theater."

Projection Light Output Basics

- The projector outputs a fixed amount of light.
- As screen size increases, foot-Lamberts decrease.
- Gain on the screen will increase the foot-Lambert reading.
- Negative-gain screens used for better black levels will decrease foot-Lambert value.
- Doubling the screen size diagonally results in 1/4 the brightness of the smaller screen.

• A formula can be assigned to every projector to calculate its true foot-Lambert measurement capability for any screen.

Runco will continue to provide ANSI-lumen specifications as a secondary means of comparison with those products that have not yet been converted to the foot-Lambert system.

CSMS Implementation And Methodology

The Cinema Standards Measurement System (CSMS) is a method of measuring home theater projector light output in terms that Runco believes can be better understood by the typical consumer. It consists of three separate measurement steps to provide three separate ratings for the projector, each of which is described below:

I. ANSI Lumens

This value is measured on the production line using the following criteria:

Default settings for Contrast and Brightness are utilized.

While Color Temperature can be set anywhere the manufacturer wishes because it is not detailed in the ANSI specification, it is usually set around 9300K—depending on the white point or color temperature of the lamp used in the projector. When adjusting the projector to produce a different color temperature than the lamp naturally outputs, this can result in a dramatic reduction in light output from the projector. In the case of ANSI LUMENS, manufacturers are looking for the highest reading possible. In addition, when a projector is measured using different types of light metering equipment, the readings can vary greatly—by 20 to 30 percent at this stage due to tolerances in the meters.

This ANSI method is a 9-point system, measured from the screen's position—so that screen material does not become a factor. To accomplish this, a screen is positioned and the projector installed at the appropriate throw distance to fill the screen image area proportionally. The projector is then properly focused and calibrated. The screen is then removed and measuring equipment positioned at the exact placement the screen had occupied. Each point, among nine different points within the screen surface area, is measured using the LUX unit of measurement, from that screen position. The light measurement meter is pointed at the projector lens(s) to obtain the LUX value. Each of the nine readings is then added together and divided by nine so an average reading in LUX is obtained. The average LUX reading is then multiplied by the screen surface area from which the nine measurements were taken, using square meters as the multiplier value. The result is the ANSI lumen output specification for the projector.

II. Home Theater ANSI Lumens

This measurement standard was created by Runco International. It is a modified ANSI lumen reading, determined by calibrating the projector to ISF (Imaging Science Foundations) specifications with a 6500K color temperature, which is necessary for obtaining an accurate video image. The

measurements take place in a "theatre" environment utilizing ANSI lumen methodology. Runco has selected a 72-inch-wide 1.78:1 (16:9) aspect ratio screen standard for these measurements. In practical application, the actual screen size used will not materially affect the resulting light output measurement because as LUX values may decrease when distributed across a larger mass, this is offset by the resulting increase in the multiplier. The nine-point system is incorporated as in the standard ANSI procedure and the LUX from each point is averaged and multiplied by the surface area of the screen, again in square meters.

The resultant Home Theater ANSI lumen specification is much lower than the standard ANSI lumen equivalent and is provided as an indicator of the actual performance of the projector when it is not run in a "torch mode," as commonly occurs when a manufacturer wishes to embellish the light output measurement as much as possible while still adhering to the broad ANSI specifications. However, it is still not necessarily a number the consumer can clearly understand, due to its lack of a 'real world' relationship.

III. Foot-Lamberts

The foot Lambert is a measurement used in commercial theatres. The SMPTE standard specifies 16 foot-Lamberts of brightness measured off the screen in a commercial theatre. This is taken without film in the projector, or open-gate—so it is a measurement of the lamp projecting through the lens directly onto the screen. The THX® Theater Alignment Program surveyed over 300 theatres in the U.S. and found the average fL measurement, even with no film, to be 11 foot-Lamberts with some as low as 7-8 foot-Lamberts, far from the recommended 16 foot-Lamberts. This may be because some theatre owners run the lamps at a lower wattage in order to conserve lamp life, while the opposite is often actually true.

When Runco measures foot-Lamberts, they use a 72-inch wide, 1.78:1 screen with 1.3 gain. The screen gain is a fundamental factor in this instance because unlike the ANSI measurement system, the foot-Lambert measurement is taken directly from the screen surface. The projector undergoes a proper ISF calibration as with the Home Theater ANSI measurement, and nine points are measured off of the screen surface and averaged. The measurements are taken with a Photo Research Spectra Colorimeter, which reads foot-Lamberts directly. After the measurements are taken off of the 1.3 gain material, they are taken again using a Labsphere 1.0 gain compressed PTFE disk—which is a reference standard used by the best screen manufacturers. (This same disk is also used to calibrate the optics on the Hubble space telescope, so Runco determined that it would serve well for its projectors.) The foot-Lambert is measured off of the 1.0 surface and averaged again over the nine points. Theoretically, the average should be 1.3 times lower than before—however this is not always the case due to a variety of variables, including actual screen gain and variation from gain specification.

Next Runco calculates the foot-Lamberts from the LUX reading taken earlier. After performing a calculation that converts the LUX, surface area, and screen gain to foot-Lamberts, they compare those results with the measurements taken using the Photo Research Spectra Colorimeter. The measured and the calculated foot-Lamberts must be within 10 percent in order to validate the readings. The results are published as foot-Lamberts. Generally, the Runco one-chip DLP projectors can achieve 18 to 20 foot-Lamberts on this screen. A measurement of 16 foot-Lamberts is considered very bright as referenced by the SMPTE standards. Calculations can also be performed to take a foot-Lambert reading from the test screen size and convert it to a larger or smaller size to give the consumer an idea of how bright (in fL) the image will be in their theatre with the particular screen they are using.

IV. Theatre Environment

The home theatre environment utilized by Runco consists of a 20- x 30-foot room, finished with a neutral gray carpeted floor. The walls and ceiling are painted flat black to eliminate any reflectivity and minimize ambient light conditions. *Widescreen Review* and many of the most reputable custom installers have adopted a similar approach when working with their customers to achieve an environment for optimal home theatre video performance. In many cases, custom installers have selected decorator materials which achieve the same objective (though providing greater variation in color choices), while also providing superior acoustic characteristics.

Runco's test screen is mounted on T-stands. The room is totally void of illumination (blackened) as any ambient light on the screen will artificially increase the foot-Lambert measurement results. Seating for this process is established so that the first row is set back from the screen a distance of 1.5x the width of the screen—and in Runco's simulated home theatre environment each successive row is placed 36 inches back from that point. Eye level is at an average of 0.33x the height of the screen as measured from the screen's bottom. For example, when using a 54-inch high screen, the eye level is set at 18 inches from the screen's bottom. The actual foot-Lambert light measurement is conducted from a position 1.5x the width of the screen back from the screen's position and centered with the screen center.

Black level is measured with the projector properly calibrated and displaying a black field test pattern. Contrast ratio is measured using a "16 checker board pattern" with alternating white and black squares. The difference in readings between the white squares and the black squares is the contrast ratio measurement, in essence the dynamic range.

Another way to measure contrast ratio is the "Full On/ Full Off" method in which the projector displays a white field with contrast and brightness turned all the way up and a measurement taken. Then the projector displays a black field and contrast and brightness are turned all the way down. The "FOFO" method yields exaggerated contrast ratio measurements and is not representative of home theatre performance. FOFO is generally mentioned next to the contrast ratio specification if this method was used for the measurement. Runco does not use the FOFO method, but rather the more suitable and useful checkerboard method.

Summary

The CSMS system developed by Runco allows the consumer to compare ANSI to ANSI as they might normally do. In addition, they can reference Home Theater ANSI to determine how the projector will perform in their theatre environment. Finally, foot-Lamberts can be referenced should the consumer want to compare their home theatre projector/screen combination to a commercial theatre. By providing more information to the consumer Runco's CSMS allows the consumer to make a more educated choice regarding their viewing environment and screen size requirements—instead of a knee-jerk, "make it as big as will fit the room." It is hoped that "make it the appropriate size to achieve the best image quality," will be the response elicited. ■