

Digital Cinema Screen Luminance Measurement

Introduction

During movie production, screen luminance measurement is commonly conducted by many parties such as creatives (directors, cinematographers), post-production houses, cinema system installers or cinema projector manufacturers

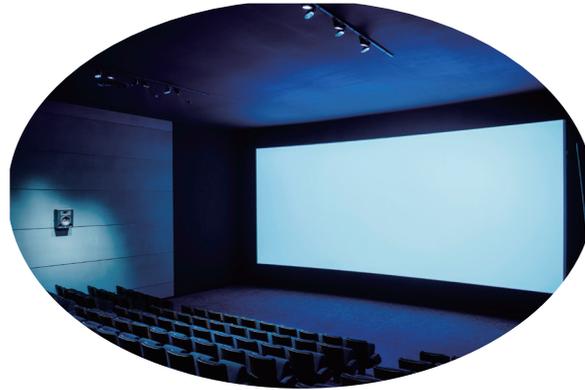
Color relationships are first established by the creatives to achieve the desired emotional effect of the movie. However, the human visual system sees color relationships differently depending on the brightness of the image. For instance, when image become darker, our perception tends to become bluer and less vivid and this [phenomenon](#) is apparent at the typical screen brightness levels seen in cinemas.

When the brightness on the cinema screen is different from the level established by the creatives, different emotional effect will be portrayed to the audience due to the difference in color and contrast perception. Hence, consistent screen luminance across all parties within the movie production process is necessary to ensure the content is viewed as intended.

What is Screen Luminance?

Screen luminance, or generally known as screen brightness, is an objective measure of how much light is reflected from the screen to the audience. The S.I. unit for luminance is candela per square meter (cd/m^2) and the US customary unit for luminance is foot-lambert (fL).

Standardized Practice for Screen Luminance Measurement



[ST 431-1:2006](#) - D-Cinema Quality — Screen Luminance Level, Chromaticity and Uniformity, established by [Society of Motion Picture and Television Engineers \(SMPTE\)](#), is the widely adopted digital cinema projection standard. This standard specifies the

critical image parameters like absolute luminance level, [white point chromaticity](#), and luminance uniformity of the reflected screen light, necessary for review rooms and commercial cinemas to achieve consistent and repeatable color quality.

The ST 431-1:2006 document stated that the digital cinema screen luminance should be $48 \text{ cd}/\text{m}^2$ (14 fL). Furthermore, the luminance distribution across the screen should be 85% of center luminance (nominal) but no less than 75% of peak brightness at the sides and corners of the screen.

SMPTE also specifies that when measuring luminance, the theatre should be set up in its “operational” mode, with show lighting in its normal setting. It is important to note that any screen luminance measurements must be made with the projector in a fully calibrated mode (i.e. white point and primaries calibrated) as the [calibration](#) process may affect the color corrected light’s output.

Frequency of Measurement

Over time, cinema screen luminance changes as bulbs age and screens get dirty or due to bulb replacement. Hence, regular measurements should be made as often as possible to ensure luminance

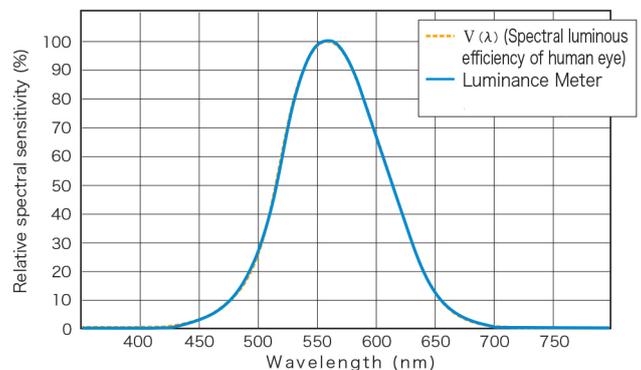
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level stay within the limits specified by relevant standards and recommended practices.

Cinema operator should first establish an internal procedure for periodic measurement of screen luminance based on the experience of the user and the recommendation from the projector manufacturer and the lamp manufacturer. In general, the best cinemas recalibrate their lamps at least once per week or whenever anything is changed in the digital cinema projection system.

Professional Screen Luminance Meter

Luminance can be measured using a spot luminance meter with sensor that has a spectral response that closely matches the spectral luminous efficiency function of the human eye. This is also known as the photopic spectral response as defined by CIE 1931 2 degree observer. To ensure accurate measurement near the edge of the screen, the luminance meter should preferably have an acceptance angle of 1 degree or less.



Beside the measurement of screen brightness, the measurement of sequential contrast ratio or black luminance (i.e. residual luminance of a black screen) is also an important aspect of image performance. As implied in the Digital Cinema System Specification, the selected luminance meter should be capable of measuring luminance of 0.01 cd/m² or lower with reasonable accuracy.

[Konica Minolta Luminance Meter LS-150](#) and its predecessor model LS-100 are used widely for cinema screen luminance measurement. LS-150 conforms to the luminance meter classification requirements for Class B of DIN 5032-7 and it is capable to measure luminance as low as 0.001cd/m² making it an ideal instrument for accurate black luminance measurement.

For more information or product demonstration, please click [here](#). Alternatively, you may also contact us at (+65) 6563 5533 for a free consultation.