

Shedding Light on Screen Luminance Meters

To Measure Light, You Need a Photometer

Standard ANSI/SMPTE 196M "Screen Luminance and Viewing Conditions" specifies the "Photometer type" as follows:

"Screen luminance shall be measured with a spot photometer having the spectral luminance response of the standard observer (photopic vision) as defined in CIE S002. The acceptance angle of the photometer shall be 2° or less. The photometer response to the alternation of light and dark on the screen shall be to integrate over the range of 24 Hz to 72 Hz and display the arithmetic mean value."

Can You Please Translate That?

Simply put, the meter should "see" the light reflected by the screen as the human eye does. Some meters have photocells that are more sensitive to invisible infrared energy, and may give incorrect measurement of visible light. Meters designed specifically to measure screen luminance use special sensors and filters to have a "photopic" response just like the human eye.

Second, the photometer used to measure screen luminance in a theatre should measure light reflected from a small area of the screen, no more than two degrees in viewing angle. For example, if you take measurements 60 feet from a screen 20 feet high, a meter with a two degree acceptance angle "sees" an area on the screen only about two feet in diameter. Having a relatively narrow viewing angle allows the user to measure luminance in various parts of the screen, to evaluate the uniformity of illumination across the screen.

Since screen luminance is measured "open gate" with the projector running, the light on the screen is actually going off and on 48 or 72 times per second. At the normal 24 frames per second, a two-blade shutter gives 48 interruptions of light every second. A three-blade shutter gives 72 interruptions. A meter used for measuring screen luminance needs to be properly calibrated for the alternating light/dark cycle of a projector.

Professional Screen Luminance Photometers

Several photometers are designed and calibrated specifically for measuring screen luminance in theatres. They are available through theatre equipment suppliers, professional photography dealers, or from the manufacturers.

Minolta Model LS-100 Luminance Meter

This digital meter is available from Minolta is sensitive enough to measure luminance as low as 0.001 footlambert. It can be used to measure screen contrast ratio (black luminance) and stray light as well as screen luminance. Earlier models of Minolta screen luminance meters may also be available on the used equipment market. Additional information is available at www.minoltausa.com. Click on the menu items for "Business," then go to "Color/Light Measurement," "Light Meters" and "LS-100."

SpectraCine CineSpot Model SC-600

The SpectraCine CineSpot One Degree Spotmeter Model SC-600 is popular with many theatre technicians. Complete product information is at: www.spectracine.com/msc600.htm

UltraStereo Labs PSA-200

Projection System Analyzer This unique technology for measuring screen luminance uses a CCD camera and laptop computer to display luminance measurements simultaneously for 45 areas on the screen. Other measurements and diagnostic graphs are also available. The PSA-200 is especially useful when aligning a lamphouse for uniform illumination, as the CCD camera can be set up in the theatre auditorium while the laptop computer display can be located next to the projector while the technician makes adjustments. Information can be found at the UltraStereo Labs website at: www.uslinc.com/products/features/psa200.htm. For an article about the design and use of the Projection System Analyze, go to: www.uslinc.com/forum/smppte97.htm

Other Meters

Luminance meters (or spotmeters) designed for general photographic use can also be used to measure screen luminance. These meters may not have the specified spectral response, or may be "fooled" by the shutter interruptions, so they need to be calibrated against a known "standard" screen luminance

meter. As long as the measuring conditions remain constant (same color of light, same type of projector shutter), the calibration should be valid. For example, the Sekonic L-508 Cine Zoom Master can be used as a screen luminance meter if properly calibrated. Information on this meter is at: www.sekonic.com/Products/L-508c.html

Other photographic spotmeters made by Pentax, Minolta, or other manufacturers may also be suitable, as long as they are calibrated against a standard screen luminance meter for footlamberts or candelas/metre?.

Unsuitable Meters

Incident light meters are NOT useful in measuring screen luminance, since they can only measure light falling on the screen (footcandles), and not the light reflected back to the audience. Incident light readings do not take screen gain or curvature into account, and are not a good indicator of screen luminance.

Reflected light meters used for general photography usually measure a much broader area than two degrees, and often are not precise enough to measure slight changes in light level. For example, many photometers are only calibrated in Exposure Value (EV) increments equivalent to one full photographic stop, so they can barely discern the difference between eight and 16 footlamberts. Even a meter calibrated in 1/3 EV increments is not able to accurately measure the difference between 12 and 16 footlamberts.

The meters built into cameras for exposure control are likewise not precise enough to sense small differences in screen luminance. In most cases, they also measure an area that is too large, and may not have the proper spectral sensitivity.

Need for Periodic Calibration

Regardless of the meter used, periodic calibration is necessary to ensure accurate measurements. Calibration services are usually available from the companies supplying the meter (e.g., www.spectracine.com/repair.htm).

Obtaining Copies of SMPTE Standards

Copies of standard ANSI/SMPTE 196M "Screen Luminance and Viewing

Conditions" are available from the SMPTE, 595 West Hartsdale Avenue, White Plains, NY 10607, Telephone: (914) 761-1100. Standards and test films can be ordered at the SMPTE website: www.smpte.org/smpte_store/standards/

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