A.9 Selecting virtual machines/groups

To switch the data flow path to a specified virtual machine/group within the system service level of the tributary; or to select the correct virtual circuit linkage for the indicated virtual machine, within the bus controller, VIRTUAL MACHINE/GROUP SELECT is used. Further details are given in SMPTE RP 139.

A.10 Information fields (I/F) within the bus controller

In a manner similar to virtual machines, the bus controller contains information fields.

The bus controller information field comprises:

- a table of all linkages currently established;
- a table of all supervisory level groups;
- a table of all virtual groups;
- status information for the bus controller.

A.11 Clocks

Many applications require a common time scale across several virtual machines. This is usually implemented as a (software) clock, the machine internal clock, which must be synchronized by a simultaneous command to all appropriate virtual machines.

Of all the bus participants only the bus controller can guarantee simultaneous transmission of a preset command for those clocks.

Therefore the bus controller is designated as the keeper of a bus clock that is used to synchronize the timelines in all appropriate tributaries.

To support this general concept, the following assumptions are made:

A.11.1 Bus clock

If present in the system, the bus clock is resident in the bus controller.

The bus clock is set by means external to the control bus.

The bus clock is incremented by an external, unspecified signal (tick) common to all virtual machines.

A.11.2 Machine internal clock

The machine internal clock is resident in the virtual machine level of the tributary.

The machine internal clock is preset by messages carried on the control bus.

The machine internal clock is incremented by the same external, unspecified signal (ticks) as the bus clock.

The machine internal clock may be selected as the source of the machine TIMELINE.

A.11.3 Time synchronization

Machine internal clocks are preset by the bus controller.

The bus controller, using the supervisory level message GROUP SELECT ALL CALL, transmits to all virtual machines connected to the bus, the common message TIMELINE RUN, with the time value from the bus clock.

The bus controller is responsible for transmitting the time consistent with the common external tick signal and intended use of time in the system.

The bus controller performs synchronization of the system in response to the system service message REQUEST TIME TRANSMISSION.

Annex B (informative)
Bibliography

ANSI/SMPTE 207M-1992, Television — Digital Control Interface — Electrical and Mechanical Characteristics

SMPTE RP 113-1992, Supervisory Protocol for Digital Control Interface

SMPTE RP 138-1992, Control Message Architecture

SMPTE RP 139-1992, Tributary Interconnection

PROPOSED SMPTE STANDARD

SMPTE 196M
Revision of
SMPTE 196M-1986

for Motion-Picture Film — Indoor Theater and Review Room Projection — Screen Luminance and Viewing Conditions

1 Scope

This standard specifies the screen luminance level, luminance distribution, and spectral distribution (color temperature) of the projection light for theatrical, review-room, and nontheatrical presentation of 16-, 35-, and 70-mm motion-picture prints intended for projection at 24 frames per second. This standard also specifies review-room viewing conditions. It is the purpose of these specifications to achieve the tone scale, contrast, and pictorial quality of the projected print that will be of the quality intended during its production.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

CIE S002-1986, Colorimetric Observers

3 Projector operating conditions

Measurement of screen luminance shall be made with the projector in normal operation (with shutter running), with its lens set at focus position, but with no film in the aperture. The measurement of spectral distribution (color temperature) of the projection light is best made with the shutter momentarily stopped and held open, and with no film in the aperture.

4 Photometer type

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 (see annex A.4). 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.

5 Luminance level

5.1 Measurement location

To simulate audience viewing, screen luminance measurements shall be taken from the center of the seating area at a height of approximately 1 m (39 in) above the floor. To ensure reasonable luminance at other seating locations, measurements shall also be taken from the center and each end of the middle row, and shall be within the limits given in 5.3 or 5.4.

5.2 Theater nominal luminance

Theater screen luminance shall be nominally 55 cd/m^2 (16 fL) measured at the screen center. The luminance of the screen sides and corners shall be measured at a distance of 5% of the screen width from the screen edges. The readings shall be taken from each location specified in 5.1.

5.3 Theater luminance limits

Theater screen luminance at the screen center shall be between 41 cd/m^2 (12 fL) and 75 cd/m^2 (22 fL). Luminance at the screen sides shall be 75% to 90% of the screen center luminance.

5.4 Review room luminance and limits

Review room screen luminance shall be 55 cd/m^2 ± 7 cd/m^2 (16 fL ± 2 fL) at the screen center. The luminance of the screen sides and corners, measured as described in 5.2, shall be at least 80% of the screen center reading.

6 Luminance distribution

The screen luminance shall be symmetrically distributed about the geometric center of the screen. The luminance of any point on the screen between the center and the edges, as measured from any seat in the middle row, shall not exceed the screen center reading (see annex A.2).

7 Spectral distribution

7.1 For 35- and 70-mm prints, the light reflected from the screen in review rooms and primary theaters shall have a spectral distribution approximating that of a blackbody at a color temperature of 5400 K ± 200 K, the use of short-arc or carbon-arc light sources being assumed. For general theaters, the color temperature shall be 5400 K ± 400 K.

7.2 16-mm prints are made for projection with either arc or tungsten illuminant. When the intended illuminant cannot be specified uniquely, 16-mm prints should be evaluated at 5400 K.

8 Multiple projector adjustment

8.1 Same format

The resultant luminance from all projectors intended for use in the continuous sequential viewing of material of the same format shall not vary by more than 7 cd/m^2 (2 fL).

8.2 Different formats

The resultant luminance from projectors intended for use in a sequential system of viewing material of different formats shall not vary by more than 14 cd/m^2 (4 fL) (see annex A.5).

8.3 The apparent color temperature of the projection light from projectors intended for continuous sequential operation shall be consistent within a total range of 400 K. For 16-mm projection with light sources with a color temperature of less than 3500 K, the range shall be limited to 7% or 200 K.

9 Review room viewing conditions

All observers in a review room shall be located within a standard observing area which shall be:

– within the limits of a 15° angle on either side of a perpendicular to the center of the screen, in both the horizontal and vertical planes;

– at a distance of 3 picture heights ± 1 picture height from the screen.

10 Stray light

10.1 No stray light or illuminated area with luminance greater than 3.4 cd/m^2 (1.0 fL) shall be visible from the normal observing area of theaters or review rooms.

10.2 Screen luminance due to stray light, as described in annex A.6, shall be less than 0.25% of the screen center luminance for review rooms and primary theaters and less than 0.50% for other theatrical projection facilities.

Annex A (informative)
Additional data

A.1 Luminance level limits

Acceptable luminance levels are limited by a minimum value below which the visual process becomes less efficient and by a maximum value above which (assuming a shutter frequency of 48 flashes/s) flicker becomes objectionable. The permissible luminance range is limited by the criterion that a good release print must provide acceptable quality when projected at any luminance within the specified range. Users are reminded that screen luminance may decrease as a function of bulb age, dirt on optics, dirt on screen, etc. Projection equipment should be chosen to have more than sufficient light output to meet the specifications in this standard over a period of time. Usually, arc current is adjusted to compensate for changes in light output.

A.2 Light incident on the screen

Misadjustment of the projector light source optical system may cause luminance readings taken at various locations in the seating area and on various areas of the screen to exceed the screen center reading taken as described in clause 5 (hot spots). To avoid this possibility, it is desirable to measure directly the light from the projector falling on the screen. This may be done by measuring the incident light across the screen surface with a footcandle meter and adjusting the light source optics to ensure that no area on the screen receives incident light greater than the screen center.

A.3 Normal print

To provide interchangeability in motion-picture projection, it is desirable that print quality conforms to that of a normal print so that theaters can operate at known projection conditions and will, thereby, be able to exhibit projected pictures of good pictorial quality. It has not been possible to specify this normal print in terms of its optical density and other objective measurements because of the difficulties of specifying artistic quality in scientific terms. Accordingly, the normal print is defined as that print which conveys the desired artistic impression when projected under review room conditions as described by this standard.

A.4 Meter acceptance angle and response

A photometer with a photopic spectral response allows use of a well known standard response for all photometer manufacturers. A mesopic (partially dark adapted) response might be better but no standard has been set for the mesopic observer under typical screen viewing conditions. When entering a theater from daylight, we find it difficult to see others in the audience although they see us because they are partially dark adapted. The degree of adaption varies with the film subject matter. A typical film reduces the average screen luminance from 55 cd/m^2 to 5.5 cd/m^2 (16 fL to 1.6 fL). The rest of the theater is much darker. Because of increased blue sensitivity of the eyes (Purkinje effect) as one becomes somewhat dark adapted, a photometer with a photopic response may give readings on a xenon illuminated screen and a carbon-arc illuminated screen that are the same, although many observers see the xenon illuminated screen as the brighter. The xenon-arc spectrum has a peak in the blue region where, because of the Purkinje shift, there is increased sensitivity. A representative mesopic curve may be developed and adopted in the future.

A.5 Matching luminance of different formats

It may be necessary to adjust projector light output to compensate for the different aperture sizes and magnifications used when projecting different formats. The projector light source should be capable of achieving the specified screen luminance for the format with the least light efficiency (usually nonanamorphic wide screen). Adjustment may be made by changing arc current or by the use of attenuators in the light beam to reduce the screen luminance to the recommended value when projecting more light-efficient formats.

A.6 Stray light

Stray light is measured by comparing the center screen luminance described in clause 5 with the luminance of the image of an opaque test object placed in the center of the projector aperture. The test object preferably should have a diameter of 5% of frame width, and should not exceed 10°. The balance of the projected beam is attenuated by any suitable neutral density film that produces through the normal projection system an average screen luminance equal to 10% of the luminance of the screen as defined in 5.1. All sources of illumination in the auditorium, such as exit and aisle lights, should be used in their normal manner while stray light is being measured. Excessive stray light or flare should be corrected to ensure proper print contrast.

A.7 Other applications

Specifications for drive-in theater screen luminance are covered in SMPTE RP 12.

Annex B (informative)
Bibliography

SMPTE RP 12-1988, Screen Luminance for Drive-In Theaters

SMPTE RP 94-1989, Gain Determination of Front Projection Screens

SMPTE RP 95-1989, Installation of Gain Screens

SMPTE RP 98-1990, Measurement of Screen Luminance in Theaters