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Projected Image System Contrast Ratio

InfoComm International Performance Standard

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Abstract

This Standard defines projected image system contrast ratio and its measurement. It applies to both permanently installed systems and live events. It applies to front and rear projection. This Standard defines four contrast ratios based on content viewing requirements. System contrast ratio refers to the image as it is presented to viewers in a space with ambient light. Practical metrics to measure and validate the defined contrast ratios are provided.

Keywords

Analytical decision making; audiovisual; audiovisual standard; AV; AV system performance; basic decision making; contrast; contrast ratio; detail; digital signage; front projection; full motion video; image contrast; image quality; InfoComm; information; informational display; inspection; passive viewing; presentation; projected image; projector; projection; projection screen; rear projection; system contrast ratio; videoconferencing

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Foreword

A projected image is often the centerpiece of an installed audiovisual system or a live event. Viewers depend on a projected image to convey information in adequate detail and quality to achieve the content viewing requirements relative to their stated purpose or application while avoiding eyestrain or fatigue. Image contrast, a relative metric (expressed as a ratio), is one of the most important measurable criteria when assessing projected image quality. Historically, definitions of image contrast and the way contrast is measured have generated confusion. This Standard provides a clear definition of the projected system contrast in practical applications. It complements subjective assessment with new objective measurement techniques.

It is important to note that no singular contrast ratio will satisfy the wide range of projected image system viewing requirements. Contrast ratio requirements vary, depending on intended purpose. As such, this Standard defines four viewing categories based on their stated purpose and establishes the required minimum contrast ratios for each viewing category.

The human visual system perceives light differently than a light meter measures it. The eye is a sensitive instrument, working within a dynamic range of luminance greater than 1,000,000:1. The magnitude of this dynamic range requires significant mediation by the human visual system. Light meters are typically linear instruments while the human visual system's responses to light are typically logarithmic (a similar distinction occurs in the case of sound and hearing). These factors are considered in this Standard.

The quality of a projected image is not determined by contrast alone, however. Image quality can be assessed using other criteria such as luminance, color rendition, resolution, video motion rendition – and even how glossy a screen is. Nevertheless, contrast remains the fundamental metric to determine image quality because significant elements from other criteria are often implicit in, or connected to, contrast. Acceptable contrast levels usually imply – although not guarantee – other performance metrics.

Neither contrast ratio nor this Standard determines the preferred white or black levels relative to the luminance levels from surfaces adjacent to a projected image, which can influence eyestrain for users in the given environment. Users of this Standard are urged to include such ergonomic factors within their wider project considerations.

This Standard is not designed to be used for competitive positioning between manufacturers or technologies. It is the system that is tested and evaluated, without reference to the component elements.

This Standard applies to both front and rear projection.

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1. Scope, Purpose, and Application

Scope

This Standard addresses the image contrast ratio of display systems typically used in presentation environments utilizing front and rear projection. Although these methodologies and procedures can be applied to many display system types and applications, this Standard pertains to audiovisual presentation systems including permanently installed systems and live events.

This Standard is limited to image contrast ratio measurements and does not include testing and measurement of related display factors such as display luminance, image size, display resolution, or other factors relating to the overall performance of the projected image. This Standard does not use any kind of on/off or sequential tests, typically found in sales specifications and brochures. Measurement is of contrast achievable on the same image at the same time using a 16-zone black-and-white intra-frame (checkerboard) test pattern.

Purpose

The purpose of this Standard is to define acceptable minimum contrast ratios for projected images, relative to their stated purpose or application. By defining the projected image system contrast ratio and providing suitable measurement and reporting methodologies, metrics for system specification and verification can be applied.

The contrast ratios defined in this document comprise a combined output of a “projected image system,” defined within the Standard as a projector, projection screen, and the impact of ambient light. The term “contrast” is further qualified as “projected image system contrast ratio” (PISCR) because the individual performance factors of the projector and screen are only contributory factors to the delivered contrast ratio of the installed system. It is also termed as “system” contrast ratio because the maximum contrast ratio a projector and screen can deliver is ultimately affected and thus determined by ambient light.

In this context, contrast is defined as the absolute difference in luminance between the peak white and black levels, where white and black luminance is displayed simultaneously. The definition and its measurement is commonly referred to as “ANSI contrast ratio.” However, the original ANSI standards, retired in July of 2003, ANSI/NAPM IT7.228-1997 *Electronic Projection – Fixed Resolution Projectors* and ANSI/PIMA IT7.227-1998 *Electronic Projection – Variable Resolution Projectors*, measured illuminance (i.e., measurement of direct light from the projector). This Standard uses the 16-zone black-and-white checkerboard intra-frame test pattern used in the aforementioned standards to measure luminance reflected from or transmitted through the projection screen.

Application

This Standard is designed to facilitate informed decision-making for projector and screen selection, relative to location and stated purpose. Requirements of this Standard apply to:

- Planning and designing projected image system installations;
- Setting minimum and optimum contrast ratios relative to stated purposes;
- Testing and signing off completed projected image system installations; and
- Assisting in determining possible remedial solutions where a system is out of conformance with this Standard or otherwise inadequate for the stated purpose.

This Standard defines four viewing requirement categories. These categories define the required contrast ratio relative to stated purpose or application.

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