

INTERNATIONAL STANDARD



Laser display devices – **STANDARD PREVIEW**
Part 5-3: Measuring methods of image quality for laser projection display
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LASER DISPLAY DEVICES –

**Part 5-3: Measuring methods of image quality
for laser projection displays**

FOREWORD

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IEC 62906-5-3 has been prepared by IEC technical committee 110: Electronic displays. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
110/1269/FDIS	110/1285/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62906 series, published under the general title *Laser display devices*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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LASER DISPLAY DEVICES –

Part 5-3: Measuring methods of image quality for laser projection displays

1 Scope

This document specifies the standard measurement conditions and measuring methods for determining the parameters of image quality for full-frame laser projection displays integrating the projection devices and screens. The front and rear projection screens are included in this document. Other display devices, such as raster-scanned (flying spot) projection devices, are not included.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-845, *International Electrotechnical Vocabulary (IEV) – Part 845: Lighting*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC TR 60825-8, *Safety of laser products – Part 8: Guidelines for the safe use of laser beams on humans*

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IEC 62341-6-3:2017, *Organic light emitting diode (OLED) displays – Part 6-3: Measuring methods of image quality*

IEC 62471-5, *Photobiological safety of lamps and lamp systems – Part 5: Image projectors*

IEC 62906-1-2, *Laser display devices – Part 1-2: Vocabulary and letter symbols*

ISO/CIE 11664-1, *Colorimetry – Part 1: CIE standard colorimetric observers*

ISO/CIE 19476, *Characterization of the performance of illuminance meters and luminance meters*

CIE 63, *The spectroradiometric measurement of light sources*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845, IEC 62906-1-2 and ISO/CIE 11664-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.2 Abbreviated terms

DUT	Device under test
LDD	Laser display device
LPD	Laser projection display
LMD	Light measuring device

4 Standard measuring conditions

4.1 General

Unless stated otherwise, the following conditions shall be applied. During the measurement, the protection of optical radiation safety shall be implemented according to IEC 60825-1 and IEC TR 60825-8 for the products with a classification over M2, and IEC 62471-5 for RG2 and RG3.

4.2 Environmental conditions

Measurements shall be carried out under the standard environmental conditions:

- temperature: 25 °C ± 3 °C,
- relative humidity: 25 % to 85 % RH,
- atmospheric pressure: 86 kPa to 106 kPa.

When different environmental conditions are used, they shall be noted in the measurement report.

4.3 Power supply

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The power supply for driving the DUT shall be adjusted to the rated voltage ± 0,5 %, and the frequency shall be supplied at the rated frequency ± 0,2 %.

4.4 Warm-up time

The measurements should be carried out after the light output is sufficiently stable. It is defined as the time elapsed from when the supply source is switched on, and a full level of input signal is applied to the DUT, until the repeated measurements with the interval of one minute show a variation within ten minutes in luminance (or illuminance) of less than 3 %.

4.5 Dark ambient conditions

The LPDs are intended to be measured under the dark room conditions. Any background illuminance at the image plane shall be less than 1 % of the projector maximum illuminance when measured with a projector mask blocking the direct beam from the projector (for example refer to [1] in 15.1.4). The measurements should be conducted in a room with matte black surfaces having a photometric reflectance of less than 3 %.

4.6 Measuring equipment

The configurations and operating conditions of the measuring equipment shall comply with the requirements specified in each item. Unless stated otherwise, the measurement point shall be at the centre of the image area to be measured. The measurement area at the image plane shall be at least 1 cm in diameter and contain at least 10 pixels x 10 pixels. It shall be confirmed that this number of pixels is sufficient by shifting the LMD 20 % laterally and verifying that the luminance is less than 2 %. A large enough measurement area is needed to average out speckle-induced non-uniformity; in addition, the entrance pupil of the LMD shall be not less than 2 cm in diameter. To ensure accurate results for static measurements, the LMD integration time shall be a multiple n ($n \geq 1$) of the frame time, or larger than 200 frame periods.

Filtered luminance meters and colorimeters are generally considered not to be accurate enough for laser projector measurements. Spectroradiometric instruments are preferred for these narrow bandwidth light sources. Filtered luminance meters and colorimeters shall only be used if they are corrected with a precision spectral radiance meter. However, it is noted that the correction factors shall be achieved for every given spectral distribution of the light from the screen (e.g. red, green, blue primaries, in addition to white and black).

To ensure repeatable measurements, the following requirements shall be applied.

- 1) Spot luminance meter: refer to ISO/CIE 19476. The spectral responsivity shall comply with the CIE photopic luminous efficiency function, and the general $V(\lambda)$ mismatch index f'_1 should be no greater than 6 %; the relative luminance uncertainty shall not be greater than 4 % for high luminance over 10 cd/m² and not be greater than 10 % for low luminance of 10 cd/m² and below.
- 2) Colorimetric luminance meter: the spectral responsivity shall comply with the colour-matching functions for the CIE 1931 standard colorimetric observer (see ISO/CIE 11664-1) with chromaticity accuracy of 0,004 for x , y .
- 3) 2D imaging luminance meter: the number of pixels of the imaging detector shall be 4 times of the image subpixel within the measurement field as given in following each item. When a large measurement field angle is applied, it shall be noted that the measured luminance might be different between the centre and edge field. The digitalization dynamic range shall not be smaller than 12 bit per sample, The spectral responsivity shall comply with the CIE photopic luminous efficiency function, and the general $V(\lambda)$ mismatch index f'_1 shall be not higher than 6 %.
- 4) Spectral radiance meter: The narrow spectral line widths of the laser projection displays usually require the use of a spectral radiance meter for accurate results of luminance and chromaticity. The requirements are as follows:
 - the wavelength accuracy shall be within $\pm 0,5$ nm;
 - the wavelength measuring range shall be at least 380 nm to 780 nm;
 - the stray light shall be less than 10^{-3} ;
 - The sampling interval shall be set to $1/N$ (N is an integer) of the spectral bandwidth of the spectroradiometer referred to in CIE 63 to achieve uniform spectral sampling function for accurate results. For example, a 2,5 nm sampling interval can be used for a 2,5 nm or 5 nm bandwidth.

It is recommended to use a spectroradiometer with a spectral bandwidth of not more than 5 nm.

- 5) Illuminance meter: It is used for checking ambient illuminance and shall refer to ISO/CIE 19476.

5 Installation and adjustment of the DUT

5.1 Placement of the projection device and screen

The laser projection device and screen to be tested shall be installed in the position as shown in the product specification.

The projection distance from the projection device to the screen, projection direction, viewing mode, height and tilted angle of the installation shall be reported.

5.2 Focusing and alignment of the LPD

- 1) The LDD mode shall be set to the factory settings or "standard".

The LMD shall be placed in the front of the screen at the measuring distance, and with its optical axis perpendicular to the screen. These adjustments shall be held constant during the measurement. Otherwise it shall be noted in the measurement report.

- 2) Projection image placement: The image resolution and even luminance level of the projection image on the screen can be affected by the focus and zoom of the projector lens. The zoom and preferred image size will dictate an optimum state by applying an appropriate pattern provided by the manufacturer. A lens-shift projector shall be positioned at its optimum optical path as specified by the manufacturer. If the manufacturer does not define the optimum optical set-up, the lens shift shall be set either to the factory settings or in a way that centres the projected image along the geometrical axis of the projection lens. If the projector has a zoom lens, it shall be set to its widest angle. A manufacturer provided alignment pattern, or a pattern as shown in Figure 1, can be used to focus the projection image on the screen. The focus shall be adjusted until the centre features and the edge of the projected image on the image screen are the clearest. In Figure 1, W and H are the width and height of the image screen, respectively.

In Figure 2, an example of a DUT set-up is shown, the projector is set in front of the projecting screen. In Figure 2, L is the distance between the screen and the projector, and β is the angle between the optical and geometrical axes of the projector. Adjust the figure so that the geometrical axis is perpendicular to the screen.

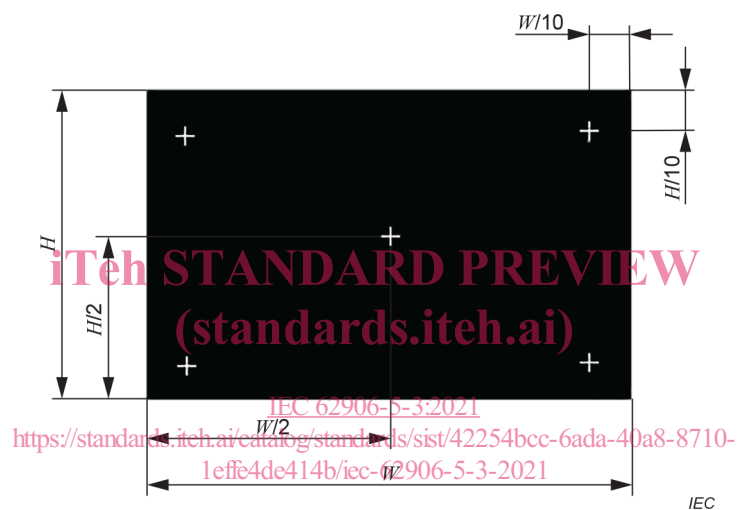


Figure 1 – Example of an image pattern with width W and height H

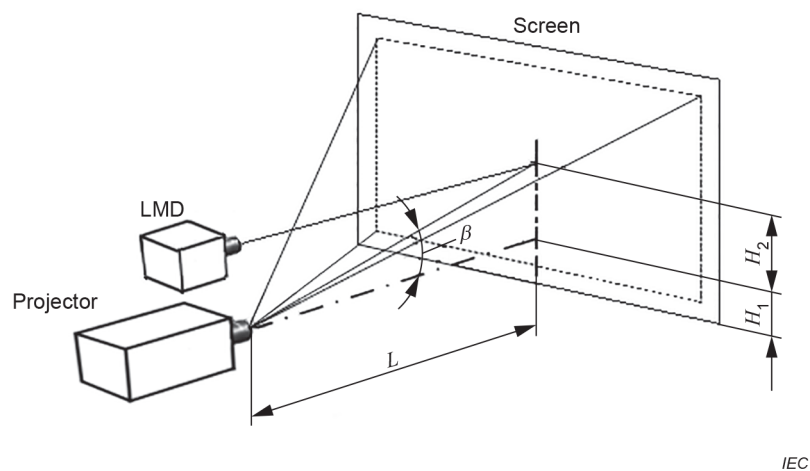


Figure 2 – Example of DUT setup