IEC 62906-5-6

Edition 1.0 2020-04

INTERNATIONAL STANDARD

colour inside

Laser displays –
Part 5-6: Measuring methods for optical performance of projection screens

IEC 62906-5-6:2020-04(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC 62906-5-6

Edition 1.0 2020-04

INTERNATIONAL STANDARD

colour inside

Laser displays –
Part 5-6: Measuring methods for optical performance of projection screens

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.260

ISBN 978-2-8322-8233-5

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

LASER DISPLAYS –

Part 5-6: Measuring methods for optical performance of projection screens

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62906-5-6 has been prepared by IEC technical committee 110: Electronic displays.

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

FDIS	Report on voting
10/1187/FDIS	110/1198/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

LASER DISPLAYS –

Part 5-6: Measuring methods for optical performance of projection screens

1 Scope

This part of IEC 62906 specifies the standard measurement conditions and measuring methods for determining the optical performance of a projection screen in terms of its photometric characteristics, including screen gain and speckle contrast, from different viewing directions. These methods are only applied for the case in which the projection screen and a laser projector are integrated and used with a fixed configuration as a set to create a real image. Both front and rear projection screens, with a flat surface, are included. This document excludes projection screens which are classified as optically see-through screens, including head-up displays.

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* (available at www.electropedia.org)

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

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

IEC 62906-5-2, *Laser display devices – Part 5-2: Optical measuring methods of speckle contrast*

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

CIE S 014-1, *Colorimetry – Part 1: Standard Colorimetric Observers*

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 CIE S 014-1 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

3.1.1
screen gain
relative deviation from Lambertian distribution of light from the screen

3.1.2
peak gain
maximum screen gain of the screen

3.1.3
half-gain angle
viewing angle from normal at which the screen gain drops to half of the peak gain

3.1.4
screen colour shift
chromaticity difference between images projected on the screen and a reference reflectance or transmittance target

3.2 Abbreviated terms

DUT Device under test

LMD Light measuring device

LPD Laser projection display

NOTE DUT in this document means the combination of the LPD and the screen.

4 Standard measuring conditions

4.1 General

Unless stated otherwise, the following conditions shall be applied. During the measurement, optical radiation safety shall be implemented in accordance with IEC 60825-1 for the products classified above Class 2M, and/or 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

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

4.4 Warm-up time

The measurements shall be carried out after the light output is sufficiently stable. The warm-up time 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 LPD in the DUT, until the repeated measurements show a variation in illuminance of no more than ±5 %. The illuminance shall not vary by more than ± 5 % over the entire measurement.

4.5 Measurement coordinate system

The viewing direction is the direction under which the observer looks at the point of interest on the DUT surface (screen surface). During the measurement, the LMD simulates the observer, by aiming the LMD at the point of interest on the DUT from the viewing direction. The viewing direction is defined by two angles: the angle of inclination θ (relative to the surface normal of the DUT) and the angle of rotation Φ (also called azimuth angle) as illustrated in Figure 1. Although the azimuth angle is measured in the counter-clockwise direction, it is related to the directions on a clock face as follows: Φ = 0° is the 3-o'clock direction ("right"), Φ = 90° the 12-o'clock direction ("top"), Φ = 180° the 9-o'clock direction ("left") and Φ = 270° the 6-o'clock direction ("bottom").

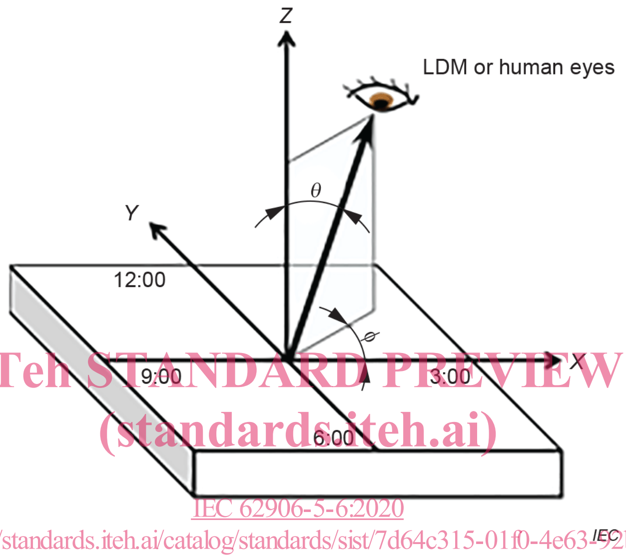

Figure 1 – Coordinate system for projection direction and viewing direction

4.6 Darkroom conditions

The luminance contribution from the background illumination reflected off the screen shall be less than 1/20 of the lowest black level of the display. If these conditions are not satisfied, then background subtraction is required and it shall be noted in the report. The average reflectance of the inner walls of the measurement room shall be lower than 3 %.

4.7 Measuring facilities

The configuration and operating conditions of the measuring equipment shall comply with the structures specified in each item. The sensitivity and the dynamic range of each measuring equipment shall be checked if it is suitable for the required task. To ensure repeatable measurements, the following requirements shall be applied.

a) Luminance meter: Filtered luminance meters are generally considered not to be accurate enough for laser projector measurements. Spectral measurement instruments are preferred for these narrow bandwidth light sources. Filtered luminance meters shall only be used if they are calibrated with a precision spectral radiance meter. However, it is noted that this calibration is valid only for a given spectral distribution of the light source (e.g. red, green, blue primaries, in addition to white and black), and the luminance meter will need a unique calibration factor for every different spectral distribution.

b) Illuminance meter: Filtered illuminance meters are generally considered not to be accurate enough for laser projector measurements. Spectral measurement instruments are preferred for these narrow bandwidth light sources. Filtered illuminance meters shall only be used if they are calibrated with a precision spectral irradiance meter. However, it is noted that this calibration is valid only for a given spectral distribution of the light source (e.g. red, green, blue primaries, in addition to white and black), and the illuminance meter will need a unique calibration factor for every different spectral distribution. Many illuminance meters employ diffusers to capture the incident illumination. These tend to also be valuable in scrambling projector polarization and smoothing speckle non-uniformity. The validity of using diffusers for the illuminance measurement was reported in [1][1]. If a light scrambling element (such as a diffuser) is not employed in the illuminance meter, then its insensitivity to polarization and speckle shall be confirmed with a precision spectral irradiance meter that uses a diffusing element.

c) Spectral radiance/irradiance meter: The narrow spectral line widths of the projector laser sources usually require the use of a spectroradiometer with relatively small spectral bandwidths for accurate results. A spectroradiometer can be configured with an integrating sphere or cosine-corrected diffuser to measure the spectral irradiance of the projector directly. The following requirements are given for these instruments:

   – the spectroradiometer wavelength accuracy shall be < 1 nm;
   – the wavelength measuring range shall be at least 380 nm to 780 nm;
   – it is recommended to use a spectroradiometer with a spectral bandwidth of < 5 nm (full-width-at-half-maximum). The higher resolution spectrometer produces a more accurate colour measurement, especially for lasers sources;
   – the spectral bandwidth of the spectroradiometer shall be an integer multiple of the sampling interval. For example, a 2,5 nm sampling interval can be used for a 2,5 nm or 5 nm bandwidth.

   An alternative method of spectral irradiance can be implemented by using a spectral radiance meter with a diffuse reflectance standard. If measurements are taken at large incident angles, such as in the case of short-focus projectors, it is recommended to use the spectral radiance meter with a reflectance standard or integrating sphere with a thin entrance port wall.

d) Speckle contrast measuring equipment: An imaging camera which is constructed according to IEC 62906-5-2 shall be applied.

5 Installation and adjustment of the DUT

5.1 Placement of the projector and the screen

The screen's optical properties can be very dependent on the optical configuration of the projected light on the screen. Therefore, the screen shall be measured in the same optical geometry as the intended projector and use case. The LMD is located at the normal view to the screen. The measurement distance shall be the same as the standard audience viewing distance which is decided by a manufacturer or a supplier. 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 of the projector

A factory-provided alignment pattern, or a pattern as shown in Figure 2, can be used to focus the projector at the optimal projection distance. The projector focus shall be adjusted until the centre and edge features of the projected image at the image plane are the sharpest.

1 Numbers in square brackets refer to the Bibliography.