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Date: 13 December 2024

Origin: International

Latest date for receipt of comments: 1 January 2025

Project No. 2023/00538

Responsible committee: EPL/100 Audio-visual and Electronic equipment

Interested committees:

Title: BS IEC 63145-20-10 Eyewear display

Part: 20-10 Fundamental measurement methods. Optical properties Eyewear display

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



110/1726/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 63145-20-10 ED2

DATE OF CIRCULATION:

2024-12-06

CLOSING DATE FOR COMMENTS:

2025-01-31

SUPERSEDES DOCUMENTS:

110/1581/CD, 110/1608B/CC

IEC TC 110 : ELECTRONIC DISPLAYS

SECRETARIAT:

Japan

SECRETARY:

Mr Yoshi SHIBAHARA

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 100, TC 124

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

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TITLE:

Eyewear display - Part 20-10: Fundamental measurement methods - Optical properties

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EYEWEAR DISPLAY –

Part 20-10: Fundamental measurement methods – Optical properties

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IEC 63145-20-10 has been prepared by IEC technical committee 110: Electronic displays. It is an International Standard.

This second edition cancels and replaces the first edition published in 2019-08-16. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Add the description of eyeball rotation situation;
- b) Revise the light measuring device (LMD) conditions;
- c) Revise the colour gamut issues;
- d) Revise the measuring procedure of the field of view (FOV);
- e) Revise the measuring method of the pixel angular density.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

150
151 Full information on the voting for its approval can be found in the report on voting indicated in
152 the above table.

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

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

158 A list of all parts in the IEC 63145 series, published under the general title *Eyewear display*,
159 can be found on the IEC website.

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

- 163 • reconfirmed,
164 • withdrawn, or
165 • revised.

166

EYEWEAR DISPLAY –

Part 20-10: Fundamental measurement methods – Optical properties

1 Scope

This part of IEC 63145 specifies the standard measurement conditions and measurement methods for determining the optical properties of eyewear displays. This document applies to non-see-through type (virtual reality “VR” goggles) and see-through type (augmented reality “AR” glasses) eyewear displays using virtual image optics.

Contact lens-type displays and retina direct projection displays are out of the scope of this document.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, abbreviated terms and letter symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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

entrance pupil of the LMD

optical image of the physical aperture stop, as ‘seen’ through the front of the LMD lens system

Note 1 to entry: If there is no lens in front of the aperture, the entrance pupil's location and size are identical to that of the aperture stop.

3.1.2

eye-box

qualified viewing space

three-dimensional space within which users place their eye so as to be able to properly see the entire virtual image without moving the head or making any other adjustment (other than the natural rotation of the eye)

Note 1 to entry: “Able to properly see” means that the display image fulfils all the requirements indicated in the product specification.

3.1.3

eye point

design location at which the entrance pupil of the eye is placed to achieve the optimal performance when using an eyewear display and which serves as the origin location of the measurement

Note 1 to entry: An estimating example is shown in Annex A.

3.1.4

eye relief

distance from the cornea of the eye to the closest optical element of the virtual-image display

3.1.5**field of view**

angular region subtending the proper active area of the virtual image as observed from the eye point of the eyewear display

Note 1 to entry: “Proper” means that the display image fulfils all the requirements indicated in the product specification, for example the limits of luminance, resolution, etc.

3.1.6**measurement direction**

angular coordinates (in spherical coordinates) of the LMD viewing direction relative to its pivot position on the optical axis

Note 1 to entry: See Figure 1 .

3.1.7**pixel angular density**

pixel number per unit degree

3.2 Abbreviated terms

AR augmented reality

DUT device under test

FOV field of view

LMD light measuring device

VR virtual reality

3.3 Letter symbols (symbols for quantities and units)

The letter symbols for eyewear displays are shown in Table 1 .

232

Table 1 – Letter symbols (symbols for quantities and units)

Quantities	Symbol	Unit
Measuring point ($i = 0$: centre)	P_i	
Arbitrary luminance of a position (x, y, z) and direction (α, ψ) on the eyewear display	$L_v(x, y, z; \alpha, \psi)$	cd/m ²
Maximum luminance	L_{vM}	cd/m ²
Minimum luminance	L_{vm}	cd/m ²
Average luminance (spatial)	L_{va}	cd/m ²
Centre luminance	L_{vC}	cd/m ²
Luminance uniformity	U	%
Luminance non-uniformity	NU	%
Angle of horizontal FOV	A_h	degree
Angle of vertical FOV	A_v	degree
Angle of diagonal FOV	A_d	degree
Width of eye-box	W_{box}	mm
Height of eye-box	H_{box}	mm
CIE 1976 chromaticity coordinates at P_i	u'_i, v'_i	
Chromaticity difference in CIE 1976 uniform-chromaticity-scale diagram	$\Delta u'v'$	
Contrast ratio	CR	
Pixel angular density	PPD	1/degree
Solid angle of measurement field	Ω	sr

233 4 Standard measurement conditions

234 4.1 Standard environmental conditions

235 Unless otherwise specified, all tests and measurements for eyewear displays shall be carried
 236 out after sufficient warm-up time for the illumination sources and DUT (see 4.3), under the
 237 following standard environmental conditions:

- 238 – temperature 22 °C to 28 °C,
- 239 – relative humidity 25 % to 85 %, and
- 240 – atmospheric pressure 86 kPa to 106 kPa.

241 When different environmental conditions are used, they shall be reported in detail in the
 242 specification.

243 4.2 Power supply

244 In order to stabilize the performances of the DUT, the power supply for driving the DUT shall
 245 be adjusted according to the specification of the DUT.

246 NOTE When the DUT is driven by a battery, it is less susceptible to power supply fluctuations.

247 4.3 Warm-up time

248 The optical performance of DUT is affected by the transient temperature behaviour of the device.
 249 It takes a certain time for the luminance output of the DUT to achieve a steady state. If the
 250 luminance output is not within a ± 3 % variation, it shall be reported. All measuring conditions
 251 shall be kept constant during the measurements.

252 NOTE If the measurement result does not become a steady state, it might be influenced by the output fluctuation of
 253 the DUT or the fluctuation of the LMD or both such as noise.

4.4 Dark room condition

The luminance contribution from the background with the virtual image turned off shall be less than 1/20 of the minimum luminance output from the DUT. If the condition is not satisfied, then background subtraction is required and it shall be noted in the report.

5 Measurement systems

5.1 Standard coordinate systems

To indicate the spatial positions of virtual images, a spherical coordinate system of elevation (latitude) and azimuth (longitude) shall be used in the measurements; the polar axis is vertically oriented as shown in Figure 1. The angles measured in the vertical half plane of the data are elevation angles, denoted as α , and the horizontal angles to the half plane are azimuth angles, denoted as ψ . The origin direction ($\alpha = 0$, $\psi = 0$) of the spherical coordinate system shall be coincident with the optical axis of the DUT.

NOTE The spatial positions of the virtual image can be expressed in a geographic coordinate chart, as shown in Annex B.

For the pupil rotation measurement, the origin of the spherical coordinate system is at the pupil centre of the eye, and the LMD's entrance pupil is located at the pupil centre, as shown in Figure 1 a). Therefore, for pupil rotation measurements, the LMD pivots about the centre of the LMD entrance pupil.

For the eyeball rotation measurement, the origin of the spherical coordinate system is at the centre of the eyeball (10 mm behind the pupil centre), as shown in Figure 1 b) and 1 c). Therefore, for eye rotation measurements, the LMD pivots about a point 10 mm behind the entrance pupil along its optical axis.

The pupil rotation centre or eyeball rotation centre for the measurement should be reported.

A three-dimensional Cartesian coordinate system (x , y , z) is used to indicate the positional relationship among the eye-box, eye point, eye relief of the DUT, entrance pupil of the LMD and so on, as shown in Figure 2. Unless specified otherwise, the pupil centre of the eye is placed at the eye point of the DUT when the eye is initially gazing at the centre of the virtual image, and the z -axis of the three-dimensional Cartesian coordinate system passes through the centre of the virtual image and the eye point of the DUT. The manufacturer or supplier of the DUT shall specify the eye point position or the eye relief from a reference point of the eyewear display.

For both pupil rotation and eye rotation measurements, the origin of the three-dimensional Cartesian coordinate system is located at the eye point of the DUT. The LMD is typically initially aligned such that the LMD's optical axis is along the z -axis and the LMD entrance pupil is centred on the eye point, as shown in Figure 2.

NOTE In the case of a binocular eyewear display, the left ocular can be used as the origin of the Cartesian coordinate system.

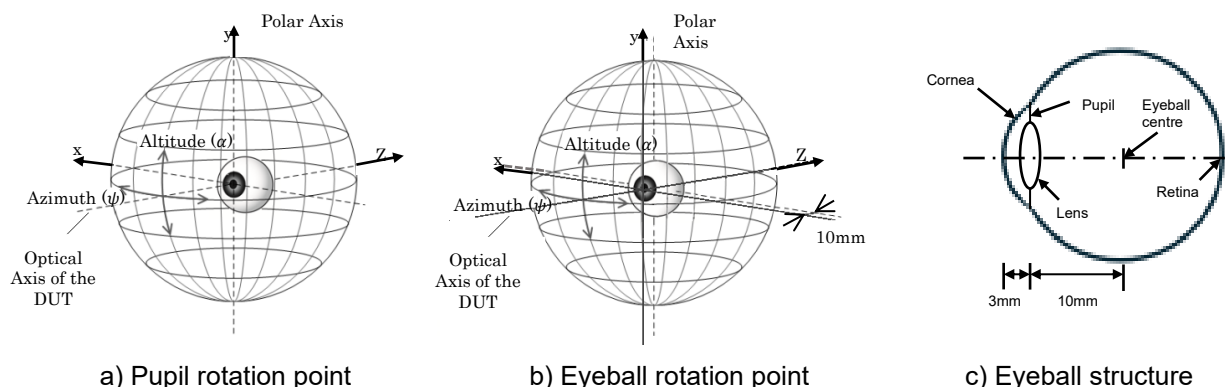


Figure 1 – Spherical coordinate system