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**Eyewear display –
Part 10: Specifications**

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EYEWEAR DISPLAY –**Part 10: Specifications****FOREWORD**

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

| FDIS | Report on voting |
|---------------|------------------|
| 110/1539/FDIS | 110/1560/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.

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 63145 series, published under the general title *Eyewear display*, 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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EYEWEAR DISPLAY –

Part 10: Specifications

1 Scope

This part of IEC 63145 establishes specifications and requirements for eyewear displays. This document is applicable to virtual reality (VR)-type (non-see-through) and augmented reality (AR)-type (see-through) eyewear displays using virtual image optics. The specifications and requirements for prescription lenses are out of the scope of this document.

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 63145-1-2, *Eyewear display – Part 1-2: Generic – Terminology*

IEC 63145-20-10:2019, *Eyewear display – Part 20-10: Fundamental measurement methods – Optical properties*

IEC 63145-20-20:2019, *Eyewear display – Part 20-20: Fundamental measurement methods – Image quality*

IEC 63145-22-10:2020, *Eyewear display – Part 22-10: Specific measurement methods for AR type – Optical properties*

IEC 63145-22-20¹, *Eyewear display – Part 22-20: Specific measurement methods for AR type – Image quality*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63145-1-2 and the following apply.

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

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

¹ Under preparation. Stage at the time of publication: IEC AFDIS 63145-22-20:2023.

3.1.1**number of electrically addressable pixels**

total number of physical pixels which are electrically accessible and constitute the micro display that is used to display the image

Note 1 to entry: It is described by $H \times V$, where H and V are the numbers of horizontal and vertical pixels, respectively.

Note 2 to entry: This term does not consider the kind of sub-pixel arrangement.

3.2 Abbreviated terms

| | |
|-----|------------------------|
| AR | augmented reality |
| DUT | device under test |
| FOV | field of view |
| LCD | liquid crystal display |
| LMD | light measuring device |
| VR | virtual reality |

4 Specification tables**4.1 Generic specification tables**

Table 1 and Table 2 shall be applied as the generic specification tables of optical characteristics of eyewear displays. These tables show the list of items which specifies the optical characteristics of eyewear displays.

**Table 1 – Blank detail specification table of optical characteristics
(applicable to AR and VR)**

| Characteristics | Symbol | Unit | VR | | AR | | Measurement methods |
|-------------------------------------|---------------------------------|-------------------|------|------|------|------|---------------------------|
| | | | Min. | Max. | Min. | Max. | |
| Monocular characteristics | | | | | | | |
| Maximum centre luminance | L_{vCM} | cd/m ² | - | | - | | IEC 63145-20-10:2019, 6.3 |
| Minimum centre luminance | L_{vCm} | cd/m ² | | - | | - | IEC 63145-20-10:2019, 6.3 |
| Nine-point luminance | L_{vi} ($i = 0$ to 8) | cd/m ² | | | | | IEC 63145-20-10:2019, 6.3 |
| Average luminance | L_{va} | cd/m ² | | | | | IEC 63145-20-10:2019, 6.3 |
| Luminance uniformity | U | % | | | | | IEC 63145-20-10:2019, 6.3 |
| Luminance non-uniformity | NU | % | | | | | IEC 63145-20-10:2019, 6.3 |
| Chromaticity of white at the centre | $(x_W, y_W),$ (u'_W, v'_W) | | | | | | IEC 63145-20-10:2019, 6.4 |
| Chromaticity of red at the centre | $(x_R, y_R),$ (u'_R, v'_R) | | | | | | IEC 63145-20-10:2019, 6.4 |
| Chromaticity of green at the centre | $(x_G, y_G),$ (u'_G, v'_G) | | | | | | IEC 63145-20-10:2019, 6.4 |
| Chromaticity of blue at the centre | $(x_B, y_B),$ (u'_B, v'_B) | | | | | | IEC 63145-20-10:2019, 6.4 |

| Characteristics | Symbol | Unit | VR | | AR | | Measurement methods |
|--|--|------------------------|------|------|------|------|---------------------------|
| | | | Min. | Max. | Min. | Max. | |
| Chromaticity gamut | $GA_{u'v'}$ | % | | | | | IEC 63145-20-10:2019, 6.4 |
| Chromaticity uniformity | $(\Delta u'v')_{\max}$ | | | | | | IEC 63145-20-10:2019, 6.5 |
| Centre contrast ratio | CR_C | | | | | | IEC 63145-20-10:2019, 6.6 |
| Nine-point contrast ratio | Cr_i ($i = 0$ to 8) | | | | | | IEC 63145-20-10:2019, 6.6 |
| Averaged contrast ratio | CR_a | | | | | | IEC 63145-20-10:2019, 6.6 |
| Contrast non-uniformity | NU_{CR} | % | | | | | IEC 63145-20-10:2019, 6.6 |
| Diagonal FOV based on luminance | $A_{d, l}$ | degree | | | | | IEC 63145-20-10:2019, 6.7 |
| Diagonal FOV based on Michelson contrast | $A_{d, MC}$ | degree | | | | | IEC 63145-20-20:2019, 6.7 |
| Horizontal, vertical FOV based on luminance | $A_{H, l}, A_{V, l}$ | degree | | | | | IEC 63145-20-10:2019, 6.7 |
| Horizontal, vertical FOV based on Michelson contrast | $A_{H, MC}, A_{V, MC}$ | degree | | | | | IEC 63145-20-20:2019, 6.7 |
| Eye-box width, height based on luminance | $W_{\text{BOX}, l}, H_{\text{BOX}, l}$ | mm | | | | | IEC 63145-20-10:2019, 6.8 |
| Eye-box width, height based on Michelson contrast | $W_{\text{BOX}, MC}, H_{\text{BOX}, MC}$ | mm | | | | | IEC 63145-20-20:2019, 6.8 |
| Distortion ^a | δ_{vh} | % | | | | | IEC 63145-20-20:2019, 6.3 |
| Colour registration error (red-green) | $\varepsilon_{vh, \text{red}}$ | degree | | | | | IEC 63145-20-20:2019, 6.4 |
| Colour registration error (blue-green) | $\varepsilon_{vh, \text{blue}}$ | degree | | | | | IEC 63145-20-20:2019, 6.4 |
| Michelson contrast | $C_{M, i, \text{freq}}$ ($i = 0$ to 8) | lp/degree ^b | | | | | IEC 63145-20-20:2019, 6.5 |
| Centre focal distance (diopetre) | D_0 | m ⁻¹ | | | | | IEC 63145-20-20:2019, 6.6 |
| Number of electrically addressable pixels | R_H, R_V | pixel | | | | | |
| Eye relief | ER | mm | | | | | |

^a "Distortion" is referred to as "geometrical distortion" in ISO 9241-305 [1]².

^b "lp" stands for "line pair".

NOTE "Number of electrically addressable pixels" and "Eye relief" are specified by the manufacturer or the supplier.

For multi-point measurement such as that of nine-point luminance, the positions of measurement points shall be reported.

² Numbers in square brackets refer to the Bibliography.

For FOV measurements, several measurement methods based on luminance (see IEC 63145-20-10:2019, 6.7), chromaticity (see IEC 63145-20-10:2019, 6.7), contrast ratio (see IEC 63145-20-10:2019, 6.7) and Michelson contrast (see IEC 63145-20-20:2019, 6.7) are proposed. The type of FOV measurement method which was used for evaluation shall be reported.

For eye-box measurements, several measurement methods based on luminance (IEC 63145-20-10:2019, 6.8) and Michelson contrast (IEC 63145-20-20:2019, 6.8) are proposed. The type of eye-box measurement method which was used for evaluation shall be reported.

NOTE 1 Table 1 and Table 2 show the list of optical characteristics of eyewear displays. For example, when presenting product specifications in a catalogue, etc., one or more items in Table 1 and Table 2 will be filled. Not necessarily all items will be shown in the product specifications. The table shows the range of performance of characteristic items for multiple eyewear displays with a specific model number.

NOTE 2 For characterizing and reporting characteristics of eyewear display devices, it is useful to consider that performance can be affected by body temperature as well as ambient conditions.

**Table 2 – Blank detail specification table
of optical characteristics (applicable to AR)**

| Characteristics | Symbol | Unit | AR | | Measurement methods |
|--|---------------------|------|------|------|---------------------------|
| | | | Min. | Max. | |
| Monocular characteristics | | | | | |
| Directional transmittance | $T_{0/0}$ | % | | | IEC 63145-22-10:2020, 6.1 |
| Chromaticity difference through DUT | $\Delta u'v'_{0/0}$ | | | | IEC 63145-22-10:2020, 6.2 |
| Front side stray light | $H_{de/0}$ | % | | | IEC 63145-22-10:2020, 6.3 |
| Contrast modulation (Michelson contrast) through DUT | C_{CM} | % | | | IEC 63145-22-10:2020, 6.4 |

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4.2 Basic specification tables

Subclause 4.2 contains requirements for style and layout of basic specification tables. These requirements are applicable when the detail specification is published.

Table 3 and Table 4, which are subsets of Table 1 and Table 2, shall be applied as the basic specification tables of AR-type and VR-type eyewear displays, respectively. These tables show the minimum required optical items for users to know the basic characteristics of AR-type and VR-type eyewear displays. When presenting product specifications in a catalogue, etc., all items should be filled.

All of the parameters in Table 3 or Table 4 shall be shown in the detail specification. Any additional values shall be given at the appropriate place, but without subclause number(s).

For FOV measurements, several measurement methods based on luminance (see IEC 63145-20-10:2019, 6.7), chromaticity (see IEC 63145-20-10:2019, 6.7), contrast ratio (see IEC 63145-20-10:2019, 6.7) and Michelson contrast (see IEC 63145-20-20:2019, 6.7) are proposed. The supplier or the manufacturer can pick either method. The type of FOV measurement method which was used for evaluation shall be reported.