

INTERNATIONAL STANDARD

**Eyewear display –
Part 20-20: Fundamental measurement methods – Image quality**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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.

Preview generated by EVS

INTERNATIONAL STANDARD

**Eyewear display –
Part 20-20: Fundamental measurement methods – Image quality**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 17.180.99; 31.120

ISBN 978-2-8322-7352-4

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

CONTENTS

| | |
|---|----|
| FOREWORD..... | 4 |
| 1 Scope..... | 6 |
| 2 Normative references | 6 |
| 3 Terms, definitions, abbreviated terms and letter symbols..... | 6 |
| 3.1 Terms and definitions..... | 6 |
| 3.2 Abbreviated terms..... | 7 |
| 3.3 Letter symbols (quantity symbols/unit symbols)..... | 7 |
| 4 Standard measurement conditions..... | 7 |
| 4.1 Standard environmental conditions | 7 |
| 4.2 Power supply | 7 |
| 4.3 Warm-up time | 8 |
| 4.4 Dark room conditions | 8 |
| 5 Measurement systems..... | 8 |
| 5.1 Standard coordinate system..... | 8 |
| 5.2 Measurement equipment..... | 9 |
| 5.2.1 Light measuring device (LMD) | 9 |
| 5.2.2 Stage conditions..... | 11 |
| 5.2.3 Setup conditions..... | 11 |
| 5.3 Test patterns..... | 13 |
| 5.3.1 General | 13 |
| 5.3.2 Checkerboard pattern | 13 |
| 5.3.3 Solid colour patterns..... | 13 |
| 5.3.4 Test patterns for Michelson contrast..... | 13 |
| 5.4 Measurement points..... | 14 |
| 6 Measurement methods for image quality..... | 15 |
| 6.1 General..... | 15 |
| 6.2 Preparation | 15 |
| 6.3 Distortion | 15 |
| 6.3.1 General | 15 |
| 6.3.2 Procedure..... | 16 |
| 6.3.3 Calculation | 17 |
| 6.3.4 Report | 18 |
| 6.4 Colour registration error | 18 |
| 6.4.1 General | 18 |
| 6.4.2 Procedure..... | 18 |
| 6.4.3 Calculation | 19 |
| 6.4.4 Report | 19 |
| 6.5 Michelson contrast..... | 19 |
| 6.5.1 General | 19 |
| 6.5.2 Procedure..... | 19 |
| 6.5.3 Calculation | 20 |
| 6.5.4 Report | 20 |
| 6.6 Focal distance (diopetre) | 20 |
| 6.6.1 General | 20 |
| 6.6.2 Procedure..... | 21 |
| 6.6.3 Calculation | 22 |

| | | |
|-------|--|----|
| 6.6.4 | Report | 22 |
| 6.7 | FOV based on Michelson contrast..... | 22 |
| 6.7.1 | General | 22 |
| 6.7.2 | Procedure..... | 22 |
| 6.7.3 | Calculation | 23 |
| 6.7.4 | Report | 23 |
| 6.8 | Eye-box based on Michelson contrast | 23 |
| 6.8.1 | General | 23 |
| 6.8.2 | Procedure..... | 23 |
| 6.8.3 | Calculation | 24 |
| 6.8.4 | Report | 25 |
| | Bibliography..... | 26 |
| | Figure 1 – Spherical coordinate system | 9 |
| | Figure 2 – Three-dimensional Cartesian coordinate system | 9 |
| | Figure 3 – Example of LMD structure | 10 |
| | Figure 4 – Examples of measurement setup..... | 12 |
| | Figure 5 – Example of 5 x 5 checkerboard pattern | 13 |
| | Figure 6 – Example of Michelson contrast test pattern | 14 |
| | Figure 7 – Measuring points for the centre- and multi-point measurement..... | 14 |
| | Table 1 – Letter symbols (symbols for quantities, and units) | 7 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EYEWEAR DISPLAY –

**Part 20-20: Fundamental measurement methods –
Image quality**

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 63145-20-20 has been prepared by IEC technical committee TC 110: Electronic displays.

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

| FDIS | Report on voting |
|---------------|------------------|
| 110/1110/FDIS | 110/1139/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 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

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

A bilingual version of this publication may be issued at a later date.

EYEWEAR DISPLAY –

Part 20-20: Fundamental measurement methods – Image quality

1 Scope

This part of IEC 63145 specifies the standard measurement conditions and measurement methods for determining the image quality of eyewear displays. This document is applicable to non-see-through type (virtual reality “VR” goggle) 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.

NOTE See IEC TR 63145-1-1 [1]¹ for eyewear displays, ISO 9241-302:2008, 3.5.45, for see-through types.

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 63145-20-10:–², *Eyewear display – Part 20-10: Fundamental measuring methods – Optical properties*

ISO 9241-302:2008, *Ergonomics of human-system interaction – Part 302: Terminology for electronic visual displays*

3 Terms, definitions, abbreviated terms and letter symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63145-20-10 and ISO 9241-302 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>

NOTE 1 Terms related to eyewear displays will be defined in specific projects.

NOTE 2 Some terms relating to eyewear displays are given in IEC TR 63145-1-1 [1].

¹ Numbers in square brackets refer to the Bibliography.

² Under preparation. Stage at the time of publication: IEC FDIS 63145-20-10:2019.