TECHNICAL SPECIFICATION

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Ergonomics of human-system interaction — Electronic paper display — Indoor use

Ergonomie de l'interaction homme-système — Affichage de papier électronique — Utilisation à l'intérieure

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Foreword

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The committee responsible for this document is ISO/TC 159, *Ergonomics*, Subcommittee SC4, *Ergonomics of human–system interaction*.

Introduction

The publication of the ISO 9241-300 series of International Standards addressed a wide range of visual display tasks and environments and provided the means for evaluating them. Not covered by those standards was the more recently developed electronic paper display (EPD) technology.

Owing to its unique optical characteristics, the current existing measuring methods may not be suitable for evaluating EPD.

Until measuring methods and compliance routes for EPD can be developed in the ISO 9241-300 series, this Technical Specification provides intermediate instruction and guidance. Using this Technical Specification together with ISO 9241-303 and ISO 9241-305 gives a good understanding of how to analyse an environment for which a specific analysis and compliance method does not yet exist.

Ergonomics of human-system interaction — Electronic paper display — Indoor use

1 Scope

This Technical Specification establishes test methods for evaluating electronic paper display (EPD) when used in indoor tasks and environments. It is intended to be applied together with the measurement procedures of ISO 9241-305 and the generic requirements of ISO 9241-303 to define compliance routes suitable for EPD.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 9241-303, *Ergonomics of human-system interaction — Part 303: Requirements for electronic visual displays*

ISO 9241-305, *Ergonomics of human-system interaction — Part 305: Optical laboratory test methods for electronic visual displays*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9241-302 and the following apply.

3.1
electronic paper display
EPD
electronic display that shows information by diffuse reflection and holds the image with low power consumption

3.2
electronic reader
e-reader
electronic device which shows information using EPD

4 Electronic paper display for indoor use — Display laboratory method

4.1 Intended context of use

The attributes of the user, environment, tasks and the use of electronic readers based on electronic paper display (EPD) are summarized in Table 1. Attributes are derived from analysis of the intended context of use and are an essential prerequisite for the compliance assessment. Therefore, context elements different from those described in this method could influence the Pass/Fail criteria.

The supplier shall specify the intended context of use as well as the value or value range of an attribute. The values specified shall match the intended context of use. The intended context of use is part of the compliance report.

NOTE 1 Electronic readers with a diagonal of the active display area of up to approximately 7,1 inches (180 mm), corresponding to ISO A6 paper size, and up to 20,2 inches (514 mm), corresponding to ISO A3 paper size, are considered in this compliance route for typical visual display tasks for indoor use in work environments.

NOTE 2 Automotive environments, such as those of cars, trains and other vehicles, are not addressed here.

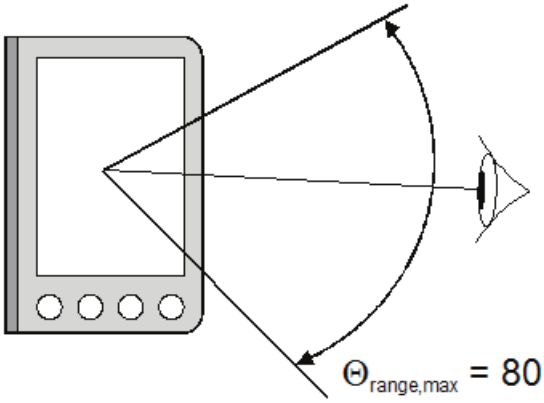
Table 1 — Intended context of use

Element	Attribute	Quantification
User	Age and vision	User with normal or to normal corrected vision of any age, 7 years or older (any literate user).
Environment	Design screen illuminance, E_S	At indoor locations: — minimum 20 lx — maximum 1 500 lx The supplier shall specify the design screen illuminance (or its range).
	Typical components of the illumination: large aperture source (15°) and small aperture source (1°) illumination.	N/A. There is no evaluation of unwanted reflections.
	Illuminant	For this compliance route CIE illuminant A, D50, D65, F11 and F12 are considered.[5] The supplier may specify the intended illuminant. All these illuminants exist at every illuminance level of indoors use. Often in combinations. It is assumed that by verifying that the visual display complies in each of the illuminants, the visual display will also comply with any combination of illuminants. The compliance assessment need only be performed once, with a spectrally broad-band laboratory illumination. The compliance calculations are then made using spectral calculations and repeated for each of the specified illumination levels and illuminants.
	Ambient temperature	For this compliance route an ambient temperature of approximate 15°C to 35°C is considered, if not otherwise specified by the supplier.

Table 1 *(continued)*

Element	Attribute	Quantification
Task	Content and perception	For this compliance route the following contexts for perception of information are considered, if not otherwise specified by the supplier. **Artificial information** Visualization of objects and scenes that do not have originals in our world, e.g. text (i.e. alphanumeric characters), graphical signs, symbols, etc. in monochrome (including achromatic) and/or multicolour (including full-colour) presentation. The Pass/Fail criteria may contain three different requirement levels, "High", "Medium" and "Low", which determine the degree to which a criterion is fulfilled: **"High"** for visual display tasks require high performance in e.g. colour gamut, grey scale but also higher comfort regarding character attributes; **"Medium"** for general visual display tasks require sufficient performance to perceive colour and to read the information without discomfort by the user; **"Low"** for visual display tasks require low performance in e.g. colour gamut and grey scale, but with sufficient performance to read the information without discomfort by the user.
	Amount of information	Preferred screen size for sufficient amount of information with appropriate object size and resolution.
	Image type	For this compliance route the visual display shall be capable of displaying still and quasi-static images.
	Design viewing distance, $D_{\text{design,view}}$	The minimum design viewing distance, $D_{\text{design,view,min}}$, is > 200 mm. The supplier shall specify $D_{\text{design,view}}$.
	Design viewing direction, Θ_{D}, Φ_{D}	Within a specific range of angles from the normal. For this compliance route, perpendicular viewing direction is assumed, if not otherwise specified by the supplier. Therefore, the default design viewing direction, (Θ_{D}, Φ_{D}), is (0°, –).

Table 1 *(continued)*

Element	Attribute	Quantification
Task	Design viewing direction range (angle of inclination and azimuth)	For this compliance route, a design viewing direction range of up to 80° is considered, if not otherwise specified by the supplier (as shown below).  Therefore, the maximum angle of inclination, Θ, is 40°. The azimuth angle, Φ, is 0° to 360°
	Eye and head position	From fixed to moving.
	Number of users	Typically single.
Usage	Display handling	For this compliance route, stationary and portable display handling is considered, unless otherwise specified by the supplier.

4.2 Information about the technology

The basic physical attributes of electronic readers are given in Table 2.

The supplier shall submit a detailed technical specification which includes

— rated voltage,

— rated frequency,

— rated current,

— rated power consumption,

— panel specification,

— horizontal/vertical pixel size,

— original resolution,

— sub-pixel drawing,

— anti-reflection treatment,

— pixel fault declaration,

— prepared gamma-value, and

— factory setting of *brightness*, *contrast*, *colour* control.

The supplier shall also submit the test pattern, if required.