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**Ergonomics of human-system  
interaction —**

**Part 311:  
Application of ISO 9241-307: LCD  
screens for workstations**

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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

This first edition cancels and replaces ISO 9241-3:1992.

A list of all parts in the ISO 9241 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The ISO 9241-30x family of standards has replaced ISO 9241-3<sup>1)</sup>, ISO 9241-7<sup>1)</sup>, ISO 9241-8<sup>1)</sup>, ISO 13406-1<sup>1)</sup> and ISO 13406-2<sup>1)</sup>. The overall goal of the restructuring was to design a modular standard enabling an easy way of adding new intended contexts of use, new measurement methods or new technologies in the ISO 9241-30x family of standards.

The ISO 9241-30x family of standards consists of seven individual standards. [Table 1](#) gives an overview (for details see the standards themselves).

This document refers to ISO 9241-307. It helps explain the transition from the earlier structure of the related standards to the current structure. It will be revised or withdrawn following the revision of ISO 9241-307.

**Table 1 — Overview of the ISO 9241-30x family of standards**

Part of ISO 9241-30x	Title and explanation
ISO 9241-300	Introduction to electronic visual display requirements — This part introduces the ISO 9241-30x family of standards and explains the modular structure.
ISO 9241-302	Terminology for electronic visual displays — This part explains the terms and definitions used in the series.
ISO 9241-303	Requirements for electronic visual displays — This part establishes fundamental image-quality requirements on a generic basis. For assessing its requirements, a testing method is needed regarding its technology, task and environment.
ISO 9241-304	User performance test methods for electronic visual displays — This part provides guidance for assessing the visual ergonomics of display technologies with user performance test methods.
ISO 9241-305	Optical laboratory test methods for electronic visual displays — This part contains test methods for measurement of the requirements given in ISO 9241-303.
ISO 9241-306	Field assessment methods for electronic visual displays — This part describes simplified optical, geometrical and visual assessment methods that can be used for on-site measurements at visual display workstations. <sup>a</sup>
ISO 9241-307	Analysis and compliance test methods for electronic visual displays — This part establishes test methods for the analysis of a variety of visual display technologies, tasks and environments. It refers to the general requirements given in ISO 9241-303 and test methods given in ISO 9241-305 for assessment of conformity for different (display-) technologies and the anticipated contexts of use.
<sup>a</sup> ISO test charts for the visual assessment of the display output by yes/no question are available from: <a href="https://standards.iso.org/iso/9241/306/ed-2/index.html">https://standards.iso.org/iso/9241/306/ed-2/index.html</a> <a href="https://standards.iso.org/iso/9241/306/ed-2/AE09/AE09F0PX.PDF">https://standards.iso.org/iso/9241/306/ed-2/AE09/AE09F0PX.PDF</a> (achromatic, 2 MB) <a href="https://standards.iso.org/iso/9241/306/ed-2/AE18/AE18F0PX.PDF">https://standards.iso.org/iso/9241/306/ed-2/AE18/AE18F0PX.PDF</a> (chromatic, 14 MB)	

1) Cancelled and replaced by ISO 9241-302, ISO 9241-303, ISO 9241-304, ISO 9241-305, ISO 9241-307 and ISO 9241-311.



# Ergonomics of human-system interaction —

## Part 311:

# Application of ISO 9241-307: LCD screens for workstations

## 1 Scope

This document provides information relating to the specification of liquid crystal display (LCD) screens at visual display workstations in indoor locations, in accordance with ISO 9241-307:2008, 5.2. The information is limited to LCD screens, since these are typically used at workstations.

The information is intended to support managerial decision makers (e.g. procurement operators, companies' safety committees, occupational safety and health professionals) who are responsible for the acquisition of visual 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.

ISO 9241-302:2008, *Ergonomics of human-system interaction — Part 302: Terminology 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.

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

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

### 3.1

#### artificial information

visualization of objects and scenes that do not have originals in our world in monochrome (including achromatic) and/or multicolour (including full-colour) presentation

EXAMPLE Text (i.e. alphanumeric characters), graphical signs, symbols.

Note 1 to entry: See ISO 9241-307:2008, Table 38.

### 3.2

#### reality information

imaging of objects and scenes that do have existing originals in our world in monochrome (including achromatic) and/or multicolour (including full-colour) presentation

EXAMPLE Faces, people, landscapes.

Note 1 to entry: See ISO 9241-307:2008, Table 38.

**3.3  
design viewing direction**

specific direction from which the visual display is intended to be viewed

Note 1 to entry: See ISO 9241-307:2008, Table 38.

Note 2 to entry: Reality information is not considered.

**3.4  
design screen illuminance**

specific maximum illuminance on the screen caused by ambient illumination

Note 1 to entry: See ISO 9241-307:2008, Table 38.

**3.5  
luminance balance**

ratio between the luminances of the displayed image and its adjacent surround or sequentially viewed surfaces

[SOURCE: ISO 9241-302:2008, 3.4.18]

**3.6  
colour non-uniformity**

change of a colour in the active area of the screen

Note 1 to entry: See ISO 9241-303:2011, 5.4.3.

Note 2 to entry: Variation considers lateral and directional changes.

**3.7  
contrast non-uniformity**

unintended variations in contrast (luminance ratio) in the active area of the screen

Note 1 to entry: There are three different forms of contrast non-uniformity:

- variation in area average luminance contrast from the centre of a display to the edge of any portion thereof;
- variation of the peak contrast of character elements (dots or strokes) at different locations of the screen;
- variation of the peak contrast of character elements (dots or strokes) within a character.

Note 2 to entry: See ISO 9241-303:2011, 5.4.4.

**3.8  
visual artefacts**

**Moiré effects**

regular image superimposed on the intended image

Note 1 to entry: Moiré effects can appear as ripples, waves and intensity variations.

Note 2 to entry: Moiré effects are disturbing information.

Note 3 to entry: See ISO 9241-303:2011, 5.4.9.

**3.9  
unintended depth effects**

perception of depth by combination of spectrally extreme colours

EXAMPLE      Combination of red and blue.

Note 1 to entry: See ISO 9241-303:2011, 5.4.12.



**3.10****luminance contrast**

ratio between the higher luminance,  $L_H$ , and lower luminance,  $L_L$ , that defines the feature to be detected

Note 1 to entry: ISO 9241-303:2011, ISO 9241-305:2008 and ISO 9241-307:2008 use luminance contrast measured by contrast modulation or measured by contrast ratio.

[SOURCE: ISO 9241-302:2008, 3.1.7, modified — Notes to entry replaced.]

**3.11****image polarity**

relationship between background brightness and image brightness

Note 1 to entry: The presentation of brighter characters on a darker background is designated as *negative* polarity, and the presentation of darker characters on a brighter background is designated as *positive* polarity.

[SOURCE: ISO 9241-302:2008, 3.4.15]

**3.12****character format**

number of horizontal and vertical elements of a character

Note 1 to entry: An element is understood to be a pixel, which is the smallest element that is capable of generating the full intended functionality (e.g. colour and grey scale) of the display.

[SOURCE: ISO 9241-302:2008, 3.6.5, modified — definition revised and notes to entry replaced.]

**3.13****luminance coding**

information presented by temporally independent differences in image luminances

EXAMPLE Information highlighted by differences in luminance.

Note 1 to entry: Absolute luminance coding is understood to be information presented where the only dimension that is used for visual differentiation is the difference in image luminances (see ISO 9241-302:2008, 3.4.1).

[SOURCE: ISO 9241-302:2008, 3.4.19, modified — example and Note 1 to entry added.]

**3.14****blink coding**

information presented by temporal luminance variations in images

[SOURCE: ISO 9241-302:2008, 3.3.8]

**3.15****colour coding**

information coding by using distinguishable colours

Note 1 to entry: See ISO 9241-303:2011, 5.6.4.

**3.16****geometrical coding**

information coding by using different geometrical shapes

EXAMPLE Use of graphical symbols (e.g. triangles and circles for distinguishing curves in diagrams).

Note 1 to entry: See ISO 9241-303:2011, 5.6.5.

**3.17****object size**

visual angle required for objects to be recognizable

Note 1 to entry: See ISO 9241-303:2011, 5.7.2.

Note 2 to entry: Object size can be monochrome or multicolour.

### **3.18**

#### **contrast for object legibility**

contrast required for objects to be recognizable

Note 1 to entry: See ISO 9241-303:2011, 5.7.3.

### **3.19**

#### **colour considerations for graphics**

summary of requirements for coloured symbols or characters

Note 1 to entry: A default colour set with distinguishable colours is required to be available. Characters and symbols need to be presented with a visual angle of at least 20' of arc at the design viewing distance (2,9 mm height of character or symbol at 500 mm viewing distance). Where accurate colour identification of an isolated image such as a character or symbol is required, the image should be at least 30' of arc at the design viewing distance, preferably 45' of arc.

Note 2 to entry: See ISO 9241-303:2011, 5.7.4.

### **3.20**

#### **surrounding image effects**

background

effects with reference to the discriminability of image background and image foreground

Note 1 to entry: For colours to be discriminable and identifiable, coloured foreground images should be used on achromatic background and vice versa.

Note 2 to entry: See ISO 9241-303:2011, 5.7.5.

### **3.21**

#### **colour gamut**

number of colours used by an application as a percentage of all colours of the chromaticity diagram

Note 1 to entry: Depending on the application for office tasks (artificial information), a minimum of six and a maximum of 11 discriminable colours should be provided.

Note 2 to entry: See ISO 9241-303:2011, 5.7.6 and 5.8.2.1 and ISO 9241-307:2008, Table 83.

### **3.22**

#### **reference white**

specified reference for the white achromatic stimulus displayed on the monitor

Note 1 to entry: See ISO 9241-307:2008, Table 83.

### **3.23**

#### **electro-optical transfer function**

function describing the relationship between input signal of a display and the displayed luminance

Note 1 to entry: See ISO 9241-307:2008, Table 86.

### **3.24**

#### **grey scale**

greys displayed by more than two luminance levels

Note 1 to entry: See ISO 9241-307:2008, Table 86.

### **3.25**

#### **image formation time**

time that is needed by the display to change the image from one luminance state to another luminance state and vice versa

[SOURCE: ISO 9241-302:2008, 3.4.14, modified — definition revised; example and note to entry deleted.]

**3.26****spatial resolution**

display resolution in horizontal pixels times vertical pixels

Note 1 to entry: See ISO 9241-303:2011, 5.8.6.

**3.27****fill factor**

fraction of the total pixel area geometrically available that can be altered to display information

Note 1 to entry: For discrete-pixel displays, the outer boundary of all the pixels defines the active area. Between the pixels and subpixels are gaps that structurally support or define the pixel. The ratio of the active area minus the area of the gaps to the active area is the fill factor.

[SOURCE: ISO 9241-302:2008, 3.4.10]

**3.28****pixel density**

number of pixels per dimension

EXAMPLE      ppi = pixels per inch.

Note 1 to entry: The dimension can be a length measured in centimetres or inches, or an angle measured in degrees at the design viewing distance.

Note 2 to entry: See ISO 9241-303:2011, 5.8.7, 5.8.8 and ISO 9241-307:2008, Table 91.

**4 Classification, profiles and screen selection****4.1 General**

In combination with ISO 9241-303 and ISO 9241-305, ISO 9241-307 forms the basis for conformity assessment of LCD screens and is therefore considered to be the relevant standard for the acquisition and specification of screens.

Whereas ISO 9241-3, ISO 9241-7, ISO 9241-8, ISO 13406-1 and ISO 13406-2 mainly took visual display workstations into account, the scope of ISO 9241-307 was broadened and additional technologies were considered.

The broad scope of ISO 9241-307 includes the following changes:

- consideration of illuminance between 50 lx and 1 500 lx;
- consideration of the luminance of an extended light source that can reflect in the screen, with higher values of 300 cd/m<sup>2</sup> or 500 cd/m<sup>2</sup>;
- integration of CIE-illuminants A, F11 and F12<sup>2)</sup>;
- discrimination between “artificial information” and “reality information” regarding content and perception.

ISO 9241-307 considers the following technologies:

- Cathode ray tube (CRT) displays;
- emissive flat-panel LCD;
- plasma display panels;
- front-screen projection visual displays;

2) CIE standard illuminant A (ISO 11664-2:2007/CIE S 014-2:2006), CIE illuminants FL11 and FL12 (CIE 018:2018)