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**Ergonomics — Accessible design —  
Indicator lights on consumer products**

*Ergonomie — Conception accessible — Voyants lumineux sur les  
produits de consommation courante*

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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 24500:2010.

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

Indicator lights of consumer products provide important information to use products properly. Although their importance is recognized widely, many difficulties exist in relation to indicator lights such as insufficient on/off visibility, unclear implications of lighting modes, and discomforting glare are reported by users, particularly by older persons or persons with visual disabilities. These claims result from the lack of a relevant standard related to indicator lights design. This document is intended to provide design requirements and recommendations for adequate brightness, colour, and use of blinking lights of indicator lights considering the needs of older persons and persons with visual disabilities.

This document adopts the concepts of accessibility given in ISO/IEC Guide 71 and in ISO/TR 22411.

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# Ergonomics — Accessible design — Indicator lights on consumer products

## 1 Scope

This document specifies design requirements and recommendations for indicator lights, mainly LED sourced, on consumer products for use by older people and people with visual disabilities. It does not consider the needs of persons who are blind.

Indicator lights include those that inform users visually about the conditions, changes in functional status and settings, and malfunction of products. They convey information by light on/off, time-modulated intensity, blinking, colour, luminance level, and layout.

This document addresses household and home appliances. It excludes electronic displays presenting characters and graphics, machinery, and appliances in special use for professional, technical, and industrial applications.

## 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/IEC Guide 71, *Guide for addressing accessibility in standards*

ISO 17049, *Accessible design — Application of braille on signage, equipment and appliances*

CIE S 017, *ILV: International Lighting Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC Guide 71 and CIE S 017 and the following apply.

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

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

### 3.1 consumer product

product that is intended to be acquired and used by an individual for personal rather than professional use

[SOURCE: ISO/TS 20282-2:2013, 4.3]

### 3.2 indicator light

light which is associated with the operation of a product and is indicative of the operation of a product

Note 1 to entry: Indicator light informs users about the conditions, changes in functional statuses and settings, or malfunction of products.

Note 2 to entry: Indicator light conveys information by light on/off, time-modulated intensity, blinking, colour, luminance level, and layout.

Note 3 to entry: Indicator light can have different shapes, e.g. circular, rectangular, triangular, or arrow shape.

Note 4 to entry: Indicator light includes lights with a light conductor or cover. It can be located on a control panel, labelled with text or an icon, or be an integral part of a control element.

### 3.3

#### **small indicator light**

indicator light emitting area that is smaller than 20' in diameter of the visual angle

Note 1 to entry: Visual angle of 20' corresponds to 3 mm length viewed at a 50 cm distance.

Note 2 to entry: Visual appearance of small indicator light smaller than 20' of visual angle changes in brightness and colour. According to the spatial summation of vision, brightness of a light smaller than 20' of visual angle changes proportionally with its size. Brightness of a light larger than 20' of visual angle is determined by luminance only. Colour for a smaller visual field than 20' also changes its appearance described small-field tritanopia, a kind of colour defect.

### 3.4

#### **low vision**

impairment of visual functioning even after treatment and/or standard refractive correction

Note 1 to entry: A person with low vision has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but uses, or is potentially able to use, vision for the planning and/ or execution of a task for which vision is essential.

[SOURCE: Adapted from Low Vision Services or Care, WHO]

### 3.5

#### **fundamental colour**

set of basic colours perceived by people with normal colour vision, which are red, orange (yellow-red), yellow, green-yellow, green, blue-green, blue, purple-blue, purple, red-purple, black, grey, and white

Note 1 to entry: Black and grey are not applicable for luminous mode, such as indicator lights.

### 3.6

#### **luminance**

intensity of light emitted from a surface per unit area and per unit solid angle in a given direction

Note 1 to entry: More information of luminance is given in CIE S017.

### 3.7

#### **control**

device that directly responds to an action of the operator, e.g. by the operator applying pressure

[SOURCE: ISO 11064-5:2008, 3.8, modified — Note 1 to entry and the example have been omitted.]

## 4 Accessibility considerations related to indicator lights

### 4.1 Modes of lighting condition

Modes of the conditions of indicator lights shall be classified as follows. These modes shall be clearly recognizable by users.

- a) Light-on: Light-on mode is the steady luminous condition of an indicator light by electric current flow. The following are some examples of indications associated with the light-on mode:
- indication of running condition;
  - indication of standby status;
  - indication of connection to the power source;

- indication of next operation;
  - indication of recovery from malfunction to normal status.
- b) Light-off: light-off mode is the steady non-luminous condition without electric current flow. The following are some examples of indications associated with the light-off mode:
- indication of pause or standby;
  - indication of being disconnected from the power source.
- c) Blinking: Blinking mode is the repetition of light-on and light-off modes. It also includes clear periodical changes of the difference between the lighter and darker conditions. The following are some examples of indications associated with the blinking mode.
- indication of a change of status among normal, abnormal, standby and pause;
  - indication of an abnormal condition;
  - calling for user's awareness or attention.
- d) Others: Any other lighting mode not included among those above. For example, a mode that uses a gradual increase or decrease of luminance.

## 4.2 Colour

- a) Colours of indicator lights shall be noticeable from the surroundings.

NOTE 1 Selection of colour for indicator lights relative to surroundings using fundamental colours that can be readily identified (see ISO 24505).

NOTE 2 The surrounding means the vicinity of an indicator light. This applies to other parts using this term in this document.

- b) If changes of multiple colours are employed in one light, or if use of multiple lights of different colours in one product, each colour shall be discriminable from the others.

NOTE A combination of fundamental colours tends to be discriminated easily (ISO 24505).

- c) Colour shall not be the only means of discriminating indicator lights. Other ways, e.g. difference in luminance contrast, shape, physical location, temporal patterns, may also be used.

NOTE 1 People with colour deficiency can have difficulty discriminating colours between red and green.

NOTE 2 People with low vision can need greater colour differences or luminance contrasts to discriminate colours.

NOTE 3 Lights appear differently when the size of them is smaller than 20' of visual angles. See Notes to entry 3.3 and Notes in 4.4.

- d) Colour naming of indicator lights should use colour terms based on fundamental colours (see 3.6).

## 4.3 Luminance

- a) The indicator light luminance should be set at a level of good visibility at the viewing axis and condition. Factors supporting good visibility include colour, size, luminance of the surroundings, blinking or not blinking, ambient illuminance level of a product, and the visual capability of the user.

In case of white coloured lights with black or white surroundings, steady lights, and in photopic or mesopic conditions, [Table 1](#) or [Table 2](#) should be used to determine the luminance.

When designing luminance for young people, older people and people with low vision altogether, the luminance level should be within the range between the highest value of the minimum level and the lowest value of the glare level among those three groups.

**EXAMPLE** In cases of white coloured lights with black surroundings, steady lights in photopic condition, luminance can be set between 300 cd/m<sup>2</sup> (the minimum luminance of people with low vision in [Table 1](#)), to 2 000 cd/m<sup>2</sup> (the glare level of young and older adults in [Table 1](#)).

The luminance of highly saturated coloured lights can be set lower than the values of white coloured lights presented in [Tables 1](#) and [2](#).

**NOTE** Highly saturated colours have an effect of enhancing brightness. According to CIE 075, A highly saturated colour, depending on its hue, is three times as bright as an achromatic colour (greys) of the same luminance.

- b) The luminance of small indicator light should be set at higher luminance depending on their size. It should not exceed the glare level of [Tables 1](#) and [2](#).

**NOTE** Luminance of small indicator light (smaller than 20' of visual angles) appears to be darker as its size becomes smaller (see [3.6](#)).

- c) Automatic adjustment of the luminance in relation to the environmental light conditions and adjustability by the user supports accessibility.

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**Table 1 — Luminance values of white coloured lights (cd/m<sup>2</sup>)  
For fixed lights with black surroundings and visual angle of more than 20'**

Level of visibility	500 lx (Photopic level)			0,5 lx (Mesopic level)		
	Young people	Older people	People with low vision	Young people	Older people	People with low vision
Minimum level	10	30	300	3	10	100
Good visibility level	100–300	300–1 000	3 000–10 000	30–100	100–300	1 000–2 000
Glare level	2 000	2 000	10 000	300	300	2 000

NOTE 1 Minimum level is the level at which 90 % of people can see the lights on at least, but still 50 % of people judge as “difficult to see”.

NOTE 2 Good visibility level is the level at which 75 % of people judge as “easy to see” or “moderate to see”.

NOTE 3 Glare level is the level at which 50 % people feel glare of the lights.

NOTE 4 Illuminances of 500 lx and 0,5 lx respectively denote the representative values of photopic and mesopic conditions.

**Table 2 — Luminance values of white coloured lights (cd/m<sup>2</sup>)  
For fixed lights with white surroundings and visual angle of more than 20'**

Level of visibility	500 lx (Photopic level)			0.5 lx (Mesopic level)		
	Young people	Older people	People with low vision	Young people	Older people	People with low vision
Minimum level	30	100	1 000	5	20	200
Good visibility level	300–1 000	1 000–3 000	10 000	50–200	200–500	2 000
Glare level	2 000	2 000	10 000	300	500	2 000

NOTE 1 Illuminances of 500 lx and 0,5 lx respectively denote the representative values of photopic and mesopic conditions.

NOTE 2 The glare level values are the corresponding values in [Table 1](#), except that the value shown for older people is set as 500 cd/m<sup>2</sup>.

#### 4.4 Size

- a) Indicator lights size shall be designed adequately so that they are clearly visible for users taking account of the viewing distance and the visual ability of users.

NOTE 1 Indicator lights smaller than 20' of visual angle cause small-field tritanopia, a kind of colour defect. Colours of such lights are difficult to be discriminated.

NOTE 2 Some people with low vision have difficulty in detection and discrimination of indicator lights even if they are larger than 20' of visual angle.

#### 4.5 Temporal luminance difference and blinking light frequency

- a) Blinking of indicator lights shall be visible. For 1 Hz white coloured lights with black surroundings, [Table 3](#) should be used to determine the modulation amplitude.

**Table 3 — Modulation amplitude of white coloured lights  
For blinking lights with black surroundings**

	Small indicator lights			Large indicator lights		
	Young people	Older people	People with low vision	Young people	Older people	People with low vision
Modulation amplitude of a 1 Hz blinking light	0,2	0,3	0,3	0,2	0,3	0,3
Modulation amplitude of an 8 Hz blinking light	0,1	0,2	0,3	0,05	0,1	0,2

NOTE 1 Sizes of small and large lights are, respectively, less than and greater than 20' of visual angle.

NOTE 2 Amplitude modulation is defined as  $(L_{\max} - L_{\min}) / (L_{\max} + L_{\min})$ , where  $L_{\max}$  represents the maximum level and  $L_{\min}$  represents the minimum level of luminance.

NOTE 3 Blinking lights in this table are 50 % bright and dark conditions in a cycle (50 % duty cycle).

- b) Blinking lights that have a luminance difference of greater than 20 cd/m<sup>2</sup> between highest and lowest parts, a frequency higher than 3 Hz, and a subtended visual angle of more than 1/4 of 10 degree of the central visual field shall be avoided. (see ISO 9241-391).
- c) High-frequency blinking should not be used for people with low vision.
- NOTE Some people with low vision have extremely low sensitivity to flicker perception of 10 Hz or more.
- d) Blinking lights should be clearly visible for people with low vision who have a very narrow visual field.
- NOTE Blinking lights of 0,5 Hz or lower are difficult for people with low vision to see.

#### 4.6 Location

- a) Indicator lights shall be easy to see from the user's place of operation and monitoring.
- b) Indicator lights for controls should be located so that each light clearly corresponds to each of the controls.
- c) If the indicator light shape is convex, the light should be placed so as not to interfere with reading Braille that exists nearby. To avoid interfering with Braille reading, the exclusion zone (area where nothing is placed around a braille cell or cells) shall comply with ISO 17049.
- d) Indicator lights should be placed so that their visibility is not obstructed or deteriorated by operation.

#### 4.7 Alternative presentation of indicator light information

- a) To increase accessibility of users with the widest range of capabilities, other information should be used in conjunction with indicator lights.
- NOTE Vibration, auditory signals, voice, and text on the screen are regarded as the alternative presentation of indicator lights information.
- b) When combined with some other alternative information, it should correspond to the mode of conditions described in 4.1.