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Grafična tehnologija - Zasloni za barvno preskušanje - Značilnosti in pogoji za vizualno opazovanje

Graphic technology -- Displays for colour proofing -- Characteristics and viewing conditions

Technologie graphique -- Affichages pour la réalisation d'épreuves en couleur -- Caractéristiques et conditions d'examen visuel

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Graphic technology — Displays for colour proofing — Characteristics and viewing conditions

Technologie graphique — Affichages pour la réalisation d'épreuves en couleur — Caractéristiques et conditions d'examen visuel

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 12646 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

Introduction

The ability to match colour images displayed on colour monitors to the images produced when the same digital file is rendered by proofing and printing systems (commonly referred to as “soft” proofing) is increasingly expected in graphic arts. Obtaining such a match is not simple and to be fully accurate requires careful control of many aspects of the process. The primary purpose of this International Standard is to make recommendations with respect to the soft proof viewing conditions. If these are controlled it is then possible for users to exchange meaningful calibration and characterization data such that a consistent and, possibly, accurate colour match to the hard copy proof is achieved; see Annex A. (Calibration is the operation to establish that the measured values agree with the values specified by a standard, or a characterization process; characterization is the process of relating device-dependent colour values to device-independent colour values. In the case of visual display devices, the RGB device values are related to CIE tristimulus values.)

This International Standard is primarily based on the needs of Cathode-Ray Tube display technology, but it is anticipated that many of the recommendations will be appropriate to newer display technologies.

The appearance of a colour image on a colour display is influenced by many physical factors other than controlled ambient viewing conditions. Amongst the most important of these are uniformity, convergence, size and resolution (in order to permit rendition of the proof at close to its normal size and with the finest detail visible on the hard copy at normal viewing distances), freedom from flicker, the opto-electronic calibration of the display and the settings of its display-driver software. So, to be acceptable as a proofing system which provides a reasonable level of image quality, the display must also exhibit acceptable quality of these properties. This International Standard specifies the minimum requirements for factors such as uniformity, convergence, refresh rate, size and spatial resolution. However, since these parameters are subject to improvement as display technology changes, this International Standard should be seen as defining minimum requirements for these parameters. It is assumed that displays used for this purpose will always conform to accepted industry “standards” for Computer-Aided Design (CAD), and generally provide quality levels considered acceptable for this purpose, where they offer an improvement over the specifications herein.

It should be noted that, even for displays of the highest quality, the appearance of the displayed image will be limited by the accuracy of the colour transformation used for converting the digital file from its encoded colour space to that required for display purposes. This International Standard provides no formal specifications for these transforms, although the issues are discussed in an informative annex, together with recommendations for achieving an acceptable colour transformation.

It should be noted that this International Standard only considers the setting up of colour displays as “soft” proofing devices. It is primarily directed at applications where the displayed image will be directly compared to a hard copy. It is therefore concerned with modifying the “hard” and “soft” controls of the display to enable it to simulate a proof. In this sense, it can be looked on as a “slave” device. However, it is in the interests of a CAD user, where the colour display in a real sense “originates” the image, to set the display up in a similar way. This will enable simpler optimization of the colour transformation to the selected hard-copy system used for rendering the image in order to produce an accurate reproduction, if this is an important requirement. However, it is possible to undertake image processing to modify the image when rendered to make it look like the displayed image (colour gamuts permitting), whatever the opto-electronic calibration of the display. This is briefly discussed in Annex A.

Users of this International Standard also need to be familiar with CIE Publication 122. Those unfamiliar with the judgement of displays may also find it helpful to read International Standard IEC 1223-2-5[6] which contains much useful detailed information about evaluation and testing of image display devices.

Graphic technology — Displays for colour proofing — Characteristics and viewing conditions

1 Scope

This International Standard specifies requirements for uniformity, size, resolution, convergence, refresh rate, luminance levels and viewing conditions for a colour display used to simulate a hard copy proofing system.

NOTE This International Standard has been produced with regard to CRT displays, which was by far the dominant technology in use at the time of preparation. However, displays using other technologies are expected to at least meet the minimum of the specifications provided herein.

2 Normative references

The following referenced documents are indispensable for the application 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 3664, *Viewing conditions — Graphic technology and photography*

CIE Publication 15, *Colorimetry*

CIE Publication 122, *The relationship between digital and colorimetric data for computer controlled CRT displays*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
convergence
ability of the three electron beams (R, G and B) to come together at a single spot on the surface of the CRT

3.2
gamma
⟨display⟩ exponent of a power law relationship between amplified video voltages and beam currents

[adapted from CIE Publication 122]

3.3
hard-copy proofing system
system for simulating a printed image using a printing device which may be different from that used for production

3.4
opto-electronic transfer function
relationship between the input values provided to, and the luminance values produced by, a display device

3.5
refresh rate
frequency with which the image on the screen is redrawn

NOTE The refresh rate is expressed in hertz.

3.6
tracking
the process (by adjustment of the amplifiers) of ensuring that the relationship between the three channels of a display balance, so that for all levels equal values in each channel produce a neutral sensation

4 Requirements

4.1 Resolution

The display resolution shall be sufficient to display an image of 1 280 × 1 024 pixels without interpolation. When a test image with dimensions as defined in 5.1 is displayed, all specified lines shall be visible at a normal viewing distance (defined as 0,5 m for the purposes of this International Standard).

4.2 Size

The display shall be capable of displaying an image having a diagonal measurement of at least 43 cm and a height of at least 22 cm.

4.3 Refresh rate

The CRT display shall have a refresh rate of at least 80 Hz, non-interlaced.

4.4 Uniformity

The display should be visually uniform when displaying flat white, grey and black images. When measured as described in 5.2, all luminance values should be within 5 % of the luminance of the centre and shall be within 10 % of it. However, there should not be areas of significant visual non-uniformity between these areas.

NOTE Uniformity of chromaticity is described in 4.8.

4.5 Geometric accuracy

When displaying the grid pattern defined in 5.3, the display should essentially be free of distortion. The length of adjacent lines of the grid pattern shall be within 2 mm of each other and no line length shall deviate by more than 2,5 mm from the mean length.

4.6 Convergence

When displaying the grid pattern defined in 5.3, all lines shall appear wholly free of colour fringing within the central region (defined as the area within half the linear diagonal distance). A small amount of fringing may be accepted outside of this area but is not recommended.

4.7 Ambient illumination conditions

Although the ambient illumination conditions specified in this subclause are consistent with those of ISO 3664, it is important to note that the specification of that International Standard is intended for viewing displayed images independently of any hard copy. For the purposes of this International Standard, in which comparison to hard copy is assumed, a more restrictive illumination condition is required. Thus, a lower level of ambient illumination, with a more restrictive colour temperature and surround condition than that in ISO 3664, is

specified. An additional constraint beyond those of ISO 3664 is added to ensure that any reflected glare from the front surface of the display does not significantly reduce the perceived contrast.

This subclause requires the following.

— The level of illumination, when measured at the face of the monitor or in any plane between the monitor and the observer, shall be less than 32 lx.

— The surround shall be no more than 10 % of the maximum luminance of the screen.

— The colour temperature of the ambient illumination shall approximate D50 (particularly if the level of ambient illumination is towards the high end of the specification).

— The level of illumination, when viewing a black screen (i.e., an image defined as R = G = B = 0), shall be less than 5 % of that obtained when viewing a white screen (i.e., an image defined as R = G = B = 255) as measured at the plane of the observer.

4.8 Chromaticity and luminance of the white and black points and tracking (channel balance)

At the centre of the white image defined in 5.2, the chromaticity of the display should be set to that of D50; namely $u' = 0{,}209\ 2$, $v' = 0{,}488\ 1$ (as defined in CIE Publication 15). The chromaticity obtained shall be within a circle of radius 0,005 from this point. The chromaticity shall also be measured at the other points shown in Figure 2 and must be within 0,01 of the chromaticity of D50.

The luminance level should be as high as practical but shall be at least 80 cd/m^2 and should be at least 120 cd/m^2.

NOTE 1 It is important to insure that the display driver look-up tables be loaded to achieve this specification.

NOTE 2 It is important to take care not to set the display at luminance levels higher than that recommended by the manufacturer.

The black point shall have a luminance that is less than 1 % of the maximum luminance (i.e., a luminance ratio of at least 100 to 1).

NOTE The dynamic range of the monitor (black to white) specified in this subclause is higher than that specified in 4.7. This is because it is assumed that measurement of the luminance of the black of the display will be made in contact, thereby avoid the viewing flare defined in 4.7.

At the centre of the display, the chromaticity of any neutral image (defined by equal digital values for R, G, and B) should be within a radius of 0,005 (in u', v') from the chromaticity of the white. However, the chromaticity tolerance may increase linearly with decreasing luminance such that at 10 % of the maximum luminance it shall be within a circle of radius 0,03 of the chromaticity of the white point. It is for this luminance that the individual channel offsets should be adjusted where possible.

4.9 Opto-electronic transfer function

The gamma of a CRT display should be in the range 2 to 2,4 for each channel. This shall be measured as described in 5.5. The procedure for defining offset and gain is specified in 5.6.

For device technology other than CRTs, the gamma function may be very different from this simple power function. The display driver look-up tables should be loaded to achieve this specification.

NOTE The term gamma has been used here as defined in CIE Publication 122. As such, it is being used in a quite unambiguous way and, together with the offset and gain, it provides the opto-electronic transfer function of the CRT display. However, traditionally in graphic technology, gamma was often defined as the “best fit” exponent when ignoring offset and gain. It is important not to confuse this usage with the definition here. Some standards (such as IEC 61966-2-1[7]) go further and suggest that, since the term has been used in various ways, it is preferable not to use it