

Multimedia systems and equipment — Colour measurement and management —

Part 4: Equipment using liquid crystal display panels

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Summary of pages

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**Multimedia systems and equipment - Colour measurement and management
Part 4: Equipment using liquid crystal display panels
(IEC 61966-4:2000)**

Systèmes et appareils multimédia
Mesure et gestion de la couleur
Partie 4: Appareils utilisant des
afficheurs à cristaux liquides
(CEI 61966-4:2000)

Multimediasysteme und -geräte
Farbmessung und Farbmanagement
Teil 4: Geräte mit Flüssigkristallanzeigen
(IEC 61966-4:2000)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of document 100/119/FDIS, future edition 1 of IEC 61966-4, prepared by IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61966-4 on 2000-04-01.

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at national level by publication of an identical
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-04-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61966-4:2000 was approved by CENELEC as a European Standard without any modification.

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MULTIMEDIA SYSTEMS AND EQUIPMENT – COLOUR MEASUREMENT AND MANAGEMENT –

Part 4: Equipment using liquid crystal display panels

1 Scope

A series of characteristics for colour reproduction and management, and the associated methods of measurement for use in multimedia systems and equipment, are applicable to the assessment of colour reproduction. This part of IEC 61966 deals with equipment using transmissive-type liquid crystal display (LCD) panels to display colour images for use in multimedia applications.

The methods of measurement standardized in this part are designed to make possible the objective performance assessment and characterization of colour reproduction of LCDs which accept red – green – blue analogue or digital signals from electrical input terminals and output colour images on LCD screens. For LCDs to which analogue signals are applicable, the corresponding digital signals are taken into account. The measured results are intended to be used for the purpose of colour management in multimedia systems.

This part of IEC 61966 defines input test signals, measurement conditions and methods of measurement, so as to make possible the colour management and comprehensive comparison of the results of measurements.

Colour control within equipment is outside the scope of this part. It does not specify limiting values for various parameters.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61966. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61966 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(845):1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting* / CIE 17.4: 1987, *International Lighting Vocabulary (joint IEC/CIE publication)*

ISO/CIE 10527:1991, *CIE standard colorimetric observers*

CIE 15.2:1986, *Colorimetry*

CIE 63:1984, *The spectroradiometric measurement of light sources*

ISO 9241-8:1997, *Ergonomic requirements for office work with visual display terminals (VDTs) – Part 8: Requirements for displayed colours*

3 Terms and definitions

For the purpose of this part of IEC 61966, the definitions of IEC 60050(845), CIE 17.4, as well as the following definitions, apply.

3.1

background

image on a screen of the LCD other than the test area

3.2

colour patch, test area

square colour image on a screen of the LCD to be measured, in which the input data for the red, green and blue channels are kept constant within the image area

3.3

CRT display

colorimetrically well-controlled equipment using cathode ray tubes to present colour images with digital inputs for reference

3.4

LCD

any multimedia equipment using a transmissive-type liquid crystal display panel to present colour images

3.5

effective screen height

vertical dimension of the area where a picture can be produced

3.6

effective screen width

horizontal dimension of the area where a picture can be produced

3.7

normalized (image) signal

input signal divided by its full-scale value. See also 5.3

3.8

uncertainty (of measurement)

parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the particular quantity subject to measurement. See [5]¹⁾

¹⁾ Figures in square brackets refer to the bibliography.

4 Letters and symbols

The notations consistently adopted in this part of IEC 61966 are summarized below.

N	the number of bits in digital data per channel
M	maximum integer for non-negative N-bit system, $M = 2^N - 1$
m	the number of measurements in a set of data
D_R	digital data applied to red channel
D_G	digital data applied to green channel
D_B	digital data applied to blue channel
R	normalized input level to red channel
G	normalized input level to green channel
B	normalized input level to blue channel
X, Y, Z	measured raw data using spectroradiometers and colorimeters corresponding to tristimulus values
X', Y', Z'	tristimulus values normalized by one of the tristimulus values, Y'_W for a peak white
h	effective screen height
w	effective screen width
d	distance between LCD screen and measuring instrument

5 Conditions

5.1 Environmental conditions

All measurements specified in this standard shall be carried out in a dark room. Particular attention should be paid to prevent reflected illumination caused by the ambient objects (desktop, wall, etc.) and direct illumination from light-emitting indicators of measuring instruments.

An hour warm-up time should precede any measurement in 7.2, 9.2, 11.2, 12.2 and 15.2, if not specified by the manufacturer of the equipment.

The mains voltage and frequency shall be at the rated value specified by the manufacturer. If the mains voltage fluctuates, a regulated power supply shall be used to maintain the supply voltage to within $\pm 5\%$ of the rated value.

Other environmental conditions such as room temperature and relative humidity shall be reported together with the results of measurements.

If additional environmental conditions are described in the manufacturer's specifications, these should be taken into account.

5.2 Conditions for measurements

Contrast, brightness and additional adjustments shall be set to the preset positions specified by the manufacturer. If the adjustment is set to another position than the preset, the position or corresponding value shall be reported with the results of the measurements.

The arrangement of equipment for measurements shall be as shown in Figure 1. It incorporates a spectroradiometer or a non-contact colorimeter, depending on the characteristics to be measured.

The instrument optical axis should be perpendicular to the surface of the LCD. If the other measurement angle is recommended by the manufacturer, it shall be reported together with the results of measurements. The distance d shall be $4h$ or larger.

NOTE 1 It is recommended to take precautions so that the measurement is not influenced by vibration and no picture elements are missing within the field of view of the measuring instrument.

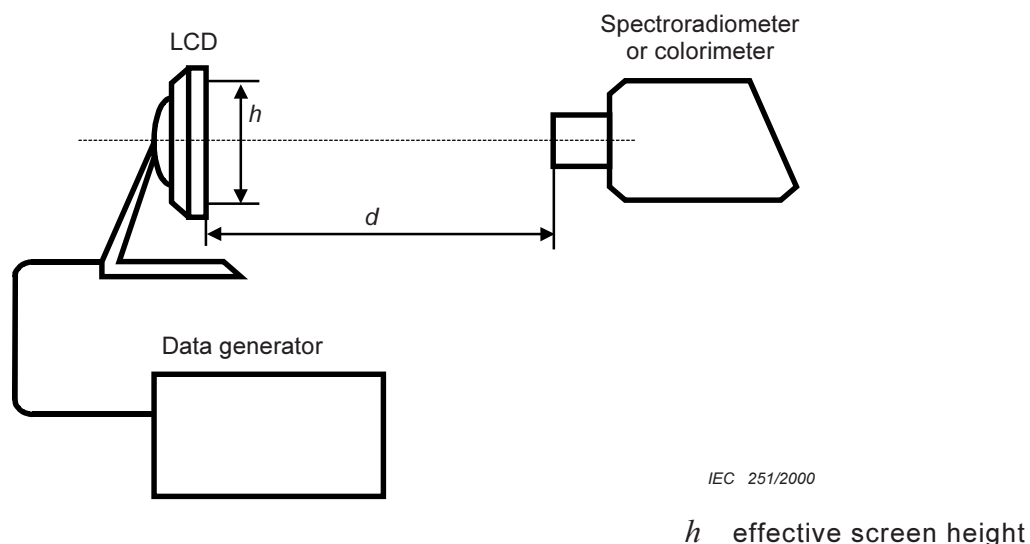
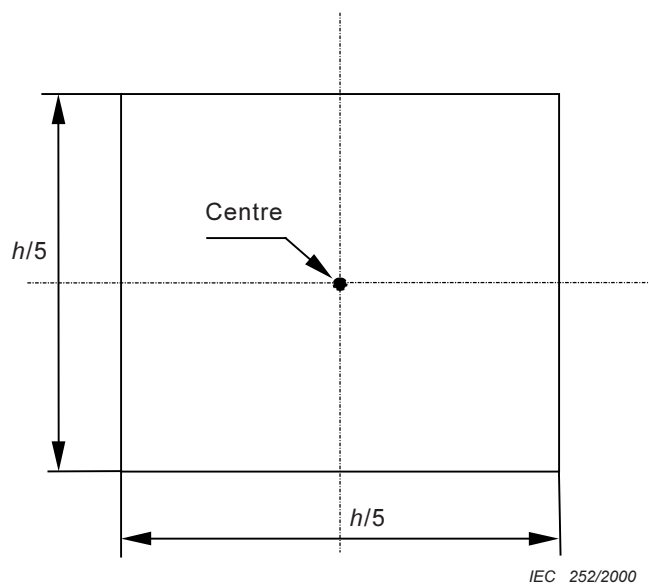


Figure 1 – Equipment arrangement for non-contact measurements

Test signals applied to the red, green and blue channels shall result in a colour patch of the size shown in Figure 2 on the LCD. The positioning of the colour patch shall be referred to by the centre as in Figure 2. The background shall be black ($D_R=0$, $D_G=0$, $D_B=0$), unless otherwise specified.

NOTE 2 The measurement area in the colour patch should include more than 500 picture elements.



h effective screen height

Figure 2 – Size of a colour patch

The test area shall be measured immediately after the application of input values to the LCD for specific colours.

5.3 Input digital data

The relationship between the input digital data, D_R, D_G, D_B , of N bits per channel and corresponding normalized signal levels R, G, B for calculation shall be

$$R_i = \frac{D_{R_i}}{2^N - 1}$$

$$G_i = \frac{D_{G_i}}{2^N - 1}$$

$$B_i = \frac{D_{B_i}}{2^N - 1}$$

where the index i denotes the i -th measurement step.

6 Measurement equipment

6.1 Spectroradiometer

A spectroradiometer with the following specification should be used for the measurements,

- | | |
|---------------------------|--|
| a) Wavelength range | at least 380 nm to 780 nm |
| b) Field of view | between 0,1° and 2,0° |
| c) Wavelength uncertainty | less than 0,5 nm at wavelengths specified by the manufacturer of the instrument |
| d) Scanning interval | 5 nm or less |
| e) Bandpath | 5 nm or less |
| f) Repeatability | 0,001 in x, y and 0,5 % in luminance (in candela per square metre) for the light source specified by the manufacturer of the instrument |
| g) Uncertainty | 0,005 in x, y for red, green, blue and white of a CRT display and 4 % in luminance (in candela per square metre) for white of the CRT display that has a definite x, y and luminance value |
| h) Polarization error | within 5 % |

The (x, y) is the CIE 1931 chromaticity coordinate defined in CIE 15.2.

NOTE 1 For polarization errors, see [6].

NOTE 2 Periodic calibration should be carried out with a standard source of known spectral power distribution.

NOTE 3 Further technical details of the design, characterization, and calibration of spectroradiometers can be found in CIE 63 and [4].

NOTE 4 The standard CRT display is referred to because no standard LCD panel exists at the time of publication of this part. When it is available, the standard CRT display should be replaced by the LCD.

If the spectroradiometer used for measurements does not meet the above specifications, the name of the model and the specification of the equipment shall be reported, together with the results of measurements.

6.2 Colorimeter

The colorimeter in Figure 1 should have the following specifications.

- | | |
|--------------------------|---|
| a) Field of view | any value between 0,1° and 2,0°. |
| b) Spectral responsivity | conforming to the CIE 2° colour-matching functions as defined in ISO/CIE 10527. |
| c) Repeatability | 0,002 in x, y and 0,5 % for luminance for a light source specified by the manufacturer of the instrument. |
| d) Uncertainty | 0,005 in x, y for red, green, blue and white of the CRT display and 4 % in luminance (in candela per square metre) for white of the CRT display that has a definite x, y and luminance value. |

The (x, y) is the CIE 1931 chromaticity coordinate defined in CIE 15.2.