

INTERNATIONAL STANDARD

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**Multimedia systems and equipment – Colour measurement and management –
Part 5: Equipment using plasma display panels**

**Systèmes et appareils multimédia – Mesure et gestion de la couleur –
Partie 5: Appareils utilisant des afficheurs à plasma**

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**MULTIMEDIA SYSTEMS AND EQUIPMENT –
COLOUR MEASUREMENT AND MANAGEMENT –**

Part 5: Equipment using plasma display panels

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International Standard IEC 61966-5 has been prepared by technical area 2: Colour measurement and management of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 2000. This edition includes the following significant technical changes with respect to the previous edition: Annex A has been deleted as it is no longer relevant.

This bilingual version (2012-11) corresponds to the monolingual English version, published in 2008-11.

The text of this standard is based on the following documents:

CDV	Report on voting
100/1295/CDV	100/1387/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61966 series, under the general title *Multimedia systems and equipment – Colour measurement and management*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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INTRODUCTION

A series of methods and parameters for colour measurements and management for use in multimedia systems and equipment is applicable to the assessment of colour production and reproduction. This part of IEC 61966 deals with equipment using plasma display panels (PDP) to display colour images for use in multimedia applications.

The methods of measurement standardized in this part of IEC 61966 are designed to make possible the objective performance assessment and characterization of colour reproduction of PDP displays which accept red – green – blue analogue or digital signals from electrical input terminals and output colour images on PDP display screens. For PDP displays 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 equipment specific colour control in order to enable colour management in open multimedia systems.

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MULTIMEDIA SYSTEMS AND EQUIPMENT – COLOUR MEASUREMENT AND MANAGEMENT –

Part 5: Equipment using plasma display panels

1 Scope

This part of IEC 61966 defines input test signals, measurement conditions, methods of measurement and reporting of the measured data, to be used for colour characterization and colour management of plasma display panels in multimedia systems.

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

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.

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

IEC 61966-3:2000, *Multimedia systems and equipment – Colour measurement and management – Part 3: Equipment using cathode ray tubes*

ISO 5-4:1995, *Photography – Density measurements – Part 4: Geometric conditions for reflection density*

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

ISO/CIE 10526:1999, *CIE standard illuminants for colorimetry*

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

CIE 15:2004, *Colorimetry*

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 PDP display other than the interested area of a colour patch

3.2 colour control

effort to convert equipment dependent colour image data to equipment independent data for a specific colour space including tone characteristics

3.3

colour patch, test area

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

3.4

CRT

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

3.5

PDP display

any multimedia equipment using plasma display panels to present colour images

3.6

effective screen height

vertical dimension of the effective screen area

3.7

effective screen area

area where a picture can be produced

3.8

normalized (image) signal

input signal normalized by its full scale value, whose level is of interest in calculation and evaluation of colour control function within PDP display, see also equation (1)

3.9

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

NOTE See also [16]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.

A	display area ratio
N	number of bits in digital data for each channel
M	maximum integer for non-negative N -bit system; $M = 2^{N-1}$
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	one of measured raw data using spectroradiometers and colorimeters corresponding to tristimulus values
Y	one of measured raw data using spectroradiometers and colorimeters corresponding to tristimulus values in candela per square metre
Z	one of measured raw data using spectroradiometers and colorimeters corresponding to tristimulus values
R'	linearized data for red channel taking into account the tone characteristics of the channel
G'	linearized data for green channel taking into account the tone characteristics of the channel
B'	linearized data for blue channel taking into account the tone characteristics of the channel
X'	one of the tristimulus values normalized by Y_n (candela per square metre) for peak white
Y'	one of the tristimulus values normalized by Y_n (candela per square metre) for peak white
Z'	one of the tristimulus values normalized by Y_n (candela per square metre) for peak white

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 reflected illumination caused by the ambient objects (desktop, wall, etc.) and to direct illumination from light-emitting indicators of measuring instruments.

A 1 h warm-up time should precede the measurements in 7.2, 9.2, 10.2, 11.2 and 14.2, if not specified by the manufacturer of the equipment.

The mains voltage and frequency shall be at the rated values specified by the manufacturer of a PDP display. When the mains voltage fluctuates, a regulated power supply should be used to maintain the supply voltage 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 the measurements.

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

5.2 Conditions of measurements

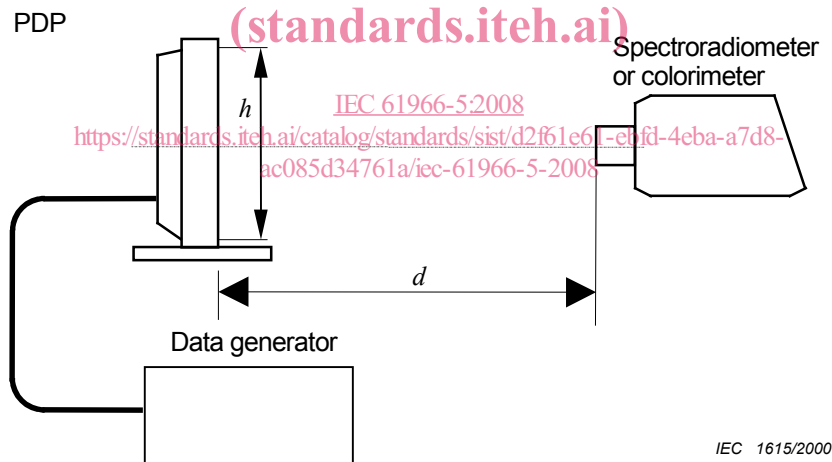
Contrast, brightness and additional adjustments shall be set to the preset positions specified by the manufacturer of the PDP display under measurement. When the adjustment is set to a position other than the preset, the position or corresponding value should be reported with the results of the measurements.

The equipment arrangement for non-contact measurements should 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 normal to the centre of the surface of the PDP display.

The distance d between the faceplate of the PDP display and the measuring instrument shall be $4h$ or larger, where h is the effective screen height of the display, see Figure 1.

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

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



h the effective screen height

Figure 1 – Equipment arrangement for non-contact measurements

The equipment arrangement for contact measurements should be as shown in Figure 2, where a measurement probe is placed on the faceplate of the PDP display.

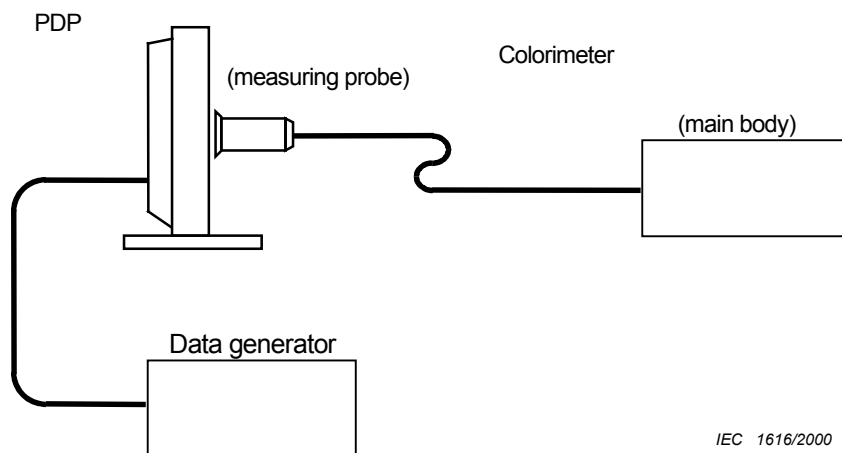
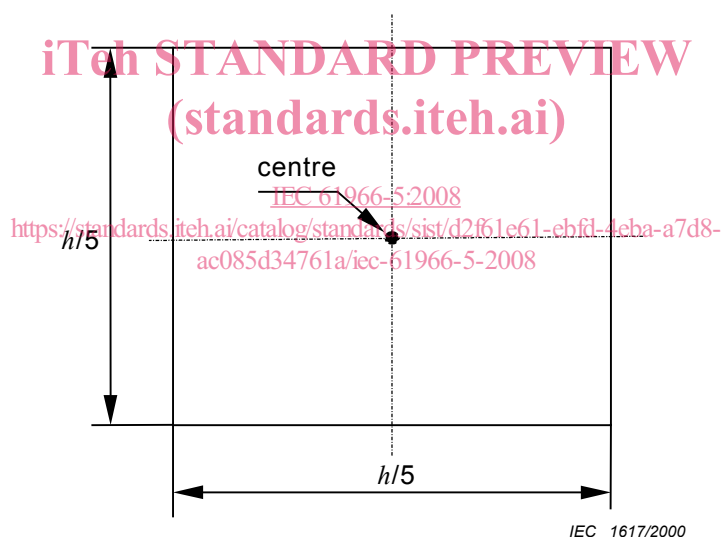


Figure 2 – Equipment arrangement for contact measurements

Test signals applied to red, green and blue channels shall result in a colour patch of the size shown in Figure 3 on the PDP display. The positioning of the colour patch shall be referred to by the centre as in Figure 3. The background shall be black, unless otherwise specified.



h the effective screen height

Figure 3 – Size of a colour patch

The area for measurement shall be circular, centred on the colour patch, with a diameter between $0,05 h$ and $0,15 h$.

5.3 Input digital data

The relationship between input digital data, D_R, D_G, D_B , of N bits and corresponding normalized signal level for calculation shall be

$$R_i = \frac{D_{R_i}}{2^N - 1} \quad (1a)$$

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

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

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

NOTE When the input signal is applicable in analogue voltage, the signal level normalized by the maximum input voltage should correspond to the signal level for each step defined in equation (1).

6 Measurement equipment

6.1 Spectroradiometer

A spectroradiometer with the following specifications should be used for the measurements:

- a) wavelength range including 380 nm to 780 nm
- b) field of view between 0,1° and 2,0°
- c) wavelength uncertainty less than 0,5 nm throughout the wavelength range
- d) scanning interval 5 nm or less
- e) bandpass 5 nm or less
- f) repeatability 0,001 in *x, y* and 0,5 % in luminance (cd/m²)
- g) uncertainty 0,005 in *x, y* for red, green, blue and white of a CRT and 4 % in luminance (cd/m²) for white of the CRT that has a definite *x, y* and luminance value

The (*x, y*) is the CIE 1931 chromaticity coordinate specified in CIE 15.

NOTE 1 Periodic calibration should be done with a standard source of known spectral power distribution.

NOTE 2 Further technical details of the design, characterization, and calibration of spectroradiometers can be found in CIE 63 [17] and JIS Z 8724 [7].

NOTE 3 The standard CRT is referred to because no standard PDP displays exist at the time of publication of this part of IEC 61966. When it is available, the standard CRT should be replaced by the standard PDP display.

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

6.2 Colorimeter

The colorimeter should have the following specifications:

- | | | |
|----|-------------------------------------|--|
| a) | measurement area
(contact type) | 0,05 h to 0,15 h , where h is the effective screen height of the PDP display |
| b) | field of view
(non-contact type) | any value between 0,1° and 2,0° |
| c) | spectral responsivity | compliant to the CIE 2-degree colour matching functions as defined in ISO/CIE 10527 |
| d) | repeatability | 0,001 in x, y and 0,5 % for luminance |
| e) | uncertainty | 0,005 in x, y for red, green, blue and white of the CRT and 4 % in luminance (cd/m^2) for white of the CRT that has a definite x, y and luminance value |

The (x, y) is the CIE 1931 chromaticity coordinate defined in CIE 15.

NOTE 1 If the original uncertainty of the colorimeter does not meet this recommendation, correction methods are available to improve the accuracy for the PDP display measurement. (See [5], [6] and [11].)

NOTE 2 The instrument should be calibrated periodically to assure the uncertainty recommendation given in item e) above.

NOTE 3 The standard CRT is referred to because no standard PDP displays exist at the time of publication of this part of IEC 61966. When it is available, the standard CRT should be replaced by the standard PDP display.

The readings of the colorimeter, X , Y (in candela per square metre), and Z shall be normalized by the luminance level of a peak neutral colour (white), Y_n (in candela per square metre), as follows:

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$$X' = \frac{X}{Y_n} \quad (2a)$$

$$Y' = \frac{Y}{Y_n} \quad (2b)$$

$$Z' = \frac{Z}{Y_n} \quad (2c)$$

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

NOTE 4 It is known that small tilt angles of the contact-measuring head on the surface of the PDP display can lead with some instruments to large chromaticity errors. Therefore, care should be taken.

NOTE 5 Synchronization of the colorimeter and scan timing of the PDP display should be taken into account.

7 Spectral characteristics and intensity of the primaries and white

7.1 Characteristics to be measured

Spectral radiance distributions and corresponding tristimulus values for the peak of three primaries, red – green – blue, as well as white.

7.2 Measurement conditions

The arrangement of equipment shall be as in Figure 1 with the spectroradiometer.