

Multimedia systems and equipment — Colour measurement and management —

Part 9: Digital cameras

The European Standard EN 61966-9:2004 has the status of a
British Standard

ICS 33.160.60; 35.040; 37.040

National foreword

This British Standard is the official English language version of EN 61966-9:2004. It is identical with IEC 61966-9:2003. It supersedes BS EN 61966-9:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio, visual and multimedia systems and equipment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 31 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 January 2005

© BSI 28 January 2005

ISBN 0 580 45329 4

English version

**Multimedia systems and equipment –
Colour measurement and management
Part 9: Digital cameras
(IEC 61966-9:2003)**

Systèmes et appareils multimedia -
Mesure et gestion de la couleur
Partie 9: Appareils numériques
de prise de vue
(CEI 61966-9:2003)

Multimediasysteme und -geräte -
Farbmessung und Farbmanagement
Teil 9: Digitale Kameras
(IEC 61966-9:2003)

This European Standard was approved by CENELEC on 2004-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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

Foreword

The text of the International Standard IEC 61966-9:2003, prepared by IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the formal vote and was approved by CENELEC as EN 61966-9 on 2004-09-01 without any modification.

This European Standard supersedes EN 61966-9:2000.

The European Standard includes the following significant technical changes from EN 61966-9:2000:

- a) in the light of issuing EN 61966-2-2, the relevant reference to EN 61966-2-1 in Annex C has been replaced by EN 61966-2-2 together with sRGB by scRGB;
- b) Annex C has been replaced and Figure C.1 has been deleted.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2005-09-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-09-01

Endorsement notice

The text of the International Standard IEC 61966-9:2003 was approved by CENELEC as a European Standard without any modification.

CONTENTS

1	Scope	5
2	Normative references	5
3	Terms and definitions	6
4	Conditions	6
4.1	Environmental conditions	6
4.2	Conditions of measurements	6
5	Measurement equipment	8
5.1	Spectral light source	8
5.2	Colour temperature conversion filter	8
5.3	Dark box	8
5.4	Test charts	10
5.5	Radiance meter	12
5.6	Spectro-radiometer	13
5.7	Luminance meter	13
6	Tone characteristics	13
6.1	Characteristics to be measured	13
6.2	Measurement conditions	13
6.3	Method of measurement	14
6.4	Presentation of results	14
7	Spectral responsivity characteristics	16
7.1	Characteristics to be measured	16
7.2	Measurement conditions	16
7.3	Method of measurement	16
7.4	Presentation of results	17
8	Spectral distribution of built-in electronic flash	18
8.1	Characteristics to be measured	18
8.2	Measurement conditions	18
8.3	Method of measurement	18
8.4	Presentation of results	19
9	Spatial non-uniformity	19
9.1	Characteristics to be measured	19
9.2	Measurement conditions	19
9.3	Method of measurement	19
9.4	Presentation of results	20
	Annex A (normative) Letters and symbols	22
	Annex B (informative) Procedure to calculate the inverse function	23
	Annex C (informative) Example of the use of the reported results for colour management	24
	Annex D (normative) Method to compensate spectral responsivity characteristics at the neutral point	27
	Annex E (informative) Automated extraction of data from the test chart image	28
	Annex ZA (normative) Normative references to international publications with their corresponding European publications	
	Bibliography	31

Figure 1 – Equipment arrangement for measurements 7

Figure 2 – Dark box 9

Figure 3 – Test chart 1 10

Figure 4 – Test chart 2 with replaceable chip *i* 11

Figure 5 – Test chart 3 11

Figure 6 – Example plot of tone characteristics (correlated colour temperature: 5 500 K).....15

Figure 7 – Example of spectral responsivity characteristics (correlated colour temperature: 5 500 K).....18

Figure 8 – Example of the spectral distribution characteristics of a built-in electronic flash.....19

Figure 9 – Equipment arrangement for measurement of spatial non-uniformity 20

Figure C.1 – An example of spectral responsivity controlled to approximate the ideal scRGB characteristics superimposed as the broken curves.....26

Figure E.1 – Example to compare a typical optical viewfinder area and the corresponding image sensible area (outer rectangle) 28

Figure E.2 – Test chart with extended orientation markers 28

Table 1 – Nominal reflectances of the grey-scale section and the grey chips 12

Table 2 – Example of tone characteristics (correlated colour temperature: 5 500 K) 15

Table 3 – An example of reporting form for spatial non-uniformity 21

MULTIMEDIA SYSTEMS AND EQUIPMENT – COLOUR MEASUREMENT AND MANAGEMENT –

Part 9: Digital cameras

1 Scope

This part of IEC 61966 is applicable to the assessment of colour reproduction of digital cameras used in open computer systems and similar applications.

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 reproduction.

This standard deals with digital cameras to capture colour still images and moving images for use in multimedia applications.

The methods of measurement standardized in this standard are designed to make possible the objective performance assessment and characterization of the colour reproduction of digital cameras which can capture colour still and moving images, and output colour information corresponding to red – green – blue digital image data. The measured results are intended to be used for the purpose of colour management in multimedia systems, typically in the Internet.

This standard defines test charts, measurement conditions and methods of measurement, so as to make possible the colour management in open multimedia systems and comprehensive comparison of the results of measurements for assessment of digital cameras.

Colour control within digital cameras is outwith the scope of this part. 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*.

IEC 61146-1:1994, *Video cameras (PAL/SECAM/NTSC) – Methods of measurement – Part 1: Non-broadcast single-sensor cameras*

IEC 61966-2-1:1999, *Multimedia systems and equipment – Colour measurement and management – Part 2-1: Colour management – Default RGB colour space – sRGB*

ISO 2813:1994, *Paints and varnishes – Determination of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*

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

CIE 17.4:1987, *International lighting vocabulary*

3 Terms and definitions

For the purposes of this document, the definitions in IEC 60050-845 and CIE 17.4, as well as the following definitions, apply.

3.1

colour control

conversion of equipment-dependent colour-image data to equipment-independent data for a specific colour space including tone characteristics

3.2

digital camera

electronic imaging equipment which can capture colour still and moving images, and outputs digital image data for red – green – blue channels either by itself or using incorporated colour control software

4 Conditions

4.1 Environmental conditions

All measurements specified in this standard shall be carried out in a dark room.

Electric power to a digital camera under test shall be supplied using an a.c. adapter or batteries recommended by the manufacturer.

The mains voltage and frequency applied to the a.c. adapter shall be at the rated value specified by the manufacturer of the digital camera. When the mains voltage fluctuates, a stabilizer shall be used to attain a stability value of $\pm 5\%$ of the rated value.

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

For additional environmental conditions not specified in this subclause, if any, the specifications of the manufacturer of the digital camera shall be taken into account.

4.2 Conditions of measurements

4.2.1 Measurement arrangement

Unless otherwise specified, a shooting object shall be a test chart with the dark box shown in Figure 1. The specifications for the centre hole of the chart are given in Figure 3. Relative positions shall be selected to prevent unnecessary glare from the diffuser.

NOTE The spectral light source consisting of the lamp, the iris, the monochromator, the optical fibre and the diffuser may be configured in other ways, provided that the required specifications are met.

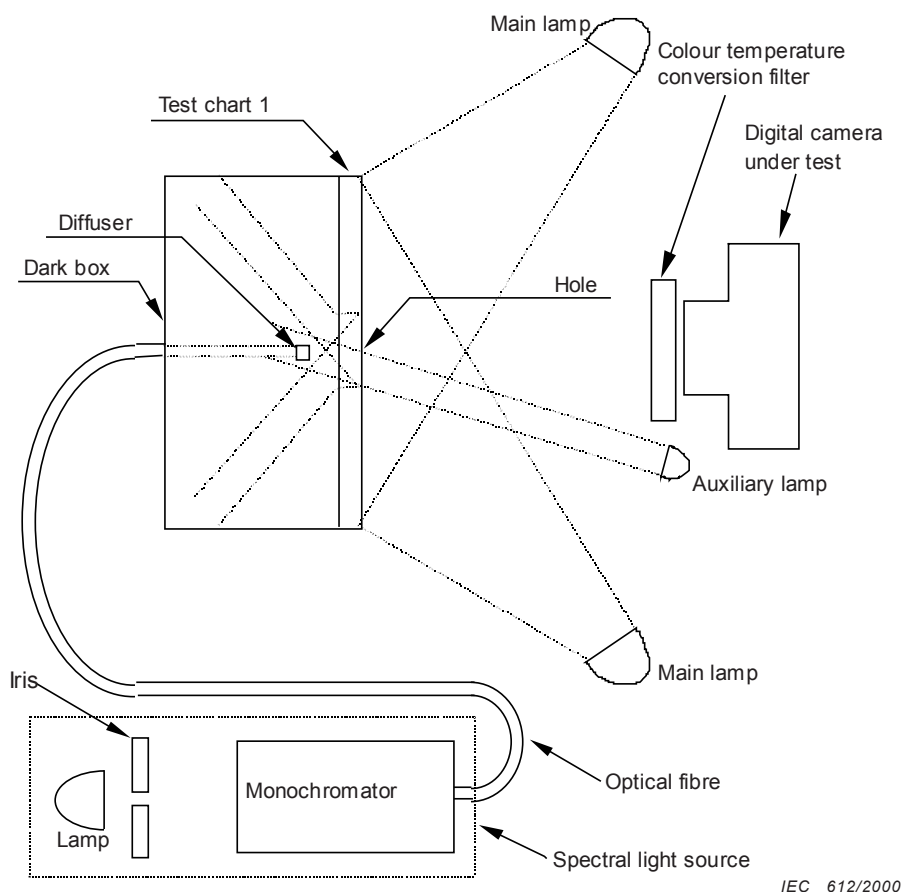


Figure 1 – Equipment arrangement for measurements

4.2.2 Illumination

Illumination of the test charts shall be performed by two or four main lamps and one auxiliary lamp depending on the characteristics to be measured. Incident lights from the main lamps shall be 45° relative to the surface of the test chart. An auxiliary lamp to illuminate the diffuser in Figure 1 is used only for the measurement specified in Clause 7. The diffuser shall not be directly illuminated by the main lamps. The main lamps and the auxiliary lamp shall be halogen lamps with a well-regulated power supply.

The correlated colour temperature of the lamps shall be $3\,100\text{ K} \pm 100\text{ K}$ as specified in IEC 61146-1. The non-uniformity of illumination shall be less than 5 %. The average illuminance on the test chart shall be $2\,000\text{ lx} \pm 100\text{ lx}$.

4.2.3 Shooting conditions

The optical axis of the digital camera under test shall coincide with the normal to the test chart.

If the digital camera under test is equipped with a zoom lens, the distance between the test chart and the digital camera under test, unless otherwise specified, shall be approximately 1,5 m. The zooming shall be adjusted so that the horizontal and vertical markers fit within the full frame of an image area.

If the digital camera under test is not equipped with a zoom lens, the distance between the test chart and the digital camera under test, unless otherwise specified, shall be adjusted so that the horizontal and vertical markers fit within the full frame of an image area.

4.2.4 Digital image data

The red – green – blue data necessary for the calculation and characterization of the digital camera under measurement shall be acquired and recorded depending on the cases described below.

- a) If red – green – blue digital image data are obtained direct from the digital camera under test, the values shall be recorded.
- b) If red – green – blue digital image data are not directly obtainable, they should be calculated by the manufacturer's driver software.
- c) If red – green – blue digital image data are calculated by any independent application software on the digital camera under measurement, the name and version of the software shall be reported together with the values.

5 Measurement equipment

5.1 Spectral light source

The spectral light source consists of a halogen lamp powered by a well-regulated d.c. electric power source, an iris, a monochromator and an optical fibre with a diffuser as in Figure 1. Specifications of the constituent parts of the equipment arrangement should be as follows.

a) Output of spectral light source

- 1) Diameter of the diffuser: approximately $\frac{1}{45}h$
- 2) Radiance: more than 10 mW/sr/m²
- 3) Stability of light output: within $\pm 0,5\%$

NOTE An integrating sphere may be incorporated to increase uniformity.

b) Monochromator

- 1) Wavelength range: including from 380 nm to 780 nm
- 2) Spectral bandwidth: 5 nm (FWHM¹⁾), triangle
- 3) Wavelength accuracy: $\pm 0,5$ nm
- 4) Stray light: less than 10^{-4}

NOTE Higher-order spectra from the monochromator should be removed.

5.2 Colour temperature conversion filter

The amount of reciprocal correlated colour temperature change shall be -140 MK^{-1} in order to achieve $5\,500 \text{ K} \pm 300 \text{ K}$.

5.3 Dark box

The dark box for the measurements should be as shown in Figure 2. The reflectance of the inside of the dark box shall be less than 2 %. The accuracy of the dimensions should be within $\pm \frac{1}{50}h$. The geometrical specification of the holes whose positions are designated by "0" shall be as in Figure 3.

1) FWHM stands for full-width half maximum.

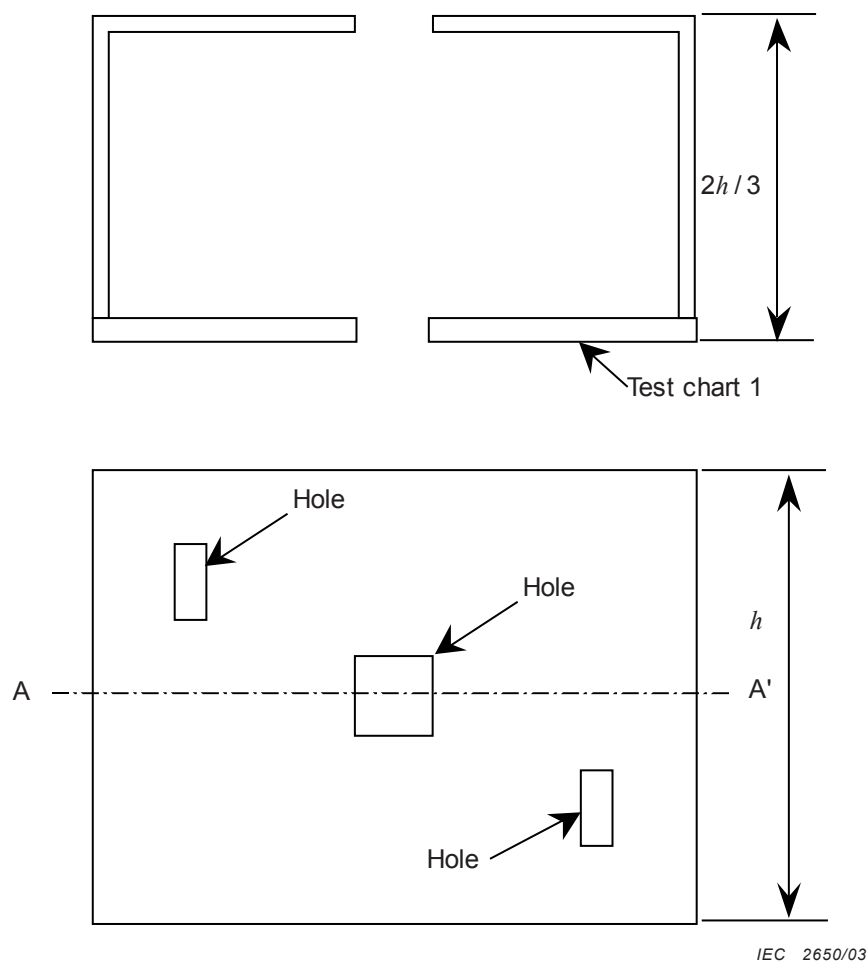


Figure 2 – Dark box