

INTERNATIONAL STANDARD

IEC
61966-9

First edition
2000-06

Multimedia systems and equipment – Colour measurement and management –

Part 9: Digital cameras

*Systèmes et appareils multimedia –
Mesure et gestion de la couleur –*

*Partie 9:
Appareils numériques de prise de vue*

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For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembé Geneva, Switzerland
e-mail: inmail@iec.ch

IEC web site <http://www.iec.ch>



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Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MULTIMEDIA SYSTEMS AND EQUIPMENT – COLOUR MEASUREMENT AND MANAGEMENT –

Part 9: Digital cameras

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this international standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61966-9 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

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

| | |
|--------------|------------------|
| FDIS | Report on voting |
| 100/130/FDIS | 100/151/RVD |

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

IEC 61966 consists of the following parts, under the general title: Multimedia systems and equipment – Colour measurement and management:

- Part 1: General
- Part 2-0: Colour management
- Part 2-1: Colour management – Default RGB colour space – sRGB
- Part 2-2: Colour management – Extended RGB colour space – sRGB64
- Part 3: Equipment using cathode ray tubes
- Part 4: Equipment using liquid crystal display panels
- Part 5: Equipment using plasma display panels
- Part 6: Equipment for use on digital data projections
- Part 7-1: Colour printers – Reflective prints – RGB inputs
- Part 7-2: Colour printers – Reflective prints – CMYK inputs
- Part 7-3: Colour printers – Transparent prints
- Part 8: Multimedia colour scanners
- Part 9: Digital cameras
- Part 10: Quality assessment – Colour image in network systems
- Part 11: Quality assessment – Impaired video in network systems

Annexes A and D form integral parts of this standard.

Annexes B, C and E are for information only.

A bilingual version of this publication may be issued at a later date.

The committee has decided that the contents of this publication will remain unchanged until 2003. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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.

Part 9 deals with digital cameras to capture colour still images and moving 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 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 part of IEC 61966 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 out of 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 International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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*.

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/CIE 10527:1991, *Colorimetric observers*

CIE 15.2:1986, *Colorimetry*

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

3 Terms and definitions

For the purpose of this part of IEC 61966, the definitions in IEC 60050(845), CIE 17.4 and 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, 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. Specifications of a centre hole of the chart are given in figure 3. Relative positions shall be selected to prevent unnecessary glare of 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.

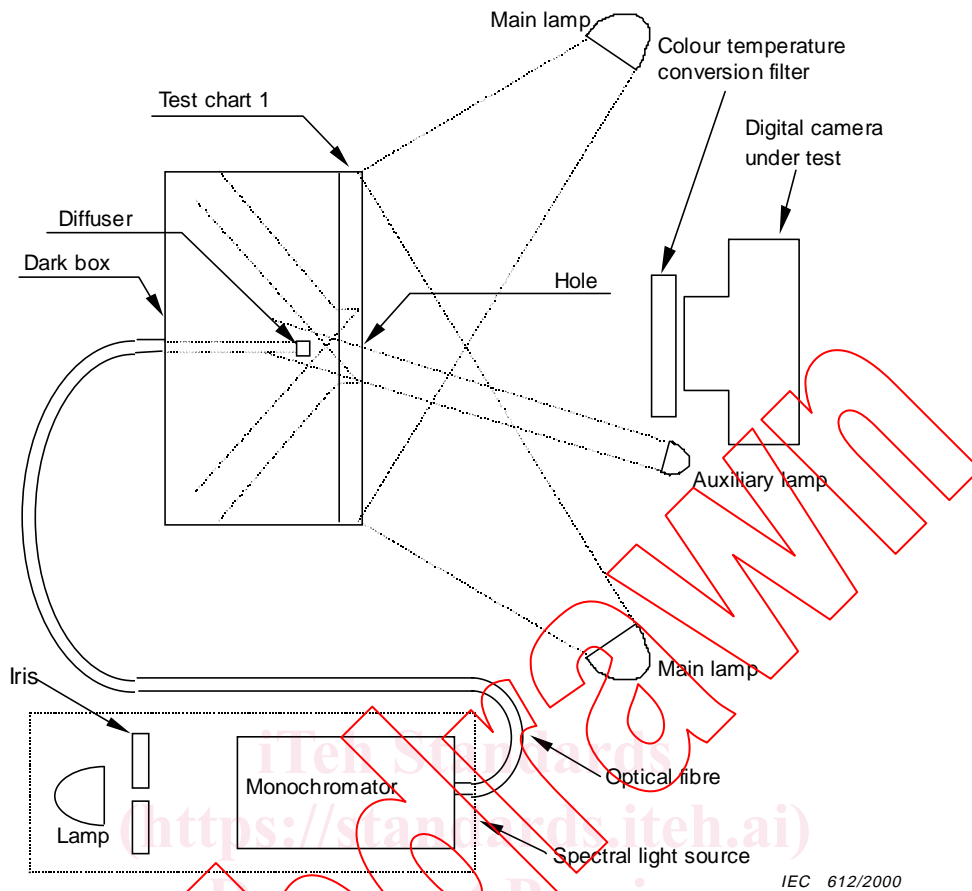


Figure 1 – Equipment arrangement for measurements

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 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 calculation and characterization of the digital camera under measurements shall be acquired and recorded depending on the cases as described below:

- a) If red – green – blue digital image data are directly obtained 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 in 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

A dark box for the measurements should be as shown in figure 2. Reflectance of the inside of the dark box shall be less than 2 %. Accuracy of the dimensions should be within $\pm \frac{1}{50}h$.

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."