

INTERNATIONAL STANDARD

IEC
61966-9

Second edition
2003-11

Multimedia systems and equipment – Colour measurement and management –

Part 9: Digital cameras

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

*Partie 9:
Appareils numériques de prise de vue*

<https://standards.iteh.ai/catalog/standards/iec/64dd1d9b-1881-4c06-b6de-bca1526c28eb/iec-61966-9-2003>



Reference number
IEC 61966-9:2003(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications (www.iec.ch/online_news/justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre: custserv@iec.ch

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC
61966-9

Second edition
2003-11

Multimedia systems and equipment – Colour measurement and management –

Part 9: Digital cameras

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

*Partie 9:
Appareils numériques de prise de vue*

<https://standards.iteh.ai/catalog/standards/iec/64dd1d9b-1881-4c06-b6de-bca1526c28eb/iec-61966-9-2003>

© IEC 2003 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

V

For price, see current catalogue

CONTENTS

| | |
|---|----|
| FOREWORD | 4 |
| 1 Scope | 6 |
| 2 Normative references | 6 |
| 3 Terms and definitions | 7 |
| 4 Conditions | 7 |
| 4.1 Environmental conditions | 7 |
| 4.2 Conditions of measurements | 7 |
| 5 Measurement equipment | 9 |
| 5.1 Spectral light source | 9 |
| 5.2 Colour temperature conversion filter | 9 |
| 5.3 Dark box | 9 |
| 5.4 Test charts | 11 |
| 5.5 Radiance meter | 13 |
| 5.6 Spectro-radiometer | 14 |
| 5.7 Luminance meter | 14 |
| 6 Tone characteristics | 14 |
| 6.1 Characteristics to be measured | 14 |
| 6.2 Measurement conditions | 14 |
| 6.3 Method of measurement | 15 |
| 6.4 Presentation of results | 15 |
| 7 Spectral responsivity characteristics | 17 |
| 7.1 Characteristics to be measured | 17 |
| 7.2 Measurement conditions | 17 |
| 7.3 Method of measurement | 17 |
| 7.4 Presentation of results | 18 |
| 8 Spectral distribution of built-in electronic flash | 19 |
| 8.1 Characteristics to be measured | 19 |
| 8.2 Measurement conditions | 19 |
| 8.3 Method of measurement | 19 |
| 8.4 Presentation of results | 20 |
| 9 Spatial non-uniformity | 20 |
| 9.1 Characteristics to be measured | 20 |
| 9.2 Measurement conditions | 20 |
| 9.3 Method of measurement | 20 |
| 9.4 Presentation of results | 21 |
| Annex A (normative) Letters and symbols | 23 |
| Annex B (informative) Procedure to calculate the inverse function | 24 |
| Annex C (informative) Example of the use of the reported results for colour management | 25 |
| Annex D (normative) Method to compensate spectral responsivity characteristics at the neutral point | 28 |
| Annex E (informative) Automated extraction of data from the test chart image | 29 |
| Bibliography | 31 |

| | |
|--|----|
| Figure 1 – Equipment arrangement for measurements | 8 |
| Figure 2 – Dark box | 10 |
| Figure 3 – Test chart 1 | 11 |
| Figure 4 – Test chart 2 with replaceable chip <i>i</i> | 12 |
| Figure 5 – Test chart 3 | 12 |
| Figure 6 – Example plot of tone characteristics (correlated colour temperature: 5 500 K)..... | 16 |
| Figure 7 – Example of spectral responsivity characteristics (correlated colour temperature: 5 500 K)..... | 19 |
| Figure 8 – Example of the spectral distribution characteristics of a built-in electronic flash..... | 20 |
| Figure 9 – Equipment arrangement for measurement of spatial non-uniformity | 21 |
| Figure C.1 – An example of spectral responsivity controlled to approximate the ideal sRGB characteristics superimposed as the broken curves..... | 27 |
| Figure E.1 – Example to compare a typical optical viewfinder area and the corresponding image sensible area (outer rectangle) | 29 |
| Figure E.2 – Test chart with extended orientation markers | 29 |
| Table 1 – Nominal reflectances of the grey-scale section and the grey chips | 13 |
| Table 2 – Example of tone characteristics (correlated colour temperature: 5 500 K) | 16 |
| Table 3 – An example of reporting form for spatial non-uniformity | 22 |

Document Preview

[IEC 61966-9:2003](https://standards.iteh.ai/catalog/standards/iec/64dd1d9b-1881-4c06-b6de-bca1526c28eb/iec-61966-9-2003)

<https://standards.iteh.ai/catalog/standards/iec/64dd1d9b-1881-4c06-b6de-bca1526c28eb/iec-61966-9-2003>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTIMEDIA SYSTEMS AND EQUIPMENT –
COLOUR MEASUREMENT AND MANAGEMENT –****Part 9: Digital cameras**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. 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.

This second edition cancels and replaces the first edition published in 2000. This edition includes the following significant technical changes from the previous edition.

- a) In the light of issuing IEC 61966-2-2, the relevant reference IEC 61966-2-1 in Annex C has been replaced by IEC 61966-2-2 together with sRGB by scRGB.
- b) The previous Annex C has been replaced by the new Annex C where the previous Figure C.1 has been deleted.

The text of this standard was submitted to the national committees for voting under the Fast Track Procedure as the following documents:

| CDV | Report on voting |
|-------------|------------------|
| 100/666/CDV | 100/722/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.

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

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 – scRGB
- Part 3: Equipment using cathode ray tubes
- Part 4: Equipment using liquid crystal display panels
- Part 5: Equipment using plasma display panels
- Part 6: Front projection displays
- Part 7-1: Colour printers – Reflective prints – RGB inputs
- Part 7-2: Colour printers – Reflective prints – CMYK inputs
- 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

The committee has decided that the contents of this publication will remain unchanged until 2008. 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.

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. [61966-9:2003](https://standards.iteh.ai/catalog/standards/iec/64dd1d9b-1881-4c06-b6de-bca1526c28eb/iec-61966-9-2003)

<https://standards.iteh.ai/catalog/standards/iec/64dd1d9b-1881-4c06-b6de-bca1526c28eb/iec-61966-9-2003>

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.

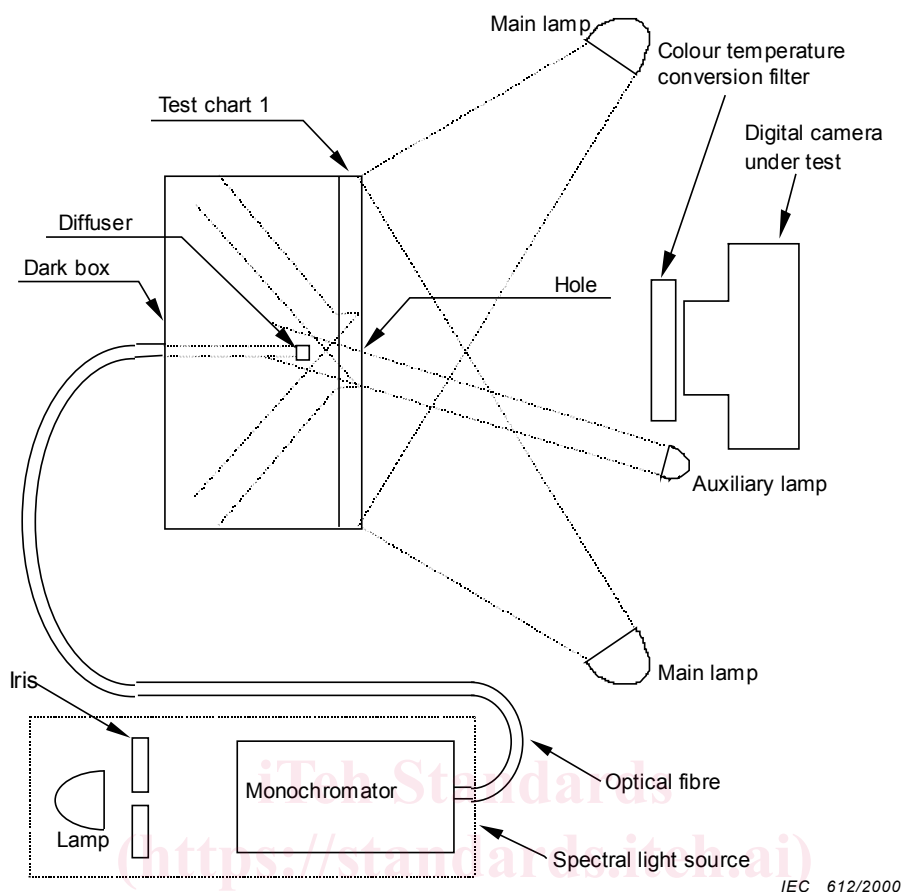


Figure 1 – Equipment arrangement for measurements

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 K ± 100 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 lx ± 100 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.