

INTERNATIONAL STANDARD

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First edition
2001-05

**Multimedia systems and equipment –
Colour measurement and management –**

**Part 7-1:
Colour printers – Reflective prints –
RGB inputs**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTIMEDIA SYSTEMS AND EQUIPMENT –
COLOUR MEASUREMENT AND MANAGEMENT –**
Part 7-1: Colour printers – Reflective prints – RGB inputs

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.
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International Standard IEC 61966-7-1 has been prepared by TC 100/TA 2: Colour measurement and management, of 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
100/238/FDIS	100/248/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.

Annexes A, B and C form an integral part of this standard.

Annexes D, E and F are for information only.

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 in multimedia systems
- Part 2-1: Colour management – Default RGB colour space – sRGB
- Part 2-2: Colour management – Extended RGB colour space – sRGB64
- Part 2-3: Colour management – Default YCC colour space – sYCC
- 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 used for digital image projection
- 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

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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- withdrawn;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

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

INTRODUCTION

This part of IEC 61966 is applicable to characterization of colour printers that produce colour images on opaque substrate corresponding to digital data files in which colour image information is expressed in a red – green – blue colour space. The characterization will be realized by objective measurements to be utilized for colour management in open systems. The measured and reported results are used to relate the equipment-dependent and undefined red – green – blue colour space to the default RGB colour space defined as the sRGB by IEC 61966-2-1. This standard is also applicable to assessment of colour image attributes on reflective prints reproduced from colour digital image files.

Withdrawing

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MULTIMEDIA SYSTEMS AND EQUIPMENT – COLOUR MEASUREMENT AND MANAGEMENT –

Part 7-1: Colour printers – Reflective prints – RGB inputs

1 Scope

This part of IEC 61966 specifies a set of data in colour digital image files for measurements, sampling of successive prints, measurement conditions and forms of reporting the results so as to make possible the characterization of the colour printer and comparison of the results of measurements. The sets of data for measurements are in colour digital image files expressed in a red – green – blue colour space, to which corresponding colour images are reproduced on reflective substrate. The methods of measurement in this standard are designed to be applicable to reflective colour prints for consumer use. The reflective colour prints may be produced by non-impact colour printers, incorporating such technologies as ink-jet, sublimation transfer, thermal transfer, electro-photography and other similar technologies.

This standard does not specify limiting values for various attributes.

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)

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 10526: 1999, *CIE standard illuminants for colorimetry*

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

CIE 15.2:1986, *Colorimetry*

ISO 216:1975, *Writing paper and certain classes of printed matter – Trimmed sizes – A and B series*

3 Terms and definitions

For the purpose of this part of IEC 61966, terms which relate to lighting in IEC 60050(845)/CIE 17.4 and the following definitions apply.

3.1

colour printer

system composed of application program to handle colour digital image files, driver for equipment that produces colour images on a substrate, and the equipment itself which accepts equipment specific data for each input channel and is able to process by such technologies as ink jet, sublimation transfer, thermal transfer, or electro-photography and other similar technologies

NOTE The colour printer includes a system whereby the equipment that reproduces prints is directly connected to another piece of equipment in which a set of colour digital image data is contained.

3.2

driver

software code which converts output data from an application program to feed a series of digital signals to the equipment which produces reflective prints

3.3

application program

any software which has access to the colour digital image file and output colour image information to the driver, and possibly renders the colour image on displays

3.4

consumable

any material necessary to run colour printers; for example, sheets of paper, toners, ink, fuser oil, etc.

3.5

half-tone screen

set of rules for two dimensional pixel layouts to render a tone

3.6

image

visible two-dimensional representation of electronic signals intended to form a picture

3.7

substrate

opaque substance providing support for a medium

3.8

reflective print

colour image reproduced on a piece of substrate

3.9

gamut of colours

three-dimensional maximum range of reproducible colours expressed in CIE 1976 $L^*a^*b^*$ colour space defined in CIE 15.2

3.10

primary colours

colours used to define a colour space incorporated in the colour digital image file

NOTE Red, green and blue are the primary colours for this standard.

3.11

secondary colours

colours to be defined by a mixture of two primary colours except black

NOTE Cyan, magenta and yellow are the secondary colours for this standard.

3.12**saturated colours**

primary colours and secondary colours intended to be reproduced corresponding to their maximum excitation of electronic signals

NOTE Saturation means the maximum excitation purity (chromaticity), limited by each specific system.

3.13**reproduced colours**

colorimetric information measured from the reflective print, expressed in the CIE 1976 colour space defined in CIE 15.2

3.14**tone reproduction**

relationship between data in the colour digital image file which are intended to reproduce the images of primary, secondary and achromatic colours and the CIE 1976 lightness values of reflective prints actually reproduced

3.15**characterization**

process of obtaining the spectral characteristics, basic colorimetric characteristics, tone reproduction characteristics, spatial non-uniformity characteristics, temporal instability characteristics or dependency on illuminant characteristics. In general, these characteristics relate the input RGB signal to some measured CIE colour values

3.16**electronic signal**

data prepared as a colour digital image file intended to form a picture

4 Letters and symbols

The letters and symbols consistently adopted in this part of IEC 61966 are summarized below.

N_s	The number of samples of reflective prints for measurements
N_u	Metric in colour difference ΔE_{ab}^* for spatial non-uniformity within a page
N_t	Metric in colour difference ΔE_{ab}^* for short-term instability among successive reflective prints
p	Printing speed of the colour printer
$S(\lambda)$	Spectral power distribution of the illuminant D50
$\rho(\lambda)$	Spectral reflectance of a printed image
D_R, D_G, D_B	Digital data in integers fed to colour printers
R, G, B	Data normalized by $2^N - 1$, where N is the number of bits per channel
$\tilde{L}^*, \tilde{a}^*, \tilde{b}^*$	Colour in CIE 1976 UCS in reference to printed colour white, see also equation (4)

5 Conditions

5.1 Environmental conditions

Sampling and measurements shall be carried out within the environmental conditions specified by the manufacturer of the equipment that produces reflective prints, unless otherwise specified by this standard. The environmental conditions, at least the room temperature and the relative humidity, during sampling and measurement, shall be reported together with the presentation of the results of measurements.

NOTE Recommended environmental conditions are a temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, a relative humidity of $65\% \pm 10\%$ and atmospheric pressure from 86 kPa to 106 kPa, unless otherwise specified.

5.2 Sampling conditions

5.2.1 Substrate

The substrate shall be opaque as specified by the manufacturer of the equipment that produces reflective prints as either recommended or default. The substrate shall be exposed for at least one day in order to be accustomed to the environmental conditions.

5.2.2 Settings and operation

5.2.2.1 Half-tone screen

All sampling shall be carried out in the half-tone screen mode whenever applicable. This shall be as specified by the manufacturer of the equipment that produces reflective prints as either recommended or default. When multiple options such as half-tone screen for texts, graphics, and natural pictures are available, the choices shall be reported together with the presentation of the results of measurements.

If the half-tone screen is not applicable, this shall be reported together with the presentation of the results.

5.2.2.2 Resolution

All sampling shall be carried out with the resolution setting specified by the manufacturer of the equipment that produces reflective prints as either recommended or default. When multiple options such as resolution for texts, graphics, natural pictures are available, the choices shall be reported together with the presentation of the results of measurements.

5.2.2.3 Miscellaneous settings

Colour rendering, digital filtering and tone reproduction characteristics shall be set as specified by the manufacturer of the printing equipment that produces reflective prints as either recommended or default.

The application programme used should provide no extra colour processing or enhancement. Otherwise, a type of colour processing or enhancement shall be reported.

5.2.3 Number of samples

To minimize an error due to short-term variation and non-uniformity within a page, the number of samples of reflective prints N_s should be decided by equation (1), except for clause 9, and subclauses 10.1 and 10.2.

$$N_s = \sqrt{N_u^2 + N_t^2} \quad (1)$$