

Nederlandse norm

NEN-ISO 12640-5

(en)

Graphic technology - Prepress digital data exchange - Part 5: Scene-referred standard colour image data (RIMM/SCID) (ISO 12640-5:2013, IDT)

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Preview

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Preview

COLOUR

**Graphic technology — Prepress digital
data exchange —**

**Part 5:
Scene-referred standard colour image
data (RIMM/SCID)**

*Technologie graphique — Échange de données numériques de
préimpression —*

*Partie 5: Données d'image standard en couleurs montrées en
référence par scène (RIMM/SCID)*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword – Supplementary information

The committee responsible for this document is Technical Committee ISO/TC 130, *Graphic technology*.

ISO 12640 consists of the following parts, under the general title *Graphic technology — Prepress digital data exchange*:

- Part 1: *CMYK standard colour image data (CMYK/SCID)*
- Part 2: *XYZ/sRGB standard colour image data (XYZ/SCID)*
- Part 3: *CIELAB standard colour image data (CIELAB/SCID)*
- Part 4: *Wide gamut display-referred standard colour image data (Adobe RGB(1998)/SCID)*
- Part 5: *Scene-referred standard colour image data (RIMM/SCID)*

Introduction

0.1 Need for standard colour image data

Standard colour image data provide a set of data that can be used for any of the following tasks:

- evaluating the colour reproduction of imaging systems;
- evaluating colour image output devices;
- evaluating the effect of image processing algorithms applied to the images;
- evaluating the coding technologies necessary for the storage and transmission of high-definition image data, etc.

These standard, well-defined image data sets, are typical of the high quality image content commonly encountered when capturing and printing images. Users can therefore be confident that the images should produce good quality reproductions if properly rendered, and that they provide a reasonable test of the evaluation task being undertaken. No limited set of images can fully test any system, but the sets provided give as reasonable a test as can be expected from a limited image set. Furthermore, the existence of a standard set enables users in different locations to produce comparisons without the need to exchange images prior to reproduction.

Different applications require that the standard image data be provided in different image states using different image encodings (see ISO 22028-1), so the user needs to select those appropriate to the evaluation task being undertaken. While transformation of the image data to another image state is always possible, there is, in general, no agreement amongst experts as to how this should be done. Thus, it has been considered preferable to provide data in different image states in the various parts of ISO 12640. The relationship between image states is shown in [Figure 1](#) along with the applicable parts of ISO 12640.

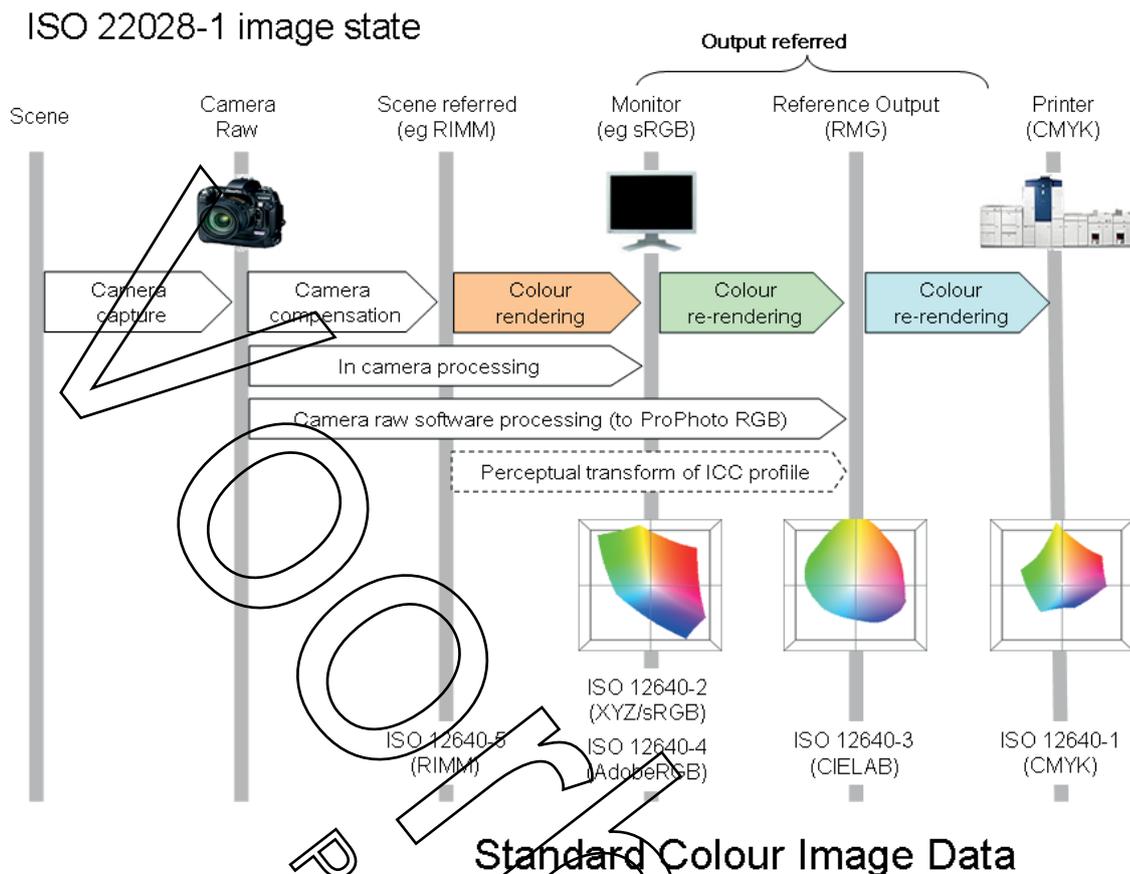


Figure 1 Relationship between image states

ISO 12640-1 provides a set of 8 bits/channel data that is defined in terms of CMYK dot percentages. The colours resulting from reproduction of CMYK data are strictly defined only at the time of printing, and as such the data are only applicable to evaluation of CMYK printing applications. Transformations to other image states and colour encodings might not be well defined. In fact, the data might not even be useful for CMYK printing processes different from those typically found in traditional graphic arts applications, as the image data are defined to produce “pleasing” images when reproduced on systems using “typical” inks and producing “typical” tone value rendering. Printing systems that use inks of a distinctly different colour, or produce a very different tone value rendering, will not reproduce them as pleasing images without a well-defined colour transformation. Moreover, with a bit depth of only 8 bits/channel, any colour transformation employed might well introduce artefacts.

ISO 12640-2 provides a set of test image data encoded both as XYZ values with each channel scaled to the range 0-65535, and as sRGB (defined in IEC 61966-2-1), with a bit depth of 8 bits/channel. (The higher bit depth for the XYZ encoding is necessary because of the perceptual non-uniformity of the linear colour space.) Both sets of data are optimized for viewing on a reference sRGB display in the reference sRGB viewing environment, and relative to CIE standard illuminant D65 for which the XYZ tristimulus values were computed prior to scaling. The images are mainly designed to be used on systems utilizing sRGB as the reference encoding, and as such are primarily applicable to systems for which a colour monitor similar to the sRGB reference display is the “hub” device. Although such systems are used for consumer photography, they are less popular in the graphic arts industry because the sRGB colour gamut is quite different in shape from the colour gamut of typical offset printing. This difference can necessitate fairly aggressive colour re-rendering to produce optimal prints from sRGB image data.

ISO 12640-3 provides a set of test image data with a large reflection medium colour gamut, illuminated using illuminant D50. The bit depth of the natural images is 16 bits/channel, while the colour charts and

vignettes are 8 bits/channel. In order to be useful for applications where large, print-referred output gamuts are encountered, common in graphic technology and photography, it was felt that it would be desirable to produce an image set in which some colours are permitted to be encoded close to the boundary of the full colour gamut attained with surface colours. Furthermore, from the perspective of colour management, it is advantageous if the images are referenced to illuminant D50, which is the predominant reference illuminant used in graphic arts and photography, both for viewing and measurement. For this reason, it has also become the predominant reference illuminant for most colour management applications.

ISO 12640-4 provides a set of wide-gamut test image data encoded as Adobe RGB with a bit depth of 16 bits/channel. These data are optimized for viewing on a reference Adobe RGB display in the reference Adobe RGB viewing environment (defined in the Adobe RGB (1998) Colour Image Encoding specification). The images are designed to be used mainly on systems utilizing Adobe RGB as the reference encoding, and as such are mainly applicable to the professional market and those systems for which the wide gamut colour monitor is the "hub" device. Such workflows are popular among professional photographers, and are increasingly used in the graphic arts. The Adobe RGB reference display colour gamut is closer to typical offset printing gamuts than the sRGB reference display colour gamut. Adobe RGB encoded images generally require much less aggressive colour re-rendering going to print than sRGB encoded images, although this difference can necessitate colour re-rendering between Adobe RGB images and sRGB images. The purpose of ISO 12640-4 is therefore to provide a test image data set with a larger colour gamut than sRGB, related to the Adobe RGB wide-gamut display-referred colour space. The bit depth of the natural images and synthetic images is 16 bits/channel.

The possible wide gamut colour encoding choices considered were Adobe RGB, opRGB (IEC 61966-2-5) and ROMM RGB (ISO 22028-2). For ISO 12640-4, it was important that the images were well-colour-rendered to a well-defined large gamut reference display, for which reason Adobe RGB was preferred over the other two choices. With opRGB, the completeness of the colour rendering is left more ambiguous, i.e. it is not as clearly output-referred, and the reference medium and viewing conditions are also slightly different. ROMM RGB (ISO 22028-2) is clearly output-referred, but the reference medium is a virtual reflection print (the ICC perceptual reference medium), so the image state is identical to that for ISO 12640-3.

This part of ISO 12640 provides a set of scene-referred test image data encoded as RIMM RGB with a bit depth of 16 bits/channel. These data are estimates of scene colorimetry obtained by capturing natural scenes using a variety of digital cameras and transforming the captured raw camera RGB signals to scene colorimetry estimates. The accuracy of these estimates is influenced by a number of factors including the degree to which the camera spectral sensitivities approximate human visual system colour matching functions, the appropriateness of the transformation from raw camera RGB signals to colorimetry estimates, optical effects such as off-axis decrease in signal, aberrations and flare, and the noise present in the camera signals. The transformations applied to obtain the colorimetry estimates were general transformations, i.e. they were not optimized for the spectral characteristics of each scene. Consequently, there can in some cases be significant errors in the estimates. The image state of these data is scene-referred because no attempt has been made to colour render the data to produce a pleasing reproduction on some output medium. The only processing applied to these data based on visual evaluation was to select the scene adopted white. This was accomplished by applying gains individually to the camera channels to achieve the desired white balance, converting to scene-referred, and then adjusting the overall gain in a linear, scene-referred working space while viewing the image with the example colour rendering transform specified in ISO/TS 22028-3:2012, Annex A, applied. Different white balances can be desired in some cases for aesthetic reasons, and different overall gains can be needed if different colour rendering transforms are used. The images provided in this part of ISO 12640 are mainly applicable for evaluating colour rendering to different output media.

0.2 Characteristics of the test images

The performance of any colour reproduction system will normally be evaluated both subjectively (by viewing the final output image) and objectively (by measurement of control elements). This requirement dictates that the test images include both natural scenes (pictures) and synthetic images (colour charts and colour vignettes). Because the results of subjective image evaluation are strongly affected by the image content, it was important to ensure that the natural images were of high quality and contained

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diverse subject matter. However, it is difficult within a single, relatively small, sample set to produce elements in the scene that contain all the subtle colour differences required in test images, and that span the full range of colours that can be encountered in real scenes. For this reason, synthetic colour charts are also included. These colour charts are limited by the integer RIMM RGB encoding and by the spectral locus (for areas where the RIMM RGB encoding extends outside the spectral locus). In the future, it is proposed to develop a second set of floating point RIMM/SCID which are not limited by the integer RIMM RGB encoding.

To obtain the images, a survey was conducted of all TC 130 member countries to identify desirable image content and to solicit submission of suitable images for consideration. The image set that resulted consists of 44 natural images, two colour charts and a series of colour vignettes. The natural images include flesh tones, hair, foliage, water, sky, flowers and other memory colours in scenes with a variety of dynamic ranges.

0.3 File format of the digital test images

All of the images consist of pixel interleaved data (R then G then B), with the data origin at the upper left of the image, as viewed naturally, and organized by rows. These data are included as individual files within this part of ISO 12640. The image file format is as specified in ISO 12639 (TIFF/IT). A RIMM RGB ICC profile meeting the requirements of ISO 15076-1 is embedded in each image file.

The images can be imported and manipulated as necessary by a wide variety of commonly used imaging software tools and platforms in general use in the industry. (See [Annex C](#) for details of the TIFF header and the RIMM RGB ICC profile.)

Graphic technology — Prepress digital data exchange —

Part 5: Scene-referred standard colour image data (RIMM/SCID)

1 Scope

This part of ISO 12640 specifies a set of standard scene-referred colour images (encoded as 16-bit RIMM RGB digital data) that can be used to evaluate transforms from a scene-referred image state to an output-referred image state (colour rendering transforms). They can be used for research, testing and assessing colour rendering transforms, in systems such as digital cameras, camera raw processing applications, colour management systems, colour profiles, and output devices such as displays and printers.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12639:2004, *Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT)*

ISO/TS 22028-3:2012, *Photography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange — Part 3: Reference input medium metric RGB colour image encoding (RIMM RGB)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

additive RGB colour space

colorimetric colour space having three colour primaries (generally red, green and blue) such that CIE XYZ tristimulus values can be determined from the RGB colour space values by forming a weighted combination of the CIE XYZ tristimulus values for the individual colour primaries, where the weights are proportional to the radiometrically linear colour space values for the corresponding colour primaries

Note 1 to entry: A simple linear 3×3 transformation can be used to transform between CIE XYZ tristimulus values and the radiometrically linear colour space values for an additive RGB colour space

Note 2 to entry: Additive RGB colour spaces are defined by specifying the CIE chromaticity values for a set of additive RGB primaries and a colour space white point, together with a colour component transfer function.

[SOURCE: ISO 22028-1:2004, 3.3]

3.2

adopted white

spectral radiance distribution as seen by an image capture or measurement device and converted to colour signals that are considered to be perfectly achromatic and to have an observer adaptive luminance factor of unity; i.e. colour signals that are considered to correspond to a perfect white diffuser

Note 1 to entry: The adopted white may vary within a scene.

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Note 2 to entry: No assumptions should be made concerning the relation between the adapted or adopted white and measurements of near perfectly reflecting diffusers in a scene, because measurements of such diffusers will depend on the illumination and viewing geometry, and other elements in the scene that may affect perception. It is easy to arrange conditions for which a near perfectly reflecting diffuser will appear to be grey or coloured.

[SOURCE: ISO 22028-1:2004, 3.4]

3.3 colour component transfer function

CCTF

single variable, monotonic mathematical function applied individually to one or more colour channels of a colour space

Note 1 to entry: Colour component transfer functions are frequently used to account for the nonlinear response of a reference device and/or to improve the visual uniformity of a colour space.

Note 2 to entry: Generally, colour component transfer functions will be nonlinear functions such as a power-law (i.e. "gamma") function or a logarithmic function. However, in some cases a linear colour component transfer function may be used.

[SOURCE: ISO 22028-1:2004, 3.6, modified — Abbreviated term has been added]

3.4 colour gamut

solid in a colour space, consisting of all those colours that are: present in a specific scene, artwork, photograph, photomechanical or other reproduction; or capable of being created using a particular output device and/or medium

[SOURCE: ISO 22028-1:2004, 3.8]

3.5 colour rendering

mapping of image data representing the colour-space coordinates of the elements of a scene to output-referred image data representing the colour-space coordinates of the elements of a reproduction

Note 1 to entry: Colour rendering generally consists of one or more of the following: compensating for differences in the input and output viewing conditions, tone scale and gamut mapping to map the scene colours onto the dynamic range and colour gamut of the reproduction, and applying preference adjustments.

[SOURCE: ISO 22028-1:2004, 3.11]

3.6 colour sequence

order in which the colours are stored in an image data file

3.7 orientation

origin and direction of the first line of data, with respect to the image content as viewed by the end user

Note 1 to entry: The codes used to specify orientation are contained in ISO 12639.

3.8 output-referred image state

image state associated with image data that represents the colour-space coordinates of the elements of an image that has undergone colour rendering appropriate for a specified real or virtual output device and viewing conditions

Note 1 to entry: When the phrase "output-referred" is used as a qualifier to an object, it implies that the object is in an output-referred image state. For example, output-referred image data are image data in an output-referred image state.

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