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Graphic technology — Prepress digital data exchange —

Part 4:

Wide gamut display-referred standard colour image data [Adobe RGB (1998)/SCID]

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

*Partie 4: Données d'image standard montrées en référence par gamme
large de couleur [Adobe RGB (1998)/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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12640-4 was prepared by 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 encoded 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)*

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Introduction

0.1 Need for standard digital test images

Standard test images 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.

Because they exist as standard, well-defined image data sets, typical of the high quality image content commonly encountered, standard test images enable users to be confident that the images will 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.

However, different applications require that the standard image data be provided in different image states using different image encodings (see ISO 22028-1). The user needs to select those appropriate to the evaluation task being undertaken. Whilst transformation of the image data to another image state is always possible, there is, in general, no agreement amongst experts as to how this is best done. Thus, it has been considered preferable to provide data in different image states in the various parts of ISO 12640.

ISO 12640-1 provides a set of 8-bits-per-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 per 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 to 65 535, and as sRGB (defined in IEC 61966-2-1), with a bit depth of 8 bits per 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 CRT 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 mainly applicable to the consumer market and those systems for which the colour monitor is the "hub" device. Although such systems are used for some applications in the graphic arts industry, sRGB is by no means the most common image encoding. Furthermore, a particular drawback is the fact that the sRGB colour gamut is quite different in shape to 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 per channel, while the colour charts and vignettes are 8 bits per 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

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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, for both viewing and measurement. For this reason, it has also become the predominant reference illuminant for most colour management applications.

This part of ISO 12640 provides a set of wide gamut test image data encoded as Adobe RGB with a bit depth of 16 bits per 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) Color Image Encoding specification*]. The preferred rendering of these images to any media, other than the reference Adobe RGB display in the reference Adobe RGB viewing environment, is dependent on the media and viewing environment used. Therefore, no colorimetry associated with reproduction on any other media is provided.

The images are mainly designed to be used 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 this part of ISO 12640 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 per channel.

The possible wide gamut colour encoding choices considered were Adobe RGB, opRGB (IEC 61966-2-5) and ROMM RGB (ISO 22028-2). For this part of ISO 12640 we want the images well-colour-rendered to a well-defined large gamut reference display. For this 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).

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 diverse subject matter. However, by requiring the images to look natural, it is difficult within a single, relatively small, sample set to produce elements in the scene that contain the subtle colour differences required in such test images, that cover the full reference colour gamut defined. Thus, while most images contain colours that extend to the gamut boundary this is often only for a limited range of hues in each image. The full reference colour gamut can only be explored by utilizing the synthetic colour chart.

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 14 natural images, a colour chart and a series of colour vignettes. The natural images include flesh tones, images with detail in the extreme highlights or shadows, neutral colours, brown and wood tone colours which are often difficult to reproduce, memory colours, complicated geometric shapes, fine detail, and highlight and shadow vignettes. The colour chart and colour vignette show the colour gamut of this wide gamut display-referred colour space.

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 12639:2004 (TIFF/IT). The images can be imported and manipulated as necessary by a wide variety of imaging software tools and platforms in general use in the industry. See Annex C for details of the TIFF header.