INTERNATIONAL STANDARD

ISO 17321-1

First edition
2006-12-01

Graphic technology and photography — Colour characterisation of digital still cameras (DSCs) —

Part 1: Stimuli, metrology and test procedures

Technologie graphique et photographie — Caractérisation de la couleur des appareils photonumériques —

Partie 1: Stimuli, métrologie et modes opératoires d'essai

Reference number
ISO 17321-1:2006(E)

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Published in Switzerland

Contents

Page

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 17321-1 was prepared by Technical Committee ISO/TC 42, *Photography* in collaboration with ISO/TC 130, *Graphic technology*.

ISO 17321 consists of the following parts, under the general title *Graphic technology and photography — Colour characterization of digital still cameras (DSCs)*:

— *Part 1: Stimuli, metrology and test procedures*

Introduction

The spectral responses of the colour analysis channels of digital still cameras (DSCs) do not, in general, match those of a typical human observer, such as defined by the CIE standard colorimetric observer. Nor do the responses of different DSCs ordinarily match each other. In characterizing DSCs, it is therefore necessary to take account of the DSC spectral sensitivities, illumination, and encoding colour space. This part of ISO 17321 will begin to address these considerations. This part of ISO 17321 defines stimuli (spectral illumination or a colour target), metrology and photographic test procedures for acquiring DSC characterization data. It specifies test procedures for "scenes", the most general picture taking conditions where metameric colours and a range of illumination sources are encountered. It also specifies test procedures for hardcopy "originals", a more narrowly defined picture-taking condition in which the illumination source and the colorants being imaged are pre-defined.

The ISO 17321 series will distinguish among several possible image representations in different colour encodings as depicted in Figure 1 which shows the diagram of a generic image workflow for digital photography.

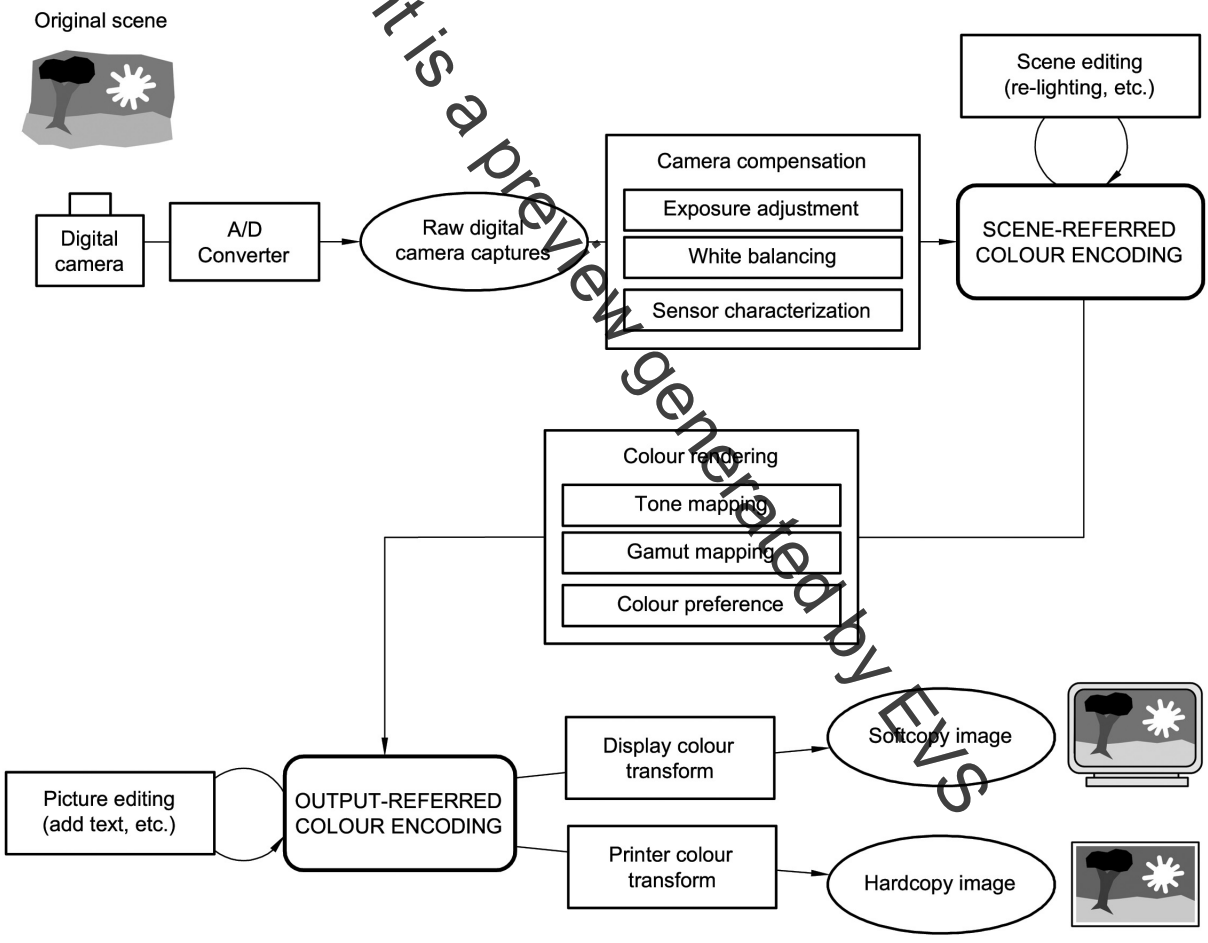

Figure 1 — Generic image workflow for digital photography

The DSC characterizations obtained using this part of the ISO 17321 will be applicable to raw (sensor-referred) DSC data. Two alternative methods are described for obtaining these characterization data. Method A, the spectral method, uses spectral lights as stimuli for measuring the colour performance of a DSC. Method B, the target method, involves the use of a physical colour test target under specific lighting conditions

to measure DSC colour performance. Annexes A to C recommend a laboratory set-up for photographing reflection targets, provide target patch selection criteria, and provide a digital still camera metamerism index.

Some operations (colour pixel reconstruction, flare removal, white balancing) can be performed without disqualifying the DSC data as being raw. However, operations that render the image data so that they become output-referred (ready to display or to print) generally do disqualify the data. With such cameras, this standard can only be applied if the capability exists to extract or to regenerate raw data, e.g. by applying the inverse of the rendering transform or by tapping the appropriate signals internal to the camera.

The technical experts who have developed this part of ISO 17321 recognize that a standard that could be applied generally to any (not just raw) DSC output would be desirable. Such a standard is problematic for DSCs that employ colour-rendering algorithms in order to produce output-referred image data. For such DSCs, it would frequently be impossible to determine if colour analysis errors relative to the scene or original captured were due to sensor image encoding errors or to proprietary colour rendering algorithms. The only way to make this distinction is if the colour rendering used is well documented and available, and the rendered data can be converted to un-rendered data by inverting the colour rendering. This situation is unlikely to occur because one of the major differentiators in DSC performance is the colour rendering. Sophisticated colour-rendering algorithms can be image dependent, and locally varying within an image. This makes it extremely difficult to reliably determine the exact colour rendering used by analysing captured test scenes.

The purpose of this part of ISO 17321 is both to assist in the characterization of DSCs for colour management purposes and to assist camera manufacturers in the determination of the colour analysis capabilities of DSCs that they are developing. This standard is applicable to any DSC intended for photographic or graphic technology applications. However, for many users it is not practical to apply this part of ISO 17321 to individual DSCs. Some of the measurements described in this part of ISO 17321 require complex, expensive measurement equipment. In the case of test targets that are commercially produced, spectral as well as colorimetric measurement data would ideally accompany the target.

Those unfamiliar with this part of ISO 17321 are encouraged to read through the entire standard (in particular the informative annexes) before proceeding with DSC characterization, in order to verify appropriateness for their particular application. In some cases, the procedures described in the multimedia standard, IEC 61966-9 [5] might be more applicable.

It is proposed that other parts of ISO 17321 will be developed in the future to deal with other aspects of the colour characterization of digital still cameras.

Graphic technology and photography — Colour characterisation of digital still cameras (DSCs) —

Part 1: Stimuli, metrology and test procedures

1 Scope

This part of ISO 17321 specifies colour stimuli, metrology, and test procedures for the colour characterization of a digital still camera (DSC) to be used for photography and graphic technology. Two methods are provided, one using narrow spectral band illumination and the other using a spectrally and colorimetrically calibrated target. Except for a specific set of permitted data operations, these DSC data are raw.

This part of ISO 17321 does not specify the methods for deriving transformations from raw DSC data in order to estimate scene colorimetry.

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.

ISO 7589:2002, *Photography — Illuminants for sensitometry — Specifications for daylight, incandescent tungsten and printer*

ISO 13655:1996, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

ISO 14524:1999, *Photography — Electronic still-picture cameras — Methods for measuring opto-electronic conversion functions (OECFs)*

3 Terms and definitions

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

3.1
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 The adopted white can vary within a scene.