SLOVENSKI STANDARD
SIST ISO 12232:2011

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Fotografija - Digitalne kamere za mirujoče slike - Določanje indeksa ekspozicije, splošnih občutljivosti ISO, standardne izhodne občutljivosti in priporočenega indeksa ekspozicije

Photography - Digital still cameras - Determination of exposure index, ISO speed ratings, standard output sensitivity, and recommended exposure index

Photographie - Appareils de prises de vue numériques - Détermination de l'indice d'exposition, des régimes de vitesse ISO, de la sensibilité normale de sortie et de l'indice d'exposition recommandé

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Photography — Digital still cameras — Determination of exposure index, ISO speed ratings, standard output sensitivity, and recommended exposure index

Photographie — Appareils de prises de vue numériques — Détermination de l'indice d'exposition, des régimes de vitesse ISO, de la sensibilité normale de sortie et de l'indice d'exposition recommandé

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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 12232 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 12232:1998), which has been technically revised.

This corrected version incorporates the following corrections:

— the normative reference ISO 7589 has been dated;

— the symbol for the effective *f*-number of the lens has been made consistent in Equations (2), (3) and (4);

— the cross-references in the column headings have been corrected in Table 1;

— Figure A.1 has been changed and notes and footnotes have been added for better clarity;

— Equation (B.1) has been corrected and the symbol for the vignetting factor changed;

— the second paragraph in Annex D has been reworded and changed to a note to reflect its intentional informative nature;

— the second sentence in Table D.1 has been slightly reworded and added at the end of the paragraph preceding Table D.1;

— in Table D.1, zeros have been added to values to improve their readability and the text below the values has been changed to Note 1 to show its intentional informative nature;

— a note has been added to both Figure A.1 and Table D.1 to notify the reader that the decimal sign is a comma in accordance with ISO 31-0;

— ISO 31-0 has been added to the Bibliography and the references have been renumbered accordingly.

Introduction

The ISO speed rating, standard output sensitivity (SOS) and recommended exposure index (REI) are important attributes of digital still cameras (DSCs). Standardization assists users and manufacturers in obtaining proper exposures and in determining the low light capability of DSCs.

The exposure level of a DSC is determined by the exposure time, the lens aperture, the lens transmittance, the level and spectral distribution of the scene illumination, and the scene reflectance. When an image from a DSC is obtained using an insufficient exposure, proper tone reproduction can generally be maintained by increasing the electronic or digital gain, but the image will contain an unacceptable amount of noise. As the exposure is increased, the gain can be decreased, and, therefore, the image noise can normally be reduced to an acceptable level. If the exposure is increased excessively, the resulting signal in bright areas of the image may exceed the maximum signal level capacity of the image sensor or camera signal processing. This can cause the image highlights to be clipped to form a uniformly bright area, or to bloom into surrounding areas of the image. Therefore, it is important to guide the user in setting proper exposures. An ISO speed rating is intended to serve as such a guide. The methods for assigning an ISO speed rating to a DSC harmonize with current film-based photographic standards. In order to be easily understood by photographers, the ISO speed rating for a DSC should directly relate to the ISO speed rating for photographic film cameras. For example, if a DSC has an ISO speed rating of ISO 100, then the same exposure time and aperture should be appropriate for an ISO 100 rated film/process system.

The ISO speed ratings described in this International Standard are intended to harmonize with film ISO speed ratings. However, there are differences between electronic and film-based imaging systems that preclude exact equivalency. DSCs can include variable gain and can provide digital processing after the image data has been captured, enabling desired tone reproduction to be achieved over a range of camera exposures. It is therefore possible for DSCs to have a range of speed ratings. This range is defined as the ISO speed latitude. To prevent confusion, a single value is designated as the ISO speed, with the ISO speed latitude upper and lower limits indicating the speed range.

Photography — Digital still cameras — Determination of exposure index, ISO speed ratings, standard output sensitivity, and recommended exposure index

1 Scope

This International Standard specifies the method for assigning and reporting ISO speed ratings, ISO speed latitude ratings, standard output sensitivity values, and recommended exposure index values, for digital still cameras. This International Standard is applicable to both monochrome and colour digital still cameras.

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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

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

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

IEC 61966-2-1, *Multimedia systems and equipment — Colour measurement and management — Part 2-1: Colour management — Default RGB colour space — sRGB*

ITU-R BT.709, *Parameter values for the HDTV standards for production and international programme exchange*

3 Terms and definitions

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

3.1
digital still camera
DSC
device which incorporates an image sensor and which produces a digital signal representing a still picture

NOTE A digital still camera is typically a portable, hand-held device. The digital signal is usually recorded on a removable memory, such as a solid-state memory card or magnetic disk.

3.2
exposure index
EI
numerical value that is inversely proportional to the exposure provided to an image sensor to obtain an image

NOTE Images obtained from a DSC using a range of exposure index values will normally provide a range of image quality levels.

3.3
exposure series
series of images of the same subject taken using different exposure index values

3.4
image sensor
electronic device that converts incident electromagnetic radiation into an electronic signal

EXAMPLE A charge coupled device (CCD) array.

3.5
ISO speed
numerical value calculated from the exposure provided at the focal plane of a DSC to produce specified camera output signal characteristics using the methods described in this International Standard

NOTE The ISO speed is usually the highest exposure index value that still provides peak image quality for normal scenes. However, a DSC does not necessarily use the ISO speed value as the exposure index value when capturing images.

3.6
ISO speed latitude
set of two numerical values calculated from the exposure provided at the focal plane of a DSC to produce specified camera output signal characteristics using the methods described in this International Standard

NOTE The ISO speed latitude is expected to correlate with the range of exposure index values that provide acceptable image quality for normal scenes.

3.7
photosite integration time
total time period during which the photosites of an image sensor are able to integrate the light from the scene to form an image

3.8
recommended exposure index
REI
specific exposure index value recommended by a DSC provider as a reference for adjusting photographic accessories, as defined in this International Standard

NOTE REI provides a practical exposure index value for setting the reference exposure index of light meters, studio lighting, etc., but images taken using this exposure index value do not necessarily provide the best image quality.

3.9
signal processing
operations performed by electronic circuits or algorithms that convert or modify the output of an image sensor

3.10
standard output sensitivity
SOS
specific exposure index value for a DSC that provides a still image with a specified digital output signal value under specified test conditions, as defined in this International Standard

NOTE SOS provides a practical exposure index value based on the signal level of images captured with a DSC, but images taken using this exposure index value do not necessarily provide the best image quality.

4 Exposure index values

4.1 General

An exposure index (EI) is a numerical value that is inversely proportional to the exposure provided to an image sensor to obtain an image. Images obtained from a DSC using a range of EI values will normally provide a range of image quality levels. The ISO speed of a DSC is equal to a particular exposure index value calculated from the exposure provided at the focal plane of the DSC to produce specified camera output signal characteristics, using the methods described in this International Standard. The equations used in this International Standard have been chosen to create a link between electronic and conventional silver-halide-based photographic systems. Using a particular ISO speed value as the exposure index on a DSC should result in the same camera exposure settings, and resulting focal plane exposures, as would be obtained using the same exposure index on a film camera or other photographic exposure meter.

Where possible, the exposure index values corresponding to the arithmetic mean focal plane exposure used to capture an image should be reported in the image file header as the exposure index.

4.2 Focal plane measurement

For DSC exposure meters, where the arithmetic mean focal plane exposure is measured within a circle lying in the centre of the image with a diameter of 75/100 times the shorter dimension of the image field, the exposure index values, I_{EI}, should be computed using Equation (1), as described in ISO 2721.

$$I_{EI} = 10/H_a \tag{1}$$

where H_a is the arithmetic mean focal plane exposure, expressed in lux-seconds (lx·s).

NOTE 1 The value of 10 as the constant in Equation (1) is consistent with ISO 2721 and ISO 5763. These International Standards assume that the exposure is an arithmetic mean value, as is normally provided by a camera light meter. If the geometric mean exposure was used in place of the arithmetic mean exposure, a lower value for this constant would be appropriate. Note that the arithmetic mean exposure is obtained when the linear exposure values are averaged, while a geometric mean exposure is obtained by taking the antilog of the average of the logarithmic exposure values. An approximation to the geometric mean is also obtained by taking the antilog of the average measured film densities in conventional photographic systems, provided that the film H&D curve has a straight line characteristic over the film exposure range. Note also that the brightness response of the human visual system to the luminances of objects in a scene is approximately logarithmic.

NOTE 2 The arithmetic mean focal plane exposure for statistically average scenes is often assumed to be equal to approximately 18 % of the focal plane exposure, which would be obtained from a perfectly diffuse 100 % reflectance object in a statistically average scene. Therefore, the arithmetic mean focal plane exposure would equal 2/10 times the focal plane exposure that would be obtained from a 90 % reflectance test card in a statistically average scene.

4.3 Scene luminance measurement

For DSC exposure meters where the arithmetic mean scene luminance is measured, the expected value of the arithmetic mean focal plane exposure, H_a, required in Equation (1) can be computed using Equation (2). The derivation of Equation (2) is given in Annex B.

$$H_a = \frac{65 L_a t}{100 A_{eff}^2} \tag{2}$$

where

A_{eff} is the effective f-number of the lens;

L_a is the arithmetic mean luminance, expressed in candelas per square metre;

t is the photosite integration time, expressed in seconds.