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Photography — Digital cameras — Measuring low-light performance

Photographie — Caméras numériques — Mesurage des performances dans des conditions de faible luminosité

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The major engineering difference between a system camera, a point and shoot camera, and a camera in a mobile device is the sensor size. The sensor size is also related to the overall system size including the lens. With smaller sensors, the individual light sensitive areas are also smaller and therefore less light falls onto each of the pixels.

Smaller individual light sensitive areas require higher signal amplification that leads to higher noise levels or other problems that can occur due to denoising algorithms. These problems become more visible at low-light conditions because of the lower signal levels.

Most cameras are used without a tripod even at low-light conditions. At low light in combination with a tripod, the performance of a camera is always good because the sensitivity setting can be kept to a low value and the exposure time can be very long. For these reasons the low-light performance is measured using conditions that reflect the result of a handheld shot.

Sometimes the data sheets of a camera state a light level for the low-light performance of a camera. Prior to the creation of this document, the way to determine these values was not defined and therefore the values were unreliable to users.

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Photography — Digital cameras — Measuring low-light performance

1 Scope

This document specifies a protocol to measure the low-light performance of a camera. It is applicable to the measurement of digital cameras including camera phones and other mobile devices.

The performance aspects defined in this document are intended to all be tested. Picking one or some of them by the tester is out of scope of the usage of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *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)*

ISO 15739, *Photography — Electronic still-picture imaging — Noise measurements*

ISO/TS 19567-1, *Photography — Digital cameras — Texture reproduction measurements — Part 1: Frequency characteristics measurements using cyclic pattern*

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

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
handheld limit exposure time
exposure time empirically considered as an upper limit to give a reasonably sharp image with handheld shooting, which is 1/*f* s, where *f* is the value of the 35 mm sensor equivalent focal length of the lens

Note 1 to entry: If the camera has a mechanism for image stabilization, a longer exposure time than 1/*f* s for handheld shooting can still produce reasonably sharp images.

3.2
35 mm film equivalent focal length
focal length of a lens attached to a camera with a sensor size of 24 mm × 36 mm (originated from 35 mm film) that produces the same field of view as the camera system with a lens at a given focal length for which the 35 mm sensor equivalent focal length is specified

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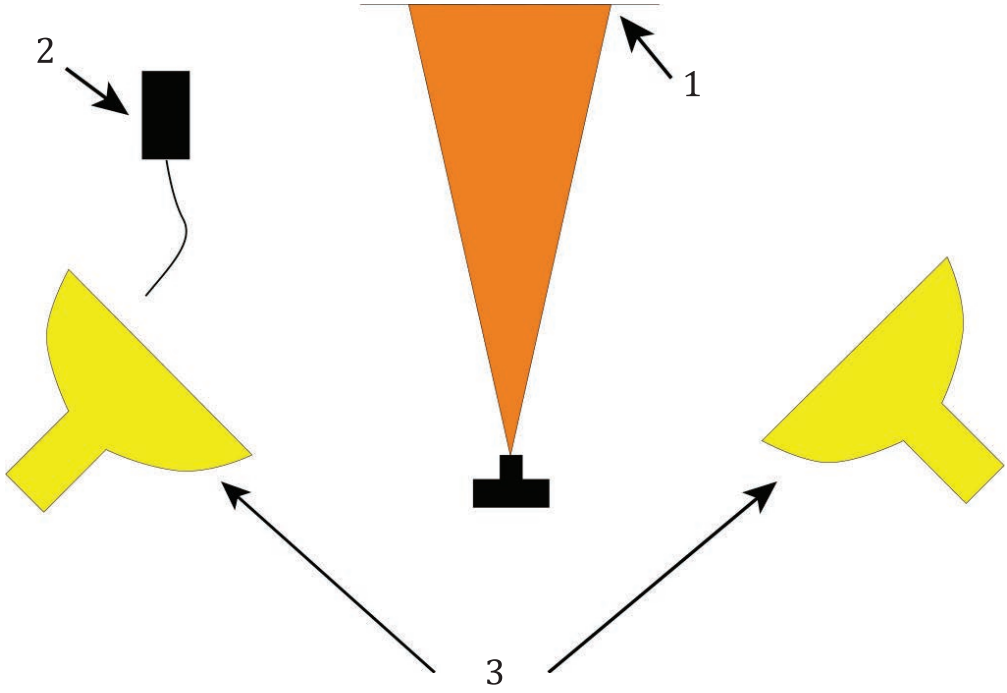
3.3
full frame sensor
image sensor that fills the full 24 mm × 36 mm image size of the 35 mm film format

4 Test conditions and setup

4.1 Test chart

4.1.1 Test chart and illumination

The lighting condition shall be consistent with the daylight conditions specified in ISO 7589. The chart shall be uniformly illuminated in a way that minimizes stray light and specular reflection. The light source needs to be dimmable without a significant change in the spectral distribution of the light. Using a set of polarizing filters, neutral density filters or using a special spectrally tunable LED light source can achieve this. See Figure 1.



Key

1 test chart
2 spectroradiometer
3 dimmable daylight source

Figure 1 — Setup of the chart illumination

Since modern still cameras provide scene-dependent image processing, the ideal approach for a low-light test is using a test chart that contains all necessary structures for evaluating the relevant image-quality parameters. The following chart is one commercially available example for such a chart.

The chart shall contain at least the following structures:

— a grey scale according to ISO 14524 with a contrast range of at least 100:1 and at least 16 grey levels to determine the opto-electronic conversion function (OECF) and noise performance according to ISO 14524 and ISO 15739;

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