
**Photography — Electronic still-picture
cameras — Terminology**

Photographie — Caméras de prises de vue électroniques — Terminologie

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Foreword

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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.

International Standard ISO 12231 was prepared by Technical Committee ISO/TC 42, *Photography*.

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Introduction

Electronic photography concepts are drawn from traditional photography, electronics, video, and information technology. In some cases the concepts must be redefined to apply to electronic photography. For example, unlike traditional photography, measurements cannot be defined in terms of "film" or "sensitized material", since images acquired by electronic still cameras are stored electronically and not immediately exposed on film. The meaning of shutters and exposure time is also different for electronic still cameras, because an electronic imaging sensor, usually a charged-coupled device (CCD), has image acquisition characteristics which are different from film.

The purpose of this terminology is to standardize the use and meaning of terms associated with electronic still-picture cameras. It is organized alphabetically and follows natural (English) word order whenever possible. The majority of the terms listed in this International Standard are derived from the first three references listed in the annex.

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Photography - Electronic still-picture cameras - Terminology

1 Scope

This International Standard defines terms used in electronic photography.

Only terms related to electronic still-picture cameras are included. These terms are relevant to the current tasks or of general interest in electronic photography.

2 Definitions

The source of most of the terms in this International Standard are the documents on electronic still-picture cameras developed by ISO/TC 42/WG 18 and listed as the first three references in the annex. Definitions from some existing International Standards, e.g. optical transfer function, are included here for completeness.

The term given in angle brackets prior to the definition references one of the first three documents listed in the annex that serves as the source of the definition. At the end of some definitions, a phrase in italic font, beginning with *cf.*, lists other terms that are related to the term being defined.

2.1

addressable photoelements

< Resolution > The number of active photoelements on an image sensor. This is equal to the number of active lines of photoelements times the number of active photoelements per line.

NOTE: This term is included to provide an appropriate term for describing the dimensionality of image sensors. The term **resolution** should not be used when referring to the number of addressable photoelements on an image sensor.

2.2

aliasing

< Resolution > Output image artifacts that occur in a sampled imaging system for input images having significant energy at frequencies higher than the Nyquist frequency of the system. Aliasing can be prevented by filtering the input image to suppress these high spatial frequencies prior to sampling, but such filtering may not be desirable.

2.3

aliasing ratio

< Resolution > The value equal to the "maximum minus minimum" modulation divided by the

"average" modulation of an electronic still-picture camera when imaging a frequency burst of constant spatial frequency.

2.4

aspect ratio *cf. image aspect ratio, pixel aspect ratio.*

2.5

compression *cf. image compression.*

2.6

edge spread function (ESF)

< Resolution > The normalized spatial signal distribution in the output of an imaging system resulting from imaging a theoretical infinitely sharp edge. *cf. line spread function, point spread function.*

2.7

effectively spectrally neutral

< Resolution > Having relative spectral radiance characteristics which result in a specific imaging system producing the same output as for a spectrally neutral object. *cf. spectrally neutral.*

2.8

electronic still-picture camera

< ISO speed > A camera incorporating an image sensor which outputs an analog or digital signal representing a still picture, or records an analog or digital signal representing a still picture on a removable media, such as a memory card or magnetic disk.

2.9

electronic shutter

< ISO speed > Any one of three devices for controlling the exposure time of an electronic still-picture camera.

2.9.1

electronically shuttered sensor

A component of an electronic still camera which electronically controls the image sensor itself in order to set the exposure time.

2.9.2

electromechanical shutter

A mechanical shutter which is electronically controlled.

2.9.3

electro-optical shutter

An electronically driven device in front of the sensor which changes the optical path transmittance.

2.10

exposure index

< ISO speed > A numerical value which is inversely proportional to the exposure provided to an image sensor to obtain an image. Images obtained from a camera using a range of exposure

index values will normally provide a range of image quality levels. *cf. ISO speed of an electronic still-picture camera.*

2.11

exposure process

< ISO speed > Various methods to capture images in the electronic still-picture camera.

2.11.1

single exposure

Acquiring a picture by a single exposure, with one or more image sensors, that exposes all sensor pixels, all colours, and all image locations at the same time.

2.11.2

colour sequential

Acquiring a picture by combining repeated exposures to capture different colour components; for example, by means of three colour illuminations, or by three colour filters.

2.11.3

time sequential

Acquiring a picture by combining repeated exposures to capture different spatial components; for example, with a line array (line scanning) or an area array. With a line sensor, the picture is acquired by optical or physical sub-scanning with an image sensor in one dimension. With an area array, for example, repeated exposures may integrate smaller pictures into a larger picture by means of image sensor shifting.

2.12

exposure series

< ISO speed > A series of images of the same subject taken using different exposure settings.

2.13

field/frame

Types of picture formats formed by video signals.

2.13.1

field

For an *interlaced video* signal, a "field" is the assembly of alternate (odd or even) lines of a frame. Therefore an *interlaced frame* is composed of two fields, an odd field and an even field, representing the odd- and even-numbered lines respectively.

NOTE: Adapted from ISO/IEC 13818-2:1996.

2.13.2

frame

A frame contains lines of spatial information of a video signal. For *progressive video*, these lines contain samples starting from one time instant and continuing through successive lines to the bottom of the frame. For *interlaced video* a frame consists of two fields, an odd field and an even field. One of these fields will commence one field period later than the other.

NOTE: Adapted from ISO/IEC 13818-2:1996.

2.13.3

movie frame or studio frame

When *interlaced video* is applied to still-picture imaging, the resulting movie frame consists of two fields taken simultaneously.

2.14

file system

< Memory > The software structure which specifies how the data is logically organized on a given storage media.

2.15

gamma correction

< Resolution > A process which alters the image data in order to modify the tone reproduction.

NOTE: The gamma correction is usually an algorithm, lookup table, or circuit which operates separately on each colour component of an image.

2.16

horizontal resolution

< Resolution > A resolution value measured in the line readout (fast readout) direction, typically using a vertically oriented resolution wedge.

2.17

image aspect ratio

< Resolution > The ratio of the image width to the image height. *cf. pixel aspect ratio.*

2.18

image compression

< Resolution > A process that alters the way image data is encoded in order to reduce the average size of an image file.

2.19

image data format

< Memory > The structure and content which specifies image data and the organization of the image-related data in a device-independent manner.

2.20

image sensor

< ISO speed > An electronic device which converts incident electromagnetic radiation into an electronic signal; for example, a charge coupled device (CCD) array.

2.21

imager size (for an area array sensor)

< Resolution > The physical dimensions, height and width, of the photoresponsive area of an imaging sensor.

NOTE: The following addition is adapted from EIAJ EDX-5301: The *measure* of imager size for a video-based still-picture camera is described by the approximate diameter of a tube-type image

sensor which is equivalent to a diagonal length of the solid state image sensor. The expressions of diameters of 2/3, 1/2, 1/3 or 1/4 inch (type) correspond to actual imager sizes of 6,6 mm x 8,8 mm, 4,8 mm x 6,4 mm, 3,6 mm x 4,8 mm, and 2,7 mm x 3,6 mm respectively, for 4:3 image aspect ratio sensors.

2.22

image storage application profile (ISAP)

< Memory > The media profile plus the image data format. *cf. media profile, image data format.*

2.23

ISO speed of an electronic still-picture camera

< ISO speed > A numerical value calculated from the exposure provided at the focal plane of an electronic camera to produce specified camera output signal characteristics using the methods described in the referenced standard. An ISO speed value of 100 is designated as ISO 100. *cf. exposure index.*

2.24

limiting resolution

< Resolution > The value of that portion of a specified resolution test pattern, measured in line widths per picture height (LW/PH), which corresponds to an average modulation value equal to some specified percentage of the modulation value at a specified reference, also measured in LW/PH. For example, the limiting resolution may be the test pattern value, in LW/PH, corresponding to a camera output modulation level of 5% of the camera output modulation level at a reference frequency of 10 LW/PH. *cf. resolution, visual resolution.*

2.25

line spread function (LSF)

< Resolution > The normalized spatial signal distribution in the output of an imaging system resulting from imaging a theoretical infinitely thin line. The LSF is equal to the first derivative of ESF. *cf. edge spread function, point spread function.*

2.26

line widths per picture height (LW/PH)

< Resolution > A metric for specifying the width of a solid line on a test chart, relative to the height of the active area of the chart, equal to the height of the active area of the test chart divided by the width of the line. This is equal to the total number of lines of the same width which can be placed edge to edge within the height of a test chart, or within the vertical field of view of a camera. *cf. resolution, limiting resolution.*

NOTE: The greater the LW/PH, the smaller the width of the line. Therefore, a camera that distinguishes test patterns having a higher LW/PH has better limiting resolution than one that

distinguishes only test patterns having a lower LW/PH.

2.27

media profile

< Memory > The portion of the memory module specification which is specific to a given memory technology; including the form factor, interconnection and access protocol. *cf. image storage application profile, image data format.*

2.28

memory module

< Memory > The physical implementation of Removable Memory, containing the image data format combined with a specified physical form factor, interconnect definition and access protocol.

2.29

modulation

< Resolution > The difference between the minimum and maximum signal levels divided by the sum of these levels.

2.30

modulation transfer function (MTF)

< Resolution > The modulus of the optical transfer function $OTF(r,s)$ [ISO 9334] *cf. optical transfer function, spatial frequency response.*

2.31

Nyquist limit

< Resolution > The spatial frequency equal to 1/2 times the inverse of the sampling period. Input spatial frequencies above the Nyquist limit will alias to a spatial frequency below the Nyquist limit in the output image. The Nyquist limit may be different in the two orthogonal sampling directions.

2.32

optical transfer function (OTF)

< Resolution > The Fourier transform of the imaging system's point spread function. For the OTF to have significance it is necessary that the imaging system be operating in an isoplanatic region and in its linear range.

$OTF(r, s) =$

$$\iint_{-\infty}^{\infty} PSF(u, v)$$

$$\exp\{-i2\pi(ur + vs)\} du dv$$

where r and s are spatial frequency variables associated with the space coordinate (u,v) .

NOTES:

1 Adapted from ISO 9334:1996.

2 The OTF is a complex function whose modulus has the value unity at zero spatial frequency.

2.33**photosite integration time**

< ISO speed > The total time period during which the photosites of an image sensor are able to integrate the light from the scene to form an image.

2.34**pixel aspect ratio**

< Resolution > The ratio of the distance between sampling points in the two orthogonal sampling directions. If the distances are equal, the pixel aspect ratio equals 1:1, and is said to be "square". *cf. image aspect ratio.*

2.35**point spread function (PSF)**

< Resolution > The normalized spatial signal distribution in the output of an imaging system resulting from imaging a theoretical infinitely small point source. *cf. edge spread function, line spread function.*

2.36**removable memory**

< Memory > Storage in a user-removable form factor, which is transportable, and intended for the digital storage of image data in electronic still cameras. The memory media may be read/write, write once, etc. but must be non-volatile when removed from the camera, i.e. it must retain the data.

2.37**resolution**

< Resolution > A measure of the ability of an imaging system, or a component of an imaging system, to depict picture detail. Resolution measurement metrics include resolving power, visual resolution, limiting resolution, SFR, MTF and OTF. *cf. limiting resolution.*

NOTE: This is a general definition applicable to both conventional photography and electronic imaging.

2.38**sampled imaging system**

< Resolution > An imaging system or device which generates an image signal by sampling an image at an array of discrete points, or along a set of discrete lines, rather than a continuum of points. The sampling at each point is done using a finite size sampling aperture or area.

NOTE: This term describes a basic distinction between electronic and traditional photography. The image sensors used for the electronic acquisition of pictures usually operate by sampling an image rather than the continuous spatial imaging of traditional photography.

2.39**sampling period**

< Resolution > The physical distance between sampling points or sampling lines. The sampling period may be different in the two orthogonal sampling directions.

2.40**scene luminance ratio**

< ISO speed > The ratio of the highest (highlight) luminance value to the lowest (shadow) luminance value in a scene.

2.41**signal processing**

< ISO speed > Operations performed by electronic circuits or algorithms which convert or modify the output of an image sensor.

2.42**sound compression**

< Memory > A process of altering the sound data coding in order to reduce the average size of a sound file in the electronic still-picture camera. *cf. sound recording.*

2.43**sound recording for an electronic still-picture camera**

< Memory > Recording of the sound data relative to an image acquired by the electronic still-picture camera. The sound recording may be made before, during, or after the time of the image acquisition.

NOTE: A sound recording attached to an electronic still picture is considered an annotation of the image, as distinguished from a sound recording which is attached to and synchronized with motion pictures or video pictures.

2.44**spatial frequency response (SFR) of an electronic still-picture camera**

< Resolution > The measured amplitude response of an imaging system as a function of input spatial frequency. The SFR is normally represented by a curve of the average output response to an input sine wave of unit amplitude, over a range of spatial frequencies.

2.45**spectrally neutral**

< Resolution > Having the same relative spectral radiance characteristics as a specified standard source over a defined region of the electromagnetic spectrum. *cf. effectively spectrally neutral.*

2.46**test chart**

< Resolution > An arrangement of test patterns designed to test particular aspects of an imaging system.

NOTE: This definition is more general than that given in ISO 6328:1982.

2.47

test pattern

< Resolution > A specified arrangement of spectral reflectance or transmittance characteristics used in measuring an image quality attribute. The test pattern spectral characteristics include the following types:

2.47.1

bi-tonal patterns

Patterns which are spectrally neutral or effectively spectrally neutral, and consist exclusively of only two reflectance or transmittance values in a prescribed spatial arrangement. Bi-tonal patterns are typically used to measure resolving power, limiting resolution, and SFR.

2.47.2

grey scale patterns

Patterns which are spectrally neutral or effectively spectrally neutral, and consist of a large number of reflectance or transmittance values in a prescribed spatial arrangement.

Grey scale patterns are typically used to measure opto-electronic conversion functions.

2.47.3

spectral patterns

Patterns which are specified by the spatial arrangement of features with differing spectral radiances. Spectral patterns are typically used to measure colour reproduction.

2.48

vertical resolution

< Resolution > A resolution value measure in the page readout (slow readout) direction, typically using a horizontally oriented resolution wedge.

2.49

visual resolution

< Resolution > The spatial frequency at which the individual black and white lines of a test pattern reproduced on a display or print can no longer be distinguished, or are reproduced at a spatial frequency lower than that of the corresponding area of the test chart, as a result of aliasing. *cf. limiting resolution, resolution.*

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