INTERNATIONAL STANDARD

ISO 12231

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Photography — Electronic still picture imaging — Vocabulary

Photographie — Prises de vue électroniques — Vocabulaire

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

This second edition cancels and replaces the first edition (ISO 12231:1997), which has been technically revised.

Introduction

Electronic still picture imaging concepts are drawn from traditional photography, electronics, video, and information technology. In some cases the concepts must be redefined to apply to electronic still picture imaging. For example, unlike traditional photography, measurements cannot be defined in terms of “film” or “sensitized material”, since images acquired by digital image capture devices are stored electronically and are not immediately exposed on film. The meaning of shutter and exposure time is also different for digital image capture devices, because an electronic imaging sensor typically has image acquisition characteristics that are different from those of film.

The purpose of this vocabulary is to standardize the use and meaning of terms associated with electronic still picture imaging. It is organized alphabetically and follows natural (English) word order wherever possible. The source of most of the terms in this International Standard are the documents on electronic still picture imaging developed by ISO/TC 42/WG 18, and ISO/TC 42/JWG 20 and 23 (with ISO/TC 130). Definitions from some other TC 42 International Standards, e.g. flare, are also included for completeness. The ISO numbers provided in brackets following the definition reference documents listed in the bibliography that serve as the source of the definition. At the end of some definitions, other terms are listed (preceded by “cf.”) that are related to the term being defined. An alphabetical index is included at the end of the document.

Terms from working drafts and committee drafts of standards under development within ISO/TC 42 (as of 15 August 2002) are provided in Annex A. These terms are more likely to change as the source documents progress. Definitions are provided in this International Standard to facilitate communication. Where possible, the latest draft of the source document should be reviewed to see if a more current definition is available. Future revisions of this International Standard will include updated terms and definitions consistent with the source documents at the time the revision is prepared.

Photography — Electronic still picture imaging — Vocabulary

1 Scope

This International Standard defines terms used in electronic still picture imaging.

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

2 Terms and definitions

2.1
addressable photoelements
number of active photoelements on an image sensor, which is equal to the number of active lines of photoelements times the number of active photoelements per line

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE The term resolution should not be used when referring to the addressable photoelements. It is possible that the addressable photoelements may be different for the different colour records of an image. When the signal values of the photoelements are digitized, the digitized code values may be referred to as picture elements, or pixels.

2.2
aliasing
output image artefacts that occur in a sampled imaging system for input images having significant energy at frequencies higher than the Nyquist frequency of the system

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE These artefacts usually manifest themselves as moiré patterns in repetitive image features or as jagged stair-stepping at edge transitions.

2.3
aliasing ratio
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

[ISO 12233]

2.4
analog-to-digital converter
A/D or **ADC**
circuit that converts an analog signal, having a continuously varying amplitude, to a digitally quantized representation using binary output signals

2.5
application
image application software for use on a personal computer

[ISO 12234-3]

2.6 Aspect ratio

2.6.1
image aspect ratio
ratio of the image width to the image height

[ISO 12233, ISO 15740]

2.6.2
pixel aspect ratio
ratio of the distance between sampling points in the two orthogonal sampling directions

NOTE 1 If the distances are equal, the pixel aspect ratio equals 1:1, and is said to be “square”.

NOTE 2 Retained from ISO 12231:1997.

2.7
charge coupled device
CCD
type of silicon integrated circuit used to convert light into an electronic signal

2.8
colour filter array
CFA
mosaic or stripe layer of coloured transmissive filters fabricated on top of an imager in order to obtain a colour image from a single image sensor

2.9
colour matching functions
tristimulus values of monochromatic stimuli of equal radiant power

[CIE Publication 17.4 (845-03-23), ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **tristimulus value**

2.10
colour space
geometric representation of colours in space, usually of three dimensions

[CIE Publication 17.4 (845-03-25), ISO 17321-1, ISO 17321-2, ISO 22028-1]

2.11 Compression

2.11.1
image compression
process that alters the way digital image data are encoded in order to reduce the size of an image file

[ISO 12233]

2.11.2
sound compression
process of altering the sound data coding in order to reduce the size of a sound file in the electronic still picture camera

[ISO 12234-1]

cf. **sound recording**

2.12
cycles per millimetre
cy/mm
unit used for specifying resolution characteristics in terms of the response of an imaging system to a linear radiance sine wave input, as a function of the frequency of the sine wave

[ISO 12233]

NOTE 1 A range of input sine wave frequencies is obtained in ISO 12233 through the use of a sharp edge target.

NOTE 2 Most pictorial imaging systems exhibit non-linear behaviour, which may result in the nature of the target affecting the measured resolution characteristics. Distance units other than millimetres may also be used.

2.13
DCF
design rule for camera file system
design rules for camera file system as specified in ISO 12234-3

NOTE DCF provides a standard convention for camera file systems that specifies the file format, folders, and naming conventions in order to promote file interoperability between conforming digital still photography devices.

2.14
DCF basic file
image file stored directly under a DCF directory, having a DCF filename and the extension “JPG” and having the DCF-defined data structure, based on the Exif standard

[ISO 12234-3]

2.15
DCF basic main image
Exif primary image included in a DCF basic file

[ISO 12234-3]

2.16
DCF basic thumbnail
Exif thumbnail image included in a DCF basic file

[ISO 12234-3]

2.17
DCF-compatible
meeting the requirements of ISO 12234-3

[ISO 12234-3]

2.18
DCF directory
directory under the DCF image root directory for storing images, created in accordance with the DCF directory rules

[ISO 12234-3]

2.19
DCF directory name
directory name assigned in accordance with the DCF directory-naming conventions

[ISO 12234-3]

2.20
DCF extended image file
image file stored directly under a DCF directory, having an extension and data structure different from a DCF basic file

[ISO 12234-3]

2.21
DCF file name
file name assigned in accordance with the DCF file-naming conventions

[ISO 12234-3]

2.22
DCF image root directory
directory directly under the root directory, created in accordance with the DCF directory rules

[ISO 12234-3]

2.23
DCF media
removable memory recorded in accordance with the DCF requirements

[ISO 12234-3]

2.24
DCF object
group of files having the same file number stored in the same DCF directory

[ISO 12234-3]

2.25
DCF thumbnail file
compressed file for storing the thumbnail image of a DCF extended image file

[ISO 12234-3]

2.26
depth of field
difference between the maximum and minimum distances from a camera lens's front nodal point to objects in a scene that can be captured in acceptably sharp focus

2.27
digital output level
digital code value
numerical value assigned to a particular output level

[ISO 14524, ISO 15739, ISO 16067-1, ISO 16067-2, ISO 21550]

2.28
digital still camera
DSC
device which incorporates an image sensor and produces a digital signal representing a still picture

[ISO 12234-3, ISO 17321-1, ISO 17321-2]

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.

2.29
directory number
three-digit number which is comprised of the first three characters of the DCF directory name

[ISO 12234-3]

2.30
edge spread function
ESF
normalized spatial signal distribution in the linearized output of an imaging system resulting from imaging a theoretical infinitely sharp edge

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

cf. **line spread function, point spread function**

2.31
effectively spectrally neutral
having spectral characteristics which result in a specific imaging system producing the same output as for a spectrally neutral object

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

cf. **spectrally neutral**

2.32
electronic scanner(1)
⟨photographic films⟩ scanner incorporating an image sensor that outputs a digital signal representing a still film image

[ISO 16067-2, ISO 21550]

2.33
electronic scanner(2)
⟨photographic prints⟩ scanner incorporating an image sensor that outputs a digital signal representing a still print image

[ISO 16067-1]

2.34
electronic shutter
any one of three devices for controlling the exposure time of an electronic still picture camera

2.34.1
electronically shuttered sensor
component of an electronic still camera which electronically controls the image sensor itself in order to set the exposure time

2.34.2
electromechanical shutter
mechanical shutter which is electronically controlled

2.34.3
electro-optical shutter
electronically driven device in front of the image sensor which changes the optical path transmittance

2.35
electronic still picture camera
camera incorporating an image sensor that outputs an analog or digital signal representing a still picture, and/or records an analog or digital signal representing a still picture on a removable medium, such as a memory card or magnetic disc

[ISO 12232, ISO 12233, ISO 15739]

2.36
Exif
exchangeable image file format
digital still camera image file format standard of the Japan Electronic Industry Development Association (JEIDA)

[ISO 12234-3]

NOTE The JPEG version of Exif provides a compressed file format for digital cameras in which the images are compressed using the baseline JPEG standard described in ISO/IEC 10918-1, and metadata and thumbnail images are stored using TIFF tags within an application segment at the beginning of the file.

2.37
exposure index
numerical value that is inversely proportional to the exposure provided to an image sensor to obtain an image

[ISO 12232]

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

2.38
exposure process
various methods to capture images in the electronic still picture camera

2.38.1
single exposure
acquisition of 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

2.38.2
colour sequential exposure
acquisition of a picture by combining repeated exposures to capture different colour components

NOTE Colour sequential exposure can be by means of three colour illuminations, or by three colour filters.

2.38.3
time sequential exposure
acquisition of a picture by combining repeated exposures to capture different spatial components

NOTE Time sequential exposure can be with a line array (line scanning) or an area array. With a line array, the picture is acquired by optical or physical sub-scanning with an image sensor in one dimension. With an area array, repeated exposures may integrate smaller pictures into a larger picture by means of image sensor shifting.

2.39
exposure series
series of images of the same subject taken using different exposure index values

[ISO 12232]

2.40
fast scan direction
scan direction corresponding to the direction of the alignment of the addressable photoelements in a linear array image sensor

[ISO 16067-1, ISO 16067-2, ISO 21550]

2.41
file extension
three identifying characters used in the DOS/FAT file system following the file name and dot

[ISO 12234-3]

2.42
file name
eight-character file name of the DOS/FAT file system, excluding the dot and file extension

[ISO 12234-3]

2.43
file number
four-digit number which comprises the last four characters of the DCF file name

[ISO 12234-3]

2.44
file system
software structure which specifies how the data are logically organized on a given storage medium

[ISO 12234-1, ISO 12234-2]

2.45
flare
light falling on an image, in an imaging system, which does not emanate from the subject point

[ISO 3664]

cf. **veiling glare**

NOTE Veiling glare is also sometimes referred to as flare.

2.45.1
veiling flare
relatively uniform but unwanted irradiation in the image plane of an optical system, caused by the scattering and reflection of a proportion of the radiation which enters the system through its normal entrance aperture

[ISO 3664]

NOTE 1 The veiling flare radiation may be from inside or outside the field of view of the system.

NOTE 2 Light leaks in an optical system housing can cause additional unwanted irradiation of the image plane. This irradiation may resemble veiling flare.

2.46
free characters
five characters following the directory number in a DCF directory name, or the four characters at the beginning of a DCF file name

[ISO 12234-3]

2.47
gamma correction
signal processing operation that changes the relative signal levels in order to adjust the image tone reproduction

[ISO 12232, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE 1 Gamma correction is performed in part to correct for the nonlinear light-output versus signal input characteristic of the display. The relationship between the light input level and the output signal level, called the OECF, provides the gamma correction curveshape for an image capture device.

NOTE 2 The gamma correction is usually an algorithm, lookup table, or circuit which operates separately on each colour component of an image.

2.48
hardcopy
representation of an image on a substrate which is self-sustaining and reasonably permanent

[ISO 3664, ISO 17321-2, ISO 22028-1]

2.49
horizontal pixels
number of luminance pixels of image data in the main (x-axis) scanning direction

[ISO 12234-3]

2.50
horizontal resolution
resolution value measured in the longer image dimension, corresponding to the horizontal direction for a "landscape" image orientation, typically using a vertically oriented test chart feature

[ISO 12233]

2.51
illuminance scale exposure series
series of exposures produced using a constant exposure time and a varying focal plane illuminance

[ISO 14524]

cf. **time scale exposure series**

2.52
image data format
structure and content which specifies how the data is logically organized on a given storage medium

[ISO 12234-1, ISO 12234-2]

2.53
image sensor
electronic device that converts incident electromagnetic radiation into an electronic signal

[ISO 12232, ISO 12233, ISO 15739, ISO 16067-1, ISO 16067-2, ISO 21550]

EXAMPLE A charge coupled device (CCD) array.

2.54
image storage application profile
ISAP
media profile plus the image data format

[ISO 12234-1]

NOTE The ISAP specifies all the information necessary to completely implement the removable memory.

2.55
imager size
〈area array sensor〉 physical dimensions, in 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 × 8,8 mm, 4,8 mm × 6,4 mm, 3,6 mm × 4,8 mm, and 2,7 mm × 3,6 mm respectively, for 4:3 image aspect ratio sensors.

2.56
incremental gain function
change in the output level (digital code value) divided by the change in the input level (luminance or exposure) as a function of input level

[ISO 14524, ISO 15739, ISO 21550]

NOTE 1 For the determination of incremental gain values, log input values are not used.

NOTE 2 If the input exposure points are very finely spaced and the output noise is small compared to the quantization interval, the incremental gain function may have a jagged shape. Such behaviour is an artefact of the quantization process and should be removed by using an appropriate smoothing algorithm or by fitting a smooth curve to the data. In some cases it may be desirable to fit a curve to the input-output data and then determine the incremental gain function by taking the first derivative of the function used for the curve fit.

2.57
incremental output signal
input level (luminance or exposure, not logged) multiplied by the system incremental gain at that level

[ISO 14524, ISO 15739, ISO 21550]

cf. **incremental gain function**

2.58
incremental signal-to-noise ratio
ratio of the incremental output signal to the root mean square (rms) noise level, at a particular signal level

[ISO 15739, ISO 21550]

NOTE The incremental signal-to-noise ratio is typically expressed as a graph or table showing the rms noise level versus output signal level for the full range of output signal levels.

2.59
ISO DSC dynamic range
ratio of the maximum luminance level that appears unclipped to the minimum luminance level that can be reproduced with an incremental signal-to-temporal-noise ratio of at least 1, as determined according to ISO 15739

[ISO 15739]

2.60
ISO speed
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 ISO 12232

NOTE The ISO speed should correlate with the highest exposure index value that provides peak image quality for normal scenes.

2.61
ISO speed latitude
set of two numerical values 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 ISO 12232

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

2.62
JPEG
Joint Photographic Experts Group
image compression method defined in ISO/IEC 10918-1 | ITU-T Recommendation T81

[ISO 12234-3]

2.63
Level 1
playback compatibility level capable of detecting the existence of a DCF basic file and recognizing thumbnail images

2.64
Level 2
playback compatibility level capable of playing and using DCF basic file main images

2.65
limiting resolution
value of that portion of a specified resolution test pattern, measured in line widths per picture height, that corresponds to an average modulation value equal to some specified percentage of the modulation value at a specified reference frequency

[ISO 12233]

EXAMPLE The limiting resolution may be the test pattern value, in line widths per picture height (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.

2.66
line pairs per millimetre
lp/mm
metric for specifying resolution in terms of the number of equal width black and white line pairs per millimetre that can be resolved according to some criterion, such as visual resolution or limiting resolution

[ISO 12233]

NOTE Distance units other than millimetres may also be used.

2.67
line spread function
LSF
normalized spatial signal distribution in the linearized output of an imaging system resulting from imaging a theoretical infinitely thin line

[ISO 12233]

NOTE If the imaging system is operating in an isoplanatic region and in its linear range, the LSF is equal to the first derivative of the ESF.

2.68
line widths per picture height
LW/PH
metric for specifying the width of a feature on a test chart, relative to the height of the active area of the chart, which is equal to the height of the active area of the test chart divided by the width of a black line that 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 target or within the vertical field of view of a camera

NOTE Adapted from ISO 12233.

EXAMPLE If the height of the active area of the chart equals 20 cm, a black line of 1 000 LW/PH has a width equal to 20/1 000 cm.

2.69
linearized
digital signal conversion performed to invert either the focal plane or the camera opto-electronic conversion function (OECF) so that the resulting signal is approximately linearly proportional to focal plane exposure or scene luminance, respectively

[ISO 12233]

2.70
lines per millimetre
lines/mm
metric for specifying resolution in terms of the number of equal width black and white lines per millimetre that can be resolved according to some criterion, such as visual resolution or limiting resolution

[ISO 12233]

NOTE 1 Distance units other than millimetres may also be used.

NOTE 2 1 lp/mm = 2 lines/mm.

2.71
luminance factor
ratio of the luminance of the surface element in the given direction to that of a perfect reflecting or transmitting diffuser identically illuminated

[CIE Publication 17.4 (845-04-69), ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **equivalent neutral luminance factor, luminance ratio**

2.72
main image
primary (e.g. full resolution) image data

[ISO 12234-3]

2.73
maximum exposure limit
smallest exposure which produces the digital output level corresponding to the maximum detectable exposure

[ISO 14524]

cf. **minimum exposure limit**

NOTE The maximum detectable exposure is also known as the saturation or quantization ceiling.

2.74
media profile
portion of the memory module specification which is specific to a given memory technology; including the form factor, interconnection and access protocol

[ISO 12234-1]

cf. **image storage application profile, image data format**

2.75
memory card
specific type of memory module with a physical form factor no larger than that of a credit card in outline, i.e. approximately 85 mm × 55 mm

[ISO 12234-1]

2.76
memory module
physical implementation of the removable memory, containing the image data format combined with a specified physical form factor, interconnect definition and access protocol

[ISO 12234-1]

2.77
minimum exposure limit
largest exposure below saturation which produces an incremental output signal equal in magnitude to the output noise

[ISO 14524]

cf. **incremental output signal, maximum exposure limit, output noise**

2.78
modulation
difference between the minimum and maximum signal levels divided by the sum of these levels

[ISO 12233]

2.79
modulation transfer function
MTF
modulus of the optical transfer function

[ISO 12233]

cf. **optical transfer function, spatial frequency response**

2.80
noise
unwanted variations in the response of an imaging system

2.80.1
total noise
all the noise captured by a single exposure

2.80.2
fixed pattern noise
noise that is consistent for every exposure

2.80.3
temporally varying noise
random noise due to sensor dark current, photon shot noise, analogue processing, and quantization, that varies from one image to the next

[ISO 15739, ISO 21550]

2.81
noise spectral power distribution
curve or equation that expresses the camera output noise as a function of two-dimensional image spatial frequencies

[ISO 15739]

2.82
normalized spatial frequency
cycles
unit used for expressing spatial frequency response, where the distance dimension has been removed by multiplying the spatial frequency in cycles per millimetre by the sampling period in millimetres

[ISO 12233]

NOTE Normalized spatial frequency is particularly appropriate for comparing the spatial frequency response of imaging systems where the rendering magnification is unknown, and the total number of samples is equal.

2.83
Nyquist limit
spatial frequency equal to 0,5 times the inverse of the sampling period

[ISO 12233]

NOTE Energy at 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 directions.

2.84
optical transfer function
OTF
two-dimensional Fourier transform of the imaging system's point spread function

[ISO 12233]

cf. **modulation transfer function, spatial frequency response**

NOTE For the OTF to have significance, it is necessary that the imaging system be operating in an isoplanatic region and in its linear range. The OTF is a complex function whose modulus has unity value at zero spatial frequency.

2.85
opto-electronic conversion function
OECF
relationship between the log of the input levels and the corresponding digital output levels for an opto-electronic digital image capture system

[ISO 14524]

NOTE If the input log exposure points are very finely spaced and the output noise is small compared to the quantization interval, the OECF may have a step-like character. Such behaviour is an artefact of the quantization process and should be removed by using an appropriate smoothing algorithm or by fitting a smooth curve to the data.

2.85.1
camera opto-electronic conversion function
camera OECF
relationship between the input scene log luminances and the digital output levels for an opto-electronic digital image capture system

NOTE The units of measurement for this function are $\log_{10}$ candelas per square metre.

[ISO 14524, ISO 15739]

2.85.2
focal plane opto-electronic conversion function
focal plane OECF
relationship between the input focal plane log exposures (units: $\log_{10}$ lux seconds) and the digital output levels for an opto-electronic digital image capture system

[ISO 14524]

2.86
opto-electronic digital image capture system
system which converts either a light exposure at the focal plane, or a spatial arrangement of luminances (a scene) to digital information

[ISO 14524]

2.87
output noise
root-mean-square fluctuation about the mean in the digital output level for a constant input level

[ISO 14524]

2.88
PC
personal computer

[ISO 12234-3]

NOTE A PC can employ various hardware architectures and operating systems, and does not imply a specific type of hardware, or operating system.

2.89
photography
acquisition, processing or reproduction of optically-formed images using chemical or electronic technologies

2.90
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

[ISO 12232, ISO 15739]

2.91 Picture formats formed by video signals

2.91.1
field
⟨interlaced video⟩ assembly of alternate (odd or even) lines of a frame

NOTE 1 An interlaced frame is composed of two fields: an odd field and an even field, representing the odd- and even-numbered lines respectively.

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

2.91.2
frame(1)
⟨progressive video⟩ lines of spatial information of a video signal, containing samples starting from one time instant and continuing through successive lines to the bottom of the frame

NOTE Adapted from ISO/IEC 13818-2:1996

2.91.3
frame(2)
⟨interlaced video⟩ lines of spatial information of a video signal, consisting of an odd field and an even field; one of which will commence one field period later than the other

NOTE Adapted from ISO/IEC 13818-2:1996

2.91.4
movie frame
studio frame
⟨interlaced video⟩ frame consisting of two fields taken simultaneously

2.92
play
display an image or output an image as a hard copy

[ISO 12234-3]

2.93
point spread function
PSF
normalized spatial signal distribution in the linearized output of an imaging system resulting from imaging a theoretical infinitely small point source

[ISO 12233]

2.94
protection
setting the ReadOnly attribute for a DCF object or directory

[ISO 12234-3]

2.95
Reader 1
playback device function that meets the requirements of the DCF Reader 1 specification

[ISO 12234-3]

2.96
Reader 2
playback device function that meets the requirements of the DCF Reader 2 specification

[ISO 12234-3]

2.97
removable memory
storage in a user-removable form factor, which is transportable and intended for the digital storage of image data in electronic still cameras

[ISO 12234-1]

NOTE The memory media may be read/write, write once, etc. but must be non-volatile; when removed from the camera, it must retain the data.

2.98
resolution
measure of the ability of a digital image capture system, or a component of a digital image capture system, to depict spatial picture detail

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE Resolution measurement metrics include resolving power, visual resolution, limiting resolution, SFR, MTF and OTF.

2.99
sample spacing
physical distance between sampling points or sampling lines

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE The sample spacing may be different in the two orthogonal sampling directions.

2.100
sampled imaging system
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

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE The sampling at each point is done using a finite-size sampling aperture or area.

2.101
sampling aspect ratio
ratio of the sample spacing in the two orthogonal sampling directions

[ISO 12233]

NOTE If the sample spacing is equal, the aspect ratio of the sampling grid is 1:1, or “square”, so that the sampling aspect ratio provides “square pixels".

2.102
sampling frequency
reciprocal of the sample spacing

[ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE The sampling frequency is expressed in samples per unit distance.

2.103
scanner
electronic device that converts a fixed image, such as a print or film transparency, into an electronic signal

[ISO 16067-1, ISO 16067-2, ISO 21550]

2.104
scanner opto-electronic conversion function
scanner OECF
relationship between the input density and the digital output levels for an opto-electronic digital image capture system

[ISO 16067-1, ISO 16067-2, ISO 21550]

2.105
scene luminance ratio
ratio of the highest (highlight) luminance value to the lowest (shadow) luminance value in a scene

[ISO 14524]

2.106
signal processing
operations performed by electronic circuits or algorithms that convert or modify the output of an image sensor

[ISO 12232, ISO 15739]

2.107
slow scan direction
direction in which the scanner moves the photoelements (perpendicular to the lines of active photoelements in a linear array image sensor)

[ISO 16067-1, ISO 16067-2, ISO 21550]

2.108
softcopy
representation of an image produced using a device capable of directly representing different digital images in succession and in a non-permanent form

[ISO 3664, ISO 22028-1]

EXAMPLE A monitor.

2.109
sound recording
recording of the sound data relative to an image acquired by the electronic still camera

[ISO 12234-1]

NOTE 1 The sound recording may be made before, during, or after the time of the image acquisition.

NOTE 2 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.

2.110
spatial frequency response
SFR
measured amplitude response of an imaging system as a function of relative input spatial frequency

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

NOTE The SFR is normally represented by a curve of the output response to an input sinusoidal spatial luminance distribution of unit amplitude, over a range of spatial frequencies. The SFR is normalized to yield a value of 1,0 at a spatial frequency of 0.

2.111
spectrally neutral
spectrally non-selective
exhibiting reflective or transmissive characteristics which are constant over the wavelength range of interest

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 17321-1, ISO 17321-2, ISO 21550]

cf. **effectively spectrally neutral**

2.112
test chart
arrangement of test patterns designed to test particular aspects of an imaging system

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

2.113
test pattern
specified arrangement of spectral reflectance or transmittance characteristics used in measuring an image quality attribute

NOTE The test pattern spectral characteristics include the types given in 2.113.1 to 2.113.3.

2.113.1
bi-tonal pattern
pattern that is spectrally neutral or effectively spectrally neutral, and consists exclusively of two reflectance or transmittance values in a prescribed spatial arrangement

NOTE Bitonal patterns are typically used to measure resolving power, limiting resolution, and SFR.

2.113.2
grey scale pattern
pattern that is spectrally neutral or effectively spectrally neutral, and consists of a large number of different reflectance or transmittance values in a prescribed spatial arrangement

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

2.113.3
spectral pattern
pattern that is specified by the spatial arrangement of features with differing spectral reflectance or transmittance values

NOTE Spectral patterns are typically used to measure colour reproduction.

[ISO 12233, ISO 16067-1, ISO 16067-2, ISO 21550]

2.114
thumbnail
small version of the main image, used for indexing

[ISO 12234-3]

2.115
time scale exposure series
series of exposures produced using a constant focal plane illuminance and a varying exposure time

[ISO 14524]

cf. **illuminance scale exposure series**

2.116
tristimulus value
amounts of the three reference colour stimuli, in a given trichromatic system, required to match the colour of the stimulus considered

[CIE Publication 17.4 (845-03-22), ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **colour matching functions**

2.117
vertical pixels
number of luminance pixels of image data in the sub-scanning (i.e. y-axis) direction

[ISO 12234-3]

2.118
vertical resolution
resolution value measured in the shorter image dimension, corresponding to the vertical direction for a "landscape" image orientation, typically using a horizontally oriented test chart feature

[ISO 12233]

2.119
video signal-to-noise ratio
⟨video systems⟩ ratio of the maximum (peak) output signal level to the root mean square (rms) noise level

[ISO 15739]

NOTE 1 Typically expressed in decibels (dB).

NOTE 2 This term should not be used to express the noise in an electronic still imaging system.

2.120
visual resolution
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 by human observers, or are reproduced at a spatial frequency lower than the spatial frequency of the corresponding area of the test chart, as a result of aliasing

[ISO 12233]

2.121
white balance
adjustment of electronic still picture colour channel gains or image processing so that radiation with relative spectral power distribution equal to that of the scene illumination source is rendered as a visual neutral

[ISO 14524]

2.122
writer
recording device function that meets the requirements of the DCF Writer specification

[ISO 12234-3]

Annex A
(informative)

Other terms and definitions

A.1 Rationale

Included in this annex are terms collected from standards that have not reached the enquiry stage. These terms are more likely to change as the source documents progress. Where possible, the latest draft of the source document should be reviewed to see if a more current definition is available. These terms and definitions are provided in this International Standard to facilitate communication. Future revisions of this International Standard will include updated terms and definitions consistent with the source documents at the time the revision is prepared.

A.2 Terms and definitions

A.2.1
absolute colorimetric coordinates
tristimulus values, or other colorimetric coordinate derived from tristimulus values, where the numerical value corresponds to the magnitude of the physical stimulus

[ISO 22028-1, ISO 17321-1, ISO 17321-2]

cf. **tristimulus value**

NOTE When CIE 1931 2° standard observer colour matching functions are used, the Y value corresponds to the luminance, not the luminance factor (or some scaled value thereof).

A.2.2
adapted white
colour stimulus that an observer who is adapted to the viewing environment would judge to be perfectly achromatic and to have a luminance factor of unity; i.e. have absolute colorimetric coordinates that an observer would consider to be the perfect white diffuser

[ISO 22028-1, ISO 17321-1, ISO 17321-2]

cf. **adopted white**

NOTE The adapted white may vary within a scene.

A.2.3
additive RGB colour space
colorimetric colour space having three colour primaries (generally red, green and blue) such that CIE XYZ tristimulus values can be determined from the RGB colour space values by forming a weighted combination of the CIE XYZ tristimulus values for the individual colour primaries, where the weights are proportional to the radiometrically linear colour space values for the corresponding colour primaries

[ISO 22028-1]

NOTE 1 A simple linear 3×3 matrix transformation can be used to transform between CIE XYZ tristimulus values and the radiometrically linear colour space values for an additive RGB colour space.

NOTE 2 Additive RGB colour spaces are defined by specifying the CIE chromaticity values for a set of additive RGB primaries and a colour space white point, together with a colour component transfer function.

A.2.4
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

[ISO 22028-1, ISO 17321-1, ISO 17321-2]

cf. **adapted white**

NOTE 1 The adopted white may vary within a scene.

NOTE 2 No assumptions should be made concerning the relation between the adapted or adopted white and measurements of near perfectly reflecting diffusers in a scene, because measurements of such diffusers will depend on the illumination and viewing geometry, and other elements in the scene that may affect perception. It is easy to arrange conditions for which a near perfectly reflecting diffuser will appear to be grey or coloured.

A.2.5
album
end-user created object that is used to logically group data objects according to some user-defined criteria

[ISO 15740]

NOTE An album may or may not be a physical folder in a filesystem. In ISO 15740, album is a type of association.

A.2.6
appearance model
cf. **single-stimulus appearance model, image appearance model**

A.2.7
application programming interface
API
high-level functional description of a software interface

[ISO 15740]

NOTE An API is typically language-dependent.

A.2.8
artefactual attribute
attribute of image quality that, when evident in an image, nearly always leads to a loss of overall image quality

[ISO 20462-1, ISO 20462-3]

NOTE Noise and aliasing are examples of artefactual attributes. The commonly used terms *defect* and *impairment* are similar in meaning.

A.2.9
association
logical construct used to expose a relationship between discrete objects

[ISO 15740]

NOTE Associations are used to indicate that separate data objects are related. Associations are represented like folders, and may be nested using a standard branched hierarchical tree structure.

EXAMPLE A time sequence, or user-defined groupings by content or capture session.

A.2.10
attribute
aspect, dimension, or component of overall image quality

[ISO 20462-1, ISO 20462-3]

cf. **artefactual attribute, preferential attribute**

NOTE Image quality attributes include image structure properties such as sharpness and noise; colour and tone reproduction properties such as contrast, colour balance, and relative colourfulness; and digital artefacts such as aliasing, contouring, and compression defects.

A.2.11
attribute just noticeable difference
attribute JND
measure of the detectability of appearance variations, corresponding to a stimulus difference that would lead to a 75:25 proportion of responses in a paired comparison task in which univariate stimuli pairs were assessed in terms of a single attribute identified in the instructions

[ISO 20462-1]

cf. **quality just noticeable difference**

NOTE 1 As an example, a paired comparison identifying the sharper of two stimuli that differed only in their generating system modulation transfer function (MTF) would yield results in terms of sharpness attribute JNDs. If the MTF curves differed monotonically and did not cross, the outcome of the paired comparison would depend primarily upon the observers' ability to detect changes in the appearance of the stimuli as a function of MTF variations, with little or no value judgement required of the observers. If a given stimulus difference were genuinely detected by one-half of observers, then on average a 75:25 proportion of responses would result, because those observers detecting the difference would all identify the same sample as being sharper, whereas those not detecting the difference would be forced to guess, and would therefore be equally likely to choose either sample. The relationship between paired comparison proportions and stimulus differences is discussed in greater detail in Annex A of ISO 20462-1.

NOTE 2 If observers are instead asked to choose which of a pair of stimuli is higher in overall image quality, and if the stimuli in aggregate are multivariate such that the observer must make value judgements of the importance of a number of attributes rather than focusing on one aspect of image appearance, it is observed experimentally that larger objective stimulus differences (for example, MTF changes) are required to obtain a 75:25 proportion of responses, which in this case corresponds to a quality JND. In the cases of sharpness and noisiness, approximately twice as large an objective stimulus difference is required to produce one quality JND compared to one attribute JND. Because an attribute change cannot affect quality unless it is detectable, the number of attribute JNDs will always place an upper bound on the number of quality JNDs.

A.2.12
categorical sort method
psychophysical method involving the classification of a stimulus into one of several ordered categories, at least some of which are identified by adjectives or phrases that describe different levels of image quality or attributes thereof

[ISO 20462-1, ISO 20462-2]

NOTE The application of adjectival descriptors is strongly affected by the range of stimuli presented, so that it is difficult to compare the results of one categorical sort experiment with those of another. Range effects and the coarse quantization of categorical sort experiments also hinder conversion of the responses to JND units. Given these limitations, it is not possible to unambiguously map adjectival descriptors to JND units; but it is worth noting that in some experiments where a broad range of stimuli have been presented, the categories excellent, very good, good, fair, poor, and not worth keeping have been found to provide very roughly comparable intervals that average about six quality JNDs in width.

A.2.13
colorimetric colour space
colour space having an exact and simple relationship to CIE colorimetric values

[ISO 22028-1]

NOTE Colorimetric colour spaces include those defined by CIE (e.g. CIE XYZ, CIELAB, CIELUV, etc.), as well as colour spaces that are simple transformations of those colour spaces (e.g. additive RGB colour spaces).

A.2.14
colour component transfer function
single variable, monotonic mathematical function applied individually to one or more colour channels of a colour space

[ISO 17321-2, ISO 22028-1]

NOTE 1 Colour component transfer functions are frequently used to account for the nonlinear response of a reference device and/or to improve the visual uniformity of a colour space.

NOTE 2 Generally, colour component transfer functions will be nonlinear functions such as a power-law (i.e. “gamma”) function or a logarithmic function. However, in some cases a linear colour component transfer function may be used.

A.2.15
colour encoding
a generic term for a quantized digital encoding of a colour space, encompassing both colour space encodings and colour image encodings

[ISO 22028-1]

A.2.16
colour gamut
solid in a colour space, consisting of all those colours that are: present in a specific scene, artwork, photograph, photomechanical or other reproduction; or capable of being created using a particular output device and/or medium

[ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **luminance ratio**

A.2.17
colour image encoding
digital encoding of the colour values for a digital image, including the specification of a colour space encoding, together with any information necessary to properly interpret the colour values such as the image state, the intended image viewing environment and the reference medium

[ISO 22028-1]

NOTE 1 In some cases the intended image viewing environment will be explicitly defined for the colour image encoding. In other cases, the intended image viewing environment may be specified on an image-by-image basis using metadata associated with the digital image.

NOTE 2 Some colour image encodings will indicate particular reference medium characteristics, such as a reflection print with a specified density range. In other cases the reference medium will be not applicable, such as with a scene-referred encoding, or will be specified using image metadata.

NOTE 3 Colour image encodings are not limited to pictorial digital images that originate from an original scene, but are also applicable to digital images with content such as text, line art, vector graphics and other forms of original artwork.

A.2.18
colour pixel reconstruction
demosaicing
colour pixel interpolation
algorithm that creates a fully populated colour image record from the output of a CFA-type sensor by interpolating values for each colour at each pixel location

[ISO 17321-1, ISO 17321-2]

A.2.19
colour rendering
mapping of image data representing the colour-space coordinates of the elements of a scene to output-referred image data representing the colour-space coordinates of the elements of a reproduction

[ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **colour re-rendering, image appearance model, reproduction model, preferred-reproduction model**

NOTE Colour rendering generally consists of one or more of the following: compensating for differences in the input and output viewing conditions, tone scale and gamut mapping to map the scene colours onto the dynamic range and colour gamut of the reproduction, and applying preference adjustments.

A.2.20
colour re-rendering
mapping of picture-referred image data appropriate for one specified real or virtual imaging medium and viewing conditions to picture-referred image data appropriate for a different real or virtual imaging medium and/or viewing conditions

[ISO 22028-1]

cf. **colour rendering, image appearance model, reproduction model, preferred-reproduction model**

NOTE Colour re-rendering generally consists of one or more of the following: compensating for differences in the viewing conditions, compensating for differences in the dynamic range and/or colour gamut of the imaging media, and applying preference adjustments.

A.2.21
colour space encoding
digital encoding of a colour space, including the specification of a digital encoding method, and a colour space value range

[ISO 22028-1]

NOTE Multiple colour space encodings may be defined based on a single colour space where the different colour space encodings have different digital encoding methods and/or colour space value ranges. (e.g. 8-bit sRGB and 10-bit e-sRGB use different colour space encodings based on a particular RGB colour space.)

A.2.22
colour space white point
colour stimulus to which colour space values are normalized

[ISO 22028-1]

NOTE The colour space white point may or may not correspond to the assumed adapted white point and/or the reference medium white point for a colour image encoding.

A.2.23
connection
transport-provided mechanism for establishing paths for transferring data between devices

[ISO 15740]

A.2.24
continuous colour space values
real-valued, unbounded colour space values that have not been encoded using a digital encoding method

[ISO 22028-1]

A.2.25
data object
image or other type of data that typically exists in persistent storage of a DSPD or other device

[ISO 15740]

A.2.26
datacode
sixteen-bit unsigned integer whose most significant nibble (four bits) is used to indicate the category of code and whether the code value is standard or vendor-extended

[ISO 15740]

A.2.27
dataset
transport-independent collection of one or more individual data items with known interpretations

[ISO 15740]

NOTE Data sets are not necessarily opaque nor atomic to transport implementations.

A.2.28
device-dependent colour space
colour space defined by the characteristics of a real or idealized imaging device

[ISO 22028-1]

NOTE Device-dependent colour spaces having a simple functional relationship to CIE colorimetry can also be categorized as colorimetric colour spaces. For example, additive RGB colour spaces corresponding to real or idealized CRT displays can be treated as colorimetric colour spaces.

A.2.29
device discovery
act of determining the set of all devices present on a particular transport or platform that are physically or logically accessible

[ISO 15740]

A.2.30
digital imaging system
system that records and/or produces images using digital data

[ISO 17321-2, ISO 22028-1]

A.2.31
digital print order format
DPOF
standardized ASCII file stored on removable media along with the image files that indicates how many copies of which images should be printed

[ISO 15740]

NOTE DPOF also allows index prints, cropping, and text overlays to be specified.

A.2.32
digital still photography device
DSPD
device with persistent storage that captures a two-dimensional digital still image

[ISO 15740]

A.2.33
DSC colour analysis error index
index relating to the ability of a DSC to analyse scene element colorimetric coordinates, based on errors in analysing specified test colours represented in a specified scene-referred colour space

[ISO 17321-1, ISO 17321-2]

NOTE The DSC colour analysis error index applies only to the ability of a DSC to analyse scene colours, and does not provide a means for evaluating DSC colour rendering. Raw or scene-referred image data must be obtained for application of the DSC colour analysis error index.

A.2.34
DSC raw response space
colour space whose coordinates consist of the responses of the DSC channels

[ISO 17321-1, ISO 17321-2]

NOTE These responses are the integrated products of each channel's spectral sensitivity and the radiance at each wavelength. No matrixing of these responses has occurred, nor have any colour transforms been applied.

A.2.35
effective visual density
base ten logarithm of the ratio of the luminance of the adopted white of a scene or original to the luminance of a measured area of the scene or original

[ISO 17321-1, ISO 17321-2]

A.2.36
electro-optical conversion function
EOCF
relationship between the digital code values provided to an output device and the equivalent neutral densities produced by the device

[ISO 17321-1, ISO 17321-2]

A.2.37
enumeration
act of creating an ordered increasing numerical list that contains one representative element for each member of a set

[ISO 15740]

A.2.38
equivalent neutral density
END
visual density or effective visual density of an analysis primary or rendering colorant, when it is combined with the amounts of the other system primaries or colorants required to produce a visual neutral

[ISO 17321-1, ISO 17321-2]

cf. **equivalent neutral luminance factor**

A.2.39
equivalent neutral luminance factor
luminance factor of an analysis primary or rendering colorant, when it is combined with the amounts of the other system primaries or colorants required to produce a visual neutral

[ISO 17321-1, ISO 17321-2]

cf. **luminance factor, equivalent neutral density**

A.2.40
extended gamut
colour gamut extending outside that of the standard sRGB CRT display as defined by IEC 61966-2-1

[ISO 22028-1]

A.2.41
film rendering transform
mapping of image data representing measurements of a photographic negative to output-referred image data representing the colour-space coordinates of the elements of a reproduction

[ISO 22028-1]

A.2.42
film unrendering transform
mapping of image data representing measurements of a photographic negative to scene-referred image data representing estimates of the colour-space coordinates of the elements of the original scene

[ISO 22028-1]

A.2.43
FlashPix
image file format, defined in *FlashPix Format Specification*, using a structured storage file containing metadata and a tiled, hierarchical image representation

[ISO 15740]

NOTE The tiles in a FlashPix image are normally baseline JPEG images, and individual image tiles of a particular resolution can be easily accessed for rapid display and editing.

A.2.44
folder
optional sub-structure in a hierarchical storage area that can contain data objects

[ISO 15740]

A.2.45
gamut mapping
mapping of the colour-space coordinates of the elements of a source image to colour-space coordinates of the elements of a reproduction to compensate for differences in the source and output medium colour gamut capability

[ISO 22028-1]

NOTE The term gamut mapping is somewhat more restrictive than the term colour rendering because gamut mapping is performed on colorimetry which has already been adjusted to compensate for viewing condition differences and viewer preferences, although these processing operations are frequently combined in reproduction and preferred-reproduction models.

A.2.46
ICC profile
International Color Consortium's file format, used to store transforms from one colour encoding to another, e.g. from device colour coordinates to profile connection space, as part of a colour management system

[ISO 15740, ISO 22028-1]

A.2.47
IEEE1394
high-speed serial bus standardized by the IEEE (Institute of Electrical and Electronics Engineers) currently having clock rates of 100, 200, and 400 Mbit/s

[ISO 15740]

NOTE IEEE1394 is often referred to as Firewire.

A.2.48
image appearance model
mathematical model that uses information about viewing conditions and other colours in an image to estimate the subjective appearance of any element of an image from colorimetric measurements of the image

[ISO 17321-1, ISO 17321-2]

cf. **colour rendering, preferred-reproduction model, reproduction model, single-stimulus appearance model**

NOTE 1 An image appearance model can describe the elements of either a scene, an original, or a reproduction, but it does not consider the characteristics of any potential output medium for subsequent reproduction.

NOTE 2 There is no general consensus on the appropriate form for an image appearance model. There is an expectation that reproducing the colorimetric coordinates of every colour in an image will result in a reproduction of the appearance of the entire image, as long as the viewing condition remains the same and it is possible to reproduce the colorimetric coordinates of every colour in the image. A single-stimulus appearance model cannot be expected to deal completely with the effect of changing viewing conditions in an image because the combined effect of macroscopic viewing conditions and other colours in the image could result in the appearance of any colour in the image changing in a way that is not predictable by the single-stimulus model, since it is not keeping track of the other colours.

NOTE 3 An image appearance model followed by its inverse is appropriate for use as a reproduction model provided the reproduction medium does not impose any limitations on the colours to be reproduced in the image.

A.2.49
image capture device
device for converting a scene or a fixed image such as a print, film, or transparency, to digital image data

[ISO 15740]

A.2.50
image output device
device that can render a digital image to hardcopy or softcopy media

[ISO 15740]

A.2.51
image quality
an impression of the overall merit or excellence of an image, as perceived by an observer neither associated with the act of photography, nor closely involved with the subject matter depicted

[ISO 20462-1, ISO 20462-3]

NOTE The purpose of defining image quality in terms of third-party (uninvolved) observers is to eliminate sources of variability that arise from more idiosyncratic aspects of image perception and pertain to attributes outside the control of imaging system designers.

A.2.52
image state
attribute of a colour image encoding indicating the type of image data to which the encoded image colour values are referred

[ISO 22028-1]

NOTE The standard image states defined in this document are scene-referred, original-referred and output-referred.

A.2.53
in-band event
event transmitted on the same logical connection as operations and responses

[ISO 15740]

NOTE Events are only asynchronous to the degree of data precision for which the transport implementation allows event interleaving.

A.2.54
initiator
device that initiates a conversation by opening a session, and issues all formal operations to the responder

[ISO 15740]

NOTE The initiator is analogous to the client in the client/server paradigm.

A.2.55
input-referred image data
image data which is either scene-referred or original-referred

[ISO 22028-1]

cf. **original-referred image data, scene-referred image data**

A.2.56
instructions
set of directions given to the observer for performing the psychophysical evaluation task

[ISO 20462-1, ISO 20462-3]

A.2.57
International Color Consortium profile connection space
ICC PCS
standard colour image encoding defined by the International Color Consortium providing a standard connection point for combining ICC profiles

[ISO 22028-1]

NOTE The ICC.1:2001 specification defines two variations of the PCS. An original-referred variation for colorimetric intent profiles, and a standard output-referred variation for perceptual intent profiles.

A.2.58
IrDA
Infrared Data Association

[ISO 15740]

NOTE The IrDA has defined an infrared wireless communication system that currently supports wireless communication at data rates between 9,6 kbit/s and 4 Mbit/s.

A.2.59
ISO scanner dynamic range
difference of the maximum density where the incremental gain is higher than 0,5, as determined according to ISO 21550, and the minimum density that appears unclipped

A.2.60
just noticeable difference
JND
stimulus difference that would lead to a 75:25 proportion of responses in a paired comparison task

[ISO 20462-1, ISO 20462-3]

cf. **attribute just noticeable difference, quality just noticeable difference**

A.2.61
LogicalStorageID
least significant sixteen bits of a StorageID

[ISO 15740]

NOTE The LogicalStorageID uniquely identifies one logical storage area within the physical store indicated in the PhysicalStorageID.

A.2.62
luminance ratio
ratio of the maximum luminance to the minimum luminance, either present in a specific scene, artwork, photograph, photomechanical or other reproduction; or capable of being created using a particular output device and medium

[ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **colour gamut**

A.2.63
magnitude estimation method
psychophysical method involving the assignment of a numerical value to each test stimulus that is proportional to image quality

[ISO 20462-1, ISO 20462-3]

NOTE 1 Typically, a reference stimulus with an assigned numerical value is present to anchor the rating scale.

NOTE 2 The numerical scale resulting from a magnitude estimation experiment is usually assumed to constitute a ratio scale, which, ideally, is a scale in which a constant percentage change in value corresponds with one JND. In practice, modest deviations from this behaviour occur, complicating the transformation of the rating scale into units of JNDs without inclusion of unidentified reference stimuli (having known quality) among the test stimuli.

A.2.64
medium black point
lowest luminance neutral that can be produced by an imaging medium in normal use, measured using the specified measurement geometry

[ISO 22028-1]

NOTE It is generally desirable to specify a medium black point that has the same chromaticity as the medium white point.

A.2.65
medium white point
highest luminance neutral that can be produced by an imaging medium in normal use, measured using the specified measurement geometry

[ISO 22028-1]

A.2.66
metadata
data associated with a digital image aside from the pixel values that comprise the digital image

[ISO 22028-1]

NOTE Metadata is typically stored as tags in the digital image file.

A.2.67
most significant nibble
MSN
most-significant four bits of the most-significant byte

[ISO 15740]

A.2.68
multivariate
describing a series of test or reference stimuli that vary in multiple attributes of image quality

[ISO 20462-1, ISO 20462-3]

A.2.69
object aggregation
act of taking one or more location-specific lists of objects that exist on a particular device and grouping them together into one set

[ISO 15740]

A.2.70
ObjectHandle
device-unique 32-bit unsigned integer assigned by a device to each data object in local persistent storage which is provided to external devices

[ISO 15740]

NOTE External recipients of an ObjectHandle must use it to reference that piece of data in subsequent transactions. ObjectHandles are guaranteed to be persistent over at least a session.

A.2.71
observer
individual performing the subjective evaluation task in a psychophysical method

[ISO 20462-1, ISO 20462-2, ISO 20462-3]

A.2.72
original-referred image data
image data which represents the colour-space coordinates of the elements of a two-dimensional hardcopy or softcopy image, typically produced by scanning artwork, photographic transparencies or prints, or photomechanical or other reproductions

[ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **colour rendering, input-referred image data, output-referred image data, scene-referred image data**

NOTE 1 Original-referred image data is related to the colour-space coordinates of the original as measured according to ISO 13655, and does not include any additional veiling glare or other flare.

NOTE 2 The characteristic of original-referred image data that most generally distinguishes it from scene-referred image data is that it is referred to a two-dimensional surface, and the illumination incident on the two dimensional surface is assumed to be uniform (or the image data corrected for any non-uniformity in the illumination).

NOTE 3 There are classes of originals that produce original-referred image data with different characteristics. Examples include various types of artwork, photographic prints, photographic transparencies, emissive displays, etc. When selecting a colour re-rendering algorithm, it is usually necessary to know the class of the original in order to determine the appropriate colour re-rendering to be applied. For example, a colorimetric intent is generally applied to artwork, while different perceptual algorithms are applied to produce photographic prints from transparencies, or newsprint reproductions from photographic prints. In some cases the assumed viewing conditions are also different between the original classes, such as between photographic prints and transparencies, and will usually be considered in well-designed systems.

NOTE 4 In a few cases, it may be desirable to introduce slight colorimetric errors in the production of original-referred image data, for example to make the gamut of the original more closely fit the colour space, or because of the way the image data was captured (such as a Status A densitometry based scanner).

A.2.73
out-of-band event
event transmitted on a different logical connection as operations and responses

[ISO 15740]

NOTE Out-of-band events are asynchronous from operation transactions.

A.2.74
output-referred image data
image data which represents the colour-space coordinates of the elements of an image that has undergone colour rendering appropriate for a specified real or virtual output device and viewing conditions

[ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **colour rendering, input-referred image data, original-referred image data, scene-referred image data, picture-referred image data**

NOTE 1 The output-referred image data is referred to the specified output device and viewing conditions. A single scene can be colour rendered to a variety of output-referred representations depending on the anticipated output viewing conditions, media limitations, and/or artistic intents.

NOTE 2 Output-referred image data may become the starting point for a subsequent reproduction process. For example, sRGB output-referred image data is frequently considered to be the starting point for the colour re-rendering performed by a printer designed to receive sRGB image data.

A.2.75
paired comparison method
psychophysical method involving the choice of which of two simultaneously presented stimuli exhibits greater or lesser image quality or an attribute thereof, in accordance with a set of instructions given to the observer

[ISO 20462-1, ISO 20462-2, ISO 20462-3]

NOTE Two limitations of the paired comparison method are as follows.

1. If all possible stimulus comparisons are done, as is usually the case, a large number of assessments are required for even modest numbers of experimental stimulus levels (if N levels are to be studied, $N(N - 1)/2$ paired comparisons are needed).

2. If a stimulus differences exceeds approximately 1,5 JNDs, the magnitude of the stimulus difference cannot be directly estimated reliably because the response saturates as the proportions approach unanimity. However, if a series of stimuli having no large gaps are assessed, the differences between more widely separated stimuli may be deduced indirectly by summing smaller, reliably determined (unsaturated) stimulus differences.

The various methods for transformation of paired comparison data to an interval scale (a scale linearly related to JNDs) perform statistically optimized procedures for inferring the stimulus differences using all the available data in a weighted estimate.

A.2.76
PhysicalStorageID
most significant sixteen bits of a StorageID

[ISO 15740]

NOTE This value uniquely identifies one physical storage area on a device, although there may be more than one logical store per physical store.

A.2.77
picture-referred image data
image data which represents the colour-space coordinates of the elements of a hardcopy or softcopy image, encompassing both original-referred image data and output-referred image data

[ISO 22028-1]

NOTE 1 Picture-referred image data will generally be colour rendered for a specific real or virtual imaging medium and viewing condition.

NOTE 2 Picture-referred image data can include image data that does not originate from an original scene, such as text, line art, vector graphics and other forms of original artwork.

A.2.78
PNG
portable network graphics
extensible file format for lossless, portable, compressed storage of raster images

[ISO 15740]

NOTE PNG supports indexed-colour, greyscale, truecolour, and an optional alpha channel.

A.2.79
preferred-reproduction model
mathematical model that produces transformations which are applied to scene- or original-referred image data to produce image data describing a pleasing reproduction

[ISO 17321-1, ISO 17321-2]

cf. **colour rendering, image appearance model, reproduction model**

NOTE Preferred-reproduction models are different from reproduction models in that the pleasing reproduction need not be an attempt to reproduce the appearance of the original. In fact, what is considered pleasing may depend on viewer preferences. The transformations produced by a preferred-reproduction model are generally dependent on the characteristics of the scene or original and the output medium.

A.2.80
preferential attribute
attribute of image quality that is invariably evident in an image, and for which the preferred degree is a matter of opinion, depending upon both the observer and the image content

[ISO 20462-1, ISO 20462-3]

NOTE 1 Examples of preferential image quality attributes include colour and tone reproduction properties such as contrast and relative colourfulness. Because the perceived quality associated with a preferential attribute is dependent upon both the observer and image content, in studies involving variations of preferential attributes, particular care is needed in the selection of representative sets of stimuli and groups of observers.

NOTE 2 The term *noticeable* in just noticeable difference is not linguistically strictly correct when applied to a preferential attribute, but is nonetheless retained in this document for convenience. For example, the higher contrast stimulus of a pair differing only in contrast might be readily identified by all observers, whereas there might be a lack of consensus regarding which of the two images was higher in overall image quality. Nonetheless, if the responses from the paired comparison for quality were in the proportion of 75:25, the image chosen more frequently would be said to be one JND higher in quality. The JND is best regarded as a measurement unit tied to the predicted or measured outcome of a paired comparison.

A.2.81
protocol
defined mechanisms for exchanging data between devices

[ISO 15740]

A.2.82
psychophysical experimental method
experimental technique for subjective evaluation of image quality or attributes thereof, from which stimulus differences in units of JNDs may be estimated

[ISO 20462-1, ISO 20462-2, ISO 20462-3]

cf. **categorical sort method, magnitude estimation method, paired comparison method, quality ruler method, rank ordering method, triplet comparison method**

A.2.83
pull model
use paradigm for DSPDs where the object receiver initiates the operation requests to transfer data objects from the sender

[ISO 15740]

A.2.84
push model
use paradigm for DSPDs where the object sender initiates the operation requests to transfer data objects to the receiver

[ISO 15740]

A.2.85
quality just noticeable difference
quality JND
measure of the significance or importance of quality variations, corresponding to a stimulus difference that would lead to a 75:25 proportion of responses in a paired comparison task in which multivariate stimuli pairs were assessed in terms of overall image quality

[ISO 20462-1, ISO 20462-3]

cf. **attribute just noticeable difference**

NOTE The attribute JND is a measure of detectability of appearance changes, whereas the quality JND is a measure of significance or importance of stimulus differences in terms of their impact on quality. An attribute JND is a useful unit for predicting how observers would react to an advertisement showing images carefully matched in all respects but one, and drawing the attention of the observer to the attribute varying. In contrast, a quality JND is useful for predicting how observers would perceive overall quality as a function of one or more stimulus variations, and so is a more useful quantity in optimizing imaging system design, where different attributes must be balanced against one another. The overall quality of an image may be predicted from a knowledge of the impact of each attribute in isolation, expressed in terms of quality JNDs, whereas the same is not true of attribute JNDs. Therefore, it is often highly desirable to obtain results expressed in quality JNDs, even if the stimuli being assessed are univariate in nature. This can be accomplished if test stimuli are rated against a series of appropriately calibrated reference stimuli, as in the quality ruler method.

A.2.86
quality ruler method
psychophysical method described in ISO 20462-3, which involves quality or attribute assessment of a test stimulus against a series of ordered, univariate reference stimuli that differ by known numbers of JNDs

[ISO 20462-1, ISO 20462-3]

A.2.87
QuickDraw picture
file format consisting of sequences of saved drawing commands

[ISO 15740]

NOTE QuickDraw files are commonly referred to as PICT files.

A.2.88
rank ordering method
psychophysical method involving the arrangement by an observer of a series of stimuli in order of increasing or decreasing image quality or an attribute thereof, in accordance with the set of instructions provided

[ISO 20462-1]

A.2.89
raw DSC image data
image data produced by or internal to a DSC that has not been processed, except for analog-to-digital conversion and the following optional steps: linearization, dark current/frame subtraction, shading & sensitivity (flat field) correction, flare removal, white balancing (e.g. so the adopted white produces equal RGB values or no chrominance), missing colour pixel reconstruction (without colour transformations)

[ISO 17321-1, ISO 17321-2]

cf. **scene-referred image data**

A.2.90
reference stimulus
image provided to the observer for the purpose of anchoring or calibrating the perceptual assessments of test stimuli in such a manner that the given ratings may be converted to JND units

[ISO 20462-1, ISO 20462-3]

A.2.91
reproduction model
mathematical model that produces transformations which are applied to scene- or original-referred image data to produce image data describing a reproduction which is as close as possible to being an appearance match to the original

[ISO 17321-1, ISO 17321-2]

cf. **colour rendering, image appearance model, preferred-reproduction model**

NOTE Transformations produced by reproduction models will generally depend on the luminance ratio and colour gamut of the scene or original and the output medium.

A.2.92
responder
device that responds to operations from the initiator

[ISO 15740]

NOTE The responder is analogous to a server in the client/server paradigm.

A.2.93
scene
spectral radiances of a view of the natural world as measured from a specified vantage point in space and at a specified time

[ISO 17321-1, ISO 22028-1]

NOTE A scene may represent an actual view of the natural world or a computer-generated simulation of such a view.

A.2.94
scene analysis colour matching functions
colour matching functions obtained by applying a matrix to the CIE 1931 standard 2° observer colour matching functions as prescribed in ISO 17321-2

A.2.95
scene analysis colour space
colour space whose coordinates are tristimulus values determined using the scene analysis colour matching functions

[ISO 17321-2]

A.2.96
scene analysis error minimization colour space
colour space whose coordinates are tristimulus values determined using the scene analysis colour matching functions, to which the scene analysis error minimization transform has been applied

[ISO 17321-2]

NOTE The scene analysis error minimization colour space is selected so that characterization transformations which minimize analysis errors in this colour space produce the best visual estimates of scene-referred colorimetry, based on subjective testing of candidate colour spaces.

A.2.97
scene analysis error minimization transform
nonlinear transform which is applied to the scene analysis colour space to produce the scene analysis error minimization colour space

[ISO 17321-2]

A.2.98
scene-referred image data
image data which represents estimates of the colour-space coordinates of the elements of a scene

[ISO 17321-1, ISO 17321-2, ISO 22028-1]

cf. **input-referred image data, original-referred image data, output-referred image data, raw DSC image data**

NOTE 1 Scene-referred image data can be determined from raw DSC image data before colour rendering is performed. Generally, DSCs do not write scene-referred image data in image files, but some may do so in a special mode intended for this purpose. Typically, DSCs write standard output-referred image data where colour rendering has already been performed.

NOTE 2 Scene-referred image data typically represents relative scene colorimetry estimates. Absolute scene colorimetry estimates may be calculated using a scaling factor. The scaling factor can be derived from additional information such as the image OECF, FNumber or ApertureValue, and ExposureTime or ShutterSpeedValue tags.

NOTE 3 Scene-referred image data may contain inaccuracies due to the dynamic range limitations of the capture device, noise from various sources, quantization, optical blurring and flare that are not corrected for, and colour analysis errors due to capture device metamerism. In some cases, these sources of inaccuracy can be significant. ISO 17321-1 specifies a DSC/SMI (DSC Sensitivity Metamerism Index), which can be used to estimate the amount of inaccuracy resulting from capture device metamerism.

NOTE 4 The transformation from raw DSC image data to scene-referred image data depends on the relative adopted whites selected for the scene and the colour space used to encode the image data. If the chosen scene adopted white is inappropriate, additional errors will be introduced into the scene-referred image data. These errors may be correctable if the transformation used to produce the scene-referred image data is known, and the colour encoding used for the incorrect scene-referred image data has adequate precision and dynamic range.

NOTE 5 Standard methods for the calculation of scene-referred image data from raw DSC image data will be specified in ISO 17321-2.

NOTE 6 The scene may correspond to an actual view of the natural world, or a computer-generated simulation of such a view. It may also correspond to a modified scene determined by applying modifications to an original scene to produce some different desired scene. Any such scene modifications should leave the image in a scene-referred image state, and should be done in the context of an expected colour rendering transform.

A.2.99
session
logical connection between two devices defining a period of time during which obtained state information, such as handle persistence, may be relied upon

[ISO 15740]

A.2.100
single-stimulus appearance model
mathematical model which uses information about viewing conditions to estimate the subjective appearance of a coloured patch from colorimetric measurements of that patch and its surround

[ISO 17321-1, ISO 17321-2]

cf. **colour rendering, image appearance model, preferred-reproduction model, reproduction model**

A.2.101
square pixel sampling
image having equal sample spacing in the two orthogonal sampling directions

[ISO 15740]

A.2.102
standard original-referred colour encoding
standardized colour encoding for original-referred image data

[ISO 22028-1]

A.2.103
standard output-referred colour encoding
standardized colour encoding for output-referred image data

[ISO 22028-1]

A.2.104
standard quality scale
SQS
fixed numerical scale of quality defined in ISO 20462-3 and having the following properties: (1) the numerical scale is anchored against physical standards; (2) a one-unit increase in scale value corresponds to an improvement of one JND of quality; and (3) a value of zero corresponds to an image having so little information content that the nature of the subject of the image is difficult to identify

[ISO 20462-1, ISO 20462-3]

A.2.105
standard scene-referred colour encoding
standardized colour encoding for scene-referred image data

[ISO 22028-1]

A.2.106
standard reference stimuli
SRS
set of reflection prints used in the hardcopy quality ruler, which vary in sharpness and are calibrated against the standard quality scale (SQS)

[ISO 20462-3]

NOTE The SRS are available on the I3A website.

A.2.107
stimulus
image presented or provided to the observer either for the purpose of anchoring a perceptual assessment (a reference stimulus) or for the purpose of subjective evaluation (a test stimulus)

[ISO 20462-1, ISO 20462-3]

A.2.108
StorageID
device-specific four-byte unsigned integer (UINT32) that represents a unique storage area that may contain data objects

[ISO 15740]

NOTE The most significant sixteen bits of a StorageID represent the PhysicalStorageID, while the least significant sixteen bits of a StorageID represent the LogicalStorageID.

A.2.101
square pixel sampling
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[ISO 15740]

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standard original-referred colour encoding
standardized colour encoding for original-referred image data

[ISO 22028-1]

A.2.103
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standardized colour encoding for output-referred image data

[ISO 22028-1]

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A.2.103
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standardized colour encoding for output-referred image data

[ISO 22028-1]

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