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Electronic still-picture imaging — Removable memory —

Part 1: Basic removable-memory model

Imagerie de prises de vue électroniques — Mémoire mobile —

Partie 1: Modèle de mémoire mobile de base

Reference number
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Foreword

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ISO 12234-1 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 12234-1:2001), which has been technically revised.

ISO 12234 consists of the following parts, under the general title *Electronic still-picture imaging — Removable memory*:

— *Part 1: Basic removable-memory model*

— *Part 2: TIFF/EP image data format*

Introduction

The ISO 12234 series addresses removable memory requirements for electronic still cameras. Unlike a traditional photographic system, an electronic photography system divides the imaging chain into discrete components separately devoted to image acquisition, storage, transmission, processing and display. Since the components may be made by different manufacturers, there is a need to specify a standard format for data interchange among the various components of an electronic imaging system.

This part of ISO 12234 describes data interchange using a removable storage media. The purpose of the removable storage media is to store images digitally in a media that is compact, low in power, and mechanically rugged. These removable storage media will be used to transport the data to other components in the imaging chain. This part of ISO 12234 further specifies the required information content for a removable memory data format. The information content includes both the image data and data items describing the image. Normative Annex A and informative Annexes B and C describe various conforming formats. The data features supported by each of these formats are also described in Clause 6. The information content further includes the filing system which organizes the image data. Informative Annex D describes a conforming filing system. The filing system features are described in Clause 7.

An implementation is said to be in compliance if, at a minimum, all mandatory elements are present. Recommended features are not required, but will substantially enhance interoperability, performance and/or robustness.

In developing this part of ISO 12234, a structured methodology was followed. A reference model describes the environment as well as the overall architecture in which this part of ISO 12234 is applicable. The architecture separates the software-only layers, termed the image data format and the filing system, from the hardware technology-dependent layers, termed the media profile. An image data format is media independent and contains the image data, image related data and a means for structuring these data elements. A filing system defines the data organization on the storage media used but which is independent of the media.

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Electronic still-picture imaging — Removable memory —

Part 1:
Basic removable-memory model

1 Scope

This part of ISO 12234 specifies a basic removable-memory reference model for digital electronic still-picture cameras. The reference model includes image file formats for storing image data and metadata, filing system requirements for storing and retrieving the image files on the removable memory, and media profiles which are specific to a given storage technology. The reference model allows the image data and metadata to be interchanged among the various components of an electronic imaging system by using the removable storage media.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12232, *Photography — Digital still cameras — Determination of exposure index, ISO speed ratings, standard output sensitivity, and recommended exposure index*

ISO 12233, *Photography — Electronic still-picture cameras — Resolution measurements*

ISO 12234-2, *Electronic still-picture imaging — Removable memory — Part 2: TIFF/EP image data format*

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

3 Terms and definitions

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

3.1
filing system
software structure which specifies how the data is logically organized on a given storage media

3.2
image data format
structure and content which specify image data and the organization of the image related data in a device independent manner

3.3
image storage application profile
ISAP
media profile, the filing system and the image data format

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

3.4
media profile
portion of the memory module specification which is specific to a given memory technology; including the form factor, interconnection and access protocol

3.5
memory card
specific type of memory module with a physical form factor no larger than that of a credit card in outline and approximately 85 mm × 55 mm in size

3.6
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

3.7
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

NOTE The memory media can be read/write, write once, etc., but has to be non-volatile when removed from the camera so as to retain the data.

3.8
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

cf. **sound recording** (3.9).

3.9
sound recording
recording of the sound data relative to an image acquired by the electronic still camera

NOTE 1 The sound recording can 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.

4 Reference model

4.1 General considerations

Table 1 summarizes the reference model for this part of ISO 12234. The reference model is a layered model. The implementation of any one layer can be changed without affecting the implementation of any other layer. The reference model describes the types of elements included in each layer.

Table 1 — Reference model for removable storage

Layer	Intent	Examples	Implementation
Application	Content-image data and parameters	Image data	Image data format
Presentation	Define structure of image data and encoding mechanism	Tags or tuples	
Session	Define data organization on media	Filing system for image storage/retrieval	Filing system
Transport	Communication of data across a channel	Data transmission protocol	Media profile
Network	Conformance layer	Compatibility and interoperability with other systems	
Data link	a) Assures reliable data read/write b) Storage media specific recording information	a) Card information structure b) Error correction methods c) Control for insert/removal	
Physical	Assure basic compatibility in physical form factor and electrical signals	a) Form factor, pin alignment, size b) Electrical interface specification c) Protocol/command sets	

4.2 Image storage application profiles (ISAP)

The ISAP completely specifies all the information necessary to implement a particular type of removable storage. The image storage application profile consists of three parts:

— the image data format, which describes the structure and content of the image data;

— the filing system, which describes how the image files are stored and retrieved;

— the media profile, which describes the media used to store the image files.

4.3 Image data format

The image data format consists of the application and presentation layers. The application layer defines the content of the image data. The presentation layer defines the encoding of the image data. This part of ISO 12234 specifies image data formats that are consistent across implementations and independent of the media used for storage.

The content defined in the application layer includes the image and image related information, called metadata, such as the date the image was captured. The encoding defined in the presentation layer includes the structures which define the image and the image related information as digital values. For example, the encoding describes whether the image is stored as strips or tiles, and whether the metadata is stored as numbers or characters. The detailed elements in three allowed image data formats are described in Clause 6.

The image data formats described in this part of ISO 12234 provide an explicit binding between the content in the application layer and the encoding method given in the presentation layer.

4.4 Filing system

The filing system definition includes the information required for the session layer. It defines the data organization on the storage media used.

4.5 Media profiles

Many different removable memory types are used in digital electronic still-picture cameras. The storage technologies include various solid state memory cards, magnetic hard drives and optical discs. Each of these removable memory types can be described by an appropriate media profile.

The media profile definition includes the information required for the transport, network, data link and physical layers. The *transport layer* defines the protocol for how this data is transported between the digital electronic still-picture camera and the removable memory. The *network layer* describes the conformance requirements needed to maintain compatibility and interoperability with other systems. The *data link layer* describes the mechanisms for assuring reliable communications, and the specifications for reading, writing, erasing, removing and inserting specific types of media. The *physical layer* assures the basic compatibility of the physical and electrical interface. It defines the physical form factor, connector specifications and electrical interface specifications.

5 Required characteristics for image storage application profiles

5.1 General

The characteristics required for suitable image data formats and media profiles are specified in 5.2 to 5.8. These criteria were used in the development of this part of ISO 12234 and will be used in developing its future versions.

5.2 Interoperability

This part of ISO 12234 fosters interoperability between systems manufactured by different vendors. Here interoperability permits

a) storage of image data on a removable medium,

b) removal of that media from a digital electronic still-picture camera,

c) insertion of that media into a second system, and

d) transfer of the image data to the second device.

5.3 Flexibility

This reference model permits flexibility across applications requiring different levels of feature sets. Some image formats allow default values for specific data elements in order to simplify the implementation.

5.4 Extensibility

This reference model allows for various extensions to provide the possibility of incorporating new features. Some image data formats include the capability for private extensions to meet special needs. In future revisions of this part of ISO 12234, new features may be added to the present image data formats. In addition, new media profiles or image data formats may be included.

5.5 Ease of implementation

This reference model allows easy and unambiguous implementation. In particular, many electronic still-picture cameras have limited processing power and even many of the hosts reading the data may have limited processing power. Hence, the standard format requires minimal encoding and decoding of the image data.

5.6 Platform independence

Because it will be necessary to exchange data between different hardware platforms running under different operating systems, this reference model is platform independent. In particular, the data and data structures presented to the application are platform independent.

5.7 Multiple physical media types

This reference model supports multiple physical media types. Media based on various different storage technologies, e.g. solid state EEPROM and rotating magnetic disc storage, are supported for use as removable storage media in electronic still-picture cameras.

5.8 Elimination of redundancy

Information should appear once and only once within the image data format. This prevents conflicts if the data is entered in two different places and happens to be inconsistent. If a type of information appears in multiple places, the data written needs to be consistent, e.g. by assigning equivalent values. This applies both to explicitly entered data and to data implicitly derived from other fields.

6 Image data format specification

6.1 General considerations

The image data format corresponds to the application and presentation layers of the reference model, and is independent of the storage media used. The image data formats described in Annexes A, B, C, and D are intended for use as image interchange formats for photographic images within the scope of the reference model. It is recognized that images from sources other than electronic still-picture cameras may use different image data formats.

6.2 Application layer for image data

The application layer defines what image data may be present in the information to be exchanged between systems. The data defined here determines what information is available to a host system about the image, the picture-taking conditions, the camera system which took the image and any annotations to help describe the image for the user. Table 2 represents a list of image data features that should be included in an image data format.

6.3 Presentation layer

The presentation layer defines what data may be present in the information to be exchanged between systems. The data defined here describes the organization of data in the format. It is media independent.

6.4 Image data formats

It is recognized that different applications require different levels of support. Some applications are highly standardized with many of the data elements assuming default values, while other applications require more flexibility. To accomodate different applications, three different image formats, TIFF/EP, Exif, and SISRIF, are allowed. The image data formats differ in their required elements and degree of flexibility. When used, the TIFF/EP image data formats (see Annex A) shall be used in accordance with ISO 12234-2. The Exif image format is described in Annex B. The SISRIF image format is described in Annex C. The use of the SISRIF image data format in new electronic still picture imaging systems is not encouraged. The DCF filing system is described in Annex D.

The use of the SISRIF image data format in new electronic still-picture imaging systems is not encouraged.

Table 2 summarizes the image data features supported by the allowed image data formats. One of them is supported by a specific filing system. For each image data format, the support for the feature can be

mandatory, recommended, optional or not used. Further information concerning implementation of each format is contained in the informative annexes.

Different requirements are imposed on writing, reading and editing devices by the image data format. The writing device should support all mandatory features, but need not support features listed as recommended or optional. The reading device should support all mandatory features, and also should support optional or recommended features at least to the extent of allowing the image to be interpreted without corrupting the data. Therefore, a reader may ignore recommended or optional features as long as it is done so in a safe manner. If an editor ignores some features, it is required that the ignored features be passed along unchanged as part of the data file, rather than truncating or eliminating them. This permits the previously ignored features to be interpreted by a subsequent reader.

Table 2 — Image data feature descriptions and requirements, with field names and codes

Feature name		Description	SISRIF [a] Status Tuple code, parameter	Exif [b, c, d] Status Tag code, applicability	TIFF/EP [e] Status Tag code, applicability
Camera information					
1	Make	Manufacturer of camera that captured the image (ASCII)	NU	R 271	M 271
2	Model	Model number of the camera that captured the image (ASCII)	NU	R 272	M 272
3	Software version	Version of software or firmware within camera (ASCII)	NU	O 305	M 305
Camera/lens characterization					
4	ISO speed	ISO speed of the camera, as defined in ISO 12232	NU	O 34855	O 34855
5	Focal length	Focal length of the lens	NU	O 37386	O 37386
6	Interlace scan	Field number of multi-field images	O 90h, scanning system	NU	O 34857
7	Spatial frequency response	Electro-optical spatial frequency response of the camera, as defined in ISO 12233	NU	O 41484	O 37388
8	Noise	The rms noise levels of each camera channel at one or more signal levels.	NU	NU	O 37389
9	Opto-electronic conversion function (OECF)	The relationship between the focal plane or input scene luminances and the digital output levels, as defined in ISO 14524	NU	O 34856	O 34856
10	Focal plane X resolution	Number of pixels in the focal plane in the X-direction, per focal plane resolution unit	NU	O 41486	R 37390
11	Focal plane Y resolution	Number of pixels in the focal plane in the Y-direction, per focal plane resolution unit	NU	O 41487	R 37391
12	Focal plane resolution unit	Measurement unit for focal plane resolution data	NU	O 41488	R 37392
13	Max aperture value	Minimum *f*-number camera can attain, in APEX units	NU	O 37381	O 37381
14	CFA pattern	Colour filter array pattern on sensor	NU	O 41730	O 33422

Table 2 (*continued*)

Feature name		Description	SISRIF [a] Status Tuple code, parameter	Exif [b, c, d] Status Tag code, applicability	TIFF/EP [e] Status Tag code, applicability
Image annotation					
15	Date time original	Date and time of image capture	O 81h	O/M [d] 36867	R 36867
16	Date time digitized	Date and time of image digitized	NU	O/M [d] 36868	NU
17	Date time last modified	Date and time of last modification to image file	NU	R 306	M 306
18	Image description	Description of image, e.g. title or subject (ASCII)	NU	R 270	M 270
19	Image number	Index number assigned to image (ASCII)	NU	NU	O 37393
20	Artist	Identifier for creator of image (ASCII)	NU	O 315	O 315
21	Copyright	Image copyright holder (ASCII)	NU	O 33432	M 33432
22	Security classification	Identifier specifying the security classification given to the image	NU	NU	O 37394
23	Image history	Text describing the history of modifications to the image (ASCII)	NU	NU	O 37395
Image Information					
24	Thumbnail	Differentiate image (full resolution) and thumbnail image (reduced resolution) data	NU	O/M [d] image in IFD0, thumbnail in IFD1 only	M 254, NewSubFile Type
25	Image width	Number of pixel columns	O 90h, number of pixels/ horizontal pixels	M [f] 256	M 256
26	Image length	Number of pixel rows	O 90h, number of pixels/ vertical pixels	M [f] 257	M 257
27	Aspect ratio (pixel)	Ratio of X resolution to Y resolution[g]	O 90h, pixel aspect ratio	M g	M g
28	Aspect ratio (image)	Ratio of X resolution/image width to Y resolution/image length [h]	O 90h, pixel aspect ratio	M h	M h
29	X resolution	Number of pixels per output distance unit in the ImageWidth direction	NU	M 282	M 282
30	Y resolution	Number of pixels per output distance unit in the ImageLength direction	NU	M 283	M 283

Table 2 (*continued*)

Feature name		Description	SISRIF [a] Status Tuple code, parameter	Exif [b, c, d] Status Tag code, applicability	TIFF/EP [e] Status Tag code, applicability
31	Resolution unit	Physical units for output distance data	NU	M 296	M 296
32	Orientation	Orientation of the captured image relative to its rows and columns	NU	R 274	O 274
33	Samples per pixel	Number of components (samples) stored for each pixel	O 90h, image mode	M [f] 277	M 277
34	Bits per sample	Number of bits used to store each sample or component	O 90h, bits per pixels	M [f] 258	M 258
35	Compressed bits per pixel	Setting of bit rate at the time of compression	O 90h, compression ratio	O [i] 37122	O 37122
36	Reference black white (polarity)	Minimum and maximum code values used to specify black and white in the image for each component	O 90h, signal level	O 532 ReferenceBlackWhite	R 34675 (ICP, TRC tags)
37	Compression	Type of image compression method (none, JPEG, DPCM, etc.) applied to the image data	O 90h, coding method	M [f] 259	M 259
38	JPEG tables (DQT, DHT)	Tables to aid in decoding compressed image data; e.g. Huffman tables	M (VIDEO1) 80h, option code	M [i] JPEG marker	O 347, JPEG tables or JPEG marker
39	Planar configuration	Storage pattern of the colour components in the image data (Interleaving pattern)	O 90h, uncompressed data recording mode	M [f] 284	M 284
40	Photometric interpretation	Image colour space: RGB, YCbCr, etc.	O 90h, image mode	M [f] 262	M 262
41	Components configuration	Order of the image data colour components for each pixel within an image	O 90h, image mode component ID	M [i] 37121	included in 262
42	YCbCr subsampling	Subsampling factors for the chrominance components	O 90h, number of pixels	M [f] 530	M [j] 530
43	YCbCr positioning	Position of subsampled chrominance components relative to luminance samples	NU	M [j] 531	M [j] 531
Camera settings					
44	Light source	Actual lighting present during image capture (daylight, tungsten, fluorescent, flash, etc.)	NU	O 37384	O 37384
45	*f*-number (aperture)	Focal length of lens/ diameter of lens opening	NU	O 33437	O 33437

Table 2 (*continued*)

Feature name		Description	SISRIF [a] Status Tuple code, parameter	Exif [b, c, d] Status Tag code, applicability	TIFF/EP [e] Status Tag code, applicability
46	Aperture value (APEX)	Lens aperture value in APEX units	NU	O 37378	O 37378
47	Exposure time	Time in seconds for exposure	NU	O 33434	O 33434
48	Time value (APEX)	The exposure time or shutter speed value, in APEX units	NU	O 37377	O 37377
49	Exposure bias	Exposure bias relative to a normal exposure, in APEX units	NU	O 37380	O 37380
50	Metering mode	Method used for exposure metering	NU	O 37383	O 37383
51	Exposure program	Type of exposure program used	NU	O 34850	O 34850
52	Brightness value	Measured scene brightness in APEX units	NU	O 37379	O 37379
53	Subject distance	Distance of camera from the subject within the captured image	NU	O 37382	O 37382
54	Flash	State of flash during image capture: on, off, fill or backlight	NU	R 37385	O 37385
Colour management information					
55	Gamma (up to 3)	Gamma exponents (one for each colour component) used to transform image data from linear space to gamma-corrected space (VALUES)	O 90h, gamma characteristic	O/M [c] 42240	NU
56	Primary chromaticities	RGB reference primaries (VALUES)	NU	O/M [c] 319	R 34675, ColorantTags
57	Whitepoint	White reference chromaticity	NU	O/M [c] 318	R 34675, MediaWhitePointTag
58	Transfer function	RGB lookup tables to scene reflectance from output code values	O 91h-95h, Gamma tuple	O 301	R 34675, TRCTags
59	Matrix	An $(n \times n)$ matrix used in processing the color image data	NU	NU	O 34675, ColorantTags
60	YCbCr coefficients	Coefficients of color space conversion from RGB to YCbCr	NU	O/M [c] 529	M [j] 529
61	Colour space info	Colour device profile	NU	M 40961, ColorSpace	R 34675, InterColor Profile

Table 2 (*continued*)

Feature name		Description	SISRIF [a] Status Tuple code, parameter	Exif [b, c, d] Status Tag code, applicability	TIFF/EP [e] Status Tag code, applicability
Format profile					
62	Format used	Format description	M 80h, file format name and version	M TIFF header, JPEG marker	M TIFF header
63	Version & standard identifier	Current version of format used	M 80h, file format name and version	M 36864 Exif version	M 37398 TIFF/EP StandardID
64	Byte order	Meaning of first byte accessed, i.e. whether MSB or LSB	M 80h, order of data storage	M TIFF header	M TIFF header
65	Control parameters	Control values used in relating files to one another	O (RELATION)	NU/O [d] DCF - file number match indicates same DCF object	NU
66	Vendor unique	Information unique to a particular vendor	O 82h, Options tuple	O 37500, MakerNote	O TIFF private tags
Interoperability					
67	Interoperability index	Name of interoperability rule	NU	O/M [d] 1	NU

The status for a particular information field for the image data formats described in Annexes A, B, C and D may fall into one of the following categories.

— Mandatory (M): These features shall be present.

— Recommended (R): These features are not required, but their implementation is strongly advised.

— Optional (O): These features may be present but are not required. If not present there are no defaults to be assumed. Readers are required to respond gracefully to optional information fields. Writers are not required to implement optional features.

— (O / M): These features are optional for an Exif file, unless the Exif file is used with DCF as a DCF basic or optional file, in which case these features are mandatory. See Annex D for the details.

— Not used (NU): These features are not applicable and are not present in the given profile.

a See Annex B.

b See Annex C.

c Tags shall be present only for DCF optional file but not for DCF basic file when an Exif file is used with DCF.

d When an Exif file is used with DCF as a DCF basic or optional file, some optional features are mandatory as indicated in this table. See Annex D for the details.

e See Annex A.

f Tag not used with JPEG compressed image, because same information is contained in the JPEG marker.

g The aspect ratio, γ, expressed in pixels, is equal to the ratio of the X resolution, R_X, to the Y resolution, R_Y as follows:

$$\gamma = \frac{R_X}{R_Y}$$

h The aspect ratio of the image, β, is equal to the ratio of the X resolution to the image width, w_i with respect to the ratio of the Y resolution to the image length, l_i.

$$\beta = \frac{R_X / w_i}{R_Y / l_i}$$

i Tag used only for JPEG compressed image.

j All M tags shall be present for YCC images, but not for RGB images.

6.5 Application layer for sound data

The application layer can define what sound data may be present in the information to be exchanged between the various components of an electronic imaging system. The data defined here determines what information is available to a host system on the sound, the sound conditions, and information used to interpret the sound.

Table 3 gives a list of sound data features to be included in a sound data format. The data can be supplied implicitly by setting some of the fields to default values.

Sound data recording is defined within the SISRIF and Exif format, but not in TIFF/EP. For TIFF/EP, sound can be recorded in a separate file that is not described in this part of ISO 12234.

Table 3 — Sound data format

Multimedia information		Description	SISRIF Annex B	Exif Annex C
1	Sound duration	Length of time in seconds	O	NU
2	Sample frequency	A/D conversion frequency	O	NU [b]
3	Quantizing bits	Number of bits per sample	O	NU [b]
4	Coding method	Method to code data (PCM, ADPCM, etc.)	O [a]	NU [b]
5	Sound data	Binary data representing a digitized sound recording	O(EL)	NU [c]
6	Number of channels	Number of audio channels	O(EL)	NU [b]

Information fields which are required or optional may be categorized by allowable values as follows:

EL Enumerated list of valid values for this field.

NU Not used.

O Optional.

[a] ITU-T G726 (SOUND 1).

[b] Same information is contained in the WAVE format.

[c] PCM, ITU-T G.711, IMA-ADPCM.

7 Filing system requirements

7.1 General considerations

The filing system corresponds to the session layer of the reference model, and is also independent of the storage media used. The filing system described in Annex D is intended to be used as an image interchange format for photographic images within the scope of the reference model.

JEITA CP-3461 is a suitable example of a complete set of requirements which describes the filing system and the basic image format. Table 4 summarizes the set of requirements for the filing system.

7.2 Directory structure and name

The primary part of the filing system requirements is the directory structure and the names of the directories used to store image files. The structure and naming conventions of the image storage directory shall be strictly defined. These enable the reading/editing devices to find the directories in which the image files are stored.

The definition includes rules defining the tree structure of the directories, where the image storage directories can be located, and rules on directory names, such as the number of characters and the allowed character set. The naming conventions may limit the number of the image storage directories allowed.

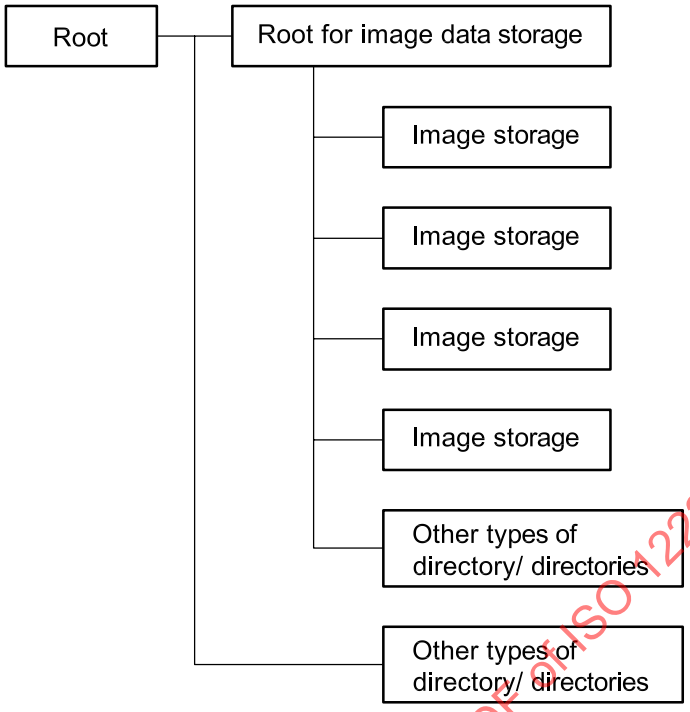

Figure 1 — Typical directory structure

7.3 Object

7.3.1 General

Another part of the filing system requirements is the definition of the objects which are stored in the image storage directory. The type, name and file extension of the object shall meet the definition. This enables the reading/editing devices to correctly find objects recorded by the digital still-picture camera and use them according to their attributes.

7.3.2 Object type

The object type for those objects to be stored in the image storage directory, such as image object and thumbnail image object.

7.3.3 Object file name and file extension

The file name and file extension of a given object type shall meet criteria such as the number of characters, the allowed character set and the predetermined file extension.

These conventions can be used as a machine and human readable object type mark or a beacon of matched file combinations such as matched large and thumbnail images or matched image and audio files.

NOTE DCF Object (see Annex D) defines different concept, which consists of matched file combinations.

7.4 Interoperability

An interoperability index shall be given to each object file. The index shall clearly show the reading/editing devices if data stored in the removable memory is interoperable with the devices.

The index includes the version number of the filing system and the image format used. It further includes the image size (number of pixels) when the reading/editing devices are constrained in terms of maximum image size handled as an interoperability attribute.

7.5 Device requirement level

Table 4 summarizes the features and requirements for the recommended filing system, JEITA CP-3461, which covers the filing system and image data format of an ISAP. Further information concerning implementation of each feature is contained in Annex D.

Each item listed in Table 4 implies different levels of requirement. They are mandatory and optional and are imposed on writer, reader and editor. The writer should support all mandatory features, but need not support features defined as optional. The reader should support all mandatory features as well as optional features, at least to the extent of allowing the image to be interpreted without corrupting the data. Therefore, a reader may ignore optional features as long as it is done so in a safe manner. If an editor ignores some features, it is required that the ignored features be passed along unchanged as part of the data file, rather than truncating or eliminating them. This permits the previously ignored features to be interpreted by a subsequent reader.

Table 4 — An example of filing system feature description and requirements: JEITA CP-3461 (Design rule for Camera File System/DCF Version 2.0)

Feature name		Description	Requirement level for writer	Subclause reference
Directory				
	Structure	Directory structure requirement: — define where to locate the image root and image storage directory	M	7.2
	Name	Directory name requirement: — define number and usage/combination of characters and allowed character set in the directory name	M	7.2
Object				
	Type	Type of objects: main image, thumbnail image, other image	M	7.3.2
	Name	Object name and file extension requirement: — number and usage/combination of characters and allowed characters set in the file name — predetermined file extension	M	7.3.3
	Object combination	Matching method of objects using file name and their usage rules	M	7.3.3
Interoperability index				
	Index	Interoperability index in each file: — version, image file format, image size	M	7.4
	Version	Version of the filing system	M	7.4
	Related image file format	Image format employed	O	7.4
	Related image width	Image width	O	7.4
	Related image length	Image length	O	7.4
M: Mandatory O: Optional				