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Electronic still-picture imaging — Removable memory

Part 1: Basic removable-memory model

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National foreword

This British Standard is the UK implementation of ISO 12234-1:2012. It supersedes BS ISO 12234-1:2007 which is withdrawn.

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Electronic still-picture imaging — Removable memory —

Part 1: Basic removable-memory model

Imagerie de prises de vue électroniques — Mémoire amovible —

Partie 1: Modèle de mémoire amovible de base

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

This third edition cancels and replaces the second edition (ISO 12234-1:2007), 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*

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Introduction

ISO 12234 addresses removable memory requirements for electronic still-picture 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 can 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 removable storage media. The purpose of removable storage media is the storage of digitized images on media that is compact, is mechanically rugged, and has low power requirements. The removable storage media is used to transport the digitized image 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 annexes A, 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 a description of the file system which organizes the files containing digitized image data. Informative Annex D describes a conforming file system. The file 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 layers (termed the “image data format” and the “file system”) from the hardware technology-dependent layer (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 file system defines the data organization on the storage media used, but it is independent of the media.

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INTERNATIONAL STANDARD ISO 12234-1:2012(E)

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

ISO 15444-1, *Information technology — JPEG 2000 image coding system — Part 1*

ISO 15444-2, *Information technology — JPEG 2000 image coding system: Extensions — Part 2*

3 Terms and definitions

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

3.1
file 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 file 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 using non-volatile solid-state memory and having a flat physical form factor

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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, intended for the digital storage of image data in electronic still-picture cameras

NOTE The memory media can be read/write, write once, etc., but have 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

NOTE See also **sound recording** (3.9).

3.9
sound recording
recording of the sound data relative to an image acquired by the electronic still-picture 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.

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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	
Session	Define data organization on media	File system for image storage/retrieval	File system
Transport	Communication of data across a channel	Data transmission protocol	Media profile
Network	Conformance layer	Compatibility and interoperability with other systems	
Data link	Assures reliable data read/write Storage media-specific recording information	Card information structure Error correction methods Control for insertion/removal	
Physical	Assure basic compatibility in physical form factor and electrical signals	Form factor, pin alignment, size Electrical interface specification 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 file 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 are 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 File system

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

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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 these data are 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 ensures 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 editions.

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.

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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 are entered in two different places and happen 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 normative Annexes A, B and C 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 describe 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 accommodate different applications, three different image formats, TIFF/EP, Exif and JPEG 2000, are allowed. The image data formats differ in their required elements and degree of flexibility. When used, the TIFF/EP image data format (see Annex A) shall be implemented in accordance with ISO 12234-2. The Exif image format is described in Annex B. The JPEG 2000 image format is described in Annex C. When used, the JPEG 2000 image data format (see Annex C) shall be implemented in accordance with ISO 15444-1 and ISO 15444-2. The DCF file system is described in Annex D. Reference [8] describes the development and structure of these image formats and this file system.

Table 2 summarizes the image data features supported by the allowed image data formats. Each is supported by a specific file 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 normative Annexes A, B, and C.

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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 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	Exif[a] Tag code, applicability[d]	TIFF/EP[b] Tag code, applicability	JPEG 2000 Part 1 and 2[c] JPEG 2000 element, applicability
		Camera information			
1	Camera Make	Manufacturer of the camera that captured the image (ASCII)	M 271, Make	M 271, Make	M /IMAGE_CREATION /CAMERA_-CAPTURE /CAMERA_INFO /-MANUFACTURER
2	Camera Model	Model number of the camera that captured the image (ASCII)	M 272, Model	M 272, Model	M /IMAGE_CREATION /CAMERA_-CAPTURE /CAMERA_INFO /MODEL
3	Camera Serial Number	The serial number of the camera used to capture the image (ASCII)	NU	NU	O /IMAGE_CREATION /CAMERA_-CAPTURE /CAMERA_INFO /SERIAL
4	Camera Version	The version of the camera model used to capture the image (ASCII)	NU	NU	M /IMAGE_CREATION /CAMERA_-CAPTURE /CAMERA_INFO /VERSION
5	Lens Make	Manufacturer of the lens that captured the image (ASCII)	NU	NU	O /IMAGE_CREATION /CAMERA_-CAPTURE /LENS_INFO /-MANUFACTURER
6	Lens Model	Model number of the lens that captured the image (ASCII)	NU	NU	O /IMAGE_CREATION /CAMERA_-CAPTURE /LENS_INFO /MODEL

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