INTERNATIONAL STANDARD

ISO/IEC 11694-5

Second edition
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Identification cards — Optical memory cards — Linear recording method —

Part 5: Data format for information interchange for applications using ISO/IEC 11694-4

Cartes d'identification — Cartes à mémoire optique — Méthode d'enregistrement linéaire —

Partie 5: Format de données pour l'échange d'informations pour les applications utilisant l'ISO/IEC 11694-4

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

This second edition cancels and replaces the first edition (ISO/IEC 11694-5:2006), which has been technically revised.

ISO/IEC 11694 consists of the following parts, under the general title *Identification cards — Optical memory cards — Linear recording method*:

— *Part 1: Physical characteristics*

— *Part 2: Dimensions and location of the accessible optical area*

— *Part 3: Optical properties and characteristics*

— *Part 4: Logical data structures*

— *Part 5: Data format for information interchange for applications using* ISO/IEC 11694-4

— *Part 6: Use of biometrics on an optical memory card*

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Introduction

This part of ISO/IEC 11694 is one of a series of International Standards defining the parameters for optical memory cards and the use of such cards for the storage and interchange of digital data.

This part of ISO/IEC 11694 is specific to optical memory cards using the linear recording method. Characteristics which apply to other specific recording methods shall be found in separate International Standards.

This part of ISO/IEC 11694 defines a logical structure to facilitate the interchange of data written to optical memory cards using the linear recording method.

All numbers in this part of ISO/IEC 11694 are written in decimal notation unless otherwise specified.

All multi-byte numbers in this part of ISO/IEC 11694 are placed in their respective data structures and written to the media in "little-endian" format. This format puts the least significant byte of the number first, followed by the more significant byte(s).

All examples that show hexadecimal values corresponding to displayed characters use the ASCII character set. Characters written to cards according to this specification can use any desired character set, as long as the character set is specified in the corresponding tag document.

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Identification cards — Optical memory cards — Linear recording method —

Part 5:
Data format for information interchange for applications using ISO/IEC 11694-4

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1 Scope

This part of ISO/IEC 11694 defines the data format for optical memory cards necessary to allow compatibility and interchange between systems using the linear recording method.

2 Normative references

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

ISO/IEC 11694-4, *Identification cards — Optical memory cards — Linear recording method — Part 4: Logical data structures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 11694-4 and the following apply.

3.1
application
computer application program which writes to or makes use of the data read from an optical memory card

Note 1 to entry: This also applies more generally to a system that makes use of the card or the way the card is used.

3.2
data element
set of data bytes that is only useful in its entirety

EXAMPLE A person's surname or a JPEG file containing a single image.

3.3
data file
a stream of bytes which is referenced by a single entry in the card's directory

Note 1 to entry: A data file can contain either a single data item (associated with a single tag) or a TLV stream having multiple data items.

3.4
data item
data element or well-defined set of data elements that is associated with a single tag, which defines its meaning and layout

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3.5
data sector
sector (as defined in ISO/IEC 11694-4) that contains all or part of a data file

3.6
directory
structure used to keep track of the presence and location of data on a random access storage media

3.7
directory sector
sector on a random access media that contains directory information

3.8
layout
specific sequence of bytes required in the data item

Note 1 to entry: This is in contrast to the *meaning* of the data item, which describes its use.

EXAMPLE A card can contain two JPEG “files”. The layout of these items is the same, but the meaning can be different. One can be a portrait of the card holder, and the other can be an image of the card holder’s fingerprint, for example.

3.9
little-endian format
format for defining the order of bytes in a multi-byte number

Note 1 to entry: This format is sometimes referred to as “Intel” format. The first byte of a multi-byte number contains the least significant byte of the number, and the last byte contains the most significant byte of the number.

EXAMPLE If the decimal number 8765 (which is expressed as 223D in hexadecimal notation) is written out as a 16-bit quantity in little-endian format, the series of bytes containing the number is: 3D followed by 22. So the least significant byte (3D hex) is written out followed by the most significant byte (22 hex).

3.10
logical track
sequence of bytes, the length of which is the data capacity of a track, which make up part of a file

EXAMPLE A file can have a length that exceeds the capacity of a single track on the card. In such a case, the file shall be broken up into several pieces, each of which shall be written to a different track on the card. The reading application shall put the pieces of the file back together after it has read all the tracks containing the file. Each of these “pieces” is considered a “logical track”, with the first piece containing the beginning of the file being counted as logical track zero. Most of the time, the logical tracks will be written to succeeding physical tracks, so if a file is written starting at physical track 8 for 2 tracks, logical track 0 occupies track 8 and logical track 1 occupies track 9. In some cases, a given logical track can be written twice, so it can be that the reading application finds logical track 0 at both physical tracks 8 and 9 and finds logical track 1 at physical track 10. In this case, the reader shall ignore the second copy of logical track 0 and paste the contents of tracks 8 and 10 together to form the original file.

3.11
meaning
use to which the data item can be put

EXAMPLE The data associated with a given tag can have the *meaning* that it is a colour photograph of the head of the person to whom the card was issued.

3.12
physical track
track on the optical memory stripe that is referenced by a physical track address as defined in ISO/IEC 11694-4

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3.13
public zone
part of the optical stripe on the card that is accessible to all optical card drives

Note 1 to entry: Optical memory cards can also contain a private zone that is accessible to only a specific set of card drives operated by the card issuer.

3.14
tag
unique unsigned 16-bit number in the range 0 through 65535 (inclusive) that is used to identify a data item stored on the card

Note 1 to entry: A single set of tags applies to any and all data stored in the pubic zone of an optical memory card that conforms to this part of ISO/IEC 11694.

3.15
tag document
document that completely describes both the meaning and the layout of one or more data items associated with a tag or a numerically contiguous group of tags

Note 1 to entry: This document is created by the body which wishes to issue or update cards and is submitted to the tag issuing body for publication. An organization that desires to create or read and use the described data item(s) shall be able to do so by reading the tag document and any references incorporated in the tag document.

3.16
tag issuing body
organization responsible for issuing tags to organizations which wish to issue or update cards complying with this part of ISO/IEC 11694

Note 1 to entry: The tag issuing body maintains a list of tags to ensure that each tag corresponds to a unique type of data item and publishes tag documents which describe the meaning and layout of the data associated with each tag. It is proposed that HID Global be the tag issuing body for ISO/IEC 11694-5.

3.17
tag, length, value (TLV) data stream
data storage structure that involves placing multiple data items in serial fashion on a storage medium and keeping track of these items through a tag

Note 1 to entry: The tag identifies the meaning and layout of the data, followed by the length of the data in bytes, followed by the value, which is the data itself. The last byte of the "value" part is then optionally followed by another TLV structure within the stream. The stream is terminated by a "tag" of zero. Although such a data stream is a serial entity, a random access technology can contain any number of such streams, and parts of a TLV stream can be read independently if desired. Each TLV data stream is contained in a file that is referenced by a single entry in the card's directory.

3.18
track
physical location on an optical memory card that can contain one or more sectors

Note 1 to entry: This term is the same as the term "physical track" and is defined in ISO/IEC 11694-4.

3.19
unique stamp
unique 12-byte value that is created based on the time of writing and the unique serial number of the optical memory card writing device

Note 1 to entry: This stamp is used to identify two separate sectors as containing parts of the same data file.

4 General structure

The purpose of this part of ISO/IEC 11694 is to allow for the interchange of data on optical cards by specifying both the directory structure on the card and the method of identifying individual data

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elements that are written to the card. The directory provides a mapping between the identity of a data element and that element's location on the card. Tags are used to identify data elements both in their meaning and in the layout of the referenced data.

This document defines the starting location of the directory on the card. It does not define the location of the data. The entity that writes to the card selects the location of the data, writes the data to the card using the format defined in this document, and then writes the directory to allow compliant applications that subsequently access the card to read this data and/or to add more data to the card.

4.1 Tags

A tag is a unique 16-bit number used to identify a type of data item (colour portrait, encoded fingerprint template, first name, etc.). Although this document in general doesn't define the meanings of individual tags, it does specify ranges of tags that will be assigned to items according to the meaning of the item. The tags will be kept unique and universal by a single tag issuing body. The tag issuing body shall issue groups of numerically adjacent tags to a party that wishes to issue or update cards. The party to whom the tags are issued is responsible for returning to the tag issuing body - a document describing the data item corresponding to each issued tag. This document is called the 'tag document'. It is the responsibility of the tag issuing body to publish these tag documents, thereby allowing other card writing organizations to make use of new tags as their individual meanings and data layouts are defined. A card shall not be considered fully compliant with ISO/IEC 11694-5 unless there is a tag document published for each data item written to the public zone of the card.

4.1.1 Defined tag ranges

This part of ISO/IEC 11694 defines a set of tag ranges in order to allow card readers to search for data items that are relevant to a desired application. For example, an application may wish to display an image of the card holder. There may be more than one tag associated with the general idea of a 'card holder image', either because the meanings are slightly different or because the meanings are the same, but the data layout is different. In this case, the reader may look for tags within a specific range that meets with their criteria.

The defined ranges are as follows:

Tag Range (decimal)	General meaning of data items
0	Reserved to mark the end of a TLV stream. Finding a tag value of zero tells the reader to stop reading because the TLV stream has ended. Any further bytes in the stream are undefined.
1000 – 1000	ICAO standard MRZ (machine readable zone) data as defined in ISO/IEC 7501[1]
1001 – 1999	Demographic Information (Text)
2000 – 2999	Encoded Face
3000 – 3999	Encoded Finger
4000 – 4999	Encoded Eye
5000 – 5999	Encoded Hand
6000 – 6999	Displayed Portrait
7000 – 7999	Displayed Single-Digit Fingerprint
8000 – 8999	Displayed Signature or Usual Mark
9000 – 9999	Data Features
10000 – 10999	Structure Features
11000 – 11999	Substance Features
12000 – 12999	Additional Personal Data Elements

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Tag Range (decimal)	General meaning of data items
13000 – 13999	Additional Document Data Elements
14000 – 14999	Discretionary Data Elements
15000 – 15999	Data Authentication Code
16000 – 16999	Person(s) to Notify Data Elements
17000 – 17999	Miscellaneous Data Elements

The rest of the ranges are not defined and can be used for future expansion.

4.1.2 The tag document

Each tag has associated with it a single tag document that completely describes both the meaning and the layout of the referenced data item. A single tag document may describe the data items associated with multiple tags as long as those tags are numerically consecutive and the difference between each of the referenced tags is clearly defined in the document.

A tag document shall contain the following minimum set of information:

— The tag or range of tags defined by the document, in decimal notation

— The title of the tag or tag range

— The name and contact information of the requesting organization

— The date the document was submitted to the tag issuing body

— The date the document was accepted by the tag issuing body (if accepted)

— The status of the tag document (submitted, accepted, etc.)

— Any standards that apply to the layout of the data

— A complete description of the meaning and layout of the data to be associated with the tag or tag range

— If multiple tags are defined, a complete listing of the difference in meaning and layout from one tag to another

The following is an example tag document:

Tag(s): 3010 – 3019

Title: Government of Potsylvania fingerprint biometric version 1

Requested by: Government of Potsylvania, Passport division

123 Main Street

Potsylvania

Administrator: Joe Smith (jsmith@potsylvania.gov)

Phone: 99 123-456-7890

Date submitted: 2001.10.03

Date accepted: 2001.12.04

Status: Accepted. In use.

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Applicable Standards: ISO/IEC 19785, Information technology — Common Biometric Exchange Framework Format[2]

Description:

This data item contains a CBEFF compliant file containing a fingerprint biometric template created by the FingerId corporation FP-101 fingerprint biometric identifier system version 4.5 or later compatible. The following required and optional CBEFF fields are included in this file:

Field	Value	Description
Format owner	C12B (hex)	Finger ID corporation
Format type	0003 (hex)	FP-101 and compatibles
SBH Security Options	30 (hex)	Privacy and Integrity
Integrity	02 (hex)	Signed
Biometric Type	08 (hex)	Fingerprint
Biometric Feature	001fffhh (binary)	Finger as defined in CBEFF (f = finger, h = hand)
Format document	CBEFF.C12B.0003	Document fully describing the BDB format

The SBH Security Options value will never change, but the reader of passports must be prepared for the Integrity option to switch from 0x02 (signed) to 0x01 (MACed), which is planned for the future. The BDB of this file contains the following fields:

Offset (bytes)	Length (bytes)	Example	Meaning
0	10	“2001.12.01”	Date the fingerprint template was created
10	8	“12345678”	ID number of biometric device
18	500	--	Standard Finger ID template version 4.5 or greater

The tag set applies as follows:

Tag	Finger
3010	Right hand thumb
3011	Left hand thumb
3012	Right hand index finger
3013	Left hand index finger
3014	Right hand middle finger
3015	Left hand middle finger
3016	Right hand ring finger
3017	Left hand ring finger
3018	Right hand little finger
3019	Left hand little finger

In addition to the particular finger being encoded into the tag to allow the reader to determine the finger from reading only the directory, the reader can determine the finger from the optional ‘Biometric Feature’ field of the CBEFF file.

In the above example, the card issuer had a choice to encode the finger within the data item or to use different tags. It was decided to request one tag for each finger so that receiving states could determine more quickly from the directory which fingers were present on the media without having to first read the data.

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4.2 The TLV stream

When multiple data items are written together in serial fashion and accessed by a single directory entry, the data items shall be written as a TLV stream. A TLV stream consists of a tag (T) corresponding to a data item, followed by a length (L) that records the size of the data item in bytes, followed by the data item itself (V). Each set of TLV bytes is followed by another, until all desired items have been written. When all items have been written, a tag (T) of zero is written. Any unused bytes in the area referenced by the directory entry or in the remainder of the last sector of the stream shall be set to all zeroes by the writer and shall be ignored by any compliant reader.

The structure of a TLV entry is:

Offset (bytes)	Length (bytes)	Example (decimal)	Example bytes (hex)	Field	Meaning
0	2	1005	ED 03	T	Tag representing the data item to follow, e.g. First name
2	4	3	03 00 00 00	L	Length of the data item in bytes
6	Var	“Joe”	4A 6F 65	V	The data item itself. Its length is the number in the L field.

In some cases, it is desired to specify that a given item is present or known, but contains a NULL value. For example, if most documents of a given type contain both a first name and a last name for the card holder, but a specific card holder does not have a first name - it may be desired to deliberately specify this fact instead of just leaving the first name out. In these cases, the corresponding TLV entry can be included that has a length of zero. In these cases the ‘L’ field (zero) shall be immediately followed by the ‘T’ field of the next element.

Here is an example of a TLV stream containing a few text items:

Item Name	Tag	Value on this card
Surname	12345 (3039 hex)	PUBLIC
First Name	12346 (303A hex)	< None >
Phone Number	12347 (303B hex)	123–456–7890

The items do not have to be written to the stream in order of increasing tag number, although in this case they are. Here is the resulting stream in hexadecimal notation:

```
39 30 06 00 00 00 50 55 42 4C 49 43 3A 30 00 00 00 00 3B 30 0C 00 00 00 31 32 33 2D 34 35 36
T     L           V                 T     L           T     L           V

2D 37 38 39 30 00 00
               T
```

The stream starts with the number 3039 (hex) in little-endian format (least significant byte first), followed by the number 6, followed by the 6 bytes “PUBLIC”. Immediately after the ‘C’ in public, we have the next tag 303A, followed by the data length of 0 bytes. Since the length is zero, there is no ‘V’ part and the next byte after the length of zero is the tag of the next element 303B, followed by its length of 12 bytes, followed by “123-456-7890”. The next two bytes should be the tag of the next element in the stream. This tag is set to zero because item 303B was the last item in the stream, and the zero tag marks the end of the stream.

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4.3 Guidelines for assigning data elements to data items

Because this part of ISO/IEC 11694 allows different data elements to be placed within a single data item, or split up into different data items, a card issuer must decide how to break up their data into items. Here are a few guidelines:

— If two data elements are useless without each other, they shall be in the same data item

— If a data element is optional, it shall be in its own data item, unless it will always fit in a sector with the required elements.

— If several data elements are always written and read together, they shall be in the same data item

— If several data elements are small enough to fit in a single sector together, they shall be in the same data item.

— If a data element will be updated independently of other data elements, that element shall not be in the same data item.

5 Directory structure

This part of ISO/IEC 11694 only specifies the starting location for the directory. The location of the remainder of the directory and of the data is determined by the application that writes the card. This location information is recorded within the directory.

Track Use	Required / Optional	Track	Format
First directory track	Required	6	1112 byte
Second directory track	Optional	7	Any
Redundant copy of first directory track	Optional	n – 7	1112 byte
Redundant copy of second directory track	Optional	n – 8	Any

Because the total number of tracks on a card may vary, the track addresses for optional redundant copies are expressed in parametric form. The meaning of ‘n’ is described in ISO/IEC 11694-4.

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5.1 Directory sectors

Directory sectors always start with a sector signature. This identifies it as a directory sector of a card that complies with this part of the standard.

There are two types of directory sector. Type A sectors usually describe files that contain only a single data item. Type B sectors describe files that contain multiple data items in a TLV stream. A given directory sector shall contain either Type A or Type B directory entries, but not both types. If a directory consists of more than one sector, some sectors may contain Type A entries while others contain Type B entries.

Directory sectors always start with the following header:

Offset (bytes)	Length (bytes)	Example	Meaning
0	5	AB 4D 52 54 44 (hex)	Sector signature for directory sector
5	1	5E (hex)	Directory sector type (5F for Type A, 5E for Type B)
6	3	7	Track address of next logical directory sector
9	1	4	Sector type of next logical directory sector

Along with the signature and directory sector type, this header contains the location of the next directory sector on the card. Only the track address and sector type are required because directory sectors always start with the first sector on the track and use all of the sectors on that track for continuing

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the directory. If a reader finds a directory sector that contains the same physical track address as the directory sector just read, it shall find the next directory sector in the next physical sector of the same track. The last sector on the track shall contain the track number of another track where the directory continues. At some point, the system issuing or updating the card will have written all of its directory sectors. If the last sector written as part of this update is the last sector on the current directory track, the issuer shall write into that sector's header – the track address of a free track where it is suggested that the directory continue when the card is later updated again.

The directory sector header shall be followed by one or more directory entries of the type specified by the 'Directory sector type' field described in the above header.

5.1.1 Type A directory entries

A Type A directory entry is written to describe a file that contains a single data item. Each Type A entry has the following format:

Offset (bytes)	Length (bytes)	Example	Meaning
0	2	12345	Tag representing a data item on the media
2	3	200	Track address of first track of file containing data associated with this tag
5	1	4	Sector type of file containing data associated with this tag
6	2	1	Number of data items in the file containing this data item. Usually this is 1. It may be greater than 1 if the described data file contains a TLV stream.

Typically, when using Type A entries, the number of tagged items in the described file is 1. In this case, the described file shall contain only the described data item without the 'T' and 'L' fields of a TLV stream.

Although Type B entries are generally better for this purpose, the issuer may use multiple Type A entries to describe multiple data items in the same TLV stream. In this case, the 'number of tagged items' field above will be greater than 1, and the card issuer shall write a Type A directory entry for each tag in the described TLV stream. These entries shall be identical to one another except for the tag. The 'track address' field in the Type A entry shall always refer to the starting track of the file containing the TLV stream regardless of the physical track on which the referenced data item might actually be written. In other words, if a given data item is in a TLV stream that starts on track T and this stream is several tracks long and the item is actually written to track T + 2, the 'track address' field of the Type A entry containing this data item's tag shall still have the value T, not T + 2. Although there will be multiple directory entries describing the same file, the reader shall read the TLV stream once and parse it to retrieve the individual data items.

If there are multiple data files to be described by this directory sector, the above directory entries shall be followed by more Type A entries, until all files have been described.

When the card writing application has written all its data, it knows which tracks it used and which track is the first available for subsequent applications to write. If updates are to be allowed, it shall point the next application to the first remaining free track by ending its list of the above structures with a final entry containing a tag of zero and containing the track address of the first free track on the media. All other fields of the structure shall be set to zero, so the last Type A entry will have the form:

Offset (bytes)	Length (bytes)	Example	Meaning
0	2	0	Zero tag that terminates the directory sector
2	3	210	Track address of first free track available for updates
5	1	0	Always zero
6	2	0	Always zero

Whether or not a 'first free track' is specified, the reader application shall also use this 'zero tag' entry as a signal that no more files are described by the current directory sector. Any unused part of a directory

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sector shall be filled with zeroes by the writer. The reader shall ignore any data after the 'first free track' field.

5.1.2 Type B directory entries

A Type B directory entry is written to describe a file that contains multiple data items or that is written redundantly to multiple locations on the card. With the exception of the terminating entry (described below), each Type B entry starts with the following header:

Offset (bytes)	Length (bytes)	Example	Abbreviation	Meaning
0	1	4	T	Sector type of track containing this file (see Table B.3 of ISO/IEC 11694-4)
1	1	2	R	Number of tag ranges in this file
2	1	3	C	Number of copies of this file on the card
3	1	2	O	Number of offset entries for this file

The field abbreviated 'R' specifies the number of sets of numerically contiguous tags in the described TLV stream, and shall be greater than zero, except in the case of the terminating entry, which will be described later. In all other cases, the above header shall be immediately followed by quantity 'R' copies of the following structure:

Offset (bytes)	Length (bytes)	Example	Abbreviation	Meaning
0	2	1234	S	Starting tag of this range of tags contained in the TLV stream
2	1	10	N	Number of tags in this range

This set of sub-entries comprises a complete directory of all the tags that are contained in the described file. The 'S' field is the tag value of the first tag in a contiguous range of tags, all of which correspond to TLV entries within the file. The 'N' field specifies the number of tags in that range.

The 'O' field in the header may be zero or greater. It specifies the number of sets of tracks which contain the specified file, but which are not in standard 'data sectors' as described in a later section. This allows a file to share sectors with other data structures on the card if the writer wishes. The tag range sub-entries described above shall be followed by quantity 'O' copies of the following structure:

Offset (bytes)	Length (bytes)	Example	Abbreviation	Meaning
0	2	320	F	Byte offset of TLV stream on the corresponding track (0 means first byte)

The first quantity 'O' sets of tracks of the total quantity 'C' sets of tracks described below shall be the sets of tracks on which the TLV stream starts at byte offset 'F'. Immediately following the list of 'O' offsets (if any), shall be the list of starting tracks for each redundant copy of the data. This list consists of quantity 'C' copies of the following:

Offset (bytes)	Length (bytes)	Example	Abbreviation	Meaning
0	2	5	I	Physical track address of the first track of this file

Depending on the length of the file, the file may reside on one or more tracks. If this is the case, the remainder of the file shall be written to subsequent tracks with consecutive physical track addresses. For example, if the file starts at track 'n', it shall continue on tracks n+1, n+2, etc.

If there are more files to be described, the directory entry for the next file shall start immediately after the quantity 'C' starting track entries.

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A value of zero in the 'R' field signals the end of the directory sector. In the R = 0 case, the next two bytes (that otherwise would be C and O) shall contain the physical track address of the first available track on the card available for future updates. This is a 16-bit number in 'little-endian' format. The header of the terminating entry (which has no body) has the following structure:

Offset (bytes)	Length (bytes)	Example	Abbreviation	Meaning
0	1	4	T	Always zero
1	1	2	R	Always zero (marks this as the last entry)
2	2	25	F	Physical track address of first track of card available for updates

If the card issuer expects the card to be updated and has a suggested 'first free track', the 'F' field above shall be a non-zero physical track address that suggests where the updating application can start putting its data. Otherwise F will be zero.

Here is an example of a Type B directory. In this case the card issuer wants to put a TLV stream containing elements with tags 1 through 10 and tags 15 through 20 (inclusive) into standard data sectors on tracks 100 and 200, and in addition wants to put a 'quick access' copy at the end of the directory sector itself, which is on track 6. We will put it at offset 556 in the sector which leaves the first half of the 1112 byte sector for the directory. The issuer also wants to put a simple one item file containing tag 21 in the area starting at track 201. This is what the directory track will contain for our example. All values are in decimal except 'content' which are all in hexadecimal.

Offset (bytes)	Length (bytes)	Content (hex)	Entry: Abbrev	Meaning
0	6	AB 4D 52 54 44 5E	Header	Sector signature for type B directory sector
6	3	07 00 00	Header	Track address of next directory sector
9	1	04	Header	Sector type of next directory sector
10	1	04	1: T	Using the 1112 byte sector type for data
11	1	02	1: R = 2	Data elements are in two tag ranges
12	1	03	1: C = 3	Two copies in standard sectors plus one on this track
13	1	01	1: O = 1	First copy is at a specified byte offset
14	2	01 00	1: R1	First tag range starts at Tag = 1
16	1	0A	1: R1	First tag range is 1 through 10 = 10 tags in the range
17	2	0F 00	1: R2	Second tag range starts at Tag = 15
19	1	06	1: R2	Second tag range is 15 through 20 = 6 tags in the range
20	2	2C 02	1: O1	First copy is at offset 022Ch = 556 on specified track
22	2	06 00	1: C1	First copy is on track 6, which is the directory track
24	2	64 00	1: C2	Second copy is on track 64h = 100
26	2	C8 00	1: C3	Third copy is on track C8h = 200
28	1	04	2: T	Using the 1112 byte sector type for data
29	1	01	2: R = 1	Data elements are in a single tag range
30	2	01	2: C = 1	Only one copy is written
32	1	00	2: O = 0	No copies at a specified byte offset
33	2	15 00	2: R1	First (and only) tag range starts at Tag = 21
35	1	01	2: R1	First tag range is 21 through 21 = 1 tag in the range
36	2	C9 00	2: C1	First (and only) copy starts at track 00C9h = 201

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