International Standard

ISO 7487/3

Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 1,9 tpmm (48 tpi), on two sides —
Part 3 : Track format B

Traitement de l'information — Échange de données sur cartouches à disquette de 130 mm (5,25 in) utilisant un enregistrement à modulation de fréquence modifiée à 7 958 ftprad, 1,9 tpmm (48 tpi), sur deux faces — Partie 3 : Schéma de piste B

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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. Every 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7487/3 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

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Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 1,9 tpmm (48 tpi), on two sides —
Part 3 : Track format B

0 Introduction

ISO 7487 specifies the characteristics of 130 mm (5.25 in) flexible disk cartridges recorded at 7 958 ftprad on both sides using modified frequency modulation (MFM) recording.

ISO 7487/1 specifies the dimensional, physical, and magnetic characteristics of the cartridge so as to provide physical interchangeability between data processing systems.

ISO 7487/2 specifies an alternative track format for data interchange.

Together with the labelling scheme specified in ISO 7665, ISO 7487/1 and ISO 7487/3 provide for full data interchange between data processing systems.

1 Scope and field of application

This part of ISO 7487 specifies the quality of recorded signals, the track layout, and a track format to be used on such a flexible disk cartridge, which is intended for data interchange between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurement system in this International Standard may have been rounded off and therefore are consistent with, but not exactly equal to, each other. Either system may be used, but the two should be neither intermixed nor re-converted. The original design of this part of ISO 7487 was made using SI units.

2 Conformance

A flexible disk cartridge shall be in conformance with ISO 7487 when it meets all requirements either of parts 1 and 2 or of parts 1 and 3 of ISO 7487.

3 References

ISO 646, *Information processing — ISO 7-bit coded character set for information interchange.*

ISO 2022, *Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques.* [1]

ISO 4873, *Information processing — ISO 8-bit code for information interchange — Structure and rules for implementation.* [2]

ISO 7487, *Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 1,9 tpmm (48 tpi), on two sides —*

  Part 1 : Dimensional, physical and magnetic characteristics.

  Part 2 : Track format A.

ISO 7665, *Information processing — File structure and labelling of flexible disk cartridges for information interchange.*

4 Track format

4.1 General requirements

4.1.1 Mode of recording

The mode of recording shall be Modified Frequency Modulation (MFM) for which the conditions are

  a) a flux transition shall be written at the centre of each bit cell containing a ONE;

  b) a flux transition shall be written at each cell boundary between consecutive bit cells containing ZERO's.

Exceptions to this are defined in 4.1.12.

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1) At present at the stage of draft. (Revision of ISO 2022-1982.)

2) At present at the stage of draft. (Revision of ISO 4873-1979.)

4.1.2 Track location tolerance of the located flexible disk cartridge

The centrelines of the recorded tracks shall be within ± 0,085 mm (0.003 3 in) of the nominal positions, over the range of operating environment specified in ISO 7487/1. This tolerance corresponds to twice the standard deviation.

4.1.3 Recording offset angle

At the instant of writing or reading a magnetic transition, the transition may have an angle of 0° ± 18' with the radius. This tolerance corresponds to twice the standard deviation.

4.1.4 Density of recording

4.1.4.1 The nominal density of recording shall be 7 958 ftprad. The nominal bit cell is 125,5 μrad.

4.1.4.2 The long-term average bit cell length shall be the average bit cell length measured over a sector. It shall be within ± 3,5 % of the nominal bit cell length.

4.1.4.3 The short-term average bit cell length, referred to a particular bit cell, shall be the average of the lengths of the preceding eight bit cells. It shall be within ± 8 % of the long-term average bit cell length.

4.1.5 Flux transition spacing (see figure 1)

The instantaneous spacing between flux transitions may be influenced by the reading and writing process, the bit sequence recorded (pulse crowding effects), and other factors. The locations of the transitions are defined as the locations of the peaks in the signal when reading. Tests should be carried out using a peak-sensing amplifier.

4.1.5.1 The spacing between the flux transitions in a sequence of ONE's shall be between 80 % and 120 % of the short-term average bit cell length.

4.1.5.2 The spacing between the flux transition for a ONE and that between two ZERO's preceding or following it shall be between 130 % and 165 % of the short-term average bit cell length.

4.1.5.3 The spacing between the two ONE flux transitions surrounding a ZERO bit cell shall lie between 185 % and 225 % of the short-term average bit cell length.

4.1.6 Average signal amplitude

For each side the average signal amplitude on any non-defective track (see ISO 7487/1) of the interchanged flexible disk cartridge shall be less than 160 % of SRA_{1f} and more than 40 % of SRA_{2f}.

4.1.7 Byte

A byte is a group of eight bit-positions, identified B1 to B8, with B8 the most significant and recorded first.

The bit in each position is a ZERO or a ONE.

4.1.8 Sector

All tracks are divided into 16 sectors.

4.1.9 Cylinder

A pair of tracks, one on each side, having the same track number.

4.1.10 Cylinder number

The cylinder number shall be a two-digit number identical with the track number of the track of the cylinder.

4.1.11 Data capacity of a track

The data capacity of a track shall be 4 096 bytes.

4.1.12 Hexadecimal notation

Hexadecimal notation shall be used hereafter to denote the following bytes :

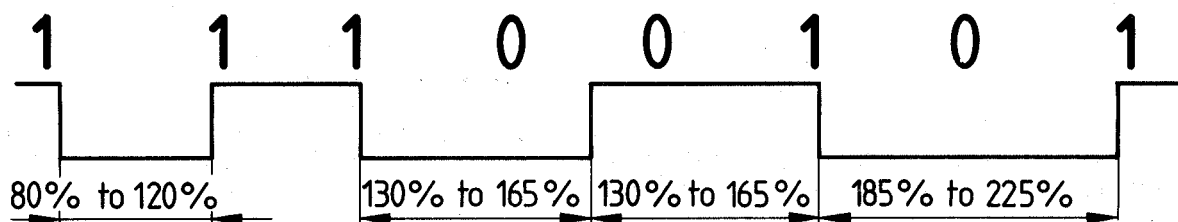(00) for (B8 to B1) = 00000000

(01) for (B8 to B1) = 00000001

Figure 1

(4E) for (B8 to B1) = 01001110

(FE) for (B8 to B1) = 11111110

(FB) for (B8 to B1) = 11111011

(F8) for (B8 to B1) = 11111000

(A1)* for (B8 to B1) = 10100001

where the boundary transition between B3 and B4 is missing.

4.1.13 Error detection characters (EDC)

The two EDC-bytes are hardware generated by shifting serially the relevant bits, specified later for each part of the track through a 16-bit shift register described by

$$X^{16} + X^{12} + X^5 + 1$$

(See also annex A.)

4.2 Track layout after the first formatting for all tracks

After the first formatting, there shall be 16 usable sectors on each track. The layout of each track shall be as shown in figure 2.

During formatting the rotational speed of the disk, averaged index to index, shall be 300 ± 6 r/min.

4.2.1 Index gap

At nominal density this field shall comprise not less than 32 bytes and not more than 146 bytes, the content of which is not specified except that there shall be no (A1)*-bytes.

4.2.2 Sector identifier

This field shall be as given in table 1.

4.2.2.1 Identifier mark

This field shall comprise 16 bytes :

12 (00)-bytes

3 (A1)*-bytes

1 (FE)-byte

4.2.2.2 Address identifier

This field shall comprise 6 bytes.

4.2.2.2.1 Track address

This field shall comprise 2 bytes :

a) Cylinder address (C)

This field shall specify in binary notation the cylinder address from 00 for the outermost cylinder to 37 for the innermost cylinder.

b) Side number (Side)

This field shall specify the side of the disk. On side 0, it shall be (00) on all tracks. On side 1, it shall be (01) on all tracks.

4.2.2.2.2 Sector number (S)

The 3rd byte shall specify in binary notation the sector number from 01 for the 1st sector to 16 for the last sector.

Table 1

Sector identifier						
Identifier mark			Address identifier			
			Track address		S		EDC
12 bytes (00)	3 bytes (A1)*	1 byte (FE)	C 1 byte	Side 1 byte (00) or (01)	1 byte	1 byte (01)	2 bytes

1st Sector — 16th Sector
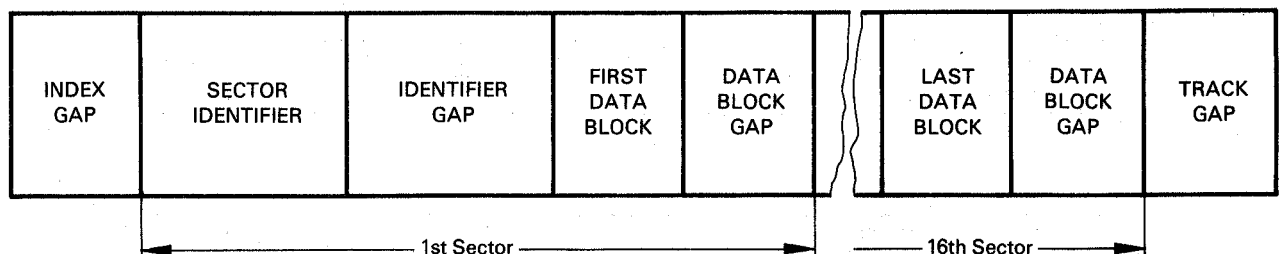
Figure 2

The sectors shall be recorded in the natural order :

1, 2, 3 … 15, 16

4.2.2.2.3 4th byte

The 4th byte shall always be a (01)-byte.

4.2.2.2.4 EDC

These two bytes shall be generated as defined in 4.1.13 using the bytes of the sector identifier starting with the first (A1)*-byte (see 4.2.2.1) of the identifier mark and ending with the 4th byte (see 4.2.2.2.3) of the sector address.

4.2.3 Identifier gap

This field shall comprise 22 initially recorded (4E)-bytes.

4.2.4 Data block

This field shall be as given in table 2.

Table 2

Data block				
Data mark			Data field	EDC
12 bytes (00)	3 bytes (A1)*	1 byte (B)	256 bytes	2 bytes

4.2.4.1 Data mark

This field shall comprise

12 (00)-bytes

3 (A1)*-bytes

1 (FB)-byte

4.2.4.2 Data field

This field shall comprise 256 bytes. No requirements are implied beyond the correct EDC for the content of this field (see also 4.3.4.2.4.2).

4.2.4.3 EDC

These two bytes shall be generated as defined in 4.1.13 using the bytes of the data block starting with the first (A1)*-byte of the data mark (see 4.2.4.1) and ending with the last byte of the data field (see 4.2.4.2).

4.2.5 Data block gap

This field shall comprise 54 initially recorded (4E)-bytes. It is recorded after each data block and it precedes the following sector identifier. After the last data block, it precedes the track gap.

4.2.6 Track gap

This field shall follow the data block gap of the last sector. (4E)-bytes are written until the index hole is detected, unless it has been detected during writing of the last data block gap, in which case there shall be no track gap.

4.3 Track layout of a recorded flexible disk for data interchange

4.3.1 Representation of characters

Characters shall be represented by means of the 7-bit coded character set (ISO 646) and, where required, by its 7-bit or 8-bit extensions (ISO 2022) or by means of the 8-bit coded character set (ISO 4873).

Each 7-bit coded character shall be recorded in bit-positions B7 to B1 of a byte; bit position B8 shall be recorded with bit ZERO.

The relationship shall be as shown in figure 3.

Each 8-bit coded character shall be recorded in bit-positions B8 to B1 of a byte.

The relationship shall be as shown in figure 4.

4.3.2 Good and bad cylinders

A good cylinder is a cylinder which has both tracks formatted according to 4.3.4.

A bad cylinder is a cylinder which has both tracks formatted according to 4.3.5.

Bits of the 7-bit combination	0	b7	b6	b5	b4	b3	b2	b1
Bit-positions in the byte	B8	B7	B6	B5	B4	B3	B2	B1

Figure 3

Bits of the 8-bit combination	b8	b7	b6	b5	b4	b3	b2	b1
Bit-positions in the byte	B8	B7	B6	B5	B4	B3	B2	B1

Figure 4

4.3.3 Requirements for cylinders

Cylinder 00 shall be a good cylinder and shall have no defective sectors on side 0. There shall be at least 37 good cylinders between cylinder 01 and cylinder 39.

4.3.4 Layout of the tracks of a good cylinder

4.3.4.1 Index gap

Description : see 4.2.1.

4.3.4.2 Sector identifier

4.3.4.2.1 Identifier mark

Description : see 4.2.2.1.

4.3.4.2.2 Address identifier

Description : see 4.2.2.2.

4.3.4.2.2.1 Track address

This field shall comprise 2 bytes :

a) Cylinder address (C)

This field shall specify in binary notation the cylinder address from 00 for the outermost cylinder to 37 for the innermost cylinder.

NOTE — A unique cylinder number is associated with each cylinder (see 4.1.10). Two of these cylinders are intended for use only when there are one or two defective cylinders. Each good cylinder possesses a unique cylinder address; a defective cylinder does not possess a cylinder address. Cylinder addresses are assigned consecutively to the good cylinders in the ascending sequence of cylinder addresses.

b) Side number (Side)

Description : see 4.2.2.2.1.

4.3.4.2.2.2 Sector number (S)

Description : see 4.2.2.2.2.

4.3.4.2.2.3 4th byte

Description : see 4.2.2.2.3.

4.3.4.2.2.4 EDC

Description : see 4.2.2.2.4.

4.3.4.2.3 Identifier gap

Description : see 4.2.3. These bytes may have become ill-defined due to the overwriting process.

4.3.4.2.4 Data block

4.3.4.2.4.1 Data mark

For all tracks, this field shall comprise

   12 (00)-bytes

   3 (A1)*-bytes

   1 byte

The 16th byte shall be

   (FB) indicating that the data is valid and that the whole data field can be read;

   (F8) indicating that the first byte of the data field shall be interpreted according to ISO 7665.

4.3.4.2.4.2 Data field

This field shall comprise 256 bytes as specified in 4.2.4.2.

If it comprises less than the requisite number of data bytes, the remaining positions shall be filled with (00)-bytes.

Data fields in cylinder 00 are reserved for operating system use, including labelling.

4.3.4.2.4.3 EDC

Description : see 4.2.4.3.

If the last byte of the data mark is (F8) and the 1st character of the data field is CAPITAL LETTER F, the EDC may or may not be correct, as the sector contains a defective area. If the 1st character is CAPITAL LETTER D, then the EDC shall be correct.

On cylinder 00, only CAPITAL LETTER D shall be allowed.

4.3.4.2.5 Data block gap

This field is recorded after each data block and it precedes the following sector identifier. After the last data block, it precedes the track gap.

It comprises initially 54 (4E)-bytes (see 4.2.5). These bytes may have become ill-defined due to the overwriting process.

4.3.4.2.6 Track gap

Description : see 4.2.6.

4.3.5 Layout of the tracks of a bad cylinder

4.3.5.1 Contents of the fields

The fields of the tracks of a bad cylinder should have the following contents :