International Standard ISO 7065/2

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Information processing — Data interchange on 200 mm (8 in) flexible disk cartridges using modified frequency modulation recording at 13 262 ftprad, 1,9 tpmm (48 tpi), on both sides — Part 2: Track format

Traitement de l'information — Échange de données sur cartouches à disquette de 200 mm (8 in) *utilisant un enregistrement à modulation de fréquence modifiée à* 13 262 ftprad, 1,9 tpmm (48 tpi), *sur deux faces — Partie 2: Schéma de piste*

First edition — 1985-03-15

Adopted for Use by
the Federal Government

FIPS PUB 115

See Notice on Inside
Front Cover

.63

Ref. No. ISO 7065/2-1985 (E)

processing, information interchange, data recording devices, magnetic disks, flexible disks, track formats, specifications.

Price based on 12 pages

This standard has been adopted for Federal Government use.

Details concerning its use within the Federal Government are contained in Federal Information Processing Standards Publication 115, 200 mm (8 in) Flexible Disk Cartridge Track Format Using Modified Frequency Modulation Recording at 13262 bprad on Two Sides — 1.9 tpmm (48 tpi) for Information Interchange. For a complete list of the publications available in the Federal Information Processing Standards Series, write to the Standards Processing Coordinator (ADP), Institute for Computer Sciences and Technology, National Bureau of Standards, Gaithersburg, MD 20899.

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.

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 7065/2 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

Printed in Switzerland

Contents

Information processing — Data interchange on 200 mm (8 in) flexible disk cartridges using modified frequency modulation recording at 13 262 ftprad, 1,9 tpmm (48 tpi), on both sides — Part 2: Track format

0 Introduction

ISO 7065 specifies the characteristics of 200 mm (8 in) flexible disk cartridges recorded at 13 262 ftprad, 1,9 tpmm (48 tpi), on both sides using modified frequency modulation (MFM) recording.

ISO 7065/1 specifies the dimensional, physical, and magnetic characteristics of the cartridge, so as to provide physical interchangeability between data processing systems.

Together with the labelling scheme specified in ISO 7665, ISO 7065/1 and ISO 7065/2 provide for full data interchange between data processing systems.

1 Scope and field of application

This part of ISO 7065 specifies the magnetic characteristics, the track layout, and a track format to be used on a 200 mm (8 in) flexible disk cartridge, recorded at 13 262 ftprad on both sides using modified frequency modulation recording at a track density of 1,9 tracks per millimetre (tpmm) [48 tracks per inch (tpi)] 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 are therefore consistent with, but not exactly equal to, each other. Either system may be used, but the two should be neither intermixed nor reconverted. The original design of this part of ISO 7065 was made using the Imperial measurement system.

2 Conformance

A flexible disk cartridge shall be in conformance with ISO 7065 when it meets all the requirements of parts 1 and 2 of ISO 7065 and when it implements one of the three sector sizes specified in 4.11.

Data interchange is possible only when the interchange parties implement the same sector size.

NOTE — ISO 7665 specifies a field in the VOL label in which the implemented sector size is identified.

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.*

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

ISO 7065/1, *Information processing — Data interchange on* 200 mm (8 in) *flexible disk cartridge using modified frequency modulation recording at* 13 262 ftprad, 1,9 tpmm (48 tpi), *on both sides — Part 1: Dimensional, physical and magnetic characteristics.*

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

4 General requirements

4.1 Mode of recording

4.1.1 Track 00, side 0

The mode of recording shall be two-frequency where the start of every bit cell is a clock flux transition. A ONE is represented by a data flux transition between two clock flux transitions. Exceptions to this are defined in 4.12.

4.1.2 All tracks excluding track 00, side 0

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 4.12.

4.2 Track location tolerance of the recorded 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 7065/1. This tolerance corresponds to twice the standard deviation.

4.3 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.

4.4 Density of recording

4.4.1 The nominal density of recording shall be 13 262 ftprad. The nominal bit cell length for track 00, side 0 is 151 µrad, and for all the other tracks it is 75,5 µrad.

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

NOTE — It is recognized that at extremes of supply frequency encountered on computer sites, the deviation may be ± 5 % in exceptional circumstances. Successful data interchange may then still be possible provided that formatting of the cartridge and subsequent writing of data are not carried out at the opposite limits of this range.

4.4.3 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.

4.5 Flux transition spacing

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 read amplifier (see annex B).

4.5.1 Flux transition spacing for track 00, side 0 (see figure 1)

4.5.1.1 The spacing between two clock flux transitions surrounding a data flux transition or between two data flux transitions surrounding a clock flux transition shall be between 90 % and 140 % of the nominal bit cell length.

4.5.1.2 The spacing between two clock flux transitions not surrounding a data flux transition or between two data flux transitions surrounding a missing clock flux transition shall be between 60 % and 110 % of the nominal bit cell length.

4.5.1.3 The spacing between a data flux transition and the preceding clock flux transition (when not missing) or between a clock flux transition and the preceding data flux transition (when not missing) shall be between 45 % and 70 % of the nominal bit cell length.

4.5.2 Flux transition spacing for all tracks excluding track 00, side 0 (see figure 2)

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

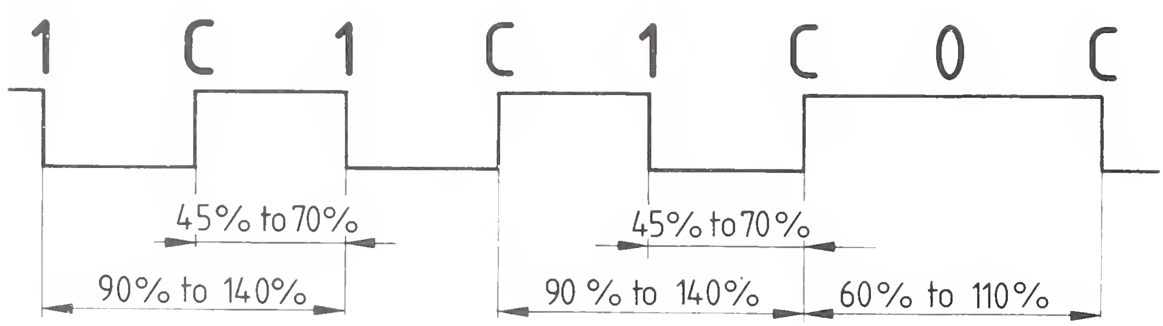


Figure 1

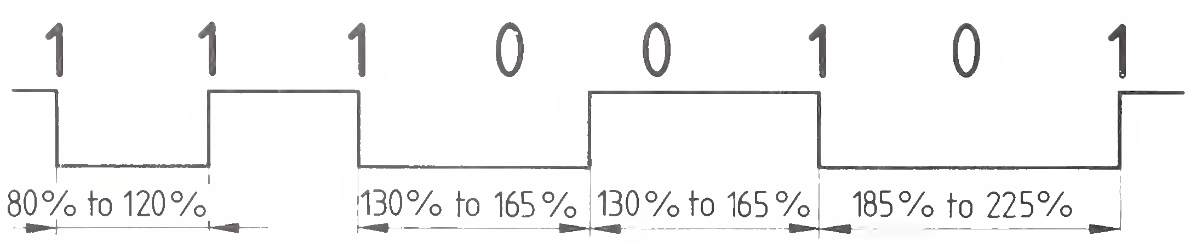


Figure 2

4.5.2.2 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.

4.5.2.3 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.

4.6 Average signal amplitude

The average signal amplitude on any non-defective track of the interchanged flexible disk cartridge shall be less than 160 % of SRA_{1f} and more than 40 % of SRA_{2f}.

4.7 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.

4.8 Sector

Track 00, side 0 and side 1 shall be divided into 26 sectors. All other tracks of the flexible disk cartridge shall have the same number of sectors, which can be 8, 15 or 26.

4.9 Cylinder

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

4.10 Cylinder number

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

4.11 Data capacity of a track

The data capacity of track 00, side 0 shall be 3 328 bytes. The data capacity of track 00, side 1 shall be 6 656 bytes.

The data capacity of all other tracks shall be as shown in table 1.

Table 1

Number of sectors	Number of data bytes in the sector	Data capacity of a track
26	256	6 656 bytes
15	512	7 680 bytes
8	1 024	8 192 bytes

4.12 Hexadecimal notation

Hexadecimal notation shall be used to denote the following bytes:

(00) for (B8 to B1) = 00000000
(01) for (B8 to B1) = 00000001
(02) for (B8 to B1) = 00000010
(03) for (B8 to B1) = 00000011
(FF) for (B8 to B1) = 11111111
(FC)* for (B8 to B1) = 11111100

where the clock transitions of B6 and B4 are missing

(FE)* for (B8 to B1) = 11111110

where the clock transitions of B6, B5 and B4 are missing

(FB)* for (B8 to B1) = 11111011

where the clock transitions of B6, B5 and B4 are missing

(F8)* for (B8 to B1) = 11111000

where the clock transitions for B6, B5 and B4 are missing

(4E) for (B8 to B1) = 01001110
(FC) for (B8 to B1) = 11111100
(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

(C2)* for (B8 to B1) = 11000010

where the boundary transition between B4 and B5 is missing.

4.13 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 the generator polynominal:

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

(See also annex A.)

5 Track layout after the first formatting for track 00, side 0

After the first formatting, there shall be 26 usable sectors on the track. The layout of the track shall be as shown in figure 3.

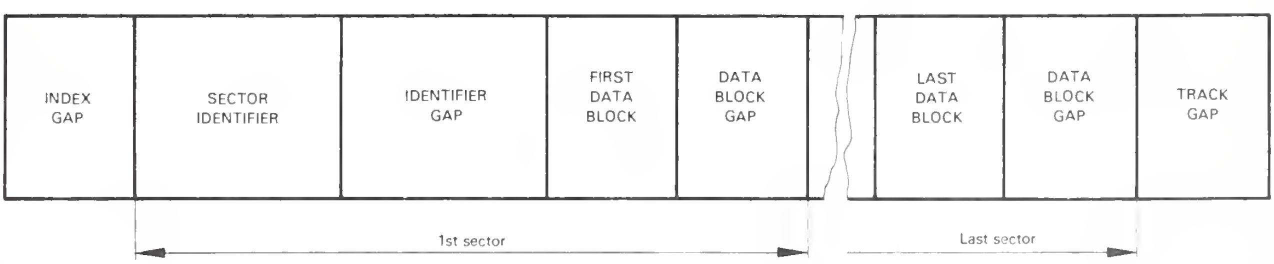


Figure 3

5.1 Index gap

This field shall comprise 73 bytes nominally

40 (FF)-bytes
6 (00)-bytes
1 (FC)*-bytes
26 (FF)-bytes

Writing the index gap is started when the index hole is detected. Any of the first 20 bytes may be ill-defined due to subsequent overwriting.

5.2 Sector identifier

This field shall be as given in table 2.

Table 2

Identifier mark		Address identifier				
		Track address				
		C	Side	S		EDC
6 bytes (00)	1 byte (FE)*	1 byte (00)	1 byte (00)	1 byte	1 byte (00)	2 bytes

5.2.1 Identifier mark

This field shall comprise 7 bytes

6 (00)-bytes
1 (FE)*-byte

5.2.2 Address identifier

This field shall comprise 6 bytes.

5.2.2.1 Track address

This field shall comprise 2 bytes

a) Cylinder address (C)

This field shall specify in binary notation the cylinder address. It shall be (00) for all sectors.

b) Side number (Side)

This field shall specify the side of the disk. It shall be (00) for all sectors.

5.2.2.2 Sector number (S)

The 3rd byte shall specify in binary notation the sector number from 01 for the 1st sector to 26 for the last sector.

The 26 sectors shall be recorded in the natural order:

1, 2, 3 . . ., 25, 26

5.2.2.3 4th byte of the sector address

The 4th byte shall always be a (00)-byte.

5.2.2.4 EDC

These two bytes shall be generated as defined in 4.13 using the bytes of the sector identifier starting with the (FE)*-byte (see 5.2.1) of the identifier mark and ending with the 4th byte (see 5.2.2.3) of the sector address.

5.3 Identifier gap

The field shall comprise 11 initially recorded (FF)-bytes.

5.4 Data block

This field shall be as given in table 3.

Table 3

Data mark		Data field	EDC
6 bytes (00)	1 byte (FB)*	128 bytes	2 bytes

5.4.1 Data mark

This field shall comprise

6 (00)-bytes
1 (FB)*-byte

5.4.2 Data field

This field shall comprise 128 bytes. No requirements are implied beyond the correct EDC for the content of this field (see also 7.4.2.4.2).

5.4.3 EDC

These two bytes shall be generated as defined in 4.13 using the bytes of the data block starting with the 7th byte of the data mark (see 5.4.1) and ending with the last byte of the data field (see 5.4.2).

5.5 Data block gap

This field shall comprise 27 initially recorded (FF)-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.

5.6 Track gap

This field shall follow the data block gap of the 26th sector. At nominal density, it shall comprise 247 (FF)-bytes. Writing of the track gap takes place 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.

6 Track layout after the first formatting for all tracks excluding track 00, side 0

After the first formatting, there shall be a number of sectors with the number determined by the sector length byte (see 6.2.2.3) of the sector address. The layout of each track shall be as shown in figure 4.

NOTE — Track 00, side 1 is always recorded with 26 sectors (see 4.8)

6.1 Index gap

This field shall comprise 146 bytes nominally

80 (4E)-bytes
12 (00)-bytes
3 (C2)*-bytes
1 (FC)-byte
50 (4E)-bytes

Writing the index gap is started when the index hole is detected. Any of the first 40 bytes may be ill-defined due to subsequent overwriting.

6.2 Sector identifier

This field shall be as given in table 4.

6.2.1 Identifier mark

This field shall comprise 16 bytes

12 (00)-bytes
3 (A1)* bytes
1 (FE)-byte

6.2.2 Address identifier

This field shall comprise 6 bytes.

6.2.2.1 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 74 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.

6.2.2.2 Sector number (S)

The 3rd byte shall specify in binary notation the sector number from 01 for the 1st sector to the number of the last sector (8, 15 or 26).

The sectors shall be recorded in the natural order:

1, 2, 3, ..., up to the last sector.

Table 4

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

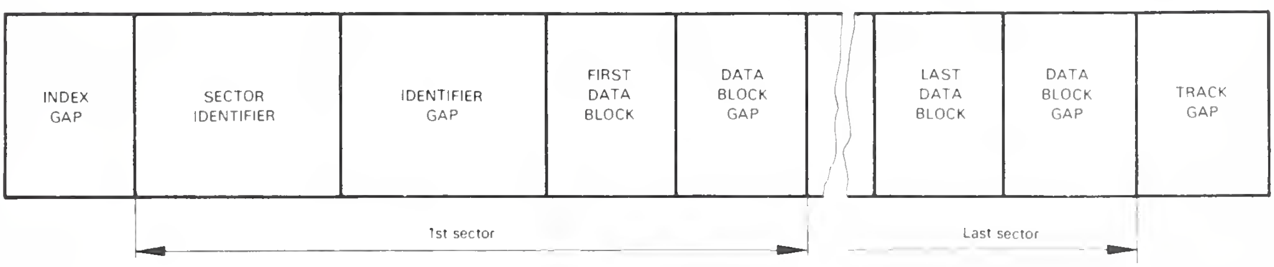


Figure 4

6.2.2.3 Sector length (SL)

This field shall have one of three values (see table 5) which defines the number of bytes of the data field and consequently determines the number of sectors of the track. The value shall be the same for all sectors on a track, and for all cylinders except cylinder 00.

Table 5

(SL) value in hexadecimal	Number of bytes of the data field	Number of sectors of the track
(01)	256	26
(02)	512	15
(03)	1 024	8

On track 00 side 1, only 26 sectors of 256 data bytes are allowed, consequently the (01)-byte only is allowed in this field on this track.

6.2.2.4 EDC

These two bytes shall be generated as defined in 4.13 using the bytes of the sector identifier starting with the first (A1)*-byte (see 6.2.1) of the identifier mark and ending with the sector length byte (see 6.2.2.3) of the sector address.

6.3 Identifier gap

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

6.4 Data block

This field shall be as given in table 6.

Table 6

Data mark			Data field	EDC
12 bytes (00)	3 bytes (A1)*	1 byte (FB)		2 bytes

6.4.1 Data mark

This field shall comprise

12 (00)-bytes
3 (A1)*-bytes
1 (FB)-byte

6.4.2 Data field

This field shall comprise a number of bytes as defined by the sector length byte (6.2.2.3) in the sector address. No requirements are implied beyond the correct EDC for the content of this field (see also 7.4.2.4.2).

6.4.3 EDC

These two bytes shall be generated as defined in 4.13 using the bytes of the data block starting with the first (A1)*-byte of the data mark (see 6.4.1) and ending with the last byte of the data field (see 6.4.2).

6.5 Data block gap

This field shall comprise a number of initially recorded (4E)-bytes. The number is dependent on the number of bytes in the data field (6.4.2) as given in table 7.

Table 7

Number of bytes in the data field	Number of bytes in the data block gap
256	54
512	84
1 024	116

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

6.6 Track gap

This field shall follow the data block gap of the last sector. It should comprise a number of initially recorded (4E)-bytes. The number at nominal density is dependent on the number of bytes in the data field (see 6.4.2) as given in table 8.

Table 8

Number of bytes in the data field	Number of bytes in the track gap
256	598
512	400
1 024	654

Writing of the track gap takes place until the index hole is detected, unless it has been detected during writing of the last data block gap, in which case there will be no track gap.

7 Track layout of a recorded flexible disk for data interchange

7.1 Representation of characters

Characters shall be represented by means of the 7-bit coded character set (see ISO 646) and, where required, by its 7-bit or 8-bit extensions (see ISO 2022) or by means of the 8-bit coded character set (see 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 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 5

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 6.

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 6

7.2 Good and bad cylinders

A good cylinder is a cylinder which has both tracks formatted according to 7.4.

A bad cylinder is a cylinder which has both tracks formatted according to 7.5.

7.3 Requirements for cylinders

Cylinder 00 shall be a good cylinder. There shall be at least 74 good cylinders between cylinder 01 and cylinder 76.

7.4 Layout of the tracks of a good cylinder

References to clause 4 are for track 00, side 0.

References to clause 5 are for all other tracks.

7.4.1 Index gap

Description: see 5.1 and 6.1.

7.4.2 Sector identifier

7.4.2.1 Identifier mark

Description: see 5.2.1 and 6.2.1.

7.4.2.2 Address identifier

This field shall comprise 6 bytes.

7.4.2.2.1 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 74 for the innermost cylinder.

NOTE — A unique cylinder number is associated with each cylinder. 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 numbers.

b) Side number (Side)

Description: see 5.2.2.1 and 6.2.2.1.

7.4.2.2.2 Sector number (S)

Description: see 5.2.2.2 and 6.2.2.2.

7.4.2.2.3 4th byte of the sector address

Description: see 5.2.2.3 and 6.2.2.3.

7.4.2.2.4 EDC

Description: see 5.2.2.4 and 6.2.2.4.

7.4.2.3 Identifier gap

Description: see 5.3 and 6.3. These bytes may have become ill-defined due to the overwriting process.

7.4.2.4 Data block

7.4.2.4.1 Data mark

For track 00, side 0, this field shall comprise

6 (00)-bytes
1 byte

The 7th 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.

For all other 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.

7.4.2.4.2 Data field

This field shall contain a number of bytes as specified in 5.4.2 and 6.4.2.

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.

7.4.2.4.3 EDC

Description: see 5.4.3 and 6.4.3.

If the last byte of the data mark is (F8)* or (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.

7.4.2.5 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 27 (FF)-bytes (see 5.5) or a number of (4E)-bytes (see 6.5). These bytes may subsequently become ill-defined due to the overwriting process.

7.4.2.6 Track gap

Description: see 5.6 and 6.6.

7.5 Layout of the track of a bad cylinder

7.5.1 Contents of the fields

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

7.5.1.1 Index gap

This field should comprise 146 (4E)-bytes.

7.5.1.2 Sector identifier

This field should comprise an identifier mark and sector address.

7.5.1.2.1 Identifier mark

This field should comprise 16 bytes

12 (00)-bytes
3 (A1)*-bytes
1 (FE)-byte

7.5.1.2.2 Address identifier

This field should comprise 6 bytes

4 (FF)-bytes
2 EDC-bytes

These two EDC-bytes shall be generated as defined in 4.13 using the bytes of the sector identifier starting with the first (A1)*-byte (see 6.5.1.2.1) of the identifier mark and ending with the above 4 (FF)-bytes.

7.5.1.3 Identifier gap

This field should comprise 22 (4E)-bytes.

7.5.1.4 Data block

7.5.1.4.1 Data mark

This field should comprise 16 (4E)-bytes.

7.5.1.4.2 Data field

This field should contain a number of (4E)-bytes. The number should be the same as that defined by the sector length byte (see 6.2.2.3) in the sector address of good cylinders.

7.5.1.4.3 EDC

This field should comprise 2 (4E)-bytes.

7.5.1.5 Data block gap

This field should comprise a number of (4E)-bytes. The number is dependent on the number of bytes in the data field (see 6.5).

7.5.1.6 Track gap

Description: see 6.6.

7.5.2 Requirements for tracks

Each track of a bad cylinder shall have at least one of its sector identifiers with the content specified in 7.5.1.2. If this condition is not satisfied, the cartridge shall be rejected. All other fields of such tracks may be ill-defined.

Annex A

EDC implementation

(This annex does not form part of the standard.)

Figure 7 showns the feedback connections of a shift register which may be used to generate the EDC bytes.

Prior to operation, all positions of the shift register are set to ONE. Input data are added (exclusive OR) to the contents of position C_{15} of the register to form a feedback. This feedback is in its turn added (exclusive OR) to the contents of position C_4 and position C_{11}.

On shifting, the outputs of the exclusive OR gates are entered respectively into positions C_0, C_5 and C_{12}. After the last data bit has been added, the register is shifted once more as specified above.

The register then contains the EDC bytes.

If further shifting is to take place during the writing of the EDC bytes, the control signal inhibits exclusive OR operations.

To check for errors when reading, the data bits are added into the shift register in exactly the same manner as they were during writing. After the data, the EDC bytes are also entered into the shift register as if they were data. After the final shift, the register contents will be all ZERO if the record does not contain errors.

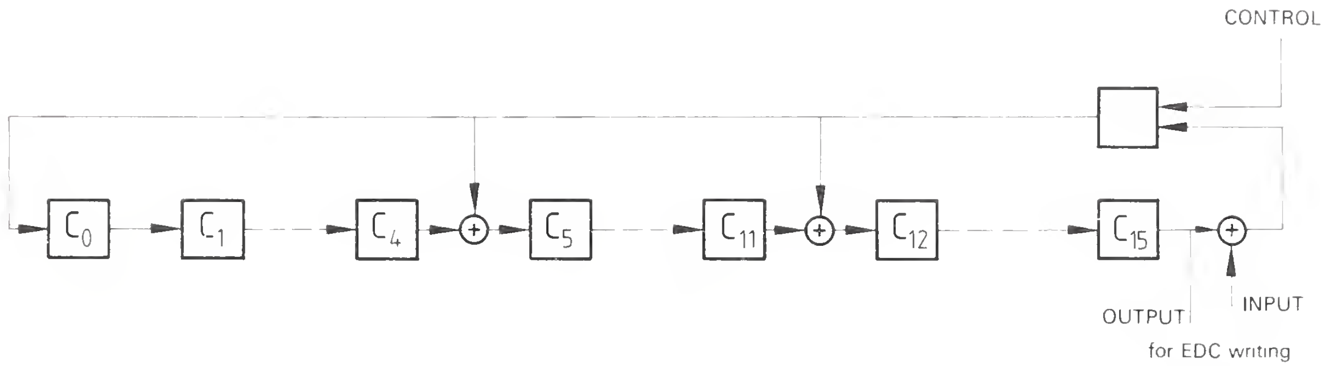


Figure 7

Annex B

Procedure and equipment for measuring flux transition spacing

(This annex does not form part of the Standard.)

B.1 General

This annex specifies equipment and a procedure for measuring flux transition spacing on 200 mm (8 in) flexible disk cartridges using MFM recording at 13 262 ftprad on two sides.

B.2 Format

The disk to be measured shall be written by the disk drive for data interchange use.

Testing shall be done on tracks 00, 43, 44 and 76 on both sides.

Write current shall be switched as provided in ISO 7065/1.

Track 00, side 0 shall have the test patterns 00100000 (20) and 11101111 (EF) written repeatedly.

All other test tracks shall have the test patterns 11011011 (DB) and 11011100 (DC) written repeatedly.

B.3 Test equipment

B.3.1 Disk drive

The disk drive shall have a rotational speed of 360 r/min, with a tolerance of ± 3 r/min, averaged over one revolution. The average angular speed taken over 32 μs shall not deviate by more than 0,5 % from the speed averaged over one revolution.

B.3.2 Head

B.3.2.1 Resolution

The head shall have an absolute resolution of 55 % to 65 % at track 76 on side 0 and at track 72 on side 1, using the reference material RM 5654, applying the calibration factor of the reference material, and recording with the appropriate test recording current.

The resonant frequency of the head shall be at least 500 000 Hz.

The resolution shall not be adjusted by varying the load impedance of the head.

The resolution shall be measured at the output of the amplifier defined in B.3.3.1.

B.3.2.2 Offset angle

The head shall have gap offset angle of 0° ± 6′ with the disk radius on the testing drive.

B.3.2.3 Contact

Care shall be taken that the heads are in good contact with the media during the tests.

B.3.3 Read channel

B.3.3.1 Read amplifier

The read amplifier shall have a flat reponse from 1 000 to 375 000 Hz within ± 1 dB, and amplitude saturation shall not occur.

B.3.3.2 Peak sensing amplifier

Peak sensing shall be carried out by a differentiator and limiting amplifier.

B.3.4 Time interval measuring equipment

The time interval counter shall be able to measure to 2 µs to at least 5 ns resolution.

A triggering oscilloscope may be used for this purpose.

B.4 Procedure of measurement

B.4.1 Flux transition spacing measurement

The transition locations shall be measured by the locations of the peaks in the signal when reading.

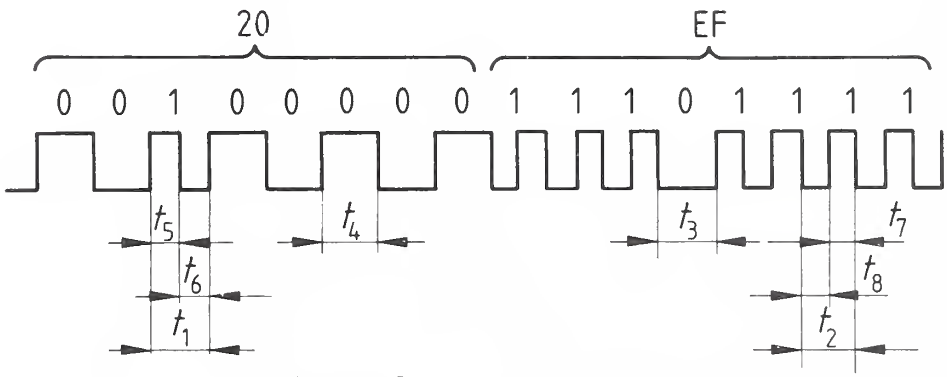
The flux transition spacing shall be measured by the pulse timing intervals after the read channel amplifier defined in B.3.3.

B.4.2 Flux transition spacing for track 00, side 0

Measure time intervals t_1 to t_8 as shown in figure 8.

B.4.3 Flux transition spacing for all other tracks

Measure time intervals, t_1 to t_5 as shown in figure 9.

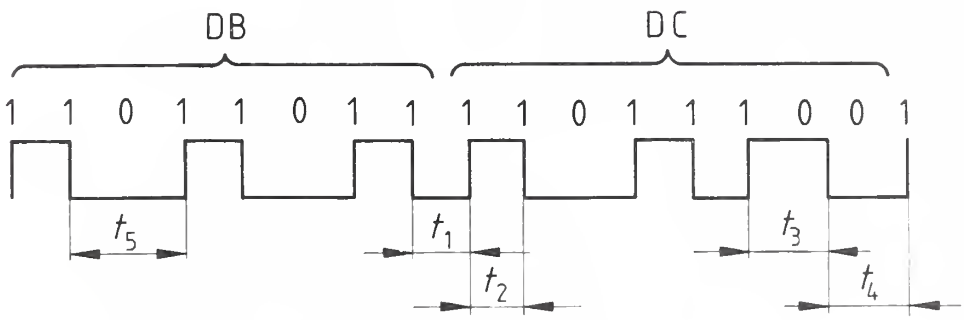


Sub-clause 4.5.1.1 corresponds to t_1 and t_2

Sub-clause 4.5.1.2 corresponds to t_3 and t_4

Sub-clause 4.5.1.3 corresponds to t_5, t_6, t_7 and t_8

Figure 8



Sub-clause 4.5.2.1 corresponds to t_1 and t_2

Sub-clause 4.5.2.2 corresponds to t_3 and t_4

Sub-clause 4.5.2.3 corresponds to t_5

Figure 9

Annex C

Data separators for decoding MFM recording

(This annex does not form part of the standard.)

C.1 On track 00, side 0 the two-frequency recording results in nominal flux transition periods of

t for a ONE cell

2 t for a ZERO cell

where t = 2 µs

The data separator should be capable of resolving a difference of 2 µs. This can be achieved satisfactorily by the use of a digital data separator, or one using a fixed timer.

C.2 On all other tracks, the MFM recording method gives nominal flux transition spacings of

t for the patterns 11 or 000

$3t/2$ for the patterns 10 or 01

$2t$ for the pattern 101

The data separator should be capable of resolving a difference of only 1 µs. To achieve this with a low error rate, the separator cannot operate on a fixed period but should follow changes in the bit cell length.

It is recognized that various techniques may be developed to achieve dynamic data separation; with present technology only an analogue data separator based on a phase-locked oscillator can provide the necessary reliability.