INTERNATIONAL STANDARD

ISO/IEC 17345

Second edition
2006-12-01

Information technology — Data Interchange on 130 mm Rewritable and Write Once Read Many Ultra Density Optical (UDO) Disk Cartridges — Capacity: 30 Gbytes per Cartridge — First Generation

Technologies de l'information — Échange de données sur cartouches de disques de 130 mm de diamètre, pour réécriture et pour "write once read many", de densité ultra-optique (UDO) — Capacité: 30 Go par cartouche — Première génération

Reference number
ISO/IEC 17345:2006(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national 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 and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 17345 was prepared by Ecma TC 31 (as ECMA-350) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This second edition cancels and replaces the first edition (ISO/IEC 17345:2005), which has been technically revised.

Introduction

Ecma Technical Committee TC 31 was established in 1984 for the standardization of Optical Disks and Optical Disk Cartridges (ODC). Since its establishment, the Committee has made major contributions to ISO/IEC JTC 1/SC 23 toward the development of International Standards for optical disks with a diameter of 80 mm, 90 mm, 120 mm, 130 mm, 300 mm and 356 mm. Numerous standards have been developed by TC 31 and published by Ecma, almost all of which have also been adopted by ISO/IEC under the fast-track procedure as International Standards. The following International Standards for 130 mm disks have been published by Ecma and adopted by ISO/IEC JTC 1: ISO/IEC 11560:1992, ISO/IEC 13481:1993, ISO/IEC 13549:1993, ISO/IEC 13842:1995, ISO/IEC 15486:1998, ISO/IEC 18093:1999, ISO/IEC 22092:2002.

This International Standard specifies two types of double-sided ODCs — Rewritable (Type RW) and Write Once Read Many (Type WORM), both using thermo-optical Phase Change effects.

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Section 1 — General

1 Scope

This International Standard specifies the mechanical, physical, and optical characteristics of a 130 mm optical disk cartridge (ODC) that employs thermo-optical Phase Change effects to enable data interchange between such disks.

This International Standard specifies two types:

- Type RW (Rewritable) provides for data to be written read and erased many times over the recording surfaces of the disk.

- Type WORM (Write Once Read Many) provides for data once written to be read a multiplicity of times. This type uses a Write Once Read Many times recording material (written marks cannot be erased and attempted modifications of the written marks are detectable). Multisession (incremental write operations) recording may be performed on Type WORM disks.

The disk is two-sided with a nominal capacity of 15,0 Gbytes per side and the cartridge (two sides) provides a nominal capacity of 30,0 Gbytes.

This International Standard specifies:

- the conditions for conformance testing and the Reference Drive;

- the environments in which the cartridges are to be operated and stored;

- the mechanical, physical and dimensional characteristics of the cartridge so as to provide mechanical interchangeability between data processing systems;

- the format of the information on the disk, both embossed and user-written, including the physical disposition of the tracks and sectors, the error correction codes, the modulation methods used;

- the characteristics of the embossed information on the disk;

- the thermo-optical characteristics of the disk, enabling processing systems to write data onto the disk; and

- the minimum quality of user-written data on the disk, enabling data processing systems to read data from the disk.

This International Standard provides for interchange between optical disk drives. Together with a standard for volume and file structure, it provides for full data interchange between data processing systems.

2 Conformance

2.1 Optical disk

An ODC shall be in conformance with this International Standard if it meets all mandatory requirements specified therein.

A claim of conformance with this International Standard shall specify the Type, RW, WORM, implemented.

2.2 Generating system

A claim of conformance with this International Standard shall specify which Type(s) is (are) supported. A system generating an ODC for interchange shall be in conformance with this International Standard if it meets the mandatory requirements of this International Standard for the Type(s) supported.

2.3 Receiving system

A claim of conformance with this International Standard shall specify which Type(s) is (are) supported.

A system receiving an ODC for interchange shall be in conformance with this International Standard if it is able to process any recording made on the cartridge according to 2.1 on the Type(s) specified.

2.4 Compatibility statement

A claim of conformance with this International Standard shall include a statement listing any other Optical Disk Cartridge Standard supported by the system for which conformance is claimed. This statement shall specify the number of the Standard(s), including, where appropriate, the ODC Type(s), and whether support includes reading only or both reading and writing.

3 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.

ECMA-287 (2002), *Safety of electronic equipment*

4 Terms and definitions

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

4.1
asymmetry
deviation between the centre levels of signals generated by two distinct repeating mark and space length patterns

4.2
band
annular area on the disk having a constant clock frequency

4.3
case
housing for an optical disk that protects the disk and facilitates disk interchange

4.4
Case Reference Plane
plane defined for each side of the case, to which the dimensions of the case are referred

4.5
channel bit
elements by which, after modulation, the binary values ZERO and ONE are represented by marks and spaces on the disk

4.6
clamping zone
annular part of the disk within which the clamping force is applied by the clamping device

4.7
cover layer
transparent layer of the disk through which the optical beam accesses the recording layer

4.8
Cyclic Redundancy Code
CRC
method for detecting errors in data

4.9
data field
subdivision of a sector intended for the recording of user data

4.10
Defect Management
method for handling the defective areas on the disk

4.11
Disk Reference Plane
plane defined by the perfectly flat annular surface of an ideal spindle onto which the clamping zone of the disk is clamped, and which is normal to the axis of rotation

4.12
entrance surface
surface of the disk onto which the optical beam first impinges

4.13
Error Correction Code
ECC
error-detecting code designed to correct certain kinds of errors in data

4.14
field
subdivision of a sector

4.15
format
arrangement or layout of information on the disk

NOTE The annular area on the disk bearing the format is the formatted zone.

4.16
hub
central feature on the disk, which interacts with the spindle of the disk drive to provide radial centring and the clamping force

4.17
interleaving
process of allocating the physical sequence of units of data so as to render the data more immune to burst errors

4.18
land and groove
trench-like feature of the disk, applied before the recording of any information, and used to define the track location

NOTE The land is located nearer to the entrance surface than the groove with which it is paired to form a Physical Track. Recording is performed on both the land and groove.

4.19
mark
feature of the recording layer which takes the form of a pit, change in the reflectivity, or any other type or form that can be sensed by the optical system

NOTE The pattern of marks represents the data on the disk.

4.20
Mirror Area
area in which there is no embossed information, neither preformatted headers or grooves

4.21
optical disk
disk that will accept and retain information in the form of marks in a recording layer, that can be read with an optical beam

4.22
optical disk cartridge
ODC
device consisting of a case containing an optical disk

4.23
Phase Change
physical effect by which the area of a recording layer irradiated by a laser beam is heated so as to change from an amorphous state to a crystalline state and vice versa

4.24
Physical Block Address
PBA
numbering system of the data sectors defined to constitute a uniquely addressable sector location to the recording system

4.25
Physical Track
one revolution (360°) of adjacent groove-land pair

4.26
read power
optical power, incident at the entrance surface of the disk, used when reading

4.27
recording layer
layer of the disk on, or in, which data is written during manufacture and/or use

NOTE The recording layer may actually consist of a multiple layer stack of different materials or composite materials.

4.28
Recording Track
one revolution (360°) of either a land feature or groove feature of the disk (Land Recording Track or Groove Recording Track) where recording may be performed

4.29
Reed-Solomon code
error detection and/or correction code which is particularly suited to the correction of errors which occur in bursts or are strongly correlated

4.30
sector
smallest addressable part of a track in the formatted area of the disk

4.31
space
area between marks along the track

4.32
spindle
part of the disk drive which contacts the disk and/or hub

4.33
substrate
layer of the disk provided for mechanical support of the recording layer

4.34
track
path which is followed by the focus of the optical beam during exactly one revolution of the disk

4.35
track pitch
distance between Land Recording Track centrelines and adjacent Groove Recording Track centrelines, measured in the radial direction

4.36
User Area
area of the disk intended for the recording of user data

4.37
wobble
periodic radial deviation of the track (groove or land) from the average centreline that is used as a supplemental timing signal

4.38
write-inhibit hole
hole in the case which, when detected by the drive to be open, inhibits write operations

4.39
zone
annular area of the disk

5 Conventions and notations

5.1 Representation of numbers

A measured value is rounded off to the least significant digit of the corresponding specified value. For instance, it implies that a specified value of 1,26 with a positive tolerance of + 0,01 and a negative tolerance of - 0,02 allows a range of measured values from 1,235 to 1,275.

Numbers in decimal notations are represented by the digits 0 to 9.

Numbers in hexadecimal notation are represented by the hexadecimal digits 0 to 9 and A to F in parentheses.

The setting of bits is denoted by ZERO and ONE.

Numbers in binary notations and bit patterns are represented by strings of digits 0 and 1, with the most significant bit shown to the left.

Negative values of numbers in binary notation are given as Two's complement.

In each field the data is recorded so that the most significant byte (MSB), identified as Byte 0, is recorded first and the least significant byte (LSB) last. In a field of 8*n* bits, bit $b_{(8n-1)}$ shall be the most significant bit (msb) and bit b_0 the least significant bit (lsb). Bit $b_{(8n-1)}$ is recorded first.

A binary digit which can be set indifferently to ZERO or to ONE is represented by "x".

5.2 Names

The names of entities, e.g. specific tracks, fields, areas, zones, etc. are given a capital initial.

6 Acronyms

AM	Address Mark
CRC	Cyclic Redundancy Code
DDS	Disk Definition Structure
DIR	Drive Information Record
DMA	Defect Management Area
ECC	Error Correction Code
ESISIC	Enhanced Selective Inter-Symbol Interference Cancellation
ID	Identifier
LBA	Logical Block Address
LSB	Least Significant Byte
lsb	least significant bit
MSB	Most Significant Byte
msb	most significant bit
NA	Numerical Aperture
NBSNR	Narrow-Band Signal-to-Noise Ratio
NRZ	Non Return to Zero
ODC	Optical Disk Cartridge

PA	Postamble
PBA	Physical Block Address
PDL	Primary Defect List
PLL	Phase Locked Loop
PSA	Primary Spares Area
QWM	Quadrature Wobble Marks
QWMG	Quadrature Wobble Marks on Groove
QWML	Quadrature Wobble Marks on Land
RESYNC	Re-synchronization
RFO	Read Focus Offset
RLL	Run-Length Limited (code)
RW	Rewritable
SCSI	Small Computer System Interface
SDI	Specific Disk Information
SDL	Secondary Defect List
SPS	Start Position Shift
SSA	Secondary Spares Area
STOB	Six Time Oversampled Bi-Phase
SYNC	Synchronization
TA	Transition Area
TIA	Time Interval Analyzer
UDO	Ultra Density Optical (disk)
VAP	Verify and Protect
VFO	Variable Frequency Oscillator
WORM	Write Once Read Many
ZCAV	Zoned Constant Angular Velocity

7 General description

The optical disk cartridge, which is the subject of this International Standard, consists of a case containing an optical disk.

The case is a protective enclosure for the disk. It has access windows covered by two shutters. One of the windows is automatically uncovered by the drive when the cartridge is inserted into it.

The optical disk is made from two sides that are assembled together. Each side consists of a Phase Change recording layer placed between the substrate and the cover layer. The substrates of each side are bonded together.

The optical disk is recordable on both sides. Data can be written onto the disk as marks with Phase Change characteristics variations in the recording layer, using a focused optical beam. Data can be read by the optical beam using the change in reflectivity and diffraction between mark and space in the recording layer. The beam accesses the recording layer through the transparent cover layer of the disk.

Part of the disk contains read-only data in the form of pre-embossed pits. This data can be read using the diffraction of the optical beam by the embossed pits.