

### Standardization of Optical Disk Cartridges (ODCs) by ECMA since 1984

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(An html version of this document is available on the ECMA Web site under: ECMA activities)

#### 1 First Programme of Work of TC31, 1987-1991

TC31 was set up by ECMA with a view to producing ECMA Standards for ODCs, to respond to the market need for standards in this field. However, ODCs being a new medium - at least from a standardization point of view - it was first necessary to identify all important parameters of the unrecorded disk and to agree on those deemed to be relevant for interchange. The next problem was to agree on the format to be used for the recorded disk. Before these essential matters could be considered it was first necessary to agree on the physical dimensions of the case itself. The problem there was that these dimensions, in particular the thickness of the case, should be convenient for the different disk designs under consideration and, at the same time, allow for the design of drives the dimensions of which should be compatible with those of drives for magnetic flexible disk cartridges. The same discussions took place in ISO/IEC JTC 1/SC23.

Once the problem with the case were practically solved, TC31 decided to undertake the following programme of work:

- To participate actively in the development in SC23 of International Standard 9171, an ODC with a disk of 130 mm intended for write once read multiple (WORM) applications,
- To participate actively in the development in SC23 of International Standard 10089, an ODC with a disk of 130 mm intended for rewritable (R/W) applications,
- To develop an ECMA Standard for an ODC with a 90 mm disk intended for R/W applications,
- In parallel with these activities to produce an ECMA Standard for CD-ROM.

##### 1.2 ISO/IEC 9171

The first Draft International Standard (DIS) produced by SC23 proved to be quite unacceptable. Indeed, it was covering several different, incompatible designs and could, thus, not be considered as an interchange standard but rather as a more or less accurate description of the state of the art. As a consequence, this first DIS was rejected by a large majority. An 8-man team, four from Japan and four from ECMA met for a full week in Manchester/UK and produced a second, entirely new version of the DIS which was eventually accepted as an International Standard ISO/IEC 9171, in 1990. The main characteristics of this International Standard are that it specifies a single unrecorded disk, but two different formats, viz. one based on the continuous composite servo (CCS) tracking method, the other on the sample servo tracking format (SSF).

##### 1.3 ISO/IEC 10089 and ECMA-153

ISO/IEC 10089 is the first standard of the series of standards for R/W optical disk cartridges. It was developed in SC23 with the active participation of, and major contributions from, TC31. However, it still specifies the two different formats CCS and SSF.

TC31 derived from ISO/IEC 10089 a further standard, Standard ECMA-153, which uses the disk specified by ISO/IEC 10089, specifies a single format, viz. CCS only, and is intended for write once (WO) applications only, which is achieved by software means. This ECMA Standard was adopted under the fast-track procedure as International Standard ISO/IEC 11560.

##### 1.4 ECMA-154, ISO/IEC 10090

In close co-operation with SC23, TC31 developed Standard ECMA-154, the first standard for 90 mm ODCs. Its main characteristics are:

- a single format, CCS, is specified,

- the disk is R/W, but may contain data recorded in embossed parts (read only recording),
- the whole editing, compared to that of ISO/IEC 10089 was improved.

The editing weakness of ISO/IEC 10089 is due to the fact that because two formats are specified, it was not always possible to separate cleanly and logically requirements for the disk from some requirements for the format(s). Standard ECMA-154 was adopted by ISO/IEC under the fast-track procedure as International Standard ISO/IEC 10090.

### **1.5 ECMA-130, ISO/IEC 10149**

A small task force developed this standard. It was adopted under the fast-track procedure as an International Standard by ISO/IEC. It is the sole internationally recognized CD-ROM standard for data interchange.

The 2nd edition of ECMA-130 has been published in 1996.

## **2 Second Programme of Work of TC31, 1992-1996**

The second programme of work adopted by TC31 comprises the development of

- further 130 mm ODCs for different applications,
- one standard for a 130 mm ODC of the WORM type,
- further 90 mm ODCs for different applications,
- two standards for 300 mm ODCs of the WORM type,
- one standard for a 120 mm ODC for different applications.

As a result TC31 produced seven standards, four for 130 mm ODCs and three for 90 mm ODCs, specifying a single format of the CCS type:

- ECMA-183, ECMA-184, ECMA-195, ECMA-238 (WORM)
- ECMA-201, ECMA-223, ECMA-239

In addition two standards for 300 mm were produced, and one standard for 120 mm:

- ECMA-189 for the SSF Method
- ECMA-190 for the CCS Method
- ECMA-240 for CD with PD format.

ECMA-183, ECMA-184 and ECMA-201 have been adopted by ISO/IEC JTC1 under the fast-track procedure as International Standards ISO/IEC 13481, ISO/IEC 13549 and ISO/IEC 13963, resp.

ECMA-195 has been used by SC23 as basis for ISO/IEC 13842. The second edition of ECMA-195 is identical to this International Standard.

ECMA-238, ECMA-239 and ECMA-240 have been adopted by ISO/IEC JTC 1 under the fast-track procedure as International Standards ISO/IEC 15486, ISO/IEC 15498 and ISO/IEC 15485, resp. ECMA-238 is based on ISO/IEC 14517.

ECMA-189 and ECMA-190 have been used by SC23 as basis for ISO/IEC 13614 and ISO/IEC 13403 resp. For additional information on these standards, see annex B.

## **3 Third Programme of Work of TC31, 1997 - 2000**

The third programme of work adopted by TC31 comprises the development of:

- 120 mm DVD - Read-Only disk standard, published as ECMA-267 and ISO/IEC 16448.  
The third, improved edition of ECMA-267 will be published in June 2001.
- 80 mm DVD - Read-Only disk standard, published as ECMA-268 and ISO/IEC 16449.  
The third, improved edition of ECMA-268 will be published in June 2001.
- 120 mm DVD-RAM disk standard, published as ECMA-272 and ISO/IEC 16824.
- a standard for the case for DVD-RAM disks, published as ECMA-273 and ISO/IEC 16825.
- 120 mm ODC with RW format (+RW), published as ECMA-274 and ISO/IEC 16969.
- 120 mm ODC with RW format (+RW), and a capacity of 4,7 Gbytes and 9,4 Gbytes, to be published in 2001. It is called ECMA-a in annex A.

- 120 mm/80 mm DVD-R disk standard, published as ECMA-279 and ISO/IEC 20563.
- 130 mm ODC of the WORM type with a capacity of 5,2 Gbytes. This standard is based on ISO/IEC 15286. The development of this standard follows the same approach as used for ECMA-238 which is based on ISO/IEC 14517. Published as ECMA-280 and ISO/IEC 18093.
- 300 mm ODC of the WORM type with a capacity of 30 Gbytes, published as ECMA-317. To be published as ISO/IEC standard in 2001.
- 356 mm ODC of the WORM type with a capacity of 14,8 Gbytes and 25 Gbytes, published as ECMA-260 and ISO/IEC 15898.

#### **4 Fourth Programme of Work of TC31, 2001**

The fourth programme of work of TC31 comprises the development of

- 120/80 mm DVD-RAM disk standard, with a capacity of 4,7 Gbytes per side
- a standard for the case of the 120/80 mm DVD-RAM disk, 4,7 Gbytes per side
- 120/80mm DVD-R disk standard
- 120/80 mm DVD-RW disk standard
- 130 mm ODC of the R/W-WO type with a capacity of 9,1 Gbytes, using MO technology. To be published in June 2001. It is called ECMA-b in annex A.
- 130 mm ODC of the WORM type with a capacity of 7,8 Gbytes, using Phase Change technology. To be published in December 2001. It is called ECMA-c in Annex A.

#### **5 Modus operandi of TC31**

As in ISO/IEC JTC 1/SC23, TC31 undertakes a project when a number of Companies (National Bodies in JTC1) are willing and able to submit the necessary technical information needed for the development of a standard. These projects, which are basically application-driven, aim at offering to users the ODCs which fit best their needs. Obviously technology advances, for instance the availability of lasers with shorter wavelengths, also play a role in the decision to start a new project.

ECMA Standards for ODCs offer to the Information Technology community clear and explicit descriptions of the different media *at the time of their availability* on the market. The timely publication of these ECMA Standards is of primary interest to users. It cannot be the role of a standardization organization, whether ECMA or ISO, to make a selection amongst the proposed designs and thus preempt a decision which must be taken by the open market.

Another aspect to be noted, is that of the so-called backward compatibility. In general, this means that when an ODC of higher capacity is offered the corresponding new drive should be able to read ODCs of the previous generation. It must be understood that this is exclusively a drive and not an ODC problem. Indeed, the ability to read older ODCs is a technical-commercial decision to be taken by each manufacturer according to his analysis of the market. It is, so to say “always possible” to design a drive which can read - or even write on - previously used ODCs. This will depend on two factors a) will such a drive be needed, and b) can it be produced at a reasonable price.

#### **6 Conclusion**

From the above, it can be gathered that TC31 is operating in a controlled and systematic manner. The number of ECMA Standards and their adoption by ISO/IEC as International Standards reflect the considerable activity of the industry and the numerous but different needs of the users.

#### **7 Definitions and Acronyms**

##### **7.1 Definitions**

The following definitions are used:

### **CD-ROM**

A 120 mm one-sided optical disk, entirely pre-recorded, in an irreversible way, with data. The recording method and the format are the same as those of the audio CD.

### **R/W**

The data can be written, read and erased many times over the whole recording surface(s).

### **WORM**

The data, once written, can be read many times; data can be appended on the remaining part of the recording surface. The data is recorded in an irreversible way.

### **WO**

The data, once written, can be read many times; data can be appended on the remaining part of the recording surface. This functionality is obtained by software.

### **ROM**

An optical disk part, entirely pre-recorded, in an irreversible way, with data. The data can be read many times.

### **P-ROM**

An R/W disk which is partially ROM.

### **O-ROM**

An optical disk which is entirely ROM.

### **MO (for “magneto-optical”)**

A recording technology using thermo-magnetic and magneto-optical effects. In P-ROM and O-ROM disks the magneto-optical effect is not used for reading the pre-recorded embossed data.

### **PC (for “phase change”)**

A recording technology using the phase change effect. In P-ROM and O-ROM disks the phase change effect is not used for reading the pre-recorded embossed data.

### **Capacity**

The capacity is expressed in user bytes. Two capacities can be stated, e.g., if two sector lengths are available.

## **7.2 Acronyms**

Acronyms used are:

- CCS : Continuous Composite Servo (tracking method)
- SSF : Sample Servo (tracking) Format

## **8 Annexes**

- 8.1 Annex A** is a synopsis of the ECMA Standards for ODCs and the corresponding ISO/IEC standards. For the sake of completeness also the ISO/IEC standards are mentioned which are **not** based on ECMA Standards.
- 8.2 Annex B** provides a taxonomy, i.e. a classification of the ECMA Standards produced by TC31. These standards provide different facilities which are either simply specified in the standard or defined as specific Types, i.e. different implementations having common characteristics of the basic cartridge defined by the standard. The table of annex B is a matrix based on the diameter of the disk and on the facilities provided by each Type.
- 8.3 Annex C** is a list of the actual ECMA Standards with their full title.

## Annex A

### (Relationship between ECMA and ISO/IEC standards)

	120 mm (80 mm)	90 mm	130 mm	300 mm	356 mm
1988	ECMA-130				
1989	↓ ISO/IEC 10149				
1990			ISO/IEC 9171		
1991		ECMA-154	ISO/IEC 10089 ECMA-153		
1992		↓ ISO/IEC 10090	ISO/IEC 11560 ECMA-183    ECMA-184		
1993		ECMA-201	↓ ISO/IEC 13481	ECMA-189    ECMA-190	ISO/IEC 10885
1994		↓ ISO/IEC 13863 ↓ ECMA-154* ECMA-201*	↓ ECMA-153* ↓ ISO/IEC 13549	↓ ISO/IEC 13614	↓ ISO/IEC 13403
1995		ECMA-223	ISO/IEC 13842 ↓ ECMA-195*		
1996	ECMA-130* ECMA-240	ECMA-239	ECMA-238 ↓ ISO/IEC 14517		
1997	↓ ISO/IEC 15485 ECMA-267 ECMA-268	↓ ISO/IEC 15498 ISO/IEC 14760 ISO/IEC 15041	↓ ISO/IEC 15486		ECMA-260
1998	ECMA-279 ECMA-272 ECMA-273 ECMA-274		ECMA-280 ↓ ISO/IEC 14517 (corrected)		↓ ISO/IEC 15898
1999	↓ ISO/IEC 16969 ↓ ECMA-274* ↓ ISO/IEC 16825 ↓ ISO/IEC 16824 ↓ ECMA-272* ↓ ISO/IEC 16449 ↓ ECMA-268* ↓ ISO/IEC 16448 ↓ ECMA-267*		↓ ISO/IEC 18093 ISO/IEC 15286		

\* 2nd edition of the ECMA Standard, published for full alignment with the corresponding International Standard (endorsed by fast-track processing or in another way)

	120 mm (80 mm)	90 mm	130 mm	300 mm	356 mm
1998	ECMA - 279				
2000				ECMA-317	
2001	ISO/IEC 20563 ECMA - a		ECMA - b ECMA - c		

\* 2nd edition of the ECMA Standard, published for full alignment with the corresponding International Standard (endorsed by fast-track processing or in another way)

95-0008-E

### Legend

ECMA-a	120 mm ODC, +RW Format - Capacity: 4,7 Gbytes per side
ECMA-b	130 mm ODC, Type R/W-WO, MO - Capacity: 9,1 Gbytes
ECMA-c	130 mm ODC, Type WORM, PC - Capacity: 7,8 Gbytes

## Annex B

(Classification of Optical Disk and Case/Cartridge standards)

Size in mm	Maximum Capacity	ECMA Standard	ISO/IEC Standard	Recording Technology		Media Types				
				MO	PC	R/W	WORM	WO	P-ROM	O-ROM
80	5,3 Gbytes **	268	16449	-	-	-	-	-	-	DVD-ROM
90	128 Mbytes	154	10090	■	-	■	-	-	■	■
90	230 Mbytes	201	13963	■	-	■	-	-	■	■
90	385 Mbytes	223	none	■	-	■	-	-	-	-
90	640 Mbytes	none	15041	■	-	■	-	-	■	■
90	650 Mbytes	239	15498	■	-	■	-	-	■	■
90	1,3 Gbytes	none	14760	-	■	■	-	-	■	■
120	660 Mbytes	130	10149	-	-	-	-	-	-	CD-ROM
120	650 Mbytes	240	15485	-	■	■	■	-	-	-
120	17,0 Gbytes **	267	16448	-	-	-	-	-	-	DVD-ROM
120	5,2 Gbytes	272	16824	-	■	DVD-RAM	-	-	-	-
120	Case	273	16825	-	-	-	-	-	-	Case
120	6,0 Gbytes	274	16969	-	■	+RW	-	-	-	-
120/80	2,46/7,90 Gbytes *	279	20563	-	■	-	-	DVD-R	-	-
130	650 Mbytes	none	9171	-	-	-	■	-	-	-
130	650 Mbytes	none	10089	■	-	■	-	-	-	-
130	650 Mbytes	153	11560	■	-	-	-	■	-	-
130	1 Gbyte	183	13481	■	-	■	-	■	-	-
130	1,3 Gbytes	184	13549	■	-	■	-	■	■	■
130	2 Gbytes	195	13842	■	-	■	-	■	■	■
130	2,6 Gbytes	none	14517	■	-	■	-	■	■	■
130	2,6 Gbytes	238	15486	-	-	-	■	-	-	-
130	5,2 Gbytes	none	15286	■	-	■	-	■	■	■
130	5,2 Gbytes	280	18093	-	-	-	■	-	-	-
300	12 Gbytes	189	13614	-	-	-	■	-	-	-
300	12 Gbytes	190	13403	-	-	-	■	-	-	-
300	30 Gbytes	317	nn	-	-	-	■	-	-	-
356	6,8 Gbytes	none	10885	-	-	-	■	-	-	-
356	14,8 & 25 Gbytes	260	15898	-	-	-	■	-	-	-

### Legend

- none no ECMA or ISO/IEC standard in existence for this ODC
- specified in the standard
- not specified in the standard
- nn to be published
- \* double-sided
- \*\* double-layered, double-sided





## Annex C

### (Titles of current ECMA Standards)

- 1) **ECMA-130 - 1996**  
Data Interchange on Read-only 120 mm Optical Data Disks (CD-ROM)
- 2) **ECMA-153 - 1994**  
Information Interchange on 130 mm Optical Disk Cartridges of the Write Once, Read Multiple (WORM) Type, using the Magneto-Optical Effect  
*Note: This title conflicts with the definition of WORM given in clause 5; the Standard specifies a WO disk.*
- 3) **ECMA-154 - 1994**  
Data Interchange on 90 mm Optical Disk Cartridges, Read Only and Rewritable, M.O.
- 4) **ECMA-183 - 1992**  
Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1 GigaByte per Cartridge
- 5) **ECMA-184 - 1992**  
Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1,3 GigaBytes per Cartridge
- 6) **ECMA-189 - 1993**  
Information Interchange on 300 mm ODCs of the WORM Type using the SSF Method
- 7) **ECMA-190 - 1993**  
Information Interchange on 300 mm ODCs of the WORM Type using the CCS Method
- 8) **ECMA-195 - 1995**  
Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 2 GigaBytes per Cartridge
- 9) **ECMA-201 - 1994**  
Data Interchange on 90 mm Optical Disk Cartridges - Capacity: 230 MBytes per Cartridge
- 10) **ECMA- 223 - 1995**  
Data Interchange on 90 mm Optical Disk Cartridges - Capacity: 385 Megabytes per Cartridge
- 11) **ECMA-238 - 1996**  
Data Interchange on 130 mm Optical Disk Cartridge of Type WORM using Irreversible Effects - Capacity : 2,6 Gbytes per Cartridge
- 12) **ECMA-239 - 1996**  
Data Interchange on 90 mm Optical Disk Cartridge - HS-1 Format - Capacity: 650 Mbytes per Cartridge
- 13) **ECMA-240 - 1996**  
Data Interchange on 120 mm Optical Disk Cartridge using Phase Change Technology - PD Format - Capacity : 650 Mbytes per Cartridge
- 14) **ECMA-260 - 1997**  
Data Interchange on 356 mm Optical Disk Cartridges (WORM) - Capacity: 14,8 Gbytes and 25 Gbytes per Cartridge
- 15) **ECMA-267 - 1997**  
120 mm DVD Read-Only Disk
- 16) **ECMA-268 - 1997**  
80 mm DVD Read-Only Disk
- 17) **ECMA-272 - 1998**  
120 mm DVD Rewritable Disk (DVD-RAM)
- 18) **ECMA-273 - 1998**  
Case for 120 mm DVD-RAM Disks
- 19) **ECMA-274 - 1998**  
Data Interchange on 120 mm Optical Disk using +RW Format - Capacity: 3,0 Gbytes and 6,0 Gbytes

**20) ECMA-279 - 1998**

80 mm (1,23 Gbytes per side) and 120 mm (3,95 Gbytes per side) DVD-Recordable Disk (DVD-R)

**21) ECMA-280 - 1998**

Data Interchange on 130 mm Optical Disk Cartridges of Type WORM (Write Once Read Many) using Irreversible Effects - Capacity: 5,2 Gbytes per Cartridge

**22) ECMA-317 - 2000**

Data Interchange on 300 mm Optical Disk Cartridges of Type WORM (Write Once Read Many) using Irreversible Effects - Capacity: 30 Gbytes per Cartridge.