

Specification for

Pre-recorded optical reflective videodisk system “Laser vision” 50 Hz/625 lines — PAL

The European Standard EN 60856:1993, with the incorporation of its amendments A1:1993 and A2:1997 has the status of a British Standard

ICS 33.160.40

Cooperating organizations

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This British Standard, having been prepared under the direction of the Electronic Equipment Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 July 1993

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The following BSI references relate to the work on this standard:
Committee reference EEL/22
Draft for comment 89/20181 DC

ISBN 0 580 22151 2

Amendments issued since publication

Amd. No.	Date	Comments
9795	January 1998	Indicated by a sideline in the margin

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National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 60856:1993 *Pre-recorded optical reflective videodisk system*

“Laser vision” 50 Hz/625 lines — PAL and its Amendment A1: February 1993, and Amendment A2: July 1997, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 856:1986 and its Amendment 1: July 1991 and Amendment 2: May 1997, published by the International Electrotechnical Commission (IEC). This standard supersedes BS 6895:1987, which is withdrawn.

For ease of reference, the text introduced by Amendments A1 and A2 to EN 60856 is indicated by a single sideline in the margin.

References to page numbers in the text relate to the IEC page numbers given in brackets at the bottom of each page.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 44, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60856

February 1993

+ A1

February 1993

+ A2

July 1997

UDC 621.397.456

Supersedes HD 514 S1:1989

Descriptors: Optical recording, video recording, video disc, video disc reproducing equipment, laser, test conditions, characteristics, requirements

English version

Pre-recorded optical reflective videodisk system “Laser vision” 50 Hz/625 lines — PAL

(includes amendment A1:1993 and A2:1997)
(IEC 856:1986/A1:1991 + A2:1997)

Système de vidéodisque optique réfléchissant
préenregistré “Laser vision” 50 Hz/625 lignes
PAL

(inclut l’amendement A1:1993 et A2:1997)
(CEI 856:1986/A1:1991 + A2:1997)

System für bespielte, optische reflektierende
Videoplatten “Laser-Vision” 50 Hz/625 Zeilen
PAL

(enthält Änderung A1:1993 und A2:1997)
(IEC 856:1986/A1:1991 + A2:1997)

This European Standard was approved by CENELEC on 1992-12-09; amendment A1 was approved by CENELEC in 1997; amendment A2 was approved by CENELEC on 1997-07-01. CENELEC member are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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Ref. No. EN 60856:1993 + A1:1997 + A2:1997 E

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Foreword

At the request of the 71st Technical Board of CENELEC HD 514 S1:1989 (IEC 856:1986) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The text of the International Standard was approved by CENELEC as EN 60856 on 9 December 1992.

The CENELEC questionnaire procedure, performed for finding out whether or not Amendment 1:1991 to the International Standard IEC 856:1986 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as a European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as amendment A1 to EN 60856 on 9 December 1992. The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1993-12-01
- latest date of withdrawal of conflicting national standards (dow) 1993-12-01

For products which have complied with HD 514 S1:1989 before 1993-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1998-12-01.

Foreword to amendment A2

The text of document 100B/47/FDIS, future amendment 2 to IEC 60856:1986, prepared by SC 100B, Recording, of IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60856:1993 on 1997-07-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-04-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1998-04-01

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Introduction

The optical videodisk system functions as follows:

The information carrier is a disk structure consisting of a transparent substrate, of which one surface contains the information covered with a reflective coating.

Two such substrates are assembled, information surface against information surface to form an optical videodisk. One of these two substrates might also be a “blank”, characterized by the absence of information, but in all other mechanical aspects conform to this standard.

The information on the disk is stored in a spiral track starting at the inside at a fixed diameter and moving to the outside.

The information is read out by a beam of light which passes through the transparent substrate and is reflected by the information on the encoded surface. The reflected beam is modulated by the information on the encoded surface.

Within the system two disk formats exist: the CAV disk and the CLV disk. CAV stands for Constant Angular Velocity and CLV for Constant Linear Velocity.

In the CAV format each revolution corresponds to one complete recorded video frame. Consequently during readout the disk will rotate at constant angular velocity. A disk thus recorded makes possible features such as still pictures, slow motion, etc.

In the CLV format the velocity of the information track relative to the readout beam is constant. Therefore the angular velocity decreases as the readout beam proceeds along the spiral track to the outside. A disk recorded in this way yields a longer playing time. Features such as still pictures, however, are not possible.

IEC Publication 856 which is the current standard for “Laser vision” does not contain a specification for a push-pull radial differential signal. For future applications of the video disk, it is desirable to specify this signal and to add this specification to the current standard.

The specified amplitude variation of the signal represents the state of the art of LV-disk production.

Section 1. General

1 Scope

This standard applies to pre-recorded optical reflective videodisks compatible with 50 Hz/625 lines CCIR monochrome and colour coding PAL systems, and defines those parameters that effect the interchangeability of the disks, excluding limitations of the programming material and source.

2 Object

To serve as a reference for manufacturers intending to make disks or players compatible with the optical system described herein.

3 Standard atmospheric conditions for testing

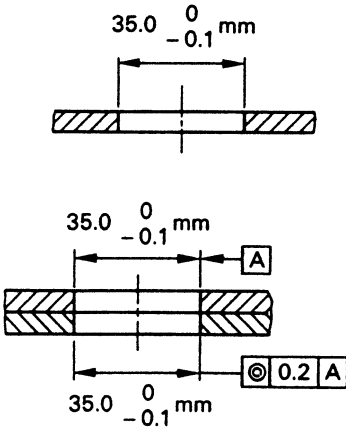
Measurements and mechanical checks shall be carried out at any combination of temperature, humidity and air pressure within the following limits unless otherwise specified for certain parameters elsewhere in this standard:

Ambient temperature:	15 °C to 35 °C
Relative humidity:	45 % to 75%
Air pressure:	86 kPa to 106 kPa

Samples shall be conditioned in the testing environment for 24 h before testing.

Section 2. Disk parameters

4 Mechanical parameters

Characteristics to be specified	Requirements	Method of measurement and/or conditions
4.1 Thickness in the programme area: 4.1.1 Thickness of protective transparent layer, (A), Figure 1 4.1.2 Thickness of double disk (B), Figure 1 4.1.3 Thickness of single disk (T), Figure 1 4.2 Outer radius of disk (C), Figure 1 — 12-in version — 8-in version 4.3 Centre hole (D), Figure 1 4.3.1 Diameter of centre hole 4.3.2 Diameter of centre hole for disk assembled from two single disks 4.3.3 Shape of edges of centre hole 4.4 Label (E), Figure 1 4.4.1 Inside diameter of label (F), Figure 1 4.4.2 Outside diameter of label (G), Figure 1 4.4.3 Outside diameter of label (G), Figure 1 of a single disk on the protective layer side 4.4.4 Thickness of label (H), Figure 1 4.4.5 Position of label	See Figure 1a min. = 2.2 mm, see Figure 1a max. = 2.8 mm min. = 1,1 mm, see Figure 1a max. = 1,4 mm 150 ± 0.5 mm 100 ± 0.5 mm  Edges shall be free from burrs A label on both sides of a double and a single disk is allowed. The label of a single disk on the transparent side is optional, but the label on the protective layer side is mandatory min. = 35 mm max. = 38 mm min. = 86 mm max. = 100 mm min. = 86 mm max. = 300 mm So that thickness of disk in clamping area 4.5.3) is within specification Should not overlap either centre hole or, in case of a single disk, the outer diameter of the protective layer side	To be measured at 20 ± 1 °C and 48 % to 52 % relative humidity To be measured with a maximum and a minimum plug gauge at 20 ± 1 °C and 48 % to 52 % relative humidity

Characteristics to be specified	Requirements	Method of measurement and/or conditions
4.5 Clamping area (I): Figure 1		
4.5.1 Inside radius of clamping area	20.5 mm	
4.5.2 Outside radius of clamping area	41.5 mm	
4.5.3 Thickness of disk in clamping area including labels		
4.5.3.1 For double disk (J), Figure 1	min. = 2,2 mm max. = 2,9 mm	
4.5.3.2 For single disk (U), Figure 1	min. = 1,1 mm, see Figure 1b max. = 1,45 mm, see Figure 1b	
4.6 Sense of rotation of disk seen from read side	Anticlockwise	
4.7 Rotation speed	Never to exceed one revolution per TV frame	
4.7.1 Angular velocity for CAV format	1 rotation/TV frame	
4.7.2 Linear velocity for CLV format	Between 8.4 m/s and 9.5 m/s	See Figure 20
4.7.3 Angular acceleration for CLV format	Maximum of -0.32 rad/s^2	See Figure 20
4.8 Maximum unbalance	1.5 N	Measured at 1 rotation/TV frame
4.9 Position of lead-in tracks	The space between starting radius of lead-in tracks and starting radius of programme area must be filled with lead-in tracks	
4.10 Starting radius lead-in tracks (K), Figure 1	$\leq 53.5 \text{ mm}$	
4.11 Starting radius programme area (L), Figure 1	$\geq 55 \text{ mm}$	
4.11.1 Minimum number of programme tracks	30	
4.12 Maximum radius programme area (M), Figure 1		
— 12-in version	145 mm	
— 8-in version	96 mm	
4.13 Position of lead-out tracks (N), Figure 1	The lead-out tracks follow directly after the end of the programme	
4.14 Minimum size of lead-out area		
4.14.1 For CAV disks	2 mm	
4.14.2 For CLV disks	2 mm	
4.15 Track pitch anywhere between any two adjacent tracks	min. $1.4 \mu\text{m}$ max. $2 \mu\text{m}$	

Characteristics to be specified	Requirements		Method of measurement and/or conditions
4.16 Vertical deviation of programme tracks during rotation at playback speed			Record supported in clamping area over a diameter of 80 mm and measured with the optical stylus (see Sub-clause 11.1)
4.16.1 Maximum distance (P) from reference plane to any point of tracks (see Figure 2)	+ 0.9 mm – 1.2 mm		
4.16.2 Maximum vertical acceleration	100 m/s ² for $f < 1.1$ kHz		See Figure 2
4.16.3 Maximum vertical deviation	$\pm 2 \mu\text{m}$ for $f > 1.1$ kHz		See Figure 2
4.16.4 Maximum vertical velocity	0.18 m/s		see Figure 2
4.16.5 Maximum radial angle (θ) between the normal on the surface (not infoside) and the optical axis	$\pm 1^\circ$		see Figure 2
4.17 Maximum static deflection of disk (Q), Figure 3	– 2.5 mm: + 1.5 mm		Record supported in clamping area over a diameter of 80 mm and measured at outside diameter with reference to hub plane
4.18 Radial deviation of programme tracks during rotation at playback speed (see Figure 4)			Record supported in clamping area over a diameter of 80 mm and measured with the optical stylus (see Sub-clause 11.1)
4.18.1 Maximum deviation (ΔV) during one revolution (see Figure 4)	160 μm		
4.18.2 Maximum radial deviation	$\pm 0.1 \mu\text{m}$ for $f > 2.2$ kHz		
4.18.3 Maximum radial acceleration	20 m/s ² for $f < 2.2$ kHz		
4.19 Tangential deviation of programme tracks at nominal velocity	CAV	CLV	Record supported in clamping area over a diameter of 80 mm and measured with the optical stylus (see Sub-clause 11.1)
4.19.1 Maximum time base error at: radius 55 mm radius 145 mm	12 μs peak-to-peak (pp) at 25 Hz roll-off with 12 dB/octave 4.6 μs peak-to-peak (pp) at 25 Hz roll-off with 12 dB/octave	12 μs peak to-peak (pp) at 25 Hz roll-off with 12 dB/octave 12 μs peak-to-peak (pp) at 9 Hz roll-off with 12 dB/octave	

Characteristics to be specified	Requirements		Method of measurement and/or conditions
4.19.2 Shift between two adjacent tracks	± 25 ns	not applicable	$\lambda = 6\,328\text{ \AA}$ (HeNe laser in air) and a numerical aperture = 0.40 ± 0.01 Double pass through transparent substrate in unmodulated area. Includes transmission losses in the substrate Parameters to be measured $20 \pm 1\text{ }^{\circ}\text{C}$ and 48 % to 52 % relative humidity after a recovery of 24 h following exposure to the specified environment
4.20 Mass	(in 10^{-3} kg)		
4.20.1 Minimum			
8-in version	35		
12-in version	35		
4.20.2 Maximum			
8-in version	280		
12-in version	280		
4.21 Mass moment of inertia	(in 10^{-3} kg m ²)		
4.21.1 Minimum			
8-in version	0.18		
12-in version	0.18		
4.21.2 Maximum			
8-in version	3.2		
12-in version	3.2		
5 Optical requirements			
5.1 Refractive index	See Figure 1a		
5.2 Birefringence of transparent disk (double pass)	40° max.		
5.3 Reflectivity	$\geq 70\text{ }\%$		
6 Temperature and humidity requirements	Must satisfy all requirements following exposure to any temperature within the range of 5 °C to 45 °C at any relative humidity within the range of 5 % to 90 % held constant for a period of 4 days		

Section 3. Recorded parameters

7 Audio parameters

7.1 Channel applications

The disk shall contain two independent audio channels. This offers the possibility of:

- Stereophonic sound
- Monophonic sound — two independent audio programmes
- Monophonic sound — one audio programme on both channels
- Use of one or both channels for control or cueing information.

7.2 Audio subcarrier modulation of main carrier

7.2.1 Type of modulation

The audio subcarrier shall be symmetrical double-edge pulsewidth modulated on the main carrier. (See Philips F. Panter: Modulation, Noise and Spectral Analysis).

7.2.2 Audio subcarrier amplitude

The level of the audio subcarriers, in the recorded frequency spectrum, shall be -26 ± 1 dB with respect to the unmodulated main carrier.

8 Audio subcarrier frequencies

Channel I (left channel in stereo)

$$f = 43.75 \times f_H = 683593.75 \text{ Hz (nominal)}$$

Channel II (right channel in stereo)

$$f = 68.25 \times f_H = 1066406.25 \text{ Hz (nominal)}$$

8.1 Type of modulation

The audio signal shall be frequency modulated on the subcarriers with a maximum deviation of ± 100 kHz for 100 % modulation. The instantaneous peak deviation at all times shall be less than ± 150 kHz.

8.2 Polarity of modulation

Both audio subcarriers shall have the same polarity of modulation which may be positive or negative.

8.3 Pre-emphasis

The audio signal prior to modulation shall have a pre-emphasis according to Figure 5.

8.4 Audio compression

The audio signal before pre-emphasis may be compressed at the option of the programme maker. In case of compression the system described in Appendix B shall be used.

9 Video parameters

9.1 Video signal

9.1.1 Video signal standards

The recorded video signal is a 50 Hz/625 lines PAL signal according to CCIR, Report 624 (1974) and additions as specified in Sub-clause 9.1.2.

9.1.2 Video signal pilot burst

On the synchronization level a pilot burst with a frequency of $240 \times f_H = 3.75$ MHz shall be superimposed. The peak-to-peak value is 6/7 of the difference between the blanking level and the peak white level ± 10 % (see Figure 6 and Figure 6a).

9.1.3 Vertical Interval Test Signals (VITS)

Vertical Interval Test Signals according to ITU-R Recommendation 473-5, Annex I (see Figure 7 to Figure 10) may be inserted in the lines 13, 19 or 20, 332 and 326 or 333. The lines 22 and 335 shall be blanked before optical recording, to enable disk noise measurements to be made.

9.1.4 Address signals

In the video signal, lines 6 through 18 and 319 through 331 are reserved for address or data signals. For signal specification, see Clause 10. The lines that are not specified have a video content set at the blanking level and are reserved for future applications. Lines 20, 21 and 333, 334 may contain subtitle data signals; in that case there are no VITS (see Sub-clause 9.1.3) on lines 20 and 333.

When additional capacity is needed for subtitle data signals, lines 14, 15, 327 and 328 may be used.

9.1.5 Maximum video level

The maximum luminance level of the video signal shall not exceed 110 % and the maximum chroma saturation shall not exceed 100 %.

9.1.6 Group delay pre-distortion

To equalize the group delay distortion of the playback low-pass filter, the video group delay shall be pre-distorted as follows (see Figure 11):

$f = 0.5$	MHz	$t_d =$	0 ns reference
$f = 2.0$	MHz	$t_d =$	$- 10 \pm 15$ ns
$f = 3.0$	MHz	$t_d =$	$- 35 \pm 15$ ns
$f = 4.0$	MHz	$t_d =$	$- 85 \pm 20$ ns
$f = 4.43$	MHz	$t_d =$	$- 135 \pm 20$ ns
$f = 4.8$	MHz	$t_d =$	$- 200 \pm 50$ ns

9.2 Video signal modulation

9.2.1 Type of modulation

The video signal shall be frequency modulated on the main carrier with positive modulation.

9.2.2 Blanking level frequency

The main carrier frequency corresponding to the 30 % blanking level shall be $7.1 \text{ MHz} \pm 50 \text{ kHz}$.

9.2.3 Main carrier deviation

The 30 % blanking level to + 100 % white level deviation shall be $800 \pm 20 \text{ kHz}$. White level is the highest frequency.

9.2.4 Video pre-emphasis

The video signal, prior to modulation, shall have a pre-emphasis as shown in Figure 12.

10 Vertical interval control and address signals

The code signals on the video disk provide special information, which can be utilized by the player to control special functions and provide picture frame or time information.

The CAV format has the following types of codes:

1. Lead-in
2. Lead-out
3. Picture numbers
4. Picture stop
5. Chapter numbers
6. Programme status code
7. Users code

On CLV format the codes are:

1. Lead-in
2. Lead-out
3. Programme time code
4. CLV code
5. Chapter numbers
6. CLV picture number
7. Programme status code
8. Users code

10.1 24-bit biphase coded signal

This signal is inserted in selected video lines during the vertical interval. It is subdivided into 6 groups of 4 bits and each group can be any hexadecimal word (see Figure 13). The first group of 4 bits is the key and starts with a logic one. Each bit cell is $2 \mu\text{s}$ long with the digital level between 30 % and 100 % (see Figure 14).