

Recording — Helical-scan digital video cassette recording system using 6, 35 mm magnetic tape for consumer use (525-60, 625-50, 1125-60 and 1250-50 systems) —

Part 6: SDL format

The European Standard EN 61834-6:2000 has the status of a British Standard

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National foreword

This British Standard is the official English language version of EN 61834-6:2000. It is identical with IEC 61834-6:2000.

The UK participation in its preparation was entrusted by Technical Committee EPL/100, Audio, video and multimedia systems and equipment, to Subcommittee EPL/100/2, Recording, which has the responsibility to:

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Helical-scan digital video cassette recording system
using 6,35 mm magnetic tape for consumer use
(525-60, 625-50, 1125-60 and 1250-50 systems)
Part 6: SDL format
(IEC 61834-6:2000)

Enregistrement -
Systèmes de magnétoscopes numériques
à cassette à balayage hélicoïdal sur
bande magnétique de 6,35 mm, pour
usage grand public (systèmes 525-60,
625-50, 1125-60 et 1250-50)
Partie 6: Format SDL
(CEI 61834-6:2000)

Aufzeichnung -
Videokassettensystem mit digitaler
Schrägschraufzeichnung auf
Magnetband 6,35 mm für den
Heimgebrauch (Systeme 525-60,
625-50, 1125-60 und 1250-50)
Teil 6: SDL-Format
(IEC 61834-6:2000)

This European Standard was approved by CENELEC on 2000-09-01. CENELEC members 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.

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CENELEC

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

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

Foreword

The text of document 100B/263/FDIS, future edition 1 of IEC 61834-6, prepared by SC 100B, Audio, video and multimedia information storage systems, 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 EN 61834-6 on 2000-09-01.

The following dates were fixed:

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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-09-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annexes A, B and ZA are normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61834-6:2000 was approved by CENELEC as a European Standard without any modification.

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HELICAL-SCAN DIGITAL VIDEO CASSETTE RECORDING SYSTEM USING 6,35 mm MAGNETIC TAPE FOR CONSUMER USE (525-60, 625-50, 1125-60 and 1250-50 systems) –

Part 6: SDL format

1 General

1.1 Scope

This part of IEC 61834 describes the format extension, using higher compression to increase recording time and reduce running cost.

While all DVCRs must have the capability of recording and/or playback in SD (SP) mode, this extension is optional.

For this part of IEC 61834, the track data structure is defined by APT = 000b which consists of four areas as described in IEC 61834-1, 4.3.2 and AP1 = AP2 = AP3 = 000b. The data structure of MIC is as clause 10 in IEC 61834-2.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61834. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61834 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 61834-1:1998, *Recording – Helical-scan digital video cassette recording system using 6,35 mm magnetic tape for consumer use (525-60, 625-50, 1125-60 and 1250-50 systems) – Part 1: General specifications*
Amendment 1 ¹⁾

IEC 61834-2:1998, *Recording – Helical-scan digital video cassette recording system using 6,35 mm magnetic tape for consumer use (525-60, 625-50, 1125-60 and 1250-50 systems) – Part 2: SD format for 525-60 and 625-50 systems*

IEC 61834-3, *Recording – Helical-scan digital video cassette recording system using 6,35 mm magnetic tape for consumer use (525-60, 625-50, 1125-60 and 1250-50 systems) – Part 3: HD format for 1125-60 and 1250-50 systems*

IEC 61883-1:1998, *Consumer audio/video equipment – Digital interface – Part 1: General*

IEC 61883-5:1998, *Consumer audio/video equipment – Digital interface – Part 5: SDL-DVCR data transmission*

ITU-R Recommendation 601-2, *Encoding parameters of digital television for studios*

ITU-R Report 624-4, *Characteristics of television systems*

¹⁾ To be published.

1.3 Definitions, symbols and abbreviations

For the purpose of this part of IEC 61834, the following definitions or abbreviations apply.

AAUX:	Audio auxiliary data
BCH code:	Bose-Chaudhuri-Hocquenghem code, one of the well-known error correction codes
CGMS:	Copy generation management system
DCT:	Discrete cosine transform
EOB:	End of block
MIC:	Memory in cassette
NABTS:	North American broadcasting teletext specifications
OETM events:	Optional events except text and maker's optional events
TOC:	Table of contents
VAUX:	Video auxiliary data
VLC:	Variable length coding

1.4 Environment and test conditions

Same as IEC 61834-2.

2 Helical recordings

2.1 Tape speed

The tape speed is 9,424/1,001 mm/s (525-60 system) or 9,424 mm/s (625-50 system).

The tape speed tolerance is $\pm 0,5$ %.

2.2 Record location and dimensions

Record location and dimensions for continuous recording shall be as specified in figure 1 of IEC 61834-2. The values are listed in table 1. For recording, helical tracks shall be contained within the tolerance specified in table 1.

Each sector location from the start of the SSA shall be as specified in figure 2 of IEC 61834-2 and table 2 (525-60 system) or table 3 (625-50 system). The physical tape pattern shall be specified by the centre line of each track.

The effective area upper edge, record and playback guarantee, overwrite margin (OM) and switching margin for recording amplifiers are as in IEC 61834-2.

2.2.1 Scanner example

Scanner dimensions in table 4 are one possible configuration. Other mechanical configurations are permitted, provided the same footprint of recorded information is produced on tape.

3 Programme track data arrangement

3.1 Introduction

Each television frame is recorded on 5 tracks for the 525-60 system and 6 tracks for the 625-50 system.

The helical tracks are recorded with video, audio and system data as for the SD format in IEC 61834-2. The arrangement of a track is as shown in IEC 61834-2 for each system.

Each track is numbered from the beginning track of the television frame in order. A track which has track number i ($i = 0$ to 4 for the 525-60 system or $i = 0$ to 5 for the 625-50 system) is referred to as track i .

The pilot frame is performed over two television frame periods for both systems. Placement of F0, F1 and F2 tracks is shown in figure 1 for the 525-60 system, and figure 2 for the 625-50 system. In the 525-60 system, pilot frame 0 and pilot frame 1 alternate with each other. In the 625-50 system, pilot frame 0 repeats.

3.2 Labelling convention

Same as IEC 61834-2.

3.3 Audio sector

As IEC 61834-2 except for track pair number. The track pairs for two fields are numbered sequentially as shown in tables 5 and 6.

3.4 Video sector

As IEC 61834-2 except for track pair number. The track pairs for two fields are numbered sequentially as shown in tables 5 and 6.

3.5 Subcode sector

Same as IEC 61834-2.

4 Audio interface

Same as IEC 61834-2.

5 Video interface

Same as IEC 61834-2.

6 Audio signal processing

6.1 Introduction

The audio signal is recorded in one audio block. The audio block is composed of five audio sectors in five consecutive tracks for the 525-60 system, or six audio sectors in six consecutive tracks for the 625-50 system. Audio signal processing in the audio block is as in IEC 61834-2.

6.2 Error correction code

Same as IEC 61834-2.

6.3 Randomization pattern

Same as IEC 61834-2.

6.4 Audio encoding

This standard provides one mode of encoding audio data within the audio block. The encoding parameters are defined in table 7.

The mode is called 32k-2ch mode, as two channels of audio signal are recorded in an audio block with the sampling frequency of 32 kHz. The encoded data are expressed in 2's complement arithmetic with 12 bits non-linear. The compression rule of 16 bits linear code to 12 bits non-linear code is shown in figure 16 of IEC 61834-2.

6.5 Audio channel allocation

6.5.1 Audio block

The audio block is the physical recording channel for the audio signal on tape. In this standard, one audio block named CH1 is provided. The construction of the audio block is shown in table 8 which shows that an audio block accommodates signals for two audio channels.

6.5.2 Channel allocation

The audio channels are named CHa and CHb. Encoded data in CHa correspond to encoded data Y, and encoded data in CHb correspond to encoded data Z respectively in figure 18 in IEC 61834-2. The basic channel allocation rule for SD-2ch audio is described in table 9.

For the channel described as "No information" in CHb, all zero data, or the same data as Cha, may be recorded.

6.6 Frame structure

6.6.1 Relative audio-video timing

Same as IEC 61834-2.

6.6.2 Audio frame processing

This standard provides the same audio frame processing modes as IEC 61834-2.

Unlocked mode

Unlocked mode is applicable to 32k-2ch mode when the sampling frequency of the audio signal is not synchronous with the video frame frequency. The number of audio samples per frame is variable within the range between the maximum and the minimum limits shown in table 10. The number of audio samples per frame is rounded to the nearest integer. The recording capacity of audio data for each audio block corresponds to the maximum for 48k mode in IEC 61834-2. The unused data area in an audio block shall be filled with undefined values, "1" or "0", ("don't-care data").

Locked mode

Locked mode is applicable to 32k-2ch mode when the sampling frequency of the audio signal is synchronous with the video frequency. The audio sampling frequency (f_s) is related to the line frequency (f_h) by the following equations:

$$\begin{array}{lll} \text{32k-2ch mode:} & f_s = f_h \times 2\,228 / 1\,125 & \text{for the 525-60 system} \\ & f_s = f_h \times 128 / 125 & \text{for the 625-50 system} \end{array}$$

The number of audio samples per frame is always a regular sequence, or a fixed value, as shown in table 11.

6.7 Shuffling method

Audio samples and undefined values are shuffled over tracks and data-sync blocks within a frame. Firstly, audio data are shuffled, then undefined values are set. Data D_n sampled at n -th order ($n = 0, 1, 2, \dots$) within a frame are located at the position derived as follows.

Audio shuffling patterns are as shown in figure 21 of IEC 61834-2 for the 525-60 system, and figure 22 of IEC 61834-2 for the 625-50 system, but with different track numbering. The numbering differences for the two TV systems are shown below:

525-60 system

"Track 0 or Track 5" is replaced by "Track 0".
 "Track 1 or Track 6" is replaced by "Track 1".
 "Track 2 or Track 7" is replaced by "Track 2".
 "Track 3 or Track 8" is replaced by "Track 3".
 "Track 4 or Track 9" is replaced by "Track 4".

625-50 system

"Track 0 or Track 6" is replaced by "Track 0".
 "Track 1 or Track 7" is replaced by "Track 1".
 "Track 2 or Track 8" is replaced by "Track 2".
 "Track 3 or Track 9" is replaced by "Track 3".
 "Track 4 or Track 10" is replaced by "Track 4".
 "Track 5 or Track 11" is replaced by "Track 5".

6.7.1 32k-2ch modes

525-60 system

$$\begin{array}{ll} \text{Track number:} & \text{INT}(n / 3) + 2 \times (n \bmod 3) \bmod 5 \\ \text{Sync block number:} & 2 + 3 \times (n \bmod 3) + \text{INT}((n \bmod 45) / 15) \\ \text{Byte position number:} & \begin{array}{ll} 10 + 3 \times \text{INT}(n / 45) & \text{for the most significant byte Y} \\ 11 + 3 \times \text{INT}(n / 45) & \text{for the most significant byte Z} \\ 12 + 3 \times \text{INT}(n / 45) & \text{for the least significant byte} \end{array} \end{array}$$

where $n = 0$ to $1\,079$

625-50 system

Track number:	$(\text{INT}(n / 3) + 2 \times (n \bmod 3)) \bmod 6$	
Sync block number:	$2 + 3 \times (n \bmod 3) + \text{INT}((n \bmod 54) / 18)$	
Byte position number:	$10 + 3 \times \text{INT}(n / 54)$	for the most significant byte Y
	$11 + 3 \times \text{INT}(n / 54)$	for the most significant byte Z
	$12 + 3 \times \text{INT}(n / 54)$	for the least significant byte
where $n = 0$ to $1\,295$		

6.8 Audio auxiliary data (AAUX)

The definition of “multi-language flag(ML)” is added to the data defined in CH1 in IEC 61834-2. Multi-language has two meanings as follows:

- the same contents are recorded using other languages in other audio channels of the same video frames;
- other audio programmes of different contents such as commentary about the same video programme are recorded in other audio channels of the same video frames.

0= recorded in multi-language

1= not recorded in multi-language

6.9 Invalid recording

Same as IEC 61834-2.

7 Video signal processing

7.1 Introduction

Video signals are initially sampled at 13,5 MHz for luminance and 6,75 MHz for colour differences. The luminance signal is subsequently undergoes sampling rate conversion to a lower rate and the number of pixels used to convey the colour difference information is reduced. Video signal processing for bit rate reduction is similar to that described in IEC 61834-3.

7.2 Error correction code

Same as IEC 61834-2.

7.3 Randomization pattern

Same as IEC 61834-2.

7.4 Video structure

7.4.1 Sampling structure

The sampling structure is defined as 4:2:2 component television signals based on ITU-R Recommendation 601-2. Sampling structures of luminance (Y) and two colour difference signals (CR, CB) are shown in table 20 of IEC 61834-2.

Pixel and line structures in one frame

For both 525-60 and 625-50 TV systems, the luminance is initially sampled at 13,5 MHz, but subsequently undergoes sampling rate conversion to 10,125 MHz (three-quarters of the initial rate). The result is 540 pixels per line to be transmitted as shown in figures 3 and 4.

For both TV systems, the number of pixels conveyed to represent both colour difference signals is halved, by substituting a single pixel for each adjacent pair of pixels along each line. The number of colour difference pixels is then halved again, by transmitting only one colour difference signal for each line, the choice of colour difference signal alternating with the line number. The result is 180 pixels per line to be transmitted, as shown in figures 3 and 4.

The sampling starting point in the active period of the CR and CB signals shall be the same as the sampling starting point in the active period of the Y signal.

Each pixel has a value from -127 to 126 which is obtained by subtraction of 128 from the input video signal level.

525-60 system

The sampling process described above results in 540 pixels per line being transmitted for luminance (Y) and 180 pixels per line being transmitted for colour-difference information as shown in figure 3.

The active lines shall be from line 23 to line 262 and from line 285 to line 524 as shown in table 20 of IEC 61834-2. From each field, 240 lines for Y signals and 120 lines for CR and CB signals shall be transmitted.

625-50 system

The sampling process described above results in 540 pixels per line being transmitted for luminance (Y) and 180 pixels per line being transmitted for colour-difference information as shown in figure 4.

The active lines shall be from line 23 to line 310 and from line 335 to line 622 as shown in table 20 of IEC 61834-2. From each field, 288 lines for Y signals and 144 lines for CR and CB signals shall be transmitted.

Filter characteristics

The recommended filter characteristics are as follows:

525-60 system and 625-50 system

less than or equal to -12 dB at 5,0625 MHz for luminance signal.

less than or equal to -6 dB at 1,6875 MHz for chrominance signal.

7.4.2 DCT block

The Y, CR and CB pixels in one frame shall be divided into DCT blocks as shown in figures 5 and 6. All DCT blocks, except the rightmost, are structured within rectangular areas of eight vertical lines and eight horizontal pixels in a frame. The value of x shows the horizontal coordinate from the left and the value of y shows the vertical coordinate from the top. Odd lines of $y = 1, 3, 5, 7$ are the horizontal lines of field one, and even lines of $y = 0, 2, 4, 6$ are those of field two.

The rightmost DCT blocks are structured with 16 vertical lines and four horizontal pixels. The rightmost DCT blocks shall be reconstructed to eight vertical lines and eight horizontal pixels by moving the lower part of eight vertical lines and four horizontal pixels to lie adjacent to the higher part of eight vertical lines and four horizontal pixels as shown in figure 6. The above reconstructed DCT block is used for signal processing.

DCT block arrangement in one frame for 525-60 system

The arrangement of horizontal DCT blocks in one frame is shown in figure 7. The same horizontal arrangement is repeated for 60 DCT blocks for Y and 30 DCT blocks for CR and CB in the vertical direction. The pixels making up one frame are thus divided into 5 400 DCT blocks.

Y: Vertical 60 DCT blocks $\times$ horizontal 67,5 DCT blocks = 4 050 DCT blocks

CR: Vertical 30 DCT blocks $\times$ horizontal 22,5 DCT blocks = 675 DCT blocks

CB: Vertical 30 DCT blocks $\times$ horizontal 22,5 DCT blocks = 675 DCT blocks

DCT block arrangement in one frame for 625-50 system

The arrangement of horizontal DCT blocks in one frame is shown in figure 7. The same horizontal arrangement is repeated for 72 DCT blocks for Y and 36 DCT blocks for CR and CB in the vertical direction. The pixels making up one frame are thus divided into 6 480 DCT blocks.

Y: Vertical 72 DCT blocks $\times$ horizontal 67,5 DCT blocks = 4 860 DCT blocks

CR: Vertical 36 DCT blocks $\times$ horizontal 22,5 DCT blocks = 810 DCT blocks

CB: Vertical 36 DCT blocks $\times$ horizontal 22,5 DCT blocks = 810 DCT blocks

7.4.3 Macro block

Each macro block consists of eight DCT blocks. Figure 8 shows the relationship between the macro block and the DCT blocks.

Macro block arrangement in one frame for the 525-60 system

Pixels in one frame are divided into 675 macro blocks.

Vertical 30 macro blocks $\times$ horizontal 22,5 macro blocks = 675 macro blocks.

The arrangement of macro blocks in one frame is shown in figure 9. The small rectangle shows a macro block.

Macro block arrangement in one frame for the 625-50 system

Pixels in one frame are divided into 810 macro blocks.

Vertical 36 macro blocks $\times$ horizontal 22,5 macro blocks = 810 macro blocks

The arrangement of macro blocks in one frame is shown in figure 10. The small rectangle shows a macro block.

7.4.4 Super block

Each super block consists of 27 macro blocks.