

Time and control code for video tape recorders

The European Standard EN 60461:2001 has the status of a
British Standard

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National foreword

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

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Code temporel de commande pour les
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(IEC 60461:2001)

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Foreword

The text of document 100B/280/FDIS, future edition 3 of IEC 60461, 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 60461 on 2001-04-01.

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Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A is informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60461:2001 was approved by CENELEC as a European Standard without any modification.

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TIME AND CONTROL CODE FOR VIDEO TAPE RECORDERS

1 Scope

This International Standard specifies a digital time and control code for use in television, film, and accompanying audio systems operating at 30, 25, and 24 frames per second.

Clauses 4, 5, and 6 specify the manner in which time is represented in frame-based systems. Clause 7 describes the structure of the time address and control bits of the code, and sets guidelines for storage of user data in the code. Clause 8 specifies the modulation method and interface characteristics of a linear time code (LTC) source. Clause 9 specifies the modulation method for inserting the code into the vertical interval of a television signal. Clause 10 summarizes the relationship between the two forms of time and control code.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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.

ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*

ISO/IEC 2022:1994, *Information technology – Character code structure and extension techniques*

SMPTE 170M:1999, *Television – Composite Analog Video Signal – NTSC for Studio Applications*

SMPTE 240M:1995, *Television – Signal Parameters – 1125-Line High-Definition Production Systems*

SMPTE 258M:1993, *Television – Transfer of Edit Decision Lists*

SMPTE 262M:1995, *Television, Audio and Film – Binary Groups of Time and Control Codes – Storage and Transmission of Data*

SMPTE 309M: *Television – Transmission of Date and Time Zone Information in Binary Groups of Time and Control Code*

SMPTE RP 164:1996, *Location of Vertical Interval Time Code*

ITU-R BT.470-6:1994, *Conventional Television Systems*

3 Definitions

For the purpose of this International Standard, the following definitions apply:

3.1

linear time code (LTC)

linear time code modulation system (previously referred to as the longitudinal track application of time and control code)

3.2

vertical interval time code (VITC)

modulation system used to insert the time code signal in the vertical blanking interval of a television signal

3.3

source

any device which generates a time and control code signal, or regenerates a time and control code signal from a recorded medium or transmission channel

An original source refers specifically to the device which is generating the time and control code signal.

3.4

binary coded decimal (BCD) system

means for encoding decimal numbers as groups of binary bits. Each decimal digit (0-9) is represented by a unique four-bit code. The four bits are weighted with the digit's decimal weight multiplied by successive powers of two

NOTE For example, the bit weights for a "units" digit would be 1×2^0 , 1×2^1 , 1×2^2 , and 1×2^3 , while the bit weights for a "tens" digit would be 10×2^0 , 10×2^1 , 10×2^2 , and 10×2^3 .

4 Time representation in 30-frame systems

4.1 Definitions of real time and NTSC time

4.1.1 In a system running at a frame rate of 30 frames per second, exactly one second of real time elapses during the scanning of 30 frames. An example of such a system is an 1125/60 high-definition system.

4.1.2 In an NTSC television system running at a vertical field rate of 60/1,001 fields per second ($\approx 59,94$ Hz), one second of NTSC time elapses during the scanning of 60 television fields or 30 television frames. Because of the difference in vertical scanning rates, the relationship between real time and NTSC time is:

$$1 \text{ s NTSC time} = 1,001 \text{ s REAL time}$$

4.2 Time address of a frame

Each frame shall be identified by a unique and complete address consisting of an hour, minute, second, and frame number. Refer to SMPTE 258M for standard formats used to display frame-based time.

The hours, minutes, and seconds follow the ascending progression of a 24-hour clock beginning with 0 hours, 0 minutes, and 0 seconds to 23 hours, 59 minutes, and 59 seconds. The frames shall be numbered successively according to the counting mode (drop frame or non-drop frame) as described below:

4.2.1 Non-drop frame – Uncompensated mode

Frames shall be numbered 0 through 29, successively, with no omissions.

4.2.2 Drop frame – NTSC time compensated mode

Because the vertical field rate of an NTSC television signal is 60/1,001 fields per second ($\approx 59,94$ Hz), straightforward counting at 30 frames per second will yield an error of approximately +108 frames (+3,6 s)_{REAL} in one hour of running time.

To minimize the NTSC time error, the first two frame numbers (00 and 01) shall be omitted from the count at the start of each minute except minutes 00, 10, 20, 30, 40, and 50.

When drop-frame compensation is applied to an NTSC television time code, the total error accumulated after one hour is reduced to –3,6 ms. The total error accumulated over a 24-hour period is –86 ms.

4.3 Colour frame identification in 525/60 television systems

If colour frame identification in the time code is required, the even units of frame numbers shall identify colour fields I and II, and the odd units of frame numbers shall identify colour fields III and IV.

5 Time representation in 25-frame systems

5.1 Definition of real time

In a system running at a frame rate of 25 frames per second, exactly one second of real time elapses during the scanning of 25 frames. An example of such a system is a 625/50 television system.

5.2 Time address of a frame

Each frame shall be identified by a unique and complete address consisting of an hour, minute, second, and frame number. The hours, minutes, and seconds follow the ascending progression of a 24-hour clock beginning with 0 hours, 0 minutes, and 0 seconds to 23 hours, 59 minutes, and 59 seconds. The frames shall be numbered successively 0 through 24.

5.3 Colour frame identification in 625/50 television systems

If identification of the eight-field colour sequence in the time code is required, the time address shall bear a predictable relationship with the eight-field colour sequence (as specified in ITU-R BT.470-6). This relationship can be expressed using either logical or arithmetic notations as given in 5.3.1 and 5.3.2, respectively.

5.3.1 Logical relationship

Given that the frame and second numbers of the time address are expressed as BCD digit pairs, the value of the logical expression $(A|B) \wedge C \wedge D \wedge E \wedge F$ shall be:

"1" for fields 1, 2, 3, and 4;

"0" for fields 5, 6, 7, and 8;

where:

- A equals the value of the 1's bit of the frame number;
- B equals the value of the 1's bit of the second number;
- C equals the value of the 2's bit of the frame number;
- D equals the value of the 10's bit of the frame number;
- E equals the value of the 2's bit of the second number;
- F equals the value of the 10's bit of the second number;
- | represents the logical OR operation;
- ^ represents the logical EXCLUSIVE OR operation.

5.3.2 Arithmetic relationship

The remainder of the quotient:

$$\frac{(S + P)}{4}$$

shall be:

- 0 for fields 7 and 8;
- 1 for fields 1 and 2;
- 2 for fields 3 and 4;
- 3 for fields 5 and 6;

where *S* equals the decimal value of the "seconds" digits of the time address, and *P* equals the decimal value of the frames digits of the time address.

6 Time representation in 24-frame systems

6.1 Definition of real time

In a system running at a frame rate of 24 frames per second, exactly one second of real time elapses during the passing of 24 frames. An example of such a system is a film system.

6.2 Time address of a frame

Each frame shall be identified by a unique and complete address consisting of an hour, minute, second, and frame number. The hours, minutes, and seconds follow the ascending progression of a 24-hour clock beginning with 0 hours, 0 minutes, and 0 seconds to 23 hours, 59 minutes, and 59 seconds. The frames shall be numbered successively 0 through 23.

7 Structure of the time address and control bits

7.1 Digital code

The digital code consists of sixteen four-bit groups, eight groups containing time address and flag bits, and eight four-bit binary groups for user-defined data and control codes.

7.2 Time address

The basic structure of the time address is based upon the BCD system, using units and tens in digit pairs for hours, minutes, seconds, and frames. Some of the digits are limited to values that do not require all four bits to be significant. These bits are omitted from the time address and include the "80's" and "40's" of hours, "80's" of minutes, "80's" of seconds, and the "80's" and "40's" of frames. Thus the entire time address is coded into 26 bits.

7.3 Flag bits

Six bits are reserved for the storage of flags which define the operational mode of the time and control code. A device which decodes a time and control code may utilize these flags to properly interpret the time address and binary group data.

7.3.1 Drop frame flag (525/60 television system only)

This flag shall be set to 1 when drop-frame compensation is being performed as specified in 4.2.2. When the count is not drop-frame compensated, this flag bit shall be set to 0.

7.3.2 Colour frame flag (525/60 and 625/50 television systems only)

If colour frame identification has intentionally been applied to the time and control code by the original source, as defined in 4.3 or 5.3, this flag shall be set to 1.

Colour frame identification may be forced by an original source of time and control code by halting the time address until the colour field to time code relationship is satisfied, after which the time address is incremented normally for each frame. As long as neither the time address counting sequence nor the colour field sequence is changed, the relationship will remain satisfied.

7.3.3 Binary group flags

Three flags provide eight unique combinations which specify the use of the binary groups (see 7.4). Three combinations of these flags also specify the time address reference as an external precision clock time reference (see 7.5) and these also select subsets of the binary group applications.

7.3.4 Modulation method specific flag

The remaining flag bit is reserved for use by each modulation method. This flag is defined in 8.2.5 and 9.2.4.

7.4 Use of the binary groups

The binary groups are intended for storage and transmission of data by the users. The format of the data contained in the binary groups is specified by the value of three binary group flag bits BGF2, BGF1, and BGF0. The following clauses define the current assignments of the binary group flag states. Table 1 summarizes the present assigned combinations.