INTERNATIONAL STANDARD

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# Cinematography — Time and control code for 24, 25 and 30 frames per second motion-picture systems — Specifications



*Cinématographie — Code de chronométrage et de commande pour les systèmes cinématographiques à 24, 25 et 30 images par seconde — Spécifications*



INTERNATIONAL ISO

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.



International Standard ISO 9642 was prepared by Technical Committee ISO/TC 36, *Cinematography*.



Annex A of this International Standard is for information only.



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# Cinematography — Time and control code for 24, 25 and 30 frames per second motion-picture systems — Specifications

## 1 Scope

This International Standard specifies digital code formats and modulation methods for motion-picture film to be used for timing, control, editing and synchronization purposes. This International Standard also specifies the relationship of the codes to the motion-picture frame.

Two types of code are described in this International Standard. The first type, Type C, is a continuous code which is very similar to the continuous code specified in IEC 461[1]. This type of code can be used in situations where the film is moving continuously at the time of both recording and reproduction.

The second type of code, Type B, is a non-continuous, block-type code, composed of blocks of data, each complete in itself, with gaps between the blocks. It is designed so that the code may be recorded and played back on equipment with intermittent film motion but still be decoded with the same type of electronic equipment used to read the Type C or continuous time code.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2022:1986, *Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques.*

ISO 4241:1987, *Cinematography — Leaders and run-out trailers for 35 mm and 16 mm release prints — Specifications.*

ISO 8758:1992, *Cinematography — Photographic control and data records on 16 mm and 35 mm motion-picture film and prints — Dimensions and location.*



## 3 Modulation method

The modulation method shall be such that a transition occurs at the beginning of every bit period. "One" is represented by a second transition half a bit period after the start of the bit. "Zero" is represented when there is no transition within the bit period.

## 4 Code formats

Two code formats are described: Type C and Type B. The unique characteristics of the two code types are described in 4.1 and 4.2 respectively. Information which applies to both code types is given in 4.3 and 4.4.

### 4.1 Type C code format

**4.1.1** Each motion-picture frame shall be defined by a unique and complete address.

**4.1.2** The frames shall be numbered successively 0 to 23, 24 or 29 inclusive, corresponding to the frame rate being used.

**4.1.3** Each address shall consist of 80 bits numbered 0 to 79 inclusive.

**4.1.4** The bits shall be assigned as shown in the appropriate columns of figure 1 and table 1.

**4.1.5** The address shall start at the clock edge before the first address bit (bit zero). The bits shall be evenly spaced throughout the address period and they shall fully occupy the address period, which is one frame. Consequently, the bit rate shall be 80 times the frame rate in frames per second.

**4.1.6** The start of the address, i.e. the clock edge before the first bit, shall coincide with the frameline at the beginning of the image to which the address refers. The tolerance of this location is + 0 % (in the direction of film travel) and – 50 % of a frame length (in the other direction). Thus, the start of the address can lie anywhere in the top half of the frame with the preferred position at the frameline. See figure 2.

**Table 1**

| Bit number | | Bit description |
|---|---|---|
| **Type C code** | **Type B code** | |
| * | 0-7 | Alternating zero, one pattern |
| * | 8-23 | Synchronizing word |
| * | 8-9 | Fixed zero |
| * | 10-21 | Fixed one |
| * | 22 | Fixed zero |
| * | 23 | Fixed one |
| 0-3 | 24-27 | Units of frame |
| 4-7 | 28-31 | First binary group |
| 8-9 | 32-33 | Tens of frames |
| 10 | 34 | Drop frame flag (see 4.4) |
| 11 | 35 | Colour frame flag (see 4.4) |
| 12-15 | 36-39 | Second binary group |
| 16-19 | 40-43 | Units of seconds |
| 20-23 | 44-47 | Third binary group |
| 24-26 | 48-50 | Tens of seconds |
| 27 | 51 | Bi-phase mark phase correction bit (see 4.4) |
| 28-31 | 52-55 | Fourth binary group |
| 32-35 | 56-59 | Units of minutes |
| 36-39 | 60-63 | Fifth binary group |
| 40-42 | 64-66 | Tens of minutes |
| 43 | 67 | Binary group flag bit (see 4.4) |
| 44-47 | 68-71 | Sixth binary group |
| 48-51 | 72-75 | Units of hours |
| 52-55 | 76-79 | Seventh binary group |
| 56-57 | 80-81 | Tens of hours |
| 58 | 82 | Unassigned address bit (zero until assigned by ISO/TC 36) |
| 59 | 83 | Binary group flag bit (see 4.4) |
| 60-63 | 84-87 | Eighth binary group |
| 64-79 | 88-103 | Synchronizing word |
| 64-65 | 88-89 | Fixed zero |
| 66-77 | 90-101 | Fixed one |
| 78 | 102 | Fixed zero |
| 79 | 103 | Fixed one |
| * | 104-111 | Alternating one, zero pattern |

* These bits do not exist in the type C code.

| BIT NUMBER TYPE C | BIT NUMBER TYPE B | BIT VALUE | DESCRIPTION | Notes |
|---|---|---|---|---|
| | 0 | 0 | TIMING BITS | START FOR TYPE B |
| | 1 | 1 | | IS CLOCK EDGE |
| | 2 | 0 | | BETWEEN BIT 111 |
| | 3 | 1 | | AND BIT 0 |
| | 4 | 0 | | |
| | 5 | 1 | | |
| | 6 | 0 | | |
| | 7 | 1 | | |
| | 8 | 0 | SYNC WORD | |
| | 9 | 0 | | |
| | 10 | 1 | | |
| | 11 | 1 | | |
| | 12 | 1 | | |
| | 13 | 1 | | |
| | 14 | 1 | | |
| | 15 | 1 | | |
| | 16 | 1 | | |
| | 17 | 1 | | |
| | 18 | 1 | | |
| | 19 | 1 | | |
| | 20 | 1 | | START FOR TYPE C |
| | 21 | 1 | | IS CLOCK EDGE |
| | 22 | 0 | | BETWEEN BIT 79 |
| | 23 | 1 | | AND BIT 0 |
| 0 | 24 | 1 | FRAMES UNITS | |
| 1 | 25 | 2 | | |
| 2 | 26 | 4 | | |
| 3 | 27 | 8 | | |
| 4 | 28 | | 1ST BINARY GROUP | |
| 5 | 29 | | | |
| 6 | 30 | | | |
| 7 | 31 | | | |
| 8 | 32 | | 10 FRAMES TENS | |
| 9 | 33 | | 20 | |
| 10 | 34 | | DROP FRAME FLAG | |
| 11 | 35 | | COLOUR FRAME FLAG | |
| 12 | 36 | | 2ND BINARY GROUP | |
| 13 | 37 | | | |
| 14 | 38 | | | |
| 15 | 39 | | | |

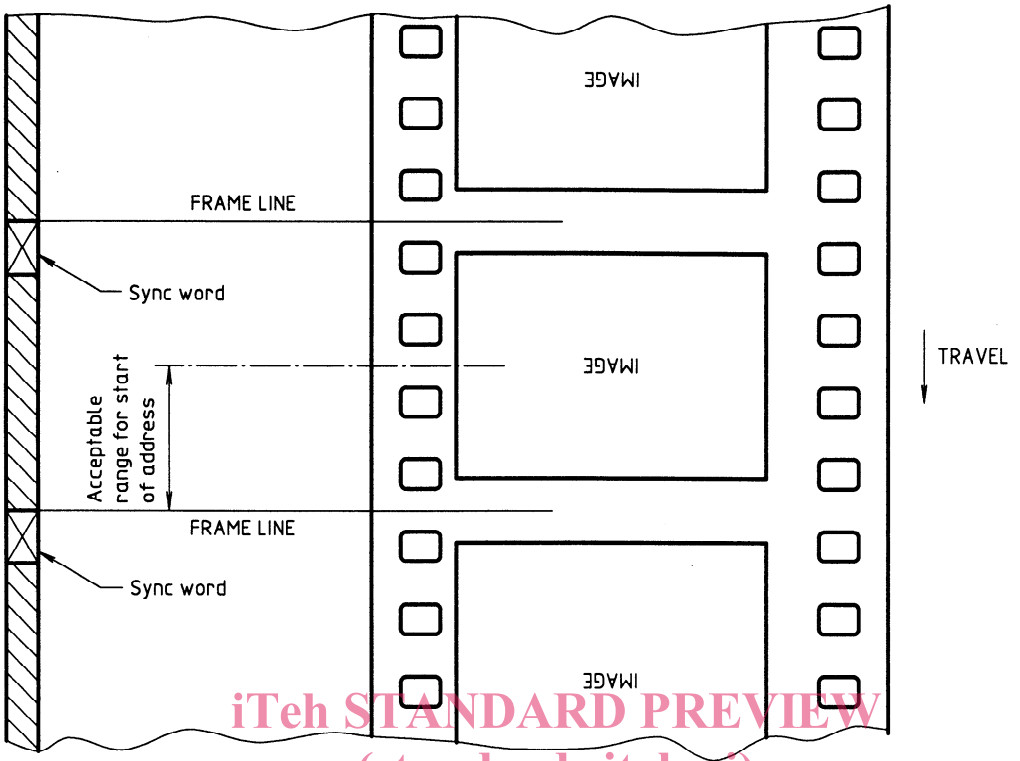
| BIT NUMBER TYPE C | BIT NUMBER TYPE B | BIT VALUE | DESCRIPTION | Notes |
|---|---|---|---|---|
| 16 | 40 | | 1 SECONDS UNITS | |
| 17 | 41 | | 2 | |
| 18 | 42 | | 4 | |
| 19 | 43 | | 8 | |
| 20 | 44 | | 3RD BINARY GROUP | |
| 21 | 45 | | | |
| 22 | 46 | | | |
| 23 | 47 | | | |
| 24 | 48 | | 10 SECONDS TENS | |
| 25 | 49 | | 20 | |
| 26 | 50 | | 40 | |
| 27 | 51 | | BI-PHASE MARK PHASE CORRECTION BIT | |
| 28 | 52 | | 4TH BINARY GROUP | |
| 29 | 53 | | | |
| 30 | 54 | | | |
| 31 | 55 | | | |
| 32 | 56 | | 1 MINUTES UNITS | |
| 33 | 57 | | 2 | |
| 34 | 58 | | 4 | |
| 35 | 59 | | 8 | |
| 36 | 60 | | 5TH BINARY GROUP | |
| 37 | 61 | | | |
| 38 | 62 | | | |
| 39 | 63 | | | |
| 40 | 64 | | 10 MINUTES TENS | |
| 41 | 65 | | 20 | |
| 42 | 66 | | 40 | |
| 43 | 67 | | BINARY GROUP FLAG BIT | |
| 44 | 68 | | 6TH BINARY GROUP | |
| 45 | 69 | | | |
| 46 | 70 | | | |
| 47 | 71 | | | |
| 48 | 72 | | 1 HOURS UNITS | |
| 49 | 73 | | 2 | |
| 50 | 74 | | 4 | |
| 51 | 75 | | 8 | |
| 52 | 76 | | 7TH BINARY GROUP | |
| 53 | 77 | | | |
| 54 | 78 | | | |
| 55 | 79 | | | |

| BIT NUMBER TYPE C | BIT NUMBER TYPE B | BIT VALUE | DESCRIPTION | Notes |
|---|---|---|---|---|
| 56 | 80 | | 10 HOURS TENS | |
| 57 | 81 | | 20 | |
| 58 | 82 | | UNASSIGNED ADDRESS BIT | |
| 59 | 83 | | BINARY GROUP FLAG BIT | |
| 60 | 84 | | 8TH BINARY GROUP | |
| 61 | 85 | | | |
| 62 | 86 | | | |
| 63 | 87 | | | |
| 64 | 88 | 0 | SYNC WORD | |
| 65 | 89 | 0 | | |
| 66 | 90 | 1 | | |
| 67 | 91 | 1 | | |
| 68 | 92 | 1 | | |
| 69 | 93 | 1 | | |
| 70 | 94 | 1 | | |
| 71 | 95 | 1 | | |
| 72 | 96 | 1 | | |
| 73 | 97 | 1 | | |
| 74 | 98 | 1 | | |
| 75 | 99 | 1 | | |
| 76 | 100 | 1 | | |
| 77 | 101 | 1 | | |
| 78 | 102 | 0 | | |
| 79 | 103 | 1 | | |
| | 104 | 1 | TIMING BITS | |
| | 105 | 0 | | |
| | 106 | 1 | | |
| | 107 | 0 | | |
| | 108 | 1 | | |
| | 109 | 0 | | |
| | 110 | 1 | | |
| | 111 | 0 | | |



| TYPE C TIME CODE 80 BITS PER FRAME | TYPE B TIME CODE 112 BITS PER FRAME |
|---|---|
| 32 USER BINARY SPARE BITS | 32 USER BINARY SPARE BITS |
| 16 SYNC | 48 SYNC |
| 31 ASSIGNED ADDRESS | 31 ASSIGNED ADDRESS |
| 1 UNASSIGNED ADDRESS | 1 UNASSIGNED ADDRESS |
| UNASSIGNED BIT IS ZERO | UNASSIGNED BIT IS ZERO |

**Figure 1 — Bit assignment**






NOTE — Figure 2 illustrates the preferred longitudinal placement of a frame of time code relative to the picture frame. The figure applies to all film formats, even though 35 mm film is shown.



**Figure 2 — Type C code**

## 4.2 Type B code format

**4.2.1** Each motion-picture frame shall be identified by a unique and complete address.

**4.2.2** The frames shall be numbered successively 0 to 23, 24 or 29 inclusive, corresponding to the frame rate being used.

**4.2.3** Each address shall consist of 112 bits numbered 0 to 111 inclusive.

**4.2.4** The bits shall be assigned as shown in the appropriate columns of figure 1 and in table 1.

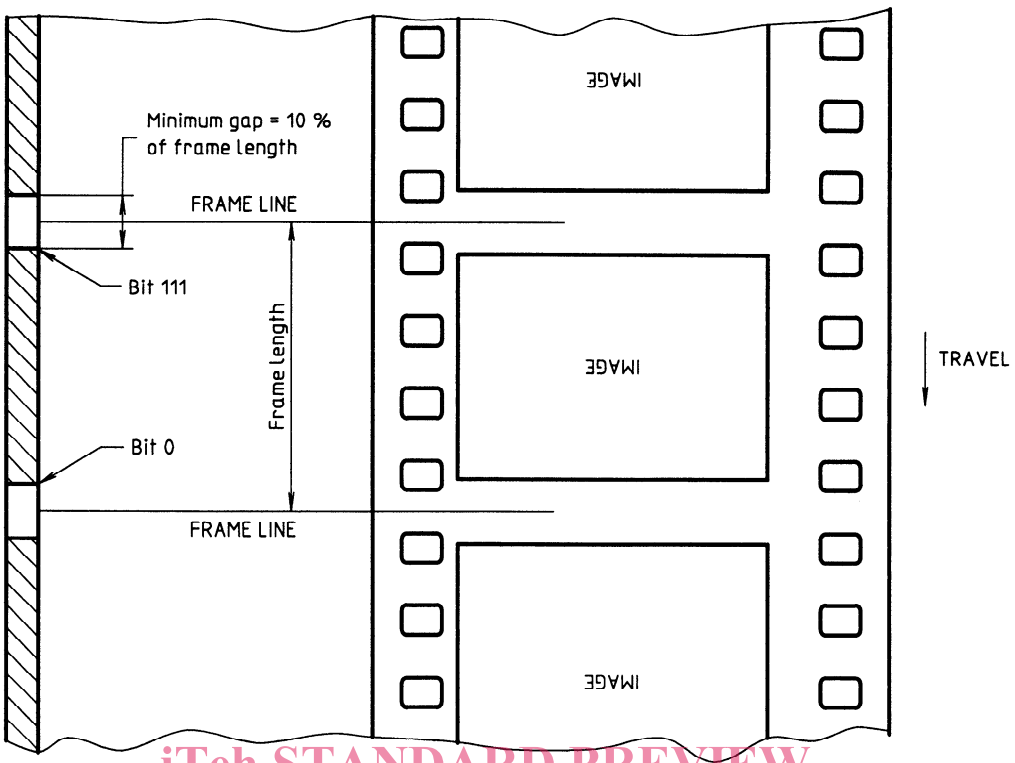
**4.2.5** The block of data for a single frame may be recorded anywhere within that frame except that no part of the block may occupy the region extending from the frameline to 5 % of a frame length on either side of it. This region is thus a gap in the data which has a minimum length of 10 % of a frame length. See figure 3.

**4.2.6** The length of any one bit shall not differ by more than 5 % from the length of either adjacent bit. In addition, the length of no bit shall be so short as to make the recording and reproduction of that data, using practical equipment, unreliable. The length of no series of bits shall cause the total length of 112 bits to exceed 90 % of frame length.

**4.2.7** In order to reduce the d.c. content of the signal, a repetitive pattern of zeros and ones shall be recorded in as much of the gap area (the frameline region defined in 4.2.5) as is practical. This region shall not contain a sync word of the previous frame or the first sync word of the following frame and shall not be decodable as a valid time code word. The bit length tolerance in 4.2.6 does not apply to data in the gap.

## 4.3 Use of binary groups

The binary groups are intended for storage of data by the users and the 32 bits within the 8 groups may be assigned in any fashion without restrictions if the character set used for the data insertion is not specified and the binary group flag bits, Nos. 43 and 59, are both zero.






NOTE — Figure 3 illustrates the preferred longitudinal placement of a frame of time code relative to the picture frame. The figure applies to all film formats, even though 35 mm film is shown.



**Figure 3 — Type B code**



**4.3.1** Encoding of frame identification by definition provides considerable redundancy that aids in minimizing decoding errors. In the design for storage of additional data for optional user applications, consideration shall be given to encoding of appropriate redundancies. In addition, data is specifically permitted to be spread across frame lines.

The binary group flag bits 43 and 59 (67 and 83 for type B code) shall be set according to table 2.

## 4.4 Assigned and unassigned address bits

**4.4.1** Six bits are reserved within the address groups: four for identifying operational modes when this type of code is used for television systems, one for bi-phase correction and one unassigned, but reserved for future assignment and defined as zero until further specified by ISO Technical Committee 36.

**4.4.2** If certain numbers are being dropped to resolve the difference between real time and colour time, as defined in 5.1.2, a one shall be recorded in the drop frame flag bit (No. 10 for type C and No. 34 for type B).

**Table 2**

| | Bit 43/67 | Bit 59/83 |
|---|---|---|
| Character set not specified | 0 | 0 |
| Unassigned | 0 | 1 |
| Character set as defined in ISO 2022 | 1 | 0 |
| Unassigned | 1 | 1 |

NOTE — The unassigned states of the truth table cannot be used and their assignment is restricted to ISO Technical Committee 36.

**4.4.3** If colour frame identification has been intentionally applied, a one shall be recorded in the colour frame flag bit (No. 11 for type C and No. 35 for type B).

**4.4.4** The bi-phase mark phase correction bit (No. 27 for type C and No. 51 for type B) shall be put in a state so that every 80-bit or 112-bit word will contain an even number of logic zeros. This requirement results in the truth table given in table 3 for bit 27 (51).