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

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

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 36, *Cinematography*.

This second edition cancels and replaces the first edition (ISO 9642:1993), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

— The title has been modified to include the word "film".

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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

1 Scope

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

Two types of code are described in this document. The first type, Type C, is a continuous code which is very similar to the continuous code specified in IEC 60461. 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 8, 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 can 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 2022, *Information technology — Character code structure and extension techniques*

ISO 4241, *Cinematography — Projection film leader (time-based), trailer and cue marks — Specifications*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
real time
<NTSC colour recording> time elapsed during the scanning of 60 fields (or any multiple thereof) in an ideal television system at a vertical field rate of exactly 60 fields per second

3.2
colour time
<NTSC colour recording> time elapsed during the scanning of 60 fields (or any multiple thereof) in a colour television system at a vertical field rate of approximately 59,94 fields per second

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4 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.

5 Code formats

Two code formats are described: Type C and Type 8. The unique characteristics of the two code types are described in 5.1 and 5.2 respectively. Information which applies to both code types is given in 5.3 and 5.4.

5.1 Type C code format

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

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

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

5.1.4 The bits shall be assigned as shown in the appropriate columns of Figure 1 and Table 1.

5.1.5 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.

5.1.6 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.

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Table 1 — Bit assignment

Bit number		Bit description
Type C code	Type 8 code	
[a]	0-7	Alternating zero, one pattern
[a]	8-23	Synchronizing word
[a]	8-9	Fixed zero
[a]	10-21	Fixed one
[a]	22	Fixed zero
[a]	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 5.4)
11	35	Colour frame flag (see 5.4)
12-15	36-39	Second binary group
16-19	40-43	Units of seconds
20-23	44-47	Third binary group

[a] These bits do not exist in the Type C code.

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Table 1 *(continued)*

Bit number		Bit description
Type C code	**Type 8 code**	
24-26	48-50	Tens of seconds
27	51	Bi-phase mark phase correction bit (see 5.4)
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 5.4)
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 further assignment)
59	83	Binary group flag bit (see 5.4)
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
[a]	104-111	Alternating one, zero pattern

[a] These bits do not exist in the Type C code.

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BIT NUMBER		BIT		
TYPE C	TYPE 8	VALUE	DESCRIPTION	Notes
	0	0	TIMING BITS	START FOR TYPE 8
	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	

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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	

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BIT NUMBER TYPE C	BIT NUMBER TYPE 8	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	

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49	73	2
50	74	4
51	75	8
52	76	7TH BINARY GROUP
53	77	
54	78	
55	79	

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BIT NUMBER		BIT		
TYPE C	TYPE 8	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		

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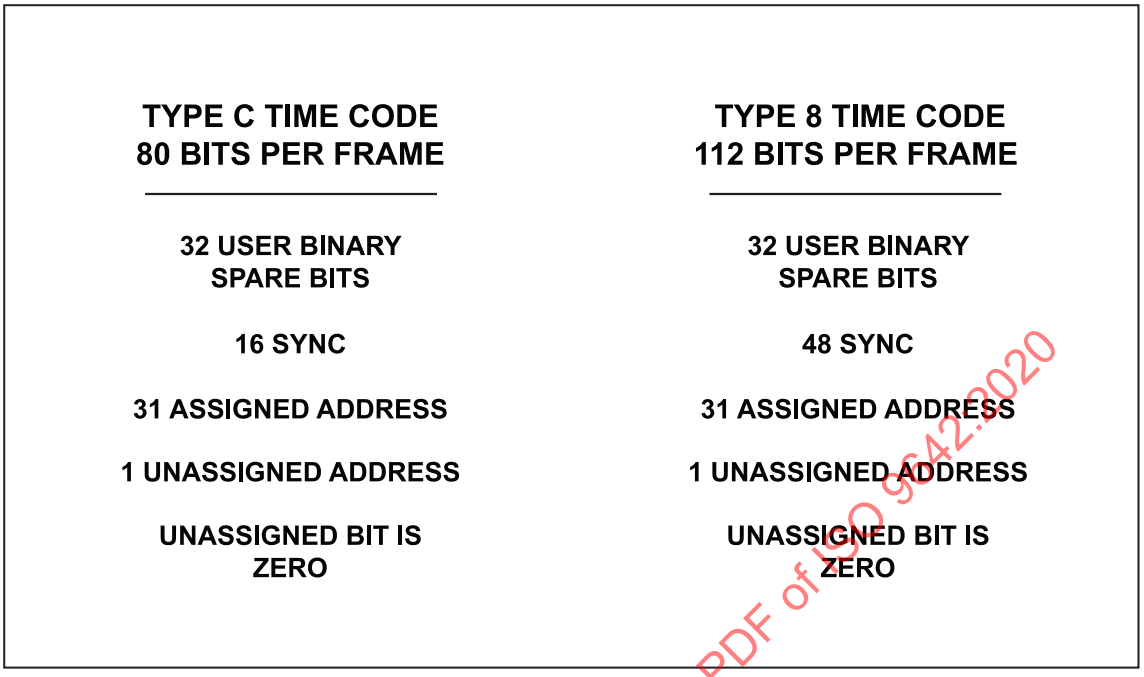

Figure 1 — Bit assignment

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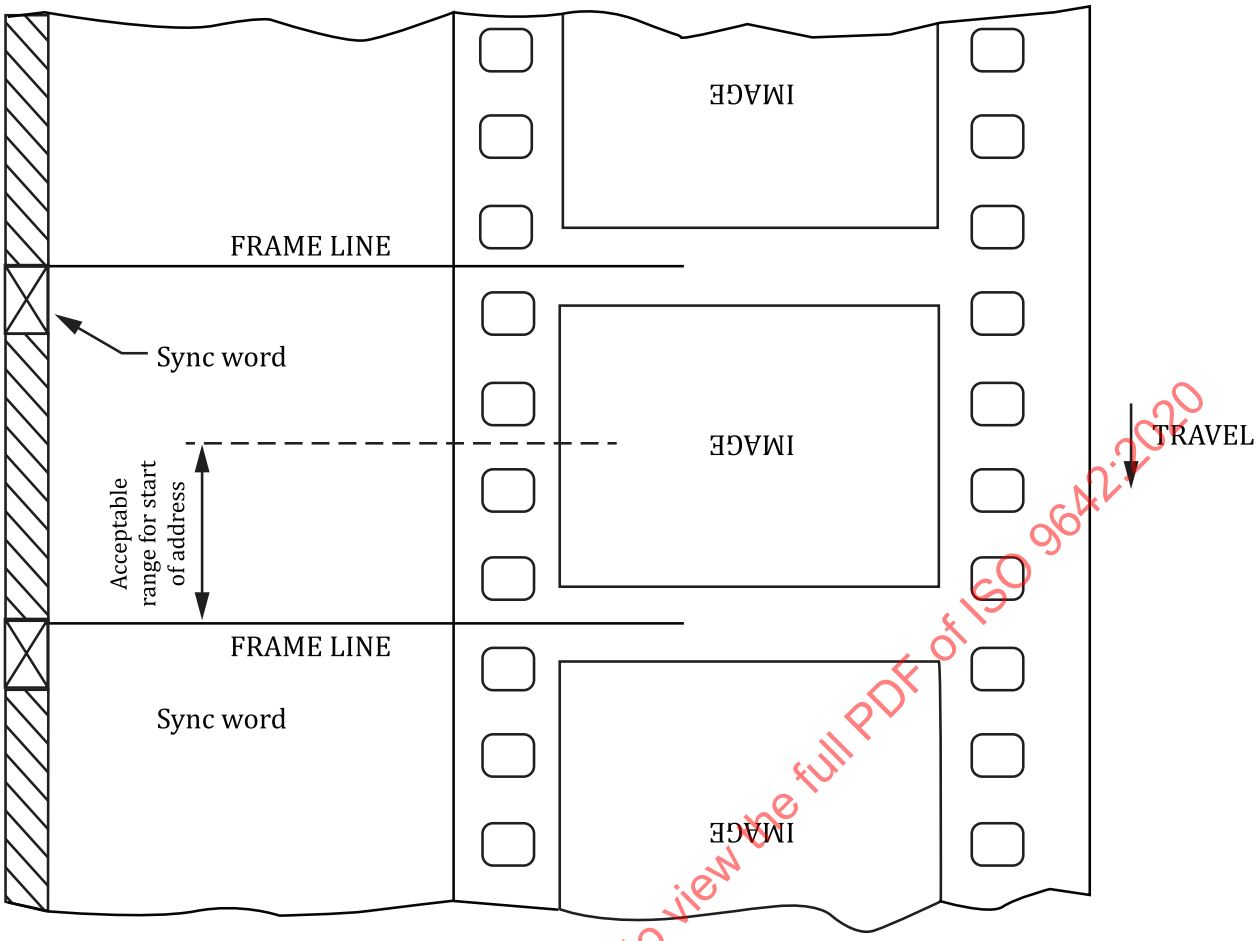

NOTE Figure 2 illustrates the preferred longitudinal placement of a frame of time code relative to the picture frame. The figure applies to all film formats, even though 35 mm film is shown.

Figure 2 — Type C code

5.2 Type 8 code format

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

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

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

5.2.4 The bits shall be assigned as shown in the appropriate columns of Figure 1 and in Table 1.

5.2.5 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.

5.2.6 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.

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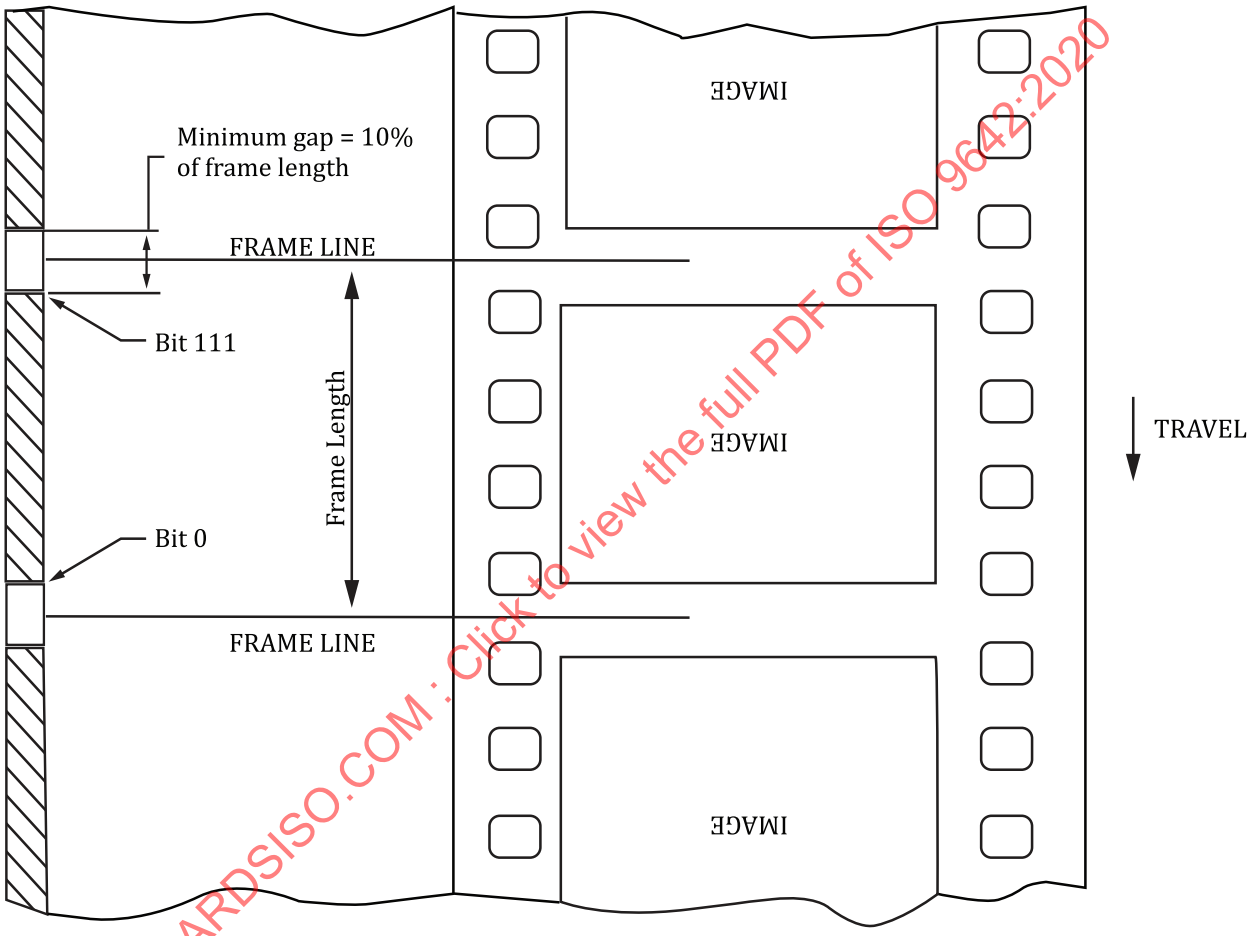
5.2.7 In order to reduce the d.c. content of the signal, a repetitive pattern of zeros and ones shall be recorded in as much of the gap area (the frameline region defined in 5.2.5) as is practical. This region shall not contain a sync word of the previous frame or the first sync word of the following frame and shall not be decodable as a valid time code word. The bit length tolerance in 5.2.6 does not apply to data in the gap.

5.3 Use of binary groups

5.3.1 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 8 code

5.3.2 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 8 code) shall be set according to Table 2.

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Table 2 — Binary group flag bits

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

5.4 Assigned and unassigned address bits

5.4.1 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.

5.4.2 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 8).

5.4.3 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 8).

5.4.4 The bi-phase mark phase correction bit (No. 27 for type C and No. 51 for Type 8) 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).

Table 3 — Bi-phase mark correction bits

Number of logic zeros in bits 0 to 26 (24 to 50) and bits 28 to 63 (52 to 871)	Type C bit 27	Type 8 bit 51
Odd	1	0
Even	0	1

5.4.5 The two binary group flag bits (Nos. 43 and 59 for type C and Nos. 67 and 83 for Type 8) shall be set in accordance with Table 2.

5.4.6 The unassigned address bit (No. 58 for type C and No. 82 for Type 8) shall be set to zero until further assignment.

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6 Time discrepancies and colour framing in film/video transfer

6.1 NTSC colour recording

6.1.1 When the film, on which the time code is recorded, is transferred from or will be transferred to television, or is otherwise used in conjunction with a 525-line/60-field television system, there can be a need to use the drop frame counting mode. In NTSC colour recording, the definitions 3.1 and 3.2 apply.

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