PROPOSED SMPTE STANDARD

SMPTE 305M
Revision of
SMPTE 305M-1998

for Television —
Serial Data Transport Interface

Table of contents

1 Scope

1.1 This standard specifies a data stream used to transport packetized data. The data packets and synchronizing signals are compatible with ANSI/SMPTE 259M (see figure 1).

1.2 Parameters of the protocol are compatible with the 4:2:2 component SDI format as shown in figure 2.

1.3 The data stream is intended to transport any packetized data signal over the active lines that have a maximum data rate up to (approximately) 200 Mb/s for 270 Mb/s system or (approximately) 270 Mb/s for 360 Mb/s system. The maximum data rate may be increased through use of the extended data space as described in annex A.

1.4 Additional documents describe particular applications of this standard and include details of data formatting, data location, and other parameters, such as compression and error correction, if applicable.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI/SMPTE 125M-1995, Television — Component Video Signal 4:2:2 — Bit-Parallel Digital Interface

ANSI/SMPTE 259M-1997, Television — 10-Bit 4:2:2 Component and $4f_{SC}$ Composite Digital Signals — Serial Digital Interface

ANSI/SMPTE 267M-1995, Television — Bit-Parallel Digital Interface — Component Video Signal 4:2:2 16 x 9 Aspect Ratio

ANSI/SMPTE 294M-1997, Television — 720 x 483 Active Line at 59.94-Hz Progressive Scan Production — Bit-Serial Interfaces

SMPTE 291M-1998, Television — Ancillary Data Packet and Space Formatting

SMPTE RP 165-1994, Error Detection Checkwords and Status Flags for Use in Bit-Serial Digital Interfaces for Television

ITU-R BT.656-4 (02/98), Interfaces for Digital Component Video Signals in 525-Line and 625-Line Television Systems Operating at the 4:2:2 Level of Recommendation ITU-R BT.601 [Part A]

ITU-R BT.1364 (02/98), Format of Ancillary Data Signals Carried in Digital Component Studio Interfaces

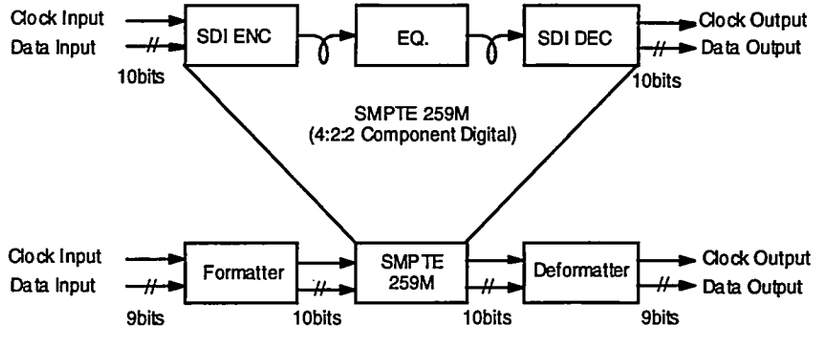


Figure 1 – System block diagram

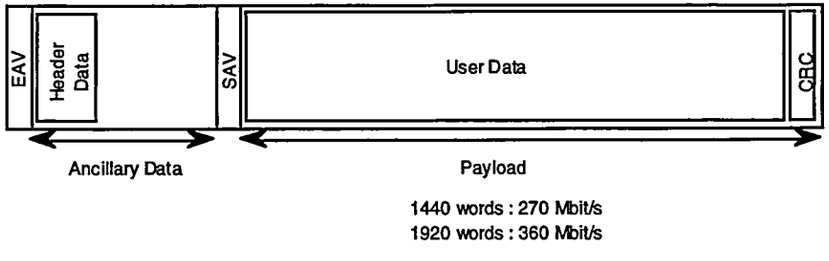


Figure 2 – Signal format (1 line)

3 Version number

The current version number of this sandard is version 1.

4 General specifications

4.1 This standard describes the assembly of a stream of 10-bit words. The resulting word stream shall be formatted, serialized, scrambled, coded, and interfaced according to ANSI/SMPTE 259M and ITU-R BT.656.

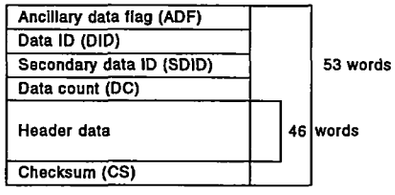
4.2 The data word length shall be 10 bits: B0 through B9. B9 is the most significant bit (MSB).

4.3 The timing reference signals (EAV and SAV) occur on every line, and shall be as described in ANSI/SMPTE 125M, ANSI/SMPTE 267M, ANSI/SMPTE 294M, or ITU-R BT.656. In the case of ANSI/SMPTE 294M, only the first 1920 words of the 2160-word active line are used.

4.4 An ANC data packet forming the header data is placed after EAV, as specified in clause 5. All payload is placed between SAV and EAV. The space after the header data but before SAV is available for ANC data as specified by SMPTE 291M and ITU-R BT.1364.

5 Header data

The data structure for the header data shall conform to SMPTE 291M and ITU-R BT.1364 ancillary data packet (type 2). The header data, shown in figure 3, shall be located immediately after the EAV on lines specified in the application document.



The header data shall include the following:

– Line number	[2 words]
– Line number CRC	[2 words]
– Code and AAI	[1 word]
– Destination address	[16 words]
– Source address	[16 words]
– Block type	[1 word]
– CRC flag	[1 word]
– Data extension flag	[1 word]
– Reserved data	[4 words]
– Header CRC	[2 words]

5.1 Ancillary data formatting

The ADF, DID, SDID, DC, and CS shall conform to SMPTE 291M and ITU-R BT.1364.

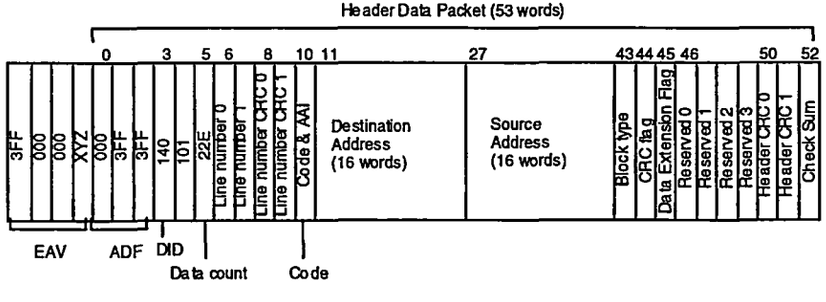


Figure 3 – Header data structure

5.1.1 Data ID (DID)

The data ID shall have the value of [40_h] for B7 through B0.

– B8 is even parity for B7 through B0
– B9 is the complement of B8

5.1.2 Secondary data ID (SDID)

The secondary data ID shall have the value of [01_h] for B7 through B0.

– B8 is even parity for B7 through B0
– B9 is the complement of B8

5.1.3 Data count (DC)

The data count shall represent 46 words for the header with the value [$2E_h$] for B7 through B0.

– B8 is even parity for B7 through B0
– B9 is the complement of B8.

5.2 Line number

5.2.1 The line number shall represent the number from 1 through 525 for 525 systems, and 1 through 625 for 625 systems in order to check the data continuity. The line numbering is described in ANSI/SMPTE 125M or ITU-R BT.601.

5.2.2 The line number shall be contained within L9 through L0. R5 through R0 are reserved and set to zero (see figure 4).

– EP1 is even parity for L7 through L0
– EP2 is even parity for R5 through R0, L9, L8

5.3 Line number CRC

Following each line number, a line number CRC shall be inserted. The line number CRC applies to the data ID through the line number for the entire ten bits (see figure 5). The generator polynomial for the line number CRC shall be $G(X) = X^{18} + X^5 + X^4 + 1$, which conforms to ITU-T X.25 (see figure 6).

Line number CRC shall be contained in C17 through C0, and the initial value shall be set to all ones.

5.4 Code and AAI (authorized address identifier)

Both code and AAI shall consist of four bits (see figure 7).

Code: B3 through B0
AAI: B7 through B4

– B8 is even parity for B7 through B0
– B9 is the complement of B8

5.4.1 Code

The code is intended to identify the length of the payload with the following values. The payload shall be contained in the area between SAV and EAV.

Description	B3	B2	B1	B0
Reserved for SDI:	0	0	0	0
1440 word payload:	0	0	0	1
1920 word payload:	0	0	1	0

NOTE – Code = 0000 is used where uncompressed 4:2:2 data are transmitted in the line containing the header. However, uncompressed video signals and compressed video signals should not be mixed in the same line or block. Code = 1000 is reserved for 143 Mb/s applications.

See annex B regarding methods of adding values to the code table.

5.4.2 AAI

The AAI is intended to identify the format of the destination and source address words with 16 different states.

Description	B7	B6	B5	B4
Unspecified format:	0	0	0	0
IPv6 address:	0	0	0	1

The value (0_h) is reserved for applications where no source and destination address format is specified.

See annex B regarding methods of adding values to the AAI table.

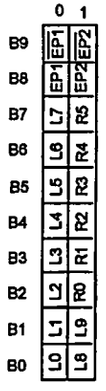


Figure 4 – Line number

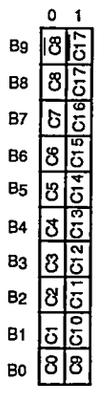


Figure 5 – Line number CRC

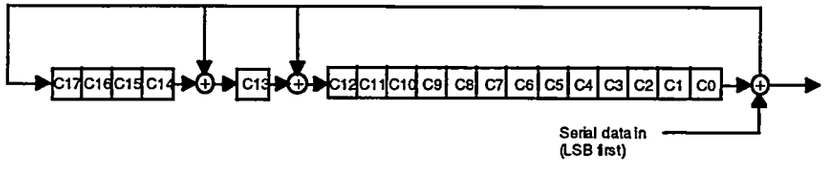


Figure 6 – Generator polynomial

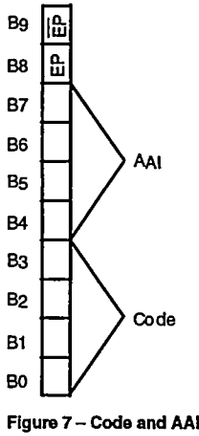


Figure 7 – Code and AAI

5.5 Destination and source address

The destination and source address represents the address of the devices within the connection according to the AAI. Sixteen bytes are allocated for both destination and source address with the following structure (see figure 8):

- Address: B7 through B0
- B8 is even parity for B7 through B0
- B9 is the complement of B8

When all 16 bytes are zero filled in accordance with AAI = 0000, it shall indicate the universal address to all devices connected to the interface. The default condition when no destination and source address are required is that all 16 bytes of the destination and source address shall be set to zero in accordance with AAI = 0000.

5.6 Block type

The block type shall consist of one word and is intended to indicate the segmentation of the payload. Either fixed block size or variable block size may be selected. B7 or B6 is the prefix to define the fixed block data structure as follows:

Description	B7	B6
Fixed block size without ECC:	0	0
Fixed block size with ECC:	0	1
Unassigned:	1	0
Reserved (**):	1	1

NOTE – ECC will be determined individually in accordance with each application.

**The reserved prefix (B7, B6) = (1, 1) can only be used with the variable block size whose value is [01_h] for B5 through B0.

5.6.1 Fixed block size

The possible segmentation of the fixed block size and the values for B5 through B0 are shown in table 1. Each data packet (data type + data block) shall be placed one right after the other.

- B8 is even parity for B7 through B0
- B9 is the complement of B8

See annex B regarding methods of adding values to the fixed block size table.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B9	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
B8	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
B7	A7	A15	A23	A31	A39	A47	A55	A63	A71	A79	A87	A95	A103	A111	A119	A127
B6	A6	A14	A22	A30	A38	A46	A54	A62	A70	A78	A86	A94	A102	A110	A118	A126
B5	A5	A13	A21	A29	A37	A45	A53	A61	A69	A77	A85	A93	A101	A109	A117	A125
B4	A4	A12	A20	A28	A36	A44	A52	A60	A68	A76	A84	A92	A100	A108	A116	A124
B3	A3	A11	A19	A27	A35	A43	A51	A59	A67	A75	A83	A91	A99	A107	A115	A123
B2	A2	A10	A18	A26	A34	A42	A50	A58	A66	A74	A82	A90	A98	A106	A114	A122
B1	A1	A9	A17	A25	A33	A41	A49	A57	A65	A73	A81	A89	A97	A105	A113	A121
B0	A0	A8	A16	A24	A32	A40	A48	A56	A64	A72	A80	A88	A96	A104	A112	A120

Figure 8 – Source and destination address

Table 1 – Fixed block size

Block type (B5-B0)	Block size	270 Mb/s	360 Mb/s
01_h	1438 (1437) words	1 block	1 block
02_h	719 (718) words	2 blocks	2 blocks
03_h	479 (478) words	3 blocks	4 blocks
04_h	359 (358) words	4 blocks	5 blocks
09_h	1918 (1917) words	–	1 block
$0A_h$	959 (958) words	1 block	2 blocks
$0B_h$	639 (638) words	2 blocks	3 blocks
11_h	766 (765) words	1 block	2 blocks
12_h	383 (382) words	3 blocks	5 blocks
13_h	255 (254) words	5 blocks	7 blocks
14_h	191 (190) words	7 blocks	10 blocks
21_h	5 (4) words	287 blocks	383 blocks
22_h	9 (8) words	159 blocks	213 blocks
23_h	13 (12) words	110 blocks	147 blocks
24_h	17 (16) words	84 blocks	112 blocks
25_h	33 (32) words	43 blocks	58 blocks
26_h	49 (48) words	29 blocks	39 blocks
27_h	65 (64) words	22 blocks	29 blocks
28_h	97 (96) words	14 blocks	19 blocks
29_h	129 (128) words	11 blocks	14 blocks
$2A_h$	193 (192) words	7 blocks	9 blocks
$2B_h$	257 (256) words	5 blocks	7 blocks
$2C_h$	385 (384) words	3 blocks	4 blocks
$2D_h$	513 (512) words	2 blocks	3 blocks
$2E_h$	609 (608) words	2 blocks	3 blocks
31_h	62 (61) words	23 blocks	30 blocks
32_h	153 (152) words	9 blocks	12 blocks
33_h	171 (170) words	8 blocks	11 blocks
34_h	177 (176) words	8 blocks	10 blocks
35_h	199 (198) words	7 blocks	9 blocks
36_h	256 (255) words	5 blocks	7 blocks
37_h	144 (143) words	10 blocks	13 blocks
38_h	160 (159) words	9 blocks	12 blocks
NOTE – The values in parentheses are the size of the data block because the first word is used for type.			

5.6.2 Variable block size

The variable block size shall have the following value:

	B7	B6	B5	B4	B3	B2	B1	B0
Variable block size:	1	1	0	0	0	0	0	1

– B8 is even parity for B7 through B0
– B9 is the complement of B8

With the variable block size, any size of consecutive block data words is permitted. The next data packet can be either placed immediately after the other, or on the next line. For block lengths exceeding the payload of one line, fields code and AAI through data extension flag, within the header data, shall be repeated for each line that carries part of the block.

5.7 Payload CRC flag

The payload CRC flag shall consist of one word. The payload CRC flag is intended to indicate the presence of the payload CRC with the following values:

– B7 through B0
– (00_h): The CRC shall not be inserted at the end of the payload, the space may be used for data.
– (01_h): The CRC shall be inserted at the end of the payload.
– (02_h) – (FF_h): Reserved

– B8 is even parity for B7 through B0
– B9 is the complement of B8.

5.8 Data extension flag

Use of the data extension facility is optional. The data extension flag shall consist of one word. The data extension flag is intended to indicate whether there are extension data packets loaded after the header data and before the SAV. Extension data packets shall conform to the format defined in annex A.

– B7 through B0
– (00_h): No extension data packet
– (01_h): One extension data packet
– (02_h): Two extension data packets
– (03_h) - (FF_h): Reserved

– B8 is even parity for B7 through B0
– B9 is the complement of B8

NOTE – The 360 Mb/s system may contain two extension data packets when (02_h) is used, since the maximum size of the user data in the ANC packet is restricted to 255 words. In the case of ANSI/SMPTE 294M, only the first 1920 words of the 2160-word active line are used.

5.9 Header expansion reserved data

The header expansion reserved data shall be positioned after the data extension flag. The default value for the reserved data is (200_h).

5.10 Header CRC

Following each ancillary data header, the header CRC shall be inserted. The header CRC applies to the code through the reserved data for the entire ten bits. The generator polynomial for the header CRC shall be the same as the line number CRC.

6 User data signal format

User data may be present on any line in the area between SAV and EAV. Some applications may constrain the use of certain lines. User data location and organization within the payload are not defined by this standard for either the data carried in the blocks defined by this clause or data carried in the data extension of annex A. Specifications for the payload are defined in application documentation linked to the data type of 5.2.3 and (when used) the assigned SDID of annex A, table A.1. The default value for the user data area is 200_h.

Although data may exist on any line, it should be noted that data can be corrupted during a switch (see SMPTE RP 168).

6.1 Data block

The data block shall consist of either 8-bit words plus even parity or 9-bit words contained in B8 through B0. B9 of the user data word shall be set to the complement of B8 (see figure 9).

6.2 Data block header

Each data block shall be preceded by the data block header. The data structure for the data block header shall be as shown in figure 10 for the fixed block size, and figure 11 for the variable block size.

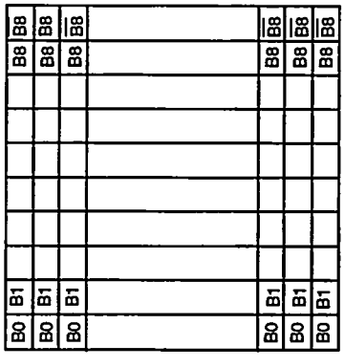


Figure 9 – Data block

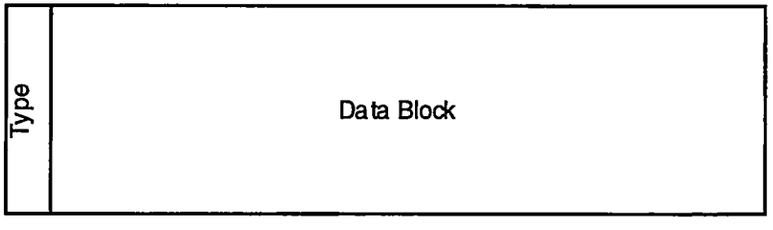


Figure 10 – Data structure (fixed block size)

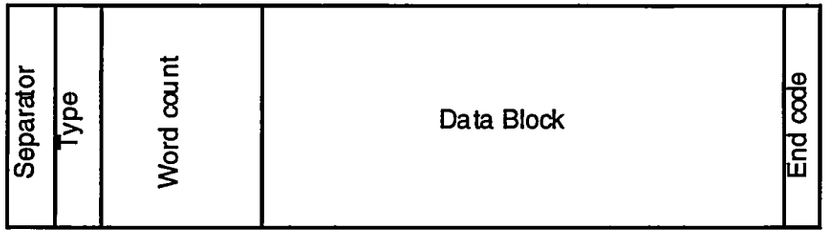


Figure 11 – Data structure (variable block size)

6.2.1 Separator and endcode

The separator, endcode, and wordcount shall be inserted, if the block type is identified as variable block size. Each data block starts with the separator and ends with the endcode. The values of separator and endcode shall be as shown in table 2.

Table 2 – Separator and endcode values

	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Separator: [309$_h$]	1	1	0	0	0	0	1	0	0	1
Endcode: [30A$_h$]	1	1	0	0	0	0	1	0	1	0

6.2.2 Wordcount

The wordcount shall consist of four words as shown in figure 12. The wordcount represents the number of data block words. The wordcount shall be contained in C31 through C0, and shall be interpreted as a single 32-bit binary value.

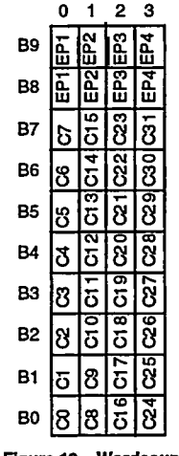


Figure 12 – Wordcount

– EP1 is even parity for C7 through C0
– EP2 is even parity for C15 through C8
– EP3 is even parity for C23 through C16
– EP4 is even parity for C31 through C24

When no wordcount is indicated, the value of the wordcount should be set to all zeros for C0 through C31. It is the intent of this standard that all receiving equipment should attempt to decode data, even if the wordcounts are expected but not present.

6.2.3 Data type

The data type shall consist of one word. The data type identifies the type of data stream and may have 256 different states (see table 3).

– Data type: B7 through B0
– B8 is even parity for B7 through B0
– B9 is the complement of B8.

See annex B regarding methods of adding values to the data type table.

6.3 Payload CRC

The payload CRC, if the payload CRC flag is active, shall be inserted at word number addresses 1438-1439 for 1440 word payload, and 1918-1919 for 1920 word payload (see figure 13). The payload CRC applies to word number addresses 0-1437 for 1440 word payload, and 0-1917 for 1920 word payload. The generator polynomial for the header payload CRC shall be the same as the line number CRC and the header CRC.

NOTE – The CRC locations are for fixed blocks where space is available. CRC usage for variable blocks is defined in the application.

7 EDH

Error checking data locations shall always be protected (see SMPTE RP 165).

NOTE – The data structure of 18-MHz sampling 4:2:2 and 4:2:0P (525P) is different in 360 Mb/s. Error checking data locations shall always be protected including 360 Mb/s 4:2:0P as defined in ANSI/SMPTE 294M.

Table 3 – Data type

Type	Description
101h	
102h	SXV
203h	
104h	CP-System
205h	CP-Picture
206h	CP-Audio
107h	CP-Data
108h	
209h	
20Ah	
10Bh	
20Ch	
10Dh	
10Eh	
20Fh	
110h	
211h	SDTI-PF
212h	
113h	
214h	
115h	
116h	
217h	
218h	
119h	
11Ah	
21Bh	
11Ch	
21Dh	
21Eh	
11Fh	
120h	
221h	DVCPRO1/Digital S
222h	DVCPRO2
123h	
224h	
125h	
126h	
227h	
228h	
129h	
12Ah	
22Bh	
12Ch	
22Dh	
22Eh	
12Fh	
230h	
131h	HD-D5
132h	
233h	
134h	
235h	
236h	
137h	
138h	
239h	
23Ah	
13Bh	
23Ch	
13Dh	
13Eh	
23Fh	
140h	

Type	Description
241h	DVCAM-1
242h	
143h	
244h	
145h	
146h	
247h	
248h	HDCam
149h	
14Ah	
24Bh	
14Ch	
24Dh	
24Eh	
14Fh	
250h	
151h	
152h	MPEG-2 P/S
253h	MPEG-2 T/S
154h	
255h	
256h	
157h	
158h	
259h	
25Ah	
15Bh	
25Ch	
15Dh	
15Eh	
25Fh	
260h	
161h	
162h	
263h	
164h	
265h	
266h	
167h	
168h	
269h	
26Ah	
16Bh	
26Ch	
16Dh	
16Eh	
26Fh	
170h	
271h	
272h	
173h	
274h	
175h	
176h	
277h	
278h	
179h	
17Ah	
27Bh	
17Ch	
27Dh	
27Eh	
17Fh	
180h	

Table 3 – Data type (concluded)

Type	Description
281h	
282h	SXA
183h	
284h	
185h	
186h	
287h	
288h	
189h	
18Ah	
28Bh	
18Ch	
28Dh	
28Eh	
18Fh	
290h	
191h	
192h	
293h	
194h	
295h	
296h	
197h	
198h	
299h	
29Ah	
19Bh	
29Ch	
19Dh	
19Eh	
29Fh	
2A0h	
1A1h	
1A2h	
2A3h	
1A4h	
2A5h	
2A6h	
1A7h	
1A8h	
2A9h	
2AAh	
1ABh	
2ACh	
1ADh	
1AEh	
2AFh	
1B0h	
2B1h	
2B2h	
1B3h	
2B4h	
1B5h	
1B6h	
2B7h	
2B8h	
1B9h	
1BAh	
2BBh	
1BCh	
2BDh	
2BEh	
1BFh	
2C0h	

Type	Description
1C1h	
1C2h	
2C3h	SXC
1C4h	
2C5h	
2C6h	
1C7h	
1C8h	
2C9h	
2CAh	
1CBh	
2CCh	
1CDh	
1CEh	
2CFh	
1D0h	
2D1h	FC
2D2h	
1D3h	
2D4h	
1D5h	
1D6h	
2D7h	
2D8h	
1D9h	
1DAh	
2DBh	
1DCh	
2DDh	
2DEh	
1DFh	
1E0h	
2E1h	User application
2E2h	User application
1E3h	User application
2E4h	User application
1E5h	User application
1E6h	User application
2E7h	User application
2E8h	User application
1E9h	User application
1EAh	User application
2EBh	User application
1ECh	User application
2EDh	User application
2EEh	User application
1EFh	User application
2F0h	User application
1F1h	User application
1F2h	User application
2F3h	User application
1F4h	User application
2F5h	User application
2F6h	User application
1F7h	User application
1F8h	User application
2F9h	User application
2FAh	User application
1FBh	User application
2FCh	User application
1FDh	User application
1FEh	User application
2FFh	User application
100h	Invalid data

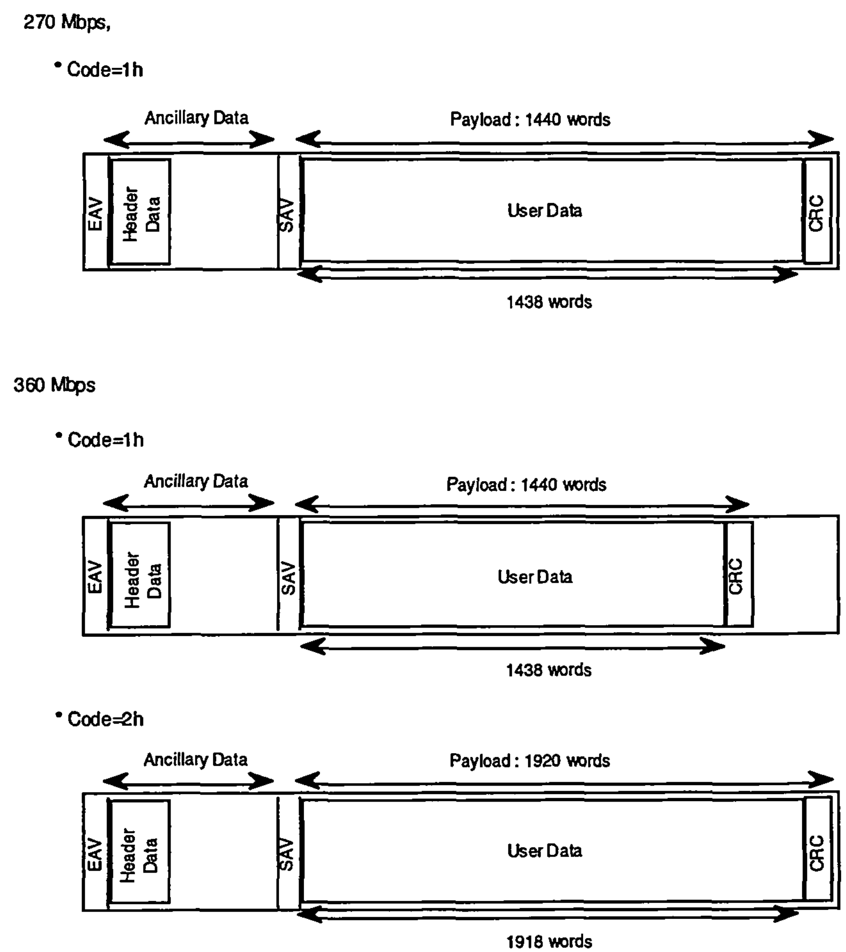


Figure 13 – Payload CRC position

Annex A (normative)
Data extension

In order to increase the amount of data carried on a line beyond that which can be incorporated in the digital active line, it is possible to insert an additional ancillary data packet following the header data in the HANC to carry the extension data. The format of this additional ancillary data packet conforms to SMPTE 291M and ITU-R BT.1364 and its presence is indicated by the data extension flag in the header data (see 5.8) being active.

User data location and organization within the payload are not defined by this standard for either the data carried in *the blocks defined by clause 6 or data carried in the data* extension. Specifications for the payload are defined in application documentation linked to the data type of 6.2.3 and (when used) the assigned SDID of table A.1.

An ancillary data packet used to carry extension data is identified by the data ID (DID) and secondary data ID (SDID) having the following values:

- DID: [140_h]
- SDID: Values are listed in table A.1.

The format of the extended data ancillary data packet is shown in figure A.1. The extended user data shall incorporate a two-word CRC generated using the same generator polynomial as the payload CRC (see 6.3) when the payload *CRC flag in the header data is active (payload CRC flag =* [101_h]). The CRC applies to DID, SDID, DC, and extended user data. When the payload CRC flag is set to 00_h, words CRC0 and CRC1 may be used for data where space is available.

The extended user data and the user data in the active line are treated as a contiguous data block as shown in figure A.2.

In the case of using a fixed block size with the extension data, a new block type needs to be registered as stated in 5.6.1.

A data extension flow chart is shown in figure A.3.

Table A.1 – SDID for data extension applications

SDID B7 – B0	Description
00_h	Undefined format
01_h 02_h FF_h	SDTI header

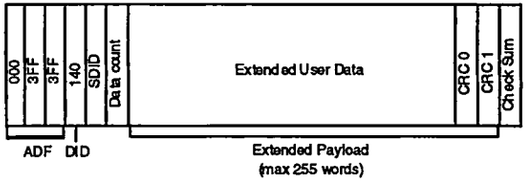


Figure A.1 – Data structure

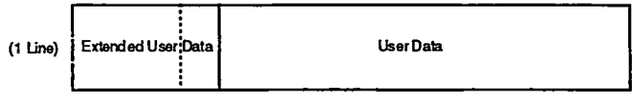


Figure A.2 – Data block

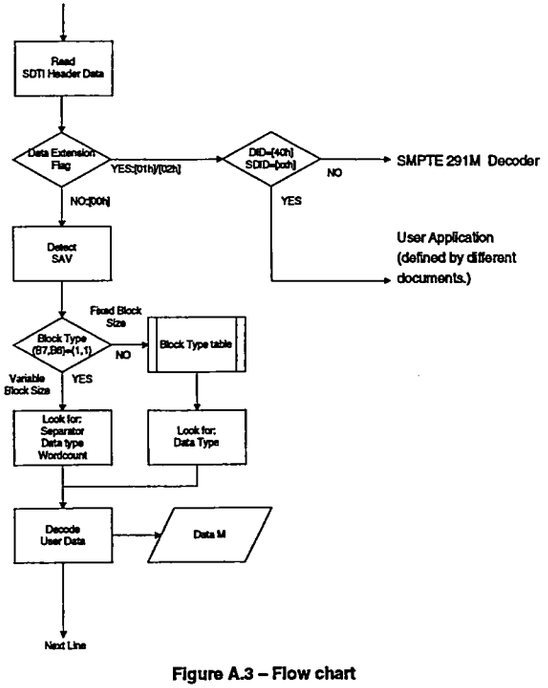


Figure A.3 – Flow chart

Annex B (informative)
Parameter registration

All changes to this standard require full SMPTE engineering processing per section XIII of the SMPTE Administrative Practices. In a future revision to this standard, a dynamic parameter registration process may be created to allow a more expeditious addition of values to the tables indicated in this standard.

Annex C (informative)
Bibliography

SMPTE RP 168-1993, Definition of Vertical Interval Switching Point for Synchronous Video Switching

IETF (Internet Engineering Task Force) Request for Comments (RFC-1883), IPv6, Internet Standards Track Protocol

ITU-R BT.601-5 (10/95), Studio Encoding Parameters of Digital Television for Standard 4:3 and Wide-Screen 16:9 Aspect Ratios

ITU-T X.25 (10/96), Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit

PROPOSED SMPTE STANDARD

for Motion-Picture Film —

35- and 16-mm Television Release Prints — Leaders and Cue Marks

SMPTE 55
Revision of
ANSI/SMPTE 55-1992

1 Scope

This standard specifies the make-up or assembly of leaders and cue marks for 35- and 16-mm analog audio motion-picture release prints for use in television studios.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

SMPTE RP 65-2000, Motion-Picture Enlargement/Reduction Ratios

3 Reduction ratio

The reduction ratio in the production of the head and foot leaders from 35-mm motion-picture film shall be in accordance with SMPTE RP 65.

4 Orientation of words and numerals

4.1 Orientation and dimensions of letters and numerals in this standard are with respect to 35-mm motion-picture film and are modified proportionally for 16-mm prints in accordance with clause 3.

4.2 The third, fourth, and fifth frames of the identification sections containing the title of the film and reel number shall be printed in clear letters on a black background so that they can be read normally when the reel is uppermost and the leading end or head of the film hangs down ready for threading.

4.3 The words "type of sound," "aspect ratio," "picture title," "company," " series," " reel No.," and "prod. No." shall be printed lengthwise with the film in clear letters on a black background.

4.4 In sections where information is to be printed lengthwise with the film, clear framelines shall be included and all such printing must be placed within the outlined areas so that it can be read on 16-mm reduction prints.

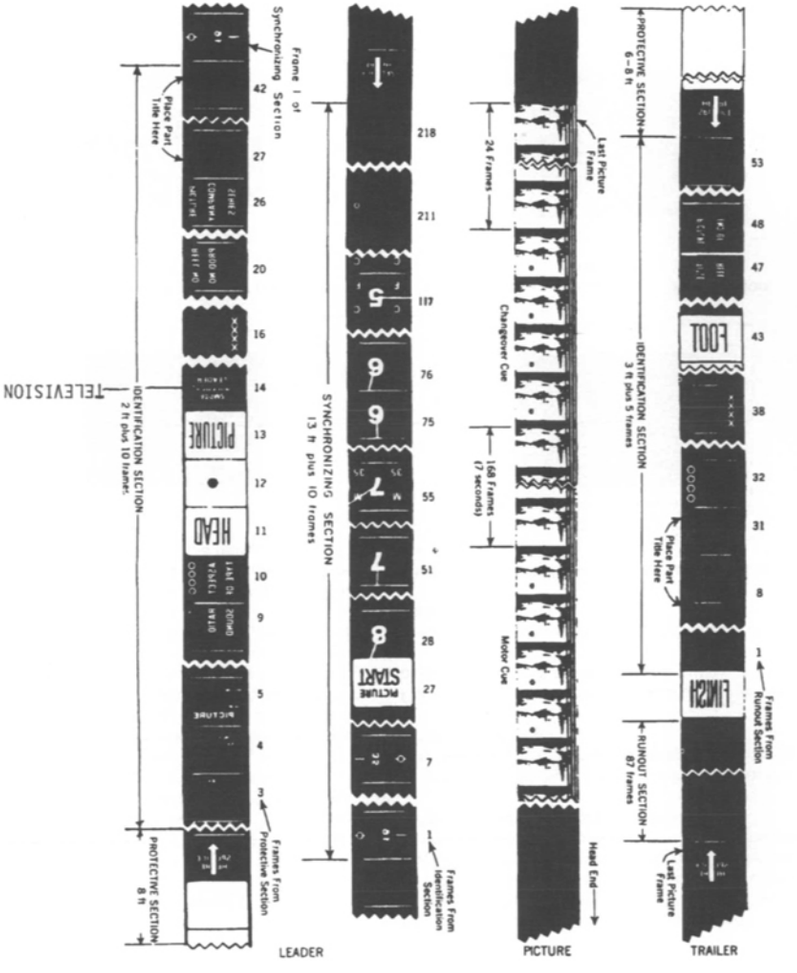
4.5 In the trailer (foot leader), the title of the film and the reel number shall be printed so that they appear inverted when the remainder of the reel is uppermost and the film hangs downward.

5 Head leader (see figure 1)

5.1 Protective section

The protective section of the 35-mm leader shall contain frameline marks and consist of 8 ft (2.44 m) of transparent or raw stock; for 16-mm leader, 3.25 ft (0.99 m). When the protective leader has been reduced to a length of 6 ft (1.83 m) for 35-mm film or 2.5 ft (0.76 m) for 16-mm film, it shall be restored to its original length.

The last frame of this section shall contain the words "splice here" and an arrow pointing to the frameline between this frame and frame 1 of the identification section. The letters should be at least 0.125 in (3.18 mm) high.



NOTE – Figure shows 35-mm film with analog audio track on right edge as seen from the light source in the projector. The analog audio track is on the left edge of 16-mm film.

Figure 1 – Leaders and cue marks

5.2 Identification section

The identification section of the leader shall be 42 frames in length. The frames may be of the 4 x 3 format or of a reduced height.

5.2.1 Since many types of film may be used for leaders, exact neutral densities have not been specified. For the purpose of this standard, the following approximate neutral densities are referred to:

- Clear (low neutral density of 0.35);
- Black (high neutral density of 1.95).

5.2.2 The identification section, when viewed as specified in 4.2, shall be made up as follows:

Frames 1-2 — Black.

Frame 3 — The printed word "subject" with letters 1/16 in (1.6 mm) high at top of frame in upright position, clear on black background (4 x 3 format).

Frame 4 — The printed word "length" at top left side of frame and the printed word "roll" at center of frame on left side. Lettering shall be comparable to that in frame 3 (4 x 3 format).

Frame 5 — The printed words "reel No." at top left side of frame and printed word "color" at center of frame on left side. Lettering, read upright, shall be comparable to that in frame 3. At bottom of frame printed word "picture" 1/8 in (3.2 mm) high.

Frames 6-10 — Five frames of black with clear framelines on which the words "aspect ratio" and "type of sound" are plainly printed lengthwise with the film in 1/8 in (3.2 mm) high clear letters. Each group of words shall start in the 10th frame and in two separate lengthwise lines reading through base of film from left to right with head end of film at right.

Frame 10 — Four letter Os vertically in line and opposite the analog audio track area approximately 5/16 in (7.9 mm) from the 35-mm camera aperture centerline opposite the analog audio area. Letters shall be 1/8 in (3.2 mm) high and 1/8 in wide, clear on black background (4 x 3 format).

Frame 11 — The printed word "head" nominally 3/8 in (9.5 mm) high in inverted black letters on clear background.

Frame 12 — A 1/8-in (3.2-mm) diameter black dot in center of 4 x 3 format on clear background with black framelines.

Frame 13 — The printed word "picture" nominally 3/8 in (9.5 mm) high in inverted black letters on clear background.

Frames 14-15 — Two frames in which the words "SMPTE Television Leader" are printed. Letters shall not be less than 1/8 in (3.2 mm) high. Inverted clear letters on a black background (4 x 3 format).

Frame 16 — Four letter Xs vertically in line adjacent to analog audio track area approximately 5/16 in (7.9 mm) from the 35-mm camera aperture centerline toward analog audio area. Letters shall be 1/8 in (3.2 mm) high and 1/8 in wide, clear on black background (4 x 3 format).

Frames 17-18 — Same as frames 14-15.

Frames 19-26 — Eight frames of black with clear framelines. The words "reel No." and "prod. No." shall be printed lengthwise with the film in 1/8 in (3.2 mm) high clear letters in frame 20. In frame 26, on three lines lengthwise, reading left to right through film base with head of leader to right, the words "picture," "company," and "series" shall be printed using the same format as that in frame 20.

Frames 27-42 — Sixteen frames in which part titles are inserted. In each frame 1) the reel number (Arabic numeral not less than 1/4 of frame height) and 2) the picture title shall be printed in black letters on a clear background. If part titles are not available, these frames should be black with clear framelines.

5.3 Synchronizing section

The synchronizing section of the leader shall be 218 frames in length.

5.3.1 The two large concentric circles used throughout the visual count-down shall be clear on a black background. Seconds count-down numerals shall be clear on a black background and shall project right side up. The broad clock arm shall be clear.

5.3.2 The synchronizing section, when viewed as specified in 4.2, shall be made up as follows (see 5.3.3):

Frame 1 — The 16-mm sound-start indication, printed in clear letters on a black background as shown in figure 2.

Frames 2-6 — Five frames of black.

Frame 7 — The 35-mm sound-start indication, printed in clear letters on a black background as shown in figure 3.

Frames 8-26 — Nineteen frames of black.

Frame 27 — The words "picture start," printed in black on a clear background. The letters in the word "picture" shall be not less than 1/8 in (3.2 mm) high and those in "start" not less than 1/4 in (6.4 mm) high. Visual count-down begins with this frame.

Frames 28-50 — Continuation of visual count-down, beginning with a clear figure "8" on a black background and a clear clock arm extending vertically from the center to the top of the frame. In each succeeding frame, the clock arm shall rotate clockwise from the center of the frame in 15° increments (see figure 4).

Frame 51 — Change of the numeral to a clear "7" on a black background. The clear clock arm shall again be vertical from the center of the frame.

Frame 55 — "M" and "35" vertically on each side of the "7" in letters 1/8 in (3.2 mm) high, clear on a black background, to indicate 35-mm magnetic sound start (see figure 5).

Frames 56-117 — Continuation of the sequence of numerals marking the seconds of film running time at 24 frames/s.

Frames 117-122 — The moving clock arm and numeral, with the addition of the Gothic letters "C" and "F" on the left- and right-hand side of the circle, respectively, to indicate the position in the leader where one to six frames may be removed and a similar number of control frames spliced in.

Frames 123-170 — Continuation of the sequence of numerals and moving clock arm marking the seconds of film running time.

Frame 171 — The numeral "2" in black on a clear background, ending the visual count-down.

Frames 172-210 — Thirty-nine frames of black density.

Frame 211 — A single clear dot, located as specified in 6.2.

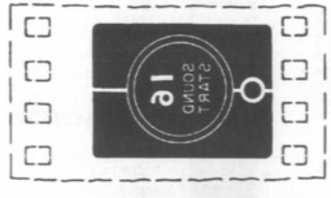


Figure 2 – 16-mm sound start identification frame

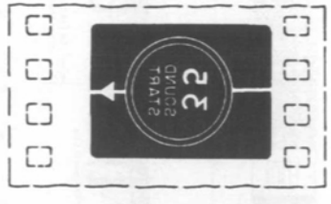


Figure 3 – 35-mm sound start identification frame

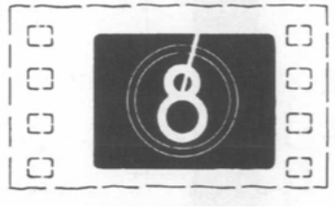


Figure 4 – Example of visual count-down

Figure 5 – 35-mm magnetic sound start

Frames 212-218 — Seven frames of black density.

5.3.3 Except for frames 172 to 218, all frames shall be separated by a clear 0.050-in (1.27-mm) nominal frameline).

5.3.4 One additional frame shall follow with the words "splice here" and an arrow pointing to a clear frameline between frame 218 and this frame. The letters should be at least 1/8 in (3.2 mm) high.

6 Picture section (see figure 1)

6.1 Picture

It is recommended that picture action start and finish on fades wherever possible. Otherwise, significant audio should be kept at least 5 ft (1.52 m) for 35-mm prints and 2 ft (0.61 m) for 16-mm prints from the start and finish of the picture.

6.2 Motor cue

The motor cue shall consist of a black circular dot with a clear outline or a clear circular dot with a black outline, printed from a 35-mm negative which has had four consecutive frames punched with a die 0.094 in (2.39 mm) in diameter. The position of this cue mark shall be as shown in figure 6.

Following the four frames containing the motor cue, there shall be 168 frames, or seven seconds running time, to the beginning of the changeover cue.

6.3 Changeover cue

The changeover cue shall consist of four frames containing circular dots of the same dimensions and position on the frame as those in the motor cue.

Following the four frames of the changeover cue, there shall be 24 frames, or one second running time, to the beginning of the runout section of the trailer.

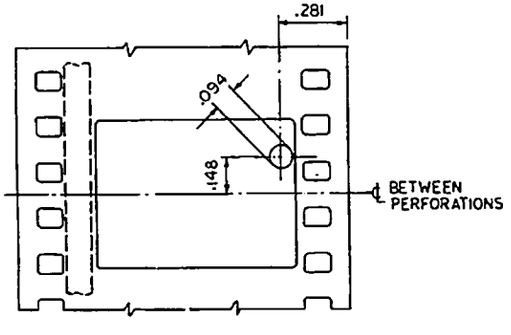
7 Trailer (foot leader) (see figure 1)

7.1 Additional frame

One additional frame shall follow with the words "splice here" and an arrow pointing to a clear frameline between the picture section and the trailer. The letters should be at least 1/8 in (3.2 mm) high.

7.2 Runout section

The runout section of the trailer shall consist of 88 frames, 87 of which are to be black. Frame 88 shall have the printed word "finish" nominally 3/8 in (9.5 mm) high in upright black letters on clear background.



NOTE – Image as seen on the screen.

Figure 6 – Position of cue marks for release prints

7.3 Identification section

The identification section of the trailer shall consist of 53 frames.

7.3.1 The identification section shall be made up as follows:

Frames 1-7 — Seven frames of black without framelines.

Frames 8-31 — Twenty-four frames in which part titles are inserted. In each frame 1) the end of reel, 2) the reel number (Arabic numeral not less than one quarter of frame height), and 3) the picture title shall be printed in black letters on a clear background. If part titles are not available, these frames shall be black with narrow clear framelines.

Frame 32 — Four letter Os vertically in line and opposite the analog audio track area approximately 5/16 in (7.9 mm) from the 35-mm camera aperture centerline opposite the analog audio area. Letters shall be 1/8 in (3.2 mm) high and 1/8 in wide, clear on black background (4 × 3 format).

Frames 33-37 — Five black frames with clear framelines for reproduction of information written on the negative.

Frame 38 — Black with four Xs adjacent to the audio track, similar to frame 16 of the head leader identification section.

Frames 39-40 — Similar to frames 14-15 of head leader identification section with words "SMPTE Television Leader," except that the words shall be upright.

Annex A (informative)
Additional data

A.1 The difference between projection rates of 24 and 25 frames/s is negligible in the normal usage of the leader.

A.2 Logos, trademarks, or other extraneous material, if absolutely necessary, should be inserted in the leader prior to the 16-mm sound-start cue or just preceding frame 32 of the trailer identification section or both.

Frame 41 — Similar to frame 13 of head leader identification section, except that the word "picture" shall be upright (not inverted).

Frame 42 — Dot similar to that in frame 12 of head leader identification section.

Frame 43 — Similar to frame 11 of head leader identification section, except printed word shall be "foot," which is upright (not inverted).

Frames 44-48 — Five blank frames of black with clear framelines upon which the words 1) "picture title" and 2) "end of reel" are printed lengthwise with the film in 1/8 in (3.2 mm) high clear letters on black background.

Frames 49-51 — Three frames identical to frames 5, 4, and 3, respectively, of head leader identification section, except that the letters shall be inverted.

Frames 52-53 — Two black frames.

7.3.2 One additional frame with the words "splice here" and an arrow pointing to a clear frameline between this frame and frame 53 to indicate where the protective section joins the trailer.

7.4 Protective section

The protective section of the trailer shall consist of 8 ft (2.44 m) of transparent or raw stock for 35-mm prints and 3.2 ft (0.99 m) for 16-mm prints.

NOTE - The Society of Motion Picture and Television Engineers makes available leaders on master positive motion-picture stock in 16-mm and 35-mm sizes. Intended for reproduction as negatives, they are identified as SMPTE Television Leaders.

A.3 The outside diameter of the larger clear circle, referred to in 5.3.1, is approximately the height of the television safe action area specified in SMPTE RP 27.3.

A.4 The outside diameter of the smaller clear circle, referred to in 5.3.1, is approximately the height of a projector aperture having an aspect ratio of 1.85:1.