Standards and Recommended Practices

Proposed SMPTE Standards

Published here for a trial period and public review are three Proposed SMPTE Standards:

SMPTE 59, Motion-Picture Film (35-mm) — Camera Aperture Images and Usage;

SMPTE 254, Motion-Picture Film (35-mm) — Manufacturer-Printed Latent Image Identification Information;

SMPTE 291M, Television Ancillary Data Packet and Space Formatting.

The proposals will be submitted to the American National Standards Institute if no adverse comments are received from publication. Comments should be addressed to Carlos V. Girod, Jr., Director of Engineering, prior to October 1, 1998. The proposals are available from Society Headquarters — SMPTE 59 and 254 for $13.00, and SMPTE 291M for $18.00.

Proposed Withdrawal of American National Standard

The Society is withdrawing American National Standard ANSI/SMPTE 261M-1993, Television — 10-Bit Serial Digital Television Signals: 4:2:2 Component and $4f_{sc}$ NTSC Composite — AMI Transmission Interface. Withdrawal action was recommended and approved by the Committee on Television Signal Technology and the Standards Committee because the standard was never implemented and shows no potential for use. Send all comments to Carlos V. Girod, Jr., at Society Headquarters, prior to October 1, 1998.

Approved SMPTE Recommended Practices

Four SMPTE Recommended Practices were approved recently by the Society's Standards Committee:

RP 124-1998, Insertion Pivot for Studio Lighting Units and Mating Holders for Use with Standing and Hanging Support Systems;

RP 194-1998, Film Negative Cutter's Conform List;

RP 195-1998, Use of the Reference Mark in Manufacturer-Printed Latent Image Key Numbers for Unambiguous Film Frame Identification; and RP 197-1998, Film-to-Video Transfer List.

RP 124 is available from Headquarters for $10.00, RP 194 and 195 for $13.00, and RP 197 for $22.00.

— Carlos V. Girod, Jr., P.E.,
Director of Engineering

PROPOSED SMPTE STANDARD

SMPTE 59
Revision of
ANSI/SMPTE 59-1997

for Motion-Picture Film (35-mm) — Camera Aperture Images and Usage

1 Scope

1.1 This standard specifies the dimensions of the camera aperture images and the relative positions of the vertical and horizontal centerlines of the intended image area with respect to the reference edge and the perforations of the camera negative film for 35-mm motion-picture cameras.

1.2 Motion-picture cameras used for different purposes require different aperture sizes. This standard specifies the image dimensions resulting from four styles of apertures used for the following purposes:

Style A: Four perforations per frame nonanamorphic sound motion pictures

Style B: Four perforations per frame anamorphic sound motion pictures

Style C: Four perforations per frame instrumentation photography and full-frame motion pictures

Style D: Three perforations per frame motion pictures

1.3 This standard also specifies the position of the photographic emulsion and the frame rate for 35-mm motion-picture cameras.

2 Dimensions

The dimensions shall be as specified in figures 1, 2, and 3 and the tables. They shall apply to measurements of the images formed on fresh film, properly exposed and processed.

3 Emulsion position

The emulsion shall be toward the camera lens, as shown in figure 4.

4 Frame rate

The standard frame rate for motion-picture photography is 24 frames per second. However, it is recognized that nonstandard frame rates are sometimes used for specific applications. For example, 24, 25, or 30 frames per second may be used for motion pictures intended for television; higher or lower frame rates may be used for special motion-picture effects and analysis. The use of nonstandard frame rates requires notification and agreement of all parties concerned with the use of the particular film.

NOTE - The displacement of 0.050 in (1.27 mm), dimension G, of the vertical centerline of the image area for styles A and B is in accord with current usage of low-shrinkage film base. However, there are in use many cameras in which the vertical centerline is displaced by 0.055 in (1.40 mm), which dimension was used prior to the development of low-shrinkage film base.

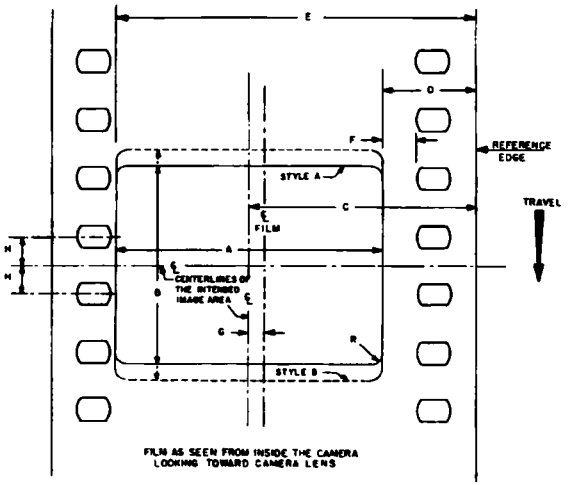


Figure 1 – Styles A and B camera aperture image area

Table 1 – Style A specifications

Dimensions	Inches	Millimeters
A	0.866 nom	22.0 nom
B	0.63 $^{+0.02}_{-0.00}$	16.0 $^{+0.5}_{-0.0}$
C	0.738 ± 0.002	18.75 ± 0.05
D	0.305 max	7.75 max
E	1.171 min	29.74 min
F	0.116 nom	2.95 nom
G	0.050 nom	1.27 nom
H	0.093 ± 0.002	2.36 ± 0.05
R	0.03 max	0.8 max

Table 2 – Style B specifications

B	0.732 $^{+0.008}_{-0.000}$	18.59 $^{+0.20}_{-0.00}$

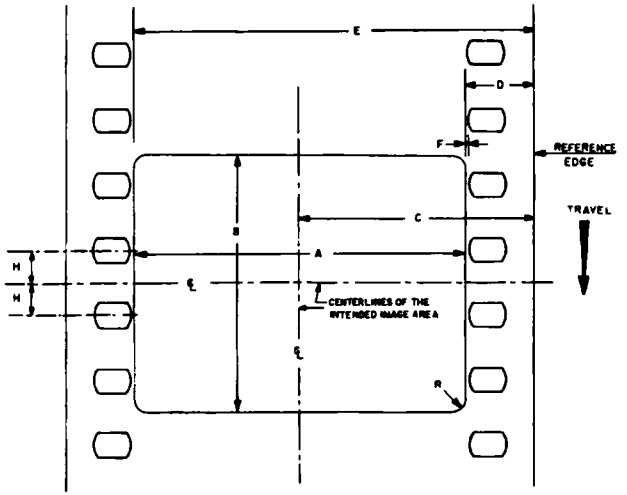


Figure 2 – Style C camera aperture image area

Table 3 – Style C specifications

Dimensions	Inches	Millimeters
A	0.981 nom	24.92 nom
B	0.735 ± 0.002	18.67 ± 0.05
C	0.688 ± 0.002	17.48 ± 0.05
D	0.198 max	5.03 max
E	1.179 min	29.95 min
F	0.009 nom	0.23 nom
H	0.093 ± 0.002	2.36 ± 0.05
R	0.03 max	0.8 max

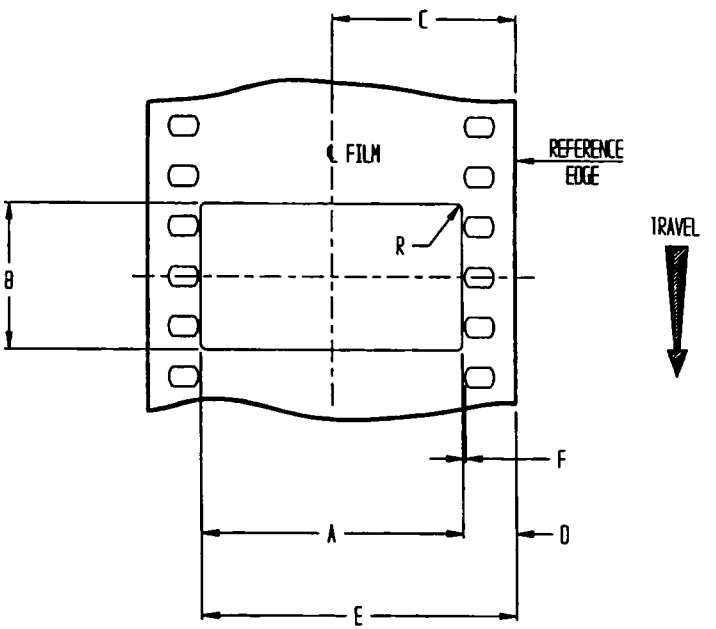


Figure 3 – Style D camera aperture image area

Table 4 – Style D specifications

Dimensions	Inches	Millimeters
A	0.981 nom	24.92 nom
B	0.546 ± 0.002	13.87 ± 0.05
C	0.688 ± 0.002	17.48 ± 0.05
D	0.198 max	5.03 max
E	1.179 min	29.95 min
F	0.009 nom	0.23 nom
R	0.020 max	0.51 max

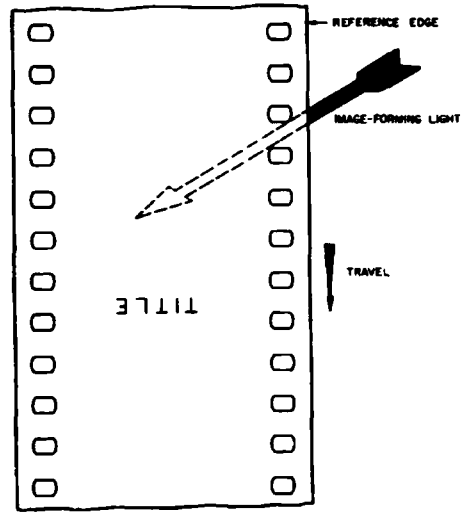


Figure 4 – Film viewed from inside camera looking toward camera lens

Annex A (informative)
Bibliography

ANSI/SMPTE 93-1998, Motion-Picture Film (35-mm) — Perforated BH

PROPOSED SMPTE STANDARD

SMPTE 254
Revision of
ANSI/SMPTE 254-1992

for Motion-Picture Film (35-mm)—

Manufacturer-Printed Latent Image Identification Information

1 Scope

1.1 This standard specifies the position and dimensions of machine-readable identification numbers. These numbers are intended to be a machine-readable version of the latent image key number. This standard also specifies the encoding format to be used for these machine-readable numbers, as well as the area scanned and the spectral characteristics of the scanner.

1.2 This standard also specifies the position, dimensions, and content of human-readable identification (key) numbers for use on 35-mm motion-picture films intended for original photography or intermediate printing which also include the machine-readable key number described in 1.1. These numbers normally will be exposed onto the film at the time of manufacture.

1.3 This standard further specifies an area that may be used for optional manufacturer-specific film-type identification information.

1.4 This standard also specifies an area on the film which is not to be exposed by the film manufacturer, thus leaving it available for customer data recording.

1.5 Finally, this standard specifies an optional frameline index mark.

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/AIM BC4-1995, Uniform Symbology Specification — Code 128

ANSI/SMPTE 93-1998, Motion-Picture Film (35-mm) — Perforated BH

3 Definition

3.1 key number: A number, sometimes referred to as an edge number or footage number, that is printed with ink or exposed onto the film at the time of manufacture. The numbers are placed at regular intervals, typically one foot. For the purposes of this standard, the key numbers are latent-image exposed.

4 General format

4.1 Format

The general format of the latent-image identification information shall be as shown in figure 1.

4.2 Use of the other edge

No latent information shall be placed along the upper edge of the film, as shown in figure 1. This area is reserved for data recording at the time of photography.

4.3 Film

This identification information is intended to be printed onto film cut and perforated in accordance with ANSI/SMPTE 93.

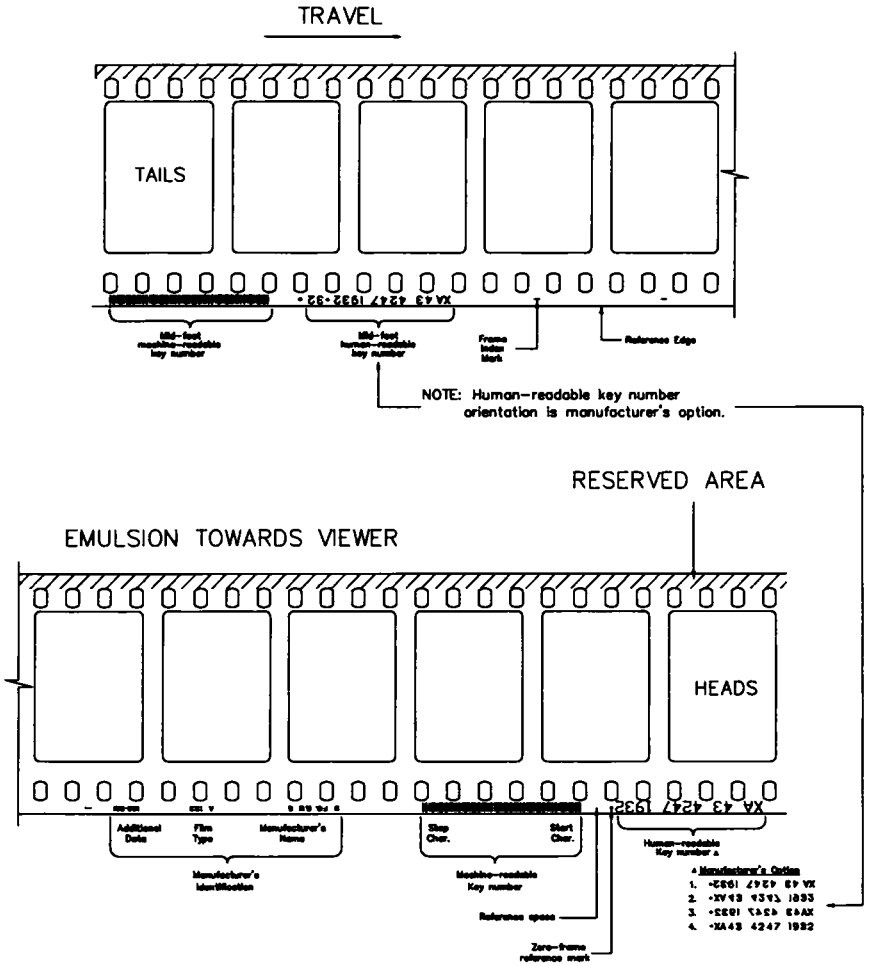


Figure 1 – General format

5 Human-readable key numbers

5.1 Key number

An incrementing, human-readable key number shall be printed onto the film at the time of manufacture. The film shall be supplied to the user with the lowest number at the outside of the roll.

5.2 Dimensions

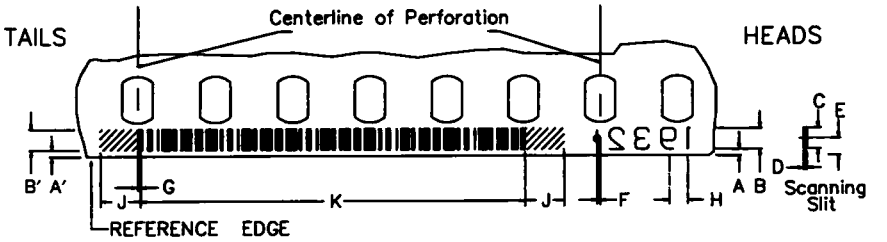
The height and width of the human-readable key numbers shall be as specified in figure 2 and table 1.

5.3 Reference mark

A zero frame reference mark shall be printed adjacent to the digit of the human-readable key number that is closest to the tail of the film as shown in figure 1. The zero frame reference mark shall be a filled circle with a diameter of approximately 0.025 in to 0.030 in (0.64 mm to 0.76 mm).

5.4 Alignment with respect to perforations

The numbers shall be printed so that the centerline of the zero frame reference mark is aligned with the centerline of a perforation, within the tolerance shown in table 1.



NOTE – This drawing shows emulsion towards the viewer. Normal film travel is from left to right.

Figure 2 – Position and dimensions

Table 1 – Specifications

	Dimensions	Inches	Millimeters
A	Edge of film to bottom of characters	0.009 ± 0.005	0.23 ± 0.13
A'	Edge of film to bottom of bars	0.009 + 0.005 − 0.009	0.23 + 0.13 − 0.23
B	Height of characters	0.060 ± 0.004	1.52 ± 0.10
B'	Height of bars	0.060 + 0.010 − 0.004	1.52 + 0.25 − 0.10
C	Scanning slit length	0.038 max	0.97 max
D	Scanning slit width	0.005 max	0.13 max
E	Edge of film to centerline of scanning slit	0.035 ± 0.002	0.89 ± 0.05
F	Zero frame reference mark displacement	0.00 ± 0.04	0.0 ± 1.0
G	Bar code displacement	0.00 ± 0.04	0.0 ± 1.0
H	Character-to-character spacing	0.060 nom	1.52 nom
J	Quiet zone (no print area)	0.100 min	2.54 min
K	Length of bar code	0.9225 ± 0.0400	23.432 ± 1.016

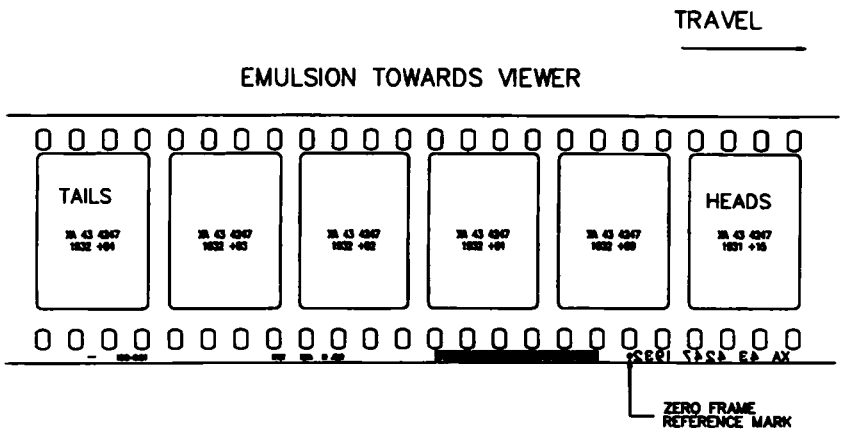


Figure 3 – Alignment of zero frame reference mark

5.4.1 This alignment is intended to facilitate frame identification with a minimum of confusion, even though the picture frame may have one of several positions relative to the key number. The following rule shall be applied to frame identification:

The frame immediately above the zero frame reference mark is the one referenced by that key number. Other frames are specified by an offset which is written as an additional digit(s) separated from the key number by a plus sign. Figure 3 shows an example of this rule.

5.5 Repeat frequency

The spacing from one key number to the next shall be 64 perforations.

5.6 Format and orientation

5.6.1 Number and grouping of digits

The human-readable key number shall consist of 2 alphabetic characters and 10 digits. This alphanumeric code shall be separated into groups of 2 characters and 2, 4, and 4 digits, which in turn shall be separated by spaces (see figure 1). For the 10 digits, only the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 shall be used, and they shall be in normal counting sequence. It is recommended, although not required, that the ten thousandths place not be allowed to increment within a single roll of film.

5.6.2 Orientation

The number may be placed in one of several orientations at the discretion of the film manufacturer. When the original negative film is held with the emulsion toward the viewer and the head toward the right, the numbers may be in any one of the following orientations:

- Right side up, reading from head to tail
- Upside down, reading from head to tail
- Right side up, reading from tail to head
- Upside down, reading from tail to head

In all cases, regardless of the orientation, the dot is to the left (closer to the tail) and adjacent to the trailing (closest to the tail) character, as shown in figure 1. The key number shall precede the machine-readable key number; i.e., the human-readable key number shall be closer to the head of the roll.

5.6.3 Contents of the alphabetic characters

The first two characters of the key number identify the manufacturer and film type. The character set used shall be the normal upper-case letters A through Z. The first character shall identify the film manufacturer according to table 2. Other letters are reserved for future assignment by the SMPTE.

The second character shall be a film-type identifier. The character is chosen at the discretion of the film manufacturer.

Table 2 – Manufacturer alphabetic code

Manufacturer	Code
Agfa-Gevaert N.V.	A
Eastman Kodak Company	K
Fuji Photo Film Company	F
Ilford Limited	I
Other or nondesignated	(nothing)

6 Machine-readable key numbers

6.1 The machine-readable key numbers are intended to be a machine-readable version of the immediately adjacent human-readable key numbers.

6.2 Dimensions

6.2.1 The dimensions and lateral location of the machine-readable identification numbers shall be as specified in figure 2 and table 1.

6.2.2 The nominal width of the narrowest bar or space shall be 0.0075 in (0.190 mm). All other bars and spaces are to be integer multiples of the narrowest bar as specified in ANSI/AIM BC4. The total bar code message, which consists of 123 elements (not counting the quiet zones), shall have a width of 0.9225 in ± 0.0400 in (23.432 mm ± 1.016 mm).

For measurement purposes, the width of the bar is the distance between two bar edges. A bar edge is defined as the point where the transmittance is halfway between the maximum adjacent space transmittance and the minimum adjacent bar transmittance.

6.2.3 The message shall be printed so that the trailing edge of the last character (the stop character) shall be longitudinally aligned with the centerline of a perforation, that perforation being six perforations displaced from the perforation specified in 5.4, within the tolerance shown in figure 2.

6.2.4 The recording shall be made so that the azimuth of the record is at an angle of $90^{\circ} \pm 1^{\circ}$ to the reference edge of the film.

6.2.5 The lateral location, length, and width of the scanned area shall be as specified in figure 2 and table 1.

6.2.6 The reproducing (scanning) slit image shall be positioned at an angle of $90^{\circ} \pm 1^{\circ}$ to the reference edge of the film.

6.3 Repeat frequency

The machine-readable message shall be immediately adjacent to the human-readable key number and shall repeat at the same frequency.

6.4 Format

6.4.1 The machine-readable numbers shall consist of a series of bars and spaces of varying width that meet the bar code specification of ANSI/AIM BC4. Code subset C of this specification, which allows double density numeric digits, shall be used.

6.4.2 The data portion of the message shall be of fixed length and shall consist of 16 digits. Since code subset C encodes two digits per bar code character, this corresponds to 8 bar code characters. In addition, quiet zones, a start character (for code C), a checksum character, and a stop character shall be recorded. Including the start and stop characters, the entire message shall be 11 bar code characters.

6.4.3 The start character shall be nearest the head end of the film and the stop character shall be nearest the tail end of the film, regardless of the orientation of the human-readable characters; i.e., when the film is transported in the normal direction of travel past a fixed scanning position, the start character shall be read first.

6.4.4 The 8 bar code characters (16 data digits) are defined as follows:

6.4.4.1 The first character shall be encoded with a two-digit manufacturer code. These codes

shall be assigned as per table 3. Other codes are reserved for future assignment by the SMPTE.

Table 3 – Manufacturer codes

Manufacturer	Code
Agfa-Gevaert N.V.	01
Eastman Kodak Company	02
Fuji Photo Film Company	03
Ilford Limited	04
Other or nondesignated	00

6.4.4.2 The second character shall be a two-digit product specification code assigned at the discretion of the manufacturer. If the manufacturer does not wish to identify the product, the digits 00 shall be encoded.

6.4.4.3 The third through seventh characters shall be encoded with the 10 characters of key number information. These shall be the same information as in the immediately adjacent human-readable key number. The third character shall contain the most significant digits and the seventh character shall contain the least significant digits.

6.4.4.4 The eighth character shall be encoded with a two-digit offset in perforations from the preceding key number. This offset shall be 00 for the key numbers described above and 32 for the mid-foot key number described in 6.5.

6.4.5 The checksum is equal to the modulo 103 sum of the value of the start character and the weighted values of the eight data characters as specified in ANSI/AIM BC4.

6.5 Mid-foot key number

A mid-foot key number, as shown in figure 1, shall be placed halfway between each key number. The mid-foot key number shall have two parts: a mid-foot human-readable key number and a mid-foot machine-readable key number.

6.5.1 Mid-foot human-readable key number

The mid-foot human-readable key number shall consist of a zero-frame reference mark, an adjacent key number that is to be nearer the head end of the roll, and an offset in perforations which is to be 32 always.

The mid-foot key number shall thus have the format "XA 12 3456 7890 + 32." The mid-foot key number shall have the same orientation as the standard human-readable key number (see 5.6.2). All characters are to be small in size (approximately ½ size).

6.5.2 Mid-foot machine-readable key number

The mid-foot machine-readable key number shall consist of a bar coded message in exactly the same format as specified in 6.4. The offset-in-perforations digits will be set to 32.

7 Optional-frame index mark

7.1 An optional-frame index mark may be placed on the film in the form of a hyphen placed every four perforations except where it would overlay some other edge information, as shown in figure 1. The index marks shall be aligned midway between the perforations coincident with a possible position of the frameline.

7.1.1 A "reference space" is defined as being the space between the perforation above the zero frame reference mark and the perforation immediately to its left (toward the tail of the film).

7.1.2 The frame index marks shall be printed at 4-perforation intervals and shall be aligned longitudinally such that, were it to be printed, a mark would fall on the reference space.

8 Optional manufacturer-identification information

8.1 Additional manufacturer information may be printed along the edge of the film as shown in figure 1. This information is to be printed in small size characters (approximately 1/2 size).

8.2 Recommended minimum information

8.2.1 Manufacturer's name

The first piece of information shall be the name of the manufacturer. This, in general, shall be an abbreviated name, rather than the full company name.

8.2.2 Film type

The second piece of information, separated from the manufacturer's name by a space, shall be the film type. Its form, whether numeric, alphabetic, or mixed, shall be at the discretion of the manufacturer.

8.2.3 Optional information

The manufacturer may place additional information following the film type, if so desired. This may include batch numbers, for example. It is recommended that the length of this information be limited so the entire string of manufacturer-identification information is no more than 12 perforations long.

8.3 Repeat distance

The repeat distance of this information is at the discretion of the manufacturer, but the repeat distance shall be a multiple of 64 perforations, and a distance of no more than 192 perforations is recommended.

9 Bar code scanner and density specifications

9.1 Scanner spectral sensitivity

The peak or maximum response of the combination of the light source, filters, and photo receptor shall be at 680 nm ± 60 nm. In addition, the lower wavelength at which the response is down to 10% of peak response shall be equal to or greater than 600 nm and the upper wavelength at which the response is down to 10% of peak response shall be equal to or less than 760 nm. Notwithstanding these specifications, the spectral response of the scanning system must be designed for good differentiation between bars and spaces with existing conventional color and black-and-white films.

9.2 Density of machine-readable messages

The edge print applied by the manufacturer shall be exposed so that, when the film is processed through the manufacturer's recommended process, the bars have a status M red density of $D_{min} + 0.75 \pm 0.25$ and the spaces have a nominal density no more than 0.05 greater than the minimum density of the film.

9.3 Density of printed machine-readable messages

When the machine-readable message is printed onto a conventional color print film, it is recommended that the edge lights on the printer be controlled to produce a status A red density of the bars of 2.00 ± 0.30.

When the machine-readable message is printed onto a conventional color intermediate film, it is recommended that the edge lights on the printer be controlled to produce a status M red density of the bars of $D_{min} + 0.75 \pm 0.10$.

Annex A (informative)
Additional data

The orientation of the human-readable key numbers has been left to the manufacturer's discretion in this standard. However, it is suggested that in the next review of this standard, an effort be made to seek agreement on a single orientation.

PROPOSED SMPTE STANDARD

for Television —

Ancillary Data Packet and Space Formatting

SMPTE 291M
Revision of
ANSI/SMPTE 291M-1996

1 Scope

1.1 This standard specifies the basic formatting structure of the ancillary data space in the digital video data stream in the form of 10-bit words. Application of this standard includes 525-line, 625-line, component or composite, and high-definition digital television interfaces which provide 8- or 10-bit data ancillary data space.

1.2 Space available for ancillary data packets is defined in the document specifying the connecting interface.

1.3 Ancillary data packet formatting for a specific application may be according to a SMPTE standard or recommended practice. In such a case, the format is considered a registered format, which is identified by a registered data identification word.

2 Overview

2.1 The serial digital interface (ANSI/SMPTE 259M) and component parallel digital interface (ANSI/SMPTE 125M) are capable of passing 10-bit words (Data 9 – Data 0), but some of the existing equipment is only capable of processing 8-bit data words (carried on the interface as Data 9 – Data 2). The passage of 10-bit words through such equipment will therefore result in truncation of the last two LSBs (Data 1 and Data 0) of the ancillary data word. Upon serializing an 8-bit word (Data 9 – Data 2) for a 10-bit word transmission, the two LSBs (Data 1 and Data 0) are usually replaced by zeros in such equipment. For these reasons, the original ancillary data would be corrupted to 6 bits and an 8-bit application without restrictions would not be possible. By reserving specific data identification, 8-bit words having the two LSBs set to zero for such an 8-bit data application, operation through a 10-bit interface is possible. These DID words therefore will not be corrupted either by truncation or by setting the two LSBs to zero.

2.2 Ancillary data packets are divided into type 1 and type 2, where type 1 uses a single ID word and type 2 uses two ID words. Using this method allows for a wider range of identification values within the limited ID word space. In addition, a total of 189 data identification values are reserved for 8-bit applications, whereas up to approximately 29,000 values are provided for 10-bit applications.

2.3 The basic formats of the ancillary data packets are similar for both type 1 and type 2, but they differ in the use of a data block number. The definitions of the individual parts that make up the ancillary data packet, such as ancillary data flags (ADF), data identification (DID), secondary data identification (SDID), data block numbers (DBN), data count (DC), data validity checksum (CS), together with the restrictions on used data, are contained in this standard.

3 Ancillary data packet format

3.1 Ancillary data packet

3.1.1 The two types of ancillary data packets in a data stream may be formatted into type 1 and type 2, which depend upon the data identification word. These two types are shown in figures 1a and 1b.

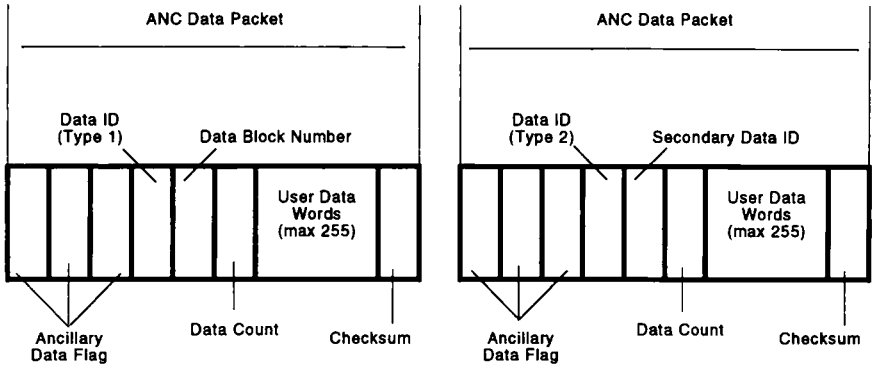


Figure 1 – Ancillary data types (component data packets shown)

3.1.2 The two types of data identification in the ancillary data packet format are specified below:

Type 1: Uses a single-word data ID; defined as data ID (DID) which is followed by data block number (DBN) and data count (DC).

Type 2: Uses a two-word data identification; defined as a combination of data ID (DID) and secondary data ID (SDID) which is followed by data count (DC).

3.1.3 Ancillary data is defined as 10-bit words. This is required by the structure of the signal format and its interface.

3.1.4 Ancillary data packets of type 1 are comprised of:

a) an ancillary data flag (ADF) which marks the beginning of the ancillary packet;

b) a data identification word (DID) which defines the use of the user data format carried in the ancillary packet's user data words;

c) a data block number (DBN) word for type 1 only which distinguishes successive ancillary packets with common data ID;

d) a data count number word (DC) which defines the quantity of user data words in the ancillary packet;

e) the user data words (UDW) of up to 255 words in each ancillary packet where the user data format is defined in a specific application document;

f) a checksum word (CS).

3.1.5 Ancillary data packets of type 2 are comprised of the same elements as type 1 ancillary packets, except the data block number (DBN) is replaced by a secondary data identification word (SDID).

3.1.6 The length of the ancillary data flag (ADF) is specified in the document defining the interconnecting interface. Unless otherwise noted in this standard, there are three words for component data and one word for composite data.

3.1.7 Either of the two data identification types may be used with component or composite ancillary data packet formatting while maintaining the same meaning.

3.2 Component ancillary data packet format

3.2.1 The format of the component ancillary data packet is shown in figure 2.

3.2.2 The ancillary data flag for the component ancillary data packet format is:

000_h $3FF_h$ $3FF_h$

NOTE – To maximize compatibility between 8- and 10-bit equipment, equipment designers are advised to process data values of 000_h – 003_h identically. Data values of $3FC_h$ – $3FF_h$ should be processed identically as well. References in this standard to specific data values in either of those two ranges should apply to all data values within the same range.

3.2.3 Definitions of other nonuser data are specified in 3.4 through 3.11.

3.3 Composite ancillary data packet format

3.3.1 The format of the composite ancillary data packet is shown in figure 3.

3.3.2 The ancillary data flag for composite ancillary data packet format is $3FC_h$.

NOTE – Equipment designers should be aware that the value of composite ancillary data flag $3FC_h$ is processed as referenced in the note of 3.2.2.

3.3.3 Definitions of other nonuser data are specified in 3.4 through 3.11.

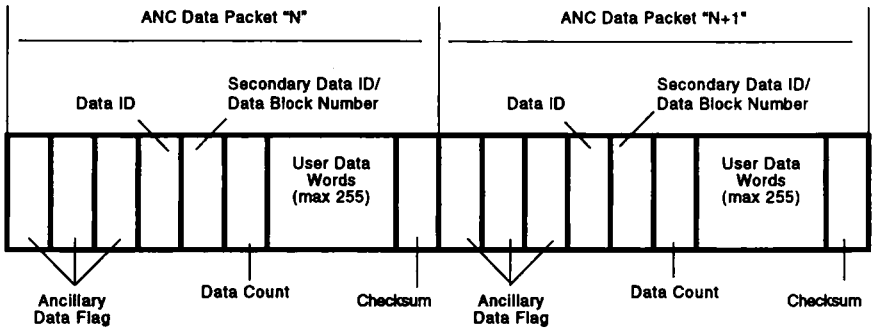


Figure 2 – Component ancillary data packet format

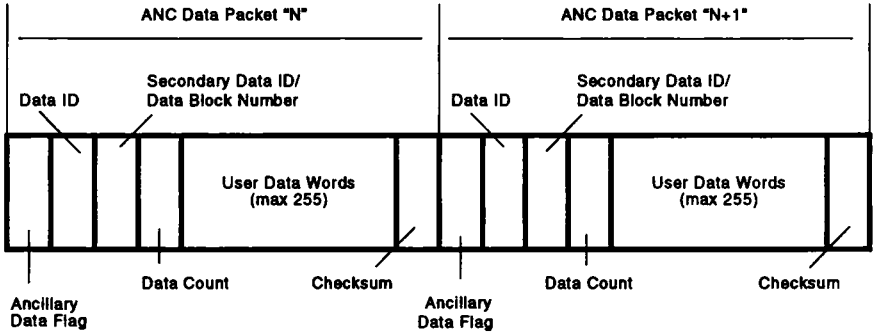


Figure 3 – Composite ancillary data packet format

3.4 Data identification word (DID)

3.4.1 The data ID word (DID) shall consist of 10 bits, an 8-bit identification word plus even parity and its inverse as shown:

bits b7 (MSB) through b0 (LSB) identification 8-bit word (00_h-FF_h)

bit b8 is even parity for b7 through b0

bit b9 = not b8

3.4.2 Data identification words are divided into type 1 and type 2 categories as shown in figures 4a and 4b. In general, the setting of bit b7=1 indicates type 1 data identification, and b7=0 indicates type 2 data identification. The exception to this categorization is word 00_h which identifies an undefined format.

3.4.3 Data identification words shown as internationally registered (see annex A) are restricted to values in the range shown and are assigned by standards-setting organizations. Ancillary data in this specific class are of general interest; therefore, strict compliance with this standard ensures compatibility between such equipment.

3.4.4 Data identification words shown as user application are not registered and are restricted to values in the range shown. They may be assigned by the user and/or by the manufacturer of the specific equipment.

NOTE – Equipment designers are encouraged to make such equipment user configurable to minimize contention problems.

3.4.5 Data identification words shown as reserved for 8-bit applications are restricted to three values in the range shown. Out of the values 04h – 0Fh reserved for 8-bit applications, the only valid values are 04h, 08h, 0Ch. Other values in the reserved range would be truncated to these three values.

3.4.6 Data identification words shown as reserved are reserved for future use.

3.5 Secondary data identification word (SDID) (Type 2 data only)

3.5.1 The secondary data ID word (SDID) shall consist of 10 bits, an 8-bit identification plus parity and its inverse as shown:

bits b7 (MSB) through b0 (LSB) identification bit word (00_h - FF_h)

bit b8 is even parity for b7 through b0

bit b9 = not b8

3.5.2 Secondary data identification word (SDID) which is part of the type 2 data identification format may be in the range from 01_h through FF_h as shown in figure 4b for a 10-bit system. Value 00_h is reserved for an undefined format.

3.5.3 When the data identification word (DID) is in the range of 01_h through $0F_h$, reserved for 8-bit applications, the SDID is restricted to the 63 values (excluding 00_h) indicated below:

$x0_h$, $x4_h$, $x8_h$, xC_h

where x may be any value in the range 0_h through F_h.

3.6 Data identification for an undefined format

3.6.1 The data identification word value of 00_h, for an undefined format that is a format not registered with SMPTE, is provided for compatibility with some equipment and should not be used in new designs. The undefined format data ID word, including the even parity bit b8=0 and its inverted form bit b9=1, shall be equal to 200_h.

3.7 Data identification word for deletion of an ancillary data packet

3.7.1 An ancillary data packet with a DID word equal to 80_h may be deleted by any equipment during a subsequent processing cycle (see annex B); however, the occupied ancillary space must remain contiguous as defined in 4.3.

NOTE – In an 8-bit system, designers of equipment should be aware that ancillary data with a DID word in the range of 80_h – 83_h must be considered as marked for deletion.

Data type	Data value	Data assignment
Type 2 (2-word ID)	00_h	Undefined format
	01_h – 03_h	Reserved (see 3.4.5)
	04_h – $0F_h$	Reserved for 8-bit applications (see 3.4.5)
	10_h – $3F_h$	Reserved
	40_h – $4F_h$	Internationally registered
	50_h – $5F_h$	User application
	60_h – $7F_h$	Internationally registered
Type 1 (1-word ID)	80_h	Ancillary packet marked for deletion
	81_h – 83_h	Reserved (see 3.7.1)
	84_h	Optional ancillary packet data end marker
	85_h – 87_h	Reserved (see 3.8.2)
	88_h	Optional ancillary packet data start marker
	89_h – $9F_h$	Reserved (see 3.8.1)
	$A0_h$ – BF_h	Internationally registered
	$C0_h$ – CF_h	User application
	$D0_h$ – DF_h	Internationally registered
	$E0_h$ – FF_h	Internationally registered

(a) DID

Data type	Data value	Data assignment
Type 2	00_h	Undefined format
	01_h – FF_h	None

(b) SDID

Figure 4 – Data identification word assignment

3.8 Data identification word for a start marker packet and an end marker packet

3.8.1 An ancillary data packet with a DID equal to 88_h identifies a start marker packet in a given ancillary space. Data count for this packet is set to zero (0) as per 3.10.1. The length of the start marker packet is constant and equal to four words excluding the ADF. Use of this packet is optional.

NOTE – Equipment designers are encouraged to include this feature in new equipment, especially equipment dedicated to deletion of ancillary data. In an 8-bit system, designers should be aware that ancillary data with a DID range of 88_h – $9F_h$ must be considered as data start marker packets.

3.8.2 An ancillary data packet with a DID equal to 84_h identifies an end marker packet in a given ancillary space. Data count for this packet is set to zero (0) as per 3.10.1. The length of the end marker packet is constant and equal to four words excluding the ADF. Use of this packet is optional.

NOTE – Equipment designers are encouraged to include this feature in new equipment, especially equipment dedicated to deletion of ancillary data. In an 8-bit system, designers should be aware that ancillary data with a DID range of 84_h – 87_h must be considered as data end marker packets.

3.9 Data block number (DBN) (Type 1 data only)

3.9.1 The data block number shall be incremented by one for each consecutive related type 1 data packet sharing a common DID and requiring a continuity indication.

3.9.2 The DBN word in the type 1 data identification system consists of 8 bits and shall increment from 1 through 255 where:

bits b7 (MSB) through b0 (LSB) are the data block (packet) number word

bit b8 is even parity for b7 through b0

bit b9 = not b8

NOTE – If the number of packets in a message is longer than 255 packets, then the DBN shall be cycled again continuously from 1 through 255 with subsequent groups of packets. Equipment designers are encouraged to include additional information about the message length in the user data words.

3.9.3 When bits b7 through b0 of the data block number (DBN) are set to zero, the DBN is inactive and shall not be used by the receiver to indicate data continuity.

3.10 Data count (DC)

3.10.1 The data count (DC) word represents the number of user data words (UDW) to follow from a minimum of 0 up to a maximum of 255 words. In 10-bit applications, it consists of 10 bits where:

bits b7 (MSB) through b0 (LSB) are the data count number

bit b8 is even parity for b7 through b0

bit b9 = not b8

NOTE – Ancillary data packets with a data count value of 0 are possible, but denote packets which are either empty, and therefore can be ignored, or end marker packets.

3.11 User data words (UDW)

3.11.1 User data words are used to convey information as identified by the DID word and must not include protected codes as defined in clause 5.

3.11.2 The maximum number of user data words in a single packet is 255.

3.11.3 In 10-bit applications, user data words shall consist of 10-bit words:

bit b9 (MSB) through b0 (LSB)

3.12 Checksum word (CS)

3.12.1 The checksum word (CS) is used to determine the validity of the ancillary data packet from the data identification (DID) word through the user data words (UDW). It consists of 10 bits: a 9-bit value and bit b9 as defined below:

bits b8 (MSB) through b0 (LSB) are the checksum value

bit b9 = not b8

3.12.2 In 10-bit applications, the checksum value is equal to the nine least significant bits of the sum of the nine least significant bits of the data identification (DID), the data block number (DBN), or the secondary data identification (SDID), the data count (DC), and all user data words (UDW) in the packet.

3.12.3 Prior to the start of the checksum count cycle, all bits shall be preset to zero and any end carry resulting from the checksum count cycle shall be ignored.

NOTE – Equipment designers are encouraged to include in a specific user application an additional data protection algorithm due to the limited capability of the checksum system. The protection algorithm should be included in the user data area.

4 Ancillary data space formatting

4.1 Component data space

Multiple ancillary data packets may be located in any area defined as available for ancillary data. They follow immediately after the EAV or SAV denoting the start of that space and are contiguous with each other.

4.2 Composite data space

Multiple ancillary data packets may be located in any area defined as available for ancillary data including all broad pulses. They follow immediately after the TRS-ID or start of the broad pulse denoting the start of that space and are contiguous with each other.

4.3 Presence, positioning and deletion of ancillary packets in available space

Ancillary data packets must be wholly contained within the ancillary space in which they are inserted.

4.3.1 The contiguity of ancillary packets in an ancillary space is maintained only within its nearest interval boundary and the packets in this interval are concatenated in time following its boundary.

NOTE – For example, if some ancillary packets are marked for deletion with DID=80_h from within a specific horizontal blanking interval or a vertical blanking interval (vertical ancillary space), then contiguity of ancillary packets in these intervals is still maintained, but contiguity of packets between different intervals (horizontal or vertical) is not required.

4.3.2 Ancillary data packets may be marked for deletion by replacing the data ID (DID) of the ancillary packet with a DID equal to 80_h and reinserting a new checksum for this packet. This will mark the ancillary packet as invalid while maintaining contiguity of data in the ancillary space. The rest of the marked ancillary packet remains unchanged.

4.3.3 It is recommended that ancillary data packets not be transmitted within an ancillary space following a normal vertical interval switching point as defined in SMPTE RP 168 for a time period covering the remainder of the switched line and during the first horizontal ancillary data space interval subsequent to the switched line.

NOTE – Receiving equipment should process data located in any ancillary data space as some existing equipment already in operation may not conform to this recommendation on the switching point.

4.3.4 Optional ancillary data packets with a DID equal to 84_h may be used as end marker packets of a contiguous ancillary space and they are the last packet in a given ancillary space. Upon reinsertion of new ancillary data, these packets are overwritten by the new data. The end marker packet will not be inserted in a given ancillary interval if the remaining ancillary space is smaller than the space required.

4.4 Exemptions from ancillary data space formatting

4.4.1 Error detection and handling (EDH) space

Error detection and handling data, as defined in SMPTE RP 165, are located within a fixed part of the ancillary data space and therefore are not overwritten or appended to other data packets or subject to the requirements of 4.3.1.

4.4.2 Serial data transmission over ANSI/SMPTE 259M (SDI)

Ancillary data packets representing header packets for serial data transmission over SDI are exempt from rules set in 4.1 and 4.2. These header packets are always located immediatly after EAV in HANC component data space or TRS-ID in ANC composite data space.

5 Protected codes

5.1 Ancillary data environment

Except for the ancillary data flag (three words in component and one word in composite systems), certain codes are protected and not permitted in other parts of the ancillary data packet format.

5.1.1 Ten-bit word values 000_h, 001_h, 002_h, 003_h and $3FC_h$, $3FD_h$, $3FE_h$, $3FF_h$ are not permitted.

Annex A (informative)
Data identification word assignments for registered DIDs

Data identification word assignments are given in tables A.1–A.3.

Table A.1 – Data type 1

10-bit DID	8-bit ID	Function	10-bit DID	8-bit ID	Function
200	00	Undefined format			
180	80	Marked packets for deletion			
260	60	Ancillary time code			
284	84	Data end marker packet			
288	88	Data start marker packet			
1E0	E0	299M, HDTV, control, Group 4	2F0	F0	METADATA packets
2E1	E1	299M, HDTV, control, Group 3	1F1	F1	
2E2	E2	299M, HDTV, control, Group 2	1F2	F2	
1E3	E3	299M, HDTV, control, Group 1	2F3	F3	
2E4	E4	299M, HDTV, audio, Group 4	1F4	F4	Error detection (EDH)
1E5	E5	299M, HDTV, audio, Group 3	2F5	F5	Time code
1E6	E6	299M, HDTV, audio, Group 2	2F6	F6	
2E7	E7	299M, HDTV, audio, Group 1	1F7	F7	
2E8	E8		1F8	F8	AES extended packet, Group 4
1E9	E9		2F9	F9	AES audio data, Group 4
1EA	EA		2FA	FA	AES extended packet, Group 3
2EB	EB		1FB	FB	AES audio data, Group 3
1EC	EC	AES control packet, Group 4	2FC	FC	AES extended packet, Group 2
2ED	ED	AES control packet, Group 3	1FD	FD	AES audio data, Group 2
2EE	EE	AES control packet, Group 2	1FE	FE	AES extended packet, Group 1
1EF	EF	AES control packet, Group 1	2FF	FF	AES audio data, Group 1

NOTES

1 Presently unassigned type 1 DID codes (in 8-bit ID format): 81_h through 83_h (reserved); 85_h through 87_h (reserved); 89_h through $9F_h$ (reserved).

2 Metadata packets have DID set to $F0_h$. A document defining metadata formatting and its use is presently in development process.

Table A.2 – Data type 2

10-bit DID	8-bit ID	Function			Function
	04	8-bit applications			
	08	8-bit applications			
	0C	8-bit applications			
	60	RP 188 ancillary time code			
NOTE – Presently unassigned type 2 DID codes (in 8-bit ID format): 01_h through 03_h (reserved); 50_h through $5F_h$ (user applications); 10_h through $3F_h$ (reserved); 60_h through $7F_h$ (registered). 40_h through $4F_h$ (registered);					

Table A.3 – SDID identification words

10-bit DID	8-bit ID	Function	10-bit DID	8-bit ID	Function
200	00	Undefined format			
	x0	8-bit applications		x8	8-bit applications
	x4	8-bit applications		xC	8-bit applications
	60	RP 188, ancillary time code			
NOTE – Where x is in the range of 0_h through F_h, except 00_h is reserved for an undefined format. Presently unassigned type 2 SDID codes (in 8-bit ID format): All range from 01_h through $5F_h$, 61_h trhough FF_h, except $x0_h$, $x4_h$, $x8_h$, xC_h.					

Annex B (informative)
Ancillary data formats

Examples of ancillary data formats are shown in tables B.1 and B.2.

Table B.1 – Component data stream format

	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	Hex
ADF	0	0	0	0	0	0	0	0	0	0	000_h
ADF	1	1	1	1	1	1	1	1	1	1	$3FF_h$
ADF	1	1	1	1	1	1	1	1	1	1	$3FF_h$
DID	p/	p	b7	b6	b5	b4	b3	b2	b1	b0	
DBN/SDID	p/	p	b7	b6	b5	b4	b3	b2	b1	b0	
DC	p/	p	b7	b6	b5	b4	b3	b2	b1	b0	
UDW (0)	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
					I						
UDW (255)	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
CS	b8/	Checksum									

Table B.2 – Composite data stream format

	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	Hex
ADF	1	1	1	1	1	1	1	1	0	0	$3FC_h$
DID	p/	p	b7	b6	b5	b4	b3	b2	b1	b0	
DBN/SDID	p/	p	b7	b6	b5	b4	b3	b2	b1	b0	
DC	p/	p	b7	b6	b5	b4	b3	b2	b1	b0	
UDW (0)	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
					I						
UDW (255)	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
CS	b8/	Checksum									

NOTES

1 In type 2 (8-bit applications), bits b0 and b1 of DID and SDID words are set to zero

ADF: Ancillary data flag
DID: Data identification word
DBN: Data block number
SDID: Secondary data identification word
DC: Data count
UDW: User data word

2 See ANSI/SMPTE 272M and SMPTE RP 165.

Annex C (informative)
Component ancillary data space

An example of a component ancillary data space is given in table C.1.

Table C.1 – Component ancillary data space

	Available ancillary space →											
	Contiguous ancillary data →										Unused ancillary space →	
ADF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	xxx	xxx
DID	2FF	1FD	2FC	180	2F5	260	2C0	140	104	284	xxx	xxx
DBN/ SDID	101	101	101	xxx	200	260	xxx	xxx	110	00	xxx	xxx
DC	230	224	206	xxx	108	110	xxx	xxx	xxx	00	xxx	xxx
UDW	48 words	36 words	6 words	xxx	8 words	16 words	xxx	xxx	xxx	none	xxx	xxx
Note	AES 20-bit audio packets Group 1 (Ch 1-4) 4 samples	AES 20-bit audio packets Group 2 (Ch 5-8) 3 samples	AES extended audio packets Group 2 (Ch 5-8) 3 samples	Marked for deletion	LTC time code	ATC ancillary time code	User defined	User defined	8-bit applica-tion	Data end marker packet		
Type	Type 1 data					Type 2	Type 1	Type 2 data		Type 1		

Reformatted ancillary space after deletion of marked packet

ADF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	000 3FF 3FF	xxx	xxx	xxx
DID	2FF	1FD	1FC	2F5	260	2C0	140	104	284	xxx	xxx	xxx
DBN/ SDID	101	101	101	200	260	xxx	xxx	110	00	xxx	xxx	xxx
DC	230	224	206	180	110	xxx	xxx	xxx	00	xxx	xxx	xxx
UDW	48 words	36 words	6 words	8 words	16 words	xxx	xxx	xxx	none			
Note	AES 20-bit audio packets Group 1 (Ch 1-4) 4 samples	AES 20-bit audio packets Group 2 (Ch 5-8) 3 samples	AES extended audio packets Group 2 (Ch 5-8) 3 samples	LTC time code	ATC ancillary time code	User defined	User defined	8-bit applica-tion	Data end marker packet		–	
Type	Type 1 data				Type 2	Type 1	Type 2		Type 1			
	← Boundary of ancillary space — Contiguous ancillary data → Boundary of ancillary space → Unused ancillary space											

NOTE – All values in the table are shown in hex; checksum word is omitted.

Annex D (informative)
Eight- and ten-bit considerations

D.1 Introduction

The parallel and serial digital video component interfaces described in ITU-R BT.656 are capable of passing 10-bit data words; however, some equipment remains in service which is capable of passing only 8-bit data words.

The passage of a 10-bit signal through such 8-bit equipment results in truncation and the loss of two LSBs. Although this can be tolerated for digital video data, it has the effect of destroying the ancillary data signal unless precautions are taken. The subsequent serializing of the truncated 8-bit signal for transmission through the 10-bit serial interface results in two additional bits — usually zeroes — being appended to the signal data bits (see figure D.1).

Similarly, data words originated in 8-bit form become extended to 10-bit form as a result of passage through a serial interface according to ITU-R BT.656.

Although the two additional bits are usually both zeroes, this cannot be guaranteed. Consequently, for detection of the timing reference signals (TRS) and ancillary data flags (ADF), data values in the ranges 00.0_h – $00.C_h$ and $FF.0_h$ – $FF.C_h$ should be processed identically as 00.0_h and $FF.C_h$, respectively.

D.2 Eight-bit compatibility

It is possible to design an ancillary data signal that is usable in both 8-bit and 10-bit systems, provided recognition is given to the effects of passage through 8- and 10-bit systems.

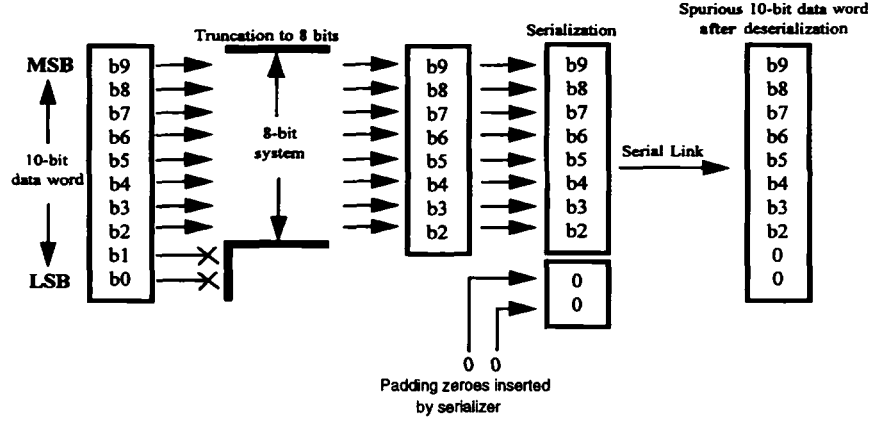


Figure D.1 – Corruption of a data word

D.2.1 Data identification

Ancillary data signals designed for 8-bit applications are type 2 signals and contain both DID and SDID data words.

DID words shown in table A.2 as reserved for 8-bit applications are restricted to three values in the range shown. Out of the values 04_h – $0F_h$ reserved for 8-bit applications, the only valid values are 04_h, 08_h, and $0C_h$. Other values in the reserved range would be truncated to these three values.

The two most-significant bits of the data words used for *SDID carry an even parity bit and is inverse*. Consequently, in 8-bit applications, only 6 bits are available in the SDID data words as shown in figure D.2. This results in 64 possible values, as indicated below:

$$x0_h, x4_h, x8_h, xC_h$$

where x may be any value in the range 0_h – F_h.

Setting aside the value 00h for the undefined format, the remaining 63 values in the SDID, combined with the 3 assigned values available in the DID for 8-bit applications, give a maximum of 189 different identification values.

D.2.2 Data count

When an ancillary data packet is intended to be used in, or is generated bt, an 8-bit application, bits b0 and b1 are either not present (8-bit interface) or are set to zero. Consequently, the DC consists of the following:

bit b7 (MSB) – b2 (LSB) are the 6 MSBs of the data count
bit b8 is the even parity parity bit for b7 – b2
bit 9 = not b8

Only 6 bits are available in the DC to specify the number of user data words in an 8-bit ancillary data signal. Consequently, if the maximum number of user data words in a packet is not to be reduced from 256 words to 64, then the *DC can be specified only in blocks of 4 words. For example*, a DC or 14 would indicate 56 data words and a DC of 15 would indicate 60 data words.

The number of user data words in an ancillary data packet for 8-bit applications is justified to an integer number of 4-word blocks by insertion of padding words if necessary.

D.2.3 User data words

It is a requirement that the protected values 00_h and FF_h do not appear in the user data words. The method used to achieve this is not part of this standard, but should be specified for each application. As examples, one method is the use of 2 bits plus a single odd parity bit in each word as for DID, SDID, DBN, and DC. A second method is the use of 7 data bits, while a third would be to restrict the coding range to exclude the protected values as is done for video data.

D.2.4 Checksum

In 10-bit applications, the checksum value is equal to the 9 least significant bits of the sum of the 9 least significant bits of the DID, the DBN or the SDID, the DC, and all UDWs in *the packet*.

In 8-bit applications, where the two LSBs of every 10-bit word in the packet are set to zeroes, the CS word is calculated in the same way as for 10-bit applications. The LSBs produce a zero sum themselves and hence produce no carry bit to affect the checksum.

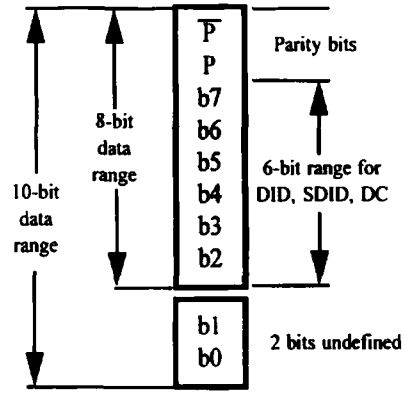


Figure D.2 – Coding range for 8-bit DID, SDID, and DC

Annex E (informative)
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