

SMPTE STANDARD

Payload Identification Codes
For Serial Digital Interfaces



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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Operations Manual.

SMPTE ST 352 was prepared by Technology Committee 32NF.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this document.

This standard defines the structure of the 4-byte payload identifier that is used to describe aspects of the payload carried on the SMPTE Serial Digital Interface (SDI). The payload identifier is transmitted as a SMPTE ST 291-1 ancillary data packet.

1 Scope

This standard defines the specification of a 4-byte payload identifier that describes aspects of the payload carried on the SMPTE Serial Digital Interface (SDI) such as: the digital interface standard; picture rate; sampling structure; aspect ratio; colorimetry; bit depth and channel or link assignment. Other application specific aspects of the payload such as audio channel usage, may optionally be described in application specific documents that reference SMPTE ST 352.

The payload identifier is applicable to all serial digital interfaces and all payloads that produce a directly viewable image on a display device. Furthermore, the viewable image must be a recognizable representation of the source image content.

The payload identifier is mandatory for some reference standards and optional in other reference standards. Refer to the applicable reference standards for further information on mandatory or optional usage of the SMPTE ST 352 payload identifier.

The standard defines how the payload identifier is placed into a 10-bit ancillary data packet according to SMPTE ST 291-1.

It also specifies the repetition rate of the ancillary data packet, and provides the preferred horizontal and vertical location for the placement of the packet in different digital interfaces.

The standard defines values for some of the bit fields of each byte of the 4-byte payload identifier, although the values for other bit fields can have custom definitions.

The standard also defines the Payload Identification Code assignment process and associated on-line register for Byte 1 Values. See Annex A for details on how to register new values.

Annex B and Annex C define the assigned Payload Identification codes and byte 2, 3 and 4 values for legacy systems.

Annex D shows the mapping of the payload identifier from the ancillary data packet structure of SMPTE ST 291-1 to the K-L-V data structure of SMPTE ST 336 as a fixed-length data pack.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document. The keyword "Reserved," indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "Reserved" and in addition indicates that the provision will never be defined in the future.

3 Normative References

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publications, 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.

SMPTE ST 291-1:2011, Ancillary Data Packet and Space Formatting

4 Glossary of Terms

4.1

Channel

In some cases, a digital interface offers sufficient capacity to be able to carry more than one payload. In this case, each payload becomes a channel of the digital interface.

4.2

Interface Transport

The data structure defined by an interface for the purpose of synchronizing the transport words at the receiver. This comprises primarily of the EAV and SAV words. The transport data is usually expressed as a 10 bit word.

4.3

Link

In some cases, the picture raster exceeds the capacity available at the digital interface. In these cases, two or more digital interfaces can be used to provide the total capacity required where each digital interface is a single link of the combined interface set.

4.4

Payload

The picture, or part of a picture, carried in the active picture area of a digital interface and comprising a matrix of horizontal and vertical pixels. The matrix usually comprises a multiplex of luma and color difference components that can be viewed on a display device as a recognizable representation of the source image content. The picture can be a part picture or be a combination of small pictures. The picture does not need to use all the bits of the interface although those bits that are not used must be defined.

4.5

Picture Raster

The matrix of samples that represents a digital video picture.

4.6

Picture Rate

The Picture Rate value is the frame rate of the originating source image.

4.7

Recommended

Throughout this standard the term Recommended is intended to indicate a preferred usage of bit fields. Specific applications may deviate from the recommended usage.

4.8

Reserved

Throughout this standard the term Reserved is intended to indicate that values are undefined, or may be defined in application specific documents. The default value for Reserved is 0.

4.9

Required

Throughout this standard the term Required is intended to indicate a mandatory usage of bit fields. Specific applications may not deviate from the required usage.

4.10

Sampling

Refers to the horizontal arrangement of picture samples, notably the arrangement of multiplexing the various luma, color difference and other data samples.

4.11

Scanning

This is the action of reading the data structure of the interface in a predetermined order for transmission. It also refers to the mapping of the picture raster to the interface for transmission. The scanning of the picture raster and the interface transport are often closely related, the notable exceptions being the PsF scanning (progressive picture on an interlaced interface).

5 Payload Identifier Packet Definition

The payload identifier shall be 4 bytes long and shall be used to identify the payload carried on a digital interface transport.

5.1 General Payload Identifier Format

Table 1a shows the overall structure of the payload identifier.

Within a specific reference standard or document, a single byte 1 value shall identify payload formats having an identical number of active lines (active line count).

The values of the remaining 3 bytes are determined by the specific requirements of the application, and shall be defined such that:

- bit-fields identified as **Required** shall be applied without modification
- bit-fields identified as **Recommended** should be applied without modification where applicable
- bit-fields identified as **Reserved** may be defined on a case-by-case basis in specific application standards or other documents that reference SMPTE ST 352.

It should be noted therefore that some of the definitions in Table 1b — and the subsequent definition of specific bit fields that follow — are provisions only and that the actual definition may vary on a case by case basis depending on the value given in byte 1. Decoders shall not assume that the definitions in Table 1b and the following sections are the only provisions for bytes 2, 3 and 4.

Table 1c shows how each byte is formatted into a complete 10-bit ancillary data packet.

The precise definition of all payload identifiers defined prior to 2008 and not contained in a separate reference standard, are documented in Annex B and Annex C of this standard. Precise definitions for bytes 2, 3 and 4 of payload identifiers defined since 2008 shall be provided for each application in the reference standard that specifies the payload.

Table 1a – Generalized payload identifier byte definitions for digital transports

Bits	Byte 1	Byte 2	Byte 3	Byte 4
Bit 7	Version identifier	Application specific (line or picture related information)	Application specific (sampling or aspect ratio related information)	Application specific (channel assignment, bit depth related or other information)
Bit 6	Payload and digital interface standards			
Bit 5				
Bit 4				
Bit 3				
Bit 2				
Bit 1				
Bit 0		Picture rate	Sampling structure identification	

Table 1b – Default payload identifier field definitions

Bits	Byte 2	Byte 3	Byte 4
Bit 7	(Required) Interlaced (0) or progressive (1) transport	(Recommended) Image aspect ratio 4:3 (0) or 16:9 (1)	(Recommended) Channel assignment Single-link or ch1 of multi-channel (0 _h), ch2 of multi-channel (1 _h), ch3 of multi-channel (2 _h), ch4 of multi-channel (3 _h), ch5 of multi-channel (4 _h), ch6 of multi-channel (5 _h), ch7 of multi-channel (6 _h), ch8 of multi-channel (7 _h)
Bit 6	(Required) Interlaced (0) or progressive (1) picture	Reserved	
Bit 5	Reserved	Reserved	
Bit 4	Reserved	Reserved	Reserved
Bit 3	(Required) Picture rate	(Required) Sampling structure identification	Reserved
Bit 2			Reserved
Bit 1			(Recommended) Bit depth 8-bit (0 _h), 10-bit (1 _h) or 12-bit (2 _h), Reserved (3 _h)
Bit 0			

Table 1c – Payload identifier ancillary data packet format

	b9 (MSB)	b8	b7	b6	b5	b4	b3	b2	b1	b0 (LSB)
Ancillary data flag (ADF)	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
Data ID (DID)	not b8	EP	0	1	0	0	0	0	0	1
Secondary data ID (SDID)	not b8	EP	0	0	0	0	0	0	0	1
Data count (DC)	not b8	EP	0	0	0	0	0	1	0	0
Payload (byte 1)	not b8	EP	Version ID	Payload identifier						
Picture rate and scanning (byte 2)	not b8	EP	I/P transport	I/P picture	0	0	Picture rate			
Sampling structure (byte 3)	not b8	EP	4:3/16:9	0	0	0	Sampling structure			
Special options (byte 4)	not b8	EP	Channel			0	0	0	Bit depth	
Checksum	not b8	Sum of b0–b8 of DID through to payload byte 4.								

EP = even parity for b0 through b7.

Notes:

1. Since the payload bytes use the two LSB.s of the 10-bit packet format, care needs to be taken when handling the payload identifier in 8-bit systems.
2. Equipment designed in compliance with previous revisions of this standard might not adhere to the bit 8 and bit 9 formatting shown in Table 1c, the payload information is conveyed by b7 through b0 only.

5.2 Byte 1: Payload and Digital Interface Identification

This first byte shall identify the combination of payload format and digital interface transport.

Within a specific reference standard or document the byte 1 value shall identify payload formats having an identical number of active lines (active line count).

Where 2 or more active line counts exist within a single reference standard or document, a separate byte 1 value shall be assigned to each format (e.g. SMPTE ST 292-1).

These provisions shall not exclude standards or documents from organizations other than SMPTE using the same byte 1 value as the SMPTE standard for the same interface specification.

Some digital interfaces can carry a number of different payload formats at the same transport bit rate. Furthermore, payload formats can now be mapped onto several digital interface transports. Within a specific reference standard or document (e.g. SMPTE ST 372), the byte 1 value shall also identify the digital interface transport mapping structure. Where 2 or more digital interface transport mapping structures exist within a single reference standard or document (e.g. SMPTE ST 425-1 or Recommendation ITU-R BT.1120), a separate byte 1 value shall be assigned to combinations of payload format and mapping structure.

By identifying the combination of both the payload format and its associated digital interface, it is possible to correctly identify the supported format and mappings purely from inspection of the first byte of the payload identifier.

Implementers should be aware that some legacy implementations complying with previous version of this standard may not comply with the full form of the above provision.

By way of example, the following list illustrates the combination of payload format and digital interface transport for a number of currently registered payload identifiers. This information is taken from the SMPTE ST 352 byte 1 register and is repeated here for convenience.

Byte 1 Value	Payload Definition	Reference Standard	Description	Status
84h	SMPTE ST 292-1	SMPTE ST 292-1	720-line video payloads on a 1.5 Gb/s (nominal) serial digital interface	In Force
85h	SMPTE ST 292-1	SMPTE ST 292-1	1080-line video payloads on a 1.5 Gb/s (nominal) serial digital interface	In Force
87h	SMPTE ST 372	SMPTE ST 372	1080-line video payloads on a dual-link 1.5 Gb/s (nominal) serial digital interface	In Force
88h	SMPTE ST 425-1	SMPTE ST 425-1	720-line video payloads on a Level A 3 Gb/s (nominal) serial digital interface	In Force
89h	SMPTE ST 425-1	SMPTE ST 425-1	1080-line video payloads on a Level A 3 Gb/s (nominal) serial digital interface	In Force
8Ah	SMPTE ST 425-1	SMPTE ST 425-1	SMPTE ST 372 dual-link 1080-line payloads on a Level B 3 Gb/s (nominal) serial digital interface	In Force

The values for byte 1 are contained in a register published on line at SMPTE RA < www.smp-te-ra.org>. Readers are encouraged to check the online site for the current registered byte 1 values for each payload format and interface combination. See Annex A for information on the process required to obtain registration of Byte 1 values

Once assigned, byte 1 values cannot be re-purposed if the specific payload identification code is deprecated in the future.

The first byte of the payload identifier shall have a non-zero value for all valid payloads. Thus, the first byte can be used to address up to 127 payload and digital interface standards.

Bit 7 of byte 1 shall be used to define the payload identification version:

- b7 = 1 identifies version 1 based on this standard;
- b7 = 0 identifies version 0 (historical codes) based on SMPTE ST 352 as first published in the July 2001 issue of the SMPTE Journal (see Annex C).

Bits b6 to b0 of byte 1 shall be used to identify the combination of payload format and digital interface transport.

5.3 Byte 2: Picture Rate and Scanning Method

The second byte shall be used to identify the Picture Rate and the picture and transport scanning methods as shown in Table 1b.

Bit b7 shall be used to identify whether the digital interface uses a progressive or interlaced transport structure such that:

b7 = 0 shall identify an interlaced transport

b7 = 1 shall identify a progressive transport

Bit b6 shall be used to identify whether the picture has a progressive or interlace structure such that.

b6 = 0 shall identify an interlaced structure

b6 = 1 shall identify a progressive structure

Note: PsF payloads are identified by a progressive scanning of the payload transported over an interlaced digital interface transport carrying the progressive payload as a first and second picture segment within the transport frame duration. These first and second picture segments are indicated by the first and second field indicators in the digital interface transport.

Bits b5 to b4 are Reserved and shall be set to 0, unless defined for application specific use in a reference application document.

Bits b3 to b0 shall be used to identify the Picture Rate in Hz in accordance with Table 2.

Table 2 – Assignment of Picture Rate values

Value	Picture rate	Value	Picture rate	Value	Picture rate	Value	Picture rate
0h	No defined value	1h	Reserved	2h	24/1.001	3h	24
4h	48/1.001	5h	25	6h	30/1.001	7h	30
8h	48	9h	50	Ah	60/1.001	Bh	60
Ch	Reserved	Dh	Reserved	Eh	Reserved	Fh	Reserved

The reserved values of Table 2 may be defined for application specific use in a reference application document.

Notes:

1. The Picture Rate can differ from the interface frame rate. For example, in the case of 1080-line payloads carried on a dual-link 1.5 Gb/s (nominal) serial digital interface, the carriage of 60 Hz; 60/1.001 Hz and 50 Hz progressive signals requires 2 links each operating at 30 Hz, 30/1.001 Hz or 25 Hz (interlaced) frame rate. In this example the Picture Rate would still be identified as 60 Hz; 60/1.001 Hz or 50 Hz progressive even though the interface frame rate is half the Picture Rate.

2. For interlaced images, the Picture Rate indicates the image frame rate. For example 30 Hz, 30/1.001 Hz or 25 Hz (interlaced) frame rate.

5.4 Byte 3: Sampling Structure Identification

The third byte shall be used to identify the sampling structure of the source image as shown in Table 1b.

Furthermore, the third byte should be used to identify the aspect ratio of the source image as shown in Table 1b.

Bit b7 should be used to identify the image aspect ratio such that:

b7 = 0 should indicate a 4:3 aspect ratio

b7 = 1 should indicate a 16:9 aspect ratio