

SMPTE STANDARD

Time Code for High Frame Rate Signals and Formatting in the Ancillary Data Space



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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 its Standards Operations Manual.

SMPTE ST 12-3 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 Engineering Document. 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 Engineering Document.

This standard forms a portion of one of the oldest SMPTE Standards for Television. SMPTE Time Code was developed originally for analog television recording systems and thus dealt only with interlaced television systems operating with frame rates up to 30 frames per second. It is, however, flexible enough in design to be used in digital television systems, either standard definition, high definition, and ultra-high definition.

The other parts of this suite of documents (SMPTE ST 12-1 and SMPTE ST 12-2) do not support time code operating at system rates higher than 60 frames per second, even though high frame rate (HFR) devices are already coming into use. This standard is intended to support such devices.

This standard defines the time code for HFR and its data structure in the ancillary data space in a way that is extensible to cover frame rates of up to 960 frames per second. To facilitate a simple approach that is consistent with existing implementations, the time address and ancillary data space formats are inherited from the existing time code standards (SMPTE ST 12-1, SMPTE ST 12-2).

1 Scope

This standard specifies time code formats with the frame counts 72, 96, 100 and 120 and the frame count 120 with drop-frame compensation. This standard also specifies a transmission format for conveyance of the time code and frame count in the ancillary data space of serial digital interfaces.

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.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; then formal languages; then figures; and then any other language forms.

3 Normative References

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

SMPTE ST 12-2:2014, Transmission of Time Code in the Ancillary Data Space

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

4 Terms and Definitions

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

4.1 Ancillary Time Code – ATC

Ancillary data packets carried in the Ancillary space (VANC or HANC) of a digital television data stream, as defined in SMPTE ST 12-2 and this standard, and payloads of these packets convey LTC or VITC as well as the “time code” defined in this standard.

4.2 Ancillary Time Code for High Frame Rate Time Code – ATC_HFRTC

ATC that carries high frame rate time code codewords as defined in this standard.

4.3 Binary Coded Decimal System – BCD

A means for encoding decimal numbers as groups of binary bits. Each decimal digit (0-9) is represented by a unique four-bit code. The four bits are weighted with the digit's decimal weight multiplied by successive powers of two.

Note: For example, the bit weights for a “units” digit would be 1×2^0 , 1×2^1 , 1×2^2 , and 1×2^3 , while the bit weights for a “tens” digit would be 10×2^0 , 10×2^1 , 10×2^2 , and 10×2^3 .

4.4 Codeword

Time address, the flag bit (i.e. drop frame flag) and a binary group for user-defined data codes comprise the codeword, commonly abbreviated as simply “time code” (note that some users spell this “timecode”).

4.5 Drop Frame – DF

Fractional system rate compensated mode as defined in Section 6.4.3.

4.6 Frame

A frame is a complete image unit of a video sequence.

4.7 Mod

An abbreviated name of the modulo operator. The expression “ $n \equiv k \bmod m$ ” would be equivalent to: ‘ n ’ is the remainder from the division of ‘ k ’ by ‘ m ’.

4.8 Time address

An address consisting of hours, minutes, seconds, super-frames, and frame identifier bits. It is intended as a label to identify discrete frames.

5 Overview (Informative)

This standard defines time code formats with the frame counts 72, 96, 100 and 120 and the frame count 120 with drop-frame compensation and also defines the formatting structure of the ancillary data space for the HFR time code. Implementation of a variable frame count is out of scope of this standard. These frame counts are needed to support the type of HFR equipment already in use. The ancillary data packet defined in this standard can be conveyed in serial digital interfaces or other applications, e.g., MXF (SMPTE ST 436-1). Reserved bits are assigned for possible future extended frame counts, i.e. counts greater than 120 frames up to 960 frames.