SMPTE 405M-2006

SMPTE STANDARD

for Television — Material Exchange Format (MXF) — Elements and Individual Data Items for the MXF Generic Container System Scheme 1

1 Scope

This standard specifies elements and individual data items that may be used in the MXF Generic Container System Scheme 1 (SMPTE 394M). This standard allows additional new elements to be added to those already defined in SMPTE 394M. This standard also defines lists of individual data items that may be used in elements of the MXF Generic Container System Scheme 1. This standard also lists the element identifier values of elements compatible with SMPTE 394M, but defined in other documents.

The MXF Generic Container is the native Essence Container of the Material Exchange Format (MXF) File Body. The MXF Generic Container is defined for the interchange of streamable audio-visual material.

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.

SMPTE 330M-2004, Television — Unique Material Identifier (UMID)

SMPTE 331M-2004, Television — Element and Metadata Definitions for the SDTI-CP

SMPTE 377M-2004, Television — Material Exchange Format (MXF) — File Format Specification

SMPTE 379M-2004, Television — Material Exchange Format (MXF) — MXF Generic Container

SMPTE 394M-2006, Television — Material Exchange Format (MXF) — System Scheme 1 for the MXF Generic Container

SMPTE RP 186-1995, Video Index Information Coding for 525- and 625-Line Television Systems

SMPTE RP 210, Metadata Dictionary Registry of Metadata Element Descriptions

3 Glossary of Acronyms, Terms and Data Types

The general glossary of acronyms, terms and data types used in the MXF specification is given in SMPTE 377M and is supplemented in SMPTE 379M. These are not repeated here to avoid any divergence of meaning.

Approved
July 7, 2006

4 Introduction

The MXF Generic Container is defined in SMPTE 379M. SMPTE 394M defines the System Scheme 1 as a System Item for use in the MXF Generic Container. These standards provide for System Items that can carry metadata in “Frame Wrapping”, “Clip Wrapping” and other wrapping modes.

This standard defines system elements and individual data items that are compatible with System Scheme 1.

5 Individual Data Definitions

In the following tables, individual metadata items are assigned with the following local tag value ranges:

- ’00.00h’ to ‘00.7Fh’ shall not be used.
- ’00.80h’ to ‘00.FFh’ shall be reserved for individual metadata items defined in SMPTE 331M.
- ’01.00h’ to ‘7F.FFh’ shall be reserved for individual metadata items defined in this standard.
- ’80.00h’ to ‘FF.FFh’ are reserved for “dark” definitions defined elsewhere, either privately, or publicly. Such definitions are beyond the scope of this standard.

5.1 CP-Compatible Individual Data Definitions

Table 1 defines the individual metadata or control data items that are compatible with SMPTE 326M.

The table defines a unique name, a data type, the length, the local tag value, the UL designator, the meaning and the standard upon which this individual data item depends. The full 16-byte SMPTE UL value defined in SMPTE RP 210 can be located from the UL designator value.

Table 1 – Specification of SDTI-CP Compatible Individual Data Items

Unique Name	Type	Length	Local Tag	UL Designator	Meaning	Standard
SMPTE 331M Metadata Items	Refer to SMPTE 331M	Refer to SMPTE 331M	00.xxh (where xx is the “Type Value” defined in SMPTE 331M	See SMPTE 331M	See SMPTE 331M. The value of ‘xxh’ is the 1-byte local tag defined in SMPTE 331M and ranges from ‘80h’ to a maximum of ‘FFh’. SMPTE 331M also defines the SMPTE UL designator where applicable.	SMPTE 331M

5.2 GC System Scheme Individual Data Definitions

Table 2 defines individual metadata or control data items that are compatible with the MXF generic container system schemes, but are not compatible with SMPTE 326M.

The table defines a unique name, a data type, the length, the local tag value, the UL designator, the meaning and the standard upon which this individual data item depends (where applicable). The full 16-byte SMPTE UL value defined in SMPTE RP210 can be located from the UL designator value.

Where required, fuller descriptions of each individual data item may be given in Table 3.

Table 2 – Specification of Individual Data Items

Unique Name	Type	Length	Local Tag	UL Designator	Meaning	Standard
Frame Count	UInt32	4	01.01h	07.02.02.01.01.01.00.00	The count of frames in either frame-wrapped or clip wrapped modes. In frame-wrapped mode, the value will be 1.	
Timecode Array	T/C Array	8+8n	01.02h	07.02.01.02.08.02.00.00	An ordered array of Time Codes with individual time code packets as specified in SMPTE 331M, section 8.2.	SMPTE 331M
Clip ID Array	UMID Array	8+32n	01.03h	01.01.15.0A.00.00.00.00	An ordered array of Basic UMIDs	SMPTE 330M
Extended Clip ID Array	ExtUMID Array	8+64n	01.04h	01.01.15.0B.00.00.00.00	An ordered array of Extended UMIDs	SMPTE 330M
VideoIndexArray	VideoIndex Array	8+15n	01.05h	04.04.04.03.01.00.00.00	An ordered array of Video Indexes. Each Video Index is a concatenation of classes 1.1, 1.2, 1.3, 2.1 and 2.2 as defined in SMPTE RP186 where each class is 3 bytes long. The CRCC bytes are not present in this data item	SMPTE RP 186
KLV Metadata Sequence	KLVMetaSequence	KLV*n	01.06h	03.01.02.10.06.00.00.00	A sequence of KLV metadata packets which shall have one KLV packet per frame in the sequence. Each individual KLV packet is as defined in SMPTE 331M, section 8.9. Each individual packet may have a zero value where no metadata exists for the associated frame.	SMPTE 331M
Sample Rate	Rational	8	30.01h	04.06.01.01.00.00.00.00	The field or frame rate of the Essence Container (not the essence pixel clock rate). See SMPTE 377M.	SMPTE 377M
Essence Track Number	UInt32	4	48.04h	01.04.01.03.00.00.00.00	Number used to link the System Item element to the essence track in the Content Package. See SMPTE 377M.	SMPTE 377M
Essence Track Number Batch	TrackNumberBatch	8+4n	68.01h	01.04.01.04.00.00.00.00	An unordered list of Track Numbers used to link the System Item element to the essence tracks in the Content Package.	SMPTE 377M
Content Package Index Array	IndexArray	8+11n	68.03h	04.04.04.02.06.00.00.00	An ordered array of index entries for each frame in this Content Package (see Table 3 below).	SMPTE 377M

NOTE – Arrays and Batches are defined in SMPTE 337M, section 3.3.

5.3 Individual Data Item Descriptions

Additional descriptions and notes may be added to Table 3 as indicated by Table 2.

Table 3 – Specification of Individual Data Item Descriptions

Name	Description	Notes
Content Package Index Array	This item is used only for multi-frame essence wrappings, such as clip, custom or other specialized essence wrappings. Each 11-byte value comprises the first four entries of the "NIE" as defined in SMPTE 377M, table 21 (Structure of Index Entry Array). The difference is that the first item in the array defines the offset of the key of the first essence element in this Content Package and not of the essence container as a whole.	***Informative Note 1****: This item will be typically used in the Picture Item Descriptor and be associated with a single video track in the Content Package.* ***Informative Note 2****: This item can be used to build a full Index Table to the specification in SMPTE 377M.*

5.4 Values copied from other documents (informative)

The values in Table 4 have been copied from other documents and are listed here to provide a single point where the elements compatible with System Item Scheme 1 can be referenced.

Table 4 – Compatible Elements for System Scheme 1 (Informative)

Unique Name	Type	Length	Element Identifier Value	Meaning	Standard
Reverse Play Element	UInt64	8	10h	This value is KLV coded as a fixed pack that defines a System Element within System Scheme 1. The value defines the difference between the byte position of the first byte of the key of the first System Element in the current Content Package and the first byte of the Key of the first System Element in the previous Content Package.	SMPTE 389M

Annex A (Informative)
Guide to using individual data items

This annex gives further guidance to the use of the individual data items defined in this standard.

All individual data items specified in other documents such as SMPTE 331M and SMPTE 389M need no further explanation in this standard.

A.1 Single Data Items

All single-valued individual data items define a value that is consistent over the duration of the essence wrapping, whether frame, clip or custom.

A.1.1 Frame Count

This value can be used in both clip and custom wrappings to define the number of individual frames in the wrapping, The frame value is defined by the primary essence component in the Generic Container and the value is directly related to the SampleRate property of the associated Essence Descriptor as defined in SMPTE 377M.

A.1.2 Sample Rate

This value defines the sample rate of the Generic Container in which it resides. This has no purpose in a frame-wrapped Generic Container. In Clip or Custom wrapped Generic Containers, this value can be used to specify the underlying rate of the essence container and may be used to aid in-line signal operations within the byte-stream for those signal processors that cannot decode the Header Metadata.

A.1.3 Essence Track Number

This item provides a value that is identical to that used for linking the Header Metadata Track Number property to the essence track within the essence container. However, its scope is constrained to the Content Package and it has no relationship with the Track Number in the Header Metadata.

The purpose of this value is to identify the essence track in the Content Package so that subsequent metadata items in the same System Element can be linked to that specific essence track. If this data item is not present in any System Element, then all individual data items within the System Element refer to all essence elements in the named System Item type.

Note that in cases where the Essence Item comprises a single essence element, then this individual data item should not be used.

A.2 Group Array Data Items

Note that all group arrays are preceded with an 8-byte header that defines, respectively, the number of individual values and the length of each individual value. These arrays have the same data construct as “xxxArray” defined in SMPTE 377M. The sequence of individual data values is directly related to the sequence of essence samples and is, therefore, inherently an array.

A.2.1 Time Code Array

Each value in the array is of 8 bytes length and has the format and byte order as defined in SMPTE 331M, section 8.2.

A.2.2 Clip ID Array

Each value in the array is a basic UMID of 32 bytes length and has the format and byte order as defined in SMPTE 330M.

A.2.3 Extended clip ID array

Each value in the array is an extended UMID of 64 bytes length and has the format and byte order as defined in SMPTE 330M.

A.2.4 Video Index Array

Each value in the array is of 15 bytes length and has the format and byte order as defined in Table 3 of this standard. Note that these 15 bytes are identical to the last section of the MPEG-2 picture editing metadata defined in SMPTE 331M, section 8.5.

A.2.5 Content Package Index Array

Table 4 defines the format of each value in this array. This metadata is typically created along with the essence and may be created by streaming devices that are intended to provide essence for MXF files with minimal latency. This metadata is specifically designed to allow for the rapid assimilation of full index tables for use in MXF files.

A.3 Group Batch

Certain individual metadata items are not related to the sequence of essence sample units and can be a batch of values. These batches have the same data construct as “xxxBatch” defined in SMPTE 377M.

A.3.1 Essence Track Number Batch

This batch allows a list of tracks to be identified for the purpose of relating the subsequent individual data items to more than one track. The application of this individual metadata item is typically in audio, where it allows, for example, a group of audio track numbers in the Sound Item to be associated with a ClipID (UMID).

A.4 Group Sequence

A few individual metadata items are related to the sequence of essence sample units but have a variable length of metadata for each sample unit of the essence container. These items must define a separate mechanism to define the length of each value in the group. As with arrays, the order of each value in the sequence is directly linked to the order of sample units within the essence container.

A.4.1 KLV Metadata Sequence

This individual data item allows specialized KLV data that has been created in-line with the essence container to be closely coupled with the essence. This data is similar to the use of KLV metadata stored as VANC packets as defined by SMPTE 291M.

Annex B (informative)
Bibliography

ANSI/SMPTE 298M-1997, Television — Universal Labels for Unique Identification of Digital Data

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

SMPTE 326M-2000, Television — SDTI Content Package Format (SDTI-CP)

SMPTE 389M-2005, Television — Material Exchange Format (MXF) — MXF Generic Container Reverse Play System Element

SMPTE EG41-2004, Television — Material Exchange Format (MXF) — Engineering Guideline