

SMPTE STANDARD

Material Exchange Format — Generic Stream Partition



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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 Administrative Practices. This SMPTE Engineering Document was prepared by Technology Committee W25.

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.

1 Scope

This document defines an extension of the MXF File Format that allows specific classes of data streams to be contained in MXF Body Partitions.

The classes of data streams are either essence that is unevenly distributed along the timeline or large amounts of metadata that cannot suitably be stored in the Header Metadata. Examples for such data streams are time-varying metadata, structured text files and 'lumpy' essence, i.e. that is not evenly spread along the timeline.

The Generic Stream Container is not intended to carry metadata that could be placed in MXF Header Metadata or essence or metadata that could suitably be stored in the MXF Generic Container.

This document defines the KLV encoding methods used to carry the data stream.

This document also defines partitions that are used to multiplex Generic Streams into the byte stream of MXF files. These Generic Stream Partitions provide for the carriage of Generic Streams in separate partitions from those partitions carrying Essence Container data or Index Table segments.

Essence and metadata payloads that are carried in Generic Stream Partitions are defined in associated documents. This document defines rules for the documents that specify the Generic Stream Payloads and their application. It also defines the basic linking mechanisms of Generic Streams to the Header Metadata of the MXF file.

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, followed by 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 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 336M-2007, Data Encoding Protocol Using Key-Length-Value

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

4 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. They are not repeated here to avoid any divergence of meaning.

AU: Access Unit

Access Unit: The smallest temporal section of a stream of data that is intended to be accessed independently. For video essence, an Access Unit is normally defined to be one complete picture (usually a frame, but occasionally a field). For audio essence, an Access Unit is normally defined to be either a fixed number of uncompressed samples, or a single block of compressed data. (Note: This may also be called an Audio Frame.)

Descriptive Metadata: Metadata strongly referenced, either directly or indirectly, from a DM Framework or a subset of a DM Framework.

Generic Stream: A stream of data bytes with a defined format. Generic streams are linear in nature, but may be divided into structured items or even temporally into Access Units

Generic Stream Data: The data bytes within a generic stream partition. This includes all bytes from the start of the first key after the partition pack, excluding the filler immediately following the partition pack if one exists, until the last byte before the start of the following partition pack key.

Generic Stream Partition: The partition defined by this document, including all bytes from the start of the partition pack key to the byte before the start of the following partition pack key.

Generic Stream Payload: Those bytes of Generic Stream Data that constitute the Generic Stream. If the Generic Stream is Intrinsically KLV Wrapped (see Section 6.3.1), all keys and length fields as well as any KLV Fill items are regarded as part of the payload, otherwise these are excluded.

Lumpy Essence: Essence that is not continuous along a timeline. For example pre-rendered subtitles may be stored as still images that are associated with particular points along the timeline.

Payload: Used to refer to the Generic Stream Payload.

SID: Stream ID.

TLV: Tag-Length-Value local set coding as used inside SMPTE 336M KLV local sets.

UL: SMPTE 298M Universal Label with a value given in the Registry defined by SMPTE 400M (RP 224)

5 Introduction (Informative)

The MXF Format specification defines partitions that can contain Header Metadata repetitions, Essence Container data, and Index Table segments either in separate partitions or within the same partition. However, there is no provision in SMPTE 377M for carrying large streams of data other than continuous essence that is regularly distributed along the timeline. This document defines the Generic Stream Partition for carrying generic data streams within the MXF body.

From the point of view of an MXF encoder or decoder, a Generic Stream may be regarded simply as an unstructured sequence of data bytes, or a sequence of multi-byte items. This document defines how this data is wrapped in KLV packets, how the Generic Stream Data is multiplexed into the MXF byte stream, and includes information that allows some manipulation of these streams independent of the semantics of the particular Generic Stream Payload. Further details of each Generic Stream are given by a mapping specification, described in Section 10, which defines the wrapping schemes to be used and the format of the payload data.

For an MXF application that is programmed with knowledge of a particular Generic Stream payload mapping, the payload can be encoded, decoded and manipulated as required.

In some MXF decoder applications, the precise nature of the stream data will be unknown or “dark”. It is important that these applications be able to extract the payload from a Generic Stream Partition and forward it to another application or codec device for processing. Similarly, it is important that an MXF encoder be able to receive a Generic Stream Payload and write it to a valid Generic Stream Partition without detailed knowledge of its format; in practice all that is required are the correct values of the bits specified in Table 4 and Table 5.

As much as possible, the application's interaction with the Generic Stream Data needs to be independent of the actual way in which any access units are divided and partitioned on the underlying KLV storage layer.

In an MXF file, a Generic Stream is enclosed in KLV packets, and is then stored in the body of one or more Partitions.

This document defines the following two component parts:

1. Generic Stream encapsulation
2. A Generic Stream Partition Pack which identifies the start of a Generic Stream Partition.

The relationship between these components is illustrated in Figure 1. The linkage between the Header Metadata and the Generic Stream Data is provided by a StreamID and the precise details of this linkage mechanism is defined in the appropriate payload mapping specification.

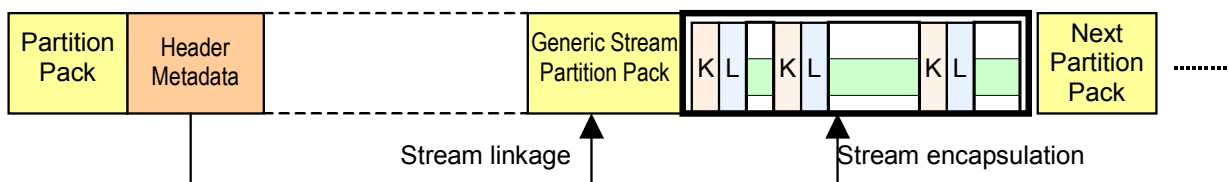


Figure 1 – Relationship between Partition Components

6 Generic Stream Partition Specification

6.1 Overview

The Generic Stream Partition is defined in the following sections; an informative summary is shown below:

1. A Generic Stream Partition is a special kind of Body Partition.
2. A Generic Stream Partition includes one or more KLV-wrapped Generic Data Elements.
3. A Generic Stream Partition contains data from a single Generic Stream.
4. A Generic Stream Partition does not include any essence container data, Header Metadata repetition or Index Table Segments.
5. The order of the Generic Stream Data Elements is significant and it is important that this is not altered by any application treating the Generic Stream Data Elements as dark.
6. The Generic Stream Data Elements may be placed in a single partition, or distributed over two or more partitions.
7. Each unique Generic Stream is assigned a Stream ID value that is unique within the file. Different Generic Streams can thus be uniquely identified even if there are several Generic Streams distributed throughout the file.
8. Generic Stream Partitions are included in the Random Index Pack.

6.2 Generic Stream Partition Pack

The Generic Stream Partition Pack shall comprise a Generic Stream Partition Pack Key, a Length and a Value as defined below. In accordance with SMPTE 377M, the Generic Stream Partition Pack shall be a KLV-coded, fixed-length pack as defined in SMPTE 336M.

6.2.1 Generic Stream Partition Pack Key

The Key of the Generic Stream Partition Pack shall be as defined in Table 1.

Table 1 – Partition Pack Key Value

Byte No.	Description	Value (hex)	Meaning
1~7	See SMPTE 377M, Table 1	—	As defined by MXF File Format Specification
8	Version Number	01h	Registry Version at the point of registration of this Key
9~13	See SMPTE 377M, Table 1	—	As defined by MXF File Format Specification
14	Set / Pack Kind	03h	Body Partition Pack
15	Partition Status	11h	Generic Stream Partition
16	Reserved	00h	

Byte 14 of the SMPTE Key defines that the partition is a Body Partition.

Byte 15 of the SMPTE Key defines that the partition is a Generic Stream Body Partition

Note: The Partition Pack keys defined in SMPTE 377M include flags for open or closed and complete or incomplete, which relate to the Header Metadata in that partition. These flags are not used for Generic Stream Partitions as according to Section 7.1.2 any metadata contained in a Generic Stream Payload is regarded as closed and complete.

6.2.2 Generic Stream Partition Pack Length

In accordance with SMPTE 377M, it is preferred that the Length field of this KLV fixed length pack be BER long-form encoded using four bytes.

MXF decoders shall be SMPTE 336M compliant and must respond to short or long-form BER encoding as received. Decoders shall not rely on a fixed number of bytes for length fields.

6.2.3 Generic Stream Partition Pack Value

The value of the Generic Stream Partition Pack shall be as defined in SMPTE 377M, with the following settings:

- The value of the **HeaderByteCount** shall be set to zero indicating that there is no Header Metadata in this partition.
- The value of the **IndexByteCount** shall be set to zero indicating that there are no Index Table segments in this partition.
- The value of the **IndexSID** shall be set to zero.
- **BodyOffset** specifies the byte offset of the Generic Stream Partition segment in this Partition relative to the start of the Generic Stream with the specified Stream ID. This parameter is used to mark repetitions of the Generic Stream data as indicated in Section 7.3. See Section 6.7 for details of byte counting.
- **BodySID** specifies the Stream ID of the Generic Stream data in this Partition. See Section 6.6 for details of Stream ID.
- **EssenceContainers** is a Batch of ULs that identifies the different Essence Container types used in or referenced by this MXF file. This property is included to provide consistency with other MXF partitions and may be incomplete; therefore its value shall be ignored by decoders.

6.3 Generic Stream Data Element Coding

The Generic Stream Partition shall contain one or more KLV triplets wrapping the data. The precise wrapping scheme will vary depending on the payload data and the requirements of the application.

The Generic Stream data may be distributed in one or more Generic Stream Partitions but each Generic Stream Partition shall only contain data from a single Generic Stream.

Signaling is provided in the Generic Stream Data Element key to distinguish a number of features of the Generic Stream (see Section 6.3.2). Table 2 is an informative summary of the features signaled.