Reaffirmed 2013

SMPTE 389M-2005

# SMPTE STANDARD

## for Television — Material Exchange Format (MXF) — MXF Generic Container Reverse Play System Element



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## 1 Scope

This standard defines an MXF extension that supports reverse play for specialized applications. Devices that use serial storage, have limited memory or computing capacity may find managing full MXF index tables difficult. This extension provides reverse play capability without altering the structure of the MXF format (SMPTE 377M) or any operating patterns (for example: SMPTE 378M – MXF Operational Pattern 1a). This extension was designed to be used with operational pattern 1a. The concept may be used with other operational patterns at the discretion of the implementers. This system element is compatible with GC system scheme 1.

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

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

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



Approved
June 7, 2005

# 3 Glossary of acronyms, terms and data types

The full glossary of acronyms, terms and data types used in the MXF specification is given in the MXF file format specification. It is not repeated here to avoid any divergence of meaning.

# 4 Introduction

When essence is KLV coded within the MXF generic container (figure 1), the keys and lengths allow parsing of the file in the forward direction without having to read each individual byte of each KLV value. In some applications, however, it is desired to play out pictures in reverse order, without having to construct and parse an index table.

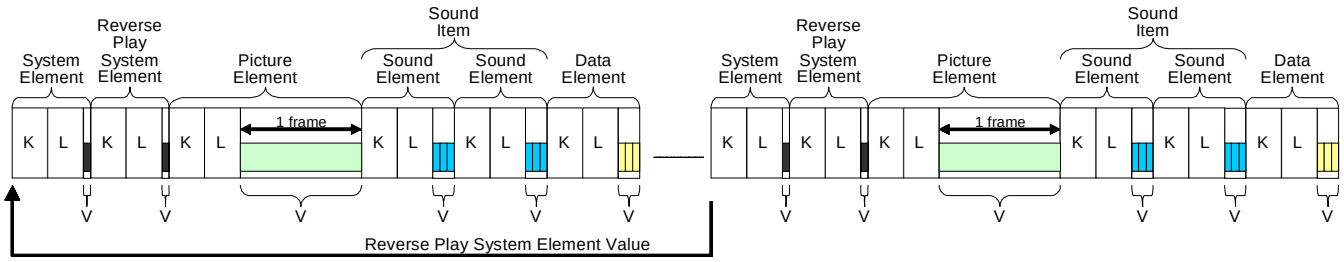



**Figure 1 – Frame wrapping within the generic container**

This standard specifies a back-pointer KLV element which may be inserted in the stream at each content package starting point. Each back pointer provides direct access to the preceding content package. This mechanism may only be used with frame wrapping where each content package represents an edit unit. A simple KLV parser is now able to rapidly parse KLVs both forwards and backwards in the file to provide simple playback without recourse to an index table.

# 5 Implementation

## 5.1 Use of back pointer

An essence container that uses this mechanism shall be frame wrapped. There shall be one picture per content package and one back pointer element per content package. The back pointer element shall be coded as a single KLV triplet.

NOTE – Any essence container that uses this mechanism may be partitioned and/or multiplexed with other essence containers.

The first back pointer KLV element in each essence container in the file shall have a value of zero to indicate it precedes the first edit unit of essence in the file.

The position of the back pointer element within the order of all the elements of content package shall be identical in each and every content package within a given essence container.

The back pointer element shall be used as an element in the system item. The “first element” defined in SMPTE 394M shall always be present and shall be the first element in each and every system item. It is recommended that the back pointer element should immediately follow the first element.

MXF implementers should not consider the insertion of the back pointer system element as replacements for MXF index tables. They do not represent the same capability as index tables in most applications. MXF index tables are optional and their use should be decided on their own merit.

### 5.2 KLV coding of the reverse play system element

The reverse play system element is coded as an MXF generic container system element compatible with the GC system scheme 1.

#### 5.2.1 System element key

The values of the bytes of the system element key are given below:

**Table 1 – Key value for the reverse play system element**

| Byte No. | Description | Value (hex) | Meaning |
|---|---|---|---|
| 1-14 | See SMPTE 394M (MXF Generic Container System Scheme 1 Specification)<br>(note that byte 6 should be set to the SMPTE 336M value indicating a fixed length pack) | | |
| 15 | Metadata or Control Element Identifier | $10_h$ | Reverse Play System Element |
| 16 | See SMPTE 394M (MXF Generic Container System Scheme 1 Specification) | | |

##### 5.2.1.1 Set or pack coding – Byte 6

This byte identifies the reverse play element in a fixed length pack.

NOTE – SMPTE 336M defines the value $05_h$ for a fixed length pack.

##### 5.2.1.2 Metadata or control element identifier – Byte 15

This byte identifies the reverse play system element and shall have the value indicated in table 1.

##### 5.2.1.3 Element number – Byte 16

This is the GC system scheme 1 element number and shall have a value as defined in SMPTE 394M.

#### 5.2.2 System element length

The length field of the KLV coded element shall be 4 bytes BER long-form encoded as recommended in SMPTE 377M (i.e., $83_h$.xx.yy.zz).

#### 5.2.3 System element value

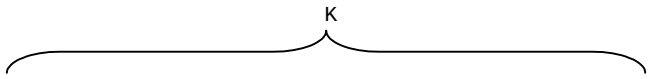
The value field of the KLV coded element shall be a Uint64 number that is the difference between absolute byte positions of the first byte of the key of the first system element in the current content package and the absolute byte positions of the first byte of the key of the first system element in the previous content package of the same essence container as shown in figure 1. The reverse play system element value shall always be positive.

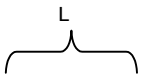
If different essence containers are multiplexed, and/or partitioned, then the MXF encoder shall correctly set the value of the reverse play system element so that any extra data between frames is skipped. Correctness of the value can be verified by checking that the first 16 bytes of the relative position from a “first system element” key in the file is also a valid “first system element” key.

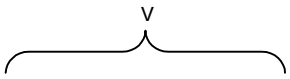
## **Annex A** (informative)
## **Using the reverse play element in isolation**

Many applications will want to use only the reverse play system element in the system item. The rules of SMPTE 394M state that there shall be a “first system element” before the reverse play element. The recommended implementation is to insert this element with a KLV length field of zero and no value field. The next KLV will be the reverse play system element. The resulting KLV sequence will be K . L . K . L . V.

The values below have been informatively copied from the relevant documents:




```
06.0e.2b.34. 02.fp.01.vv. 0d.01.03.01. 14.02.01.00      83.00.00.00
06.0e.2b.34. 02.fp.01.vv. 0d.01.03.01. 14.02.10.01      83.00.00.08     ??.??.??.??.??.??.??.??
```

The question marks represent the value of the reverse play system element. The value “vv” represents the version number of registry which first listed these keys; i.e., $01_h$.

## **Annex B** (informative)
## **Reverse play element value represented as an equation**

The reverse play element value is shown here as an equation to clarify its use in an operational pattern which may have more than one top-level file package:

$$\text{Value}_{\text{revplay,BodySID,n}} = \text{BfE}_{\text{BodySID,n}} - \text{BfE}_{\text{BodySID,(n-1)}}$$

where:

- BfE is the byte offset of a “first element” in the file
- $_{\text{BodySID}}$ is the BodySID used to identify an essence container in a partition
- $_{\text{n}}$ is an index identifying the $n^{th}$ reverse play element in a file
- $V_{\text{revplay,BodySID,0}}$ is always zero

## **Annex C** (informative)
## **Bibliography**

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

SMPTE 336M-2001, Television — Data Encoding Protocol Using Key-Length-Value

SMPTE 378M-2004, Television — Material Exchange Format (MXF) — Operational Pattern 1A (Single Item, Single Package)

SMPTE EG 41-2004, Television — Material Exchange Format (MXF) — Engineering Guideline