SMPTE ST 2067-103:2014

# SMPTE STANDARD

# Interoperable Master Format — Output Profile List — Common Audio Definition and Macros



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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 2067-103 was prepared by Technology Committee 35PM.

## 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 specifies definitions, data structures and Macros applicable to audio essence for use with the Interoperable Master Format (IMF) Output Profile List framework.

# 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 ST 377-4:2012, Multichannel Audio Labeling Framework

SMPTE, ST 2067-100:2014, Interoperable Master Format – Output Profile List

World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 1: Structures (Second Edition).

World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 2: Datatypes (Second Edition).

# 4 XML Schema

## 4.1 Definitions

Multiple structures defined in this document are specified using XML schema definitions as specified in W3C XML Schema Part 1: Structures.

In order to avoid duplication between text and schema, the cardinality and default values of elements are specified in the schema definitions only.

In the event of a conflict between schema definitions and the prose, the prose shall take precedence.

Note: The prefix associated with each namespace in an XML Schema definition document is arbitrary, and an Output Profile List instance can use other prefix value for the same namespace.

## 4.2 Versioning

The target namespace of XML Schema definitions, i.e. the value of the `targetNamespace` attribute of the `schema` element, allows implementations to unambiguously identify the defining specification.

Specifications that modify the schema definitions or the semantics of the elements, including future versions of this specification, shall use a different target namespace and no two distinct schemas shall have the same target namespace.

# 5 Additional Handles

This specification expands Section 6 of ST 2067-100 by specifying additional Handles for use with audio Macros.

A Handle conforming to the `<mca-dict-id-handle>` syntax shall reference the audio channel with MCA Dictionary Label ID equal to `<mcaid>` that is contained in the Virtual Track referenced by `<virtual-track-handle>`.

```
<mca-dict-id-handle> ::= <virtual-track-handle> "?MCADictionaryLabelID=" <mcaid>
<mcaid> ::= <hexdig>{2} ("." <hexdig>{2}){7}
```

A Handle conforming to the `<mca-link-id-handle>` syntax shall reference the audio channel with MCA Link ID equal to `<mcalid>` that is contained in the Virtual Track referenced by `<virtual-track-handle>`.

```
<mca-link-id-handle> ::= <virtual-track-handle> "?MCALinkID=" <mcalid>
<mcalid> ::= <uuid>
```

A Handle conforming to the `<mca-symbol-handle>` syntax shall reference the audio channel with MCA Tag Symbol equal to `<mcasymbol>` that is contained in the Virtual Track referenced by `<virtual-track-handle>`.

```
<mca-symbol-handle> ::= <virtual-track-handle> "?MCATagSymbol=" <mcasymbol>
<mcasymbol> ::= <alpha> (<alpha> | <digit>){1,7}
```

# 6 Audio Routing Macro

## 6.1 General

XML Schema definitions that appear in this Section 6 shall belong to the XML Schema root element definition specified in Table 1.

**Table 1 – XML Schema root element definition**

```
<xs:schema targetNamespace="http://www.smpte-ra.org/schemas/2067-103/2014"
               xmlns:arm="http://www.smpte-ra.org/schemas/2067-103/2014"
                   xmlns:opl="http://www.smpte-ra.org/schemas/2067-100/2014"
                   xmlns:dcml="http://www.smpte-ra.org/schemas/433/2008/dcmlTypes/"
                   xmlns:xs="http://www.w3.org/2001/XMLSchema"
                   elementFormDefault="qualified" attributeFormDefault="unqualified">
  <xs:import namespace="http://www.smpte-ra.org/schemas/433/2008/dcmlTypes/" />
<!-- schema definitions found in this Section 6 excluding this one -->
</xs:schema>
```

## 6.2 AudioRoutingMixingMacroType

An instance of the Audio Routing and Mixing Macro shall be a Macro instance with the type `AudioRoutingMixingMacroType` specified in Table 2.

**Table 2 – AudioRoutingMixingMacroType definition**

```
    <xs:complexType name="AudioRoutingMixingMacroType">
        <xs:complexContent>
            <xs:extension base="opl:MacroType">
                <xs:sequence>
                    <xs:element name="OutputEntityList">
                        <xs:complexType>
                                <xs:sequence maxOccurs="1" minOccurs="1">
                                        <xs:element name="OutputAudioChannel"
                   type="arm:OutputAudioChannelType" maxOccurs="unbounded"
                   minOccurs="1"/>
                                </xs:sequence>
                        </xs:complexType>
                    </xs:element>
                </xs:sequence>
            </xs:extension>
        </xs:complexContent>
    </xs:complexType>
```

### 6.2.1 OutputEntityList

Each element of the `OutputEntityList` element specifies a single audio channel output by the Macro.

No two `OutputAudioChannel` elements of the `OutputEntityList` element shall have identical `Handle` elements.

## 6.3 OutputAudioChannelType

The OutputAudioChannelType defines an output audio channel.

**Table 3 – OutputEntityType schema definition.**

```
<xs:complexType name="OutputAudioChannelType">
  <xs:sequence>
    <xs:element minOccurs="0" name="Annotation" type="dcml:UserTextType"/>
    <xs:element name="Handle" type="opl:HandleType"/>
    <xs:element name="InputEntityList">
      <xs:complexType>
        <xs:sequence>
          <xs:element maxOccurs="unbounded" name="InputEntity"
            type="arm:InputEntityType"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
```

### 6.3.1 Annotation

The `Annotation` element shall be a free-form, human-readable annotation describing the output audio channel. It is intended to be displayed to the user.

### 6.3.2 Handle

The `Handle` element uniquely identifies the output audio channel.

The value of the `Handle` element shall be a Handle in the context of the Macro instance as specified in SMPTE ST 2067-100.

### 6.3.3 InputEntityList

The InputEntityList element shall contain the list of input entities used to compute the output audio channel.

No two `InputEntity` elements shall have the same `Handle` value.

The audio characteristics and duration of all audio channels referenced by `Handle` elements shall be identical.

## 6.4 InputEntityType

**Table 4 – InputEntityType schema definition**

```
<xs:complexType name="InputEntityType">
  <xs:sequence>
    <xs:element maxOccurs="1" minOccurs="1" name="Handle"
      type="opl:HandleType"/>
    <xs:element name="Gain" minOccurs="0">
      <xs:simpleType>
        <xs:restriction base="xs:decimal">
          <xs:minInclusive value="-20"/>
          <xs:maxInclusive value="20"/>
          <xs:fractionDigits value="1"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
```

### 6.4.1 Handle

The `Handle` shall be a Handle as specified in SMPTE ST 2067-100 and shall refer to a single audio channel.

### 6.4.2 Gain

The `Gain` element shall specify the gain to be applied to the audio channel referenced by the `Handle` element.

The `Gain` element shall be expressed in dB — see Section 7 for the precise semantics of `Gain`.

## 7 Processing Model

For each `OutputAudioChannel` element of the `OutputEntityList`, the Macro shall output a single audio channel.

As illustrated in Figure 1, each sample *OS* of the output audio channel shall be computed as follows

$$OS = \sum_{i=1}^{N} IS_i \cdot 10^{G_i / 20}$$

where

$IS_i$ is the corresponding sample of the i[th] `InputEntity` element;

$N$ is the number of `InputEntity` elements; and

$G_i$ is the Gain value of the i[th] `InputEntity` element.

For instance a `Gain` element with a value of -6.0 would result in each sample of `InputEntity` to be multiplied by $10^{-6/20} \approx 0.5012$.

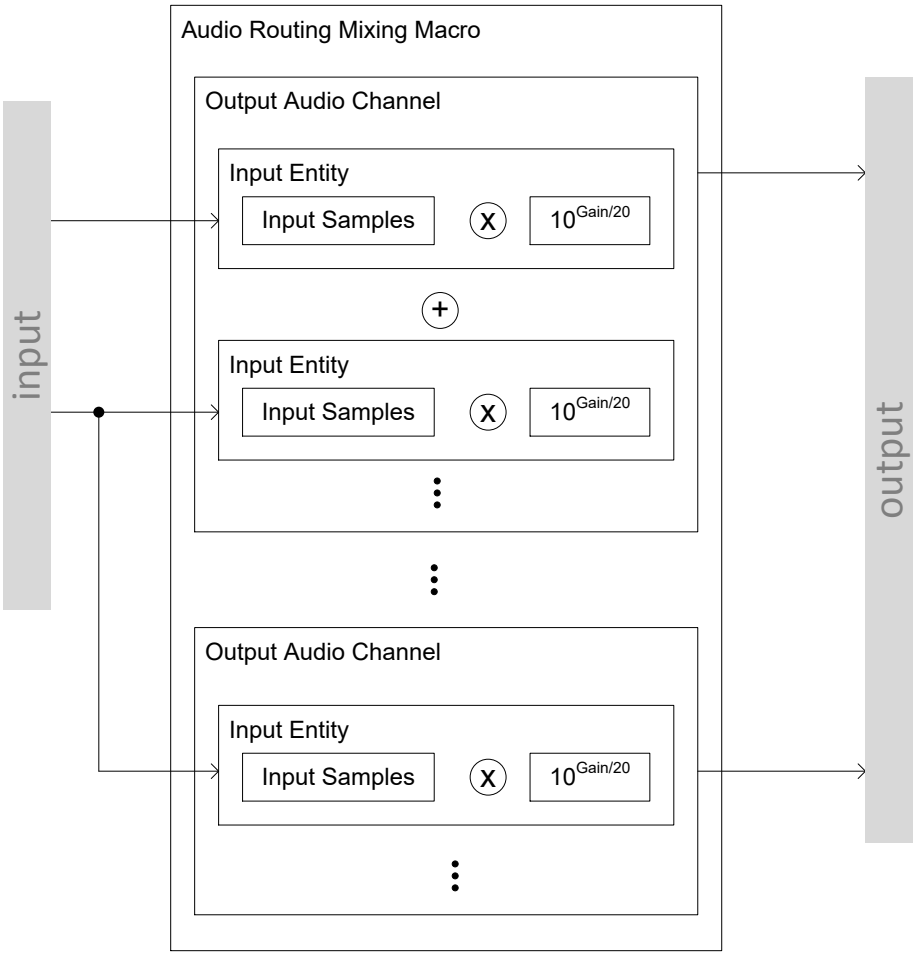


**Figure 1 – Audio Routing and Mixing Macro**

## 8 Output Audio Channel Handles

Each output audio channel, i.e. each `OutputAudioChannel` element in the `OutputEntityList`, shall be available to other Macro instances associated with a Handle equal to the value of its `Handle` element (see Section 6.3.2).

# Annex A Consolidated Schema (Informative)

This specification is accompanied by the following element, which is an XML schema document as specified in XML Schema Part 1: Structures.

st2067-103b-2014.xsd

This element collects the XML schema definitions defined in this specification. It is informative and, in case of conflict, this specification takes precedence.

# Annex B Sample Instance (Informative)

This specification is accompanied by the following element, which is an XML document that contains a sample instance of the Audio Routing and Mixing Macro as specified in Section 6.2.

st2067-103a-2014.xml

This element is for illustration only, and is neither intended to capture current or future practice, nor exercise all normative language contained in this specification.