



International  
Standard

**ISO/IEC 23002-7**

**Information technology — MPEG  
video technologies —**

Part 7:  
**Versatile supplemental  
enhancement information messages  
for coded video bitstreams**

*Technologies de l'information — Technologies vidéo MPEG —*

*Partie 7: Messages d'améliorations complémentaires polyvalents  
pour les flux binaires vidéo codés*

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## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives) or [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs)).

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T (as Rec. ITU-T H.274).

This third edition cancels and replaces the second edition (ISO/IEC 23002-7:2022), which has been technically revised.

The main changes are as follows:

- the addition of the shutter interval information SEI message,
- the addition of the neural-network post-filter characteristics SEI message,
- the addition of the neural-network post-filter activation SEI message, and
- the addition of the phase indication SEI message.

A list of all parts in the ISO/IEC 23002 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html) and [www.iec.ch/national-committees](http://www.iec.ch/national-committees).

## Introduction

### Versions of this document

Rec. ITU-T H.274 | ISO/IEC 23002-7 version 1 refers to the first approved version of this document. The first edition published by ITU-T as Rec. ITU-T H.274 (08/2020) and by ISO/IEC as ISO/IEC 23002-7:2021 corresponded to the first version.

Rec. ITU-T H.274 | ISO/IEC 23002-7 version 2 refers to the integrated text containing nine additional SEI messages, namely the annotated regions SEI message, the alpha channel information SEI message, the depth representation information SEI message, the multiview acquisition information SEI message, the multiview view position SEI message, the scalability dimension information SEI message, the extended dependent random access point indication SEI message, the display orientation SEI message, and the colour transform information SEI message. Besides these additional SEI messages, this version also contains corrections to various minor defects in the prior content of the specification. The second edition published by ITU-T as Rec. ITU-T H.274 (05/2022) and by ISO/IEC as ISO/IEC 23002-7:2022 corresponds to the second version.

Rec. ITU-T H.274 | ISO/IEC 23002-7 version 3 (the current version) refers to the integrated text containing four additional SEI messages, namely the shutter interval information SEI message, the neural-network post-filter characteristics SEI message, the neural-network post-filter activation SEI message, and the phase indication SEI message. Besides these additional SEI messages, this version also contains corrections to various minor defects in the prior content of the specification. The third edition published by ISO/IEC as ISO/IEC 23002-7:2024 corresponds to the third version. This third edition of ISO/IEC 23002-7 corresponds to the third edition published by ITU-T as Rec. ITU-T H.274 (09/2023).

### Conventions

The term "this document" is used to refer to this Recommendation | International Standard.

In this document, the following verbal forms are used:

- "shall" indicates a requirement. When used to express a mandatory constraint on the values of syntax elements or the values of variables derived from these syntax elements, it is the responsibility of the encoder to ensure that the constraint is fulfilled.
- "should" indicates a recommendation. It is used to refer to behaviour of an implementation that is encouraged to be followed under anticipated ordinary circumstances, but is not a requirement for conformance to this document.
- "may" indicates a permission.
- "can" indicates a possibility or a capability.

Information marked as "NOTE" is intended to assist the understanding or use of the document. "Notes to entry" used in [Clause 3](#) provide additional information that supplements the terminological data and can contain provisions relating to the use of a term.





# Information technology — MPEG video technologies —

## Part 7:

# Versatile supplemental enhancement information messages for coded video bitstreams

## 1 Scope

This document specifies the syntax and semantics of video usability information (VUI) parameters and supplemental enhancement information (SEI) messages. The VUI parameters and SEI messages defined in this document are designed to be conveyed within coded video bitstreams in a manner specified in a video coding specification or to be conveyed by other means determined by the specifications for systems that make use of such coded video bitstreams. This document is particularly intended for use with coded video bitstreams as specified by Rec. ITU-T H.266 | ISO/IEC 23090-3, although it is drafted in a manner intended to be sufficiently generic that it can also be used with other types of coded video bitstreams.

VUI parameters and SEI messages can assist in processes related to decoding, display or other purposes. However, unless otherwise specified in a referencing specification, the interpretation and use of the VUI parameters and SEI messages specified in this document is not a required functionality of a video decoder or receiving video system. Although semantics are specified for the VUI parameters and SEI messages, decoders and receiving video systems can simply ignore the content of the VUI parameters and SEI messages or can use them in a manner that somewhat differs from what is specified in this document.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 10646, *Information technology — Universal coded character set (UCS)*

ISO/IEC 11578:1996, *Information technology — Open Systems Interconnection — Remote Procedure Call (RPC)*

ISO/IEC 15938-17, *Information technology — Multimedia content description interface — Part 17: Compression of neural networks for multimedia content description and analysis*

Rec. ITU-T H.273 | ISO/IEC 23091-2, *Information technology — Coding-independent code points — Part 2: Video*

Rec. ITU-T T.35:2000, *Procedure for the allocation of ITU-T defined codes for non-standard facilities*

ISO/CIE 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

IETF RFC 1321, *The MD5 Message-Digest Algorithm*

IETF RFC 4151, *The 'tag' URI Scheme*

IETF RFC 5646, *Tags for Identifying Languages.*

IETF RFC 3986, *Uniform Resource Identifiers (URI): Generic Syntax*

### 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

**AU**  
access unit  
set of *PUs* that belong to different *layers* and contain *coded pictures* associated with the same *output time*

#### 3.2

**APS**  
adaptation parameter set  
*syntax structure* containing *syntax elements* that apply to zero or more *slices* as determined by zero or more *syntax elements* found in *slice headers*

#### 3.3

**alpha blending**  
process in which an auxiliary *coded picture* is used in combination with a primary *coded picture* and with other data not specified by this document in the display process

Note 1 to entry: In an alpha blending process, the luma samples of an auxiliary coded picture are interpreted as indications of the degree of opacity (or, equivalently, the degrees of transparency) associated with corresponding samples of the primary coded picture.

#### 3.4

**associated IRAP picture**  
previous *IRAP picture* (when present) in *decoding order*, for a particular picture, in the same *layer* as the particular *picture*

#### 3.5

**azimuth circle**  
circle on a sphere connecting all points with the same azimuth value

Note 1 to entry: An azimuth circle is always a *great circle* like a longitude line on the earth.

#### 3.6

**byte**  
sequence of 8 bits, within which, when written or read as a sequence of bit values, the left-most and right-most bits represent the most and least significant bits, respectively, and the bits are written or read from left to right

#### 3.7

**chroma**  
sample array or single sample representing one of the two colour difference signals related to the primary colours, represented by the symbols Cb and Cr

Note 1 to entry: The term chroma is used rather than the term chrominance in order to avoid implying the use of linear light transfer characteristics that is often associated with the term chrominance.

#### 3.8

**CLVS**  
coded layer video sequence  
sequence of *PUs* of the same layer that consists, in *decoding order*, of a *CLVSS PU*, followed by zero or more *PUs* that are not *CLVSS PUs*, including all subsequent *PUs* up to but not including any subsequent *PU* that is a *CLVSS PU*

**3.9**

**CLVSS PU**

*PU* in which the *coded picture* is a *CLVSS picture*

**3.10**

**CLVSS**

coded layer video sequence start

*coded picture* that starts a new CLVS as specified in a video coding specification

Note 1 to entry: In Rec. ITU-T H.266 | ISO/IEC 23090-3, a CLVSS picture is an *IRAP picture* with *NoIncorrectPicOutputFlag* equal to 1 or a gradual decoding refresh picture with *NoIncorrectPicOutputFlag* equal to 1. In Rec. ITU-T H.265 | ISO/IEC 23008-2, a CLVSS picture is an *IRAP picture* with *NoRaslOutputFlag* equal to 1.

**3.11**

**coded picture**

*coded representation* of a *picture* containing all *CTUs* of the *picture*

**3.12**

**coded slice NAL unit**

*NAL unit* that contains a *coded slice*

**3.13**

**coded video bitstream**

sequence of bits that forms the representation of a sequence of *AUs* forming one or more *CVSSs*

**3.14**

**CVS**

coded video sequence

sequence of *AUs* that consists, in *decoding order*, of a *CVSS AU*, followed by zero or more *AUs* that are not *CVSS AUs*, including all subsequent *AUs* up to but not including any subsequent *AU* that is a *CVSS AU*

**3.15**

**CVSS AU**

*AU* that has a *PU* for each *layer* present in the *CVS* and the *coded picture* in each *PU* is a *CLVSS picture*

**3.16**

**component**

array or single sample from one of the three arrays (*luma* and two *chroma*) that compose a *picture* in 4:2:0, 4:2:2, or 4:4:4 colour format or the array or a single sample of the array that compose a *picture* in monochrome format

**3.17**

**constituent picture**

part of a spatially *frame-packed stereoscopic picture* that corresponds to one view, or a *picture* itself when *frame packing* is not in use or the temporal interleaving *frame packing* arrangement is in use

**3.18**

**cropped decoded picture**

result of cropping a *decoded picture* based on the conformance cropping window for the corresponding *coded picture*

**3.19**

**decoded picture**

*decoded picture* is derived by decoding a *coded picture*

**3.20**

**decoder**

embodiment of a *decoding process*

**3.21**

**decoding order**

order in which *syntax elements* are conveyed in the *coded video bitstream* and are processed by a *decoding process*

**3.22**

**decoding process**

process that reads a *coded video bitstream* and derives *decoded pictures* from it

**3.23**

**elevation circle**

circle on a sphere connecting all points with the same elevation value

Note 1 to entry: An elevation circle is similar to a latitude line on the earth. Except when the elevation value is zero, an elevation circle is not a *great circle* like a longitude circle on the earth.

**3.24**

**encoder**

embodiment of an *encoding process*

**3.25**

**encoding process**

process that produces a *coded video bitstream*

**3.26**

**field**

assembly of alternative rows of samples of a *frame*

**3.27**

**flag**

variable or single-bit *syntax element* that can take one of the two possible values: 0 and 1

**3.28**

**frame**

composition of a top *field* and a bottom *field*, where sample rows 0, 2, 4, ... originate from the top *field* and sample rows 1, 3, 5, ... originate from the bottom *field*

**3.29**

**global coordinate axes**

coordinate axes associated with *omnidirectional video* that are associated with an externally referenceable position and orientation

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Note 1 to entry: The global coordinate axes could correspond to the position and orientation of a device or rig used for omnidirectional audio/video acquisition as well as the position of an observer's head in the three-dimensional space of the *omnidirectional video* rendering environment.

**3.30**

**great circle**

intersection of a sphere and a plane that passes through the centre point of the sphere

Note 1 to entry: A great circle is also known as an orthodrome or Riemannian circle.

**3.31**

**inter prediction**

aspect of the *decoding process* for a *coded picture* that makes use of data derived from the *decoding process* of one or more previously decoded *reference pictures*

**3.32**

**IRAP picture**

*coded picture* starting from which all *pictures* in the same *layer* in both *decoding order* and *output order* can be decoded without first decoding any *picture* in the same *layer* earlier in *decoding order* in the *coded video bitstream*

### 3.33

#### **layer**

set of *VCL NAL units* that all have a particular value of layer identifier and the associated non-VCL NAL units, wherein the layer identifier is a variable for which the value is specified by a video coding specification

Note 1 to entry: In the contexts of Rec. ITU-T H.266 | ISO/IEC 23090-3 and Rec. ITU-T H.265 | ISO/IEC 23008-2, the layer identifier is the value of the *nuh\_layer\_id* syntax element in the NAL unit header.

### 3.34

#### **leading picture**

*picture* that is in the same *layer* as the *associated IRAP picture* and precedes the *associated IRAP picture* in *output order*

### 3.35

#### **local coordinate axes**

coordinate axes having a specified rotation relationship relative to the *global coordinate axes*

### 3.36

#### **luma**

sample array or single sample representing the monochrome signal related to the primary colours, represented by the symbol or subscript Y or L

Note 1 to entry: The term *luma* is used rather than the term *luminance* in order to avoid implying the use of linear light transfer characteristics that is often associated with the term *luminance*. The symbol L is sometimes used instead of the symbol Y to avoid confusion with the symbol y as used for vertical location.

### 3.37

#### **NAL unit**

*syntax structure* containing an indication of the type of data that follows and *bytes* containing that data in a manner that enables the extraction of a string of data bits from the *syntax structure*

### 3.38

#### **non-VCL NAL unit**

*NAL unit* that is not a *VCL NAL unit*

### 3.39

#### **omnidirectional video**

video content in a format that enables rendering according to the user's viewing orientation, e.g., if viewed using a head-mounted device, or according to a user's desired *viewport*, reflecting a potentially rotated viewing position

### 3.40

#### **output order**

order in which the *decoded pictures* are output from the *decoder* (for the *decoded pictures* that are to be output from the *decoder*)

### 3.41

#### **output time**

time when a *decoded picture* is to be output from the *decoder* (for the *decoded pictures* that are to be output from the *decoder*)

### 3.42

#### **packed region**

region in a *region-wise packed picture* that is mapped to a *projected region* according to a *region-wise packing*

### 3.43

#### **picture**

array of *luma* samples in monochrome format or an array of *luma* samples and two corresponding arrays of *chroma* samples in 4:2:0, 4:2:2, and 4:4:4 colour format

Note 1 to entry: A picture could be either a frame or a field. However, in one CLVS, either all pictures are frames or all pictures are fields.

**3.44**

**PPS**

**picture parameter set**

A *syntax structure* containing *syntax elements* that apply to zero or more entire *coded pictures* as determined by a *syntax element* that is the same for all *slices* of a picture and found in the picture header or *slice headers* of each *picture*

**3.45**

**PU**

**picture unit**

set of *NAL units* that contain all *VCL NAL units* of a *coded picture* and their associated non-VCL *NAL units*

**3.46**

**projected picture**

*picture* that uses a *projection* format for *omnidirectional video*

**3.47**

**projected region**

region in a *projected picture* that is mapped to a *packed region* according to a *region-wise packing*

**3.48**

**projection**

specified correspondence between the colour samples of a *projected picture* and azimuth and elevation positions on a sphere

**3.49**

**random access**

act of starting the decoding process for a *coded video bitstream* at a point other than the beginning of the bitstream

**3.50**

**RASL picture**

*leading picture* that cannot be correctly decoded when the decoding process starts from the *associated IRAP picture*

**3.51**

**reference picture**

*picture* that contains samples that could be used for *inter prediction* in the decoding process of subsequent pictures in decoding order

**3.52**

**reference picture list**

list of *reference pictures* that is used for *inter prediction* of a *slice*

**3.53**

**region-wise packed picture**

decoded picture that contains one or more *packed regions*

Note 1 to entry: A region-wise packed picture could contain a *region-wise packing* of a *projected picture*.

**3.54**

**region-wise packing**

transformation, resizing, and relocation of *packed regions* of a *region-wise packed picture* to remap the *packed regions* to *projected regions* of a *projected picture*

**3.55**

**sample aspect ratio**

indicated width-to-height aspect ratio of the luma samples of the associated *decoded pictures*