



**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*

**Fourth edition
2026-09**



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2026

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	vi
Introduction	viii
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Abbreviated terms	9
5 Conventions	11
5.1 General	11
5.2 Arithmetic operators	11
5.3 Logical operators	12
5.4 Relational operators	12
5.5 Bit-wise operators	12
5.6 Assignment operators	13
5.7 Range notation	13
5.8 Mathematical functions	13
5.9 Order of operation precedence	14
5.10 Variables, syntax elements and tables	15
5.11 Text description of logical operations	16
5.12 Processes	17
6 Syntax and semantics	18
6.1 General	18
6.2 Method of specifying syntax in tabular form	19
6.3 Specification of syntax functions and descriptors	20
7 Video usability information parameters	21
7.1 General	21
7.2 VUI parameters syntax	21
7.3 VUI parameters semantics	22
8 SEI messages	29
8.1 General	29
8.2 Filler payload SEI message	31
8.2.1 Filler payload SEI message syntax	31
8.2.2 Filler payload SEI message semantics	31
8.3 User data registered by Rec. ITU-T T.35 SEI message	31
8.3.1 User data registered by Rec. ITU-T T.35 SEI message syntax	31
8.3.2 User data registered by Rec. ITU-T T.35 SEI message semantics	31
8.4 User data unregistered SEI message	32
8.4.1 User data unregistered SEI message syntax	32
8.4.2 User data unregistered SEI message semantics	32
8.5 Film grain characteristics SEI message	32
8.5.1 Film grain characteristics SEI message syntax	32
8.5.2 Film grain characteristics SEI message semantics	33
8.6 Frame packing arrangement SEI message	42
8.6.1 Frame packing arrangement SEI message syntax	42
8.6.2 Frame packing arrangement SEI message semantics	42
8.7 Parameter sets inclusion indication SEI message	50
8.7.1 Parameter sets inclusion indication SEI message syntax	50
8.7.2 Parameter sets inclusion indication SEI message semantics	50
8.8 Decoded picture hash SEI message	51
8.8.1 Decoded picture hash SEI message syntax	51
8.8.2 Decoded picture hash SEI message semantics	51
8.9 Mastering display colour volume SEI message	53
8.9.1 Mastering display colour volume SEI message syntax	53

8.9.2	Mastering display colour volume SEI message semantics	53
8.10	Content light level information SEI message	55
8.10.1	Content light level information SEI message syntax	55
8.10.2	Content light level information SEI message semantics	55
8.11	Dependent random access point indication SEI message	56
8.11.1	Dependent random access point indication SEI message syntax	56
8.11.2	Dependent random access point indication SEI message semantics	56
8.12	Alternative transfer characteristics information SEI message	57
8.12.1	Alternative transfer characteristics information SEI message syntax	57
8.12.2	Alternative transfer characteristics SEI message semantics	57
8.13	Ambient viewing environment SEI message	57
8.13.1	Ambient viewing environment SEI message syntax	57
8.13.2	Ambient viewing environment SEI message semantics	57
8.14	Content colour volume SEI message	58
8.14.1	Content colour volume SEI message syntax	58
8.14.2	Content colour volume SEI message semantics	58
8.15	Omnidirectional video specific SEI messages	61
8.15.1	Sample location remapping process	61
8.15.2	Equirectangular projection SEI message	71
8.15.3	Generalized cubemap projection SEI message	74
8.15.4	Sphere rotation SEI message	80
8.15.5	Region-wise packing SEI message	81
8.15.6	Omnidirectional viewport SEI message	88
8.16	Frame-field information SEI message	90
8.16.1	Frame-field information SEI message syntax	90
8.16.2	Frame-field information SEI message semantics	90
8.17	Sample aspect ratio information SEI message	93
8.17.1	Sample aspect ratio information SEI message syntax	93
8.17.2	Sample aspect ratio information SEI message semantics	93
8.18	Annotated regions SEI message	94
8.18.1	Annotated regions SEI message syntax	94
8.18.2	Annotated regions SEI message semantics	95
8.19	Scalability dimension information SEI message	98
8.19.1	Scalability dimension information SEI message syntax	98
8.19.2	Scalability dimension information SEI message semantics	98
8.20	Multiview acquisition information SEI message	100
8.20.1	Multiview acquisition information SEI message syntax	100
8.20.2	Multiview acquisition information SEI message semantics	101
8.21	Multiview view position SEI message	105
8.21.1	Multiview view position SEI message syntax	105
8.21.2	Multiview view position SEI message semantics	105
8.22	Depth representation information SEI message	106
8.22.1	Depth representation information SEI message syntax	106
8.22.2	Depth representation information SEI message semantics	106
8.23	Alpha channel information SEI message	110
8.23.1	Alpha channel information SEI message syntax	110
8.23.2	Alpha channel information SEI message semantics	110
8.24	Extended DRAP indication SEI message	113
8.24.1	Extended DRAP indication SEI message syntax	113
8.24.2	Extended DRAP indication SEI message semantics	113
8.25	Display orientation SEI message	114
8.25.1	Display orientation SEI message syntax	114
8.25.2	Display orientation SEI message semantics	115
8.26	Colour transform information SEI message	116
8.26.1	Colour transform information SEI message syntax	116
8.26.2	Colour transform information SEI message semantics	116
8.27	Shutter interval information SEI message	120
8.27.1	Shutter interval information SEI message syntax	120
8.27.2	Shutter interval information SEI message semantics	120

8.28	Neural-network post-filter SEI messages.....	121
8.28.1	Neural-network post-filter characteristics SEI message.....	121
8.28.2	Neural-network post-filter activation SEI message.....	150
8.29	Phase indication SEI message.....	153
8.29.1	Phase indication SEI message syntax.....	153
8.29.2	Phase indication SEI message semantics.....	153
8.30	SEI processing order and processing order nesting SEI messages.....	155
8.30.1	SEI processing order SEI message.....	155
8.30.2	Processing order nesting SEI message.....	164
8.31	Encoder optimization information SEI message.....	168
8.31.1	Encoder optimization information SEI message syntax.....	168
8.31.2	Encoder optimization information SEI message semantics.....	169
8.32	Source picture timing information SEI message.....	173
8.32.1	Source picture timing information SEI message syntax.....	173
8.32.2	Source picture timing information SEI message semantics.....	174
8.33	Object mask information SEI message.....	178
8.33.1	Object mask information SEI message syntax.....	178
8.33.2	Object mask information SEI message semantics.....	179
8.34	Modality information SEI message.....	184
8.34.1	Modality information SEI message syntax.....	184
8.34.2	Modality information SEI message semantics.....	184
8.35	Text description information SEI message.....	186
8.35.1	Text description information SEI message syntax.....	186
8.35.2	Text description information SEI message semantics.....	186
8.36	Generative face video and generative enhancement face video SEI messages.....	189
8.36.1	Generative face video SEI message.....	189
8.36.2	Generative enhancement face video SEI message.....	206
8.37	Digitally signed content SEI messages.....	215
8.37.1	General.....	215
8.37.2	Digitally signed content initialization SEI message.....	216
8.37.3	Digitally signed content selection SEI message.....	220
8.37.4	Digitally signed content verification SEI message.....	222
8.38	AI usage restrictions request SEI message.....	225
8.38.1	AI usage restrictions request SEI message syntax.....	225
8.38.2	AI usage restrictions request SEI message semantics.....	225
8.39	Packed regions information SEI message.....	227
8.39.1	Packed regions information SEI message syntax.....	227
8.39.2	Packed regions information SEI message semantics.....	228
8.40	Image format metadata SEI message.....	233
8.40.1	Image format metadata SEI message syntax.....	233
8.40.2	Image format metadata SEI message semantics.....	234
8.41	Reserved SEI message.....	236
8.41.1	Reserved SEI message syntax.....	236
8.41.2	Reserved SEI message semantics.....	236
9	Parsing process for k-th order Exp-Golomb codes.....	236
9.1	General.....	236
9.2	Mapping process for signed Exp-Golomb codes.....	238
	Bibliography.....	239

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 Specification 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 Specification was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this Specification may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this Specification, ISO and IEC had received notice of (a) patent(s) which may be required to implement this Specification. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and <https://patents.iec.ch>. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this Specification is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This Specification 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 fourth edition cancels and replaces the third edition (ISO/IEC 23002-7:2024), which has been technically revised.

The main changes are as follows:

- extensions to the film grain characteristics SEI message, the neural-network post-filter characteristics SEI message, and the neural-network post-filter activation SEI message,
- the addition of the SEI processing order SEI message and the processing order nesting SEI message,
- the addition of the encoder optimization information SEI message,
- the addition of the source picture timing information SEI message,
- the addition of the object mask information SEI message,
- the addition of the modality information SEI message,
- the addition of the text description information SEI message,
- the addition of the generative face video SEI message and the generative enhancement face video message,
- the addition of the digitally signed content initialization SEI message, the digitally signed content selection SEI message, and the digitally signed content verification SEI message,
- the addition of the AI usage restrictions request SEI message,
- the addition of the packed regions information SEI message, and

— the addition of the image format metadata 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 Specification 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 and www.iec.ch/national-committees.

Introduction

Versions of this Specification

Rec. ITU-T H.274 | ISO/IEC 23002-7 version 1 refers to the first approved version of this Specification. 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 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).

Rec. ITU-T H.274 | ISO/IEC 23002-7 version 4 (the current version) refers to the integrated text additionally containing extensions to the film grain characteristics SEI message, the neural-network post-filter characteristics SEI message, the neural-network post-filter activation SEI message, and 15 additional SEI messages, namely the SEI processing order SEI message, the processing order nesting SEI message, the encoder optimization information SEI message, the source picture timing information SEI message, the object mask information SEI message, the modality information SEI message, the text description information SEI message, the generative face video SEI message, the generative enhancement face video message, the digitally signed content initialization SEI message, the digitally signed content selection SEI message, digitally signed content verification SEI message, the AI usage restrictions request SEI message, the packed regions information SEI message, and the image format metadata SEI message. Additionally, the version 4 integrated text also contains corrections to various minor defects in the prior content of the Specification. The fourth edition published by ITU-T as Rec. ITU-T H.274 (XX/2026) corresponds to the fourth version.

Conventions

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

In this Specification, 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 Specification.
- “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 Specification 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 Specification 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 Specification 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 Specification 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 Specification.

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 Specification. 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 12234-2, *Electronic still-picture imaging — Removable memory — Part 2: TIFF/EP image data format*

ISO 15076-1, *Image technology colour management — Architecture, profile format and data structure — Part 1: Based on ICC.1:2022*

ISO 16684-1, *Graphic technology — Extensible metadata platform (XMP) — Part 1: Data model, serialization and core properties*

ISO 16684-3, *Graphic technology — Extensible metadata platform (XMP) specification — Part 3: JSON-LD serialization of XMP*

ISO 20677, *Image technology colour management — Extensions to architecture, profile format and data structure*

ISO/IEC 21617-1, *Information technology — JPEG Trust — Part 1: Core Foundation*

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*

Rec. ITU-T T.871 | ISO/IEC 10918-5, *Information technology – Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF)*

CTA-766-D (ANSI), *U.S. and Canadian Region Rating Tables (RRT) and Content Advisory Descriptors for Transport of Content Advisory Information Using ATSC Program and System Information Protocol (PSIP)*

CIPA-DC-008-2023, *Camera & Imaging Products Association Exif, Exchangeable image file format for digital still cameras*

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*

NIST FIPS PUB 180-4, *Secure Hash Standard (SHS)*

Bibliography

- [1] Rec. ITU-T H.264 | ISO/IEC 14496-10, *Information technology — Coding of audio-visual objects — Part 10: Advanced video coding*
- [2] Rec. ITU-T H.265 | ISO/IEC 23008-2, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding*
- [3] Rec. ITU-T H.266 | ISO/IEC 23090-3, *Information technology — Coded representation of immersive media — Part 3: Versatile video coding*
- [4] Rec. ITU-T H.271, *Video back-channel messages for conveyance of status information and requests from a video receiver to a video sender*
- [5] Supplement ITU-T H-Suppl. 19 | ISO/IEC TR 23091-4, *Information technology — Coding-independent code points — Part 4: Usage of video signal type code points*
- [6] Rec. ITU-R BT.1886, *Reference electro-optical transfer function for flat panel displays used in HDTV studio production*
- [7] Rec. ITU-R BT.2020, *Parameter values for ultra-high definition television systems for production and international programme exchange*
- [8] Rec. ITU-R BT.2035, *A reference viewing environment for evaluation of HDTV program material or completed programmes*
- [9] Rec. ITU-R BT.2100, *Image parameter values for high dynamic range television for use in production and international programme exchange*
- [10] ANSI/CTA 861-G, *A DTV Profile for Uncompressed High Speed Digital Interfaces*
- [11] ATSC A/341:2022-03, *ATSC Standard: Video – HEVC*
- [12] CIE 15, *Colorimetry*
- [13] ISO/CIE 11664-3, *Colorimetry — Part 3: CIE tristimulus values*
- [14] SMPTE RDD 5, *Film Grain Technology – Specifications for H.264/MPEG-4 AVC Bitstreams*
- [15] SMPTE ST 2086, *Mastering Display Color Volume Metadata supporting High Luminance and Wide Color Gamut Images*
- [16] CEA 861.3, *HDR Static Metadata Extensions*