INTERNATIONAL STANDARD

ISO/IEC 14496-10

Third edition
2005-12-15

Corrected version
2006-03-01

AMENDMENT 1
2007-07-01

Information technology — Coding of audio-visual objects —

Part 10: Advanced Video Coding

AMENDMENT 1: Support for colour spaces and aspect ratio definitions

Technologies de l'information — Codage des objets audiovisuels —

Partie 10: Codage visuel avancé

AMENDEMENT 1: Support pour espaces couleurs et définitions du format de l'image

Reference number
ISO/IEC 14496-10:2005/Amd.1:2007(E)

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Published in Switzerland

Foreword

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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Amendment 1 to ISO/IEC 14496-10:2005 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

Amendment 1 to ISO/IEC 14496-10:2005, together with ISO/IEC 14496-10:2005/Cor.2:2006, is technically aligned with ITU-T Rec. H.264 (2005)/Amd.1 (2006) but is not published as identical text.

Information technology — Coding of audio-visual objects —

Part 10:
Advanced Video Coding

AMENDMENT 1: Support for colour spaces and aspect ratio definitions

In E.2, replace Table E-1 with the following:

Table E-1 – Meaning of sample aspect ratio indicator

aspect_ratio_idc	Sample aspect ratio	(informative) Examples of use
0	Unspecified	
1	1:1 ("square")	1280x720 16:9 frame without overscan 1920x1080 16:9 frame without overscan (cropped from 1920x1088) 640x480 4:3 frame without overscan
2	12:11	720x576 4:3 frame with horizontal overscan 352x288 4:3 frame without overscan
3	10:11	720x480 4:3 frame with horizontal overscan 352x240 4:3 frame without overscan
4	16:11	720x576 16:9 frame with horizontal overscan 528x576 4:3 frame without overscan
5	40:33	720x480 16:9 frame with horizontal overscan 528x480 4:3 frame without overscan
6	24:11	352x576 4:3 frame without overscan 480x576 16:9 frame with horizontal overscan
7	20:11	352x480 4:3 frame without overscan 480x480 16:9 frame with horizontal overscan
8	32:11	352x576 16:9 frame without overscan
9	80:33	352x480 16:9 frame without overscan
10	18:11	480x576 4:3 frame with horizontal overscan
11	15:11	480x480 4:3 frame with horizontal overscan
12	64:33	528x576 16:9 frame without overscan
13	160:99	528x480 16:9 frame without overscan
14	4:3	1440x1080 16:9 frame without overscan
15	3:2	1280x1080 16:9 frame without overscan
16	2:1	960x1080 16:9 frame without overscan
17..254	Reserved	
255	Extended_SAR	

In E.2, replace Table E-3 with the following:

Table E-3 – Colour primaries

Value	Primaries			Informative Remarks
0	Reserved			For future use by ITU-T / ISO/IEC
1	primary green blue red white D65	x 0.300 0.150 0.640 0.3127	y 0.600 0.060 0.330 0.3290	ITU-R Recommendation BT.709-5 ITU-R Recommendation BT.1361 conventional colour gamut system and extended colour gamut system IEC 61966-2-4 Society of Motion Picture and Television Engineers RP 177 Annex B
2	Unspecified			Image characteristics are unknown or are determined by the application.
3	Reserved			For future use by ITU-T / ISO/IEC
4	primary green blue red white C	x 0.21 0.14 0.67 0.310	y 0.71 0.08 0.33 0.316	ITU-R Recommendation BT.470-6 System M (historical) ITU-R Recommendation BT.1700 (2007 revision) 625 PAL or 625 SECAM United States National Television System Committee 1953 Recommendation for transmission standards for color television United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	primary green blue red white D65	x 0.29 0.15 0.64 0.3127	y 0.60 0.06 0.33 0.3290	ITU-R Recommendation BT.1358 625 ITU-R Recommendation BT.470-6 System B, G (historical)
6	primary green blue red white D65	x 0.310 0.155 0.630 0.3127	y 0.595 0.070 0.340 0.3290	ITU-R Recommendation BT.1700 NTSC ITU-R Recommendation BT.1358 525 Society of Motion Picture and Television Engineers 170M (functionally the same as the value 7)
7	primary green blue red white D65	x 0.310 0.155 0.630 0.3127	y 0.595 0.070 0.340 0.3290	Society of Motion Picture and Television Engineers 240M (functionally the same as the value 6)
8	primary green blue red white C	x 0.243 0.145 0.681 0.310	y 0.692 (Wratten 58) 0.049 (Wratten 47) 0.319 (Wratten 25) 0.316	Generic film (colour filters using Illuminant C)
9-255	Reserved			For future use by ITU-T / ISO/IEC

In E.2, replace Table E-4 with the following:

Table E-4 – Transfer characteristics

Value	Transfer Characteristic		Informative Remarks
0	Reserved		For future use by ITU-T / ISO/IEC
1	$V = 1.099 * L_c^{0.45} - 0.099$ $V = 4.500 * L_c$	for $1 >= L_c >= 0.018$ for $0.018 > L_c >= 0$	ITU-R Recommendation BT.709-5 ITU-R Recommendation BT.1361 conventional colour gamut system (functionally the same as the value 6)
2	Unspecified		Image characteristics are unknown or are determined by the application.
3	Reserved		For future use by ITU-T / ISO/IEC
4	Assumed display gamma 2.2		ITU-R Recommendation BT.470-6 System M (historical) United States National Television System Committee 1953 Recommendation for transmission standards for color television United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	Assumed display gamma 2.8		ITU-R Recommendation BT.1700 625 PAL or 625 SECAM ITU-R Recommendation BT.470-6 System B, G (historical)
6	$V = 1.099 * L_c^{0.45} - 0.099$ $V = 4.500 * L_c$	for $1 >= L_c >= 0.018$ for $0.018 > L_c >= 0$	ITU-R Recommendation BT.1700 NTSC ITU-R Recommendation BT.1358 525 or 625 Society of Motion Picture and Television Engineers 170M (functionally the same as the value 1)
7	$V = 1.1115 * L_c^{0.45} - 0.1115$ $V = 4.0 * L_c$	for $1 >= L_c >= 0.0228$ for $0.0228 > L_c >= 0$	Society of Motion Picture and Television Engineers 240M
8	$V = L_c$	for $1 > L_c >= 0$	Linear transfer characteristics
9	$V = 1.0 - \text{Log}_{10}(L_c) \div 2$ $V = 0.0$	for $1 >= L_c >= 0.01$ for $0.01 > L_c >= 0$	Logarithmic transfer characteristic (100:1 range)
10	$V = 1.0 - \text{Log}_{10}(L_c) \div 2.5$ $V = 0.0$	for $1 >= L_c >= 0.0031622777$ for $0.0031622777 > L_c >= 0$	Logarithmic transfer characteristic (316.22777:1 range)
11	$V = 1.099 * L_c^{0.45} - 0.099$ $V = 4.500 * L_c$ $V = -(1.099 * (-L_c)^{0.45} - 0.099)$	for $L_c >= 0.018$ for $0.018 > L_c > -0.018$ for $-0.018 >= L_c$	IEC 61966-2-4
12	$V = 1.099 * L_c^{0.45} - 0.099$ $V = 4.500 * L_c$ $V = -(1.099 * (-4 * L_c)^{0.45} - 0.099) \div 4$	for $1.33 > L_c >= 0.018$ for $0.018 > L_c >= -0.0045$ for $-0.0045 > L_c >= -0.25$	ITU-R Recommendation BT.1361 extended colour gamut system
13..255	Reserved		For future use by ITU-T / ISO/IEC

In E.2, replace the semantics of matrix_coefficients and Table E-5 with the following:

matrix_coefficients describes the matrix coefficients used in deriving luma and chroma signals from the green, blue, and red primaries, as specified in Table E-5.

matrix_coefficients shall not be equal to 0 unless both of the following conditions are true

– $BitDepth_C$ is equal to $BitDepth_Y$

– chroma_format_idc is equal to 3 (4:4:4)

The specification of the use of matrix_coefficients equal to 0 under all other conditions is reserved for future use by ITU-T | ISO/IEC.

matrix_coefficients shall not be equal to 8 unless one of the following conditions are true

– $BitDepth_C$ is equal to $BitDepth_Y$

– $BitDepth_C$ is equal to $BitDepth_Y + 1$ and chroma_format_idc is equal to 3 (4:4:4)

The specification of the use of matrix_coefficients equal to 8 under all other conditions is reserved for future use by ITU-T | ISO/IEC.

When the matrix_coefficients syntax element is not present, the value of matrix_coefficients shall be inferred to be equal to 2 (unspecified).

The interpretation of matrix_coefficients is defined as follows.

– If transfer_characteristics is not equal to 11 or 12, E'_R, E'_G, and E'_B are analog with values in the range of 0 to 1.
– Otherwise (transfer_characteristics is equal to 11 (IEC 61966-2-4) or 12 (ITU-R BT.1361 extended colour gamut system)), E'_R, E'_G and E'_B are analog with a larger range not specified in this Specification.
– Nominal white is specified as having E'_R equal to 1, E'_G equal to 1, and E'_B equal to 1.
– Nominal black is specified as having E'_R equal to 0, E'_G equal to 0, and E'_B equal to 0.
– If video_full_range_flag is equal to 0, the following equations apply.
  – If matrix_coefficients is equal to 1, 4, 5, 6, or 7, the following equations apply.

$$Y = Clip1_Y(Round((1 << (BitDepth_Y - 8)) * (219 * E'_Y + 16))) \quad \text{(E-1)}$$

$$Cb = Clip1_C(Round((1 << (BitDepth_C - 8)) * (224 * E'_{PB} + 128))) \quad \text{(E-2)}$$

$$Cr = Clip1_C(Round((1 << (BitDepth_C - 8)) * (224 * E'_{PR} + 128))) \quad \text{(E-3)}$$

  – Otherwise, if matrix_coefficients is equal to 0 or 8, the following equations apply.

$$R = Clip1_Y((1 << (BitDepth_Y - 8)) * (219 * E'_R + 16)) \quad \text{(E-4)}$$

$$G = Clip1_Y((1 << (BitDepth_Y - 8)) * (219 * E'_G + 16)) \quad \text{(E-5)}$$

$$B = Clip1_Y((1 << (BitDepth_Y - 8)) * (219 * E'_B + 16)) \quad \text{(E-6)}$$

  – Otherwise, if matrix_coefficients is equal to 2, the interpretation of the matrix_coefficients syntax element is unknown or is determined by the application.

  - Otherwise (matrix_coefficients is not equal to 0, 1, 2, 4, 5, 6, 7, or 8), the interpretation of the matrix_coefficients syntax element is reserved for future definition by ITU-T | ISO/IEC.
- Otherwise (video_full_range_flag is equal to 1), the following equations apply.
  - If matrix_coefficients is equal to 1, 4, 5, 6, or 7, the following equations apply.

$$Y = Clip1_Y(Round(((1 << BitDepth_Y) - 1) * E'_Y)) \quad \text{(E-7)}$$

$$Cb = Clip1_C(Round(((1 << BitDepth_C) - 1) * E'_{PB} + (1 << (BitDepth_C - 1)))) \quad \text{(E-8)}$$

$$Cr = Clip1_C(Round(((1 << BitDepth_C) - 1) * E'_{PR} + (1 << (BitDepth_C - 1)))) \quad \text{(E-9)}$$

  - Otherwise, if matrix_coefficients is equal to 0 or 8, the following equations apply.

$$R = Clip1_Y(((1 << BitDepth_Y) - 1) * E'_R) \quad \text{(E-10)}$$

$$G = Clip1_Y(((1 << BitDepth_Y) - 1) * E'_G) \quad \text{(E-11)}$$

$$B = Clip1_Y(((1 << BitDepth_Y) - 1) * E'_B) \quad \text{(E-12)}$$

  - Otherwise, if matrix_coefficients is equal to 2, the interpretation of the matrix_coefficients syntax element is unknown or is determined by the application.
  - Otherwise (matrix_coefficients is not equal to 0, 1, 2, 4, 5, 6, 7, or 8), the interpretation of the matrix_coefficients syntax element is reserved for future definition by ITU-T | ISO/IEC.
- If matrix_coefficients is not equal to 0 or 8, the following equations apply.

$$E'_Y = K_R * E'_R + (1 - K_R - K_B) * E'_G + K_B * E'_B \quad \text{(E-13)}$$

$$E'_{PB} = 0.5 * (E'_B - E'_Y) \div (1 - K_B) \quad \text{(E-14)}$$

$$E'_{PR} = 0.5 * (E'_R - E'_Y) \div (1 - K_R) \quad \text{(E-15)}$$

NOTE – E'_Y is analog with the value 0 associated with nominal black and the value 1 associated with nominal white. E'_{PB} and E'_{PR} are analog with the value 0 associated with both nominal black and nominal white. When transfer_characteristics is not equal to 11 or 12, E'_Y is analog with values in the range of 0 to 1. When transfer_characteristics is not equal to 11 or 12, E'_{PB} and E'_{PR} are analog with values in the range of -0.5 to 0.5. When transfer_characteristics is equal to 11 (IEC 61966-2-4), or 12 (ITU-R BT.1361 extended colour gamut system), E'_Y, E'_{PB} and E'_{PR} are analog with a larger range not specified in this Specification.

- Otherwise, if matrix_coefficients is equal to 0, the following equations apply.

$$Y = Round(G) \quad \text{(E-16)}$$

$$Cb = Round(B) \quad \text{(E-17)}$$

$$Cr = Round(R) \quad \text{(E-18)}$$

- Otherwise (matrix_coefficients is equal to 8), the following applies.
  - If $BitDepth_C$ is equal to $BitDepth_Y$, the following equations apply.

$$Y = Round(0.5 * G + 0.25 * (R + B)) \quad \text{(E-19)}$$

$$Cb = Round(0.5 * G - 0.25 * (R + B)) + (1 << (BitDepth_C - 1)) \quad \text{(E-20)}$$