

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.230

(03/2009)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services – Systems aspects

Frame-synchronous control and indication signals for audiovisual systems

Recommendation ITU-T H.230

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Frame-synchronous control and indication signals for audiovisual systems

Summary

Digital audiovisual services are provided by a transmission system in which the relevant signals are multiplexed onto a digital path using the frame structure defined in Recommendation ITU-T H.221. In addition to the audio, video, user data and telematic information, these signals include information for the proper functioning of the system. The additional information has been named control and indication (C&I) to reflect the fact that while some bits are genuinely for "control", causing a state change somewhere else in the system, others provide for indications to the users as to the functioning of the system. Recommendation ITU-T H.230 concerns only those C&I which must be transmission frame-synchronous, or otherwise requiring rapid response.

This Recommendation details the C&I related to video and audio; means of transmitting numbers and characters; C&I for maintenance purposes; for simple multipoint conferences not using protocol in the MLP channel; for channel aggregation; and for the transfer of network addresses. The codepoint tables also indicate the circumstances under which the various functions may be mandatory or optional.

This revised version of Recommendation ITU-T H.230 introduces a number of enhancements and clarifications to the previous version, primarily the description on the usage of Unicode characters and ITU-T G.719 in H.320 systems.

Source

Recommendation ITU-T H.230 was approved on 16 March 2009 by ITU-T Study Group 16 (2009-2012) under Recommendation ITU-T A.8 procedures.

FOREWORD

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Recommendation ITU-T H.230

Frame-synchronous control and indication signals for audiovisual systems

1 Scope

Digital audiovisual services are provided by a transmission system in which the relevant signals are multiplexed onto a digital path. In addition to the audio, video, user data and telematic information, these signals include information for the proper functioning of the system. The additional information has been named control and indication (C&I) to reflect the fact that while some bits are genuinely for "control", causing a state change somewhere else in the system, others provide for indications to the users as to the functioning of the system.

The C&I may be categorized into three groups:

- a) call control – these are treated in the Q-series Recommendations;
- b) transmission frame-synchronous, or otherwise requiring rapid response;
- c) conference, data, and telematic control not requiring frame synchronism, governed by the multilayer protocol of Recommendations ITU-T T.122-T.125.

This Recommendation concerns only those C&I appearing in category b) which includes a simplified set of conference C&I for multipoint connections of simple terminals.

2 Procedures

There are two procedures: some frame-synchronous C&I are provided for directly as bit-rate allocation signal (BAS) codes in Rec. ITU-T H.221, while the remainder require the use of an escape code.

2.1 C&I codes provided in Rec. ITU-T H.221

The following codes, whose functions are defined in clause 3, are provided in Rec. ITU-T H.221:

- VCF, VCU (procedures for use in multipoint calls according to Rec. ITU-T H.243);
- LCV, LCD, LCA, LCO (for maintenance).

In each case, the code is transmitted in the BAS position at an appropriate time.

2.2 Other C&I codes

All frame-synchronous C&I codes not listed in clause 2.1 are transmitted by a sequence involving the BAS positions in two or more consecutive sub-multiframes. The full definitions of these symbols are set out in clause 3, assigning to each an alphabetic code-name; the first letter of this indicates the type; the second is C for command, I for indication; the third is for the specific function.

Codepoint values are listed in Tables 1 and 2. For convenience, the occupancy of Table 1 is shown in Table 4.

2.2.1 SBE method

The single-byte extension method involves two consecutive BAS codes. In the first, the code (111) [10001] is transmitted. In the second, the code defined in Table 1 is transmitted.

It should be noted that only one symbol is transmitted by this method – the code in the subsequent sub-multiframe is again treated as a normal BAS code.

2.2.2 Double and triple SBE symbols

A "double symbol" consists of two SBE code-pairs, the second immediately following the first. The first is one of the symbols listed as having an associated SBE number or SBE character parameter to be conveyed by the second. Thus, a double symbol occupies four successive BAS positions, and takes 80 ms to transmit.

A "triple symbol" similarly consists of three SBE code-pairs in succession; the first is one of the symbols listed as having an associated numerical or character parameter to be conveyed by the second and third. Thus, a triple symbol occupies six successive BAS positions, and takes 120 ms to transmit.

A "quadruple symbol" consists of four SBE code-pairs in succession, occupies eight successive BAS positions, and takes 160 ms to transmit.

In the case of TII*¹, it may be double or triple, or longer, but the succession of symbols shall end with the symbol TIS.

2.2.3 MBE method

The multiple-byte extension method involves three or more consecutive BAS codes, in the following format:

$$\{\text{Start-MBE}\} / N / \langle x \rangle / (N - 1) \text{ bytes}$$

where:

{Start-MBE} is specified in Table A.1/H.221;

N is a binary number in the range 1..223;

⟨x⟩ is a value from Table 2.

3 Definitions of C&I symbols

3.1 C&I related to video

3.1.1 video indicate suppressed (VIS): This symbol is used to indicate that the content of the video channel does not represent a normal camera image. The video encoder may be without video input or an electronically-generated pattern may have been substituted.

3.1.2 video indicate active (VIA): Complementary to VIS. The video source is the only one, or, in the case that more video sources are to be distinguished, it is that designated "video No. 1".

3.1.3 VIA2: Equivalent to VIA, but designating "video No. 2" as the source.

3.1.4 VIA3: Equivalent to VIA, but designating "video No. 3" as the source.

3.1.5 video indicate ready-to-activate (VIR): This symbol is transmitted by a terminal whose user has decided not to send video unless he will also receive video from the other end.

3.1.6 video command "freeze picture request" (VCF): This symbol may be transmitted prior to the "video-off" mode switch, to prepare the video decoder for this event (see Note). This symbol is also transmitted by a multipoint control unit (MCU) prior to video switching. On receipt, a terminal video decoder should complete updating of the current video frame but subsequently display the frozen picture until receipt of the freeze-picture release control which is embedded in the video.

¹ For the significance of the asterisk, see Table 4.

NOTE – If an H.261 or other H.260-series decoder receives "freeze picture request", it freezes pictures until a freeze-picture release signal is received, or a timeout period of at least six seconds has expired. If a terminal wishes to continue the freezing of the picture at the remote end more than six seconds, it should send VCF/H.230 repeatedly with an appropriate period.

3.1.7 video command "fast update request" (VCU): This symbol is transmitted by an MCU after performing a video switch. It may also be transmitted by a terminal at the start of communication when the video decoder is first ready to receive. On receipt, the terminal video encoder shall enter the fast-update mode at its earliest opportunity.

3.1.8 video indicate "video spatial temporal tradeoff preference" (ØVSTRD): This requests the far-end video encoder to change its trade-off between temporal and spatial resolution. It shall be followed by a SBE number between 0 and 31 (see clause 3.4). A value of 0 commands a high spatial resolution and a value of 31 commands a high frame rate. The values from 0 to 31 indicate monotonically a desire for higher frame rate. Actual values do not correspond to precise values of spatial resolution or frame rate. On receipt of value of zero, the encoder should send video at the highest possible spatial fidelity, and on receipt of the value of 31, the encoder should send video at highest possible frame rate. Intermediate values will indicate a preference on a sliding scale. The actual interpretation will vary for encoders.

3.1.9 video indicate "video spatial temporal tradeoff encoder level" (VSTRDEL): This informs the receiver of the current spatial temporal trade-off level being used by the far end encoder. It is followed by an SBE number between 0 and 31 which indicates the current trade-off level. This should be used by the receiver to determine an appropriate value for ØVSTRD preference.

NOTE – The abbreviation VSTRDEL was known as abbreviation VSTRDENCLVL in a previous version of this Recommendation.

3.1.10 video indicate "custom picture clock frequency" (ØCPCF): This informs the transmitter of the receiver picture clock frequency preference. This shall be followed by a SBE with values of the clockDivisor and the clockConversionCode as defined in customPCFByte1 in clause 5.2.4 of Rec. ITU-T H.242. On receipt of this message, the encoder should switch to the indicated custom picture clock frequency at the earliest opportunity.

3.1.11 video indicate "H.263 GOB header on preference" (ØGHOP): This informs the transmitter of the receiver preference for GOB headers in Rec. ITU-T H.263. This shall be followed by an SBE number N which specifies the frequency of GOB headers. GOB syncs should be sent for GOB numbers N, 2N, 3N,... in every picture. On receipt of this, the encoder should send GOB syncs for the indicated GOBs at the earliest opportunity.

3.1.12 video indicate "Cancel – H.263 GOB header on preference" (Øcancel-GHOP): This informs the transmitter that receiver no longer prefers to receive GOB headers in Rec. ITU-T H.263. On receipt of this preference, the terminal encoder may stop sending GOB headers at the earliest opportunity.

3.1.13 video indicate "H.263 Custom Source Format Preference" – using MBE ØCSFMT: Sent to indicate the receiver preference for custom source format. The message has the form:

{start-MBE / 3 / <ØCSFMT> / frameHeight/8-1 / frameWidth/8-1}

Where the frameHeight/8-1 and frameWidth/8-1 shall be binary representations of frameHeight/8-1 and frameWidth/8-1 in pixels and shall take values between 0 and 223. On receipt of this message, the encoder should switch to H.263 video at the indicated format at the earliest opportunity.

3.1.14 video indicate "H.263 Custom Pixel Aspect Ratio Preference" – using MBE ØCPAR:

Sent to indicate the receiver preference for custom pixel aspect ratio. The message has the form:

{start-MBE / 3 / <ØCPAR> / pixelHeight-1 / pixelWidth-1}

Where the pixelHeight-1 and pixelWidth-1 shall be binary representations of pixelHeight-1 and pixelWidth-1. The two numbers shall be relatively prime to each other and shall take values between 0 and 223. PixelHeight shall be set to 0 if and only if pixelWidth is also set to 0. If both pixelHeight and pixelWidth are set to 0, any pixel aspect ratio may be sent. On receipt of this message, the encoder should switch to H.263 video at the indicated pixel aspect ratio at the earliest opportunity.

3.1.15 video indicate "H.263 Scalability Preference" – using MBE ØSCLPREF: Sent to indicate the receiver preference for scalability mode. The message has the form:

{start-MBE / (numberOfLayers/3 + 2) / <ØSCLPREF> / InitByte / LayerSpecificationByte1 / / LayerSpecByte numberOfLayers / 3}

The MBE code shall first specify the number of layers. This shall be followed by a two-bit specification for each layer using the following convention:

- 00 – Spatial Scalable layer of one dimension
- 01 – Spatial Scalable layer of two dimensions
- 10 – SNR layer
- 11 – Temporal Scalable with one B-picture

The number of bytes in the message depends on the number of enhancement layers. Any layer definitions beyond the number of layers specified shall be ignored. The structure of initByte and layerSpecificationByte is as follows:

initByte:

- 0-3 Number of layers (n)-1. Valid Range: 0-13
- 4-5 Layer 1 specification
- 6-7 Layer 2 specification

layerSpecificationByte i + 1 (starting from i = 0):

- 0-1 00
- 2-3 Layer $3 \times (i + 1)$ specification
- 4-5 Layer $3 \times (i + 1) + 1$ specification
- 6-7 Layer $3 \times (i + 1) + 2$ specification

On receipt of this message, the encoder should switch to H.263 video with the indicated scalability at the earliest opportunity.

3.1.16 video indicate "videoNotDecodedMBs" – using MBE videoNotDecodedMBs: The message has the form:

{start-MBE / 7 / <videoNotDecodedMBs> / firstMByte1 / firstMByte2 / numberOfMBsByte1 / numberOfMBsByte2 / trByte1 / trByte2}

This indicates to the far-end video encoder that a set of MBs has been received erroneously and that any MB in the specified set has been treated as not coded (note that "not coded" macroblocks in H.263 terminology corresponds to "not transmitted" macroblocks in H.261 terminology). This command shall only be used with video compression algorithms that define MBs, for example, H.261 and H.263. In this message, the macroblock at the top left-hand corner is numbered 1 and the macroblock numbers increase in the scanline order from top left to bottom right. The encoder may use this information to compensate transmission errors, as illustrated in Appendix I of

Rec. ITU-T H.263. firstMByte1 and firstMByte2 together indicate the number of first MB treated as not coded and numberOfMBsByte1 and numberOfMBsByte2 together indicate the total number of successive MBs treated as not coded. firstMByte1 and numberOfMBsByte1 shall take values from 0-223. firstMByte2 and numberOfMBsByte2 shall also take values from 0-223. The first MB received erroneously is given by $224 \times \text{firstMByte1} + \text{firstMByte2}$. Similarly, total number of successive MBs treated as not coded is given by $224 \times \text{numberOfMBsByte1} + \text{numberOfMBsByte2}$. The decoder shall ensure that the first MB treated as not coded and the total number of successive MBs treated as not coded are within the valid range of the video compression algorithm in use. The encoder should ignore the message if values outside the valid range are received. The temporal reference of the picture containing not decoded MBs is indicated by trByte1 and trByte2 which shall take values from 0-223. The temporal reference is given by $224 \times \text{trByte1} + \text{trByte2}$. The decoder shall ensure that the temporal reference is valid for the video compression algorithm in use. The encoder should ignore the message if a value outside the valid range is received.

3.1.17 video command "videoFastUpdateGOB" – using MBE videoFastUpdateGOB: The message has the form:

{start-MBE / 3 / <videoFastUpdateGOB> / firstGOB / numberOfGOBs}

This commands the far-end video encoder to perform a fast update of one or more GOBs. This command shall only be used with video compression algorithms that define GOBs, for example, Recs ITU-T H.261 and H.263. firstGOB indicates the number of first GOB to be updated and corresponds to the GOB number (GN) as defined by the video compression algorithm in use. For example, valid values for Rec. ITU-T H.261 are 1, 3 and 5 in QCIF resolution and 1 to 12 in CIF resolution. In case of Rec. ITU-T H.263, valid values are 0 to (G-1), where G is the total number of GOBs in a picture. numberOfGOBs indicates the total number of successive GOBs to be updated and has a minimum value of 1. firstGOB and numberOfGOBs shall consist of one byte each and shall not take values greater than 223. The decoder shall ensure that the values sent are valid for the video compression algorithm in use. The encoder should ignore the message if any value outside valid range is received.

3.1.18 video command "videoFastUpdateMB" – using MBE videoFastUpdateMB: The message has the form:

{start-MBE / 5 / <videoFastUpdateMB> / firstMByte1 / firstMByte2 / numberOfMBsByte1 / numberOfMBsByte2}

This commands the far-end video encoder to perform a fast update of one or more MBs. This command shall only be used with video compression algorithms that define MBs, for example, Recs ITU-T H.261 and H.263. In this message, the macroblock at the top left-hand corner is numbered 1 and the macroblock numbers increase in the scanline order from top left to bottom right. firstMByte1 and firstMByte2 together indicate the number of first MB to be updated. numberOfMBsByte1 and numberOfMBsByte2 together indicate the total number of successive MBs to be updated. firstMByte1 and numberOfMBsByte1 shall take values from 0-223. firstMByte2 and numberOfMBsByte2 shall also take values from 0-223. The first MB to be updated is given by $224 \times \text{firstMByte1} + \text{firstMByte2}$. Similarly, total number of successive MBs to be updated is given by $224 \times \text{numberOfMBsByte1} + \text{numberOfMBsByte2}$. The decoder shall ensure that the first MB to be updated and the total number of successive MBs to be updated are within the valid range of the video compression algorithm in use. The encoder should ignore the command if values outside the valid range are received. Terminals may respond to this command with a GOB update which includes the MBs requested.

3.1.19 video capability "videoBadMBsCap" (VBMBC): When present, indicates the capability of a video encoder to process videoBadMBs commands and to take appropriate corrective action toward recovery of video quality.