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

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**Frame-synchronous control and indication  
signals for audiovisual systems**

ITU-T Recommendation H.230

(Previously CCITT Recommendation)

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## **ITU-T RECOMMENDATION H.230**

### **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 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. This Recommendation concerns only those C&I which must be transmission frame-synchronous, or otherwise requiring rapid response.

The 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.

#### **Source**

ITU-T Recommendation H.230 was revised by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 27th of May 1999.

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## **Recommendation H.230**

### **FRAME-SYNCHRONOUS CONTROL AND INDICATION SIGNALS FOR AUDIOVISUAL SYSTEMS**

*(revised in 1999)*

#### **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 T.122-T.125.

This Recommendation concerns only those C&I coming 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 Recommendation H.221, while the remainder require the use of an escape code.

##### **2.1 C&I codes provided in Recommendation H.221**

The following codes, whose functions are defined in clause 3, are provided in Recommendation H.221:

- VCF, VCU (procedures for use in multipoint calls according to Recommendation 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 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\*, 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:

{Start\_MBE} / N / <x> / (N-1) 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.

NOTE – If an H.261, H.262 or H.263 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 commands 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 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" (VSTRDENCLVL):** 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.

**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 5.2.4/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 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 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/LayerSpecificationByte  
1/.../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 dimension
- 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\*(i+1) specification
- 4-5 Layer 3\*(i+1)+1 specification
- 6-7 Layer 3\*(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><firstMBByte1><firstMBByte2><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 Recommendation H.263. firstMBByte1 and firstMBByte2 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 numberOfMByte1 shall take values from 0-223. firstMByte2 and numberOfMByte2 shall also take values from 0-223. The first MB received erroneously is given by  $224 * \text{firstMByte1} + \text{firstMByte2}$ . Similarly total number of successive MBs treated as not coded is given by  $224 * \text{numberOfMByte1} + \text{numberOfMByte2}$ . 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  $224 * \text{trByte1} + \text{trByte2}$ . 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, 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 H.261 are 1, 3 and 5 in QCIF resolution and 1 to 12 in CIF resolution. In case of 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><numberOfMByte1><numberOfMByte2>}
```

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, 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. numberOfMByte1 and numberOfMByte2 together indicate the total number of successive MBs to be updated. firstMByte1 and numberOfMByte1 shall take values from 0-223. firstMByte2 and numberOfMByte2 shall also take values from 0-223. The first MB to be updated is given by  $224 * \text{firstMByte1} + \text{firstMByte2}$ . Similarly total number of successive MBs to be updated is given by  $224 * \text{numberOfMByte1} + \text{numberOfMByte2}$ . 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.

The video commands 3.1.8-3.1.18 shall be supported only by terminals with the relevant video capabilities. These shall be ignored by terminals without these capabilities.

## 3.2 C&I related to audio

**3.2.1 audio indicate muted (AIM):** This symbol is used to indicate that the content of the audio channel does not represent a normal audio signal. The audio encoder may be without audio input or an electronically-generated tone may have been substituted. A terminal receiving AIM shall not mute its loudspeakers in response (otherwise, such tones and the restoration of normal audio would go unheard).

**3.2.2 audio indicate active (AIA):** Complementary to AIM.

**3.2.3 audio command equalize (ACE):** Sent by a terminal to request that the delay of the audio signal be equalized to that of the video signal ("lip synchronization"), in both directions. A terminal sending this request shall itself equalize the delays in the same way.

**3.2.4 audio command zero-delay (ACZ):** Sent by a terminal to request that the audio signal not be delayed to match that of the video signal.

## 3.3 C&I for maintenance purposes

**3.3.1 loopback command, "video loop request" (LCV):** On receipt of this symbol, a terminal shall connect the output of the video decoder to the input of the video encoder.

**3.3.2 loopback command, "digital loop request" (LCD):** On receipt of this symbol, the terminal shall disconnect the output of the multiplexer from the outgoing path, replacing it with the input to the demultiplexer. In the case of multiple B or H<sub>0</sub> connections, loopback is activated in each connection.

NOTE – If this digital loopback command is issued again, it would come back from the remote terminal. Then the original terminal would respond to this loopback command making a complete loop of the transmission path. Maintenance terminals shall avoid this situation by sending the command only once, or by ignoring the received loopback command.

**3.3.3 loopback command, "audio loop request" (LCA):** On receipt of this symbol, the terminal should if possible connect the output of the audio decoder to the input of the audio encoder.

**3.3.4 loopback command off (LCO):** On receipt of this symbol, the terminal shall disconnect all loops and restore audio, video and data paths to their normal condition.

## 3.4 SBE numbers and characters

### SBE numbers

The escape code (111) [19] defined in Recommendation H.221 gives access to a table of 224 numbers having the values 0-223 according to the 8-bit binary code. These SBE values are referred to as "SBE numbers". One SBE number or a string of such numbers is normally preceded by another SBE symbol indicating the purpose for which the number is being sent.

Terminal numbers (see Recommendation H.243) are of the form <M> <T>, where <M> and <T> are each SBE numbers.

### SBE characters

The escape code (111) [20] defined in Recommendation H.221 gives access to a table of characters coded as in Table 3. A character or string of characters is normally preceded by another SBE symbol indicating the purpose for which they are being sent.

Where asterisks are used, they identify symbols which shall be followed (always) by at least one SBE number or SBE character. See also Table 4.

### 3.5 SBE and MBE symbols used in multipoint working (see Recommendation H.243)

NOTE 1 – Some of the following codes may be cancelled by transmission of appropriate codes as listed in Table 1 but not separately defined here.

NOTE 2 – Any of the symbols prescribed here may be repeated without ill effect: they are part of a set currently in force. An MCU shall expect propagation and processing delays to slow responses from terminals and other MCUs; terminals may repeat a request that an MCU has already satisfied. It is important that terminals receiving SBE symbols that they do not recognize or cannot use shall *ignore* these, not enter any fault recovery process.

MCV	<i>Multipoint Command Visualization-forcing</i> – Transmitted by a terminal to force an associated MCU to broadcast its video signal used to transmit the picture of a chairman or VIP, alternatively to hold a picture source during the transmission of graphics.
MIV	<i>Multipoint Indication Visualization</i> – Transmitted by an MCU to indicate to a terminal that its video signal is being seen by at least one other terminal (otherwise known as "On-air" or "SeenByAtLeastOneOther" indication).
MVC	<i>Multipoint Visualization Capability</i> – Included in the cap-set of an MCU or terminal to show that it can properly generate or process the codes MVA and MVR.
MVA	<i>Multipoint Visualization Achieved</i> – Transmitted by an MCU to indicate that it has granted visualization in response to the command MCV.
MVR	<i>Multipoint Visualization Refused/Revoked</i> – Transmitted by an MCU when it cannot comply with the command MCV, when visualization status has been withdrawn due to a higher priority switch request, e.g. VCB, or as a response to Cancel-MCV.
MCC	<i>Multipoint Command Conference</i> – Transmitted by an MCU. An endpoint receiving MCC shall make its outgoing transfer rate equal to its incoming transfer rate, and its outgoing audio rate equal to its incoming audio rate.  NOTE – The command could also be used to invoke an on-screen user indication.
MCS	<i>Multipoint Command Symmetrical data-transmission</i> – Transmitted by an MCU when setting up data broadcasting. On receipt, a terminal shall prepare itself for data reception and ensure, by mode change if necessary, that its outgoing data channel occupies the same capacity as its incoming data channel. A terminal in receipt of MCS cannot initiate data broadcasting.
MCN	<i>Multipoint Command Negating MCS</i> – Transmitted by an MCU at the completion of data broadcasting. On receipt, a terminal shall close any outgoing data channel which it has opened as a result of the previous reception of MCS. Following the end of data reception and the receipt of MCN, a terminal is permitted to initiate data broadcasting.
MMS	<i>Multipoint command Mode-Symmetrize</i> – Transmitted by an MCU. When in receipt of MMS, endpoints shall respond to the MCU with whatever mode they receive, including audio coding algorithm and rate, data path(s), and video coding algorithm and image format, and also image Profile in the case of H.262.  NOTE – If MMS has not been received, terminals are free to follow the mode asymmetry allowed by MCC, e.g. to send H.263 while receiving H.261.
MIZ	<i>Multipoint Indication Zero-communication</i> – Transmitted by an MCU to a terminal for information, with the meaning that no other terminals are yet connected to the MCU.
MIS	<i>Multipoint Indication Secondary-status</i> – Transmitted by an MCU to a terminal for information, with the meaning that since other terminals of higher capability are participating in the conference-call, this terminal will not necessarily receive all the signals that are sent to those other terminals (see Recommendation H.200/AV.243).
MIM	<i>Multipoint Indicate Master-MCU</i> – Transmitted by an MCU which has claimed the master-MCU role.
MIL*	<i>Multipoint Indication Loop</i> – See clause 10/H.243; shall be followed by an SBE number.

MIH	<i>Multipoint Indicate Hierarchy</i> – This capability value indicates that the MCU can operate as a master, a slave, or a sub-slave, in a multi-level hierarchy.
MIJ	<i>Multipoint Indicate Joined_Real_Conference</i> – Sent by an MCU to a terminal to indicate that the terminal has joined an actual conference, and that any terminal numbers or identifiers previously transmitted are no longer valid.
RAN*	<i>Random Number</i> – Must be followed by a random SBE number in the range 0-223.
TIA*	<i>Terminal Indicate Assignment</i> – Used by an MCU to transmit the assigned terminal number to another MCU or to a terminal; shall be followed by <M> <T>.
TIN*	<i>Terminal Indicate Number</i> – Used to pass information concerning terminal number assignments made; shall be followed by <M> <T>.
TIL	<i>Terminal Indicate List</i> – MBE message used to transmit list of terminal numbers currently added into the conference; the message has the form {start-MBE/N/<til>/<M>/<(N-2) values of <T>}, where <til> has the value given in Table 2, <M> is a one-byte number assigned to an MCU, and each value of <T> is a one-byte value assigned to a terminal by its local MCU. One such message will be sent for each MCU participating.
TID*	<i>Terminal Indicate Dropped</i> – Used to pass information concerning any terminal number no longer effective; shall be followed by <M><T>.
TCU	<i>Terminal Command Update</i> – Transmitted by a terminal or MCU to an MCU to request an updated list of terminals connected.
TIF*	<i>Terminal Indicate Floor-request</i> – Transmitted by a terminal to its MCU; shall be followed by <M> <T> – when forwarded from one MCU to another <T> is that of the terminal requesting the floor; when transmitted by the terminal itself <0> <0> shall follow.
TIC	<i>Terminal Indicate Capability</i> – Included in the initial cap-set of a terminal to tell an MCU that it can recognize TIA and return TIX in the additional channels; included in the cap-set of an MCU to say that it can accept additional calls to the same access number and correctly associate additional channels according to the procedure described in Recommendation H.243.
TIX*	<i>Terminal Indicate additional-channel-X</i> – Sent by a terminal having capability TIC in response to TIA; shall be followed by <M> <T>.
TCI	<i>Terminal Command Identify</i> – Sent by an MCU to a directly-connected terminal or vice versa to exact identification by means of a symbol TII*.
TCS- <i>n</i>	<i>Terminal Command String</i> – Sent by an MCU to a directly-connected terminal or vice versa to exact information in the form of a symbol IIS; the meaning according to the different values of <i>n</i> is thus:  <i>n</i> = 0: reserved <i>n</i> = 1: password <i>n</i> = 2: identity (person or terminal) <i>n</i> = 3: conference identity <i>n</i> = 4: extension address <i>n</i> = 5 to 31: reserved
TII*	<i>Terminal Indicate Identity</i> – Sent in response to TCI; shall be followed by an SBE alphanumeric character according to 3.4, the content being prescribed by the MCU service provider.
IIS	<i>Information Indicate String</i> – An MBE message sent in response to TCS- <i>n</i> ; the message has the form {start-MBE//N/<iis>/<n>/<(N-2) characters} where <iis> has the value given in Table 2, where <i>n</i> corresponds to the value of <i>n</i> in TCS- <i>n</i> ; characters are as specified for TIP.
TIS	<i>Terminal Indicate identity-Stop</i> – End-marker to indicate the end of a sequence of TII symbols.

TIE	<i>Terminal Indicate End_of_Listing</i> – Sent by an MCU when it has completed the transmission of a series of complementary TIL messages.
TCP	<i>Terminal Command Personal-identifier</i> – Sent by a terminal requesting the MCU to provide the personal identity string associated with the terminal specified by the following identifier <M>, <T>. The MCU responds with TIP.
TIP	<i>Terminal Indicate Personal-identifier</i> – Response to TCP in the form {start-MBE/N/<tip>/m/t/(N-3) characters}, where <tip> has the value given in Table 2. Characters are to Table 3 and m and t are binary numbers representing the terminal number associated with this personal identifier. The null response is of the form {start-MBE/3/<tip>/m/t}.
TCA	<i>Token Command Association</i> – Sent by a terminal requesting the MCU to provide the terminal numbers associated with each token. The MCU responds with an MBE TIR.
TIR	<i>Token Indicate Response</i> – Message of the form {start-MBE/7/<tir>/m1/t1/m2/t2/m3/t3} in response to a TCA where <tir> has the value given in Table 2 and m1/t1 is terminal number of the endpoint with the SD token, m2/t2 is the terminal number of the endpoint with the HSD token, and m3/t3 is the terminal number of the endpoint with the chair token.
VIN*	<i>Video Indicate Number</i> – Transmitted by an MCU to indicate the source (terminal identity number) of the video in the signal; shall be followed by <M> <T>.
VIN2*	<i>Video Indicate Number (2)</i> – This indication is similar to VIN, except that it applies to a composed image, and is sent when a terminal is added to a composed image by the MCU. <M><T> is the terminal number, and can be used to request the associated terminal identity string. <N> is a sub-picture number taken from Figures 2/H.243 to 4/H.243.
VIC*	<i>Video Indicate Compose</i> – This indication informs terminals that picture composition is beginning. The value <M> is a number taken from the rightmost column of Table 4/H.243 that indicates which picture composition method is in use.
VIM	<i>Video Indicate Mixing</i> – Capability value indicating support for both VIC and VIN2; only applies to an MCU.
VCB*	<i>Video Command Broadcast</i> – Transmitted by a chair-control terminal or an MCU to an MCU to cause broadcasting of the video from the terminal whose identity number follows VCB.
Cancel-VCB	<i>Cancel Video Command Broadcasting</i> – Returns the conference to voice-activated video switching.
VCS*	<i>Video Command Select</i> – Transmitted by a terminal to an MCU to cause transmission to itself of the video from the terminal whose identity number follows VCS, if this requirement does not conflict with a VCB requirement.
Cancel-VCS	Transmitted by a terminal to return to automatic video switching at the MCU.
VCR	Transmitted by an MCU when it cannot comply with the commands VCB or VCS, for whatever reason.
CIC	<i>Chair-control Indicate Capability</i> – Included in the cap-set of an MCU to show that it can properly process the codes (CCA, CIT, CCR, CIS, CCD, CIR, CCK), (TIA, TIN, TID, TIL, TCU, TIF), (VCB, VIN, VCR, VCE).
CCD*	<i>Chair Command Disconnect</i> – Transmitted by a chair-control terminal to an MCU to cause dropping of the terminal whose identity number follows.
CIR	<i>Chair Indicate Release/refuse</i> – Transmitted by an MCU when it cannot comply with the command CCD.
CCK	<i>Chair Command Kill</i> – Transmitted by a chair-control terminal to drop all terminals from the conference.
CCA	<i>Chair Command Acquire</i> – Transmitted by a terminal or MCU to claim a chair-control token.

DCA-L*	<i>LSD/HSD Command Acquire-token</i> – Transmitted by a terminal or MCU to claim an
DCA-H*	LSD/HSD token; shall be followed by an SBE number indicating the data rate requested (see Tables 2/H.243 and 3/H.243).
CIT	<i>Chair Indicate Token</i> – Used by an MCU to pass the chair-control token.
DIT-L	<i>LSD Indicate Token</i> – Used by an MCU to pass the LSD token.
DIT-H	<i>HSD Indicate Token</i> – Used by an MCU to pass the HSD token.
CCR	<i>Chair Command Release/refuse</i> – Used by an MCU to withdraw/refuse assignment of chair-control token.
DCR-L	<i>LSD/HSD Command Release/refuse</i> – Used by an MCU to withdraw/refuse assignment of
DCR-H	LSD token, or by the chair-control terminal to cause this withdrawal.
CIS	<i>Chair Indicate Stopped-using-token</i> – Transmitted by a terminal holding the chair token to release it.
DIS-L	<i>LSD Indicate Stopped-using-token</i> – Transmitted by a terminal holding the LSD token to release it.
DIS-H	<i>HSD Indicate Stopped-using-token</i> – Transmitted by a terminal holding the HSD token to release it.
DCC-L	<i>LSD/HSD Command Close</i> – Transmitted by a terminal holding the LSD/HSD token to
DCC-H	release it and close the LSD/HSD channel.
DCM	<i>Data Command MLP</i> – Transmitted by a terminal to trigger establishment of an MLP channel

### 3.6 SBE symbols used in channel aggregation and restricted network situations

**3.6.1 [AggIN]\*:** A double SBE symbol indicating the number **n** as determined by the procedure described in Recommendation H.244. The sequence is (111) [17] (011) [5] followed by an SBE number.

**3.6.2 network indicate incompatible-aggregators (NII):** Transmitted by a Channel Aggregator when this is the cause of the call remaining on the initial connection only (see Recommendation H.244).

**3.6.3 Restricted\_network Indicate Restrict (RIR):** Used between MCUs – see Recommendation H.243.

**3.6.4 Restricted\_network Indicate Denied (RID):** Used between MCUs – see Recommendation H.243.

**3.6.5 Restricted\_network Indicate Unrestrict (RIU):** Used between MCUs – see Recommendation H.243.

### 3.7 Symbols used in the transfer of network addresses (Recommendation H.242)

**3.7.1 network indicate address – using MBE (NIA-m):** Sent in response to NCA-i or NCA-a when the remote terminal has MBE capability. The message has the form:

{start-MBE/N/<nia>/n/d<sub>1</sub>,d<sub>2</sub>/d<sub>3</sub>,d<sub>4</sub>/.....}

where:

n = number of the channel that the network address is to be used for;

d<sub>1</sub> = first digit of the number to be dialled coded as a 4-bit binary number;

d<sub>2</sub> = second digit to be dialled, etc.



There are N-2 groupings of packed digits. Between the country code, to Recommendation E.164/E.163, and the national number the 4-bit nibble 1100 is inserted; no local prefix is included. If the last digit occupies the first four bits of the Nth byte, the remaining four bits are filled also with 1100.

As an example, the address +44 1473 642402 is transmitted as:

```
{start-MBE/9/<nia>/n/0100 0100/1100 0001/0100 0111/0011 0110/0100 0010/0100
0000/0010 1100}
```

Partial network addresses:

```
{start-MBE/N/<niap>/n/p1,p2/p3,p4/.....px}
```

Here the address of channel  $n = (n_0 + 1)$  is indicated by taking the address of channel  $n = n_0$  by replacing the last x digits by the values  $p_1, \dots, p_x$ . If x is odd, again the vacant final four bits are filled with 1100. This allows much time to be saved if all the NIAs differ by one or two digits. Clearly, if channels  $n_0$  and  $n_0 + 1$  have the same address, the latter is conveyed by {start-MBE/2/<niap>/ $n_0+1$ }.

Following the above example, if the next address is +44 1473 64 2403 the message is:

```
{start-MBE/3/<niap>/n+1/0011 1100}
```

**3.7.2 network command send\_address-initial (NCA-i):** Sent by a calling equipment to elicit details of network addresses of the initial connection.

**3.7.3 network command send\_addresses-additional (NCA-a):** Sent by a calling equipment to elicit details of network addresses of additional connections.

**3.7.4 network indicate addresses – using SBE (NIA-s):** Sent in response to NCA-i or NCA-a when the remote terminal has no MBE capability. This symbol is followed by a string of SBE numbers: the first is the number N of following numbers forming the complete "message" and the subsequent symbols have the same form as the string defined above for <nia>, namely  $d_1, d_2/d_3, d_4/.....$ . Thus the number +44 1473 642402 is conveyed by:

```
{NIA}{num/7}{num/0100 0100}{num/1100 0001}{num/0100 0111}{num/0011 0110}
{num/0100 0010}{num/0100 0000}{num/0010 1100}
```

Other BAS codes may be inserted between {bracketed} byte groups in the sequence but not between <NIA> and the following symbol.

**3.7.5 network indicate same\_addresses (NIS):** Sent in response to NCA-a when the called end has all its additional addresses the same as the initial one.

**3.7.6 network indicate consecutive\_addresses (NIC):** Sent in response to NCA-a when the called end has all its additional addresses consecutively in a sequence above the initial one.

**3.7.7 network indicate double\_addresses (NID):** Sent in response to NCA-a when there are two connections available at each network address and the addresses are consecutive.

**3.7.8 network indicate query\_address – using SBE (NIQ-s):** Sent when a called terminal wishes to advise the calling terminal that it should seek the full network address before attempting to establish additional connections – see Recommendation H.242.

**3.7.9 network indicate query\_address – using MBE (NIQ-m):** As for NIQ-s, additionally informing that MBE-coded addresses can be processed.

**3.7.10 network indicate refuse-address (NIR):** Sent by a terminal in response to NCA-i or NCA-a when the requested address information is not to be divulged.

### 3.8 Symbols used in the indication of mode preferences (Recommendation H.242)

The values (100) [0-31] of Table 4 are assigned for mode-preference indication according to the procedure of 9.5/H.242; the prefix  $\emptyset$  is used to distinguish the names from capabilities and commands. In the case of audio modes, these correspond to commands listed in A.1/H.221. Video modes, however, correspond to capabilities listed in A.5/H.221 and clause 5/H.242, the parameters of transmitted video signals being contained within the video stream. The MLP-rate value is used as the first symbol in a string defined in Recommendation H.243.

### 3.9 Symbols for other purposes

1997 Recommendations. Transmitted by an endpoint to indicate conformance to 1997-revised versions of Recommendations H.221, H.242 and H.230.

## 4 Requirements for C&I

The C&I functions are defined such that, under various appropriate circumstances, the audiovisual system will operate in a fault-free manner and also such that sympathetic presentation to users is possible. Some functions should therefore be mandatory, others optional. This clause together with the categorization in Table 1, clarifies the circumstances under which C&I functions are mandatory.

- CM    Conditionally mandatory: If the terminal (or MCU) is capable of entering the given state, then it shall transmit the given code and, when leaving that state, the complementary code. If it has no such capability it can ignore both.
- M    Mandatory: For all equipments of either terminal or MCU type.
- X    Non-mandatory: On receipt of such a code, it may be unrecognized, or recognized but not acted upon, or recognized and acted upon, entirely at the discretion of the manufacturer or user.
- NA    The code is not applicable in that case.
- #    Directivity of the C&I signal: See Recommendation H.243 for whether it is mandatory or optional to the terminal or MCU.

It will be noted that there are only a few mandatory requirements on most terminals. All audiovisual terminals shall recognize and obey the command to make or break the digital loopback, and video loopback if they have video capability. All terminals having a video capability shall also obey fast-update, freeze-picture, and MCS/MCN, otherwise there will be system misoperation on a multipoint call.

**Table 1/H.230**

Code first 3 bits	Code last 5 bits in decimal form	Abbreviation	Transmit		Receive		Reference for procedures	
			Terminal	MCU	Terminal	MCU		
Code (000)	[0,1]	Reserved for audio-related symbols						
	[2]	AIM	CM	CM	X	X	3.2	
	[3]	AIA	CM	CM	X	X	3.2	
	[4]	ACE	CM	CM	CM	CM	3.2	
	[5]	ACZ	CM	CM	CM	CM	3.2	
	[6]-[7]	Reserved for audio-related symbols						
	[8]	TCI	#	#	#	#	H.243	
	[9]	TII*	#	#	#	#	H.243	
	[10]	TIS	#	#	#	#	H.243	
	[11]-[15]	Reserved						
	[16]	VIS	CM	CM	X	X	3.1	
	[17]	VIA	CM	CM	X	X	3.1	
	[18]	VIA2	X	NA	X	X	H.320	
	[19]	VIA3	X	NA	X	X	H.320	
	[20]	VIC*	#	#	#	#	H.243	
	[21]	Reserved						
	[22]	VIN2***	#	#	#	#	H.243	
	[23]	VIM	#	#	#	#	H.243	
	[24]-[30]	Reserved for video-related symbols						
	[31]	VIR	X	NA	X	NA	H.320	
	Code (001)	[0]	MCC	NA	M	M	CM	H.243
		[1]	Cancel-MCC	NA	M	M	CM	H.243
		[2]	MIZ	#	#	#	#	H.243
		[3]	Cancel-MIZ	#	#	#	#	H.243
		[4]	MIS	#	#	#	#	H.243
		[5]	Cancel-MIS	#	#	#	#	H.243
		[6]	MIM	#	#	#	#	H.243
		[7]	TIC	#	#	#	#	H.243
		[8]	TIX**	#	#	#	#	H.243
		[9]	RAN	#	#	#	#	H.243
		[10]	MIH	#	#	#	#	H.243
[11]		TIA**	#	#	#	#	H.243	
[12]		TIN**	#	#	#	#	H.243	
[13]		TID**	#	#	#	#	H.243	
[14]		TCU	#	#	#	#	H.243	
[15]		TCA	#	#	#	#	H.243	
[16]		MCV	#	#	#	#	H.243	
[17]		Cancel-MCV	#	#	#	#	H.243	
[18]		MIV	#	#	#	#	H.243	
[19]		Cancel-MIV	#	#	#	#	H.243	
[20]		MCS	#	#	#	#	H.243	
[21]		MCN	#	#	#	#	H.243	
[22]		VIN**	#	#	#	#	H.243	
[23]		VCB**	#	#	#	#	H.243	
[24]		Cancel-VCB	#	#	#	#	H.243	
[25]		VCS**	#	#	#	#	H.243	
[26]		Cancel-VCS	#	#	#	#	H.243	
[27]	VCR	#	#	#	#	H.243		

**Table 1/H.230 (continued)**

Code first 3 bits	Code last 5 bits in decimal form	Abbreviation	Transmit		Receive		Reference for procedures
			Terminal	MCU	Terminal	MCU	
Code (010)	[28]	MMS	#	#	#	#	H.243
	[29]	Cancel-MMS	#	#	#	#	H.243
	[30]	Cancel-MIM	#	#	#	#	H.243
	[31]	MIL*	#	#	#	#	H.243
	[0]	CIC	#	#	#	#	H.243
	[1]	CCD**	#	#	#	#	H.243
	[2]	CIR	#	#	#	#	H.243
	[3]	CCK	#	#	#	#	H.243
	[4]	CCA	#	#	#	#	H.243
	[5]	CIT	#	#	#	#	H.243
	[6]	CCR	#	#	#	#	H.243
	[7]	CIS	#	#	#	#	H.243
	[8]	TIF**	#	#	#	#	H.243
	[9]	TIE	#	#	#	#	H.243
	[10]-[11]	Reserved					
	12	MVC	#	#	#	#	H.243
	13	MVA	#	#	#	#	H.243
	14	MVR	#	#	#	#	H.243
	[15]	MIJ	#	#	#	#	H.243
	[16]	DCA-L	#	#	#	#	H.243
	[17]	DIT-L	#	#	#	#	H.243
	[18]	DCR-L	#	#	#	#	H.243
	[19]	DIS-L	#	#	#	#	H.243
	[20]	DCC-L	#	#	#	#	H.243
	[21]-[23]	Reserved					
	[24]	DCA-H	#	#	#	#	H.243
	[25]	DIT-H	#	#	#	#	H.243
	[26]	DCR-H	#	#	#	#	H.243
	[27]	DIS-H	#	#	#	#	H.243
	[28]	DCC-H	#	#	#	#	H.243
	[29]-[30]	Reserved					
[31]	DCM	#	#	#	#	H.243	
Code (011)	[0]	TCS-0	#	#	#	#	H.243
	[1]	TCS-1	#	#	#	#	H.243
	[2]	TCS-2	#	#	#	#	H.243
	[3]	TCS-3	#	#	#	#	H.243
	[4]	TCP**	#	#	#	#	H.243
	[5]	AggIN*			CM	CM	H.244
	[6]	NCA-i	CM	CM	CM	CM	H.242
	[7]	NCA-a	CM	CM	CM	CM	H.242
	[8]	NIS	CM	CM	CM	CM	H.242
	[9]	NIC	CM	CM	CM	CM	H.242
	[10]	NID	CM	CM	CM	CM	H.242
	[11]	NII			CM	CM	H.244
	[12]						
	[13]	NIA-s	CM	CM	CM	CM	H.242
	[14]	NIQ-s	CM	CM	CM	CM	H.242
[15]	NIQ-m	CM	CM	CM	CM	H.242	

**Table 1/H.230 (concluded)**

Code first 3 bits	Code last 5 bits in decimal form	Abbreviation	Transmit		Receive		Reference for procedures
			Terminal	MCU	Terminal	MCU	
	[16]	NIR	CM	CM	CM	CM	H.242
	[17]	TCS-4	#	#	#	#	H.243
	[18]-[28]	Reserved					
	[29]	RIR	NA	#	NA	#	H.243
	[30]	RID	NA	#	NA	#	H.243
	[31]	RIU	NA	#	NA	#	H.243
Code (111)	All values forbidden						
Codes listed in Annex A/H.221							
		VCF	X	M	M	M	
		VCU	X	M	M	M	
		LCV	NA	NA	CM	NA	
		LCA	NA	NA	X	X	
		LCD			M	–	H.242, H.320
		LCO			M	–	H.242, H.320
<p>* The number of * indicates how many SBE number or SBE character values must follow the symbol.                      # Indicates the direction in which the symbol is transmitted.</p>							

**Table 2/H.230 – Values assigned to type identification bytes in MBE messages**

0000 0000	Reserved
0000 0001	Reserved
0000 0010	<til> – See Rec. H.243
0000 0011	<iis> – See Rec. H.243
0000 0100	<tir> – See Rec. H.243
0000 0101	<tip> – See Rec. H.243
0000 0110	<nia> – See Rec. H.242
0000 0111	<niap> – See Rec. H.242
0000 1000	<Au_MAP> – See Rec. J.52
0000 1001	<Au_COM> – See Rec. J.52
0000 1010	<H.262/H.263> – See Rec. H.242
0000 1011	<ident> – See Rec. H.242
0000 1100	<ØCSFMT>
0000 1101	<ØCPAR>
0000 1110	<ØSCLPREF>
0000 1111	<videoNotDecodedMBs>
0001 0000	<videoFastUpdateGOB>
0001 0001	<videoFastUpdateMB>
0001 0010	} Reserved
to	
1101 1111	
1110 0000	} forbidden
to	
1111 1111	

**Table 3/H.230**

		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		(000)	(000)	(001)	(001)	(010)	(010)	(011)	(011)	(100)	(100)	(101)	(101)	(110)	(110)	(111)	(111)
		[0-15]	[16-31]	[0-15]	[16-31]	[0-15]	[16-31]	[0-15]	[16-31]	[0-15]	[16-31]	[0-15]	[16-31]	[0-15]	[16-31]	[0-15]	[16-31]
[0]	[16]			SP	0	@	P	'	p				°				
[1]	[17]			!	1	A	Q	a	q			ı	±	grave			
[2]	[18]			"	2	B	R	b	r			ç	²	acute			
[3]	[19]			#	3	C	S	c	s			£	³	circumflex			
[4]	[20]			\$	4	D	T	d	t				×	tilde			
[5]	[21]			%	5	E	U	e	u			¥	μ	macron			
[6]	[22]			&	6	F	V	f	v				¶	breve			
[7]	[23]			'	7	G	W	g	w			§	·	dot-above			
[8]	[24]			(	8	H	X	h	x			α	÷	umlaut			
[9]	[25]			)	9	I	Y	I	y								
[10]	[26]			*	:	J	Z	j	z					ring			
[11]	[27]			+	;	K	[	k	{			«	»	cedilla			
[12]	[28]			,	<	L	\	l					¼				
[13]	[29]			-	=	M	]	m	}				½	double acute			
[14]	[30]			.	>	N	^	n	~				¾	ogonek			
[15]	[31]			/	?	O	_	o					ı	caron			
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

The diacritical marks in column 12 apply to the adjacent character in the same way as in Recommendation T.51.

**Table 4/H.230 – Occupancy of escape table reached from (111) [17] of Table A.1/H.221**

	(000)	(001)	(010)	(011)	(100)	(101)	(110)	(111)
[0]		MCC	CIC (cap)	TCS-0	ØA-law,0F	1997 Recs.		
[1]		Cancel-MCC	CCD**	TCS-1	øµ-law,0F			
[2]	AIM	MIZ	CIR	TCS-2	ØG.722-m2			
[3]	AIA	Cancel-MIZ	CCK	TCS-3	ØG.722-m3			
[4]	ACE	MIS	CCA	TCP**	ØG.728			
[5]	ACZ	Cancel-MIS	CIT	AggIN*				
[6]		MIM	CCR	NCA-I				
[7]		TIC (cap)	CIS	NCA-a				
[8]	TCI	TIX**	TIF**	NIS	ØH.261/QCIF			
[9]	TII*	RAN*	TIE	NIC	ØH.261/CIF			
[10]	TIS	MIH (cap)		NID	ØH.262S_SIF			
[11]		TIA**		NII	ØH.262S_2SIF			
[12]		TIN**	MVC		ØH.262S_4SIF			
[13]		TID**	MVA	NIA-s	ØH.262M_SIF			
[14]		TCU	MVR	NIQ-s	ØH.262M_2SIF			
[15]		TCA	MIJ	NIQ-m	ØH.262M_4SIF			
[16]	VIS	MCV	DCA-L	NIR	ØH.263_SQCIF			
[17]	VIA	Cancel-MCV	DIT-L	TCS-4	ØH.263_QCIF			
[18]	VIA2	MIV	DCR-L		ØH.263_CIF			
[19]	VIA3	Cancel-MIV	DIS-L		ØH.263_4CIF			
[20]	VIC*	MCS	DCC-L		ØH.263_16CIF			
[21]	VSTRDENCLVL*	MCN			ØCPCF*			
[22]	VIN2***	VIN**			ØVSTRD*			
[23]	VIM (cap)	VCB**			ØGHOP*			
[24]		Cancel-VCB	DCA-H		Øcancel – GHOP			
[25]		VCS**	DIT-H					
[26]		Cancel-VCS	DCR-H					
[27]		VCR	DIS-H					
[28]		MMS	DCC-H					
[29]		Cancel-MMS		RIR				
[30]		Cancel-MIM		RID				
[31]	VIR	MIL*	DCM	RIU	ØMLP_rate			

The number of \* indicates how many SBE number or SBE character values must follow the symbol.

Ø Prefix identifying Mode-preference indication symbols.

(cap) identifies the only values that are allowed inside a capability set (see Recommendation H.242).





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