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# IEC 61883-8

Edition 1.1 2014-02

# CONSOLIDATED VERSION

colour inside

## Consumer audio/video equipment – Digital interface – Part 8: Transmission of ITU-R BT.601 style digital video data

IEC 61883-8:2008-11+AMD1:2014-02 CSV(EN)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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# REDLINE VERSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

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**This Consolidated version of IEC 61883-8 bears the edition number 1.1. It consists of the first edition (2008-11) [documents 100/1446/FDIS and 100/1476/RVD] and its amendment 1 (2014-02) [documents 100/2051/CDV and 100/2106/RVC]. The technical content is identical to the base edition and its amendment.**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.**

**This publication has been prepared for user convenience.**

International Standard IEC 61883-8 has been prepared by technical area 4: Digital system interfaces and protocols, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61883 series, under the general title *Consumer audio/video equipment – Digital interface,* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
- replaced by a revised edition, or
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# INTRODUCTION TO AMENDMENT 1

The revision of IEC 61883-8:2008, has become necessary to define the following new additional copy control information.

- Analog sunset token
- Digital only token
- Copy count

# CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

## Part 8: Transmission of ITU-R BT.601 style digital video data

## 1 Scope

This part of IEC 61883 specifies a protocol for the transport of uncompressed or compressed video data in the 4:2:2 format of recommendation ITU-R BT.601 (including compatible extensions to this format for the higher and lower resolutions of other commonly used video resolutions) over high performance serial bus, as specified by IEEE Std 1394-1995 as amended by IEEE Std 1394a-2000 and IEEE Std 1394b-2002 (collectively IEEE 1394). The data formats for the encapsulation of video data are compatible with those specified by IEC 61883-1. Associated audio data, if any, should be formatted as specified by IEC 61883-6.

There are many commonly used video formats unsupported by IEC 61883, such as MPEG-4, Windows Media Format (WMF) and the format used by automotive navigation applications. Support for all or most of these formats in rendering devices would require implementation of multiple video codecs. This is an undue burden that may be avoided if the source device converts to ITU-R BT.601 4:2:2 format and, if necessary, compresses the data with a codec supported by all destination devices. An additional advantage is that on-screen display (OSD) information may be mixed with video data prior to transmission to the rendering device.

Because ITU-R BT.601 4:2:2 format is widely used internally in contemporary AV equipment, this specification permits straight-forward integration of IEEE 1394 into these devices and enables markets whose usage scenarios include single video sources transmitting to one or more video displays, such as:

– consumer electronic STB or DVD video rendered by multiple displays in the home;
– automotive navigation and entertainment; and
– aeronautical in-flight entertainment.

For the sake of interoperability and bounded implementation complexity, it is essential that the specification provide the following:

– a 1394 TA controlled list of compression codecs; and
– at a minimum, a reference to one video compression codec.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61883 (all parts), *Consumer audio/video equipment – Digital interface*

IEC 61883-1, *Consumer audio/video equipment – Digital interface – Part 1: General*

ISO/IEC 11172-2:1993, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s – Part 2: Video*

IEEE Std 1394-1995, *Standard for a high performance serial bus*

IEEE Std 1394a-2000, *Standard for a high performance serial bus*
Amendment 1

IEEE Std 1394b-2002, *Standard for a high performance serial bus*
Amendment 2

Throughout this document, the term IEEE 1394 refers to IEEE Std 1394-1995 as amended by IEEE Std 1394a-2000 and IEEE Std 1394b-2002.

1394 Trade Association 2004006, AV/C Digital Interface Command Set General Specification Version 4.2

1394 Trade Association 2003017, IIDC 1394-based Digital Camera SpecificationVer.1.31

EIA/CEA-861-B 2002, *A DTV Profile for Uncompressed High Speed Digital Interfaces*

IEEE Std 1394.1-2004, Standard for High Performance Serial Bus Bridges

ITU-R BT.601-5 1995, *Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios*

ITU-R BT.656-4 1998, *Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601*

ITU-R BT.709-4 2000, *Parameter values for the HDTV standards for production and international programme exchange*

ITU-R BT.1358 1998, *Studio parameters of 625 and 525 line progressive scan television systems*

ITU-T H.263 1998, *Video coding for low bit rate communication*

SMPTE 267M-1995, *Television – Bit-Parallel Digital Interface – Component Video Signal 4:2:2 16x9 Aspect Ratio*

SMPTE 274M-1998, *Television – 1920 × 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates*

SMPTE 293M-1996, *Television – 720 × 483 Active Line at 59.94-Hz Progressive Scan Production – Digital Representation*

SMPTE 296M-2001, *Television – 1280 × 720 Progressive Image Sample Structure – Analog and Digital Representation and Analog Interface*

*VESA Monitor Timing Specifications*, VESA and Industry Standards and Guidelines for Computer Display Monitor Timing, Version 1.0, Revision 0.8

## 3 Abbreviations and conventions

### 3.1 Abbreviations

For the purposes of this document, the abbreviations given in IEC 61883-1, as well as the following, apply.

AV/C Audio Video Control

| | |
|---|---|
| BCD | Binary Coded Decimal |
| BT.601 | ITU-R BT.601-5 1995 |
| CIP | Common Isochronous Packet |
| CSR | Control and status register |
| DAC | Digital Analog Converter |
| DCT | Discrete Cosine Transform |
| DV | Digital Video |
| ND | No Data |
| OSD | Onscreen Display |
| OUI | Organizationally Unique Identifier |
| r | Reserved |
| MPEG | Moving Picture Experts Group |
| SIM | Stream Information & Metadata |
| VDSP | Video Data Source Packet |
| WMF | Windows Media Format |

## 3.2 Notation

### 3.2.1 Numeric values

Decimal and hexadecimal are used within this standard. By editorial convention, decimal numbers are most frequently used to represent quantities or counts. Addresses are uniformly represented by hexadecimal numbers. Hexadecimal numbers are also used when the value represented has an underlying structure that is more apparent in a hexadecimal format than in a decimal format.

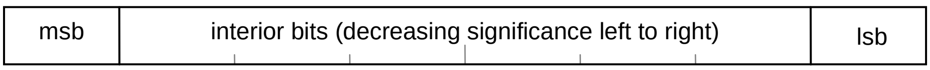
Decimal numbers are represented by Arabic numerals without subscripts or by their English names. Hexadecimal numbers are represented by digits from the character set 0 – 9 and A - F followed by the subscript 16. When the subscript is unnecessary to disambiguate the base of the number it may be omitted. For the sake of legibility hexadecimal numbers are separated into groups of four digits separated by spaces.

As an example, 42 and $2A_{16}$ both represent the same numeric value.

### 3.2.2 Bit, byte and quadlet ordering

This specification uses the facilities of Serial Bus, IEEE 1394, and therefore uses the ordering conventions of Serial Bus in the representation of data structures. In order to promote interoperability with memory buses that may have different ordering conventions, this specification defines the order and significance of bits within bytes, bytes within quadlets and quadlets within octlets in terms of their relative position and not their physically addressed position.

Within a byte, the most significant bit, msb, is that which is transmitted first and the least significant bit, lsb, is that which is transmitted last on serial bus, as illustrated below. The significance of the interior bits uniformly decreases in progression from msb to lsb.




IEC 2117/08

**Figure 1 – Bit ordering within a byte**

Within a quadlet, the most significant byte is that which is transmitted first and the least significant byte is that which is transmitted last on serial bus, as shown below.

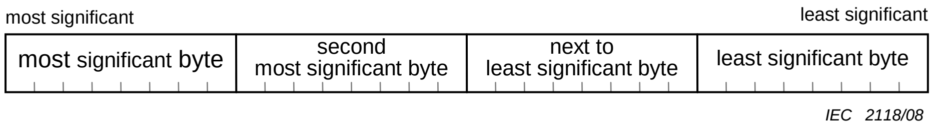



**Figure 2 – Byte ordering within a quadlet**

Within an octlet, which is frequently used to contain 64-bit serial bus addresses, the most significant quadlet is that which is transmitted first and the least significant quadlet is that which is transmitted last on serial bus, as the figure below indicates.

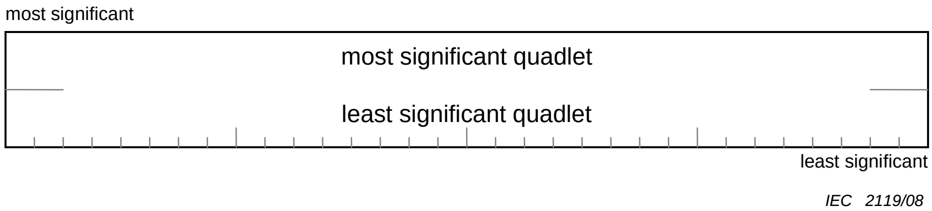



**Figure 3 – Quadlet ordering within an octlet**

When block transfers take place that are not quadlet aligned or not an integral number of quadlets, no assumptions can be made about the ordering (significance within a quadlet) of bytes at the unaligned beginning or fractional quadlet end of such a block transfer, unless an application has knowledge (outside of the scope of this specification) of the ordering conventions of the other bus.

# 4 Reference model for data transmission

## 4.1 Model overview

The presently defined compression standards for IEEE 1394 transport, DV and MPEG2, have difficulties at the system level in a practical consumer AV network. Both offer excessive compression for simple transport over a wide bandwidth network and carry the associated complexity of coding and decoding signals. Each are fine for their intended purpose, but have excessive cost for simple video transport. Conventional video equipment is interfaced with analog cables carrying a number of signal formats, and it is this low cost and universal connection capability which digital interfaces need to emulate. Thus the analog output from any DVD player will connect to any TV, and this is seen as adequate by equipment manufacturers. Digital interfaces would allow many additional features, but providing every input with the capability of decoding both DV and MPEG2 in all available standards and resolutions is unnecessarily expensive. Inside equipment variations on the broadcast equipment ITU-R BT.601-5/BT.656-4 interface are common and provide a universal interface standard for digital video transport. The coding system in ITU-R BT.601-5 sends YUV data across an 8 bit interface between integrated circuits, for example an MPEG decoder and DAC. If the decoder and DAC are separated by 1394 in their separate boxes there will be a reduction in cost at the source device and the sink device will be independent from the video encoding mechanism.

This standard describes the method of passing YUV video signals across IEEE 1394 based upon the formats defined by ITU-R BT.601-5. Familiarity with the specifications ITU-R BT.601-5, ITU-R BT.656-4 and IEC 61883 is necessary to follow the technical details.

There is also the capability to transfer data in YUV 4:4:4 and 24 bit RGB formats. This allows video to be transferred without the need for color space sub-sampling.

It is valid to transmit all video modes as uncompressed data as long as the IEEE 1394 bus bandwidth is available. In practice some video modes will not be transportable in an uncompressed state.

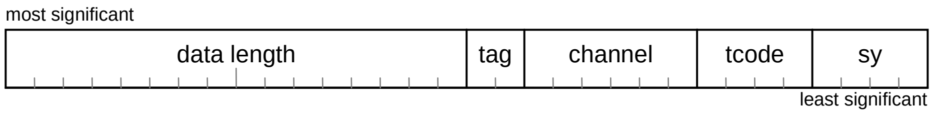
This model also allows for the future development of video codecs. Since the transport of the video data is independent of the original source encoding as new codecs are deployed, such as MPEG-4, the transport mechanism described in this document will not need to change.

### 4.2 Compression

To allow the transport of high definition video signals at bus speeds less than S1600 or to allow the transport of multiple video streams it is essential that the video stream is compressed. This compression need not be more than about 10:1 and should have minimal discernable impact on the displayed image. Since compression is required to transport some of the video modes it is necessary to reference at least one compression codec in this specification. A suitable video compression codec is referenced for this purpose in Table 2. There is no requirement that a source or sink device implement this codec. Other suitable video compression codecs may be added in the future.

### 4.3 Isochronous packet header

The header quadlet of an IEEE 1394 isochronononous packet (tcode $A_{16}$) is shown in the Figure 4 below.




IEC 2120/08

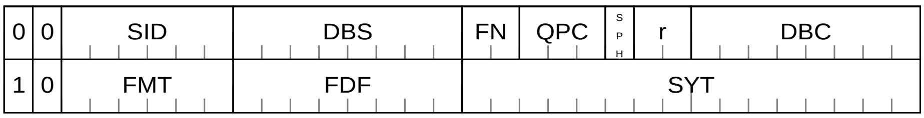
**Figure 4 – Isochronous packet header**

The tag field shall be set to $1_{16}$ indicating that the packet has the Common Isochronous Packet (CIP) Header as defined in IEC 61883-1. The contents of the CIP Header are described in 4.4.

The definition of the remaining fields is outside of the scope of this specification.

### 4.4 CIP header

The definition of the CIP header is shown in Figure 5 below.




IEC 2121/08

**Figure 5 – CIP header**

– SID denotes the source node ID. This is bus configuration dependent.

– DBS value depends upon the video mode being transported and the color space used. This value is dependent upon the compression mode, color space and video mode. The DBS value for compression mode $0_{16}$ can be calculated from the source packet size given in Table 1 by dividing the value by 4. For other compression modes refer to the documention available from the codec vendor.

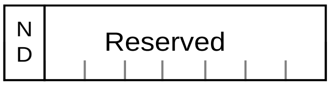
– FN shall always have a value of $0_{16}$. There shall only be 1 data block per source packet.

– QPC shall always have a value of $0_{16}$. There shall be no padding.

– SPH shall be $0_{16}$. The source packet header is not present.

– Since FN is $0_{16}$ the value of DBC shall always increment by the number of source packets present in the Isochronous packet. This field indicates the count value of the first data block in the current isochronous packet.

- The value of FMT shall be $000001_2$. This value indicates that the source packet format is as defined in this specification. This also indicates that the SYT field is present in the CIP header.
- The FDF field is encoded as shown in Figure 6 below.
- The SYT field is encoded as defined in IEC 61883-1.




IEC 2122/08

**Figure 6 – FDF field**

The ND field is used to signify whether the data payload of the isochronous packet after the CIP header is valid. If ND is set to $1_2$ it indicates that the data is not valid and shall be ignored, this setting is only used in blocking transmission mode (see 4.7.1.3). The *DBC* field in the CIP header of a packet which has *ND* set to $1_2$ shall be the count value of the next valid data block. The transmission of an isochronous packet with this bit set shall not cause the value of DBC to increment. If ND is set to $0_2$ it indicates that the data payload of the isochronous packet after the CIP header is valid. In non-blocking transmission mode, see 4.7.1.2, ND shall be set to $0_2$ for all isochronous packets.

## 4.5 Stream definition

A stream that conforms to this specification is governed by three key parameters:

- video mode, see Table 1 below. Additional information for each video mode is given in Annex B.
- compression mode, see Table 2 below.
- color space, see Table 3 below.

Each of these parameters includes an unconstrained mode that allows modes not explicitly defined to be transmitted. The use of these unconstrained modes is beyond the scope of this standard. However, it is expected that their use will be determined by negotiation before transmission.

For transmission of compression mode $0_{16}$ data the packetization and timing characteristics are defined in this specification.

For transmission of compression mode $1_{16}$ and $2_{16}$ data the packetization and timing characteristics are defined in the applicable specification document referenced in Table 2.

**Table 1 – Video mode**

| Video mode | Active vertical lines | Active horizontal pixels | Interlace or progres-sive | Vertical fre-quency<br>Hz | Source packet size for color space 0 [a, b, e]<br>bytes | Source packet size for color spaces 1 and 2 [a, b, e]<br>bytes | SYT interval for color space 0 [a, b] | SYT interval for color spaces 1 and 2 [a, b] | MAX VDSP for color space 0 [a, b] | MAX VDSP for color spaces 1 and 2 [a, b] | Specification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 480 | 640 | progr. | 59,94 | 644 | 644 | 8 | 12 | 8 | 12 | VESA |
| 1 | 480 | 640 | progr. | 60 | 644 | 644 | 8 | 12 | 8 | 12 | VESA |
| 2 | 240 | 720 | progr. | 59,94 | 724 | 724 | 4 | 6 | 4 | 6 | EIA/CEA-861-B |
| 3 | 240 | 720 | progr. | 60 | 724 | 724 | 4 | 6 | 4 | 6 | EIA/CEA-861-B |
| 4 | 480 | 720 | progr. | 59,94 | 724 | 724 | 8 | 12 | 8 | 12 | ITU-R BT.1358<br>SMPTE 293M |
| 5 | 480 | 720 | progr. | 60 | 724 | 724 | 8 | 12 | 8 | 12 | ITU-R BT.1358<br>SMPTE 293M |
| 6 | 480 | 720 | int. | 59,94 | 724 | 724 | 4 | 6 | 4 | 6 | ITU-R BT.601<br>SMPTE 267M |
| 7 | 480 | 720 | int. | 60 | 724 | 724 | 4 | 6 | 4 | 6 | ITU-R BT.601<br>SMPTE 267M |
| 8 | 720 | 1 280 | progr. | 59,94 | 644 | 964 | 24 | 24 | 23 | 23 | SMPTE 296M |
| 9 | 720 | 1 280 | progr. | 60 | 644 | 964 | 24 | 24 | 23 | 23 | SMPTE 296M |
| 10 | 480 | 1 440 | progr. | 59,94 | 724 | 724 | 16 | 24 | 16 | 24 | EIA/CEA-861-B |
| 11 | 480 | 1 440 | progr. | 60 | 724 | 724 | 16 | 24 | 16 | 24 | EIA/CEA-861-B |
| 12 | 1 080 | 1 920 | progr. | 59,94 | 964 | 964 | 36 | 54 | 34 | 51 | ITU-R BT.709<br>SMPTE 274M |
| 13 | 1 080 | 1 920 | progr. | 60 | 964 | 964 | 36 | 54 | 34 | 51 | ITU-R BT.709<br>SMPTE 274M |
| 14 | 1 080 | 1 920 | int. | 59,94 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709<br>SMPTE 274M |
| 15 | 1 080 | 1 920 | int. | 60 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709<br>SMPTE 274M |
| 16 | 288 | 720 | progr. | 50 | 724 | 724 | 4 | 6 | 4 | 6 | EIA/CEA-861-B |
| 17 | 576 | 720 | progr. | 50 | 724 | 724 | 8 | 12 | 8 | 12 | ITU-R BT.1358 |
| 18 | 576 | 720 | int. | 50 | 724 | 724 | 4 | 6 | 4 | 6 | ITU-R BT.601 |
| 19 | 720 | 1 280 | progr. | 50 | 644 | 964 | 20 | 20 | 19 | 19 | SMPTE 296M |
| 20 | 576 | 1 440 | progr. | 50 | 724 | 724 | 16 | 24 | 16 | 24 | EIA/CEA-861-B |
| 21 | 480 | 960 | int. | 59,94 | 644 | 724 | 6 | 8 | 6 | 8 | ITU-R BT.601<br>SMPTE 267M |
| 22 | 576 | 960 | int. | 50 | 644 | 724 | 6 | 8 | 6 | 8 | ITU-R BT.601 |

| Video mode | Active vertical lines | Active horizontal pixels | Interlace or progres-sive | Vertical fre-quency Hz | Source packet size for color space 0 [a, b, e] bytes | Source packet size for color spaces 1 and 2 [a, b, e] bytes | SYT interval for color space 0 [a, b] | SYT interval for color spaces 1 and 2 [a, b] | MAX VDSP for color space 0 [a, b] | MAX VDSP for color spaces 1 and 2 [a, b] | Specification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | - | Reserved | - | - | - | - | - | - | - | - | - |
| 24 | - | Reserved | - | - | - | - | - | - | - | - | - |
| 25 | 1 080 | 1 920 | progr. | 23,976 | 964 | 964 | 16 | 24 | 14 | 21 | ITU-R BT.709 SMPTE 274M |
| 26 | 1 080 | 1 920 | progr. | 24 | 964 | 964 | 16 | 24 | 14 | 21 | ITU-R BT.709 SMPTE 274M |
| 27 | 1 080 | 1 920 | progr. | 25 | 964 | 964 | 16 | 24 | 15 | 22 | ITU-R BT.709 SMPTE 274M |
| 28 | 1 080 | 1 920 | progr. | 29,97 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709 SMPTE 274M |
| 29 | 1 080 | 1 920 | progr. | 30 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709 SMPTE 274M |
| 30 | 1 080 | 1 920 | progr. | 50 | 964 | 964 | 32 | 48 | 29 | 43 | ITU-R BT.709 SMPTE 274M |
| 31 | 1 080 | 1 920 | int. | 50 | 964 | 964 | 16 | 24 | 15 | 22 | ITU-R BT.709 SMPTE 274M |
| 32 | 288 | 352 | progr. | 25 | 356 | 532 | 2 | 2 | 2 | 2 | ITU-T H.263 (CIF) |
| 33 | 240 | 352 | progr. | 30 | 356 | 532 | 2 | 2 | 2 | 2 | ISO-IEC 11172-2 (SIF) |
| 34 | 144 | 176 | progr. | 25 | 180 | 268 | 2 | 2 | 1 | 1 | H.263 (QCIF) |
| 35 | 120 | 176 | progr. | 30 | 180 | 268 | 2 | 2 | 1 | 1 | ISO-IEC 11172-2 (QSIF) |
| 3 6 | 288 | 352 | progr. | 29,97 | 356 | 532 | 6 | 6 | 3 | 3 | H.263 (CIF) |
| 37 | 144 | 176 | progr. | 29,97 | 180 | 268 | 2 | 2 | 2 | 2 | ITU-T H.263 (QCIF) |
| 38 | 234 | 480 | progr. | 29,97 | 324 | 364 | 3 | 4 | 3 | 4 | Automotive [c] |
| 39 | 234 | 480 | progr. | 15 | 324 | 364 | 3 | 4 | 2 | 2 | Automotive [c] |
| 40 | 480 | 800 | progr. | 15 | 804 | 804 | 2 | 3 | 2 | 3 | Automotive [c] |
| 41 | 240 | 320 | progr. | 15 | 324 | 244 | 2 | 4 | 1 | 2 | IIDC v.1.31 [f] |
| 42 | 240 | 320 | progr. | 30 | 324 | 244 | 2 | 4 | 2 | 4 | IIDC v.1.31 |
| 43 | 240 | 320 | progr. | 60 | 324 | 244 | 4 | 8 | 4 | 8 | IIDC v.1.31 |
| 44 | 480 | 640 | progr. | 15 | 644 | 644 | 2 | 3 | 2 | 3 | IIDC v.1.31 |
| 45 | 480 | 640 | progr. | 30 | 644 | 644 | 4 | 6 | 4 | 6 | IIDC v.1.31 |
| 46 | 480 | 640 | progr. | 60 | 644 | 644 | 8 | 12 | 8 | 11 | IIDC v.1.31 |
| 47 | 600 | 800 | progr. | 15 | 804 | 804 | 4 | 6 | 3 | 4 | IIDC v.1.31 |

| Video mode | Active vertical lines | Active horizontal pixels | Interlace or progres-sive | Vertical fre-quency Hz | Source packet size for color space 0 [a, b, e] bytes | Source packet size for color spaces 1 and 2 [a, b, e] bytes | SYT interval for color space 0 [a, b] | SYT interval for color spaces 1 and 2 [a, b] | MAX VDSP for color space 0 [a, b] | MAX VDSP for color spaces 1 and 2 [a, b] | Specification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | 600 | 800 | progr. | 30 | 804 | 804 | 6 | 9 | 5 | 7 | IIDC v.1.31 |
| 49 | 600 | 800 | progr. | 60 | 804 | 804 | 10 | 15 | 9 | 14 | IIDC v.1.31 |
| 50 | 768 | 1 024 | progr. | 15 | 516 | 772 | 8 | 8 | 6 | 6 | IIDC v.1.31 |
| 51 | 768 | 1 024 | progr. | 30 | 516 | 772 | 12 | 12 | 12 | 12 | IIDC v.1.31 |
| 52 | 768 | 1 024 | progr. | 60 | 516 | 772 | 24 | 24 | 24 | 24 | IIDC v.1.31 |
| 53 | 960 | 1 280 | progr. | 15 | 644 | 964 | 8 | 8 | 8 | 8 | IIDC v.1.31 |
| 54 | 960 | 1 280 | progr. | 30 | 644 | 964 | 16 | 16 | 15 | 15 | IIDC v.1.31 |
| 55 | 960 | 1 280 | progr. | 60 | 644 | 964 | 32 | 32 | 29 | 29 | IIDC v.1.31 |
| 56 | 1 024 | 1 280 | progr. | 15 | 644 | 964 | 8 | 8 | 8 | 8 | like IIDC v1.31 [d] |
| 57 | 1 024 | 1 280 | progr. | 30 | 644 | 964 | 16 | 16 | 16 | 16 | like IIDC v1.31 [d] |
| 58 | 1 024 | 1 280 | progr. | 60 | 644 | 964 | 32 | 32 | 31 | 31 | like IIDC v1.31 [d] |
| 59 | 1 200 | 1 600 | progr. | 15 | 804 | 964 | 12 | 15 | 9 | 12 | IIDC v.1.31 |
| 60 | 1 200 | 1 600 | progr. | 30 | 804 | 964 | 20 | 25 | 18 | 23 | IIDC v.1.31 |
| 61 | 1 200 | 1 600 | progr. | 60 | 804 | 964 | 36 | 45 | 36 | 45 | IIDC v.1.31 |
| 62 | 480 | 800 | progr. | 30 | 804 | 804 | 4 | 6 | 4 | 6 | Wide VGA |
| 63 | 480 | 800 | progr. | 60 | 804 | 804 | 8 | 12 | 8 | 12 | Wide VGA |
| 255 | - | Other video mode | - | - | - | - | - | - | - | - | - |
| Others | - | Reserved for future specification | - | - | - | - | - | - | - | - | - |

[a] These columns are applicable when the compression mode is 0, i.e. uncompressed video data only.

[b] This value includes the quadlet that contains the Type Specific Information field.

[c] These modes were requested by members of the IDB-Forum.

[d] These video modes are not in IIDC specification but are comparable to the modes that are.

[e] DBS can be calculated as: (Source packet size / 4).

[f] See Bibliography [12].

progr. progressive
int. interlace

The use of video mode $FF_{16}$ is beyond the scope of this specification. However, it is expected that the use of this video mode will be determined by negotiation before transmission.

The compression mode field is encoded as defined in Table 2 below. The use of compression mode $FF_{16}$ is beyond the scope of this standard. However, it is expected that the use of this compression mode will be determined by negotiation before transmission.

**Table 2 – Compression mode**

| Compression mode value | Compression mode description | Specification document reference |
|---|---|---|
| $0_{16}$ | Uncompressed video data | None applicable |
| $1_{16}$ | Compressed video using light codec | Oxford Semiconductor Light Codec Specification, Version 1.0, [10][1] |
| $2_{16}$ | Compressed Video using SmartCODEC | Fujitsu SmartCODEC Specification, Version1.0, [11] |
| $FF_{16}$ | Compressed Video using other video codec | None applicable |
| Others | Reserved for future specification | None applicable |

The color space field is encoded as defined in Table 3 below. The use of color space $FF_{16}$ is beyond the scope of this standard. However, it is expected that the use of this color space will be determined by negotiation before transmission.

**Table 3 – Color space**

| Color space format | Color space description |
|---|---|
| $0_{16}$ | YUV 4:2:2 (16 bits/pixel, 8 bits/sample) |
| $1_{16}$ | YUV 4:4:4 (24 bits/pixel, 8 bits/sample) |
| $2_{16}$ | RGB (24 bits/pixel, 8 bits/sample) |
| $3_{16}$ | RGB (18 bits/pixel, 6 bits/sample) |
| $FF_{16}$ | Other color space |
| Others | Reserved for future specification |

## 4.6 Packetization

### 4.6.1 Source packet format

For a stream that conforms to this specification each IEEE-1394 isochronous packet consists of the CIP header followed by zero or more source packets. The general format of the source packet for all compression modes and all source packet types is shown in Figure 7 below. It contains a single quadlet of type specific information followed by data. The size of each source packet is compression mode, video mode and color space mode dependent. The permitted video, compression and color space modes are detailed in Table 1, Table 2 and Table 3, respectively. Table 1 indicates the source packet size for each video mode and color space mode for compression mode 0. This size is the total number of bytes per source packet, i.e. type specific information and source packet data. All the source packets of a given stream are this size.

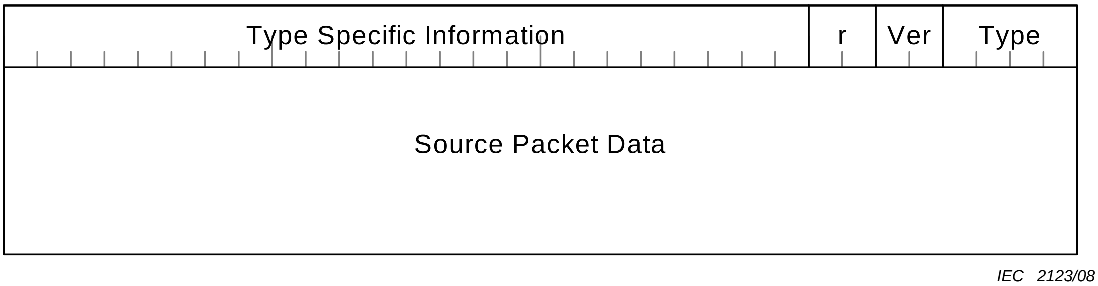



**Figure 7 – General format of a source packet**

1 The figures in square brackets refer to the Bibliography.

The *type* field indicates the type of data contained within the source packet. It is encoded as defined in Table 4 below.

The *ver* field indicates the version of the source packet. Its value is defined in the type specific sections below.

The *type specific information* field contents depends on the *type* field. Its encoding is defined in the type specific sections 4.6.2, 4.6.3 and 4.6.4 below.

The *source packet data* field contents depends on the *type* field. Its encoding is defined in the type specific sections 4.6.2, 4.6.3 and 4.6.4 below.

**Table 4 – Source packet type encoding**

| Type | Description of type |
|---|---|
| $0_{16}$ | Source packet contains video data as described in 4.6.2 below |
| $1_{16}$ | Source packet contains stream information and metadata as described in 4.6.3 below. |
| $2_{16}$ | Reserved for the future specification of the transport of audio data. Further information regarding this type is given in 4.6.4 below. |
| others | Reserved for future use. |

### 4.6.2 Type $0_{16}$ source packet – Video data source packet

#### 4.6.2.1 Video data source packet

Figure 8 shows the definition and arrangement of the fields in the video data source packet.

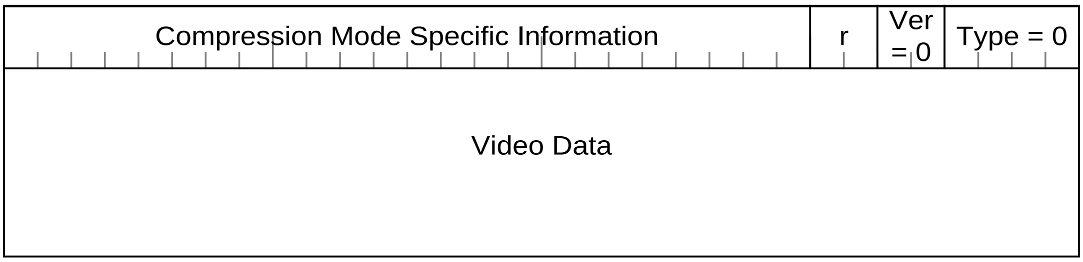



**Figure 8 – Video data source packet**

The *type* field shall be set to $0_{16}$ to indicate that this is a video data source packet

The *ver* field shall be set to $0_{16}$ to indicate that this is version 0 of the video data source packet.

The *compression mode specific information* field has a different definition for each of the compression modes. Refer to Table 2 for a list of defined compression modes. The *compression mode specific information* for compression modes $0_{16}$, $1_{16}$, $2_{16}$ and $FF_{16}$ are detailed in sections 4.6.2.2, 4.6.2.3, 4.6.2.3 and 4.6.2.5 respectively.

The *video data* field definition is determined by a combination of video mode, compression mode and color space. The reference to the applicable definition of the formatting of the *video data* field is given in Table 5 below.

**Table 5 – References for video data definition**

| Compression mode | Color space | Video mode | Reference to video data definition |
|---|---|---|---|
| $0_{16}$ | $0_{16}$ | All defined except $FF_{16}$ | See 4.6.2.6 and 4.6.2.10 |
| $0_{16}$ | $1_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.10 |
| $0_{16}$ | $2_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.11 |
| $0_{16}$ | $3_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.13 |
| $0_{16}$ | $FF_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.13 |
| $0_{16}$ | All defined | $FF_{16}$ | see 4.6.2.6 and 4.6.2.15 |
| $1_{16}$ | All defined | All defined | see 4.6.2.7 |
| $2_{16}$ | All defined | All defined | see 4.6.2.8 |
| $FF_{16}$ | All defined | All defined | see 4.6.2.9 |

#### 4.6.2.2 Compression mode $0_{16}$ type specific information

Figure 9 shows the definition and arrangement of the fields within the *type specific information* field for video data source packets being transmitted in compression mode $0_{16}$.

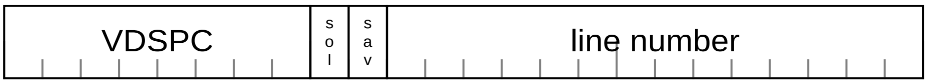



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**Figure 9 – Compression mode $0_{16}$ specific information**

The *VDSPC* (Video Data Source Packet Count) field contains a running count of video data source packets. It is incremented by 1 for every video data source packet created by the transmitter. When a stream commences the first video data source packet created has a VDSPC of 0. Since VDSPC is only 8 bits wide the value placed in VDSPC is the lowest 8 bits of the running count.

The *sol* (start of line) field is set in the source packet that contains the first pixel of a video line. There is no requirement that the start of a video line be coincident with the start of an IEEE-1394 isochronous packet.

The *sav* (start of active video) field is set in the source packet that contains the first pixel of the first active video line of each frame (progressive modes) or of each field (interlace modes). This field can only be set in a source packet that has *sol* set. There is no requirement that the start of an active video line be coincident with the start of an IEEE-1394 isochronous packet.

The *line number* field is the line on which the video data in the source packet resides as defined by the video specification given in Table 1 of the given video mode. If no line numbering is defined by the video specification the *line number* field shall be a sequential count of the lines in a frame starting with the first line that is transmitted having a *line number.*

#### 4.6.2.3 Compression mode $1_{16}$ type specific information

The *type specific information* field definition for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.4 Compression mode $2_{16}$ type specific information

The *type specific information* field definition for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.5 Compression mode $FF_{16}$ type specific information

The *type specific information* field definition for compression mode $FF_{16}$ is beyond the scope of this standard.

#### 4.6.2.6 Compression mode $0_{16}$ video data packetization

For transmission of compression mode $0_{16}$ data the video data that is transmitted is the active horizontal pixels for both the active lines and the lines of the vertical blanking period (unless they do not exist). The first pixel of a video line shall always be the first pixel in a source packet and each video line shall always fill an integer number of source packets. The number of pixels in each source packet is dependent upon the video mode and color space and is detailed in Table 1. An IEEE-1394 isochronous channel that is used to transmit data according to this specification shall only transmit a single stream of video per 1394 isochronous channel.

#### 4.6.2.7 Compression mode $1_{16}$ video data packetization

The video data packetization for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.8 Compression mode $2_{16}$ video data packetization

The video data packetization for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.9 Compression mode $FF_{16}$ video data packetization

The video data packetization for the this compression mode is beyond the scope of this standard.

#### 4.6.2.10 Color space $0_{16}$ video data packetization – YUV 4:2:2 8 bits/sample

There is a Y sample for each pixel. Each U and V sample is used for two pixels. The subscript *n* denotes the pixel number within the source packet.

| | | | |
|---|---|---|---|
| $U_0$ | $Y_0$ | $V_0$ | $Y_1$ |
| $U_2$ | $Y_2$ | $V_2$ | $Y_3$ |
| $U_4$ | $Y_4$ | $V_4$ | $Y_5$ |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| $U_{n-5}$ | $Y_{n-5}$ | $V_{n-5}$ | $Y_{n-4}$ |
| $U_{n-3}$ | $Y_{n-3}$ | $V_{n-3}$ | $Y_{n-2}$ |
| $U_{n-1}$ | $Y_{n-1}$ | $V_{n-1}$ | $Y_n$ |

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**Figure 10 – Color space $0_{16}$ video data packetization**

#### 4.6.2.11 Color space $1_{16}$ video data packetization – YUV 4:4:4 8 bits/sample

Each pixel contains a Y, U and V sample. The arrangement of the samples is shown in Figure 11. The subscript *n* denotes the pixel number within the source packet.

| | | | |
|---|---|---|---|
| $U_0$ | $Y_0$ | $V_0$ | $U_1$ |
| $Y_1$ | $V_1$ | $U_2$ | $Y_2$ |
| $V_2$ | $U_3$ | $Y_3$ | $V_3$ |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| $U_{n-3}$ | $Y_{n-3}$ | $V_{n-3}$ | $U_{n-2}$ |
| $Y_{n-2}$ | $V_{n-2}$ | $U_{n-1}$ | $Y_{n-1}$ |
| $V_{n-1}$ | $U_n$ | $Y_n$ | $V_n$ |

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**Figure 11 – Color space $1_{16}$ video data packetization**

#### 4.6.2.12 Color space $2_{16}$ video data packetization – RGB 8 bits/sample

Each pixel contains a R, G and B sample. The arrangement of the samples is shown in Figure 12. The subscript *n* denotes the pixel number within the source packet.

| | | | |
|---|---|---|---|
| $R_0$ | $G_0$ | $B_0$ | $R_1$ |
| $G_1$ | $B_1$ | $R_2$ | $G_2$ |
| $B_2$ | $R_3$ | $G_3$ | $B_3$ |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| $R_{n-3}$ | $G_{n-3}$ | $B_{n-3}$ | $R_{n-2}$ |
| $G_{n-2}$ | $B_{n-2}$ | $R_{n-1}$ | $G_{n-1}$ |
| $B_{n-1}$ | $R_n$ | $G_n$ | $B_n$ |

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**Figure 12 – Color space $2_{16}$ video data packetization**

#### 4.6.2.13 Color space $3_{16}$ video data packetization – RGB 6 bits/sample

The video data packetization for this color space is only applied for compression mode $2_{16}$ and is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.14 Color space $FF_{16}$ video data packetization

The video data packetization for the this color space is beyond the scope of this standard.

#### 4.6.2.15 Video mode $FF_{16}$ video data packetization

The video data packetization for the this video mode is beyond the scope of this standard.

### 4.6.3 Type $1_{16}$ source packet – Stream information and metadata (SIM) source packet4

#### 4.6.3.1 Stream information and metadata (SIM) source packet

A SIM source packet is transmitted exactly once per video frame for all compression modes. This type of source packet contains six data-types. Figure 13 shows the definition and arrangement of the fields of the stream information and metadata source packet.

| | | | | |
|---|---|---|---|---|
| reserved | Total Length | reserved | Ver = 1 | Type = 1 |
| reserved | Stream Info Length (bytes) | Stream Info Data (variable length field, zero or more bytes) | | |
| reserved | Auxiliary Data Length (bytes) | Auxiliary Data (variable length field, zero or more bytes) | | |
| reserved | Video Mode Specific Info Length (bytes) | Video Mode Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Compression Mode Specific Info Length (bytes) | Compression Mode Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Color Space Specific Info Length (bytes) | Color Space Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Vendor Specific Info Length (bytes) | Vendor Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Copy Control Info Length (bytes) | Copy Control Info Data (variable length field, zero or more bytes) | | |

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**Figure 13 – Stream information and metadata source packet**

For transmission of compression mode $0_{16}$ only the SIM source packet shall denote the start a video frame, that is the next video data source packet shall be the start of the first line of video data of a frame.

The six data-types included in the SIM source packet are:

– stream information;
– auxiliary data;
– video mode specific information;
– compression mode specific information;
– color space specific information;
– copy control information.

Each data-type consists of a six bit reserved field, a ten bit length and a variable number of data bytes. The six bit reserved field and the ten bit length shall be present for all data-types in all SIM source packets. If the length field is zero then no data bytes are included in the SIM source packet for that data-type. Annex D provides an example of a typical SIM source packet.

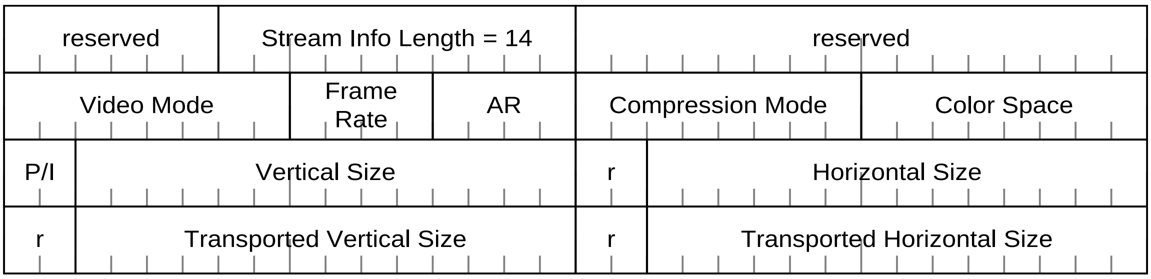
The *Type* field shall be set to $1_{16}$ to indicate that this is a SIM source packet.

The *Ver* field shall be set to $1_{16}$ to indicate that this is version 1 of the SIM source packet. This version is backward compatible with version 0. All future versions shall be backward compatible, they shall only add additional data-types in a manner consistent with those already defined. A node that receives a SIM source packet with a version number later than that which it supports should ignore the additional data-types.

The *Total Length* field indicates the number of valid bytes in the *Source Packet Data* portion of the source packet. Its value is the summation of the six length fields plus 12 bytes for the length and reserved fields themselves. The *Total Length* shall be less than or equal to (*source packet size* – 4) where *source packet size* is determined by the combination of video, compression and color space modes. Since there are a number of different source packet sizes it is unlikely that the *total length* will be equal to (*source packet size* – 4) therefore all remaining bytes in the source packet beyond those indicated by *total length* are reserved and shall be set to $00_{16}$.

#### 4.6.3.2 Stream information

The stream information data type shall be included in all SIM source packets. The definition of the fields in this data-type is shown in Figure 14 below.




IEC 2130/08

**Figure 14 – Stream information field definitions**

The *stream info length* field shall be set to 14 ($E_{16}$) to indicate that there are 14 bytes of stream information.

The *video mode* field is encoded as defined in Table 1. For all video modes except mode $FF_{16}$ the values of *frame rate*, *P/I*, *vertical size*, *horizontal dize*, *transported vertical size* and *transported horizontal size* are fixed and are given in Annex B. When video mode $FF_{16}$ is used these fields shall be set to the applicable value from the tables below. Where no value matches the required parameter the no information value shall be used, this value has all the bits set to $1_2$. The action taken by the sink node when receiving a field set to no information is beyond the scope of this standard.

The *frame rate* field is encoded as defined in Table 6 below.

**Table 6 – Frame rate**

| Frame rate | Frame rate value (frames per second) |
|---|---|
| $0_{16}$ | Reserved for future specification |
| $1_{16}$ | 24/1,001 (23,976…) |
| $2_{16}$ | 24 |
| $3_{16}$ | 25 |
| $4_{16}$ | 30/1,001 (29,97…) |
| $5_{16}$ | 30 |
| $6_{16}$ | 50 |
| $7_{16}$ | 60/1,001 (59,94…) |
| $8_{16}$ | 60 |
| $9_{16}$ | 15 |
| $F_{16}$ | No information |
| others | Reserved for future specification |

The AR field is described in Table 7 below.

**Table 7 – Aspect ratio**

| AR | Aspect ratio |
|---|---|
| $2_{16}$ | 4:3 |
| $3_{16}$ | 16:9 |
| $4_{16}$ | 2,21:1 |
| $F_{16}$ | No information |
| others | Reserved for future specification |

The P/I field indicates whether the video stream is progressive or interlaced. It is encoded as defined in Table 8 below.

**Table 8 – Progressive/interlace mode**

| P/I | Progressive/Interlace information |
|---|---|
| $0_{16}$ | Stream contains interlaced video frames |
| $1_{16}$ | Stream contains progressive video frames |
| $2_{16}$ | Reserved for future specification |
| $3_{16}$ | No Information |

The *vertical size* gives the value in lines of the vertical resolution of the video stream. This figure includes the vertical blanking if appropriate.

The *horizontal size* gives the value in pixels (not samples) of the horizontal resolution of the video stream. This figure includes the horizontal blanking if appropriate.

The *transported vertical size* gives the value in lines of the vertical resolution of the video stream that is actually transported. For all video modes currently defined, except $FF_{16}$, every line is transported and so this figure includes any vertical blanking. Whether vertical blanking is transported for video mode $FF_{16}$ is beyond the scope of this standard.

The *transported horizontal size* gives the value in pixels (not samples) of the horizontal resolution of the video stream that is actually transported. For all video modes currently defined, except $FF_{16}$, only the active portion of each video lines is transported and so this figure excludes any horizontal blanking. Whether horizontal blanking is transported for video mode $FF_{16}$ is beyond the scope of this standard.

#### 4.6.3.3 Auxiliary information

The auxiliary information data type should be included in all SIM source packets when transporting video data for which the auxiliary data is available. The definition of the fields in this data-type is shown in Figure 15 below.

<table>
<tr><td colspan="6">reserved</td><td colspan="2">Auxiliary Data Length (bits 9:8) = $0_2$</td></tr>
<tr><td colspan="8">Auxiliary Data Length (bits 7:0) = 14</td></tr>
<tr><td>TC VAL</td><td colspan="3">TC tens of frames</td><td colspan="4">TC units of frames</td></tr>
<tr><td>Drop</td><td colspan="3">TC tens of seconds</td><td colspan="4">TC units of seconds</td></tr>
<tr><td>r</td><td colspan="3">TC tens of minutes</td><td colspan="4">TC units of minutes</td></tr>
<tr><td colspan="4">TC tens of hours</td><td colspan="4">TC units of hours</td></tr>
<tr><td>RD VAL</td><td>DS</td><td colspan="2">tens of time zone</td><td colspan="4">units of time zone</td></tr>
<tr><td colspan="2">r</td><td colspan="2">tens of day</td><td colspan="4">units of day</td></tr>
<tr><td colspan="3">day of week</td><td>tens of month</td><td colspan="4">units of month</td></tr>
<tr><td colspan="4">tens of year</td><td colspan="4">units of year</td></tr>
<tr><td colspan="4">thousands of year</td><td colspan="4">hundreds of year</td></tr>
<tr><td>RT VAL</td><td colspan="3">RT tens of frames</td><td colspan="4">RT units of frames</td></tr>
<tr><td>r</td><td colspan="3">RT tens of seconds</td><td colspan="4">RT units of seconds</td></tr>
<tr><td>r</td><td colspan="3">RT tens of minutes</td><td colspan="4">RT units of minutes</td></tr>
<tr><td colspan="2">r</td><td colspan="2">RT tens of hours</td><td colspan="4">RT units of hours</td></tr>
<tr><td colspan="8">reserved</td></tr>
</table>

IEC 2131/08

**Figure 15 – Auxiliary data field definitions**

The *auxiliary data length* field shall be set to 14 ($E_{16}$) to indicate that there are 14 bytes of auxiliary data.

The remaining fields are defined below. The acquisition of the data contained in these fields is beyond the scope of this standard. The usage of the information contained in these fields by the sink device is implementation dependent.

*TC VAL*: A 1 if the Time-Code fields contain valid information.

*TC tens of frames*: The time-code tens of frames value in BCD.

*TC units of frames*: The time-code units of frames value in BCD.

*Drop*: A 1 if the time-code is based on drop-mode counting.

*TC tens of seconds*: The time-code tens of seconds value in BCD.

*TC units of seconds*: The time-code units of seconds value in BCD.

*TC tens of minutes*: The time-code tens of minutes value in BCD.

*TC units of minutes*: The time-code units of minutes value in BCD.

*TC tens of hours*: The time-code tens of hours value in BCD.

*TC units of hours*: The time-code units of hours value in BCD.

*RD VAL*: A 1 if the Record-Date fields contain valid information.

*DS*: A 1 if the record-time is based on daylight-savings-time.

*tens of time zone* : The record-time tens of time-zone value in BCD.

*units of time zone*: The record-time units of time-zone value in BCD.

*tens of day*: The record-date tens of day value in BCD.

*units of day*: The record-date units of day value in BCD.

*day of week*: The day of week, 0 (Sunday) through 6 (Saturday).

*tens of month*: The record-date tens of months value in BCD.

*units of month*: The record-date units of month value in BCD.

*tens of year*: The record-date tens of year value in BCD.

*units of year*: The record-date units of year value in BCD.

*hundreds of year*: The record-date hundreds of year value in BCD.

*thousands of year*: The record-date thousands of year value in BCD.

*RT VAL*: A 1 if the Record-Time fields contain valid information.

*RT tens of frames*: The record-time tens of frames value in BCD.

*RT units of frames*: The record-time units of frames value in BCD.

*RT tens of seconds*: The record-time tens of seconds value in BCD.

*RT units of seconds*: The record-time units of seconds value in BCD.

*RT tens of minutes*: The record-time tens of minutes value in BCD.

*RT units of minutes*: The record-time units of minutes value in BCD.

*RT tens of hours*: The record-time tens of hours value in BCD.

*RT units of hours*: The record-time units of hours value in BCD.

#### 4.6.3.4 Video mode specific information

For all video modes except $FF_{16}$ there are no data fields currently defined for this data-type. Therefore *video mode specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

For video mode $FF_{16}$ the first 3 bytes following the length field shall be the OUI of the vendor that has specified the video mode specific information data-type structure that is being transported. Therefore *video mode specific info length* shall be at least $03_{16}$. The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.5 Compression mode specific information

For compression modes $0_{16}$ there are no data fields currently defined for this data-type. Therefore *compression mode specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

For compression modes $1_{16}$ and $2_{16}$ the data-type length and structure is defined in the applicable specification document referenced in Table 2.

For compression mode $FF_{16}$ the first 3 bytes following the length field shall be the OUI of the vendor that has specified the compression mode specific information data-type structure that is being transported. Therefore *compression mode specific info length* shall be at least $03_{16}$. The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.6 Color space specific information

For all color space modes except $FF_{16}$ there are no data fields currently defined for this data-type. Therefore *color space specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

For color space $FF_{16}$ the first 3 bytes following the length field shall be the OUI of the vendor that has specified the color space specific information data-type structure that is being transported. Therefore *color space specific info length* shall be at least $03_{16}$. The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.7 Vendor specific information

If this field is unused the *vendor specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

If this field is used the first 3 bytes following the length field shall be the OUI of the vendor that has implemented the device. In this case the *vendor specific info length* shall be at least $03_{16}$. The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.8 Copy control information

The copy control information block shall be included in all SIM source packets.

If there is no CCI to convey the *copy control info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

If this field is used the first 3 bytes following the length field shall be the OUI of the vendor that has defined the copy control information. In this case the *copy control info length* shall be at least $03_{16}$. The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

Annex H contains the definition of a CCI descriptor structure that has been defined by the 1394 Trade Association.

#### 4.6.4 Type $2_{16}$ source packet – Audio source packet

##### 4.6.4.1 Audio source packet

The specification of the transportation of audio data within the same 1394 stream as video data is a likely update to this specification. Until such time as this has been specified it is recommended that audio data be transmitted as a separate 1394 stream as described by IEC 61883-6, [6]. Source packet type $2_{16}$ has been reserved for this purpose. A suggested method for synchronizing the video and audio on two separate 1394 channels is given in Annex A. The actual method of audio/video synchronization is implementation dependent.

### 4.7 Packet transmission method

#### 4.7.1 Packet transmission for compression mode $0_{16}$

##### 4.7.1.1 Overview of transmission

When a non-empty packet is ready to be transmitted, the transmitter shall transmit it within the most recent isochronous cycle initiated by a cycle start packet. The behavior of packet transmission depends on the definition of the condition in which a non-empty packet is ready to be transmitted. There are two situations in which this condition is defined.

a) A non-empty packet being ready for transmission is defined to be true if one or more video data source packets have arrived within an isochronous cycle. This transmission method is called non-blocking transmission, and is described in 4.7.1.2.

b) The condition of a non-empty packet is ready to be transmitted can also be defined as true when a fixed number of data blocks have arrived. This transmission method is called blocking transmission, and is described in 4.7.1.3.

Since a there is no source packet header (SPH) there is only one time stamp and this is in the SYT field of the CIP header. If a CIP contains multiple video data source packets, it is necessary to specify which source packet corresponds to the time stamp.

Since the stream contains a SIM source packet at the frequency of once per frame a mechanism is required to ensure that the SYT time stamp is generated at a regular interval of video data source packets. The VDSPC (Video Data Source Packet Count) field in video data source packet is used for this purpose.

The transmitter prepares the time stamp for the video data source packet, which meets this condition:

mod(VDSPC, SYT_INTERVAL) = 0;

where

VDSPC is the running count of transmitted video data source packets.

SYT_INTERVAL denotes the number of video data source packets between two successive valid SYT timestamps, which includes one of the video data source packets with a valid SYT. For example, if there are three video data source packets between two valid SYT timestamps, then the SYT_INTERVAL would be 4. The SYT_INTERVAL is dependent upon the video mode and color space used. The values of SYT_INTERVAL are given in Table 1.

The receiver knows the video data source packet for which the SYT timestamp is valid since it is the source packet whose VDSPC solve the following equation:

mod(VDSPC, SYT_INTERVAL) = 0

The receiver is responsible for estimating the timing of data blocks between valid time stamps. The method of timing estimation is implementation-dependent.

The SYT timestamp specifies the presentation time of the video data source packet at the receiver. A receiver must have the capability of presenting events at the time specified by the transmitter.

The TRANSFER_DELAY value is 875 µs, which accommodates the maximum latency time of isochronous packet transmission through an arbitrated short bus reset, worst case packetization delay and provides scope for encryption/decryption that may be required. The derivation of the TRANSFER_DELAY value is given in Annex F.

The transmitter quantizes the timing of the synchronization clock, for instance the rising edge of the video clock, by referring to its own CYCLE_TIME. It transmits the sum of this cycle time and TRANSFER_DELAY in the SYT field of the CIP. If the timing information is not required for a CIP the SYT shall indicate the no information code, that is $FFFF_{16}$.

#### 4.7.1.2 Non-blocking transmission method

The transmitter shall construct a packet in every nominal isochronous cycle. Each packet shall comply with the following constraint:

$0 \leq N \leq$ MAX_VDSP

where

*N* is the number of video data source packets in the isochronous packet.

MAX_VDSP is given in Table 1.

In normal operation the transmitter shall not transmit events late, and shall not transmit packets early. The resulting conditions may be expressed as follows:

Packet_arrival_time_L ≤ Event_arrival_time[0] + TRANSFER_DELAY

Event_arrival_time[N-1] ≤ Packet_arrival_time_F

where

*Packet_arrival_time_F* is the time (measured in µs) when the first bit of the isochronous packet arrives at the receiver.

*Packet_arrival_time_L* is the time (measured in µs) when the last bit of the isochronous packet arrives at the receiver.

*Event_arrival_time[M]* is the time (measured in µs) of the arrival at the transmitter of video data source packet M of the isochronous packet. The first video data source packet of the isochronous packet has M = 0.

Since MAX_VDSP is always greater than or equal to SYT_INTERVAL for all video modes there will only ever be a maximum of one SYT timestamp in a video data source packet.

#### 4.7.1.3 Blocking transmission method

The blocking method may be used by a transmitter, which has only the ability to transmit isochronous packets of the same size. In order to indicate no data, the transmitter may transmit an isochronous packet containing just a CIP header or a special nonempty packet which has the ND (NO DATA) flag set to $1_2$ in its FDF field and has the same size of dummy data as a nonempty packet.

The transmitter shall construct a packet that contains no more than MAX_VDSP + 1 source packets.

For blocking, the duration of the successive video data source packets in a CIP must be added to the default TRANSFER_DELAY.

If a CIP contains N video data source packets, then

ACTUAL_TRANSFER_DELAY >= TRANSFER_DELAY + (N * VDSP_DURATION)

where

TRANSFER_DELAY is the latency of transmission of 875 μs as given in section 4.7.1.1.

VDSP_DURATION is the duration of a video data source packet, it is dependent upon video mode and color space. The VDSP_DURATION for each video mode is given in Annex B. The total delay for MAX_VDSP video source packets is also given in Annex B.

It is recommended that the receiver have sufficient extra buffer to compensate for the delay in receiving data due to blocking transmission's characteristics. The actual value of extra delay required, and hence additional buffer size required, depends upon the video modes and color spaces supported by the receiving node.

#### 4.7.1.4 Bandwidth allocation

Prior to stream transmission the appropriate bandwidth must be reserved at the isochronous resource manager.

The calculation of bandwidth allocation units for this purpose uses the following equations:

Maximum number of bytes per packet = ((MAX_VDSP + 1) × Source Packet Size) + 20 [A]

Maximum number of quadlets per packet = (Maximum number of bytes per packet / 4)

Bandwidth allocation units = Maximum number of quadlets per packet × SPEED_FACTOR

SPEED_FACTOR takes the following values:

a) for S100 SPEED_FACTOR = 16;
b) for S200 SPEED_FACTOR = 8;
c) for S400 SPEED_FACTOR = 4;
d) for S800 SPEED_FACTOR = 2;
e) for S1600 SPEED_FACTOR = 1;
f) for S3200 SPEED_FACTOR = 0,5 (This may result in a fractional result for the bandwidth allocation units, in this circumstance the value shall be rounded up to the next integer value);

The addition of 1 to the MAX_VDSP is required to guarantee sufficient bandwidth for the SIM source packet that is sent once per frame. In the normal non-blocking transmission method, fewer than MAX_VDSP video data source packets will be transmitted in each packet, for some video modes this may allow sufficient bandwidth for the transmission of the SIM source packet without any extra bandwidth being allocated such that equation [A] becomes:

Maximum number of bytes per packet = (MAX_VDSP * Source Packet Size) + 20 [B]

For color space $0_{16}$ the following video modes require equation [A]:

g) modes 49, 59, 60 and 61;

For color spaces $1_{16}$ and $2_{16}$ the following video modes require equation [A]:

h) mode 61 only.

For modes that do not require equation [A] for bandwidth allocation unit calculation it is recommended that they do use equation [A] since in the event of lost opportunities to transmit a packet (such as a cycle start packet drop after a bus reset) a transmitter can catch up by transmitting up to MAX_VDSP events in one or more of the subsequent packets. Also, since the SIM source packet is only sent once per frame the bandwidth allocation calculated in equation [A] provides sufficient allocated bandwidth such that one additional video data source packet over and above MAX_VDSP can be sent per isochronous packet for most isochronous packets without violating the allocated bandwidth. Whilst this additional bandwidth will be unused most of the time it provides the extra bandwidth needed to catch up with transmission sooner.

The bandwidth allocation units have been calculated for all modes using equation [A] and are listed in Annex B.

### 4.7.2 Packet transmission for compression mode $1_{16}$

The transmission timing parameters for this compression mode are defined in the applicable specification document referenced in Table 2.

### 4.7.3 Packet transmission for compression mode $2_{16}$

The transmission timing parameters for this compression mode are defined in the applicable specification document referenced in Table 2.

### 4.7.4 Packet transmission for compression mode $FF_{16}$

The definition of the transmission timing parameters for this compression mode is beyond the scope of this standard.

# Annex A
(informative)

# Audio/video synchronization

## A.1 Logical association of audio and video streams

There is sufficient capability in the AV/C specifications, [5] to identify 1394 isochronous streams that are associated.

## A.2 Time synchronization of audio and video streams

Time synchronization may be achieved using the following principles:

A device that supports this specification and also sources IEC 61883-6 audio streams should ensure that both streams are synchronized with respect to presentation timestamp, that is audio and video data that arrived coincidently at the transmitter should be presented at the receiver coincidently.

The TRANSFER_DELAY for these streams is different, with TRANSFER_DELAY given by this specification being greater than that given by IEC 61883-6,[6]. Therefore the source should delay the IEC 61883-6 data prior to entering the 1394 system by a time equal to

(TRANSFER_DELAY for 601 Over 1394) – (TRANSFER_DELAY for IEC 61883-6).

This buffering should be done in the audio clock domain. It must be noted that IEC 61883-6 provides the capability to vary the IEC 61883-6 TRANSFER_DELAY, a transmitter that allows this functionality will have to vary this additional delay accordingly. It is be permissible to adjust the IEC 61883-6 TRANSFER_DELAY to a value greater than that used by this standard. In this situation the video data would be delayed in the video clock domain by the difference in the TRANSFER_DELAY values.

The delay in the system after the presentation time may be different between the audio and video path. The receiver should ensure that this delay is the same, and if this is not possible then the audio delay should be greater than the video delay to avoid lip-sync issues but by no more than about 10 ms.

# Annex B
(normative)

## Additional video mode parameters

This annex contains the additional parameters associated with the video modes defined in Table 1. It includes the fixed parameters that are used in the SIM source packet.

NOTE Due to the width of the tables there are two tables in this annex.

**Table B.1 – Additional video mode parameters, 1 of 2**

| Video mode | Transported vertical size [a] | Transported horizontal size [a, d] | Vertical size [a] | Horizontal size [a, d] | Vertical blanking | Horizontal blanking | P/I [a] | Frame rate [a] | Minimum bus speed comp mode $0_{16}$ color space $0_{16}$ | Minimum bus speed comp mode $0_{16}$ color spaces $1_{16}$ and $2_{16}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 640 | 500 | 800 | 20 | 160 | $1_{16}$ | $7_{16}$ | S800 | S1600 [b] |
| 1 | 500 | 640 | 500 | 800 | 20 | 160 | $1_{16}$ | $8_{16}$ | S800 | S1600 [b] |
| 2 | 263 | 720 | 263 | 858 | 23 | 138 | $1_{16}$ | $7_{16}$ | S400 | S800 |
| 3 | 263 | 720 | 263 | 858 | 23 | 138 | $1_{16}$ | $8_{16}$ | S400 | S800 |
| 4 | 522 | 720 | 522 | 858 | 42 | 138 | $1_{16}$ | $7_{16}$ | S800 | S1600 |
| 5 | 522 | 720 | 522 | 858 | 42 | 138 | $1_{16}$ | $8_{16}$ | S800 | S1600 |
| 6 | 525 | 720 | 525 | 858 | 45 | 138 | $0_{16}$ | $4_{16}$ | S400 | S800 |
| 7 | 525 | 720 | 525 | 858 | 45 | 138 | $0_{16}$ | $5_{16}$ | S400 | S800 |
| 8 | 750 | 1 280 | 750 | 1 650 | 30 | 370 | $1_{16}$ | $7_{16}$ | S1600 | S3200 |
| 9 | 750 | 1 280 | 750 | 1 650 | 30 | 370 | $1_{16}$ | $8_{16}$ | S1600 | S3200 |
| 10 | 525 | 1 440 | 525 | 1 716 | 45 | 276 | $1_{16}$ | $7_{16}$ | S1600 | S3200 |
| 11 | 525 | 1 440 | 525 | 1 716 | 45 | 276 | $1_{16}$ | $8_{16}$ | S1600 | S3200 |
| 12 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $7_{16}$ | > [c] | > [c] |
| 13 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $8_{16}$ | > [c] | > [c] |
| 14 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $0_{16}$ | $4_{16}$ | S3200 | S3200 |
| 15 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $0_{16}$ | $5_{16}$ | S3200 | S3200 |
| 16 | 314 | 720 | 314 | 864 | 26 | 144 | $1_{16}$ | $6_{16}$ | S400 | S800 |
| 17 | 625 | 720 | 625 | 864 | 49 | 144 | $1_{16}$ | $6_{16}$ | S800 | S1600 |
| 18 | 625 | 720 | 625 | 864 | 49 | 144 | $0_{16}$ | $3_{16}$ | S400 | S800 |
| 19 | 750 | 1 280 | 750 | 1 980 | 30 | 700 | $1_{16}$ | $6_{16}$ | S1600 | S3200 |
| 20 | 625 | 1 440 | 625 | 1 728 | 49 | 288 | $1_{16}$ | $6_{16}$ | S1600 | S3200 |
| 21 | 525 | 960 | 525 | 1 144 | 45 | 184 | $0_{16}$ | $4_{16}$ | S800[2] | S800 |
| 22 | 625 | 960 | 625 | 1 152 | 49 | 192 | $0_{16}$ | $3_{16}$ | S800[2] | S800 |
| 23 | - | - | - | - | - | - | - | - | - | - |
| 24 | - | - | - | - | - | - | - | - | - | - |
| 25 | 1 125 | 1 920 | 1 125 | 2 750 | 45 | 830 | $1_{16}$ | $1_{16}$ | S1600 | S3200 |
| 26 | 1 125 | 1 920 | 1 125 | 2 750 | 45 | 830 | $1_{16}$ | $2_{16}$ | S1600 | S3200 |
| 27 | 1 125 | 1 920 | 1 125 | 2 640 | 45 | 720 | $1_{16}$ | $3_{16}$ | S1600 | S3200 |
| 28 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $4_{16}$ | S3200 | S3200 |
| 29 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $5_{16}$ | S3200 | S3200 |
| 30 | 1 125 | 1 920 | 1 125 | 2 640 | 45 | 720 | $1_{16}$ | $6_{16}$ | S3200 | > [c] |
| 31 | 1 125 | 1 920 | 1 125 | 2 640 | 45 | 720 | $0_{16}$ | $3_{16}$ | S1600 | S3200 |

| Video mode | Transported vertical size [a] | Transported horizontal size [a, d] | Vertical size [a] | Horizontal size [a, d] | Vertical blanking | Horizontal blanking | P/I [a] | Frame rate [a] | Minimum bus speed comp mode $0_{16}$ color space $0_{16}$ | Minimum bus speed comp mode $0_{16}$ color spaces $1_{16}$ and $2_{16}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 288 | 352 | 288 | 352 | 0 | 0 | $1_{16}$ | $3_{16}$ | S200[2] | S200 |
| 33 | 240 | 352 | 240 | 352 | 0 | 0 | $1_{16}$ | $5_{16}$ | S200[2] | S200 |
| 34 | 144 | 176 | 144 | 176 | 0 | 0 | $1_{16}$ | $3_{16}$ | S100 | S100 |
| 35 | 120 | 176 | 120 | 176 | 0 | 0 | $1_{16}$ | $5_{16}$ | S100 | S100 |
| 36 | 288 | 352 | 288 | 352 | 0 | 0 | $1_{16}$ | $4_{16}$ | S200 | S400 [b] |
| 37 | 144 | 176 | 144 | 176 | 0 | 0 | $1_{16}$ | $4_{16}$ | S100 | S100 |
| 38 | 234 | 480 | 234 | 480 | 0 | 0 | $1_{16}$ | $4_{16}$ | S200 [b] | S200 |
| 39 | 234 | 480 | 234 | 480 | 0 | 0 | $1_{16}$ | $9_{16}$ | S100 | S200 [b] |
| 40 | 480 | 800 | 480 | 800 | 0 | 0 | $1_{16}$ | $9_{16}$ | S400 [b] | S400 |
| 41 | 240 | 320 | 240 | 320 | 0 | 0 | $1_{16}$ | $9_{16}$ | S100 | S100 |
| 42 | 240 | 320 | 240 | 320 | 0 | 0 | $1_{16}$ | $5_{16}$ | S100 | S200 [b] |
| 43 | 240 | 320 | 240 | 320 | 0 | 0 | $1_{16}$ | $8_{16}$ | S200 | S400 [b] |
| 44 | 480 | 640 | 480 | 640 | 0 | 0 | $1_{16}$ | $9_{16}$ | S200 | S400 [b] |
| 45 | 480 | 640 | 480 | 640 | 0 | 0 | $1_{16}$ | $5_{16}$ | S400 | S800 [b] |
| 46 | 480 | 640 | 480 | 640 | 0 | 0 | $1_{16}$ | $8_{16}$ | S800 | S800 |
| 47 | 600 | 800 | 600 | 800 | 0 | 0 | $1_{16}$ | $9_{16}$ | S400 | S400 |
| 48 | 600 | 800 | 600 | 800 | 0 | 0 | $1_{16}$ | $5_{16}$ | S800 [b] | S800 |
| 49 | 600 | 800 | 600 | 800 | 0 | 0 | $1_{16}$ | $8_{16}$ | S800 | S1600 |
| 50 | 768 | 1 024 | 768 | 1 024 | 0 | 0 | $1_{16}$ | $9_{16}$ | S400 | S800 |
| 51 | 768 | 1 024 | 768 | 1 024 | 0 | 0 | $1_{16}$ | $5_{16}$ | S800 | S1600 |
| 52 | 768 | 1 024 | 768 | 1 024 | 0 | 0 | $1_{16}$ | $8_{16}$ | S1600 | S3200 |
| 53 | 960 | 1 280 | 960 | 1 280 | 0 | 0 | $1_{16}$ | $9_{16}$ | S800 | S1600[2] |
| 54 | 960 | 1 280 | 960 | 1 280 | 0 | 0 | $1_{16}$ | $5_{16}$ | S1600 | S1600 |
| 55 | 960 | 1 280 | 960 | 1 280 | 0 | 0 | $1_{16}$ | $8_{16}$ | S3200 | S3200 |
| 56 | 1 024 | 1 280 | 1 024 | 1 280 | 0 | 0 | $1_{16}$ | $9_{16}$ | S800 | S1600 [b] |
| 57 | 1 024 | 1 280 | 1 024 | 1 280 | 0 | 0 | $1_{16}$ | $5_{16}$ | S1600 | S3200 [b] |
| 58 | 1 024 | 1 280 | 1 024 | 1 280 | 0 | 0 | $1_{16}$ | $8_{16}$ | S3200 | S3200 |
| 59 | 1 200 | 1 600 | 1 200 | 1 600 | 0 | 0 | $1_{16}$ | $9_{16}$ | S800 | S1600 |
| 60 | 1 200 | 1 600 | 1 200 | 1 600 | 0 | 0 | $1_{16}$ | $5_{16}$ | S1600 | S3200 |
| 61 | 1 200 | 1 600 | 1 200 | 1 600 | 0 | 0 | $1_{16}$ | $8_{16}$ | S3200 | > |
| 62 | 480 | 800 | 480 | 800 | 0 | 0 | $1_{16}$ | $5_{16}$ | S400 | S800 |
| 63 | 480 | 800 | 480 | 800 | 0 | 0 | $1_{16}$ | $8_{16}$ | S800 | S1600 |
| 255 | Other video mode | - | - | - | - | - | - | - | - | - |
| Others | Reserved for future specification | - | - | - | - | - | - | - | - | - |

a The values represent the encodings that should be used in the SIM source packet.

b These modes can be sent at the next lower bus speed if equation [B] is used to calculate bandwidth allocation units in 4.7.1.4.

c This video mode requires bus speeds greater than S3200 and so must be compressed if it is to be transported until such time as bus speeds increase beyond S3200.

d Horizontal blanking can be calculated as: (Horizontal size – Transported horizontal size).

**Table B.2 – Additional video mode parameters, 2 of 2**

| Video Mode | Lines per SYT interval, all color spaces | Duration of a source packet for color space 0<br>µs | Duration of an isochronous packet for color space 0<br>µs | Duration of a source packet for color space 1 and 2<br>µs | Duration of an isochronous packet for color space 1 and 2<br>µs | Bandwidth allocation units [a] at minimum allowed speed for color space 0 | Bandwidth allocation units [a] at minimum allowed speed for color space 1 and 2 |
|---|---|---|---|---|---|---|---|
| 0 | 4 | 16,69 | 133,52 | 11,13 | 133,56 | 2 908 | 2 098 |
| 1 | 4 | 16,67 | 133,36 | 11,12 | 133,44 | 2 908 | 2 098 |
| 2 | 2 | 31,72 | 126,88 | 21,15 | 126,9 | 3 640 | 2 544 |
| 3 | 2 | 31,69 | 126,76 | 21,13 | 126,78 | 3 640 | 2 544 |
| 4 | 4 | 15,99 | 127,92 | 10,66 | 127,92 | 3 268 | 2 358 |
| 5 | 4 | 15,97 | 127,76 | 10,65 | 127,8 | 3 268 | 2 358 |
| 6 | 2 | 31,78 | 127,12 | 21,19 | 127,14 | 3 640 | 2 544 |
| 7 | 2 | 31,75 | 127 | 21,17 | 127,02 | 3 640 | 2 544 |
| 8 | 6 | 5,57 | 128,11 | 5,57 | 128,11 | 3 869 | 2 895 |
| 9 | 6 | 5,56 | 127,88 | 5,56 | 127,88 | 3 869 | 2 895 |
| 10 | 4 | 7,95 | 127,2 | 5,3 | 127,2 | 3 082 | 2 265 |
| 11 | 4 | 7,94 | 127,04 | 5,3 | 127,2 | 3 082 | 2 265 |
| 12 | 9 | 3,71 | 126,14 | 2,48 | 126,48 | 0 | 0 |
| 13 | 9 | 3,71 | 126,14 | 2,47 | 125,97 | 0 | 0 |
| 14 | 5 | 7,42 | 126,14 | 4,95 | 128,7 | 2 172 | 3 256 |
| 15 | 5 | 7,41 | 125,97 | 4,94 | 128,44 | 2 172 | 3 256 |
| 16 | 2 | 31,85 | 127,4 | 21,24 | 127,44 | 3 640 | 2 544 |
| 17 | 4 | 16 | 128 | 10,67 | 128,04 | 3 268 | 2 358 |
| 18 | 2 | 32 | 128 | 21,34 | 128,04 | 3 640 | 2 544 |
| 19 | 5 | 6,67 | 126,73 | 6,67 | 126,73 | 3 225 | 2 413 |
| 20 | 4 | 8 | 128 | 5,34 | 128,16 | 3 082 | 2 265 |
| 21 | 2 | 21,19 | 127,14 | 15,89 | 127,12 | 2 264 | 3 268 |
| 22 | 2 | 21,34 | 128,04 | 16 | 128 | 2 264 | 3 268 |
| 23 | - | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | - | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 4 | 9,27 | 129,78 | 6,18 | 129,78 | 3 620 | 2 654 |
| 26 | 4 | 9,26 | 129,64 | 6,18 | 129,78 | 3 620 | 2 654 |
| 27 | 4 | 8,89 | 133,35 | 5,93 | 130,46 | 3 861 | 2 774 |
| 28 | 5 | 7,42 | 126,14 | 4,95 | 128,7 | 2 172 | 3 256 |
| 29 | 5 | 7,41 | 125,97 | 4,94 | 128,44 | 2 172 | 3 256 |
| 30 | 8 | 4,45 | 129,05 | 2,97 | 127,71 | 3 618 | 0 |
| 31 | 4 | 8,89 | 133,35 | 5,93 | 130,46 | 3 861 | 2 774 |
| 32 | 1 | 69,45 | 138,9 | 69,45 | 138,9 | 2 176 | 3 232 |
| 33 | 1 | 69,45 | 138,9 | 69,45 | 138,9 | 2 176 | 3 232 |
| 34 | 1 | 138,89 | 138,89 | 138,89 | 138,89 | 1 520 | 2 224 |
| 35 | 1 | 138,89 | 138,89 | 138,89 | 138,89 | 1 520 | 2 224 |

| Video Mode | Lines per SYT interval, all color spaces | Duration of a source packet for color space 0 µs | Duration of an isochronous packet for color space 0 µs | Duration of a source packet for color space 1 and 2 µs | Duration of an isochronous packet for color space 1 and 2 µs | Bandwidth allocation units [a] at minimum allowed speed for color space 0 | Bandwidth allocation units [a] at minimum allowed speed for color space 1 and 2 |
|---|---|---|---|---|---|---|---|
| 36 | 3 | 57,93 | 173,79 | 57,93 | 173,79 | 2 888 | 2 148 |
| 37 | 1 | 115,86 | 231,72 | 115,86 | 231,72 | 2 240 | 3 296 |
| 38 | 1 | 47,54 | 142,62 | 35,65 | 142,6 | 2 632 | 3 680 |
| 39 | 2 | 94,97 | 189,94 | 71,23 | 142,46 | 3 968 | 2 224 |
| 40 | 1 | 69,45 | 138,9 | 46,3 | 138,9 | 2 432 | 3 236 |
| 41 | 1 | 138,89 | 138,89 | 69,45 | 138,9 | 2 672 | 3 008 |
| 42 | 1 | 69,45 | 138,9 | 34,73 | 138,92 | 3 968 | 2 480 |
| 43 | 2 | 34,73 | 138,92 | 17,37 | 138,96 | 3 280 | 2 216 |
| 44 | 1 | 69,45 | 138,9 | 46,3 | 138,9 | 3 904 | 2 596 |
| 45 | 2 | 34,73 | 138,92 | 23,15 | 138,9 | 3 240 | 2 264 |
| 46 | 4 | 17,37 | 138,96 | 11,58 | 127,38 | 2 908 | 3 874 |
| 47 | 4 | 55,56 | 166,68 | 37,04 | 148,16 | 3 236 | 4 040 |
| 48 | 3 | 27,78 | 138,9 | 18,52 | 129,64 | 2 422 | 3 226 |
| 49 | 5 | 13,89 | 125,01 | 9,26 | 129,64 | 4 030 | 3 020 |
| 50 | 2 | 21,71 | 130,26 | 21,71 | 130,26 | 3 632 | 2 712 |
| 51 | 3 | 10,86 | 130,32 | 10,86 | 130,32 | 3 364 | 2 514 |
| 52 | 6 | 5,43 | 130,32 | 5,43 | 130,32 | 3 230 | 2 415 |
| 53 | 2 | 17,37 | 138,96 | 17,37 | 138,96 | 2 908 | 2 174 |
| 54 | 4 | 8,69 | 130,35 | 8,69 | 130,35 | 2 581 | 3 861 |
| 55 | 8 | 4,35 | 126,15 | 4,35 | 126,15 | 2 418 | 3 618 |
| 56 | 2 | 16,28 | 130,24 | 16,28 | 130,24 | 2 908 | 2 174 |
| 57 | 4 | 8,14 | 130,24 | 8,14 | 130,24 | 2 742 | 2 051 |
| 58 | 8 | 4,07 | 126,17 | 4,07 | 126,17 | 2 579 | 3 859 |
| 59 | 3 | 13,89 | 125,01 | 11,12 | 133,44 | 4 030 | 3 138 |
| 60 | 5 | 6,95 | 125,1 | 5,56 | 127,88 | 3 824 | 2 895 |
| 61 | 9 | 3,48 | 125,28 | 2,78 | 125,1 | 3 721 | 0 |
| 62 | 2 | 34,73 | 138,92 | 23,15 | 138,9 | 4 040 | 2 824 |
| 63 | 4 | 17,73 | 138,96 | 11,58 | 138,96 | 3 628 | 2 618 |
| 255 | - | - | - | - | - | - | - |
| others | - | - | - | - | - | - | - |

[a] The bandwidth allocation units have been calculated using the minimum bus speed and equation [A] given in 4.7.1.4. The maximum value of bandwidth allocation units available on an IEEE-1394 bus is 4915, [2]. Some modes are limited to a certain speed due to the packet size rather than the availability of bandwidth allocation units.

Color Space 3 is defined for use with compression mode 2 only. Refer to the documentation referenced in Table 2 for the applicable additional video parameters.

# Annex C
(informative)

## Using IEC 61883-1 plug control registers beyond S400

IEC 61883-1 [6] defines a mechanism for configuring isochronous streams up to S400. IEEE Std 1394.1-2004, Standard for high performance serial bus bridges [9]. Annex E defines a mechanism for extending this configuration for streams up to S3200.

# Annex D
(normative)

## Compliance annex

It is expected that a device that implements this standard will be an AV/C specification, [5] compliant device.

It is expected that the AV/C STREAM FORMAT command will be extended to allow the identification and selection of video, compression and color space modes. Implementation dependent means for the identification and selection of video, compression and color space modes is permitted.

A source device that supports this specification shall support at least one video mode. Video mode $FF_{16}$ is a valid mode in this context.

A source device that supports this specification shall support at least one compression mode. Compression modes $0_{16}$ and $FF_{16}$ are valid modes in this context.

A source device that supports this standard shall support at least one color space. Color space $FF_{16}$ is a valid color space in this context.

A sink device that that supports this standard and outputs the video stream, whether directly or indirectly, to a display shall support at least one video mode. Video mode $FF_{16}$ is a valid mode in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one compression mode. Compression modes $0_{16}$ and $FF_{16}$ are valid modes in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one color space. Color space $FF_{16}$ is a valid color space in this context.

A sink device that supports this standard but does not output the display, for example a device used for recording or stream monitoring purposes, need only recognize the format of the isochronous stream and its source packets and process them according to its implementation dependent requirements.

This standard defines many different video, compression and color space modes. Different deployment situations will require different levels of functionality, for example, it is likely that the automotive industry and the consumer electronic industry will require the support of different video modes. Therefore no particular video mode, compression mode or color space is mandated by this standard. It is left to implementers to choose the level of support they deem suitable for their application. Implementers are encouraged to produce implementation guidelines to provide consistency and interoperability in any given application space.

# Annex E
(informative)

## Typical SIM source packet

The SIM source packet shown below is a typical example.

If video mode is 0, compression mode is 0 and color space is zero then *source packet size* is 644 bytes (taken from Table 1). Therefore there would be (644 – (56+4)) reserved bytes at the end of the source packet, that is 584 reserved bytes.

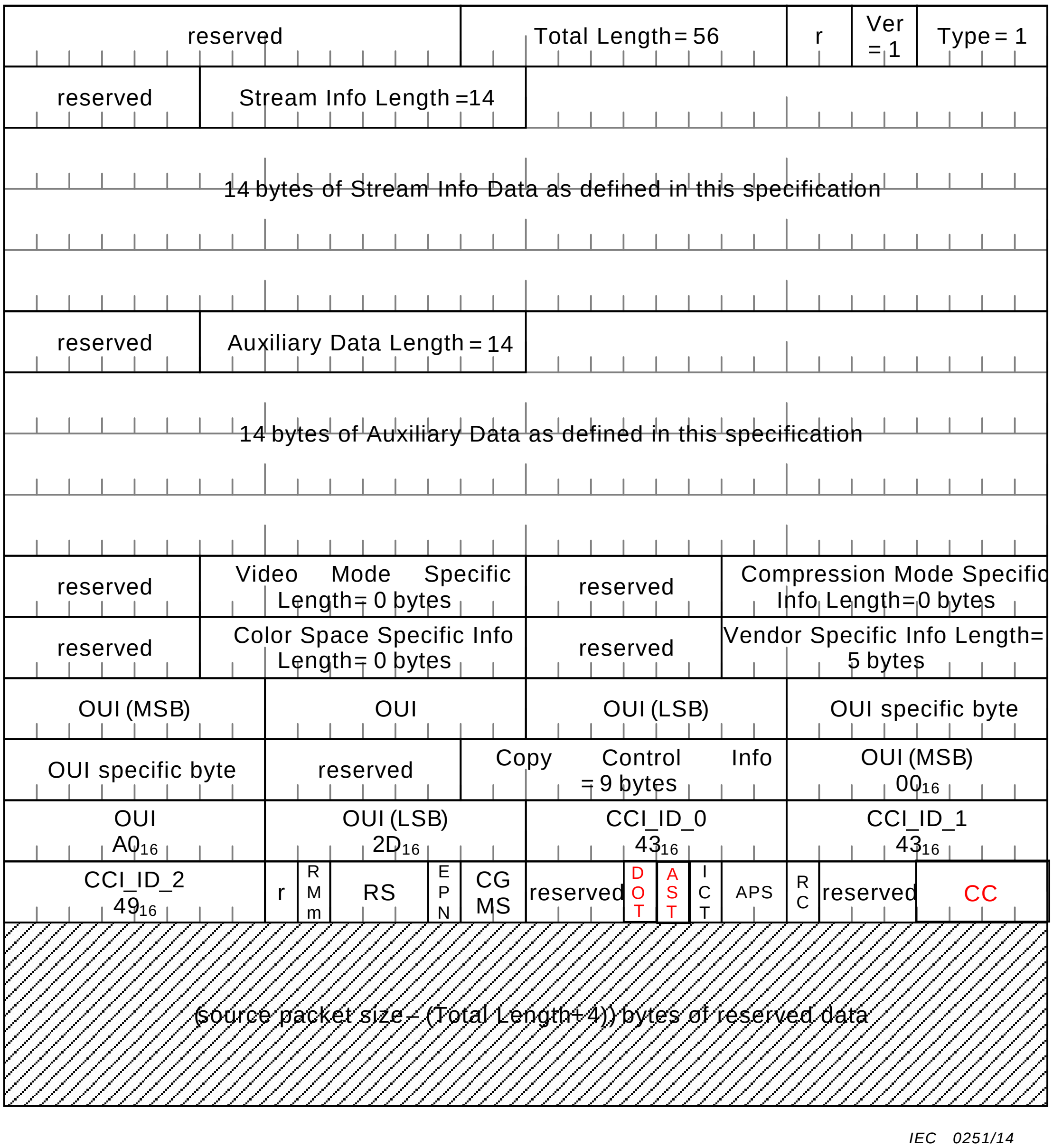



**Figure E.1 – Typical SIM source packet**

# Annex F
(informative)

## Derivation of TRANSFER_DELAY

The derivation of the TRANSFER_DELAY parameter is given below:

| | |
|---|---|
| 1394 worst case transmission delay | 358 μs |
| Allowance for encryption (after packetisation) | 125 μs |
| Allowance for decryption (before depacketisation) | 125 μs |
| Decision point to transmit the packet just missed | 125 μs |
| Slowest 601 packetisation (time to fill 1 source packet) | 140 μs |
| Allowance for 1 394 clock discrepancy at source and sink | 25 ns |
| **Total** | **873,025 μs** |

This is rounded up to 875 μs so that it is exactly 7 isochronous periods thus requiring only a simple addition to the cycle timer to generate the SYT value.

The allowance for encryption/decryption is to provide scope for implementation flexibility.

The 601 packetization delay is typically much lower than 140 μs but this is the worst case.

# Annex G
(normative)

## 1394 trade association CCI descriptor block

The structure of the 1394 TA CCI descriptor block is given in the Figure G.1. The definition of the setting of fields other than OUI and CCI_ID to particular values is beyond the scope of this standard.

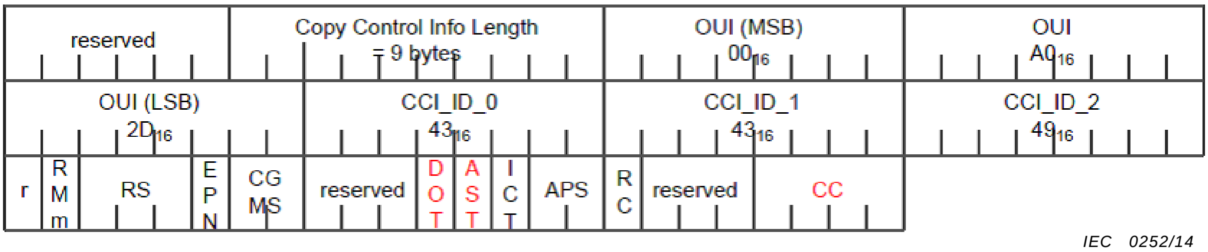



**Figure G.1 – CCI descriptor block**

OUI – This is the three byte 1394TA OUI, $00A02D_{16}$.

CCI_ID_x – This is the three byte 1394TA designated identifier for this CCI descriptor block, $434349_{16}$.

RMm – Retention move mode is used in combination with CGMS to define the move function or the retention function. The combination of values is described below:

| RMm | CGMS | Modes |
|---|---|---|
| $0_2$ | $10_2$ | Move mode |
| $0_2$ | $11_2$ | Retention mode |
| Other Combinations | | Neither move nor retention mode |

RS – Retention state is encoded as defined below:

| RS | Retention time |
|---|---|
| $000_2$ | Forever |
| $001_2$ | 1 week |
| $010_2$ | 2 days |
| $011_2$ | 1 day |
| $100_2$ | 12 h |
| $101_2$ | 6 h |
| $110_2$ | 3 h |
| $111_2$ | 90 min |

EPN – Encryption plus non-assertion is encoded as defined below:

| EPN | Meaning |
|---|---|
| $0_2$ | EPN asserted |
| $1_2$ | EPN not asserted |

CGMS – CGMS is encoded as defined below:

| CGMS | Meaning |
|---|---|
| $00_2$ | Copy free |
| $01_2$ | No more copies |
| $10_2$ | Copy one generation |
| $11_2$ | Copy never |

RC – Redistribution control is as defined below:

| RC | Meaning |
|---|---|
| $0_2$ | Technological control of consumer redistribution is not signaled |
| $1_2$ | Technological control of consumer redistribution is signaled |

ICT – Image constraint token is encoded as described below:

| ICT | Meaning |
|---|---|
| $0_2$ | High definition analog output in the form of constrained image |
| $1_2$ | High definition analog output in high definition analog form |

ACS – ACS is encoded as described below:

| ACS | Meaning |
|---|---|
| $00_2$ | Copy free |
| $01_2$ | APS is on : Type 1 (AGC) |
| $10_2$ | APS is on : Type 2 (AGC + 2L Colorstripe) |
| $11_2$ | APS is on : Type 3 (AGC + 4L Colorstripe) |

AST – Analog sunset token as described below:

| AST | Meaning |
|---|---|
| $0_2$ | AST asserted |
| $1_2$ | AST unasserted |

DOT – Digital only token as described below:

| DOT | Meaning |
|---|---|
| $0_2$ | DOT asserted |
| $1_2$ | DOT unasserted |

CC – Copy count as described below:

| CC | Meaning |
|---|---|
| $0000_2$ | Invalid |
| Others | *N* copies are allowed |

NOTE This annex may, at some point in the future, move to a separate 1394 Trade Association specification document.

# Bibliography

The following documents contain additional information related to this standard:

[1] IEEE Std 1212-2001, Standard for a Control and Status Registers (CSR) Architecture for microcomputer buses

[2] IEEE Std 1394-1995, Standard for a High Performance Serial Bus

[3] IEEE Std 1394a-2000, Standard for a High Performance Serial Bus—Amendment 1

[4] IEEE Std 1394b-2002, Standard for a High Performance Serial Bus—Amendment 2

[5] 1394 Trade Association 2004006, AV/C Digital Interface Command Set General Specification Version 4.2

[6] IEC 61883 (all parts), *Consumer audio/video equipment – Digital interface*

[7] ITU-R BT.601-5 1995, *Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios*

[8] ITU-R BT.656-4 1998, *Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601*

[9] IEEE Std 1394.1-2004, *Standard for High Performance Serial Bus Bridges*

[10] *Oxford Semiconductor Light Codec Specification, Version 1.0*

[11] *Fujitsu SmartCODEC Specification, Version 1.0*

[12] 1394 Trade Association, TA Document 2003017, *IIDC 1394-based Digital Camera Specification, Ver. 1.31*

# IEC 61883-8

Edition 1.1 2014-02

# FINAL VERSION

## Consumer audio/video equipment – Digital interface –
## Part 8: Transmission of ITU-R BT.601 style digital video data

IEC 61883-8:2008-11+AMD1:2014-02 CSV(EN)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

## Part 8: Transmission of ITU-R BT.601 style digital video data

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**This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.**

**This publication has been prepared for user convenience.**

International Standard IEC 61883-8 has been prepared by technical area 4: Digital system interfaces and protocols, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61883 series, under the general title *Consumer audio/video equipment – Digital interface,* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

# INTRODUCTION TO AMENDMENT 1

The revision of IEC 61883-8:2008, has become necessary to define the following new additional copy control information.

- Analog sunset token
- Digital only token
- Copy count

# CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

## Part 8: Transmission of ITU-R BT.601 style digital video data

## 1 Scope

This part of IEC 61883 specifies a protocol for the transport of uncompressed or compressed video data in the 4:2:2 format of recommendation ITU-R BT.601 (including compatible extensions to this format for the higher and lower resolutions of other commonly used video resolutions) over high performance serial bus, as specified by IEEE Std 1394-1995 as amended by IEEE Std 1394a-2000 and IEEE Std 1394b-2002 (collectively IEEE 1394). The data formats for the encapsulation of video data are compatible with those specified by IEC 61883-1. Associated audio data, if any, should be formatted as specified by IEC 61883-6.

There are many commonly used video formats unsupported by IEC 61883, such as MPEG-4, Windows Media Format (WMF) and the format used by automotive navigation applications. Support for all or most of these formats in rendering devices would require implementation of multiple video codecs. This is an undue burden that may be avoided if the source device converts to ITU-R BT.601 4:2:2 format and, if necessary, compresses the data with a codec supported by all destination devices. An additional advantage is that on-screen display (OSD) information may be mixed with video data prior to transmission to the rendering device.

Because ITU-R BT.601 4:2:2 format is widely used internally in contemporary AV equipment, this specification permits straight-forward integration of IEEE 1394 into these devices and enables markets whose usage scenarios include single video sources transmitting to one or more video displays, such as:

– consumer electronic STB or DVD video rendered by multiple displays in the home;
– automotive navigation and entertainment; and
– aeronautical in-flight entertainment.

For the sake of interoperability and bounded implementation complexity, it is essential that the specification provide the following:

– a 1394 TA controlled list of compression codecs; and
– at a minimum, a reference to one video compression codec.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61883 (all parts), *Consumer audio/video equipment – Digital interface*

IEC 61883-1, *Consumer audio/video equipment – Digital interface – Part 1: General*

ISO/IEC 11172-2:1993, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s – Part 2: Video*

IEEE Std 1394-1995, *Standard for a high performance serial bus*

IEEE Std 1394a-2000, *Standard for a high performance serial bus*
Amendment 1

IEEE Std 1394b-2002, *Standard for a high performance serial bus*
Amendment 2

Throughout this document, the term IEEE 1394 refers to IEEE Std 1394-1995 as amended by IEEE Std 1394a-2000 and IEEE Std 1394b-2002.

1394 Trade Association 2004006, AV/C Digital Interface Command Set General Specification Version 4.2

1394 Trade Association 2003017, IIDC 1394-based Digital Camera SpecificationVer.1.31

EIA/CEA-861-B 2002, *A DTV Profile for Uncompressed High Speed Digital Interfaces*

IEEE Std 1394.1-2004, Standard for High Performance Serial Bus Bridges

ITU-R BT.601-5 1995, *Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios*

ITU-R BT.656-4 1998, *Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601*

ITU-R BT.709-4 2000, *Parameter values for the HDTV standards for production and international programme exchange*

ITU-R BT.1358 1998, *Studio parameters of 625 and 525 line progressive scan television systems*

ITU-T H.263 1998, *Video coding for low bit rate communication*

SMPTE 267M-1995, *Television – Bit-Parallel Digital Interface – Component Video Signal 4:2:2 16x9 Aspect Ratio*

SMPTE 274M-1998, *Television – 1920 × 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates*

SMPTE 293M-1996, *Television – 720 × 483 Active Line at 59.94-Hz Progressive Scan Production – Digital Representation*

SMPTE 296M-2001, *Television – 1280 × 720 Progressive Image Sample Structure – Analog and Digital Representation and Analog Interface*

*VESA Monitor Timing Specifications*, VESA and Industry Standards and Guidelines for Computer Display Monitor Timing, Version 1.0, Revision 0.8

# 3 Abbreviations and conventions

## 3.1 Abbreviations

For the purposes of this document, the abbreviations given in IEC 61883-1, as well as the following, apply.

AV/C Audio Video Control

BCD Binary Coded Decimal

BT.601 ITU-R BT.601-5 1995

CIP Common Isochronous Packet

CSR Control and status register

DAC Digital Analog Converter

DCT Discrete Cosine Transform

DV Digital Video

ND No Data

OSD Onscreen Display

OUI Organizationally Unique Identifier

r Reserved

MPEG Moving Picture Experts Group

SIM Stream Information & Metadata

VDSP Video Data Source Packet

WMF Windows Media Format

## 3.2 Notation

### 3.2.1 Numeric values

Decimal and hexadecimal are used within this standard. By editorial convention, decimal numbers are most frequently used to represent quantities or counts. Addresses are uniformly represented by hexadecimal numbers. Hexadecimal numbers are also used when the value represented has an underlying structure that is more apparent in a hexadecimal format than in a decimal format.

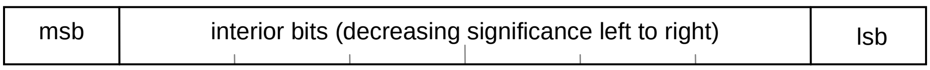
Decimal numbers are represented by Arabic numerals without subscripts or by their English names. Hexadecimal numbers are represented by digits from the character set 0 – 9 and A - F followed by the subscript 16. When the subscript is unnecessary to disambiguate the base of the number it may be omitted. For the sake of legibility hexadecimal numbers are separated into groups of four digits separated by spaces.

As an example, 42 and $2A_{16}$ both represent the same numeric value.

### 3.2.2 Bit, byte and quadlet ordering

This specification uses the facilities of Serial Bus, IEEE 1394, and therefore uses the ordering conventions of Serial Bus in the representation of data structures. In order to promote interoperability with memory buses that may have different ordering conventions, this specification defines the order and significance of bits within bytes, bytes within quadlets and quadlets within octlets in terms of their relative position and not their physically addressed position.

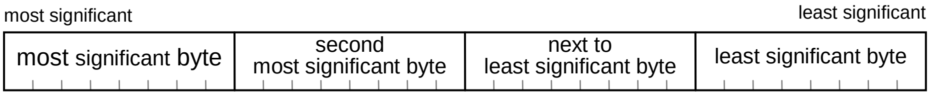
Within a byte, the most significant bit, msb, is that which is transmitted first and the least significant bit, lsb, is that which is transmitted last on serial bus, as illustrated below. The significance of the interior bits uniformly decreases in progression from msb to lsb.




IEC 2117/08

**Figure 1 – Bit ordering within a byte**

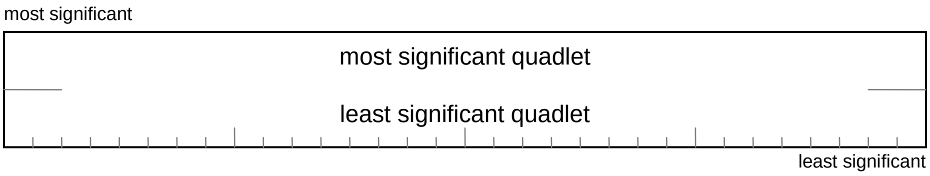
Within a quadlet, the most significant byte is that which is transmitted first and the least significant byte is that which is transmitted last on serial bus, as shown below.




IEC 2118/08

**Figure 2 – Byte ordering within a quadlet**

Within an octlet, which is frequently used to contain 64-bit serial bus addresses, the most significant quadlet is that which is transmitted first and the least significant quadlet is that which is transmitted last on serial bus, as the figure below indicates.




IEC 2119/08

**Figure 3 – Quadlet ordering within an octlet**

When block transfers take place that are not quadlet aligned or not an integral number of quadlets, no assumptions can be made about the ordering (significance within a quadlet) of bytes at the unaligned beginning or fractional quadlet end of such a block transfer, unless an application has knowledge (outside of the scope of this specification) of the ordering conventions of the other bus.

# 4 Reference model for data transmission

## 4.1 Model overview

The presently defined compression standards for IEEE 1394 transport, DV and MPEG2, have difficulties at the system level in a practical consumer AV network. Both offer excessive compression for simple transport over a wide bandwidth network and carry the associated complexity of coding and decoding signals. Each are fine for their intended purpose, but have excessive cost for simple video transport. Conventional video equipment is interfaced with analog cables carrying a number of signal formats, and it is this low cost and universal connection capability which digital interfaces need to emulate. Thus the analog output from any DVD player will connect to any TV, and this is seen as adequate by equipment manufacturers. Digital interfaces would allow many additional features, but providing every input with the capability of decoding both DV and MPEG2 in all available standards and resolutions is unnecessarily expensive. Inside equipment variations on the broadcast equipment ITU-R BT.601-5/BT.656-4 interface are common and provide a universal interface standard for digital video transport. The coding system in ITU-R BT.601-5 sends YUV data across an 8 bit interface between integrated circuits, for example an MPEG decoder and DAC. If the decoder and DAC are separated by 1394 in their separate boxes there will be a reduction in cost at the source device and the sink device will be independent from the video encoding mechanism.

This standard describes the method of passing YUV video signals across IEEE 1394 based upon the formats defined by ITU-R BT.601-5. Familiarity with the specifications ITU-R BT.601-5, ITU-R BT.656-4 and IEC 61883 is necessary to follow the technical details.

There is also the capability to transfer data in YUV 4:4:4 and 24 bit RGB formats. This allows video to be transferred without the need for color space sub-sampling.

It is valid to transmit all video modes as uncompressed data as long as the IEEE 1394 bus bandwidth is available. In practice some video modes will not be transportable in an uncompressed state.

This model also allows for the future development of video codecs. Since the transport of the video data is independent of the original source encoding as new codecs are deployed, such as MPEG-4, the transport mechanism described in this document will not need to change.

## 4.2 Compression

To allow the transport of high definition video signals at bus speeds less than S1600 or to allow the transport of multiple video streams it is essential that the video stream is compressed. This compression need not be more than about 10:1 and should have minimal discernable impact on the displayed image. Since compression is required to transport some of the video modes it is necessary to reference at least one compression codec in this specification. A suitable video compression codec is referenced for this purpose in Table 2. There is no requirement that a source or sink device implement this codec. Other suitable video compression codecs may be added in the future.

## 4.3 Isochronous packet header

The header quadlet of an IEEE 1394 isochrononous packet (tcode $A_{16}$) is shown in the Figure 4 below.

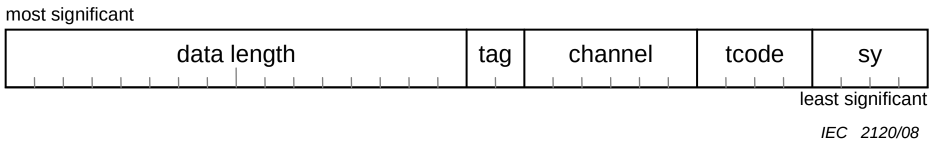



**Figure 4 – Isochronous packet header**

The tag field shall be set to $1_{16}$ indicating that the packet has the Common Isochronous Packet (CIP) Header as defined in IEC 61883-1. The contents of the CIP Header are described in 4.4.

The definition of the remaining fields is outside of the scope of this specification.

## 4.4 CIP header

The definition of the CIP header is shown in Figure 5 below.

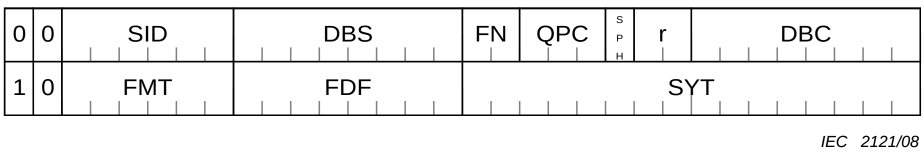


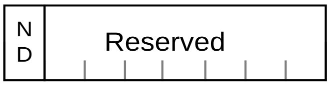

**Figure 5 – CIP header**

- SID denotes the source node ID. This is bus configuration dependent.
- DBS value depends upon the video mode being transported and the color space used. This value is dependent upon the compression mode, color space and video mode. The DBS value for compression mode $0_{16}$ can be calculated from the source packet size given in Table 1 by dividing the value by 4. For other compression modes refer to the documention available from the codec vendor.
- FN shall always have a value of $0_{16}$. There shall only be 1 data block per source packet.
- QPC shall always have a value of $0_{16}$. There shall be no padding.
- SPH shall be $0_{16}$. The source packet header is not present.
- Since FN is $0_{16}$ the value of DBC shall always increment by the number of source packets present in the Isochronous packet. This field indicates the count value of the first data block in the current isochronous packet.

– The value of FMT shall be $000001_2$. This value indicates that the source packet format is as defined in this specification. This also indicates that the SYT field is present in the CIP header.

– The FDF field is encoded as shown in Figure 6 below.

– The SYT field is encoded as defined in IEC 61883-1.




IEC 2122/08

**Figure 6 – FDF field**

The ND field is used to signify whether the data payload of the isochronous packet after the CIP header is valid. If ND is set to $1_2$ it indicates that the data is not valid and shall be ignored, this setting is only used in blocking transmission mode (see 4.7.1.3). The *DBC* field in the CIP header of a packet which has *ND* set to $1_2$ shall be the count value of the next valid data block. The transmission of an isochronous packet with this bit set shall not cause the value of DBC to increment. If ND is set to $0_2$ it indicates that the data payload of the isochronous packet after the CIP header is valid. In non-blocking transmission mode, see 4.7.1.2, ND shall be set to $0_2$ for all isochronous packets.

### 4.5 Stream definition

A stream that conforms to this specification is governed by three key parameters:

– video mode, see Table 1 below. Additional information for each video mode is given in Annex B.

– compression mode, see Table 2 below.

– color space, see Table 3 below.

Each of these parameters includes an unconstrained mode that allows modes not explicitly defined to be transmitted. The use of these unconstrained modes is beyond the scope of this standard. However, it is expected that their use will be determined by negotiation before transmission.

For transmission of compression mode $0_{16}$ data the packetization and timing characteristics are defined in this specification.

For transmission of compression mode $1_{16}$ and $2_{16}$ data the packetization and timing characteristics are defined in the applicable specification document referenced in Table 2.

**Table 1 – Video mode**

| Video mode | Active vertical lines | Active horizontal pixels | Interlace or progres-sive | Vertical fre-quency Hz | Source packet size for color space 0 [a, b, e] bytes | Source packet size for color spaces 1 and 2 [a, b, e] bytes | SYT interval for color space 0 [a, b] | SYT interval for color spaces 1 and 2 [a, b] | MAX VDSP for color space 0 [a, b] | MAX VDSP for color spaces 1 and 2 [a, b] | Specification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 480 | 640 | progr. | 59,94 | 644 | 644 | 8 | 12 | 8 | 12 | VESA |
| 1 | 480 | 640 | progr. | 60 | 644 | 644 | 8 | 12 | 8 | 12 | VESA |
| 2 | 240 | 720 | progr. | 59,94 | 724 | 724 | 4 | 6 | 4 | 6 | EIA/CEA-861-B |
| 3 | 240 | 720 | progr. | 60 | 724 | 724 | 4 | 6 | 4 | 6 | EIA/CEA-861-B |
| 4 | 480 | 720 | progr. | 59,94 | 724 | 724 | 8 | 12 | 8 | 12 | ITU-R BT.1358<br>SMPTE 293M |
| 5 | 480 | 720 | progr. | 60 | 724 | 724 | 8 | 12 | 8 | 12 | ITU-R BT.1358<br>SMPTE 293M |
| 6 | 480 | 720 | int. | 59,94 | 724 | 724 | 4 | 6 | 4 | 6 | ITU-R BT.601<br>SMPTE 267M |
| 7 | 480 | 720 | int. | 60 | 724 | 724 | 4 | 6 | 4 | 6 | ITU-R BT.601<br>SMPTE 267M |
| 8 | 720 | 1 280 | progr. | 59,94 | 644 | 964 | 24 | 24 | 23 | 23 | SMPTE 296M |
| 9 | 720 | 1 280 | progr. | 60 | 644 | 964 | 24 | 24 | 23 | 23 | SMPTE 296M |
| 10 | 480 | 1 440 | progr. | 59,94 | 724 | 724 | 16 | 24 | 16 | 24 | EIA/CEA-861-B |
| 11 | 480 | 1 440 | progr. | 60 | 724 | 724 | 16 | 24 | 16 | 24 | EIA/CEA-861-B |
| 12 | 1 080 | 1 920 | progr. | 59,94 | 964 | 964 | 36 | 54 | 34 | 51 | ITU-R BT.709<br>SMPTE 274M |
| 13 | 1 080 | 1 920 | progr. | 60 | 964 | 964 | 36 | 54 | 34 | 51 | ITU-R BT.709<br>SMPTE 274M |
| 14 | 1 080 | 1 920 | int. | 59,94 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709<br>SMPTE 274M |
| 15 | 1 080 | 1 920 | int. | 60 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709<br>SMPTE 274M |
| 16 | 288 | 720 | progr. | 50 | 724 | 724 | 4 | 6 | 4 | 6 | EIA/CEA-861-B |
| 17 | 576 | 720 | progr. | 50 | 724 | 724 | 8 | 12 | 8 | 12 | ITU-R BT.1358 |
| 18 | 576 | 720 | int. | 50 | 724 | 724 | 4 | 6 | 4 | 6 | ITU-R BT.601 |
| 19 | 720 | 1 280 | progr. | 50 | 644 | 964 | 20 | 20 | 19 | 19 | SMPTE 296M |
| 20 | 576 | 1 440 | progr. | 50 | 724 | 724 | 16 | 24 | 16 | 24 | EIA/CEA-861-B |
| 21 | 480 | 960 | int. | 59,94 | 644 | 724 | 6 | 8 | 6 | 8 | ITU-R BT.601<br>SMPTE 267M |
| 22 | 576 | 960 | int. | 50 | 644 | 724 | 6 | 8 | 6 | 8 | ITU-R BT.601 |

| Video mode | Active vertical lines | Active horizontal pixels | Interlace or progres-sive | Vertical fre-quency Hz | Source packet size for color space 0 [a, b, e] bytes | Source packet size for color spaces 1 and 2 [a, b, e] bytes | SYT interval for color space 0 [a, b] | SYT interval for color spaces 1 and 2 [a, b] | MAX VDSP for color space 0 [a, b] | MAX VDSP for color spaces 1 and 2 [a, b] | Specification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | - | Reserved | - | - | - | - | - | - | - | - | - |
| 24 | - | Reserved | - | - | - | - | - | - | - | - | - |
| 25 | 1 080 | 1 920 | progr. | 23,976 | 964 | 964 | 16 | 24 | 14 | 21 | ITU-R BT.709 SMPTE 274M |
| 26 | 1 080 | 1 920 | progr. | 24 | 964 | 964 | 16 | 24 | 14 | 21 | ITU-R BT.709 SMPTE 274M |
| 27 | 1 080 | 1 920 | progr. | 25 | 964 | 964 | 16 | 24 | 15 | 22 | ITU-R BT.709 SMPTE 274M |
| 28 | 1 080 | 1 920 | progr. | 29,97 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709 SMPTE 274M |
| 29 | 1 080 | 1 920 | progr. | 30 | 964 | 964 | 20 | 30 | 17 | 26 | ITU-R BT.709 SMPTE 274M |
| 30 | 1 080 | 1 920 | progr. | 50 | 964 | 964 | 32 | 48 | 29 | 43 | ITU-R BT.709 SMPTE 274M |
| 31 | 1 080 | 1 920 | int. | 50 | 964 | 964 | 16 | 24 | 15 | 22 | ITU-R BT.709 SMPTE 274M |
| 32 | 288 | 352 | progr. | 25 | 356 | 532 | 2 | 2 | 2 | 2 | ITU-T H.263 (CIF) |
| 33 | 240 | 352 | progr. | 30 | 356 | 532 | 2 | 2 | 2 | 2 | ISO-IEC 11172-2 (SIF) |
| 34 | 144 | 176 | progr. | 25 | 180 | 268 | 2 | 2 | 1 | 1 | H.263 (QCIF) |
| 35 | 120 | 176 | progr. | 30 | 180 | 268 | 2 | 2 | 1 | 1 | ISO-IEC 11172-2 (QSIF) |
| 3 6 | 288 | 352 | progr. | 29,97 | 356 | 532 | 6 | 6 | 3 | 3 | H.263 (CIF) |
| 37 | 144 | 176 | progr. | 29,97 | 180 | 268 | 2 | 2 | 2 | 2 | ITU-T H.263 (QCIF) |
| 38 | 234 | 480 | progr. | 29,97 | 324 | 364 | 3 | 4 | 3 | 4 | Automotive [c] |
| 39 | 234 | 480 | progr. | 15 | 324 | 364 | 3 | 4 | 2 | 2 | Automotive [c] |
| 40 | 480 | 800 | progr. | 15 | 804 | 804 | 2 | 3 | 2 | 3 | Automotive [c] |
| 41 | 240 | 320 | progr. | 15 | 324 | 244 | 2 | 4 | 1 | 2 | IIDC v.1.31 [f] |
| 42 | 240 | 320 | progr. | 30 | 324 | 244 | 2 | 4 | 2 | 4 | IIDC v.1.31 |
| 43 | 240 | 320 | progr. | 60 | 324 | 244 | 4 | 8 | 4 | 8 | IIDC v.1.31 |
| 44 | 480 | 640 | progr. | 15 | 644 | 644 | 2 | 3 | 2 | 3 | IIDC v.1.31 |
| 45 | 480 | 640 | progr. | 30 | 644 | 644 | 4 | 6 | 4 | 6 | IIDC v.1.31 |
| 46 | 480 | 640 | progr. | 60 | 644 | 644 | 8 | 12 | 8 | 11 | IIDC v.1.31 |
| 47 | 600 | 800 | progr. | 15 | 804 | 804 | 4 | 6 | 3 | 4 | IIDC v.1.31 |

| Video mode | Active vertical lines | Active horizontal pixels | Interlace or progres-sive | Vertical fre-quency<br>Hz | Source packet size for color space 0 [a, b, e]<br>bytes | Source packet size for color spaces 1 and 2 [a, b, e]<br>bytes | SYT interval for color space 0 [a, b] | SYT interval for color spaces 1 and 2 [a, b] | MAX VDSP for color space 0 [a, b] | MAX VDSP for color spaces 1 and 2 [a, b] | Specification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | 600 | 800 | progr. | 30 | 804 | 804 | 6 | 9 | 5 | 7 | IIDC v.1.31 |
| 49 | 600 | 800 | progr. | 60 | 804 | 804 | 10 | 15 | 9 | 14 | IIDC v.1.31 |
| 50 | 768 | 1 024 | progr. | 15 | 516 | 772 | 8 | 8 | 6 | 6 | IIDC v.1.31 |
| 51 | 768 | 1 024 | progr. | 30 | 516 | 772 | 12 | 12 | 12 | 12 | IIDC v.1.31 |
| 52 | 768 | 1 024 | progr. | 60 | 516 | 772 | 24 | 24 | 24 | 24 | IIDC v.1.31 |
| 53 | 960 | 1 280 | progr. | 15 | 644 | 964 | 8 | 8 | 8 | 8 | IIDC v.1.31 |
| 54 | 960 | 1 280 | progr. | 30 | 644 | 964 | 16 | 16 | 15 | 15 | IIDC v.1.31 |
| 55 | 960 | 1 280 | progr. | 60 | 644 | 964 | 32 | 32 | 29 | 29 | IIDC v.1.31 |
| 56 | 1 024 | 1 280 | progr. | 15 | 644 | 964 | 8 | 8 | 8 | 8 | like IIDC v1.31 [d] |
| 57 | 1 024 | 1 280 | progr. | 30 | 644 | 964 | 16 | 16 | 16 | 16 | like IIDC v1.31 [d] |
| 58 | 1 024 | 1 280 | progr. | 60 | 644 | 964 | 32 | 32 | 31 | 31 | like IIDC v1.31 [d] |
| 59 | 1 200 | 1 600 | progr. | 15 | 804 | 964 | 12 | 15 | 9 | 12 | IIDC v.1.31 |
| 60 | 1 200 | 1 600 | progr. | 30 | 804 | 964 | 20 | 25 | 18 | 23 | IIDC v.1.31 |
| 61 | 1 200 | 1 600 | progr. | 60 | 804 | 964 | 36 | 45 | 36 | 45 | IIDC v.1.31 |
| 62 | 480 | 800 | progr. | 30 | 804 | 804 | 4 | 6 | 4 | 6 | Wide VGA |
| 63 | 480 | 800 | progr. | 60 | 804 | 804 | 8 | 12 | 8 | 12 | Wide VGA |
| 255 | - | Other video mode | - | - | - | - | - | - | - | - | - |
| Others | - | Reserved for future specification | - | - | - | - | - | - | - | - | - |

[a] These columns are applicable when the compression mode is 0, i.e. uncompressed video data only.

[b] This value includes the quadlet that contains the Type Specific Information field.

[c] These modes were requested by members of the IDB-Forum.

[d] These video modes are not in IIDC specification but are comparable to the modes that are.

[e] DBS can be calculated as: (Source packet size / 4).

[f] See Bibliography [12].

progr. progressive
int. interlace

The use of video mode $FF_{16}$ is beyond the scope of this specification. However, it is expected that the use of this video mode will be determined by negotiation before transmission.

The compression mode field is encoded as defined in Table 2 below. The use of compression mode $FF_{16}$ is beyond the scope of this standard. However, it is expected that the use of this compression mode will be determined by negotiation before transmission.

**Table 2 – Compression mode**

| Compression mode value | Compression mode description | Specification document reference |
|---|---|---|
| $0_{16}$ | Uncompressed video data | None applicable |
| $1_{16}$ | Compressed video using light codec | Oxford Semiconductor Light Codec Specification, Version 1.0, [10][1] |
| $2_{16}$ | Compressed Video using SmartCODEC | Fujitsu SmartCODEC Specification, Version1.0, [11] |
| $FF_{16}$ | Compressed Video using other video codec | None applicable |
| Others | Reserved for future specification | None applicable |

The color space field is encoded as defined in Table 3 below. The use of color space $FF_{16}$ is beyond the scope of this standard. However, it is expected that the use of this color space will be determined by negotiation before transmission.

**Table 3 – Color space**

| Color space format | Color space description |
|---|---|
| $0_{16}$ | YUV 4:2:2 (16 bits/pixel, 8 bits/sample) |
| $1_{16}$ | YUV 4:4:4 (24 bits/pixel, 8 bits/sample) |
| $2_{16}$ | RGB (24 bits/pixel, 8 bits/sample) |
| $3_{16}$ | RGB (18 bits/pixel, 6 bits/sample) |
| $FF_{16}$ | Other color space |
| Others | Reserved for future specification |

## 4.6 Packetization

### 4.6.1 Source packet format

For a stream that conforms to this specification each IEEE-1394 isochronous packet consists of the CIP header followed by zero or more source packets. The general format of the source packet for all compression modes and all source packet types is shown in Figure 7 below. It contains a single quadlet of type specific information followed by data. The size of each source packet is compression mode, video mode and color space mode dependent. The permitted video, compression and color space modes are detailed in Table 1, Table 2 and Table 3, respectively. Table 1 indicates the source packet size for each video mode and color space mode for compression mode 0. This size is the total number of bytes per source packet, i.e. type specific information and source packet data. All the source packets of a given stream are this size.

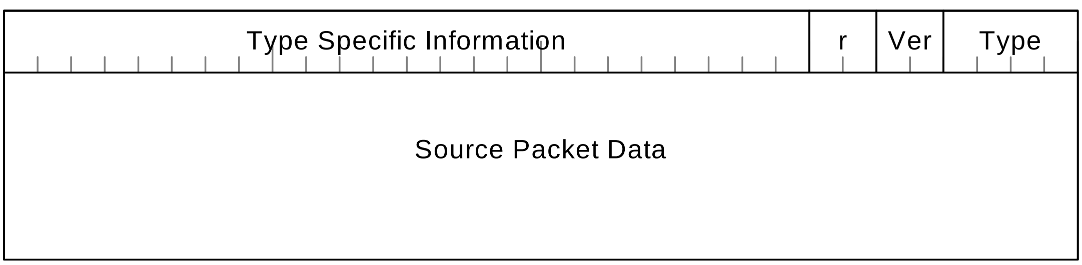



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**Figure 7 – General format of a source packet**

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1 The figures in square brackets refer to the Bibliography.

The *type* field indicates the type of data contained within the source packet. It is encoded as defined in Table 4 below.

The *ver* field indicates the version of the source packet. Its value is defined in the type specific sections below.

The *type specific information* field contents depends on the *type* field. Its encoding is defined in the type specific sections 4.6.2, 4.6.3 and 4.6.4 below.

The *source packet data* field contents depends on the *type* field. Its encoding is defined in the type specific sections 4.6.2, 4.6.3 and 4.6.4 below.

**Table 4 – Source packet type encoding**

| Type | Description of type |
|---|---|
| $0_{16}$ | Source packet contains video data as described in 4.6.2 below |
| $1_{16}$ | Source packet contains stream information and metadata as described in 4.6.3 below. |
| $2_{16}$ | Reserved for the future specification of the transport of audio data. Further information regarding this type is given in 4.6.4 below. |
| others | Reserved for future use. |

### 4.6.2 Type $0_{16}$ source packet – Video data source packet

#### 4.6.2.1 Video data source packet

Figure 8 shows the definition and arrangement of the fields in the video data source packet.

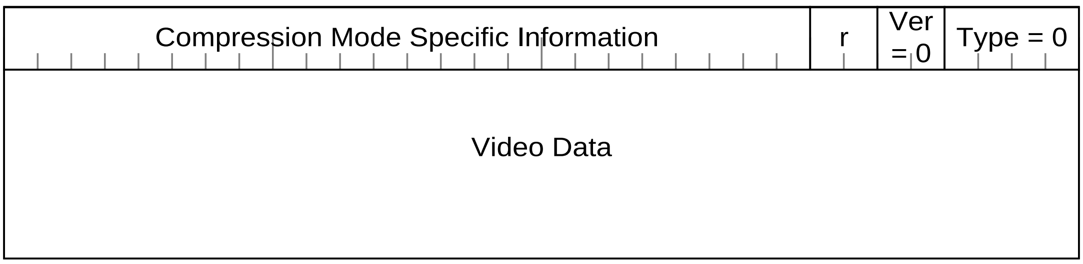


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**Figure 8 – Video data source packet**

The *type* field shall be set to $0_{16}$ to indicate that this is a video data source packet

The *ver* field shall be set to $0_{16}$ to indicate that this is version 0 of the video data source packet.

The *compression mode specific information* field has a different definition for each of the compression modes. Refer to Table 2 for a list of defined compression modes. The *compression mode specific information* for compression modes $0_{16}$, $1_{16}$, $2_{16}$ and $FF_{16}$ are detailed in sections 4.6.2.2, 4.6.2.3, 4.6.2.3 and 4.6.2.5 respectively.

The *video data* field definition is determined by a combination of video mode, compression mode and color space. The reference to the applicable definition of the formatting of the *video data* field is given in Table 5 below.

**Table 5 – References for video data definition**

| Compression mode | Color space | Video mode | Reference to video data definition |
|---|---|---|---|
| $0_{16}$ | $0_{16}$ | All defined except $FF_{16}$ | See 4.6.2.6 and 4.6.2.10 |
| $0_{16}$ | $1_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.10 |
| $0_{16}$ | $2_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.11 |
| $0_{16}$ | $3_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.13 |
| $0_{16}$ | $FF_{16}$ | All defined except $FF_{16}$ | see 4.6.2.6 and 4.6.2.13 |
| $0_{16}$ | All defined | $FF_{16}$ | see 4.6.2.6 and 4.6.2.15 |
| $1_{16}$ | All defined | All defined | see 4.6.2.7 |
| $2_{16}$ | All defined | All defined | see 4.6.2.8 |
| $FF_{16}$ | All defined | All defined | see 4.6.2.9 |

### 4.6.2.2 Compression mode $0_{16}$ type specific information

Figure 9 shows the definition and arrangement of the fields within the *type specific information* field for video data source packets being transmitted in compression mode $0_{16}$.

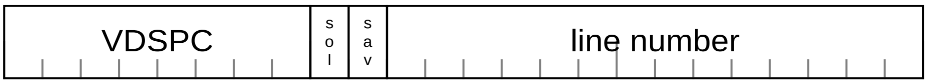


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**Figure 9 – Compression mode $0_{16}$ specific information**

The *VDSPC* (Video Data Source Packet Count) field contains a running count of video data source packets. It is incremented by 1 for every video data source packet created by the transmitter. When a stream commences the first video data source packet created has a VDSPC of 0. Since VDSPC is only 8 bits wide the value placed in VDSPC is the lowest 8 bits of the running count.

The *sol* (start of line) field is set in the source packet that contains the first pixel of a video line. There is no requirement that the start of a video line be coincident with the start of an IEEE-1394 isochronous packet.

The *sav* (start of active video) field is set in the source packet that contains the first pixel of the first active video line of each frame (progressive modes) or of each field (interlace modes). This field can only be set in a source packet that has *sol* set. There is no requirement that the start of an active video line be coincident with the start of an IEEE-1394 isochronous packet.

The *line number* field is the line on which the video data in the source packet resides as defined by the video specification given in Table 1 of the given video mode. If no line numbering is defined by the video specification the *line number* field shall be a sequential count of the lines in a frame starting with the first line that is transmitted having a *line number.*

### 4.6.2.3 Compression mode $1_{16}$ type specific information

The *type specific information* field definition for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.4 Compression mode $2_{16}$ type specific information

The *type specific information* field definition for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.5 Compression mode $FF_{16}$ type specific information

The *type specific information* field definition for compression mode $FF_{16}$ is beyond the scope of this standard.

#### 4.6.2.6 Compression mode $0_{16}$ video data packetization

For transmission of compression mode $0_{16}$ data the video data that is transmitted is the active horizontal pixels for both the active lines and the lines of the vertical blanking period (unless they do not exist). The first pixel of a video line shall always be the first pixel in a source packet and each video line shall always fill an integer number of source packets. The number of pixels in each source packet is dependent upon the video mode and color space and is detailed in Table 1. An IEEE-1394 isochronous channel that is used to transmit data according to this specification shall only transmit a single stream of video per 1394 isochronous channel.

#### 4.6.2.7 Compression mode $1_{16}$ video data packetization

The video data packetization for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.8 Compression mode $2_{16}$ video data packetization

The video data packetization for this compression mode is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.9 Compression mode $FF_{16}$ video data packetization

The video data packetization for the this compression mode is beyond the scope of this standard.

#### 4.6.2.10 Color space $0_{16}$ video data packetization – YUV 4:2:2 8 bits/sample

There is a Y sample for each pixel. Each U and V sample is used for two pixels. The subscript *n* denotes the pixel number within the source packet.

| | | | |
|---|---|---|---|
| $U_0$ | $Y_0$ | $V_0$ | $Y_1$ |
| $U_2$ | $Y_2$ | $V_2$ | $Y_3$ |
| $U_4$ | $Y_4$ | $V_4$ | $Y_5$ |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| $U_{n-5}$ | $Y_{n-5}$ | $V_{n-5}$ | $Y_{n-4}$ |
| $U_{n-3}$ | $Y_{n-3}$ | $V_{n-3}$ | $Y_{n-2}$ |
| $U_{n-1}$ | $Y_{n-1}$ | $V_{n-1}$ | $Y_n$ |

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**Figure 10 – Color space $0_{16}$ video data packetization**

### 4.6.2.11 Color space $1_{16}$ video data packetization – YUV 4:4:4 8 bits/sample

Each pixel contains a Y, U and V sample. The arrangement of the samples is shown in Figure 11. The subscript *n* denotes the pixel number within the source packet.

| | | | |
|---|---|---|---|
| $U_0$ | $Y_0$ | $V_0$ | $U_1$ |
| $Y_1$ | $V_1$ | $U_2$ | $Y_2$ |
| $V_2$ | $U_3$ | $Y_3$ | $V_3$ |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| $U_{n-3}$ | $Y_{n-3}$ | $V_{n-3}$ | $U_{n-2}$ |
| $Y_{n-2}$ | $V_{n-2}$ | $U_{n-1}$ | $Y_{n-1}$ |
| $V_{n-1}$ | $U_n$ | $Y_n$ | $V_n$ |

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**Figure 11 – Color space $1_{16}$ video data packetization**

### 4.6.2.12 Color space $2_{16}$ video data packetization – RGB 8 bits/sample

Each pixel contains a R, G and B sample. The arrangement of the samples is shown in Figure 12. The subscript *n* denotes the pixel number within the source packet.

| | | | |
|---|---|---|---|
| $R_0$ | $G_0$ | $B_0$ | $R_1$ |
| $G_1$ | $B_1$ | $R_2$ | $G_2$ |
| $B_2$ | $R_3$ | $G_3$ | $B_3$ |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| $R_{n-3}$ | $G_{n-3}$ | $B_{n-3}$ | $R_{n-2}$ |
| $G_{n-2}$ | $B_{n-2}$ | $R_{n-1}$ | $G_{n-1}$ |
| $B_{n-1}$ | $R_n$ | $G_n$ | $B_n$ |

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**Figure 12 – Color space $2_{16}$ video data packetization**

#### 4.6.2.13 Color space $3_{16}$ video data packetization – RGB 6 bits/sample

The video data packetization for this color space is only applied for compression mode $2_{16}$ and is defined in the applicable specification document referenced in Table 2.

#### 4.6.2.14 Color space $FF_{16}$ video data packetization

The video data packetization for the this color space is beyond the scope of this standard.

#### 4.6.2.15 Video mode $FF_{16}$ video data packetization

The video data packetization for the this video mode is beyond the scope of this standard.

### 4.6.3 Type $1_{16}$ source packet – Stream information and metadata (SIM) source packet4

#### 4.6.3.1 Stream information and metadata (SIM) source packet

A SIM source packet is transmitted exactly once per video frame for all compression modes. This type of source packet contains six data-types. Figure 13 shows the definition and arrangement of the fields of the stream information and metadata source packet.

| | | | | |
|---|---|---|---|---|
| reserved | Total Length | reserved | Ver = 1 | Type = 1 |
| reserved | Stream Info Length (bytes) | Stream Info Data (variable length field, zero or more bytes) | | |
| reserved | Auxiliary Data Length (bytes) | Auxiliary Data (variable length field, zero or more bytes) | | |
| reserved | Video Mode Specific Info Length (bytes) | Video Mode Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Compression Mode Specific Info Length (bytes) | Compression Mode Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Color Space Specific Info Length (bytes) | Color Space Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Vendor Specific Info Length (bytes) | Vendor Specific Info Data (variable length field, zero or more bytes) | | |
| reserved | Copy Control Info Length (bytes) | Copy Control Info Data (variable length field, zero or more bytes) | | |

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**Figure 13 – Stream information and metadata source packet**

For transmission of compression mode $0_{16}$ only the SIM source packet shall denote the start a video frame, that is the next video data source packet shall be the start of the first line of video data of a frame.

The six data-types included in the SIM source packet are:

– stream information;
– auxiliary data;
– video mode specific information;
– compression mode specific information;
– color space specific information;
– copy control information.

Each data-type consists of a six bit reserved field, a ten bit length and a variable number of data bytes. The six bit reserved field and the ten bit length shall be present for all data-types in all SIM source packets. If the length field is zero then no data bytes are included in the SIM source packet for that data-type. Annex D provides an example of a typical SIM source packet.

The *Type* field shall be set to $1_{16}$ to indicate that this is a SIM source packet.

The *Ver* field shall be set to $1_{16}$ to indicate that this is version 1 of the SIM source packet. This version is backward compatible with version 0. All future versions shall be backward compatible, they shall only add additional data-types in a manner consistent with those already defined. A node that receives a SIM source packet with a version number later than that which it supports should ignore the additional data-types.

The *Total Length* field indicates the number of valid bytes in the *Source Packet Data* portion of the source packet. Its value is the summation of the six length fields plus 12 bytes for the length and reserved fields themselves. The *Total Length* shall be less than or equal to (*source packet size* – 4) where *source packet size* is determined by the combination of video, compression and color space modes. Since there are a number of different source packet sizes it is unlikely that the *total length* will be equal to (*source packet size* – 4) therefore all remaining bytes in the source packet beyond those indicated by *total length* are reserved and shall be set to $00_{16}$.

### 4.6.3.2 Stream information

The stream information data type shall be included in all SIM source packets. The definition of the fields in this data-type is shown in Figure 14 below.

| | | | | |
|---|---|---|---|---|
| reserved | Stream Info Length = 14 | | reserved | |
| Video Mode | Frame Rate | AR | Compression Mode | Color Space |
| P/I | Vertical Size | | r | Horizontal Size |
| r | Transported Vertical Size | | r | Transported Horizontal Size |

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**Figure 14 – Stream information field definitions**

The *stream info length* field shall be set to 14 ($E_{16}$) to indicate that there are 14 bytes of stream information.

The *video mode* field is encoded as defined in Table 1. For all video modes except mode $FF_{16}$ the values of *frame rate*, *P/I*, *vertical size*, *horizontal dize*, *transported vertical size* and *transported horizontal size* are fixed and are given in Annex B. When video mode $FF_{16}$ is used these fields shall be set to the applicable value from the tables below. Where no value matches the required parameter the no information value shall be used, this value has all the bits set to $1_2$. The action taken by the sink node when receiving a field set to no information is beyond the scope of this standard.

The *frame rate* field is encoded as defined in Table 6 below.

**Table 6 – Frame rate**

| Frame rate | Frame rate value (frames per second) |
|---|---|
| $0_{16}$ | Reserved for future specification |
| $1_{16}$ | 24/1,001 (23,976…) |
| $2_{16}$ | 24 |
| $3_{16}$ | 25 |
| $4_{16}$ | 30/1,001 (29,97…) |
| $5_{16}$ | 30 |
| $6_{16}$ | 50 |
| $7_{16}$ | 60/1,001 (59,94…) |
| $8_{16}$ | 60 |
| $9_{16}$ | 15 |
| $F_{16}$ | No information |
| others | Reserved for future specification |

The AR field is described in Table 7 below.

**Table 7 – Aspect ratio**

| AR | Aspect ratio |
|---|---|
| $2_{16}$ | 4:3 |
| $3_{16}$ | 16:9 |
| $4_{16}$ | 2,21:1 |
| $F_{16}$ | No information |
| others | Reserved for future specification |

The P/I field indicates whether the video stream is progressive or interlaced. It is encoded as defined in Table 8 below.

**Table 8 – Progressive/interlace mode**

| P/I | Progressive/Interlace information |
|---|---|
| $0_{16}$ | Stream contains interlaced video frames |
| $1_{16}$ | Stream contains progressive video frames |
| $2_{16}$ | Reserved for future specification |
| $3_{16}$ | No Information |

The *vertical size* gives the value in lines of the vertical resolution of the video stream. This figure includes the vertical blanking if appropriate.

The *horizontal size* gives the value in pixels (not samples) of the horizontal resolution of the video stream. This figure includes the horizontal blanking if appropriate.

The *transported vertical size* gives the value in lines of the vertical resolution of the video stream that is actually transported. For all video modes currently defined, except $FF_{16}$, every line is transported and so this figure includes any vertical blanking. Whether vertical blanking is transported for video mode $FF_{16}$ is beyond the scope of this standard.

The *transported horizontal size* gives the value in pixels (not samples) of the horizontal resolution of the video stream that is actually transported. For all video modes currently defined, except $FF_{16}$, only the active portion of each video lines is transported and so this figure excludes any horizontal blanking. Whether horizontal blanking is transported for video mode $FF_{16}$ is beyond the scope of this standard.

#### 4.6.3.3 Auxiliary information

The auxiliary information data type should be included in all SIM source packets when transporting video data for which the auxiliary data is available. The definition of the fields in this data-type is shown in Figure 15 below.

<table>
<tr><td colspan="6">reserved</td><td colspan="2">Auxiliary Data Length (bits 9:8) = $0_2$</td></tr>
<tr><td colspan="8">Auxiliary Data Length (bits 7:0) = 14</td></tr>
<tr><td>TC VAL</td><td colspan="3">TC tens of frames</td><td colspan="4">TC units of frames</td></tr>
<tr><td>Drop</td><td colspan="3">TC tens of seconds</td><td colspan="4">TC units of seconds</td></tr>
<tr><td>r</td><td colspan="3">TC tens of minutes</td><td colspan="4">TC units of minutes</td></tr>
<tr><td colspan="4">TC tens of hours</td><td colspan="4">TC units of hours</td></tr>
<tr><td>RD VAL</td><td>DS</td><td colspan="2">tens of time zone</td><td colspan="4">units of time zone</td></tr>
<tr><td colspan="2">r</td><td colspan="2">tens of day</td><td colspan="4">units of day</td></tr>
<tr><td colspan="3">day of week</td><td>tens of month</td><td colspan="4">units of month</td></tr>
<tr><td colspan="4">tens of year</td><td colspan="4">units of year</td></tr>
<tr><td colspan="4">thousands of year</td><td colspan="4">hundreds of year</td></tr>
<tr><td>RT VAL</td><td colspan="3">RT tens of frames</td><td colspan="4">RT units of frames</td></tr>
<tr><td>r</td><td colspan="3">RT tens of seconds</td><td colspan="4">RT units of seconds</td></tr>
<tr><td>r</td><td colspan="3">RT tens of minutes</td><td colspan="4">RT units of minutes</td></tr>
<tr><td colspan="2">r</td><td colspan="2">RT tens of hours</td><td colspan="4">RT units of hours</td></tr>
<tr><td colspan="8">reserved</td></tr>
</table>

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**Figure 15 – Auxiliary data field definitions**

The *auxiliary data length* field shall be set to 14 ($E_{16}$) to indicate that there are 14 bytes of auxiliary data.

The remaining fields are defined below. The acquisition of the data contained in these fields is beyond the scope of this standard. The usage of the information contained in these fields by the sink device is implementation dependent.

*TC VAL*: A 1 if the Time-Code fields contain valid information.

*TC tens of frames*: The time-code tens of frames value in BCD.

*TC units of frames*: The time-code units of frames value in BCD.

*Drop*: A 1 if the time-code is based on drop-mode counting.

*TC tens of seconds*: The time-code tens of seconds value in BCD.

*TC units of seconds*: The time-code units of seconds value in BCD.

*TC tens of minutes*: The time-code tens of minutes value in BCD.

*TC units of minutes*: The time-code units of minutes value in BCD.

*TC tens of hours*: The time-code tens of hours value in BCD.

*TC units of hours*: The time-code units of hours value in BCD.

*RD VAL*: A 1 if the Record-Date fields contain valid information.

*DS*: A 1 if the record-time is based on daylight-savings-time.

*tens of time zone* : The record-time tens of time-zone value in BCD.

*units of time zone*: The record-time units of time-zone value in BCD.

*tens of day*: The record-date tens of day value in BCD.

*units of day*: The record-date units of day value in BCD.

*day of week*: The day of week, 0 (Sunday) through 6 (Saturday).

*tens of month*: The record-date tens of months value in BCD.

*units of month*: The record-date units of month value in BCD.

*tens of year*: The record-date tens of year value in BCD.

*units of year*: The record-date units of year value in BCD.

*hundreds of year*: The record-date hundreds of year value in BCD.

*thousands of year*: The record-date thousands of year value in BCD.

*RT VAL*: A 1 if the Record-Time fields contain valid information.

*RT tens of frames*: The record-time tens of frames value in BCD.

*RT units of frames*: The record-time units of frames value in BCD.

*RT tens of seconds*: The record-time tens of seconds value in BCD.

*RT units of seconds*: The record-time units of seconds value in BCD.

*RT tens of minutes*: The record-time tens of minutes value in BCD.

*RT units of minutes*: The record-time units of minutes value in BCD.

*RT tens of hours*: The record-time tens of hours value in BCD.

*RT units of hours*: The record-time units of hours value in BCD.

#### 4.6.3.4 Video mode specific information

For all video modes except $FF_{16}$ there are no data fields currently defined for this data-type. Therefore *video mode specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

For video mode $FF_{16}$ the first 3 bytes following the length field shall be the OUI of the vendor that has specified the video mode specific information data-type structure that is being transported. Therefore *video mode specific info length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.5 Compression mode specific information

For compression modes $0_{16}$ there are no data fields currently defined for this data-type. Therefore *compression mode specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

For compression modes $1_{16}$ and $2_{16}$ the data-type length and structure is defined in the applicable specification document referenced in Table 2.

For compression mode $FF_{16}$ the first 3 bytes following the length field shall be the OUI of the vendor that has specified the compression mode specific information data-type structure that is being transported. Therefore *compression mode specific info length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.6 Color space specific information

For all color space modes except $FF_{16}$ there are no data fields currently defined for this data-type. Therefore *color space specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

For color space $FF_{16}$ the first 3 bytes following the length field shall be the OUI of the vendor that has specified the color space specific information data-type structure that is being transported. Therefore *color space specific info length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.7 Vendor specific information

If this field is unused the *vendor specific info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

If this field is used the first 3 bytes following the length field shall be the OUI of the vendor that has implemented the device. In this case the *vendor specific info length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

#### 4.6.3.8 Copy control information

The copy control information block shall be included in all SIM source packets.

If there is no CCI to convey the *copy control info length* shall be $00_{16}$ and no data bytes shall be present in the data field of this data-type.

If this field is used the first 3 bytes following the length field shall be the OUI of the vendor that has defined the copy control information. In this case the *copy control info length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

Annex H contains the definition of a CCI descriptor structure that has been defined by the 1394 Trade Association.

#### 4.6.4 Type $2_{16}$ source packet – Audio source packet

##### 4.6.4.1 Audio source packet

The specification of the transportation of audio data within the same 1394 stream as video data is a likely update to this specification. Until such time as this has been specified it is recommended that audio data be transmitted as a separate 1394 stream as described by IEC 61883-6, [6]. Source packet type $2_{16}$ has been reserved for this purpose. A suggested method for synchronizing the video and audio on two separate 1394 channels is given in Annex A. The actual method of audio/video synchronization is implementation dependent.

### 4.7 Packet transmission method

#### 4.7.1 Packet transmission for compression mode $0_{16}$

##### 4.7.1.1 Overview of transmission

When a non-empty packet is ready to be transmitted, the transmitter shall transmit it within the most recent isochronous cycle initiated by a cycle start packet. The behavior of packet transmission depends on the definition of the condition in which a non-empty packet is ready to be transmitted. There are two situations in which this condition is defined.

a) A non-empty packet being ready for transmission is defined to be true if one or more video data source packets have arrived within an isochronous cycle. This transmission method is called non-blocking transmission, and is described in 4.7.1.2.

b) The condition of a non-empty packet is ready to be transmitted can also be defined as true when a fixed number of data blocks have arrived. This transmission method is called blocking transmission, and is described in 4.7.1.3.

Since a there is no source packet header (SPH) there is only one time stamp and this is in the SYT field of the CIP header. If a CIP contains multiple video data source packets, it is necessary to specify which source packet corresponds to the time stamp.

Since the stream contains a SIM source packet at the frequency of once per frame a mechanism is required to ensure that the SYT time stamp is generated at a regular interval of video data source packets. The VDSPC (Video Data Source Packet Count) field in video data source packet is used for this purpose.

The transmitter prepares the time stamp for the video data source packet, which meets this condition:

mod(VDSPC, SYT_INTERVAL) = 0;

where

VDSPC is the running count of transmitted video data source packets.

SYT_INTERVAL denotes the number of video data source packets between two successive valid SYT timestamps, which includes one of the video data source packets with a valid SYT. For example, if there are three video data source packets between two valid SYT timestamps, then the SYT_INTERVAL would be 4. The SYT_INTERVAL is dependent upon the video mode and color space used. The values of SYT_INTERVAL are given in Table 1.

The receiver knows the video data source packet for which the SYT timestamp is valid since it is the source packet whose VDSPC solve the following equation:

mod(VDSPC, SYT_INTERVAL) = 0

The receiver is responsible for estimating the timing of data blocks between valid time stamps. The method of timing estimation is implementation-dependent.

The SYT timestamp specifies the presentation time of the video data source packet at the receiver. A receiver must have the capability of presenting events at the time specified by the transmitter.

The TRANSFER_DELAY value is 875 μs, which accommodates the maximum latency time of isochronous packet transmission through an arbitrated short bus reset, worst case packetization delay and provides scope for encryption/decryption that may be required. The derivation of the TRANSFER_DELAY value is given in Annex F.

The transmitter quantizes the timing of the synchronization clock, for instance the rising edge of the video clock, by referring to its own CYCLE_TIME. It transmits the sum of this cycle time and TRANSFER_DELAY in the SYT field of the CIP. If the timing information is not required for a CIP the SYT shall indicate the no information code, that is $FFFF_{16}$.

#### 4.7.1.2 Non-blocking transmission method

The transmitter shall construct a packet in every nominal isochronous cycle. Each packet shall comply with the following constraint:

0 ≤ *N* ≤ MAX_VDSP

where

*N* is the number of video data source packets in the isochronous packet.

MAX_VDSP is given in Table 1.

In normal operation the transmitter shall not transmit events late, and shall not transmit packets early. The resulting conditions may be expressed as follows:

Packet_arrival_time_L ≤ Event_arrival_time[0] + TRANSFER_DELAY

Event_arrival_time[N-1] ≤ Packet_arrival_time_F

where

*Packet_arrival_time_F* is the time (measured in μs) when the first bit of the isochronous packet arrives at the receiver.

*Packet_arrival_time_L* is the time (measured in μs) when the last bit of the isochronous packet arrives at the receiver.

*Event_arrival_time[M]* is the time (measured in μs) of the arrival at the transmitter of video data source packet M of the isochronous packet. The first video data source packet of the isochronous packet has M = 0.

Since MAX_VDSP is always greater than or equal to SYT_INTERVAL for all video modes there will only ever be a maximum of one SYT timestamp in a video data source packet.

#### 4.7.1.3 Blocking transmission method

The blocking method may be used by a transmitter, which has only the ability to transmit isochronous packets of the same size. In order to indicate no data, the transmitter may transmit an isochronous packet containing just a CIP header or a special nonempty packet which has the ND (NO DATA) flag set to $1_2$ in its FDF field and has the same size of dummy data as a nonempty packet.

The transmitter shall construct a packet that contains no more than MAX_VDSP + 1 source packets.

For blocking, the duration of the successive video data source packets in a CIP must be added to the default TRANSFER_DELAY.

If a CIP contains N video data source packets, then

ACTUAL_TRANSFER_DELAY >= TRANSFER_DELAY + (N * VDSP_DURATION)

where

TRANSFER_DELAY is the latency of transmission of 875 μs as given in section 4.7.1.1.

VDSP_DURATION is the duration of a video data source packet, it is dependent upon video mode and color space. The VDSP_DURATION for each video mode is given in Annex B. The total delay for MAX_VDSP video source packets is also given in Annex B.

It is recommended that the receiver have sufficient extra buffer to compensate for the delay in receiving data due to blocking transmission's characteristics. The actual value of extra delay required, and hence additional buffer size required, depends upon the video modes and color spaces supported by the receiving node.

#### 4.7.1.4 Bandwidth allocation

Prior to stream transmission the appropriate bandwidth must be reserved at the isochronous resource manager.

The calculation of bandwidth allocation units for this purpose uses the following equations:

Maximum number of bytes per packet = ((MAX_VDSP + 1) × Source Packet Size) + 20 [A]

Maximum number of quadlets per packet = (Maximum number of bytes per packet / 4)

Bandwidth allocation units = Maximum number of quadlets per packet × SPEED_FACTOR

SPEED_FACTOR takes the following values:

a) for S100 SPEED_FACTOR = 16;
b) for S200 SPEED_FACTOR = 8;
c) for S400 SPEED_FACTOR = 4;
d) for S800 SPEED_FACTOR = 2;
e) for S1600 SPEED_FACTOR = 1;
f) for S3200 SPEED_FACTOR = 0,5 (This may result in a fractional result for the bandwidth allocation units, in this circumstance the value shall be rounded up to the next integer value);

The addition of 1 to the MAX_VDSP is required to guarantee sufficient bandwidth for the SIM source packet that is sent once per frame. In the normal non-blocking transmission method, fewer than MAX_VDSP video data source packets will be transmitted in each packet, for some video modes this may allow sufficient bandwidth for the transmission of the SIM source packet without any extra bandwidth being allocated such that equation [A] becomes:

Maximum number of bytes per packet = (MAX_VDSP * Source Packet Size) + 20 [B]

For color space $0_{16}$ the following video modes require equation [A]:

g) modes 49, 59, 60 and 61;

For color spaces $1_{16}$ and $2_{16}$ the following video modes require equation [A]:

h) mode 61 only.

For modes that do not require equation [A] for bandwidth allocation unit calculation it is recommended that they do use equation [A] since in the event of lost opportunities to transmit a packet (such as a cycle start packet drop after a bus reset) a transmitter can catch up by transmitting up to MAX_VDSP events in one or more of the subsequent packets. Also, since the SIM source packet is only sent once per frame the bandwidth allocation calculated in equation [A] provides sufficient allocated bandwidth such that one additional video data source packet over and above MAX_VDSP can be sent per isochronous packet for most isochronous packets without violating the allocated bandwidth. Whilst this additional bandwidth will be unused most of the time it provides the extra bandwidth needed to catch up with transmission sooner.

The bandwidth allocation units have been calculated for all modes using equation [A] and are listed in Annex B.

### 4.7.2 Packet transmission for compression mode $1_{16}$

The transmission timing parameters for this compression mode are defined in the applicable specification document referenced in Table 2.

### 4.7.3 Packet transmission for compression mode $2_{16}$

The transmission timing parameters for this compression mode are defined in the applicable specification document referenced in Table 2.

### 4.7.4 Packet transmission for compression mode $FF_{16}$

The definition of the transmission timing parameters for this compression mode is beyond the scope of this standard.

# Annex A
(informative)

# Audio/video synchronization

## A.1 Logical association of audio and video streams

There is sufficient capability in the AV/C specifications, [5] to identify 1394 isochronous streams that are associated.

## A.2 Time synchronization of audio and video streams

Time synchronization may be achieved using the following principles:

A device that supports this specification and also sources IEC 61883-6 audio streams should ensure that both streams are synchronized with respect to presentation timestamp, that is audio and video data that arrived coincidently at the transmitter should be presented at the receiver coincidently.

The TRANSFER_DELAY for these streams is different, with TRANSFER_DELAY given by this specification being greater than that given by IEC 61883-6,[6]. Therefore the source should delay the IEC 61883-6 data prior to entering the 1394 system by a time equal to

(TRANSFER_DELAY for 601 Over 1394) – (TRANSFER_DELAY for IEC 61883-6).

This buffering should be done in the audio clock domain. It must be noted that IEC 61883-6 provides the capability to vary the IEC 61883-6 TRANSFER_DELAY, a transmitter that allows this functionality will have to vary this additional delay accordingly. It is be permissible to adjust the IEC 61883-6 TRANSFER_DELAY to a value greater than that used by this standard. In this situation the video data would be delayed in the video clock domain by the difference in the TRANSFER_DELAY values.

The delay in the system after the presentation time may be different between the audio and video path. The receiver should ensure that this delay is the same, and if this is not possible then the audio delay should be greater than the video delay to avoid lip-sync issues but by no more than about 10 ms.

# Annex B
(normative)

## Additional video mode parameters

This annex contains the additional parameters associated with the video modes defined in Table 1. It includes the fixed parameters that are used in the SIM source packet.

NOTE Due to the width of the tables there are two tables in this annex.

**Table B.1 – Additional video mode parameters, 1 of 2**

| Video mode | Transported vertical size [a] | Transported horizontal size [a, d] | Vertical size [a] | Horizontal size [a, d] | Vertical blanking | Horizontal blanking | P/I [a] | Frame rate [a] | Minimum bus speed comp mode $0_{16}$ color space $0_{16}$ | Minimum bus speed comp mode $0_{16}$ color spaces $1_{16}$ and $2_{16}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 640 | 500 | 800 | 20 | 160 | $1_{16}$ | $7_{16}$ | S800 | S1600 [b] |
| 1 | 500 | 640 | 500 | 800 | 20 | 160 | $1_{16}$ | $8_{16}$ | S800 | S1600 [b] |
| 2 | 263 | 720 | 263 | 858 | 23 | 138 | $1_{16}$ | $7_{16}$ | S400 | S800 |
| 3 | 263 | 720 | 263 | 858 | 23 | 138 | $1_{16}$ | $8_{16}$ | S400 | S800 |
| 4 | 522 | 720 | 522 | 858 | 42 | 138 | $1_{16}$ | $7_{16}$ | S800 | S1600 |
| 5 | 522 | 720 | 522 | 858 | 42 | 138 | $1_{16}$ | $8_{16}$ | S800 | S1600 |
| 6 | 525 | 720 | 525 | 858 | 45 | 138 | $0_{16}$ | $4_{16}$ | S400 | S800 |
| 7 | 525 | 720 | 525 | 858 | 45 | 138 | $0_{16}$ | $5_{16}$ | S400 | S800 |
| 8 | 750 | 1 280 | 750 | 1 650 | 30 | 370 | $1_{16}$ | $7_{16}$ | S1600 | S3200 |
| 9 | 750 | 1 280 | 750 | 1 650 | 30 | 370 | $1_{16}$ | $8_{16}$ | S1600 | S3200 |
| 10 | 525 | 1 440 | 525 | 1 716 | 45 | 276 | $1_{16}$ | $7_{16}$ | S1600 | S3200 |
| 11 | 525 | 1 440 | 525 | 1 716 | 45 | 276 | $1_{16}$ | $8_{16}$ | S1600 | S3200 |
| 12 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $7_{16}$ | > [c] | > [c] |
| 13 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $8_{16}$ | > [c] | > [c] |
| 14 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $0_{16}$ | $4_{16}$ | S3200 | S3200 |
| 15 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $0_{16}$ | $5_{16}$ | S3200 | S3200 |
| 16 | 314 | 720 | 314 | 864 | 26 | 144 | $1_{16}$ | $6_{16}$ | S400 | S800 |
| 17 | 625 | 720 | 625 | 864 | 49 | 144 | $1_{16}$ | $6_{16}$ | S800 | S1600 |
| 18 | 625 | 720 | 625 | 864 | 49 | 144 | $0_{16}$ | $3_{16}$ | S400 | S800 |
| 19 | 750 | 1 280 | 750 | 1 980 | 30 | 700 | $1_{16}$ | $6_{16}$ | S1600 | S3200 |
| 20 | 625 | 1 440 | 625 | 1 728 | 49 | 288 | $1_{16}$ | $6_{16}$ | S1600 | S3200 |
| 21 | 525 | 960 | 525 | 1 144 | 45 | 184 | $0_{16}$ | $4_{16}$ | S800[2] | S800 |
| 22 | 625 | 960 | 625 | 1 152 | 49 | 192 | $0_{16}$ | $3_{16}$ | S800[2] | S800 |
| 23 | - | - | - | - | - | - | - | - | - | - |
| 24 | - | - | - | - | - | - | - | - | - | - |
| 25 | 1 125 | 1 920 | 1 125 | 2 750 | 45 | 830 | $1_{16}$ | $1_{16}$ | S1600 | S3200 |
| 26 | 1 125 | 1 920 | 1 125 | 2 750 | 45 | 830 | $1_{16}$ | $2_{16}$ | S1600 | S3200 |
| 27 | 1 125 | 1 920 | 1 125 | 2 640 | 45 | 720 | $1_{16}$ | $3_{16}$ | S1600 | S3200 |
| 28 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $4_{16}$ | S3200 | S3200 |
| 29 | 1 125 | 1 920 | 1 125 | 2 200 | 45 | 280 | $1_{16}$ | $5_{16}$ | S3200 | S3200 |
| 30 | 1 125 | 1 920 | 1 125 | 2 640 | 45 | 720 | $1_{16}$ | $6_{16}$ | S3200 | > [c] |
| 31 | 1 125 | 1 920 | 1 125 | 2 640 | 45 | 720 | $0_{16}$ | $3_{16}$ | S1600 | S3200 |

| Video mode | Transported vertical size [a] | Transported horizontal size [a, d] | Vertical size [a] | Horizontal size [a, d] | Vertical blanking | Horizontal blanking | P/I [a] | Frame rate [a] | Minimum bus speed comp mode $0_{16}$ color space $0_{16}$ | Minimum bus speed comp mode $0_{16}$ color spaces $1_{16}$ and $2_{16}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 288 | 352 | 288 | 352 | 0 | 0 | $1_{16}$ | $3_{16}$ | S200[2] | S200 |
| 33 | 240 | 352 | 240 | 352 | 0 | 0 | $1_{16}$ | $5_{16}$ | S200[2] | S200 |
| 34 | 144 | 176 | 144 | 176 | 0 | 0 | $1_{16}$ | $3_{16}$ | S100 | S100 |
| 35 | 120 | 176 | 120 | 176 | 0 | 0 | $1_{16}$ | $5_{16}$ | S100 | S100 |
| 36 | 288 | 352 | 288 | 352 | 0 | 0 | $1_{16}$ | $4_{16}$ | S200 | S400 [b] |
| 37 | 144 | 176 | 144 | 176 | 0 | 0 | $1_{16}$ | $4_{16}$ | S100 | S100 |
| 38 | 234 | 480 | 234 | 480 | 0 | 0 | $1_{16}$ | $4_{16}$ | S200 [b] | S200 |
| 39 | 234 | 480 | 234 | 480 | 0 | 0 | $1_{16}$ | $9_{16}$ | S100 | S200 [b] |
| 40 | 480 | 800 | 480 | 800 | 0 | 0 | $1_{16}$ | $9_{16}$ | S400 [b] | S400 |
| 41 | 240 | 320 | 240 | 320 | 0 | 0 | $1_{16}$ | $9_{16}$ | S100 | S100 |
| 42 | 240 | 320 | 240 | 320 | 0 | 0 | $1_{16}$ | $5_{16}$ | S100 | S200 [b] |
| 43 | 240 | 320 | 240 | 320 | 0 | 0 | $1_{16}$ | $8_{16}$ | S200 | S400 [b] |
| 44 | 480 | 640 | 480 | 640 | 0 | 0 | $1_{16}$ | $9_{16}$ | S200 | S400 [b] |
| 45 | 480 | 640 | 480 | 640 | 0 | 0 | $1_{16}$ | $5_{16}$ | S400 | S800 [b] |
| 46 | 480 | 640 | 480 | 640 | 0 | 0 | $1_{16}$ | $8_{16}$ | S800 | S800 |
| 47 | 600 | 800 | 600 | 800 | 0 | 0 | $1_{16}$ | $9_{16}$ | S400 | S400 |
| 48 | 600 | 800 | 600 | 800 | 0 | 0 | $1_{16}$ | $5_{16}$ | S800 [b] | S800 |
| 49 | 600 | 800 | 600 | 800 | 0 | 0 | $1_{16}$ | $8_{16}$ | S800 | S1600 |
| 50 | 768 | 1 024 | 768 | 1 024 | 0 | 0 | $1_{16}$ | $9_{16}$ | S400 | S800 |
| 51 | 768 | 1 024 | 768 | 1 024 | 0 | 0 | $1_{16}$ | $5_{16}$ | S800 | S1600 |
| 52 | 768 | 1 024 | 768 | 1 024 | 0 | 0 | $1_{16}$ | $8_{16}$ | S1600 | S3200 |
| 53 | 960 | 1 280 | 960 | 1 280 | 0 | 0 | $1_{16}$ | $9_{16}$ | S800 | S1600[2] |
| 54 | 960 | 1 280 | 960 | 1 280 | 0 | 0 | $1_{16}$ | $5_{16}$ | S1600 | S1600 |
| 55 | 960 | 1 280 | 960 | 1 280 | 0 | 0 | $1_{16}$ | $8_{16}$ | S3200 | S3200 |
| 56 | 1 024 | 1 280 | 1 024 | 1 280 | 0 | 0 | $1_{16}$ | $9_{16}$ | S800 | S1600 [b] |
| 57 | 1 024 | 1 280 | 1 024 | 1 280 | 0 | 0 | $1_{16}$ | $5_{16}$ | S1600 | S3200 [b] |
| 58 | 1 024 | 1 280 | 1 024 | 1 280 | 0 | 0 | $1_{16}$ | $8_{16}$ | S3200 | S3200 |
| 59 | 1 200 | 1 600 | 1 200 | 1 600 | 0 | 0 | $1_{16}$ | $9_{16}$ | S800 | S1600 |
| 60 | 1 200 | 1 600 | 1 200 | 1 600 | 0 | 0 | $1_{16}$ | $5_{16}$ | S1600 | S3200 |
| 61 | 1 200 | 1 600 | 1 200 | 1 600 | 0 | 0 | $1_{16}$ | $8_{16}$ | S3200 | > |
| 62 | 480 | 800 | 480 | 800 | 0 | 0 | $1_{16}$ | $5_{16}$ | S400 | S800 |
| 63 | 480 | 800 | 480 | 800 | 0 | 0 | $1_{16}$ | $8_{16}$ | S800 | S1600 |
| 255 | Other video mode | - | - | - | - | - | - | - | - | - |
| Others | Reserved for future specification | - | - | - | - | - | - | - | - | - |

[a] The values represent the encodings that should be used in the SIM source packet.

[b] These modes can be sent at the next lower bus speed if equation [B] is used to calculate bandwidth allocation units in 4.7.1.4.

[c] This video mode requires bus speeds greater than S3200 and so must be compressed if it is to be transported until such time as bus speeds increase beyond S3200.

[d] Horizontal blanking can be calculated as: (Horizontal size – Transported horizontal size).

**Table B.2 – Additional video mode parameters, 2 of 2**

| Video Mode | Lines per SYT interval, all color spaces | Duration of a source packet for color space 0 µs | Duration of an isochronous packet for color space 0 µs | Duration of a source packet for color space 1 and 2 µs | Duration of an isochronous packet for color space 1 and 2 µs | Bandwidth allocation units [a] at minimum allowed speed for color space 0 | Bandwidth allocation units [a] at minimum allowed speed for color space 1 and 2 |
|---|---|---|---|---|---|---|---|
| 0 | 4 | 16,69 | 133,52 | 11,13 | 133,56 | 2 908 | 2 098 |
| 1 | 4 | 16,67 | 133,36 | 11,12 | 133,44 | 2 908 | 2 098 |
| 2 | 2 | 31,72 | 126,88 | 21,15 | 126,9 | 3 640 | 2 544 |
| 3 | 2 | 31,69 | 126,76 | 21,13 | 126,78 | 3 640 | 2 544 |
| 4 | 4 | 15,99 | 127,92 | 10,66 | 127,92 | 3 268 | 2 358 |
| 5 | 4 | 15,97 | 127,76 | 10,65 | 127,8 | 3 268 | 2 358 |
| 6 | 2 | 31,78 | 127,12 | 21,19 | 127,14 | 3 640 | 2 544 |
| 7 | 2 | 31,75 | 127 | 21,17 | 127,02 | 3 640 | 2 544 |
| 8 | 6 | 5,57 | 128,11 | 5,57 | 128,11 | 3 869 | 2 895 |
| 9 | 6 | 5,56 | 127,88 | 5,56 | 127,88 | 3 869 | 2 895 |
| 10 | 4 | 7,95 | 127,2 | 5,3 | 127,2 | 3 082 | 2 265 |
| 11 | 4 | 7,94 | 127,04 | 5,3 | 127,2 | 3 082 | 2 265 |
| 12 | 9 | 3,71 | 126,14 | 2,48 | 126,48 | 0 | 0 |
| 13 | 9 | 3,71 | 126,14 | 2,47 | 125,97 | 0 | 0 |
| 14 | 5 | 7,42 | 126,14 | 4,95 | 128,7 | 2 172 | 3 256 |
| 15 | 5 | 7,41 | 125,97 | 4,94 | 128,44 | 2 172 | 3 256 |
| 16 | 2 | 31,85 | 127,4 | 21,24 | 127,44 | 3 640 | 2 544 |
| 17 | 4 | 16 | 128 | 10,67 | 128,04 | 3 268 | 2 358 |
| 18 | 2 | 32 | 128 | 21,34 | 128,04 | 3 640 | 2 544 |
| 19 | 5 | 6,67 | 126,73 | 6,67 | 126,73 | 3 225 | 2 413 |
| 20 | 4 | 8 | 128 | 5,34 | 128,16 | 3 082 | 2 265 |
| 21 | 2 | 21,19 | 127,14 | 15,89 | 127,12 | 2 264 | 3 268 |
| 22 | 2 | 21,34 | 128,04 | 16 | 128 | 2 264 | 3 268 |
| 23 | - | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | - | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 4 | 9,27 | 129,78 | 6,18 | 129,78 | 3 620 | 2 654 |
| 26 | 4 | 9,26 | 129,64 | 6,18 | 129,78 | 3 620 | 2 654 |
| 27 | 4 | 8,89 | 133,35 | 5,93 | 130,46 | 3 861 | 2 774 |
| 28 | 5 | 7,42 | 126,14 | 4,95 | 128,7 | 2 172 | 3 256 |
| 29 | 5 | 7,41 | 125,97 | 4,94 | 128,44 | 2 172 | 3 256 |
| 30 | 8 | 4,45 | 129,05 | 2,97 | 127,71 | 3 618 | 0 |
| 31 | 4 | 8,89 | 133,35 | 5,93 | 130,46 | 3 861 | 2 774 |
| 32 | 1 | 69,45 | 138,9 | 69,45 | 138,9 | 2 176 | 3 232 |
| 33 | 1 | 69,45 | 138,9 | 69,45 | 138,9 | 2 176 | 3 232 |
| 34 | 1 | 138,89 | 138,89 | 138,89 | 138,89 | 1 520 | 2 224 |
| 35 | 1 | 138,89 | 138,89 | 138,89 | 138,89 | 1 520 | 2 224 |

| Video Mode | Lines per SYT interval, all color spaces | Duration of a source packet for color space 0 µs | Duration of an isochronous packet for color space 0 µs | Duration of a source packet for color space 1 and 2 µs | Duration of an isochronous packet for color space 1 and 2 µs | Bandwidth allocation units [a] at minimum allowed speed for color space 0 | Bandwidth allocation units [a] at minimum allowed speed for color space 1 and 2 |
|---|---|---|---|---|---|---|---|
| 36 | 3 | 57,93 | 173,79 | 57,93 | 173,79 | 2 888 | 2 148 |
| 37 | 1 | 115,86 | 231,72 | 115,86 | 231,72 | 2 240 | 3 296 |
| 38 | 1 | 47,54 | 142,62 | 35,65 | 142,6 | 2 632 | 3 680 |
| 39 | 2 | 94,97 | 189,94 | 71,23 | 142,46 | 3 968 | 2 224 |
| 40 | 1 | 69,45 | 138,9 | 46,3 | 138,9 | 2 432 | 3 236 |
| 41 | 1 | 138,89 | 138,89 | 69,45 | 138,9 | 2 672 | 3 008 |
| 42 | 1 | 69,45 | 138,9 | 34,73 | 138,92 | 3 968 | 2 480 |
| 43 | 2 | 34,73 | 138,92 | 17,37 | 138,96 | 3 280 | 2 216 |
| 44 | 1 | 69,45 | 138,9 | 46,3 | 138,9 | 3 904 | 2 596 |
| 45 | 2 | 34,73 | 138,92 | 23,15 | 138,9 | 3 240 | 2 264 |
| 46 | 4 | 17,37 | 138,96 | 11,58 | 127,38 | 2 908 | 3 874 |
| 47 | 4 | 55,56 | 166,68 | 37,04 | 148,16 | 3 236 | 4 040 |
| 48 | 3 | 27,78 | 138,9 | 18,52 | 129,64 | 2 422 | 3 226 |
| 49 | 5 | 13,89 | 125,01 | 9,26 | 129,64 | 4 030 | 3 020 |
| 50 | 2 | 21,71 | 130,26 | 21,71 | 130,26 | 3 632 | 2 712 |
| 51 | 3 | 10,86 | 130,32 | 10,86 | 130,32 | 3 364 | 2 514 |
| 52 | 6 | 5,43 | 130,32 | 5,43 | 130,32 | 3 230 | 2 415 |
| 53 | 2 | 17,37 | 138,96 | 17,37 | 138,96 | 2 908 | 2 174 |
| 54 | 4 | 8,69 | 130,35 | 8,69 | 130,35 | 2 581 | 3 861 |
| 55 | 8 | 4,35 | 126,15 | 4,35 | 126,15 | 2 418 | 3 618 |
| 56 | 2 | 16,28 | 130,24 | 16,28 | 130,24 | 2 908 | 2 174 |
| 57 | 4 | 8,14 | 130,24 | 8,14 | 130,24 | 2 742 | 2 051 |
| 58 | 8 | 4,07 | 126,17 | 4,07 | 126,17 | 2 579 | 3 859 |
| 59 | 3 | 13,89 | 125,01 | 11,12 | 133,44 | 4 030 | 3 138 |
| 60 | 5 | 6,95 | 125,1 | 5,56 | 127,88 | 3 824 | 2 895 |
| 61 | 9 | 3,48 | 125,28 | 2,78 | 125,1 | 3 721 | 0 |
| 62 | 2 | 34,73 | 138,92 | 23,15 | 138,9 | 4 040 | 2 824 |
| 63 | 4 | 17,73 | 138,96 | 11,58 | 138,96 | 3 628 | 2 618 |
| 255 | - | - | - | - | - | - | - |
| others | - | - | - | - | - | - | - |

[a] The bandwidth allocation units have been calculated using the minimum bus speed and equation [A] given in 4.7.1.4. The maximum value of bandwidth allocation units available on an IEEE-1394 bus is 4915, [2]. Some modes are limited to a certain speed due to the packet size rather than the availability of bandwidth allocation units.

Color Space 3 is defined for use with compression mode 2 only. Refer to the documentation referenced in Table 2 for the applicable additional video parameters.

# Annex C
(informative)

## Using IEC 61883-1 plug control registers beyond S400

IEC 61883-1 [6] defines a mechanism for configuring isochronous streams up to S400. IEEE Std 1394.1-2004, Standard for high performance serial bus bridges [9]. Annex E defines a mechanism for extending this configuration for streams up to S3200.

# Annex D
(normative)

## Compliance annex

It is expected that a device that implements this standard will be an AV/C specification, [5] compliant device.

It is expected that the AV/C STREAM FORMAT command will be extended to allow the identification and selection of video, compression and color space modes. Implementation dependent means for the identification and selection of video, compression and color space modes is permitted.

A source device that supports this specification shall support at least one video mode. Video mode $FF_{16}$ is a valid mode in this context.

A source device that supports this specification shall support at least one compression mode. Compression modes $0_{16}$ and $FF_{16}$ are valid modes in this context.

A source device that supports this standard shall support at least one color space. Color space $FF_{16}$ is a valid color space in this context.

A sink device that that supports this standard and outputs the video stream, whether directly or indirectly, to a display shall support at least one video mode. Video mode $FF_{16}$ is a valid mode in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one compression mode. Compression modes $0_{16}$ and $FF_{16}$ are valid modes in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one color space. Color space $FF_{16}$ is a valid color space in this context.

A sink device that supports this standard but does not output the display, for example a device used for recording or stream monitoring purposes, need only recognize the format of the isochronous stream and its source packets and process them according to its implementation dependent requirements.

This standard defines many different video, compression and color space modes. Different deployment situations will require different levels of functionality, for example, it is likely that the automotive industry and the consumer electronic industry will require the support of different video modes. Therefore no particular video mode, compression mode or color space is mandated by this standard. It is left to implementers to choose the level of support they deem suitable for their application. Implementers are encouraged to produce implementation guidelines to provide consistency and interoperability in any given application space.

# Annex E
(informative)

## Typical SIM source packet

The SIM source packet shown below is a typical example.

If video mode is 0, compression mode is 0 and color space is zero then *source packet size* is 644 bytes (taken from Table 1). Therefore there would be (644 – (56+4)) reserved bytes at the end of the source packet, that is 584 reserved bytes.

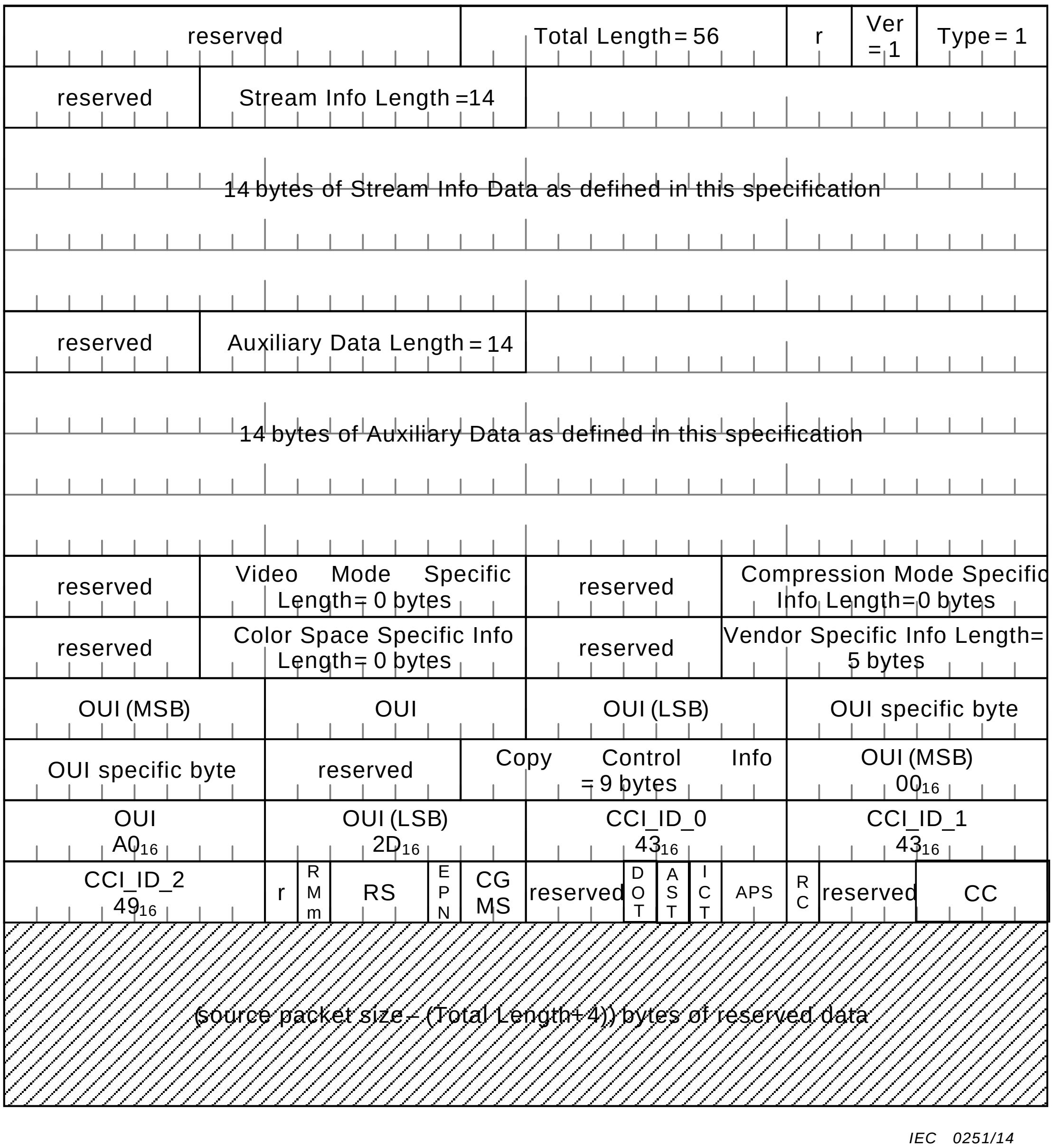


**Figure E.1 – Typical SIM source packet**

# Annex F
(informative)

## Derivation of TRANSFER_DELAY

The derivation of the TRANSFER_DELAY parameter is given below:

| | |
|---|---|
| 1394 worst case transmission delay | 358 µs |
| Allowance for encryption (after packetisation) | 125 µs |
| Allowance for decryption (before depacketisation) | 125 µs |
| Decision point to transmit the packet just missed | 125 µs |
| Slowest 601 packetisation (time to fill 1 source packet) | 140 µs |
| Allowance for 1 394 clock discrepancy at source and sink | 25 ns |
| **Total** | **873,025 µs** |

This is rounded up to 875 µs so that it is exactly 7 isochronous periods thus requiring only a simple addition to the cycle timer to generate the SYT value.

The allowance for encryption/decryption is to provide scope for implementation flexibility.

The 601 packetization delay is typically much lower than 140 µs but this is the worst case.

# Annex G
(normative)

## 1394 trade association CCI descriptor block

The structure of the 1394 TA CCI descriptor block is given in the Figure G.1. The definition of the setting of fields other than OUI and CCI_ID to particular values is beyond the scope of this

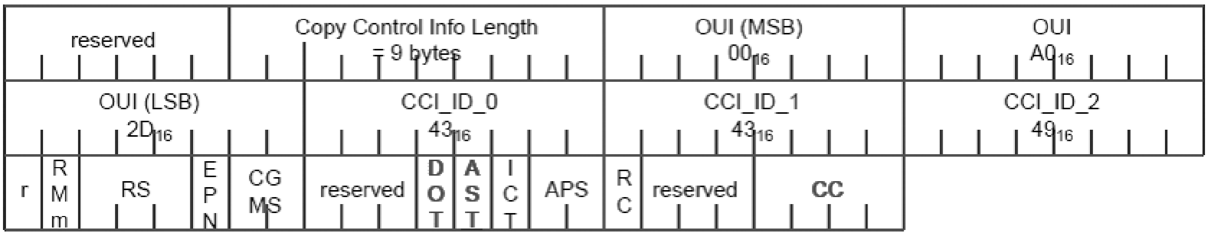


**Figure G.1 – CCI descriptor block**

OUI – This is the three byte 1394TA OUI, $00A02D_{16}$.

CCI_ID_x – This is the three byte 1394TA designated identifier for this CCI descriptor block, $434349_{16}$.

RMm – Retention move mode is used in combination with CGMS to define the move function or the retention function. The combination of values is described below:

| RMm | CGMS | Modes |
|---|---|---|
| $0_2$ | $10_2$ | Move mode |
| $0_2$ | $11_2$ | Retention mode |
| Other Combinations | | Neither move nor retention mode |

RS – Retention state is encoded as defined below:

| RS | Retention time |
|---|---|
| $000_2$ | Forever |
| $001_2$ | 1 week |
| $010_2$ | 2 days |
| $011_2$ | 1 day |
| $100_2$ | 12 h |
| $101_2$ | 6 h |
| $110_2$ | 3 h |
| $111_2$ | 90 min |

EPN – Encryption plus non-assertion is encoded as defined below:

| EPN | Meaning |
|---|---|
| $0_2$ | EPN asserted |
| $1_2$ | EPN not asserted |

CGMS – CGMS is encoded as defined below:

| CGMS | Meaning |
|---|---|
| $00_2$ | Copy free |
| $01_2$ | No more copies |
| $10_2$ | Copy one generation |
| $11_2$ | Copy never |

RC – Redistribution control is as defined below:

| RC | Meaning |
|---|---|
| $0_2$ | Technological control of consumer redistribution is not signaled |
| $1_2$ | Technological control of consumer redistribution is signaled |

ICT – Image constraint token is encoded as described below:

| ICT | Meaning |
|---|---|
| $0_2$ | High definition analog output in the form of constrained image |
| $1_2$ | High definition analog output in high definition analog form |

ACS – ACS is encoded as described below:

| ACS | Meaning |
|---|---|
| $00_2$ | Copy free |
| $01_2$ | APS is on : Type 1 (AGC) |
| $10_2$ | APS is on : Type 2 (AGC + 2L Colorstripe) |
| $11_2$ | APS is on : Type 3 (AGC + 4L Colorstripe) |

AST – Analog sunset token as described below:

| AST | Meaning |
|---|---|
| $0_2$ | AST asserted |
| $1_2$ | AST unasserted |

DOT – Digital only token as described below:

| DOT | Meaning |
|---|---|
| $0_2$ | DOT asserted |
| $1_2$ | DOT unasserted |

CC – Copy count as described below:

| CC | Meaning |
|---|---|
| $0000_2$ | Invalid |
| Others | *N* copies are allowed |

NOTE This annex may, at some point in the future, move to a separate 1394 Trade Association specification document.

# Bibliography

The following documents contain additional information related to this standard:

[1] IEEE Std 1212-2001, Standard for a Control and Status Registers (CSR) Architecture for microcomputer buses

[2] IEEE Std 1394-1995, Standard for a High Performance Serial Bus

[3] IEEE Std 1394a-2000, Standard for a High Performance Serial Bus—Amendment 1

[4] IEEE Std 1394b-2002, Standard for a High Performance Serial Bus—Amendment 2

[5] 1394 Trade Association 2004006, AV/C Digital Interface Command Set General Specification Version 4.2

[6] IEC 61883 (all parts), *Consumer audio/video equipment – Digital interface*

[7] ITU-R BT.601-5 1995, *Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios*

[8] ITU-R BT.656-4 1998, *Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601*

[9] IEEE Std 1394.1-2004, *Standard for High Performance Serial Bus Bridges*

[10] *Oxford Semiconductor Light Codec Specification, Version 1.0*

[11] *Fujitsu SmartCODEC Specification, Version 1.0*

[12] 1394 Trade Association, TA Document 2003017, *IIDC 1394-based Digital Camera Specification, Ver. 1.31*

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel:  + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch