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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Matériel audio/vidéo grand public – Interface numérique –
Partie 8: Transmission de données vidéonumériques de style UIT-R BT.601

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IEC 61883-8:2008-11(en-fr)

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Edition 1.0 2008-11

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CONTENTS

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iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 61883-8:2008
https://standards.iteh.ai/catalog/standards/sist/d68bb05d-bb8e-464f-b9b6-bc7b213caa38/iec-61883-8-2008

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CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

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

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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.

The text of this standard is based on the following documents:

FDIS	Report on voting
100/1446/FDIS	100/1476/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

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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.

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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:

IEC 61883-8:2008
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- 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*

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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*

IEC 61883-8:2008
https://standards.iteh.ai/catalog/standards/sist/d68bb05d-bb8e-464f-b9b6-bc7b213cae38/iec-61883-8-2008

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

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IEC 61883-8:2008

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.

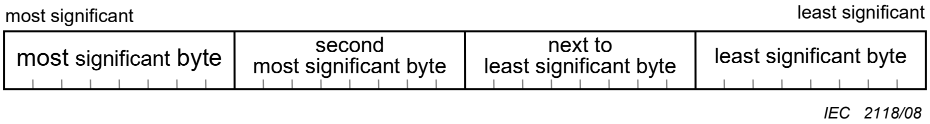

Figure 2 – Byte ordering within a quadlet

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.

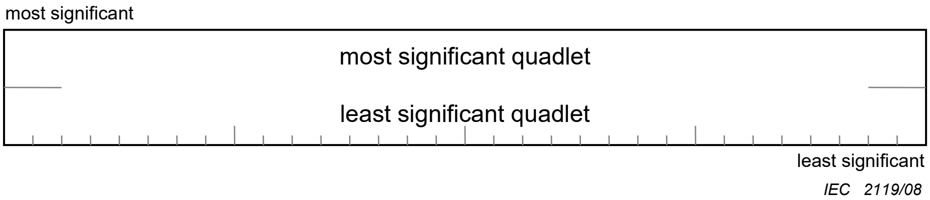

Figure 3 – Quadlet ordering within an octlet

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.

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4 Reference model for data transmission

4.1 Model overview

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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 IEEE 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.

most significant

data length	tag	channel	tcode	sy

least significant

IEC 2120/08

Figure 4 – Isochronous packet header

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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.

IEC 61883-8:2008
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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.

0	0	SID	DBS	FN	QPC	SPH	r	DBC
1	0	FMT	FDF	SYT				

IEC 2121/08

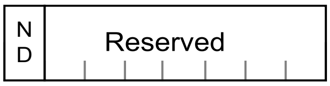
Figure 5 – CIP header

- 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:

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– 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.

IEC 61883-8:2008

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 SMPTE 293M
5	480	720	progr.	60	724	724	8	12	8	12	ITU-R BT.1358 SMPTE 293M
6	480	720	int.	59,94	724	724	4	6	4	6	ITU-R BT.601 SMPTE 267M
7	480	720	int.	60	724	724	4	6	4	6	ITU-R BT.601 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 SMPTE 274M
13	1 080	1 920	progr.	60	964	964	36	54	34	51	ITU-R BT.709 SMPTE 274M
14	1 080	1 920	int.	59,94	964	964	20	30	17	26	ITU-R BT.709 SMPTE 274M
15	1 080	1 920	int.	60	964	964	20	30	17	26	ITU-R BT.709 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 SMPTE 267M
22	576	960	int.	50	644	724	6	8	6	8	ITU-R BT.601

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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)
36	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

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