

INTERNATIONAL STANDARD

IEC
61883-6

First edition
2002-10

Consumer audio/video equipment – Digital interface –

Part 6: Audio and music data transmission protocol

*Matériel audio/vidéo grand public –
Interface numérique –*

*Partie 6:
Protocole de transmission de données
audio et musicales*



Reference number
IEC 61883-6:2002(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (http://www.iec.ch/searchpub/cur_fut.htm) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications (http://www.iec.ch/online_news/justpub/jp_entry.htm) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC
61883-6

First edition
2002-10

Consumer audio/video equipment – Digital interface –

Part 6: Audio and music data transmission protocol

*Matériel audio/vidéo grand public –
Interface numérique –*

*Partie 6:
Protocole de transmission de données
audio et musicales*

© IEC 2002 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

U

For price, see current catalogue

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Transport requirements	7
4.1 Arbitrated short bus reset	7
4.2 Bit, byte, and quadlet ordering	7
5 Packet header for audio and music data	7
5.1 Isochronous packet header format	7
5.2 CIP header format	8
6 Packetization	8
6.1 Packet transmission method	8
6.2 Transmission of timing information	9
6.3 Time stamp processing	9
6.4 Transmission control	10
7 Event Types	11
7.1 General	11
7.2 AM824 Data	14
7.3 32-bit floating point data	17
7.4 24-bit x 4 Audio Pack	17
8 Subformat	18
8.1 Basic format	18
8.2 Special Format	20
Annex A (informative) Blocking transmission method	21
Annex B (informative) Synchronization Issues	23
Annex C (informative) Catching up in Non-Blocking Transmission method	25
Bibliography	26
Figure 1 – Isochronous packet header	7
Figure 2 – Common isochronous packet (CIP) format	8
Figure 3 – Non-blocking transmission method	10
Figure 4 – Transmission parameters	11
Figure 5 – Cluster events	12
Figure 6 – Pack and cluster events	13
Figure 7 – Pack event with 24-bit event sequence	13
Figure 8 – Generic AM824 format	14
Figure 9 – IEC 60958 conformant data format	15
Figure 10 – Raw audio data format	16
Figure 11 – Alignment of 20-bit data in 24-bit field	16
Figure 12 – MIDI conformant data format	16
Figure 13 – "No Data" format	17

Figure 14 – 32-bit floating point data format	17
Figure 15 – 24-bit * 4 audio pack format.....	18
Figure 16 – Generic FDF definition.....	19
Figure 17 – FDF code for NO-DATA packet.....	20
Figure A.1 – Blocking transmission method	21

Table 1 – Isochronous packet header fields	8
Table 2 – CIP fields.....	8
Table 3 – Generic AM824 format.....	15
Table 4 – IEC 60958 conformant data format	15
Table 5 – Raw audio data format.....	16
Table 6 – MIDI conformant data format	17
Table 7 – Subformat and FDF allocations.....	18
Table 8 – DBS for AM824 and 32-bit floating point data	19
Table 9 – DBS for 24-bit x 4 audio pack	19
Table 10 – Event type (EVT) code definition.....	19
Table 11 – SFC (Nominal Sampling Frequency Code) definition.....	19
Table A.1 – TRANSFER_DELAY for differing values of STF	22

With NORM.COM: Click to view the full PDF for IEC 61883-6:2002

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

Part 6: Audio and music data transmission protocol

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard 61883-6 has been prepared by Technical Area 4: Digital system interfaces, 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
100/526/FDIS	100/569/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.

This publication replaces IEC/PAS 61883-6:1998

The committee has decided that the contents of this publication will remain unchanged until 31 October 2005. At this date, the publication will be

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

IEC 61883 consists of the following parts, under the general title *Consumer audio/video equipment – Digital interface*

- Part 1: General
- Part 2: SD-DVCR data transmission
- Part 3: HD-DVCR data transmission
- Part 4: MPEG2-TS data transmission
- Part 5: SDL-DVCR data transmission
- Part 6: Audio and music data transmission protocol
- Part 7: Transmission of Rec. ITU-R BO.1294 System B Transport 1.0

Withd 2021
IECNORM.COM: Click to view the full PDF of IEC 61883-6:2002

CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

Part 6: Audio and music data transmission protocol

1 Scope

This part of IEC 61883 describes a protocol for the transmission of audio and music data employing IEEE 1394, and specifies essential requirements for the application of the protocol.

This protocol can be applied to all modules or devices which have any kind of audio and/or music data processing, generation and conversion function blocks. This standard deals only with the transmission of audio and music data; the control, status and machine readable description of these modules or devices should be defined outside of this document according to each application area.

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 60958-1:1999, *Digital audio interface – Part 1: General*
- IEC 60958-3:1999, *Digital audio interface – Part 3: Consumer applications*
- IEC 60958-4:1999, *Digital audio interface – Part 4: Professional applications*
- IEC 61883-1, *Consumer audio/video equipment – Digital interface – Part 1: General*
- IEEE Std 754:1985, *Standard for Binary Floating-Point Arithmetic*
- IEEE Std 1394:1995, *Standard for a High Performance Serial Bus – Firewire*
- IEEE Std 1394A:2000, *Standard for a High Performance Serial Bus – Amendment 1*

3 Terms and definitions

For the purpose of this part of IEC 61883, the terms and definitions given in IEC 61883-1 apply, together with the following.

3.1.1

32-bit floating-point data

data type which is defined in IEEE 754:1985, Standard for Binary Floating-Point Arithmetic.

3.1.2

A/M Protocol

protocol for the transmission of audio and music data over IEEE 1394

3.1.3

MIDI

Musical Instrument Digital Interface

NOTE The Complete MIDI 1.0 Detailed Specification, Version 96.1, March 1996a, is a specification for the interconnection of digital music processing devices (e.g. keyboards, signal processors) and computers.

3.1.4**music data**

data generally used for controlling a tone generator

NOTE The data defined in the MIDI specification, which may be called MIDI data, are an example of music data.

3.1.5**reserved**

keyword used to describe objects - bit, byte, quadlet, octet, and field - or the code values assigned to these objects; the object or the code value is set aside for future standardization by the IEC

3.1.6**stream**

uni-directional data transmission

3.1.7**time stamp**

quantized timing in which an event occurs based on a reference clock

NOTE The reference clock is CYCLE_TIME unless otherwise specified in this standard.

4 Transport requirements**4.1 Arbitrated short bus reset**

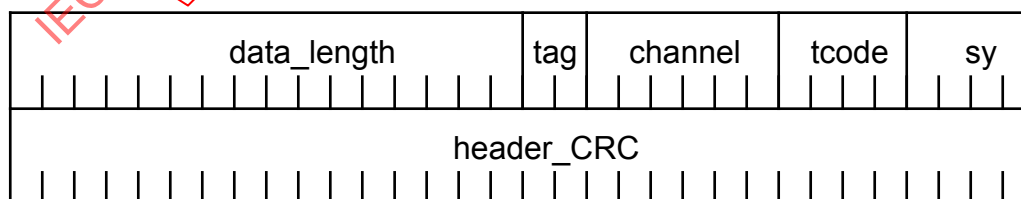
All modules or devices which implement this A/M Protocol should have the capability of "arbitrated short bus reset" in order to prevent the interruption of audio and music data transmission when a bus reset occurs.

4.2 Bit, byte, and quadlet ordering

This document adopts the ordering of bit, byte, and quadlet for bus packets in accordance with the IEEE 1394 standard.

5 Packet header for audio and music data**5.1 Isochronous packet header format**

The header for an isochronous packet which conforms to the A/M Protocol shall have the same format given in Figure 1, which is part of the isochronous packet format defined in IEEE 1394: 1995.



IEC 2358/02

Figure 1 – Isochronous packet header

The isochronous packet header fields are defined with unique values that are specified in Table 1.

Table 1 – Isochronous packet header fields

Field	Value	Comments
tag	01 b	This value indicates that a CIP header is included in the packet.
tcode	A ₁₆	This value indicates that this is an isochronous data packet.
sy	xx	This field is reserved. The transmitter shall set this field to 0 ₁₆ unless specified by another application.

5.2 CIP header format

IEC 61883-1 defines a two-quadlet CIP header for a fixed length source packet with SYT field, repeated here for clarity as Figure 2. The CIP header format for an isochronous packet which conforms to the Audio and music data transmission protocol shall use this CIP header.

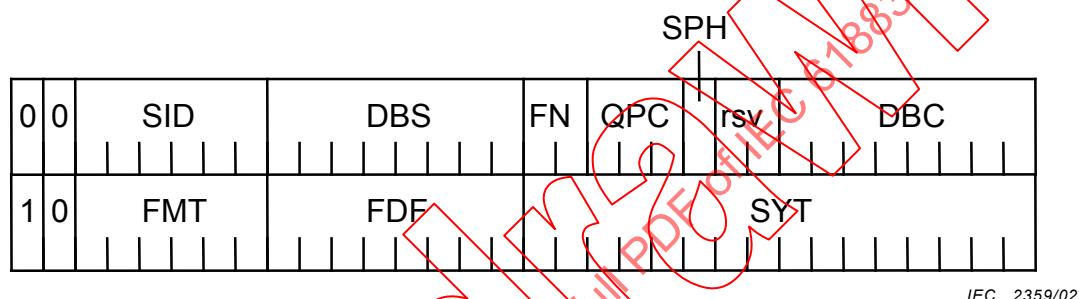


Figure 2 – Common isochronous packet (CIP) format

Table 2 defines the fields with unique values that are specified by this protocol.

Table 2 – CIP fields

Field	Value	Comments
FMT	10 ₁₆	This value indicates that the format is for Audio and Music.
FN	0 ₁₆	
QPC	0 ₁₆	
SPH	0 ₁₆	
SYT	xx	This field shall contain the time when the specified event is to be presented at a receiver.
FDF	xx	This field is defined in Clause 7.

6 Packetization

6.1 Packet transmission method

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

- a) In order to minimize TRANSFER_DELAY, the condition of a non-empty CIP being ready for transmission is defined to be true if one or more data blocks have arrived within an *isochronous cycle*. This transmission method is called Non-Blocking transmission, and is described in detail in 6.4
- b) The condition of “non-empty CIP ready” 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 Annex A.

6.2 Transmission of timing information

A CIP without a source packet header (SPH) has only one time stamp in the SYT field. If a CIP contains multiple data blocks, it is necessary to specify which data block of the CIP corresponds to the time stamp.

The transmitter prepares the time stamp for the data block which meets this condition:

$$\text{mod}(\text{data block count}, \text{SYT_INTERVAL}) = 0 \quad (1)$$

where

data block count is running count of transmitted data blocks;
SYT_INTERVAL denotes the number of data blocks between two successive valid SYTs, which includes one of the data blocks with a valid SYT. For example, if there are three data blocks between two valid SYTs, then the SYT_INTERVAL would be 4.

The receiver can derive the index value from the DBC field of a CIP with a valid SYT using the following formula:

$$\text{index} = \text{mod}((\text{SYT_INTERVAL} - \text{mod}(\text{DBC}, \text{SYT_INTERVAL})), \text{SYT_INTERVAL}) \quad (2)$$

where

index is the sequence number;
SYT_INTERVAL denotes the number of data blocks between two successive valid SYTs, which includes one of the data blocks with a valid SYT;
DBC is the data block count field of a CIP.

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

6.3 Time stamp processing

A data block contains all data arriving at the transmitter within an audio sample period. The data block contains all data which makes up an “event”.

The transmitter shall specify the presentation time of the event at the receiver. A receiver for professional use shall have the capability of presenting events at the time specified by the transmitter. A consumer-use or cost-sensitive receiver is not required to support this presentation-time adjustment capability.

If a function block receives a CIP, processes it and subsequently re-transmits it, the SYT of the outgoing CIP shall be the sum of the incoming SYT and the processing delay.

The transmitter shall add $TRANSFER_DELAY$ to the quantized timing of an event to construct the SYT. The $TRANSFER_DELAY$ value is initialized with the $DEFAULT_TRANSFER_DELAY$ value. For professional use, $TRANSFER_DELAY$ may be changed to achieve a shorter $TRANSFER_DELAY$ value, according to the bus configuration. Products for consumer use are not required to support the modification of $TRANSFER_DELAY$.

The $DEFAULT_TRANSFER_DELAY$ value is $354,17 + 125 \mu s$, which accommodates the maximum latency time of CIP transmission through an arbitrated short bus reset.

6.4 Transmission control

Figure 3 illustrates the non-blocking transmission method.

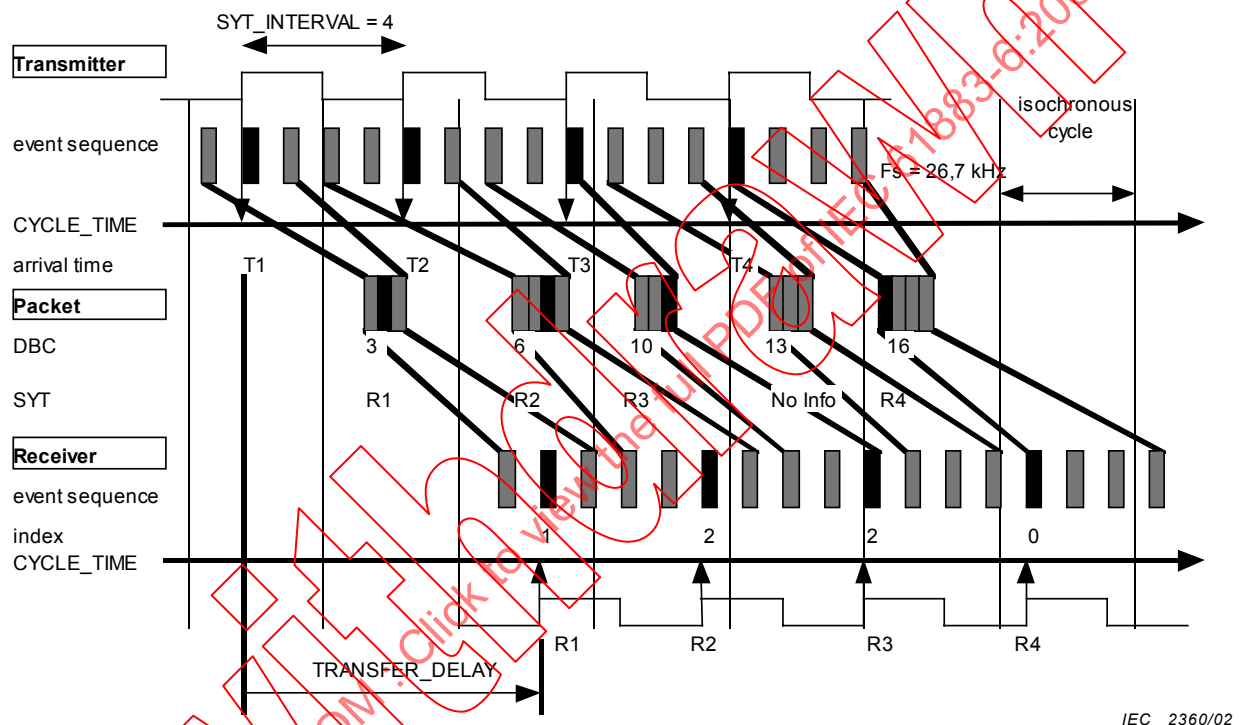


Figure 3 – Non-blocking transmission method

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

$$0 \leq N \leq SYT_INTERVAL \quad (3)$$

where

N is the number of events in the packet;

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

$$Packet_arrival_time_L \leq Event_arrival_time[0] + TRANSFER_DELAY \quad (4)$$

$$Event_arrival_time[N-1] \leq Packet_arrival_time_F \quad (5)$$

where

$Packet_arrival_time_F$ is the time (measured in μs) when the first bit of the packet arrives at the receiver;

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

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

Figure 4 illustrates the transmission control rules as described in this clause.

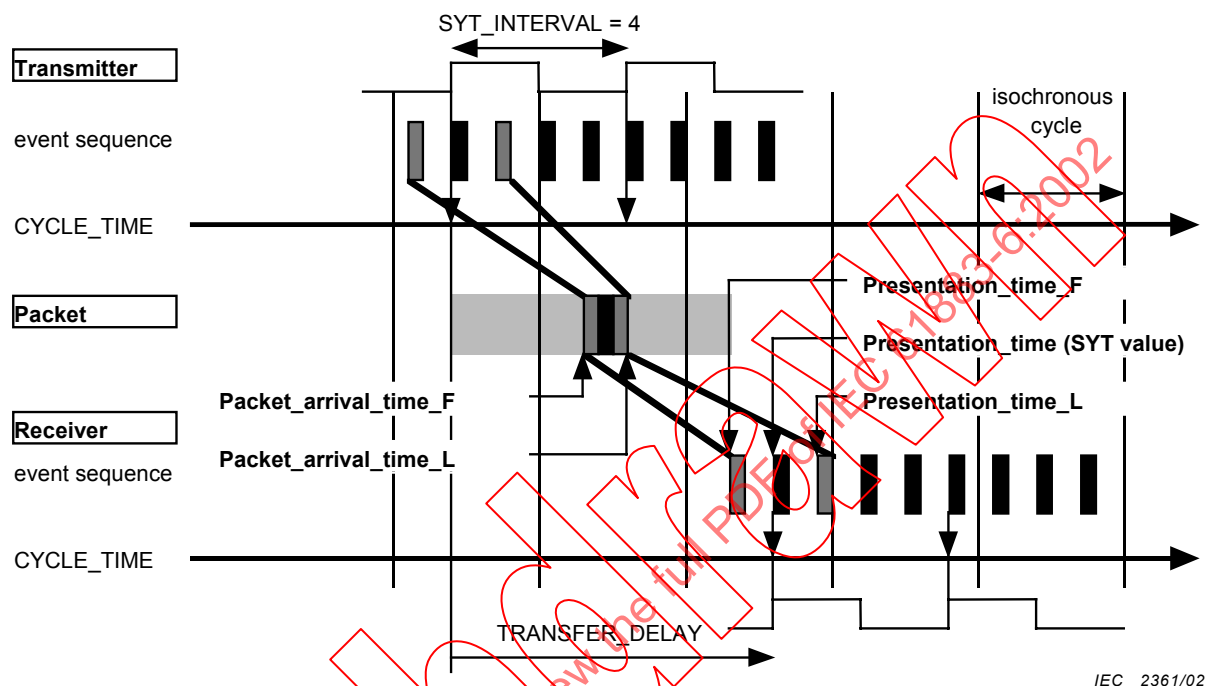


Figure 4 – Transmission parameters

In the event of lost opportunities to transmit non-blocking packets, a method of catching up may be provided. Refer to Annex C.

7 Event Types

7.1 General

All the subformats described in this standard shall use only 32-bit aligned events.

If multiple event sequences are synchronized, it is possible to convert the sequences into a single event which consists of an ordered collection of those sequences which occurred at the same time. The ordered collection is called a *cluster*. A cluster consists of ordered *units*. In the case of *data*, a unit consists of a single sequence. In the case of a *pack*, the unit may consist of several sequences packed together. The number of units in a single cluster is called the *dimension*, and is denoted by CLUSTER_DIMENSION. Figure 5 illustrates these concepts.

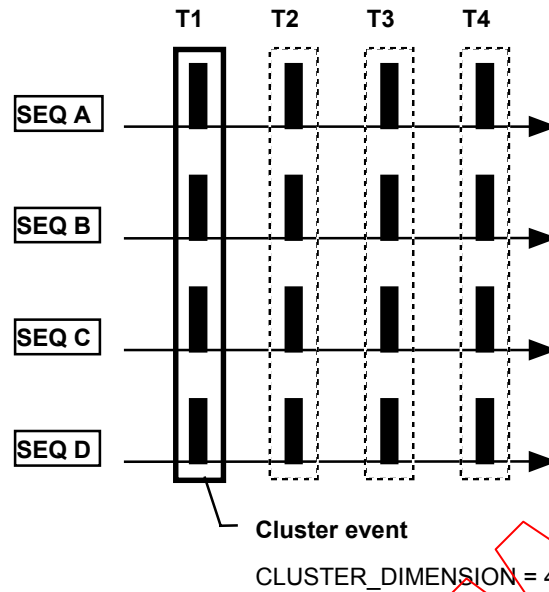


Figure 5 – Cluster events

In order to efficiently cluster non-32-bit aligned sequences which occur at the same time, the *pack* event type is defined. For example, four events of 24-bit data can be collected into a pack of three quadlets.

An event which is neither a cluster nor a pack is simply called *data*.

Only the pack and data types can be combined into *units* to make a *cluster*. All events in a *cluster* shall be of the same type.

UNIT_SIZE is the number of quadlets in a unit.

UNIT_DIMENSION is the number of sequences in a unit.

The UNIT_DIMENSION of data is always 1.

Figure 6 illustrates pack and cluster events.



Pack event (24-bit x 4)

UNIT_DIMENSION = 4

UNIT_SIZE = 3

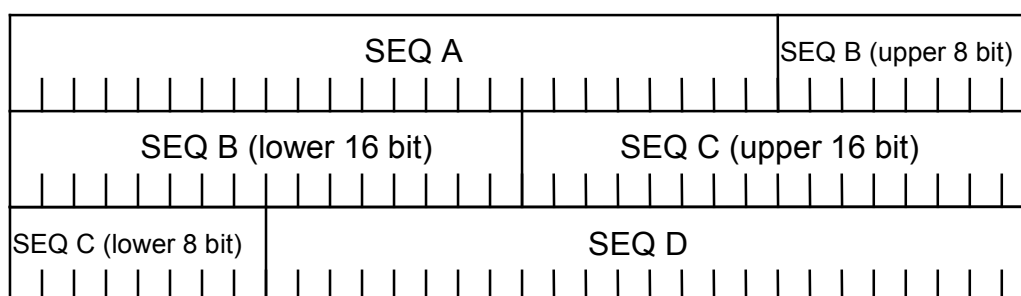
Cluster event

CLUSTER_DIMENSION = 2

IEC 2363/02

Figure 6 – Pack and cluster events

Figure 7 illustrates the structure of a pack which consists of four 24-bit event sequences (UNIT_DIMENSION = 4, UNIT_SIZE = 3).



IEC 2364/02

Figure 7 – Pack event with 24-bit event sequence

Since the cluster is an abstract event, only pack or data shall be specified as an event type for a subformat. However, the DBS shall reflect the size in quadlet of all cluster events in a data block. In case of a clustered sequence:

$$DBS = \sum_{n=0}^{(clusters-1)} (Unit_Size_n \times CLUSTER_DIMENSION_n) \quad (6)$$

where

clusters is the number of clusters in the event;
Unit_Size_n is the number of quadlets per unit of the *nth* cluster;
CLUSTER_DIMENSION_n is the number of units per cluster of the *nth* cluster.

Generally the number of elementary sequences in a CIP is given by the following:

$$number\ of\ sequences = DBS \times UNIT_DIMENSION / UNIT_SIZE \quad (7)$$

For the pack illustrated in Figures 6 and 7, DBS = 6, CLUSTER_DIMENSION = 2, UNIT_DIMENSION = 4, UNIT_SIZE = 3.

The number of successive events in a CIP is equal to the number of Data Blocks in a CIP and given by:

$$NEVENTS_SUCCESSIVE = (data_length / 4 - CIPH_SIZE) / DBS \quad (8)$$

where

data_length size of the payload of an isochronous packet (in byte);
CIPH_SIZE size of the CIP header (in quadlet).

The ordering of sequences in an event is application-specific and is not within the scope of this standard. For example, the identification of audio channels in a multichannel transmission will be defined elsewhere.

7.2 AM824 Data

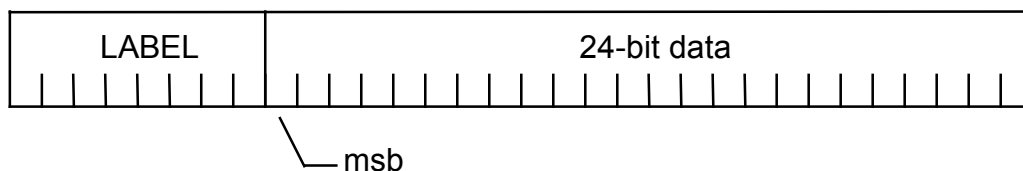
A 32-bit data consisting of an 8-bit label and 24-bit data are called AM824 data.

7.2.1 Generic Format

(see Figure 8 and Table 3)

UNIT_SIZE = 1 quadlet/unit

UNIT_DIMENSION = 1 sequence/unit



IEC 2365/02

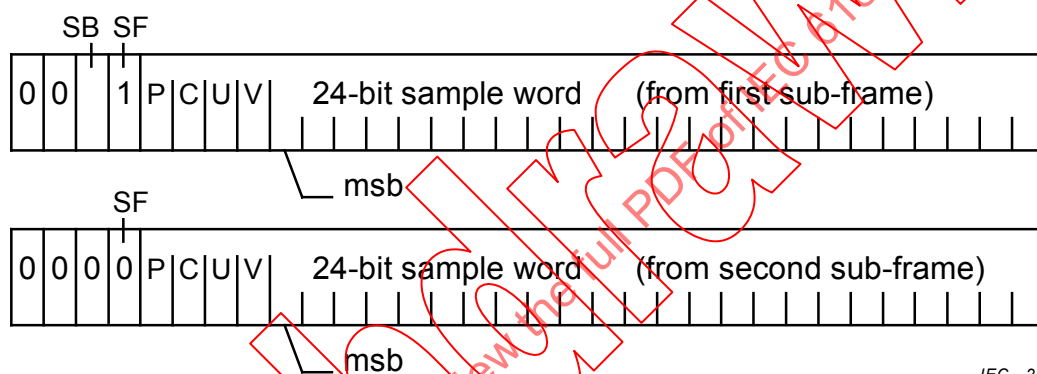
Figure 8 – Generic AM824 format

Table 3 – Generic AM824 format

LABEL definition	
Value	Description
00 ₁₆ - 3F ₁₆	IEC 60958 conformant
40 ₁₆ - 43 ₁₆	Raw audio
44 ₁₆ - 7F ₁₆	Reserved
80 ₁₆ - 83 ₁₆	MIDI conformant
84 ₁₆ - FF ₁₆	Reserved

A receiver capable of processing AM824 data shall check the label for each AM824 data in a sequence being received.

7.2.2 IEC 60958 conformant data



IEC 2366/02

Figure 9 – IEC 60958 conformant data format**Table 4 – IEC 60958 conformant data format**

SB (Start of Block) and SF (Start of Frame) definitions				
LABEL	SB	SF	Description	Equivalent IEC 60958 preamble codes
00 ₁₆ - 0F ₁₆	0	0	Second subframe of IEC 60958 frames 0 to 191	W,Y
10 ₁₆ - 1F ₁₆	0	1	First subframe of IEC 60958 frames 1 to 191	M,X
20 ₁₆ - 2F ₁₆	1	0	Reserved	-
30 ₁₆ - 3F ₁₆	1	1	First subframe of IEC 60958 frame 0	B,Z

All information defined in IEC 60958 is mapped into the data format shown in Figure 9 and Table 4. For each IEC 60958 frame, both sub-frames shall be transmitted together in the same event. The corresponding quadlets may be consecutive or non-consecutive. If multiple IEC 60958 streams are transmitted, then their sub-frames shall not be interleaved. Applications which use this data type shall follow IEC 60958.

7.2.3 Raw audio data

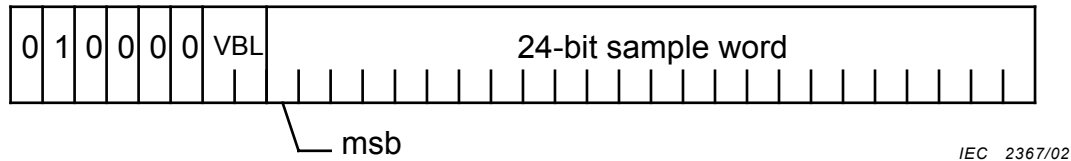


Figure 10 – Raw audio data format

Table 5 – Raw audio data format

VBL (Valid Bit Length code) definition	
Value (binary)	Description
00	24 bit
01	20 bit
10	16 bit
11	Reserved

The audio data shall be expressed in 24-bit 2's complement format. If the data active word length is less than 24 bit, the correct number of zero bit shall be padded below the least significant bit to make a 24-bit data structure.

For example, a 20-bit audio data shall be placed in a 24-bit field as shown in Figure 11 and Table 5 (note the four zero pad bit at the right end of the structure):

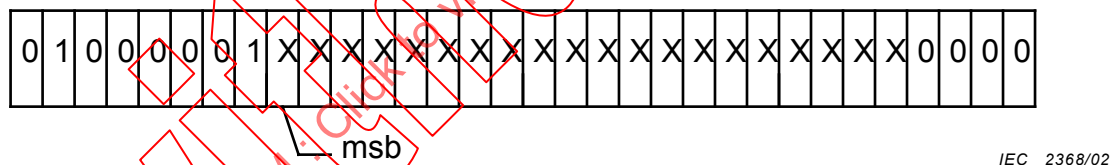


Figure 11 – Alignment of 20-bit data in 24-bit field

NOTE For audio data word lengths of less than 24 bit, the VBL indication can be used by receivers to determine if the data can be truncated to less than 24 bit without changing the value. If the word length is not known or is variable, the data should be aligned at the most significant bit and the VBL code for 24 bit indication should be used.

7.2.4 MIDI Conformant Data

(see Figure 12 and Table 6)



Figure 12 – MIDI conformant data format

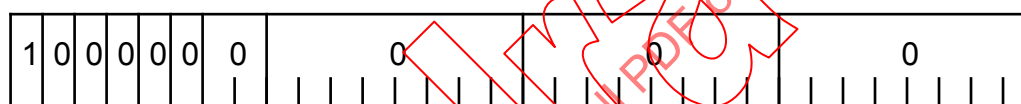
Table 6 – MIDI conformant data format

C (Counter) definition	
Value (decimal)	Description
0	No Data (Byte 1 = Byte 2 = Byte 3 = 0)
1	Byte 1 is valid
2	Byte 1 and 2 are valid
3	Byte 1, 2 and 3 are valid

If the CIP carries only MIDI conformant data or cluster, and there are no MIDI data to be packed into a CIP, the packet should be an empty packet rather than a packet of all "No Data" codes.

The "No Data" code defined in MIDI conformant data may be used as "No Data" for other AM824 data types if necessary. The usage of "No Data" described above should be applied to the AM824 data types which use "No Data".

Figure 13 illustrates the “No Data” structure.



IEC 2370/02

Figure 13 – "No Data" format

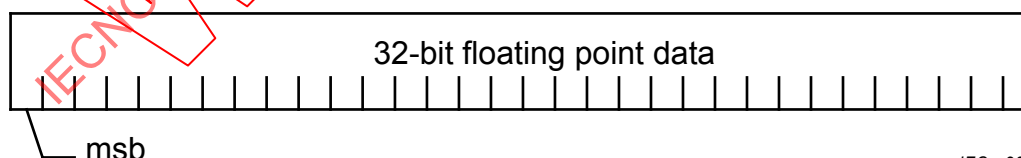
Successful implementation of MIDI conformant data may require additional information. Attention is drawn to 1394 Trade Association document 2001003: *Audio and Music Data Transmission Protocol 2.0*, and MMA/AMEI Recommended Practice 027.

7.3 32-bit floating point data

UNIT SIZE = 1 quadlet/unit

~~UNIT_DIMENSION = 1 sequence/unit~~

Figure 14 illustrates the structure of 32-bit floating point data.



IEC 2371/02

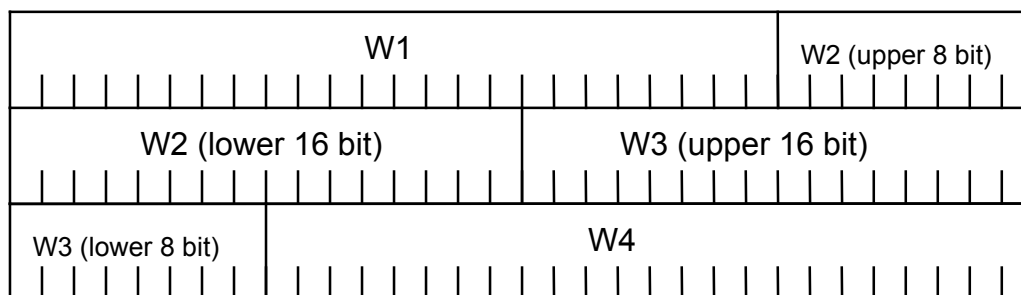
Figure 14 – 32-bit floating point data format

7.4 24-bit x 4 Audio Pack

UNIT SIZE = 3 quadlet/unit

UNIT_DIMENSION = 4 sequences/unit

Figure 15 illustrates the structure of a 24-bit x 4 audio pack.



IEC 2372/02

Figure 15 – 24-bit * 4 audio pack format

W1, W2, W3, W4: 24-bit raw audio data

The audio data shall be expressed in 24-bit 2's complement. In case of less than 24 bit, the correct number of zero bit shall be padded below the least significant bit to make a 24-bit data structure. For an example of this, refer to 7.2.3.

8 Subformat

Table 7 defines the subformat and format dependent field (FDF) allocations.

Table 7 – Subformat and FDF allocations

FDF definition	
Value (binary)	Description
0000 0xxx	Basic format for AM824
0000 1xxx	Reserved
0001 0xxx	Basic format for 24-bit x 4 audio pack
0001 1xxx	Reserved
0010 0xxx	Basic format for 32-bit floating point data
0010 1xxx	Reserved
0011 0xxx	Reserved
0011 1xxx	Reserved
0100 0000	Reserved
...	...
1111 1110	Reserved
1111 1111	Packet for NO-DATA

Each subformat may use a “cluster” for synchronized multiple sequences unless otherwise specified.

8.1 Basic format

(see Tables 8 to 11)

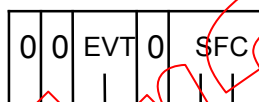
Table 8 – DBS for AM824 and 32-bit floating point data

DBS for AM824 data and 32-bit floating point data	
Value (decimal)	Description
0	CLUSTER_DIMENSION = 256
1 - 255	CLUSTER_DIMENSION = DBS

Table 9 – DBS for 24-bit x 4 audio pack

DBS for 24-bit x 4 audio pack	
Value (decimal)	Description
3 - 255	CLUSTER_DIMENSION = DBS/3

Figure 16 illustrates a generic FDF definition.

**Figure 16 – Generic FDF definition****Table 10 – Event type (EVT) code definition**

EVT code definition	
Value (decimal)	Description
0	AM824 Data
1	24-bit x 4 audio pack
2	32-bit floating point data
3	Reserved

Table 11 – SFC (Nominal Sampling Frequency Code) definition

SFC definition		
Value (decimal)	Sample transmission frequency	SYT_INTERVAL
0	32 kHz	8
1	44,1kHz	8
2	48 kHz or not indicated	8
3	88,2 kHz	16
4	96 kHz or not indicated	16
5	176,4 kHz	32
6	192 kHz or not indicated	32
7	Reserved	

If a packet of AM824 data contains only IEC 60958 conformant data and a transmitter functions as a gateway, the transmitter should estimate the sample transmission frequency for the SFC rather than copying the sampling frequency code embedded in the original IEC 60958 data.

Equation 9 can be used to determine the required bus bandwidth allocation. The required isochronous bandwidth is given below:

$$BW = (\text{int}(\max(F_s) / 8000) + 1) \times \sum_{n=0}^{\text{clusters}-1} (\text{UNIT_SIZE}_n \times \text{CLUSTER_DIMENSION}_n) \times 8000 \quad (9)$$

where

BW	is the required isochronous bandwidth (in quadlet/s);
FS	is the sample rate (in Hz);
UNIT_SIZE_n	is the number of quadlet in a unit of the n th cluster;
$\text{CLUSTER_DIMENSION}_n$	is the number of units in the n th cluster;
CLUSTERS	is the number of clusters in an event.

8.2 Special Format



IEC 2374/02

Figure 17 – FDF code for NO-DATA packet

The transmitter shall use the FDF code shown in Figure 17 when a packet is a NO-DATA packet only for blocking transmission. The transmitter shall not use this FDF code for non-blocking transmission. The receiver shall ignore all the data in a CIP with this FDF code.

Annex A (informative)

Blocking transmission method

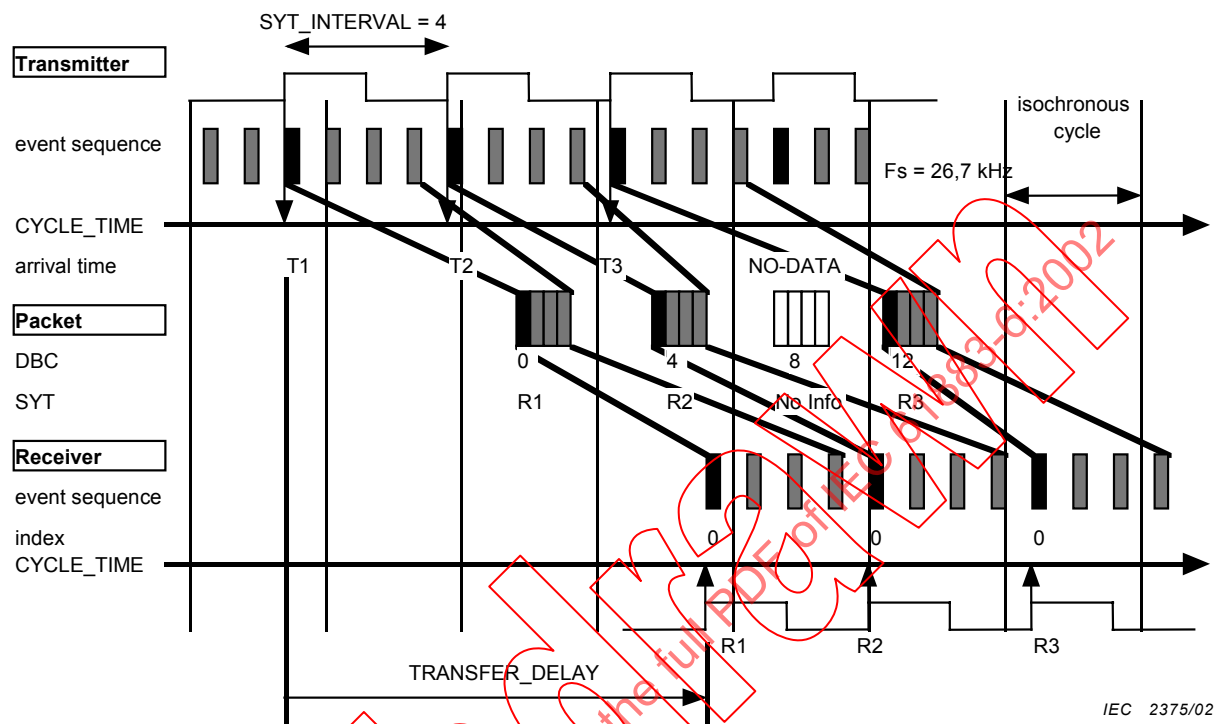


Figure A.1 – Blocking transmission method

The blocking method (see Figure A.1) may be used by a transmitter which has only the ability to transmit packets of the same size. In order to indicate "no data", the transmitter may transmit an empty packet or a special non-empty packet which has the "NO-DATA" code in its FDF and has the same size of dummy data as a non-empty packet. It is necessary for the transmitter to set the time stamp of the first data block in a packet.

For blocking, the duration of the successive events in a CIP must be added to `DEFAULT_TRANSFER_DELAY`.

If a CIP contains N audio samples of a stream at Sampling Transmission Frequency (STF), then:

$$TRANSFER_DELAY \geq DEFAULT_TRANSFER_DELAY + 1/STF \times N \times 1000 \quad (A.1)$$

where

<code>TRANSFER_DELAY</code>	is the latency of transmission;
<code>DEFAULT_TRANSFER_DELAY</code>	is the initialised value of <code>TRANSFER_DELAY</code> ;
<code>STF</code>	is the sampling transmission frequency;
N	is the number of audio samples in a CIP

The `TRANSFER_DELAY` for each STF when `DEFAULT_TRANSFER_DELAY` = 479,17 µs is defined in Table A.1.

Table A.1 – TRANSFER_DELAY for differing values of STF

STF	TRANSFER_DELAY
32 kHz	$479,17 + 250,00 = 729,17 \text{ } [\mu\text{s}]$
44,1 kHz	$479,17 + 181,41 = 660,58 \text{ } [\mu\text{s}]$
48 kHz	$479,17 + 166,67 = 645,84 \text{ } [\mu\text{s}]$
88,2 kHz	$479,17 + 181,41 = 660,58 \text{ } [\mu\text{s}]$
96 kHz	$479,17 + 166,67 = 645,84 \text{ } [\mu\text{s}]$
176,4 kHz	$479,17 + 181,41 = 660,58 \text{ } [\mu\text{s}]$
192 kHz	$479,17 + 166,67 = 645,84 \text{ } [\mu\text{s}]$
Reserved	Not defined

IECNORM.COM: Click to view the full PDF of IEC 61883-6:2002

Withd2Wm

Annex B (informative)

Synchronization Issues

The following synchronization issues have been identified:

- a) rate matching between the transmitter and receiver;
- b) adjusting the presentation time at a receiver;
- c) adjusting the location at a transmitter.

This annex focuses on rate matching in terms of sampling clock delivery, which is very familiar to audio engineers. It only applies for real time transfer which occurs when the sample transmission frequency is used to define the sampling frequency.

Since a CIP without a source packet header (SPH) has only one time stamp in the SYT field, the maximum synchronization clock frequency has to be limited to the isochronous cycle of 8 kHz.

Delivery of sampling clock of arbitrary frequency

Assume that a transmitter carries an audio stream with sampling frequency STF and that $STF > 8$ kHz.

The transmitter derives a "synchronization clock" with frequency F_{sync} according to the equation B.1:

$$F_{sync} = STF / SYT_INTERVAL \leq 8\,000 \quad (B.1)$$

where

F_{sync} is the synchronization clock frequency (in Hz);
 STF is the sampling transmission frequency (in Hz);
 $SYT_INTERVAL$ denotes the number of events between two successive valid SYTs, which includes one of the events with a valid SYT.

The transmitter quantizes the timing of the "synchronization clock", for instance the rising edge of the clock, by referring to its own CYCLE_TIME. It transmits the sum of the timing and TRANSFER_DELAY by using the SYT field of the CIP. The resolution of the time stamp is 1/(24,576 MHz), or approximately 40 ns, and CYCLE_TIME may have 40 ns of jitter due to this quantization. If the timing information is not available for a CIP, the SYT has to indicate the "No Information" code.

A receiver can reproduce the "synchronization clock" in terms of the pulse generated when the SYT equals its own CYCLE_TIME.

The sampling clock can be reproduced by multiplying the "synchronization clock" by the SYT_INTERVAL, which must be determined before receiving begins.

This sampling clock delivery does not require synchronization of the sampling clock and the isochronous cycle.

The reproduced synchronisation clock will have jitter. This jitter can degrade audio quality unless adequate jitter attenuation is used.