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Digital audio interface –
Part 1: General

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INTERNATIONAL
ELECTROTECHNICAL
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIGITAL AUDIO INTERFACE –

Part 1: General

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IEC 60958-1, edition 2 has been prepared by Technical Area 4, Digital system interfaces, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition of IEC 60958-1 cancels and replaces the first edition published in 1999 and constitutes a technical revision.

All changes introduced in this second edition of IEC 60958-1 intend to clarify the structure and the relationship between all of IEC 60958 series families.

A brief list of changes include:

- Annex B has been added to explain the definition given in 5.3 with relation of the families of the IEC 60958 series. Clause 5.3 is also added to this description.
- Annex C has been added to explain the relationship of the IEC 60958 series families.
- Annex D has been added as an explanation for a data transmission other than linear PCM.
- Subclause 5.4 has been added to define category code appliance.
- A Bibliography has been added.

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

CDV	Report on voting
100/552/CDV	100/755/RVC

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.

IEC 60958 consists of the following parts under the general title *Digital audio interface*:

Part 1: General

Part 3: Consumer applications

Part 4: Professional applications

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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- withdrawn;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

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

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DIGITAL AUDIO INTERFACE –

Part 1: General

1 Scope

This part of IEC 60958 describes a serial, uni-directional, self-clocking interface for the interconnection of digital audio equipment for consumer and professional applications.

It specifies the basic structure of the interface. Separate documents define items specific to particular applications.

The interface is primarily intended to carry monophonic or stereophonic programmes, encoded using linear PCM and with a resolution of up to 24 bits per sample.

When used for other purposes, the interface is able to carry audio data coded other than as linear PCM coded audio samples. Provision is also made to allow the interface to carry data related to computer software or signals coded using non-linear PCM. The format specification for these applications is not part of this standard.

The interface is intended for operation at audio sampling frequencies of 32 kHz and above. Auxiliary information is transmitted along with the programme.

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 60958-3, *Digital audio Interface – Part 3: Consumer applications*

IEC 60958-4, *Digital audio Interface – Part 4: Professional applications*

3 Terms and definitions

For the purpose of all parts of the IEC 60958 series, the following terms and definitions apply.

3.1

sampling frequency

frequency of the samples representing an audio signal

NOTE When more than one signal is transmitted through the same interface, the sampling frequencies are identical.

3.2

audio sample word

value of a digital audio sample. Representation is linear in 2s complement binary form

NOTE Positive numbers correspond to positive analogue voltages at the input of the Analogue-to-Digital Converter (ADC).

3.3

auxiliary sample bit

one of the four least significant bits (LSBs) that can be assigned as auxiliary sample bits and used for auxiliary information when the number of audio sample bits in the main data field is less than or equal to 20

3.4

validity bit

bit indicating whether the main data field bits in the sub-frame (time slots 4 to 27 or 8 to 27, depending on the audio word length as described in 4.1.1) are reliable or not

3.5

channel status

carrier, in a fixed format, of information associated with each main data field channel which is decodable by any interface user

NOTE Examples of information to be carried in the channel status are: length of audio sample words, pre-emphasis, sampling frequency, time codes, alphanumeric source and destination codes.

3.6

user data

data channel provided to carry any other information

3.7

parity bit

bit provided to permit the detection of an odd number of errors resulting from malfunctions in the interface

3.8

preamble

specific patterns used for synchronization

NOTE There are three different preambles (see 4.3).

3.9

sub-frame

fixed structure used to carry information (see 4.1.1 and 4.1.2)

3.10

frame

sequence of two successive and associated sub-frames

3.11

block

group of 192 consecutive frames

NOTE The start of a block is designated by a special sub-frame preamble (see 4.3).

3.12

channel coding

coding method by which the binary digits are represented for transmission through the interface

3.13

unit interval

UI

shortest nominal time interval in the coding scheme

NOTE There are 128 UI in a sample frame.

3.14 interface jitter

deviation in the timing of interface data transitions (zero crossings) when compared with an ideal clock

3.15 intrinsic jitter

output interface jitter of a device that is either free-running or is synchronized to a jitter-free reference

3.16 jitter gain

ratio of the amplitude of jitter components at the output, to their amplitude at the synchronization input to the device under test

4 Interface format

4.1 Structure of format

4.1.1 Sub-frame format

Each sub-frame is divided into 32 time slots, numbered from 0 to 31 (see Figure 1).

Time slots 0 to 3 (preambles) carry one of the three permitted preambles (see 4.1.2 and 4.3; see also Figure 2).

Time slots 4 to 27 (main data field) carry the audio sample word in linear 2's complement representation. The most significant bit (MSB) is carried by time slot 27.

When a 24-bit coding range is used, the LSB is in time slot 4 (see Figure 1).

When a 20-bit coding range is used, time slots 8 to 27 carry the audio sample word with the LSB in time slot 8. Time slots 4 to 7 may be used for other applications. Under these circumstances, the bits in the time slots 4 to 7 are designated auxiliary sample bits (see Figure 1).

If the source provides fewer bits than the interface allows (either 20 or 24), the unused LSBs are set to a logical "0".

For a non-linear PCM audio application or a data application, the main data field may carry any other information.

Time slot 28 (validity bit) carries the validity bit associated with the main data field (see 4.4).

Time slot 29 (user data bit) carries 1 bit of the user data channel associated with the main data field channel transmitted in the same sub-frame.

NOTE 1 For the applications, refer to the other parts of the IEC 60958 series.

Time slot 30 (channel status bit) carries 1 bit of the channel status information associated with the main data field channel transmitted in the same sub-frame.

NOTE 2 For details refer to the other parts of the IEC 60958 series.

Time slot 31 (parity bit) carries a parity bit such that time slots 4 to 31 inclusive carry an even number of ones and an even number of zeros (even parity).

NOTE 3 The preambles have even parity as an explicit property.

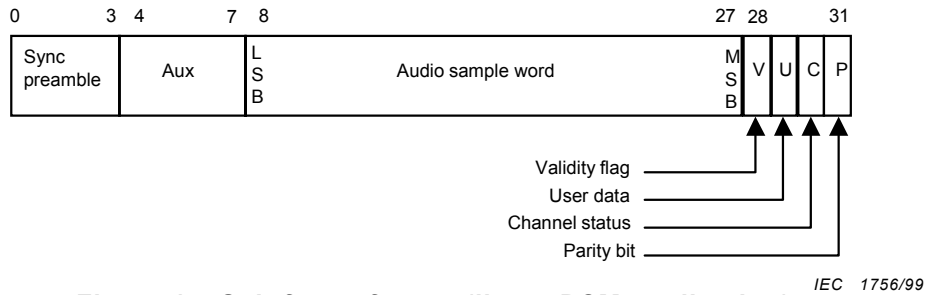


Figure 1 – Sub-frame format (linear PCM application)

4.1.2 Frame format

A frame is uniquely composed of two sub-frames (see Figure 2). For linear coded audio applications, the rate of transmission of frames normally corresponds exactly to the source sampling frequency.

In 2-channel operation mode, the samples taken from both channels are transmitted by time multiplexing in consecutive sub-frames. The first sub-frame (left or "A" channel in stereophonic operation and primary channel in monophonic operation) normally starts with preamble "M". However, the preamble changes to preamble "B" once every 192 frames to identify the start of the block structure used to organize the channel status information. The second sub-frame (right or "B" channel in stereophonic operation and secondary channel in monophonic operation) always starts with preamble "W".

In single channel operation mode in a professional application, the frame format is the same as in the 2-channel mode. Data is carried in the first sub-frame and may be duplicated in the second sub-frame. If the second sub-frame is not carrying duplicate data, time slot 28 (validity flag) shall be set to logical "1".

NOTE For historical reasons, preambles "B", "M" and "W" are, for use in professional applications, referred to as "Z", "X" and "Y", respectively.

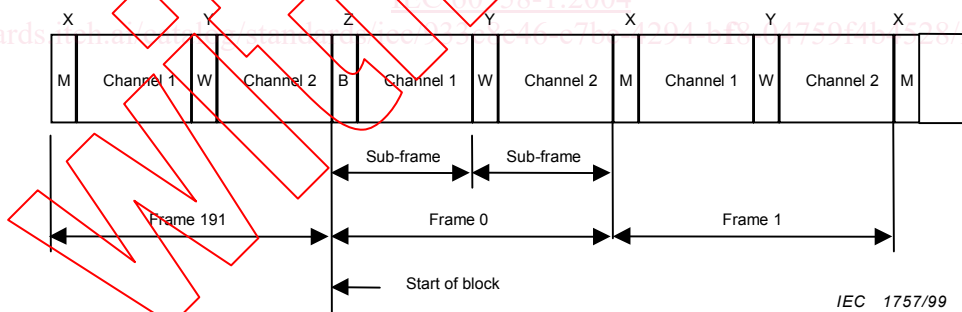


Figure 2 – Frame format

4.2 Channel coding

To minimize the direct current (DC) component on the transmission line, to facilitate clock recovery from the data stream and to make the interface insensitive to the polarity of connections, time slots 4 to 31 are encoded in biphase-mark.

Each bit to be transmitted is represented by a symbol comprising two consecutive binary states. The first state of a symbol is always different from the second state of the previous symbol. The second state of the symbol is identical to the first if the bit to be transmitted is logical "0". However, it is different if the bit is logical "1" (see Figure 3).