INTERNATIONAL STANDARD

IEC 60958-3

Second edition
2003-01

withdrawn

Digital audio interface –

Part 3: Consumer applications

Interface audionumérique –

Partie 3: Applications grand public

Reference number
IEC 60958-3:2003(E)

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Full document details: IEC 60958-3 2003

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.

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PRICE CODE X

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CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 6
4 Interface format 6
5 Channel status 7
5.1 General 7
5.2 Application 7
5.3 Copyright management guidelines for consumer application of the digital audio interface 13
6 User data 17
6.1 General 17
6.2 Application 17
7 Electrical and optical requirements 20
7.1 General 20
7.2 Timing accuracy 20
7.3 Unbalanced line 21
7.4 Optical connection 24

Annex A (normative) Application of the digital audio interface in the compact disc digital audio system 25
Annex B (normative) Application of the digital interface in the 2-channel PCM encoder/decoder 27
Annex C (normative) Application of the digital interface in the 2-channel digital audio tape recorder in the consumer mode 28
Annex D (normative) Application of the digital interface in laser optical digital audio systems for which no other category code is defined 32
Annex E (normative) Application of the digital interface in a digital audio mixer in the consumer mode 33
Annex F (normative) Application of the digital interface with a sampling rate converter in the consumer mode 34
Annex G (normative) Application of the digital interface with a digital sound sampler in the consumer mode 35
Annex H (normative) Application of the digital interface in a digital broadcast receiver (Japan) in the consumer mode 36
Annex J (normative) Application of the digital interface in a digital broadcast receiver (Europe) in the consumer mode 37
Annex K (normative) Application of the digital interface in a digital broadcast receiver (USA) in the consumer mode 38
Annex L (normative) Application of the digital interface for electronic software delivery in the consumer mode 39
Annex M (normative) Application of the digital interface in the digital compact cassette system in the consumer mode 40
Annex N (normative) Application of the digital interface in the mini disc system in the consumer mode 45
Annex O (normative) Application of the digital interface in a digital sound processor in the consumer mode 46

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60958-3 2003

Annex P (normative) Application of the digital interface in the digital versatile disc system (DVD) in the consumer mode 47
Annex Q (informative) The use of original sampling frequency, sampling frequency and clock accuracy 48

Figure 1 – Example of message structure using information units 17
Figure 2 – First UI contents 18
Figure 3 – Second UI contents 19
Figure 4 – Third UI contents 19
Figure 5 – User information 19
Figure 6 – Simplified example of the configuration of the circuit (unbalanced) 21
Figure 7 – Rise and fall times 22
Figure 8 – Intrinsic jitter measurement filter 22
Figure 9 – Eye diagram 23
Figure 10 – Receiver jitter tolerance template 24
Figure C.1 – Example of different combinations of start-ID and shortening-ID 31
Figure M.1 40
Figure M.2 41
Figure Q.1 – Player and interface model 48

Table 1– Channel status general format for consumer use 8
Table 2 – Mode 0 channel status format for consumer use 10
Table 3 – Category code groups 14
Table 4 – Category code groups for laser optical products 14
Table 5 – Category code groups for digital/digital converter and signal processing products 15
Table 6 – Category code groups for magnetic tape or magnetic disc based products 15
Table 7 – Category code groups for broadcast reception of digitally encoded audio with/without video signals 15
Table 8 – Category code groups for musical instruments, microphones and other sources that create original sound 16
Table 9 – Category code groups for A/D converters for analogue signals without copyright information 16
Table 10 – Category code groups for A/D converters for analogue signals with copyright information 16
Table 11 – Category code groups for solid state memory based products 16
Table A.1 – Example of 2-channel compact disc format 26
Table C.1 – Use of Cp-bit, L-bit and category code for DAT 28
Table C.2 – User data application in the DAT system 30
Table M.1 – Layout of message number “000000” 42
Table M.2 – Deck status codes 42
Table M.3 – ITTS packet extended message example 43
Table Q.1 – Term definition 48
Table Q.2 – Cases 49
Table Q.3 – Example 49

Withdrawn

Documents
Document Sharing Hub
Full document details: IEC 60958-3 2003

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DIGITAL AUDIO INTERFACE –

Part 3: Consumer applications

FOREWORD

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International Standard 60958-3 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 60958-3 cancels and replaces the first edition published in 1999 and constitutes a technical revision.

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

FDIS	Report on voting
100/559/FDIS	100/611/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.

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

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

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

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DIGITAL AUDIO INTERFACE –

Part 3: Consumer applications

1 Scope

This part of IEC 60958 specifies the consumer application of the interface for the interconnection of digital audio equipment defined in IEC 60958-1.

NOTE When used in a consumer digital processing environment, the interface is primarily intended to carry stereophonic programmes, with a resolution of up to 20 bits per sample, an extension to 24 bits per sample being possible.

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 60268-11:1987, *Sound system equipment – Part 11: Application of connectors for the interconnection of sound system components*

IEC 60841:1988, *Audio recording – PCM encoder/decoder system*

IEC 60908:1999, *Audio recording – Compact disc digital audio system*

IEC 60958-1, *Digital audio interface – Part 1: General*

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

IEC 61119-1:1992, *Digital audio tape cassette system (DAT) – Part 1: Dimensions and characteristics*

IEC 61119-6:1992, *Digital audio tape cassette system (DAT) – Part 6: Serial copy management system*

3 Terms and definitions

The terms and definitions given in IEC 60958-1 apply to this part of IEC 60958.

4 Interface format

The interface format as defined in IEC 60958-1 shall be used.

Unless otherwise specified in the annexes, the following specification is applicable:

- An audio sample word has a length of 20 bits/sample. The auxiliary sample bits are an optional expansion of the audio sample, if not used = “0”.
- User data is not used, all bits = “0”.
- Channel status is identical for both sub-frames of the interface, with the exception of the channel number, if that is not equal to zero.

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5 Channel status

5.1 General

For every sub-frame, the channel status bit provides information related to the audio channel that is carried in that same sub-frame.

Channel status information is organized in a 192-bit block, subdivided into 24 bytes, numbered 0 to 23 (see Table 1). The first bit of each channel status block is carried in the frame with preamble “B”.

The individual bits of a channel status block are numbered 0 to 191.

The primary application is indicated by channel status bit 0.

As stated in IEC 60958-1, for the consumer digital audio applications described in this standard, this first channel status bit equals “0”.

NOTE As stated in IEC 60958-1, for professional application this first channel status bit equals “1”.

Secondary applications may be defined within the framework of these primary applications.

5.2 Application

5.2.1 Channel status general format

For each channel, the channel status block provides the information described in this clause and summarized in Table 1.

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Table 1 – Channel status general format for consumer use

Byte		a = "0"	b	c	d			Mode	
0	bit	0	1	2	3	4	5	6	7
1	bit	8	9	10	11	12	13	14	15
2	bit	16	17	18	19	20	21	22	23
3	bit	24	25	26	27	28	29	30	31
4	bit	32	33	34	35	36	37	38	39
5	bit	40	41	42	43	44	45	46	47
6	bit	48	49	50	51	52	53	54	55
7	bit	56	57	58	59	60	61	62	63
8	bit	64	65	66	67	68	69	70	71
9	bit	72	73	74	75	76	77	78	79
10	bit	80	81	82	83	84	85	86	87
11	bit	88	89	90	91	92	93	94	95
12	bit	96	97	98	99	100	101	102	103
13	bit	104	105	106	107	108	109	110	111
14	bit	112	113	114	115	116	117	118	119
15	bit	120	121	122	123	124	125	126	127
16	bit	128	129	130	131	132	133	134	135
17	bit	136	137	138	139	140	141	142	143
18	bit	144	145	146	147	148	149	150	151
19	bit	152	153	154	155	156	157	158	159
20	bit	160	161	162	163	164	165	166	167
21	Bit	168	169	170	171	172	173	174	175
22	Bit	176	177	178	179	180	181	182	183
23	Bit	184	185	186	187	188	189	190	191

a: use of channel status block.
b: linear PCM identification.
c: copyright information.
d: additional format information.

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Byte 0: General control and mode information

Control:

Bit 0	"0"	Consumer use of channel status block. (see notes 1 and 2)

NOTE 1 The significance of byte 0, bit 0 is such that transmission from an interface conforming to IEC 60958-4 can be identified.

Bit 1	"0"	Audio sample word represents linear PCM samples. (see note 2)
	"1"	Audio sample word used for other purposes.

NOTE 2 The functions of channel status bits 0 and 1 are defined in IEC 60958-1.

Bit 2	"0"	Software for which copyright is asserted. (see note 3)
	"1"	Software for which no copyright is asserted.

NOTE 3 Bit 2 is referred to as the "Cp-bit". It should indicate whether copyright protection has been asserted.

The copyright status may be unknown for certain applications. The above interpretation is therefore not valid in combination with some category codes (as indicated in the annex associated with the category code). The Cp-bit can alternate between 0 and 1 at a rate between 4 Hz and 10 Hz (see Annex A).

Bits 3 to 5 Additional format information, meaning depends on bit 1.

When bit 1 = "0", linear PCM audio mode:

Bit	3 4 5	
State	"0 0 0"	2 audio channels without pre-emphasis.
	"1 0 0"	2 audio channels with 50 µs /15 µs pre-emphasis.
	"0 1 0"	Reserved (for 2 audio channels with pre-emphasis).
	"1 1 0"	Reserved (for 2 audio channels with pre-emphasis).

All other states of bits 3 to 5 are reserved and shall not be used until further defined.

NOTE 4 The single and dual channel operating modes are defined with the frame format in IEC 60958-1.

When bit 1 = "1", other than linear PCM applications:

Bit	3 4 5	
State	"0 0 0"	Default state for applications other than linear PCM.

All other states of bits 3 to 5 are reserved and shall not be used until further defined.

Bits 6 and 7 Channel status mode, indicates one of four possible channel status formats (bytes 1 to 23). There are four possible modes for each of the states of bit 1.

Bit	6 7	
State	"0 0"	Mode 0, refer to 5.2.2.

All other states of bits 6 and 7 are reserved and shall not be used until further defined.

The contents of bits 8 to 191 depend on the mode as indicated by bits 6 and 7. If not defined otherwise, the default value is "0".

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5.2.2 Mode 0 channel status format for digital audio equipment for consumer use

When the audio sample word represents linear PCM and the channel status mode is mode 0, the channel status format shown in Table 2 should be applied.

Table 2 – Mode 0 channel status format for consumer use

Byte									
0		a = "0"	b = "0"	c	d			Mode = "0 0"	
	bit	0	1	2	3	4	5	6	7
1		Category code							
	bit	8	9	10	11	12	13	14	15
2		Source number				Channel number			
	bit	16	17	18	19	20	21	22	23
3		Sampling frequency				Clock accuracy			
	bit	24	25	26	27	28	29	30	31
4		Word length				Original sampling frequency			
	bit	32	33	34	35	36	37	38	39
5									
	bit	40	41	42	43	44	45	46	47
6									
	bit	48	49	50	51	52	53	54	55
7									
	bit	56	57	58	59	60	61	62	63
8									
	bit	64	65	66	67	68	69	70	71
9									
	bit	72	73	74	75	76	77	78	79
10									
	bit	80	81	82	83	84	85	86	87
11									
	bit	88	89	90	91	92	93	94	95
12									
	bit	96	97	98	99	100	101	102	103
13									
	bit	104	105	106	107	108	109	110	111
14									
	bit	112	113	114	115	116	117	118	119
15									
	bit	120	121	122	123	124	125	126	127
16									
	bit	128	129	130	131	132	133	134	135
17									
	bit	136	137	138	139	140	141	142	143
18									
	bit	144	145	146	147	148	149	150	151
19									
	bit	152	153	154	155	156	157	158	159
20									
	bit	160	161	162	163	164	165	166	167
21									
	bit	168	169	170	171	172	173	174	175
22									
	bit	176	177	178	179	180	181	182	183
23									
	bit	184	185	186	187	188	189	190	191
		a: use of channel status block. b: linear PCM identification.				c: copyright information. d: additional format information.			

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Byte 0 as defined in 5.2.1, with:

Bit 1	"0"	Audio sample word represents linear PCM samples.
Bits 6 to 7	"0 0"	Mode 0.

Byte 1: Category code

The category code indicates the kind of equipment that generates the digital audio interface signal. See the relevant annexes for the assignments. Bit 8 = LSB, bit 15 = MSB.

Byte 2: Source and channel number

Bits 16 to 19	Source number, bit 16 = LSB, bit 19 = MSB.	
Bit	16 17 18 19	
State	"0 0 0 0"	Do not take into account.
	"1 0 0 0"	1
	"0 1 0 0"	2
	"1 1 0 0"	3
	.....	
	"1 1 1 1"	15

Bits 20 to 23	Channel number (audio channel), bit 20 = LSB, bit 23 = MSB.	
Bit	20 21 22 23	
State	"0 0 0 0"	Do not take into account.
	"1 0 0 0"	(left channel for stereo channel format).
	"0 1 0 0"	(right channel for stereo channel format).
	"1 1 0 0"	
	.....	
	"1 1 1 1"	

NOTE 1 The single and dual channel operating modes are defined with the frame format in IEC 60958-1.

Byte 3: Sampling frequency and clock accuracy

Bits 24 to 27	Sampling frequency	
Bit	24 25 26 27	
State	"0 0 1 0"	22,05 kHz
	"0 0 0 0"	44,1 kHz
	"0 0 0 1"	88,2 kHz
	"0 0 1 1"	176,4 kHz
	"0 1 1 0"	24 kHz
	"0 1 0 0"	48 kHz
	"0 1 0 1"	96 kHz
	"0 1 1 1"	192 kHz
	"1 1 0 0"	32 kHz
	"1 0 0 0"	Sampling frequency not indicated

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All other combinations are reserved and shall not be used until further defined.

Bits 28 to 29	Clock accuracy.	
Bit	28 29	
State	“0 0”	Level II
	“1 0”	Level I
	“0 1”	Level III
	“1 1”	Interface frame rate not matched to sampling frequency.

Byte 4: Word length and original sampling frequency

Bit 32	“0”	Maximum audio sample word length is 20 bits.
	“1”	Maximum audio sample word length is 24 bits.

Bits 33 to 35	Sample word length		
Bit	33 34 35	Audio sample word length if maximum length is 24 bits as indicated by bit 32.	Audio sample word length if maximum length is 20 bits as indicated by bit 32.
State	“0 0 0”	Word length not indicated (default)	Word length not indicated (default)
	“1 0 0”	20 bits	16 bits
	“0 1 0”	22 bits	18 bits
	“0 0 1”	23 bits	19 bits
	“1 0 1”	24 bits	20 bits
	“0 1 1”	21 bits	17 bits

All other combinations are reserved and shall not be used until further defined.

NOTE 2 The first edition of IEC 60958 had bits 32 to 35 reserved and set to zero. Therefore, the all zero state for these bits on a received signal may be an indicator that the word length indication has not been implemented.

Bits 36 to 39	Original sampling frequency	
Bit	36 37 38 39	
State	“1 1 1 1”	44,1 kHz
	“1 1 1 0”	88,2 kHz
	“1 1 0 1”	22,05 kHz
	“1 1 0 0”	176,4 kHz
	“1 0 1 1”	48 kHz
	“1 0 1 0”	96 kHz
	“1 0 0 1”	24 kHz
	“1 0 0 0”	192 kHz
	“0 1 1 1”	Reserved
	“0 1 1 0”	8 kHz
	“0 1 0 1”	11,025 kHz
	“0 1 0 0”	12 kHz
	“0 0 1 1”	32 kHz
	“0 0 1 0”	Reserved
	“0 0 0 1”	16 kHz
	“0 0 0 0”	Original sampling frequency not indicated (default)

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NOTE 3 The original sampling frequency field may be used to indicate the sampling frequency of a signal prior to sampling frequency conversion in a consumer playback system.

NOTE 4 Many of the values indicated for a frequency in the original sampling frequency field in byte 4 are the ones complement of the values used for that frequency in the sampling frequency field in byte 3.

5.3 Copyright management guidelines for consumer application of the digital audio interface

5.3.1 General

Category codes are defined for all consumer products that are capable of supplying a digital signal to consumer digital audio recorders, except for products that are fully transparent from input to output.

Category codes for products have been grouped by general function of the product. This makes it possible to take into account future digital recording products not yet defined in detail. Such a product then deals with the group code under a general rule. These rules define whether a digital recorder is enabled to record a copyright protected digital signal.

Unless otherwise specified, any consumer equipment capable of transferring digital audio information from an input terminal to an output terminal, if not fully transparent and regardless of the delay or type of transformation of the audio content of the signal, shall copy channel status bits 0, 1, 3, 4, 5, 6 and 7 from the source. Bit 2 shall be copied from the source, unless otherwise specified in the annexes.

Bit 15 is referred to as the “L-bit”. It indicates the “generation status” of the digital audio signal.

“Generation status” means:

- whether the signal emanates from a source that has been produced or published or authorized by the rights owner of the material, such as commercially released pre-recorded compact discs or DAT tapes or a digital broadcast (referred to herein as “original”) and for which copyright has been asserted; or
- whether the signal emanates from a recording made from such “original” material (i.e. “a home-copy of generation 1 or higher”).

Generally the L-bit is specified as:

Bit 15	“0”	No indication.
	“1”	Commercially released pre-recorded software.

For historical reasons, the reverse situation is valid for the signals originating from:

- laser optical products (category code “100 XXXXL”);
- broadcast reception (category codes “001 XXXXL” and “011 1XXXL”).

For these category codes, the L-bit indicates:

Bit 15	“0”	Commercially released pre-recorded software.
	“1”	No indication.

The generation status may be unknown for certain applications. The above interpretation is therefore not valid in combination with some category codes such as:

- general (category code “000 00000”);
- analogue/digital converters for analogue signals without copyright information (category code “011 00XXL”).

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5.3.2 Category code groups

5.3.2.1 The category code groups are defined in Table 3.

Table 3 – Category code groups

Bits 8 to 15	Category
“000 00000”	General. Used temporarily
“100 XXXXL”	Laser optical products
“010 XXXXL”	Digital/digital converters and signal processing products
“110 XXXXL”	Magnetic tape or disc based products
“001 XXXXL” and “011 1XXXL”	Broadcast reception of digitally encoded audio signals with or without video signals
“101 XXXXL”	Musical instruments, microphones and other sources without copyright information
“011 00XXL”	Analogue/digital converters for analogue signals without copyright information
“011 01XXL”	Analogue/digital converters for analogue signals which include copyright information in the form of “Cp-bit and L-bit status”
“000 1XXXL”	Solid state memory based products
“000 0001L”	Experimental products not for commercial sale
“111 XXXXL”	Not defined. Reserved
“000 0XXXL”	Not defined. Reserved, except “000 00000” and “000 0001L”

5.3.2.2 Within a group, a further indication of the type of source is given.

5.3.2.2.1 For the general category code (“000 00000”) the following applies:

– used temporarily;

– applied specifically for digital audio broadcast reception with or without a video signal, for example digital satellite reception in Japan in the case where no copyright information is transmitted. (See also Annex H.)

5.3.2.2.2 For the group of laser optical products (category code = “100 XXXXL”) the category codes are defined in Table 4.

Table 4 – Category code groups for laser optical products

Bits 8 to 15	Category
“100 00000”	Compact disc digital audio signal compatible with IEC 60908 (see Annex A)
“100 1000L”	Laser optical digital audio systems for which no other category code is defined (see Annex D)
“100 1001L”	Mini disc system (see Annex N)
“100 1100L”	Digital versatile disc (DVD) (see Annex P)
“100 others”	Reserved

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5.3.2.2.3 For the group of digital/digital converters and signal processing products (category code = “010 XXXXL”), the category codes are defined in Table 5.

Table 5 – Category code groups for digital/digital converter and signal processing products

Bits 8 to 15	Category
“010 0000L”	PCM encoder/decoder (see Annex B)
“010 0100L”	Digital signal mixer (see Annex E)
“010 1100L”	Sampling rate converter (see Annex F)
“010 0010L”	Digital sound sampler (see Annex G)
“010 1010L”	Digital sound processor (see Annex O)
“010 others”	Reserved

5.3.2.2.4 For the group of magnetic tape or magnetic disc based products (category code = “110 XXXXL”), the category codes are defined in Table 6.

Table 6 – Category code groups for magnetic tape or magnetic disc based products

Bits 8 to 15	Category
“110 0000L”	DAT (see Annex C)
“110 1000L”	Video tape recorder with digital sound
“110 0001L”	Digital compact cassette (see Annex M)
“110 others”	Reserved

5.3.2.2.5 For the group of broadcast reception of digitally encoded audio with/without video signals (category code = “001 XXXXL” or “011 1XXXL”), the category codes are defined in Table 7.

Table 7 – Category code groups for broadcast reception of digitally encoded audio with/without video signals

Bits 8 to 15	Category
“001 0000L”	Digital audio broadcast signal with or without a video signal (Japan) (see Annex H)
“001 1000L”	Digital audio broadcast signal with or without a video signal (Europe) (see Annex J)
“001 0011L”	Digital audio broadcast signal with or without a video signal (USA) (see Annex K)
"001 0001L"	Electronic software delivery (see Annex L)
“001 0010L”	Used by another standard (see note)
“001 others”	Reserved
“011 1XXXL”	Reserved
NOTE The code “001 0010L” is under consideration for use in connection with IEC 62105.	

Withdrawn

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