BRITISH STANDARD

BS EN
60118-14:1998
IEC
60118-14:1998

Hearing aids —

Part 14: Specification of a digital interface device

The European Standard EN 60118-14:1998 has the status of a British Standard

ICS 17.140.50

National foreword

This British Standard is the English language version of EN 60118-14:1998. It is identical with IEC 60118-14:1998.

The UK participation in its preparation was entrusted to Technical Committee EPL/29, Electroacoustics, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

The UK Technical Committee EPL/29 made detailed technical comments on this document as they felt it needed further development and therefore the UK voted against it.

A list of organizations represented on this committee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 June 1998

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Descriptors: Acoustics, hearing aids, interfaces, digital technics, control devices, electrical properties, mechanical properties, adjustment

English version

Hearing aids
Part 14: Specification of a digital interface

(IEC 60118-14:1998)

Appareils de correction auditive
Partie 14: Spécification d'interface numérique
(CEI 60118-14:1998)

Hörgeräte
Teil 14: Spezifikation einer digitale Schnittstelle
(IEC 60118-14:1998)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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Foreword

The text of document 29/389 + 389A/FDIS, future edition 1 of IEC 60118-14, prepared by IEC TC 29, Electroacoustics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60118-14 on 1998-04-01.

The following dates were fixed:

— latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-01-01

— latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2001-01-01

Annexes designated "normative" are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60118-14:1998 was approved by CENELEC as a European Standard without any modification.

Contents

Introduction

This part of IEC 60118 has been prepared to define the electrical and mechanical characteristics of the interface (the signals and connectors) to be used for the electrical setting of hearing aid parameters.

This standard was motivated by a desire to avoid the problem of incompatibility between the hearing aids and the parameter setting devices produced by different manufacturers. The standard assumes a general configuration for the electrical setting of parameters which consist of

— a general-purpose control device, such as a desktop computer;

— a hearing aid with electrical control of parameter values;

— an interface to connect the computer to the hearing aid.

This standard only specifies the requirements for the interface between the control device and the hearing aid.

1 Scope

This part of IEC 60118 specifies the electrical and mechanical requirements for an interface device to allow a general-purpose control device such as a desktop computer to be connected to hearing aids, for the purpose of electrical setting of their operating parameters.

There is no specification of anything within the hearing aid, such as types of parameters and their signal processing characteristics, nor is there any specification of the parameter setting procedure — the method used to determine which settings are most appropriate to the person wearing the hearing aid. This standard is restricted to the digital interface between the control device and the hearing aid.

This standard provides a specification such that all hearing aids which can be programmed by the specified digital interface may have their parameters set by a single control device and interface device.

The specifications of this standard are for use in connection with hearing aids with parameters set by a direct electrical connection using a cable. They do not cover hearing aids with parameters controlled by radio frequency or infrared transmission, or any other "wireless" method of control.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60118. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60118 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid normative documents.

IEC 60601-1-1:1992, *Medical electrical equipment — Part 1: General requirements for safety — Section 1: Collateral standard: Safety requirements for medical electrical systems.*

IEC 60118-12:1996, *Hearing aids — Part 12: Dimensions of electrical connector systems.*

IEC 61076-4-105:1995, *Connectors with assessed quality for use in d.c., low-frequency analogue and in digital high-speed data applications — Part 4: Printed board connectors — Section 105: Detail specification for 9 mm circular connector with 3 to 8 contacts for use in a wide range of applications including the telecommunication and audio industry.*

ITU-T Recommendation V.24:1996, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE).*

3 Definitions

For the purpose of this part of IEC 60118, the following definitions apply.

3.1
digital interface device

device for exchanging signals between a hearing aid and a control device for the electrical setting of operating parameters

3.2
control device

desktop computer or other programmable device which carries out the procedure for setting the parameters of a hearing aid. The control device is connected to the digital interface device by a serial interface.

3.3
hearing aid

device worn by a person to aid auditory function. Within this standard, the only relevant hearing aids are those which have electrically programmable controls and therefore require setting using a digital interface device and control device.

3.4
serial interface

method of sending electronic signals using pulses down a single wire or a pair of wires. A standard serial interface is defined by ITU-T V.24.

3.5
input

data transmitted from the hearing aid to the digital interface device

3.6
output

data transmitted from the digital interface device to the hearing aid

4 Symbols and abbreviations

— U_{bat}	Fixed supply voltage
— U_o	Variable data output voltage
— U_{prog}	Variable programming voltage
— U_{supply}	Variable supply voltage
— G	Common ground

5 Physical specifications of the interface

5.1 General

The digital interface device may be physically and electrically separate from the control device. If the device is not physically separate, but constructed as a part of the control device, it shall still be constructed so as to meet the requirements for patient safety given in **5.2**.

The digital interface device shall be connected to the hearing aid using a cable with connectors at both ends. It is recommended that the digital interface device provide two independent connectors, to provide for binaural fitting.

5.2 Patient safety

The digital interface device shall comply with IEC 60601-1-1, type BF.

When the digital interface device is integrated with the control device, the entire system shall comply with IEC 60601-1-1, type BF.

5.3 Connection to the control device

If the digital interface device is physically and electrically separate, it shall be controlled by a serial connection between the device and the control device, according to ITU-T V.24. The digital interface device shall conform to the specification within the referenced ITU-T V.24 recommendation for a data terminal equipment device. These specifications govern both electrical and mechanical requirements.

If the digital interface device is constructed as a part of the control device, this standard makes no specification for the interconnection between the interface device and the control device.

If the digital interface device is constructed as a physically separate entity, the connector for the cable to the control device may vary from the mechanical requirements of ITU-T V.24, provided that

a) the minimum electrical requirements are met (two data lines plus earth, conventionally referred to as TX (transmit), RX (receive) and E);

b) the physical connections are fully documented;

c) a convertor for use of a standard ITU-T V.24 cable is readily available, either in the general market or from the interface device manufacturer.

5.4 Connection to the hearing aid

The specifications of the connection of the digital interface device to the hearing aid is given in the following subclauses.

These specifications apply to each of the two connectors that are recommended to support binaural hearing aid fitting.

5.4.1 *Mechanical specifications*

5.4.1.1 *General*

The digital interface device shall connect to a hearing aid by a cable. The cable connection at the digital interface device is a six-terminal shielded connector according to IEC 61076-4-105. The cable connection at the hearing aid shall be determined by the hearing aid manufacturer. IEC 60118-12 describes suitable connectors.

5.4.1.2 *Terminal assignment*

Because of the wide range of potential requirements of various types of electronic technologies and various hearing aid designs, there are multiple ways of using several of the lines.

The digital interface device shall provide

a) four different voltage sources for supply purposes, data output and common ground;

b) a data input sense facility for receiving data;

c) a multiplexing system that allows different combinations of supply data input and data output to be assigned to the six terminals at the device.

Terminals 1, 2 and 5 are those permanently assigned to fixed supply voltages (U_{bat}), common ground (G) and variable supply voltages (U_{supply}), respectively.

Terminal	Function
1	Fixed supply voltage (U_{bat})
2	Common ground (G)
3	Data input or data output (data I/O)
4	Data input or data output (data I/O) or programming voltage (U_{prog})
5	Variable supply voltage (U_{supply})
6	Data output or common ground (G)

The following subclauses specify the capabilities of each terminal.

5.4.2 *Electrical specifications*

5.4.2.1 *Fixed supply voltage U_{bat} (terminal 1)*

This function is the hearing aid supply voltage, the substitute for a battery. The voltage shall always be available at terminal 1.

Voltage, U_{bat}	1,35 V ± 5 %
Current limiting	10 mA or 50 mA ± 20 %
Output impedance	< 5 Ω

The current limiting shall be selectable by the control device.

5.4.2.2 *Common ground (G) (terminal 2, optionally terminal 6)*

This function is a low impedance ground. It shall always be available at terminal 2. G can also optionally be assigned to terminal 6.

5.4.2.3 *Programmable output voltage U_o (terminal 3, terminal 4 and terminal 6)*

This voltage source shall be selectable by the control device for terminal 3, terminal 4 and terminal 6.

Voltage range, U_o	– 3,0 V to + 3,0 V
Resolution	< 50 mV
Tolerance	5 ± % of U_o or ± 30 mV (whichever is greater)
Rise time	< 0,3 µs

5.4.2.4 *Programming voltage U_{prog} (selectable by the control device for terminal 4)*

This voltage source may be used as a programming voltage source, as required by the various memory technologies.

Voltage range, U_{prog}	– 16 V to + 18 V
Resolution	< 500 mV
Tolerance	± 5 % of U_{prog} or ± 150 mV (whichever is greater)
Maximum current	10 mA ± 20 %
Rise time	< 3 ms

5.4.2.5 *Variable supply voltage U_{supply} (terminal 5)*

A supply voltage shall be available on terminal 5 if enabled by the control device. Its value is set by the control device.

Voltage range, U_{supply}	– 3,5 V to + 3,5 V
Resolution	< 50 mV
Tolerance	± 5 % of U_{supply} or ± 30 mV (whichever is greater)
Maximum current	30 mA ± 20 %
Output impedance	< 5 Ω
Rise time	< 10 ms

5.4.3 *Data transmission*

5.4.3.1 *General*

The digital interface device can be set up to transmit and receive data in multiple ways. Voltage as well as current coding can be implemented using generator impedances.

5.4.3.2 *Data output*

Data output is to be selected at terminals 3, 4 and 6. The data output is to be selected to switch between any of four sources U_o, U_{bat}, U_{supply} and G for low-level logic and logical high level logic. Terminals 3 and 4 may furthermore switch between five different generator impedances (3 kΩ, 10 kΩ, 20 kΩ, 50 kΩ and high impedance).

Output impedance	terminal 3	< 350 Ω
Output impedance	terminal 4	< 350 Ω
Output impedance	terminal 6	< 5 Ω
Maximum current	terminal 6	9 mA ± 20 % or > 20 mA at 1,35 V

The maximum current shall be selectable by the control device.

5.4.3.3 *Data input*

Data input is to be selected at terminals 3, 4 and 6. Data input may be either voltage (terminals 3 and 4) or current (terminals 3, 4 and 6). When a terminal is selected for input the electrical characteristics of the terminal can be set by the control device to any of the states described in **5.4.3.2**.

5.4.3.3.1 *Voltage input*

Voltage input may be used on either terminal 3 or 4. The input threshold may be selected by the control device.

Input voltage threshold range	– 3,0 V to + 3,0 V
Resolution	< 50 mV
Tolerance	± 5 % of U_0 or ± 30 mV (whichever is greater)
Hysteresis	± 200 mV ± 10 %

5.4.3.3.2 *Current input*

Current input may be used on either terminal 3, 4 or 6. The input threshold may be selected by the control device.

Input current threshold range	terminals 3 and 4	– 200 µA to + 200 µA
Input current threshold range	terminal 6	0 mA to + 5 mA
Resolution	terminals 3 and 4	< 5 µA
Resolution	terminal 6	< 50 µA
Tolerance	terminals 3 and 4	± 5 % of measured current or ± 6 µA, (whichever is greater)
Tolerance	terminal 6	± 5 % of measured current or ± 50 µA, (whichever is greater)

5.4.4 *Communication protocols*

Multiple communication protocols may be implemented. Protocols which may be used include: synchronous, asynchronous and pulsewidth. The digital interface device shall have the parameters given hereafter.

Clock frequency range	100 Hz to 10 kHz
Resolution of clock period	< 2,0 µs
Clock tolerance	$\pm 10^{-4}$
Buffer size	> 3 200 bits

5.5 Control of the digital interface device

Full documentation of the method of control of the digital interface device from the control device shall be provided. The documentation shall include all control codes and code sequences. The documentation shall also include full details of all switch positions or other settings for any manual controls.

Annex ZA (normative)
Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60601-1-1	1992	Medical electrical equipment Part 1: General requirements for safety Section 1: Collateral standard: Safety requirements for medical electrical systems	EN 60601-1-1	1993
IEC 60118-12	1996	Hearing aids Part 12: Dimensions of electrical connector systems	EN 60118-12	1996
IEC 61076-4-105	1995	Connectors with assessed quality, for use in d.c., low frequency analogue and in digital high-speed data applications Part 4: Printed board connectors Section 105: Detail specification for 9 mm circular connector with 3 to 8 contacts for use in a wide range of applications including the telecommunication and audio industry	—	—
ITU-T Recommendation V.24	1996	List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)	—	—

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