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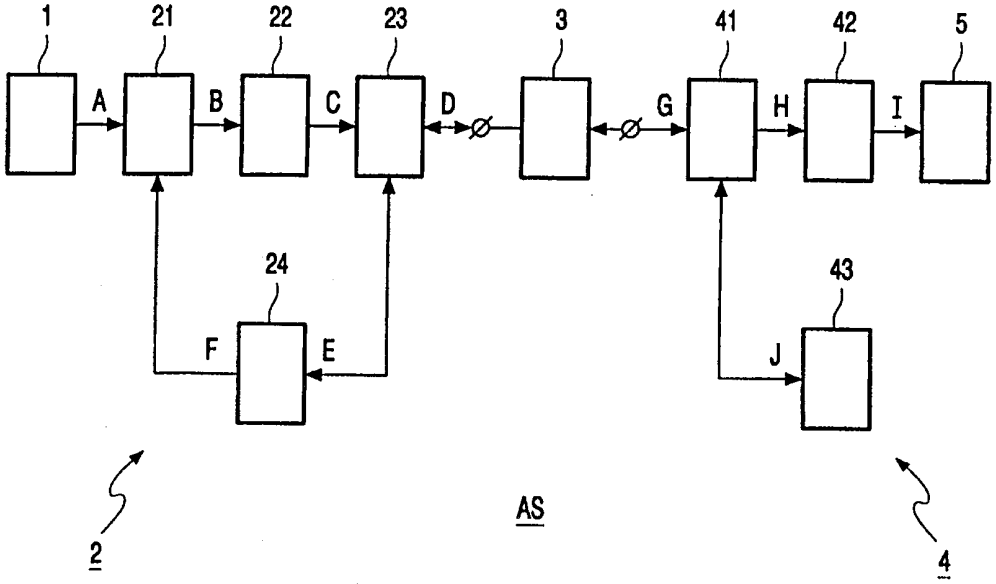

(57) Abstract

Audio systems using a digital audio interface between a sender and a receiver are known. Due to the digital revolution it is very easy to make copies of copyright protected work. Proposed is to use a bi–directional control bus in the audio interface. In this way it is made possible to send to "normal" receivers audio with a standard quality and to receivers which have been allowed to receive higher quality audio.

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Audio system and audio interface.

The invention relates to an audio system comprising an audio interface. The invention further relates to an audio interface for use in such an audio system.

Audio systems and audio interfaces are known in the art. For example such interfaces are used with CD-players, DAT and MD recorders etc. In a consumer implementation the quality is in most cases restricted to 16 bit linear PCT format, with a sample rate of 32, 44.1 or 48 kHz. However the latest consumer electronics can perform a higher quality, for example by using 24 bit samples or a sample rate of 88.2, 176.4 or 192 kHz. The present digital audio interface specification can be used till 24 bit samples, however not for higher sample rate frequencies.

Further the protection of the rights of the author and supplier of a copyright protected work is a main concern of the suppliers of such work. Due to the digital revolution to make a (almost) perfect copy is becoming very easy. As a consequence no copyright is paid. The suppliers ask regularly for technical measures to restrict the possibilities of copying and preferably to make copying impossible.

It is, inter alia, an object of the invention to obtain an audio system and an audio interface that overcomes the drawbacks of the prior art.

To this end a first aspect of the invention provides an audio system as defined in claim 1.

A second aspect of the invention provides an audio interface as defined in claim 3.

A third aspect of the invention provides a receiver device as defined in claim 5.

By using a bi-directional control bus it is made possible to amend the audio signal in the sender device, to make it suitable for the receiver device. Further in this way it is made possible to let the receiver device first make a request of allowance to receive high quality audio and after allowance to receive it.

When no request is made the sender device will send for example the normal audio quality.

It is mentioned here that from EP-A-0542345 (PHN13883) an active sound reproducer and control unit is known which uses a bi-directional control bus as control channel to supply remote control commands.

An embodiment of an audio system according to the invention comprises the features of claim 2.

With both the sender device and the receiver device having a control unit the control signals will be supplied and received by the respective control unit. The control units further can control the to be sent and to be received audio signal quality.

An embodiment of an audio interface according to the invention comprises the features of claim 4.

By splitting the audio interface in a sender and a receiver part the devices themselves are all to communicate with the other.

The invention and additional features, which may optionally be used to advantage, will be apparent from and elucidated with reference to the examples described below hereinafter and shown in the figure. Herein shows:

Figure a schematic example of an audio system according to the invention.

The figure shows a schematic example of an audio system AS according to the invention, comprising an audio source 1, for example an optical or magnetically stored audio signal. The source supplies an audio signal A to a send unit 2. The send device comprises in this example a formatting unit 21, a converting unit 22, a combining unit 23 and a control unit 24.

The formatting unit 21 receives the signal A from the audio source 1 and supplies a signal B. In this formatting unit the audio signal can be formatted, for example amending the number of bits in the samples, the sampling frequency, adding special signals (such as copyright protection or amending the possibilities of the receiver).

It is to be noticed that it can be preferred to amend the signal A into a signal B that satisfies the minimum requirements of the receiver 4. The control unit 24 with the signal F controls the amending of the signal A.

The signal B is supplied to the converting unit 22. In the converting unit the signal B is in this example converted into a signal satisfying the requirements of the specification IEC958 , or a later on derived version hereof having for example a higher sample rate frequency. The converting unit 22 can convert the signal B by itself (or in another example be controlled by the control unit 24). The converting unit supplies a signal C, and supplies this signal to the combining unit 23. In the combining unit the signal C is combined with bi-directional control signals E from the control unit 24 and supplied as a signal D to a digital audio interface 3.

The digital audio interface supplies a signal G to a receiver device 4. The receiver device comprises in this example a combining unit 41, a converting unit 42 and a control unit 43. The combining unit splits the received signal G that comprises an audio signal and control signals into an audio signal H (almost the same as signal C in the sender device 2) and bi-directional control signals J. The combining unit further sends back control signals via the audio interface 3 to the sender device 2. The converting unit 42 converts back the audio signal H (in this example in the IEC958 format) into a digital audio signal I (almost the same as signal B in the sender device 2). The signal I is supplied to an audio destination 5 (for example a DAT, CD recordable or MD recorder etc).

Between both control units 24 and 43 in respectively the sender device 2 and the receiver device 4 a negotiation process can be performed, whereby the sender device amends the audio signal as required by the receiver device. As an example a situation is described below wherein a high quality may only be supplied to receiver devices that are allowed to receive these signals.

The sender device shall at first instance use an audio signal with normal audio quality, for example 16 bit samples, 48 kHz sample rate frequency. Herewith a receiver device that is not allowed the high quality audio signal can use this audio signal to make recordings. Hereafter the sender device will send a message via the bi-directional control bus (digital audio interface 3). EP-A-0542345 describes an active sound reproducer and control unit which uses a bi-directional bus as control channel to supply remote control commands. A connected receiver device can react on this message by sending back a message of allowance for high quality audio signals. When the sender device receives this message the control unit 24 can

send a signal F to the formatting unit 21 to amend the audio signal, for example 24 bit samples, 96 kHz sample rate frequency. If the allowance is not requested (for example by use of receiver devices not having such an allowance) the sender device will sill the audio signal with the "normal" bit length and sample rate.

In this way it is possible to combine the audio system and audio interface with existing receiver devices, and on the other hand supply new receiver devices with an allowance for high quality audio signals with these high quality audio signals.

It is to be noticed that above the audio system and the audio interface of the invention has been described on the basis of an example. The man skilled in the art will be well aware of a lot of variations, which fall within the scope of the present invention.

In the above described example the converting unit 22 converts the signal into a signal satisfying the requirements of the specification IEC958 or a later on derived version hereof. It will be clear that it is also possible that the converting unit converts the signal B into a signal satisfying another specification as long as the specification can be received by the receiver 4.

CLAIMS:

1. Audio system comprising a sender device, an audio interface and a receiver device, whereby the sender device is arranged to receive a first audio signal from an audio source, converting means for converting the first audio signal into a second audio signal, and to supply the second audio signal via the audio interface to the receiver device, and the receiver device is arranged to receive the second audio signal, converting means for converting the second audio signal into a third audio signal, and supply the third audio signal to an audio destination, Characterized in that the audio interface comprises a bi-directional bus for sending control signals between the sender device and the receiver device.

2. Audio system according to claim 1, characterized in that the sender device comprises a control unit for sending and receiving the control signals to a control unit of the receiver device.

3. Audio interface for use in an audio system according to claim 1.

4. Audio interface as claimed in claim 3, characterized that a first part of the audio interface is incorporated in the sender device and a second part of the audio interface is incorporated in the receiver device.

5. Receiver device for use in an audio system according to claim 1.

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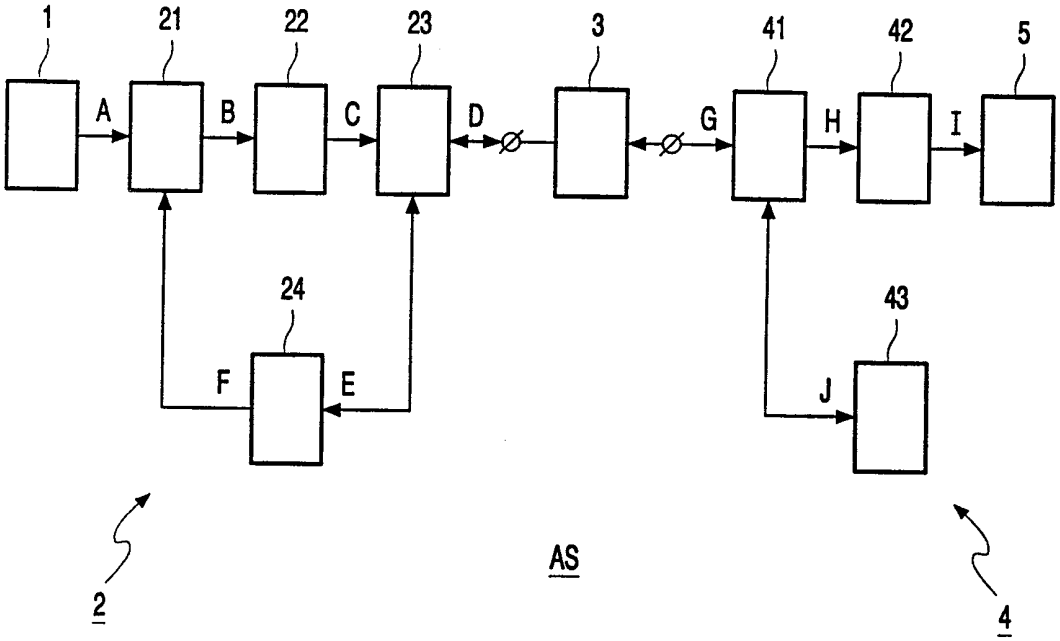

INTERNATIONAL SEARCH REPORT

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PCT/EP 99/09826

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B1/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HITACHI LTD ET AL: "5C Digital Transmission Content Protection White Paper - Revision 1.0" -, 'Online! 14 July 1998 (1998-07-14), pages 1-13, XP002134182 Retrieved from the Internet: <URL:http://www.dtcp.com/wp_spec.pdf> 'retrieved on 1999-10-15! the whole document ---	1-5
X	EP 0 813 194 A (SONY CORP) 17 December 1997 (1997-12-17) figure 1 column 4, line 4 -column 5, line 30 column 5, line 58 -column 7, line 27 column 7, line 56 -column 8, line 22 column 24, line 36 - line 58 --- -/--	1-5

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 March 2000	18/04/2000

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 542 345 A (PHILIPS NV) 19 May 1993 (1993-05-19) cited in the application column 5, line 44 -column 8, line 11 column 8, line 46 -column 10, line 24 figure 2	1-5
X	US 5 802 017 A (SATO MAKOTO ET AL) 1 September 1998 (1998-09-01) the whole document	1-5

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Information on patent family members

Internatic Application No
PCT/EP 99/09826

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