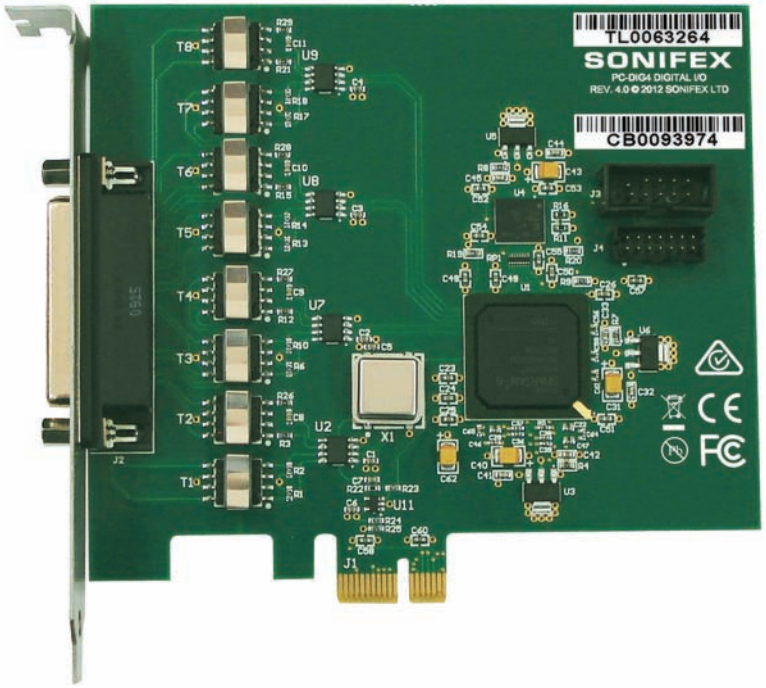
HANDBOOK

PC-DIG4

Digitorc 4, 4 Stereo AES-3 I/O PCIe Sound Card



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This handbook is for use with the following product:
PC-DIG4 Digitorc 4, 4 Stereo AES-3 I/O PCIe Sound Card
Stock Code: 30-401

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Register Online for an Extended 2 Year Warranty

As standard, Sonifex products are supplied with a 1 year back to base warranty.

If you register the product online, you can increase your product warranty to 2 years and we can also keep you informed of any product design improvements or modifications.

To register your product, please go online to www.sonifex.co.uk/register

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Product Warranty - 2 Year Extended

As standard, Sonifex products are supplied with a 1 year back to base warranty. In order to register the date of purchase and so that we can keep you informed of any product design improvements or modifications, it is important to complete the warranty registration online. Additionally, if you register the product on the Sonifex website within 30 days of purchase, you can increase your product warranty to 2 years. Go to the Sonifex website at: http://www.sonifex.co.uk/technical/register/index.asp to apply for your 2 year warranty.

Note: For your own records the product serial number is recorded on the CE certification page of this handbook.

Sonifex Warranty & Liability Terms & Conditions

1. Definitions

'the Company' means Sonifex Ltd and where relevant includes companies within the same group of companies as Sonifex Limited.

'the Goods' means the goods or any part thereof supplied by the Company and where relevant includes: work carried out by the Company on items supplied by the Purchaser; services supplied by the Company; and software supplied by the Company.

'the Purchaser' means the person or organisation who buys or has agreed to buy the Goods.

'the Price' means the Price of the Goods and any other charges incurred by the Company in the supply of the Goods.

'the Warranty Term' is the length of the product warranty which is usually 12 months from the date of despatch; except when the product has been registered at the Sonifex website when the Warranty Term is 24 months from the date of despatch.

'the Contract' means the quotation, these Conditions of Sale and any other document incorporated in a contract between the Company and the Purchaser.

This is the entire Contract between the parties relating to the subject matter hereof and may not be changed or terminated except in writing in accordance with the provisions of this Contract. A reference to the consent, acknowledgement, authority or agreement of the Company means in writing and only by a director of the Company.

2. Warranty

a. The Company agrees to repair or (at its discretion) replace Goods which are found to be defective (fair wear and tear excepted) and which are returned to the Company within the Warranty Term provided that each of the following are satisfied:

   i. notification of any defect is given to the Company immediately upon its becoming apparent to the Purchaser;

   ii. the Goods have only been operated under normal operating conditions and have only been subject to normal use (and in particular the Goods must have been correctly connected and must not have been subject to high voltage or to ionising radiation and must not have been used contrary to the Company's technical recommendations);

   iii. the Goods are returned to the Company's premises at the Purchaser's expense;

   iv. any Goods or parts of Goods replaced shall become the property of the Company;

   v. no work whatsoever (other than normal and proper maintenance) has been carried out to the Goods or any part of the Goods without the Company's prior written consent;

vi. the defect has not arisen from a design made, furnished or specified by the Purchaser;

vii. the Goods have been assembled or incorporated into other goods only in accordance with any instructions issued by the Company;

viii. the defect has not arisen from a design modified by the Purchaser;

ix. the defect has not arisen from an item manufactured by a person other than the Company. In respect of any item manufactured by a person other than the Company, the Purchaser shall only be entitled to the benefit of any warranty or guarantee provided by such manufacturer to the Company.

b. In respect of computer software supplied by the Company the Company does not warrant that the use of the software will be uninterrupted or error free.

c. The Company accepts liability:

(i) for death or personal injury to the extent that it results from the negligence of the Company, its employees (whilst in the course of their employment) or its agents (in the course of the agency);

(ii) for any breach by the Company of any statutory undertaking as to title, quiet possession and freedom from encumbrance.

c. Subject to conditions (a) and (c) from the time of despatch of the Goods from the Company's premises the Purchaser shall be responsible for any defect in the Goods or loss, damage, nuisance or interference whatsoever consequential economic or otherwise or wastage of material resulting from or caused by or to the Goods. In particular the Company shall not be liable for any loss of profits or other economic losses. The Company accordingly excludes all liability for the same.

e. At the request and expense of the Purchaser the Company will test the Goods to ascertain performance levels and provide a report of the results of that test. The report will be accurate at the time of the test, to the best of the belief and knowledge of the Company, and the Company accepts no liability in respect of its accuracy beyond that set out in Condition (a).

f. Subject to Condition (e) no representation, condition, warranty or other term, express or implied (by statute or otherwise) is given by the Company that the Goods are of any particular quality or standard or will enable the Purchaser to attain any particular performance or result, or will be suitable for any particular purpose or use under specific conditions or will provide any particular capacity, notwithstanding that the requirement for such performance, result or capacity or that such particular purpose or conditions may have been known (or ought to have been known) to the Company, its employees or agents.

g. (i) To the extent that the Company is held legally liable to the Purchaser for any single breach of contract, tort, representation or other act or default, the Company's liability for the same shall not exceed the price of the Goods.

(ii) The restriction of liability in Condition (g)(i) shall not apply to any liability accepted by the Seller in Condition (c).

h. Where the Goods are sold under a consumer transaction (as defined by the Consumer Transactions (Restrictions on Statements) Order 1976) the statutory rights of the Purchaser are not affected by these Conditions of Sale.

Unpacking Your Product

Each product is shipped in protective packaging and should be inspected for damage before use. If there is any transit damage take pictures of the product packaging and notify the carrier immediately with all the relevant details of the shipment. Packing materials should be kept for inspection and also for if the product needs to be returned.

The product is shipped with the following equipment so please check to ensure that you have all of the items below. If anything is missing, please contact the supplier of your equipment immediately.

Item	Quantity
Product Unit	1
Handbook	1
Driver CD	1

If you require a different power lead, please let us know when ordering the product.

Repairs & Returns

Please contact Sonifex or your supplier if you have any problems with your Sonifex product. Email technical.support@sonifex.co.uk for the repair/ upgrade/returns procedure, or for support & questions regarding the product operation.

CE Declaration of Conformity and Approval Information

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This document certifies that the Sonifex product that you have purchased is compliant with CE specifications. If you would like further information on compliance of all Sonifex products, please check the website at the address above where full information is available.

Sonifex Limited hereby certify that the following product with serial number shown has been designed and manufactured in accordance with the following specifications:

Product: _____

Serial No: _____

EMC:	EN 55103-1: 1997 Electromagnetic Compatibility. Limits of disturbance for audio apparatus for professional use For use in environments 1 to 4.
	EN 55103-2: 1997 Electromagnetic Compatibility. Limits of disturbance for audio apparatus for professional use For use in environments 1 to 4.
Safety:	EN 60950: 1992 Safety of Information Technology Equipment Including Electrical Business Equipment.
Hybrid Approvals:	BS6301, BS7002, BS415, CTR21, R&TTE directive (1999/5/EC)

The Reference Technical Justification File for this product is available at Sonifex Ltd.

Authorised By:

Name: Chris Stills

Position: Technical Director

Date of Issue: 01 October 2014

Signature:

WEEE Directive

The Waste Electrical and Electronic Equipment (WEEE) Directive was agreed on 13 February 2003, along with the related Directive 2002/95/EC on Restrictions of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS). The Waste Electrical and Electronic Equipment Directive (WEEE) aims to minimise the impacts of electrical and electronic equipment on the environment during their life times and when they become waste. All products manufactured by Sonifex Ltd have the WEEE directive label placed on the case. Sonifex Ltd will be happy to give you information about local organisations that can reprocess the product when it reaches its "end of use", or alternatively all products that have reached "end of use" can be returned to Sonifex and will be reprocessed correctly free of charge.

RoHS Directive

RoHS COMPLIANT

The RoHS directive limits the use of certain hazardous substances currently used in EEE manufacture, including lead, mercury, cadmium, hexavalent chromium, and halide-containing compounds PBB (polybrominated biphenyl) and PBDE (polybrominated diphenyl ether). Elimination of these substances will result in more environmentally friendly recycling of electronic equipment.

Sonifex Ltd practices lead-free (LF) manufacturing processes and does not use any of the hazardous substances identified in the European Union's Restriction of Hazardous Substances (RoHS) directive. The manufacturing processes include the assembly of purchased components from various sources. Product is offered as RoHS compliant, or LF, only after sufficient evidence is received from the component manufacturers that their components are RoHS compliant. Sonifex Ltd relies solely on the distributor, or manufacturer, of the components for identification of RoHS compliance. Thus whilst every effort is made to ensure compliance, Sonifex Ltd makes no warranty, or certification, or declaration of compliance concerning said components.

Atmosphere

The units should be installed in an area that is not subject to excessive temperature variation (<0°C, >50°C), moisture, dust or vibration.

Electromagnetic Compatibility

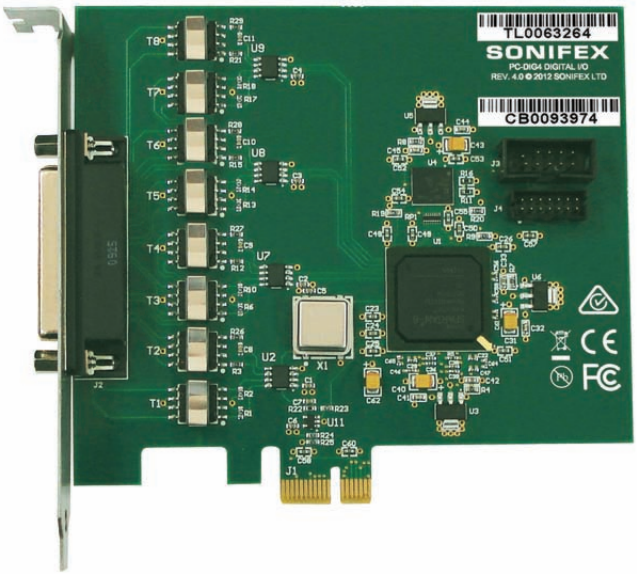
Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

This product complies with the relevant tested clauses of AS/NZS CISPR 22:2009 +A1:2010 and AS/NZS CISPR 13:2012.

This product complies with the relevant tested clauses of EN55022:2010, EN55013:2013, EN55024:2010, EN61000-3-2:2009 and EN61000-3-3:2013.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Introduction



The Digitorc 4 has four AES-3 stereo input and output channels on a Windows platform and is fully compatible with the Wave, DirectSound, DirectShow, MCI and Core Audio APIs.

On the card is implemented both a single lane bus-master PCIe interface and four x 24-bit AES-3 codecs. Independent asynchronous sampling rate conversion on the inputs supports rates from 32kHz to 96kHz, while the output rate can be configured as 96kHz, 88.2kHz, 48kHz, 44.1kHz or 32kHz, either free-running or locked to an AES3 or AES11 reference on any of the inputs. When used with an internet time standard (e.g.ntp.org), a very precise sampling rate can be achieved.

Software sampling rate conversion is automatically inserted by Windows when the application rate does not match the hardware rate, ensuring that files of any sample rate can be played. Extended software bit depths of 32 and 24 bits are supported as well as 16 and 8 bits for playback and recording.

The playback topology consists of a master output level, mute control and peak meter, a wave level and mute control, and input monitor level and mute controls for each of the line inputs. The record topology consists of a master input level, mute control and peak meter, line input level controls for each of the physical inputs and a digital loopback level control and mute. The range on the input and output master controls is -96dB to +6dB, while the individual line controls range from -96dB to 0dB. The mixer functions allow inputs to be mixed back into each output, while a digital loopback is available from each playback channel into its corresponding record channel.

High quality electrostatically-shielded transformers are used on all the inputs and outputs to give superb performance.

Multiple cards may be installed in a single PC.

A 25-pin D-type connector to 8 x XLR breakout lead is offered as an option.

Notes Regarding Windows Version Differences

Windows XP and Server 2003 are the only current versions of Windows that provide complete support for WDM audio drivers. The following limitations apply when using the Digitorc 4 with other versions of Windows.

- Windows Vista / 7 / 8 virtualise the mixer API to each application, providing only a mute and volume control on each input and output. These controls affect only the audio levels going to and from that application. A Windows XP compatibility mode is available to provide full mixer access to the hardware if needed.
- Peak meters for WDM drivers are only available through the mixer API under Windows XP and Server 2003 (and Windows Vista running in XP-compatibility mode). Windows Vista / 7 / 8 provide an IAudioMeterInformation interface as part of their EndpointVolume API, but this isn't supported on any of the earlier platforms.
- In all versions prior to Windows Vista, Microsoft's sampling rate converter, which is automatically switched in when playing multiple audio streams of differing sampling rates through a single physical output, is slightly inaccurate when doing some conversions. The error is typically at most about 0.3%. The most common conversion, that of 44.1kHz to or from 48kHz, is handled correctly, though, as are simple 2:1 ratios.

Installation

Switch off the computer and carefully install the Digitorc 4 card in any free PCIe slot, observing the normal precautions against static electricity discharge. The card can be used in single-lane or multi-lane sockets as the PCIe protocol automatically determines the number of lanes in use. Switch the computer back on and boot Windows.

Windows XP (SP2 or later), Server 2003, Vista, Server 2008 – Windows will report that new hardware has been found. Insert the driver CD supplied with the Digitorc 4 and proceed through the installation wizard. Allow Windows to search for the driver – do NOT specify a driver location or file name.

Windows 7, 8, Server 2008-R2, Server 2012 – Windows no longer searches removable media for drivers. Open Device Manager, where the Digitorc 4 will be listed under Other Devices as a Multimedia Audio Controller. Right-click on it, select Update Driver Software, then click on Browse my computer for driver software and click on the Browse button to navigate to the driver's location. Click on Next to install the driver.

Windows 8, 7, Vista, Server 2012, Server 2008-R2 and Server 2008 will recognise Innes Corporation's own digital signature on the driver and invite you to proceed with the installation. If you wish you can tick the box to always accept Innes Corporation drivers.

At the completion of the installation process, a loudspeaker symbol should appear in the toolbar at the bottom of the screen. Your Digitorc 4 is now fully operational. On Windows XP and Server 2003, if the speaker does not appear, it may be necessary to reboot your PC. This typically happens if there has been no sound card previously installed in the PC. Server 2003 by default has the loudspeaker symbol turned off; to enable it, go into **Control Panel**, select **Sounds, Speech and Audio Devices**, then click on Sounds and Audio Devices, and finally tick the box marked **Place volume icon in the task bar.**

Note also that on Windows Server installations, the audio subsystem may not be enabled by default and needs to be activated before the card can be used.

Configuration

There are two configuration settings for the Digitorc 4, these being Output Sampling Rate and Synchronisation Source.

The **output sampling rate** can be set to 32kHz, 44.1kHz, 48kHz, 88.2kHz or 96kHz. Note that this sets only the physical output sampling rate – the card can play audio files recorded at any sampling rate as rate-conversion is automatically inserted by Windows when required.

The **synchronisation source** can be set to Off, any of the four inputs, or the host PC's real time clock. In the latter case, a comparison is taken of the card's master oscillator and the real time clock, averaged over several days. When used in conjunction with an internet time standard (such as ntp.org), a very high sampling rate precision can be achieved.

To change the configuration, right-click on the **My Computer** icon on the desktop (or in the Start menu in the case of XP and Server 2003), select **Properties**, then click on **Device Manager**. Open **Sound, video and game controllers**, then right-click on **Digitorc 4** and select **Properties**. Now click on the **Configuration** tab and select the desired output rate and/or synchronisation. After clicking on OK it may take up to a minute for Windows to reconfigure itself and the screen may flicker during this time.

Topology

The playback topology consists of a master output level, mute control and peak meter, a wave level and mute control, and input monitor level and mute controls for each of the line inputs.

The record topology consists of a master input level, mute control and peak meter, line input level controls for each of the physical inputs and a digital loopback level control and mute.

The digital loopback allows the output of the card to be digitally mixed back into the input. On Windows Vista / 7 / 8, these inputs are only visible if **Show Disabled Devices** is checked on the recording device settings (right-click on any of the devices to set this).

The range on the input and output master controls is -96dB to +6dB, while the individual line controls range from -96dB to 0dB.

To access the playback and record mixer controls on Windows 2000, XP and Server 2003, double-click on the loudspeaker symbol at the bottom right hand corner of the screen. On Windows Vista / 7 / 8, right-click on the loudspeaker symbol, select Playback Devices or Recording Devices, select the desired endpoint, click on Properties, and then click on the Levels tab.

Windows Vista / 7 / 8 Mono Recording Bug

Windows Vista, Windows 7 and Windows 8 have a bug which causes mono recording streams to capture only the left channel of the source, rather than mixing the left and right as previous versions did. As a workaround until this is fixed, the driver provides a Mono Mix recording endpoint for each of the card's inputs. By default these are disabled, but can be individually enabled as follows.

Right-click on the loudspeaker symbol in the bottom right hand corner of the screen and select **Recording Devices**. Right-click on any of the sources and check **Show Disabled Devices**, which should then reveal four additional sources called **Input 1 Mono Mix, Input 2 Mono Mix, Input 3 Mono Mix** and **Input 4 Mono Mix**. To enable these, right-click on them and select **Enable**. **Note** that, after enabling, it will still show as currently unavailable as these endpoints are multiplexed with the normal stereo inputs and are only activated when opened by a recording application. Also be aware that, for the same reason, the stereo and mono mix endpoints for the same source can't be used simultaneously.

The Mono Mix endpoints should be used for communications applications such as Skype which open a mono capture stream.

Operation on Windows Vista / 7 / 8 / Server 2008 / 2008-R2 / 2012

The audio subsystem of Windows Vista / 7 / 8 has changed substantially from earlier versions of Windows, although most applications should continue to work without modification. The major differences likely to affect users of the Digitorc 4 are described below.

Audio Endpoints

Key to the new system is the concept of audio endpoints. These are the physical audio sources and destinations, such as microphones, speakers and line connectors.

Previously, an audio capture device would typically have multiple inputs which were combined in a mixer or selector. Under Windows Vista, each input is represented by its own device, and Windows itself operates the card's selector to route the chosen source to the input stream.

In the case of the Digitorc 4, each of the physical line inputs is represented by an endpoint device, and as the hardware has separate AES3 transceivers for each one, they can be used simultaneously. There are also endpoint devices for the digital loopback sources, although by default these are disabled. To enable these sources, right-click on the loudspeaker symbol at the bottom right-hand corner of the screen, select Recording Devices, right-click anywhere in the window and select Show Disabled Devices. Now right-click on the desired Wave Out Mix device and select Enable. This source will now appear as one of the available audio recording devices. Note that when an application is recording from a loopback endpoint, the corresponding line input is unavailable, and vice versa.

Windows Vista has a default playback endpoint and a default recording endpoint, which are typically used by applications where the input or output device cannot be explicitly chosen. After the Digitorc 4 driver is first installed, these may be randomly set to any of the outputs and inputs. To set the default endpoints, right-click on the loudspeaker symbol, select Playback Devices or Recording Devices, and then right-click on the desired endpoint and select Set as Default Device. The default device is remembered across reboots and should not need to be set again unless additional audio hardware is installed, in which case the defaults may need resetting.

Windows 7 and 8 provide separate defaults for communications applications. When enabled, the Mono Mix inputs become the default communications source.

Mixer API

By default, the mixer API under Windows Vista / 7 / 8 is virtualised for each application, providing just a mute and volume control for each endpoint and affecting only the audio going to and from that application. The hardware controls on the card itself are not accessible from the mixer API in this default mode.

For applications that need direct access to the hardware mixer controls, or that need access to the line input monitor controls or peak meter nodes, there are two options. Firstly, if it is a new application being written specifically for Windows Vista / 7 / 8, it can be designed to use the Core Audio APIs, which include the DeviceTopology API and the EndpointVolume API (which includes the IAudioEndpointVolume and IAudioMeterInformation interfaces). These are documented in the Windows Vista SDK which is available from Microsoft, however note that these APIs don't work with earlier versions of Windows.

Alternatively, applications can be given access to the hardware mixer controls through the mixer API by right-clicking on the application's icon, selecting Properties, clicking on the Compatibility tab and selecting Run this program in compatibility mode for Windows XP Service Pack 2. Be aware, though, that in this compatibility mode, the Digitorc 4 card is represented by a single mixer device with destination lines for each of the individual

inputs and outputs, which is slightly different to its behaviour under Windows XP where each input/output pair had its own mixer device. How this will work with any particular application that uses the mixer API can only be determined by experimentation.

Audio Engine

The audio engine in Windows Vista / 7 / 8 runs at a fixed sampling rate and bit depth. The Digitorc 4 driver sets this to be the same as the card's hardware sampling rate and with 24-bit resolution on all inputs and outputs. The Windows sampling rate converter is used whenever a different sampling rate or bit depth is requested by applications.

The Digitorc 4 supports the event-driven pull mode on Windows 7 and 8, providing lower latency and more robust performance.

DirectSound and WDM Kernel Streaming

Microsoft's DirectSound and Windows Driver Model (WDM) are designed to work hand in hand to take full advantage of audio card hardware and provide kernel-mode software emulation of features not directly supported. Kernel streaming allows audio data to be passed directly between driver modules resulting in a robust, high performance integrated sound processing system.

With its WDM driver, the Digitorc 4 can play MIDI files and audio CD's, in addition to Wave files. The kernel mixer allows multiple sounds from the same or different applications to be played simultaneously, while the kernel splitter automatically splits an input source to multiple applications. Sampling rate conversion is automatically inserted if any of the multiple playback or recording streams have different sampling rates.

Extended Bit Depth Audio

Traditionally, PC-based audio capture and playback has been restricted to either 8 bit or 16 bit encoding, with the WAVE_FORMAT_PCM descriptor used to define the audio parameters such as samples per second, bits per sample and number of channels.

With the advent of 24 bit A/D and D/A converters, there was a need to support extended bit depth. To achieve this, Microsoft introduced a new data format descriptor called WAVE_FORMAT_EXTENSIBLE. This provides additional information, including the number of valid bits per sample and support for specifying channel placement in multichannel streams.

The WAVE_FORMAT_EXTENSIBLE descriptor may be used in place of the normal WAVE_FORMAT_PCM in setting up playback and recording through either the Winmm (wave) API or the DirectSound API. For further information refer to the Microsoft DirectX 8 documentation.

Some audio editing applications, such as Syntrillium's Cooledit 2000 and Adobe Audition, support extended bit depth audio and work well with the Digitorc 4 using 24 or 32 bit recording.

Digitorc 4 Pinout

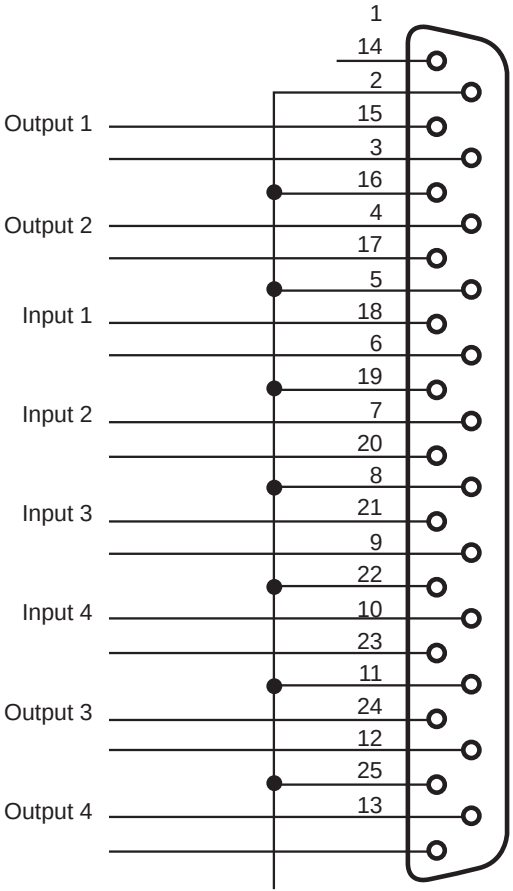


Fig 1-1: Digitorc 4 Pinout Diagram

Technical Specification For PC-DIG4

Operating Systems Supported	
Platform:	Windows XP (SP2 or later), Server 2003, Vista, Server 2008, Windows 7, Server 2008 R2, Windows 8 and Server 2012 (32- and 64-bit versions)

Features	
Card Interface:	Single lane PCI Express version 1.1
Line Interface:	Transformer coupled AES3 (AES/EBU)
Line Output Sampling Rate:	96kHz, 88.2kHz, 48kHz, 44.1kHz or 32kHz (configurable)
Line Input Sampling Rate:	32kHz to 96kHz via independent asynchronous sampling rate converters
Audio Resolution:	24 bits
Sampling Rate Accuracy:	+/- 5ppm
Software Resolution:	32, 24, 16 or 8 bits
External:	AES11 compliant synchronisation
Frequency Response:	DC to 43.5kHz (at 96 kHz sampling)
Connector:	25-pin D-type female

Equipment Type	
PC-DIG4	Digitorc 4, 4 stereo AES-3 I/O PCIe sound card

Physical Specification	
Dimensions (Raw):	14cm (L) x 12.5cm (H) x 2cm (D) 5.5” (L) x 4.9” (H) x 0.8” (D)
Dimensions (Boxed):	27cm (L) x 22.5cm (H) x 6cm (D) 10.6” (L) x 8.9” (H) x 2.4” (D)
Weight:	Nett: 0.10kg Gross: 0.20kg Nett: 0.2lbs Gross: 0.4lbs

Accessories	
PC-DIG4BC	Digitorc 4 XLR breakout cable

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