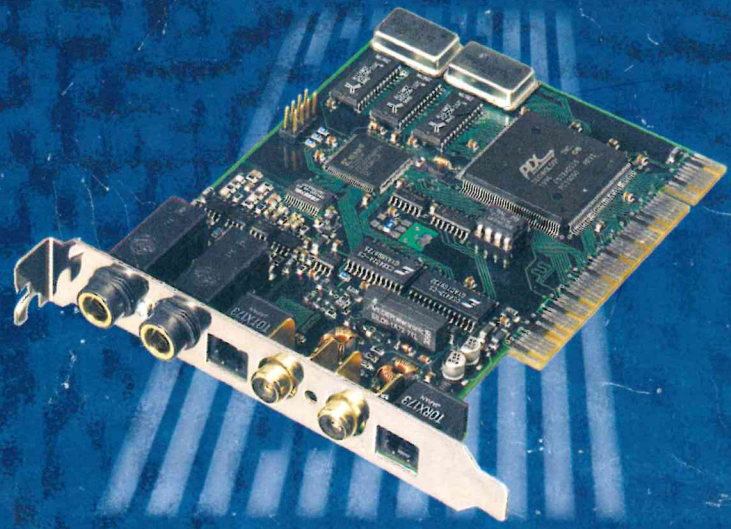
PRODIF PLUS



SEK'D

PRODIF PLUS

Users Manual

4 - 5/99

Content

1. Introduction

Congratulations on your purchase of PRODIF PLUS. This state of the art product allows the recording of digital audio from CD, DAT, digital mixing desks, ADAT™ recorders, samplers, or other digital sources directly into your computer. This sound card also features high-quality analog-to-digital and digital-to-analog converters to maximize flexibility and value. You can use the ADAT™ interface and the analog input and output simultaneously, turning PRODIF PLUS into a multi I/O card providing 10 individual tracks of recording and playback.

For those who prefer analog connection, PRODIF PLUS has built-in AD/DA converters with a resolution of 20 bit. Its S/N ratio is better than 90 dB, and its audio quality compares with the best DAT recorders.

Thanks to the convenient "Plug & Play" installation procedure of MS Windows™ even users with little computer knowledge can easily install the PRODIF PLUS.

Drivers for Windows™ 95 and 98 facilitate trouble-free, convenient and efficient operation of the PRODIF PLUS in computer systems equipped with a PCI Bus.

Supporting resolutions of up to 24 bit/96 kHz on the digital domain the PRODIF PLUS represents a state-of-the-art interface that perfectly complements the SEK'D 24/96 system.

2. Supplied Contents

When you open the PRODIF PLUS package please check if the following items are included:

- PRODIF Plus PCI Card
- User's guide
- Driver disk
- Product Registration Card

3. System requirements

- Windows 98™, Windows 95™
- A free PCI bus slot
- An unused IRQ (Interrupt)

The audio software used for recording and playback possibly makes additional requirements on your system.

4. Description of the PRODIF PLUS

4.1 Specifications

- Short PCI card
- Connectors on slot bracket:
  Analog input and output: 2 x 1/4" stereo jack
  Digital input and output: 2 x TOSLINK (Optical)
  Digital input and output: 2 x RCA

- Analog input selectable -10dBv / +4dBm (by Jumper)
- Analog Outputs can be adjusted in 0,5 dB steps (Low impedance, Headphones can be driven directly from the analog output)
- Electrical Inputs and outputs ground-free transformer coupled

- Digital input formats: S/PDIF, AES/EBU, ADAT™
- Digital output formats: S/PDIF, AES/EBU, ADAT™

- Audio resolution: 8, 16, 20 and 24 bit

- Sample rates analog: 11,05 to 48 kHz
- Sample rates digital: 32 / 44.1 / 48 / 64 / 88.2 / 96 kHz

- AD/DA converter: 20-bit, high performance
- Signal to Noise ratio: 90 dB

4.2. Features

- "Plug & Play" integration for Windows 95/98™
- System integration with Windows™ Multimedia-Manager
- Works with all non-proprietary (standard) recording or editing software
- Multiple cards can be used with a single driver

- Full Duplex (simultaneous recording and playback)
- Sample aligned simultaneous start of record and playback in Record while Play mode
- Automatic hardware test on power-up
- Zero Latency Monitoring
- Hardware pitch support
- Ignores copy protection

5. Installation and Setup of the PRODIF PLUS

5.1. Installing the PRODIF PLUS into your computer

Before you install your PRODIF PLUS make sure that your computer has been switched off properly and the power cord has been unplugged from the power supply socket.

1. Unplug all connection cables from your computer.
2. Open the housing of the computer at the adequate locations only. (Please mind the instructions of the manufacturer!)
3. Touch the metal computer chassis to ground yourself and discharge static electricity.
4. Take the PRODIF PLUS out of its protective packaging cover and carefully push it into a free PCI slot on the motherboard of your computer.
5. Attach the PRODIF PLUS using screws or retaining clips (whatever is adequate).
6. Close the housing of the computer properly.
7. Connect all signal cables and the power cable to your computer.
8. Start your computer and install the driver software according to the descriptions of the next chapter.

5.2. Driver Installation

5.2.1. Windows 95/98™

When you start your computer again, Windows™ detects the new hardware component and asks you to insert the driver disk of the manufacturer. Insert the supplied driver disk for Windows™ 95/98 into your disk drive. Select drive A:, for example, if your disk drive is assigned to letter A, and select the directory which corresponds to the language you wish to use for the setup procedure.

If the PRODIF PLUS drivers are contained on a supplied CD-ROM, select the letter that represents your CD ROM drive (e.g. D:) and select the sub-directory which corresponds to the name of your operating system and the language you wish to use for the setup procedure.

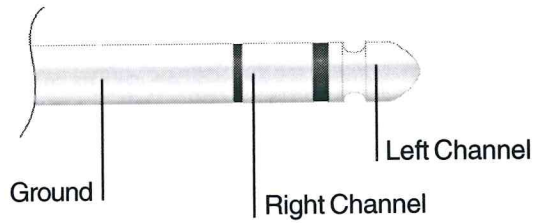
Click Ok. Windows™ 95/98 installs the driver automatically and sets up the PRODIF PLUS in "Multimedia Manager".

During the copy procedure you possibly will have to enter the path of the disk drive again.

You can use the PRODIF PLUS right away without having to restart your computer.

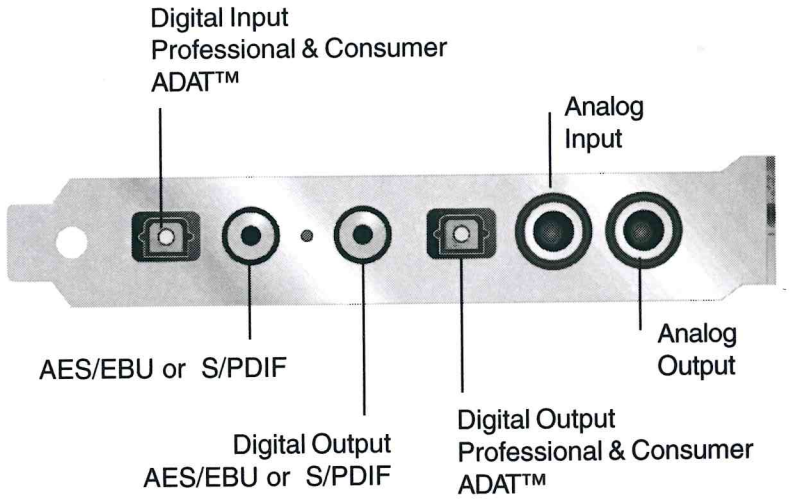
6. Connections

Analog gear can be connected to the 1/4" stereo phone jacks on the PRODIF PLUS. The tip of the phone plug must be wired to the left channel, the ring to the right channel, and the sleeve to the common ground.



Digital audio sources can be connected to the PRODIF PLUS using the RCA connectors or the optical TOSLINK connectors.

The optical terminals can work in S/PDIF format (2 channels) or ADAT™ mode (8 channels).



Most sound cards require you to enter the Windows™ control panel to select the active input. As a card of the latest generation, PRODIF PLUS is a step ahead: Each stereo pair can be accessed with its own wave device and can be selected directly from your audio software. PRODIF PLUS's input accepts all common digital sources and detects them automatically. The choice of the digital output format is all you have to select in the driver. The outputs themselves can be accessed by individual wave devices and can be selected directly from your audio software.

7. Use of the PRODIF PLUS

7.1. Playback

In your audio software you must first select which output of the PRODIF PLUS will function as the output device. In Samplitude the corresponding options can be found in the "Playback Parameters" dialog. With other programs the corresponding options can be found under menu items like "Settings", "Defaults", or "Properties".

For playback of the audio signals the PRODIF PLUS automatically uses the parameters that you set in your audio application – e.g. 16 bit/48 kHz – provided that the corresponding parameters are supported by the PRODIF PLUS. If the format is not supported, the software used for output displays an error message.

The input signal can be passed through to the output. On default, this feature is switched off. However, it is often useful to activate this function. Once activated, the peak meters start working, and the input signal appears at the output. In this case, the signal played by the software in use cannot be heard.

7.2. Recording

To make a recording you must first use your audio software to select which input of the PRODIF PLUS will function as the recording device.

In Samplitude the corresponding options can be found in the "Recording Parameters" dialog. With other programs the corresponding options can be found under menu items like "Settings", "Defaults", or "Properties".

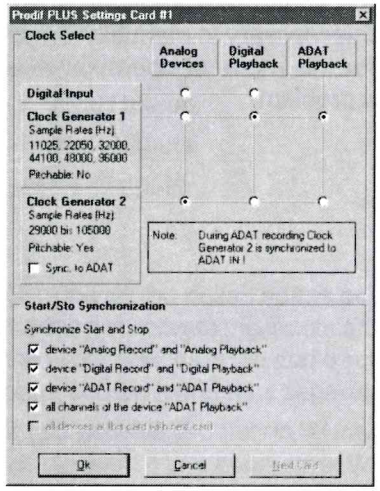
When it comes to digital recording, the internal frequencies of the whole signal chain must be synchronized. This is normally achieved automatically with self-clocking connections like S/PDIF or AES/EBU.

7.3. Card Settings

PRODIF PLUS provides fine integration with Windows™ 95/98™. With a double click on 'Audio for PRODIF PLUS Sound System' (located in the section 'Multimedia Settings') the dialog 'Properties of Audio for PRODIF PLUS' appears on the screen. A click on 'Settings' opens the window 'PRODIF PLUS Settings Card #1'. This dialog allows to set the sync sources.

This panel gives you the possibility of assigning a clock to the analog devices (common clock for In and Out), the digital output and the ADAT™ output.

There are three different clock sources: the clock of the digital input, clock-generator 1 and clock-generator 2. The clock signal of the digital input is generated from the self-clocking S/PDIF or AES/EBU data stream.



Clock-generator 1 is limited in the number of the supported sample rates, and it is not pitchable. However, any device linked with this generator can playback and record at 11 kHz and 22 kHz.

All devices linked with clock-generator 2, can playback and record with a sample rate in a range between 29 KHz and 105

KHz. Additional devices can be synced to external equipment (e.g. MIDI) as clock-generator 2 is pitchable.

In the case of ADAT™ recording, all connected devices are running off the ADAT™ playback clock. If you would like to do the same, select "Sync. to ADAT".

7.3.1 Start/Stop Synchronicity

When using the PRODIF PLUS in a hard disk recording and overdubbing situation, the ability to syncronize the start and stop time of the card is very important. Windows™ is not currently capable of doing this consistantly, so the PRODIF PLUS driver assumes responsibility for this task. If you are working in a situation where this synchronization feature is unnessesary, you may disable this option.

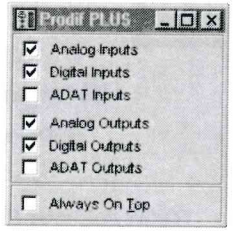
When using the PRODIF PLUS in a multi-channel ADAT™ scenario, the PRODIF driver will start and stop all data transmission to ADAT™ devices simultaneously. If you would prefer separate ADAT devices running independantly, it is neccecsary to manually switch off this feature. A typical usage for this mode of operation would be to troubleshoot a difficult sync problem.

8. The Audio Function Management

The driver provides its own control window for each input and output. Meters show the peak level in a range between -60 and 0 dB with a resolution of 1 dB between -20 and 0 dB, the inputs are equipped with selector switches, and the analog input level can be set with a pair of faders. Each window can be activated separately by checking a box in the dialog 'PRODIF PLUS', that can be opened with a double click on the PRODIF PLUS icon in the control panel.

Checking the boxes in this dialog opens the following Windows™:

- Analog Inputs
- Digital Inputs
- ADAT Inputs
- Analog Outputs
- Digital Outputs
- ADAT Outputs

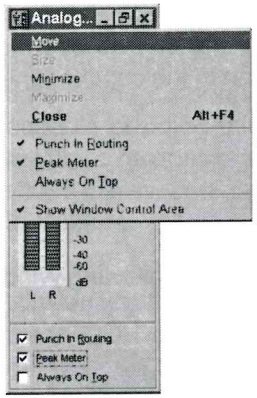


Clicking on the boxes opens or closes the display Windows™, but it does not activate the inputs and outputs. This is done by selecting the wave devices in the audio software. Each of the input and output pairs can be found as a separate wave device.

If you activate the option 'Always On Top', the window will remain visible even if you open other Windows™ applications.

Tip: When working with your audio software, it is often helpful to keep an eye on the meters. You can drag and drop the Icon 'PRODIF PLUS' from the control panel to the desktop. Then, you can open the meters by directly by clicking on this icon. You don't have to open the control panel each time to gain access to the meters.

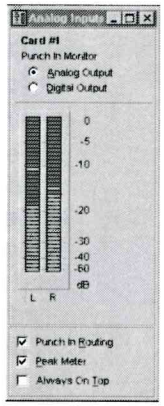
Tip: In the upper left corner of the PRODIF PLUS control screens you will find a small mixer icon. This is a pull-down menu that will give you access to more controls and features. To save space on your desktop, you can disable the "Show Window Control Area". Then if you need to access the features in this window, you can find them in the system menu.



8.1. Analog Input

Using "Punch-In Monitoring" you can select at which output the monitoring signal will be played back.

The input level can be seen on the high-resolution peak meters for each of the stereo channels.



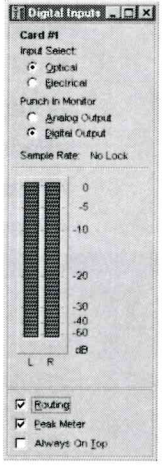
8.2. Digital Inputs

The digital input can be switched to:

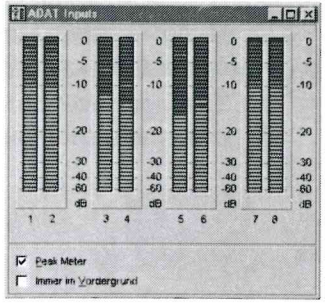
- Optical (TOSLINK port, ADAT compatible)
- Electrical (gold-plated RCA connectors)

Using "Punch-In Monitoring" you can select at which output the monitoring signal will be played back.

The digital inputs are also equipped with high-resolution meters. The meters and selectors can be displayed by clicking the checkboxes. The option 'Always On Top' is available as well.



8.3. ADAT Inputs



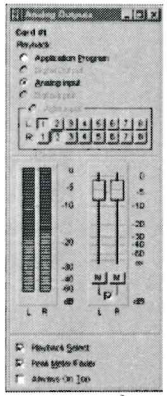
This window has no controls, there are just two meters for each of the four possible input pairs.

The ADAT™ input appears with four separate stereo devices in Windows™. These devices can be activated simultaneously, if your audio software supports multiple devices. That means, PRODIF PLUS can be used as multi I/O card if you assign the different wave devices to different tracks.

8.4. Analog output

You can select the source signal for the output:

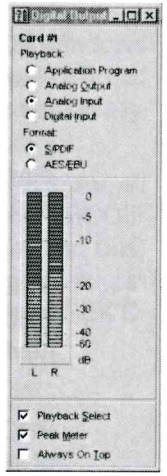
- Output of the audio software
- Pass-through from digital output
- Pass-through from analog input
- Pass-through from digital input
- Pass-through from ADAT™ input



Of course you find the high-resolution meters also in this window, and you can display the sections of the window independently. An interesting feature is the pass-through from the digital input. In this mode, the PRODIF PLUS operates as a D/A converter.

With the fader you can adjust the level of the output signal. With the mute buttons, you can mute the left or right output channel.

8.5. Digital Output



The digital output offers the same options you already found on the analog output:

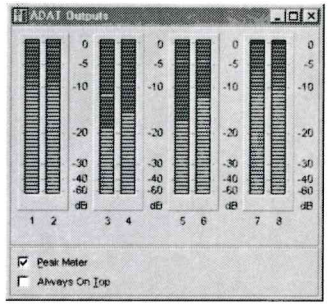
- Output of the audio software
- Pass-through from analog output
- Pass-through from analog input
- Pass-through from digital input

Moreover, you can select the output format:

- S/PDIF
- AES/EBU

High resolution meters and the three checkboxes can be found in this window. When set to pass-through from the analog input, PRODIF PLUS operates as a A/D converter.

8.6. ADAT Outputs



This window provides two high resolution meters for each of the four stereo output pairs. The ADAT™ output appears as four separate stereo devices in Windows™. These devices can be activated simultaneously if your audio software supports multiple devices. PRODIF PLUS can be used as multi I/O card, if you assign the different wave devices to different tracks.

8.7. PRODIF PLUS as a Multiple I/O Device

If your audio software is able to support multiple wave devices, PRODIF PLUS can be used as a multi I/O card. It provides four channels when using the analog and digital stereo devices at the same time. If you employ the ADAT™ interface (four stereo devices) in combination with the analog input and output (one more stereo device), you can access 10 different tracks with individual inputs and outputs, and you can record on all those tracks simultaneously!

Note: It is not possible to run ADAT™ interface and S/PDIF or AES/EBU connectors at the same time. If you activate the related wave devices, your system will display an error message.

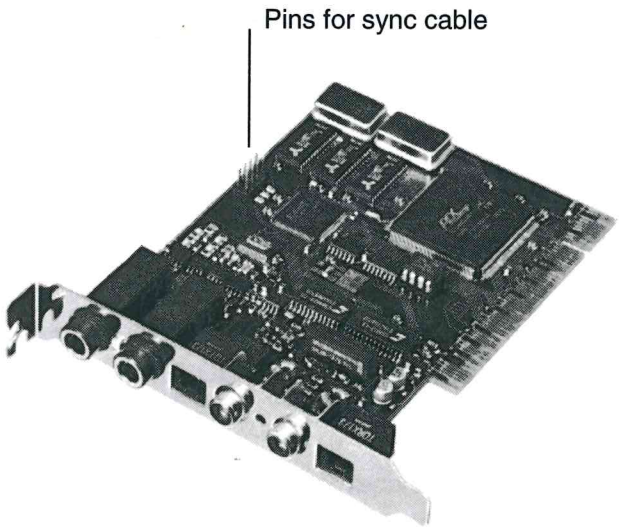
PRODIF PLUS allows the playback of wave data during the recording of further wave data. This feature known as 'Full Duplex' or 'Record During Playback' is essential for multitrack hard disk recording, however it must be supported by the recording software.

Important: Full Duplex operation requires identical sample frequencies for the signal to be recorded and the signal to be played back, if PRODIF PLUS is synched with only one clock generator. If the inputs and outputs are driven by different clock generators, PRODIF PLUS is capable of working with different sample frequencies at the same time.

9. Installing more than one Card

Installing more than one PRODIF PLUS is possible. The Windows 95/98™ drivers are able to communicate simultaneously with all cards known to the system, and it looks for a free IRQ automatically.

If multiple PRODIF PLUS cards are connected to a digital mixer, all cards must receive the same clock. For this purpose the PRODIF PLUS provides a four pin connector and a synchronization bus, which is passed through from card to card by means of a four pin ribbon cable. The ribbon cable can be ordered directly from SEK'D.



10. Additional Information in the digital Signal

The digital signal not only transmits pure audio information but additional information (called header) as well. The header contained in the output signal must be compatible with the recording device. Otherwise malfunctions may occur.

A normal consumer DAT recorder, for example, will refuse to switch to record mode if the received sample frequency is 44,1 kHz and the header is 48 kHz.

The PRODIF PLUS is much more versatile and uncomplicated than the above mentioned DAT recorder. To make sure that the output signal is always compatible, the PRODIF PLUS generates a completely new header even for recordings or in pass-through mode. Copy protection is ignored. However, if an emphasis bit exists, it will also be removed.

The header of the PRODIF PLUS's output signal has been especially optimized for maximum compatibility with other devices. It contains the following information:

- Sample frequency
- Audio use
- No copyright, copying is permitted
- Format Consumer or Professional
- Category General, generation not indicated
- 2-Channel, No emphasis or 50/15 µs
- Aux bits audio use

11. Troubleshooting

Although no error message occurred after the installation of the PRODIF PLUS, playback is impossible.

- Check the cable connections of the PRODIF PLUS and the external equipment.
- Check if the PRODIF PLUS is set up as a playback device in your audio software.

  Check the settings for monitoring the inputs and outputs.
- Select the "Audio" tab of "Multimedia Manager" and check if the PRODIF PLUS is contained in the list of playback devices.
- Select the "More/Devices" tab of "Multimedia Manager" and check if the PRODIF PLUS is contained in the list of audio devices.

  Check the device manager (Windows™ control panel) to see if there is an entry for the PRODIF PLUS.
- If the PRODIF PLUS entry is highlighted by a yellow exclamation mark, an interrupt or address conflict has occurred. To solve this problem, select "Properties|Resources" (if necessary, select "Set Manually" as well), disable the "Set Automatically" option, double-click at the resource which causes the conflict and set it manually (see window below). Restart your computer. If the problem still exists, either your computer is incompatible or the PRODIF PLUS hardware is faulty. Contact the SEK'D support.

The PRODIF PLUS cannot be used for recording (playback works well, however):

- Check the cable connections of the PRODIF PLUS and the external equipment.
- Check, if the PRODIF PLUS is set up as a recording device in your audio software.

There is a crackling noise during recording or playback:

- Increase the size and/or number of buffers in your audio software.
- Check, if one of the connection cables is faulty.

When the PRODIF PLUS is accessed for the first time, the system crashes.

- This can happen if the PRODIF PLUS is used together with a display adapter which is equipped with a "S3 968" chipset. In "Device Manager" select "Resources/Change Settings" and change the PRODIF PLUS's parameters by assigning a memory area below the display adapter's memory area to the PRODIF PLUS.

12. Basics: 24 Bit

PRODIF PLUS can transfer digital audio with a resolution of up to 24 bit. The AD/DA converters work with 20 bit sample words. Compared to other digital audio cards working with 16 bit, PRODIF PLUS is capable of providing superior and exceptional audio quality.

In order to transfer an analog signal to the digital domain, samples are taken from its amplitude in certain periods of time. Each of these samples is represented by a number, coded in a digital sample word. CD audio is working with 16 bit integer words, i.e. $2^{16} = 65,536$ different values. If the amplitude of the analog signal has a value between two of these integer numbers, there will be a deviation between the analog source an the digital target. This deviation is differing from sample to sample and results in a 'difference' signal, that seems to be added to the original audio. It is known as quantization noise, and its level is theoretically 96 dB down.

To avoid clipping, you should leave headroom when recording digitally. Unfortunately, that means the upper bits are not used, and results in a resolution of only 13 or 14 bit when working with a 16 bit converter. This is the reason, why PRODIF PLUS has a built-in 20 bit converter! Of course it needs a headroom, too - but also if you take this headroom into account, there still remains 18 of your 20 bit resolution. Therefore, there are enough used bits left to calculate optimized 16 bit sample words using dithering or noise shaping, and your recordings get the maximum in dynamic range and resolution.

Processing a digital signal is the calculation of the numbers it consists of. Each calculation results in an error in the least significant bit (LSB) due to rounding. When working with the 24 bit format, this error is 144 dB down and cannot be heard by human beings even if it cumulates in a number of subsequent signal stages. To keep this advantage when transferring a digital signal from one unit to another one, it is very important not to fall back to the 16 bit format. This is why PRODIF PLUS is capable of working with 24 bit.

13. Basics: 96 kHz

Bringing an analog signal to the digital domain, samples must be taken from its amplitude in certain periods of time. Each of these samples is represented by a number, coded in a digital sample word. The more samples are taken in a given time window, the faster the converter is able to detect amplitude changes. Being able to detect faster changes means, it can work with higher frequencies. The highest frequency that can be processed is the so-called Nyquist frequency, it is exactly half of the sampling frequency. A digital system working at 44.1 kHz can process audio up to 22.05 kHz. If the analog signal contains higher frequencies, digital processing creates audible artifacts called aliasing (lat. 'alias', the other one). For this reason, every AD converter has an anti-aliasing filter to remove spectral components above the Nyquist frequency. The construction of this filter is a difficult job, since it needs a very steep curve to ensure an uncolored audio signal up to 20 kHz on the one hand and a high damping factor above 22 kHz on the other.

Sampling with 96 kHz results in a Nyquist frequency of 48 kHz. The construction of the anti-aliasing filter is way easier, e.g. the engineers could set the cutoff frequency to 24 kHz to ensure the audible range is not influenced, and there still is a full octave left (from 24 kHz to 48 kHz) for the filter curve to fall to the desired damping factor.

When listening to the stereo image of a recording, our ears evaluate differences between the two stereo channels in time and level. Natural recordings techniques like the classical two microphone method result in a stereo image mainly based on the time aspect. We locate a signal from where the first wavefront comes from (Haas effect), even if the sound pressure level is the same on both ears. Signals with just a small offset from the middle of the stereo field result in time differences of just a few milliseconds. The time interval between two samples in a 44.1 kHz signal is one 44.100th second, i. e. 23 microseconds. Smaller time differences cannot be transferred to the digital domain, and this is the secret why some analog recordings sound way better than their digital pendants! A sample rate of 96 kHz means smaller time intervals and ensures a better audio quality.

14. Other Products From SEK'D

Samplitude 2496

Audio software for Microsoft Windows 95/98 and NT.

- High-resolution Professional Multi-track Recording, Editing and Mastering Software for the ultimate in sound quality and precise control of digital audio.
- True 24 bit 96 kHz audio for commercial and professional projects such as DVD and CD recording and mastering.

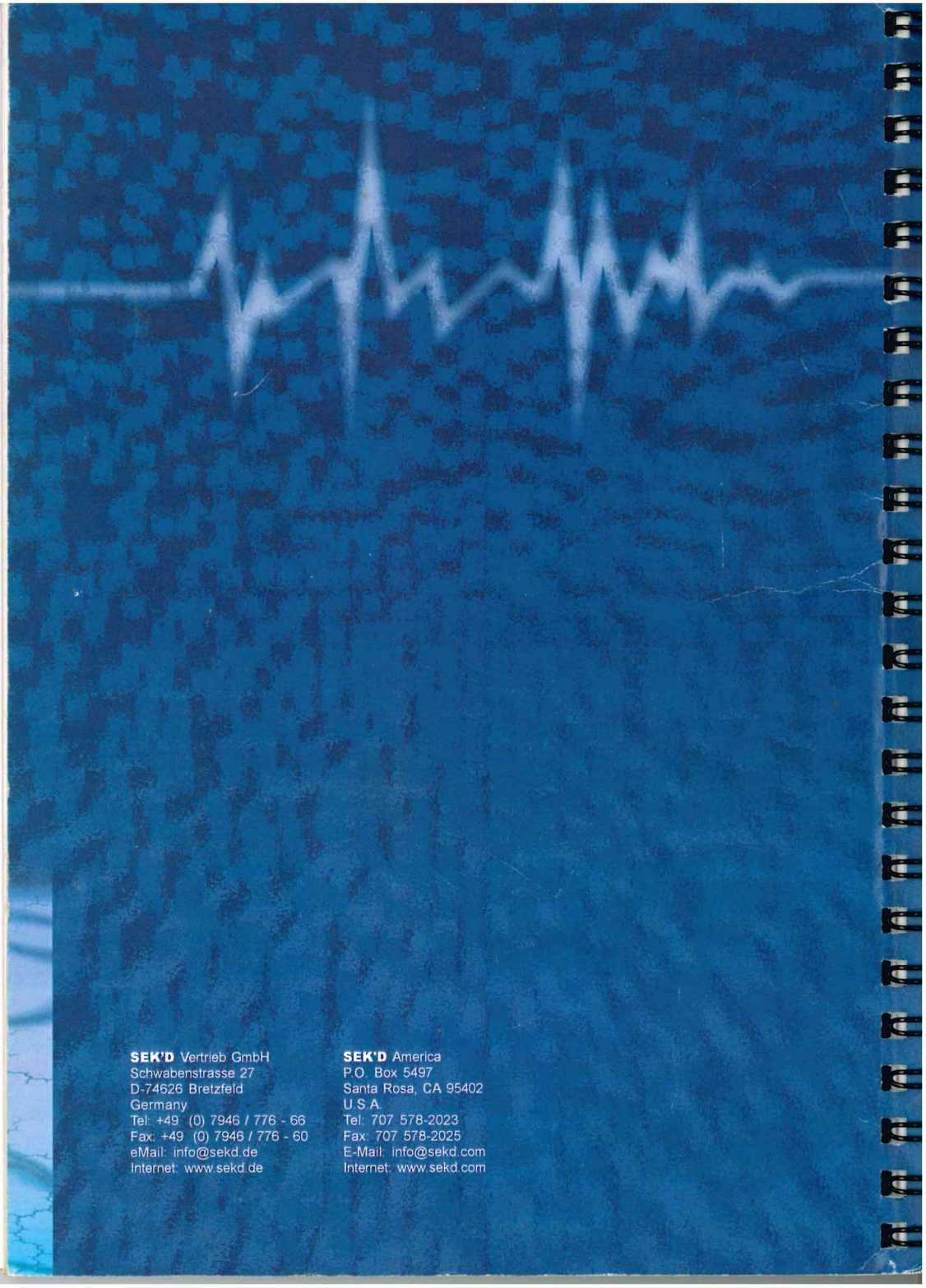
Samplitude 2496 has multi-tracking capabilities that can be compared to professional multi-track tape machines. However, Samplitude goes much further by adding real-time, non-destructive editing, mixing and automation allowing for the most complex projects to be handled quickly with exceptional results. Exceptional sound quality is achieved using 32 bit floating point precision in the processing and storage of audio. And you can burn your Red Book CD directly from the software.

ADDA 2496 S

24 bit 96 kHz external audio converter.

- Affordable, True 24 bit 96kHz Analog to Digital and Digital to Analog Audio Signal Converter
- Professional quality two-way conversion of high-resolution audio in and out of the digital realm

The ADDA 2496 S is a sensational and inexpensive alternative for high-resolution audio signal conversion. For professional environment this converter offers XLR connectors for analog audio inputs and outputs and XLR plus RCA connectors for AES/EBU and S/PDIF on the digital side. The ADDA 2496 S supports sampling rates from 44.1 kHz up to 96 kHz with 24 bit audio resolution and over 100 dB dynamic range. This is an external converter in a half-rack size and excels at audio conversion in or out of a computer environment.



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