

Whitepaper

Observations regarding professional alternatives to PC expansion cards for audio

Audio workstations

PC-based audio workstations have controlled the workflow of today's broadcast equipment for approximately ten years. Audio workstations can be found in almost all application environments where they have to meet the highest requirements on sound quality and be compatible with existing standards.

The early days of PC usage in this field entailed extra costs and efforts since the use of multimedia was not supported at that time. This was only possible by using system expansions (e.g. plug-in cards). Today's PCs and operating systems are multimedia-orientated and already offer a variety of prerequisites which now meet even professional requirements. Therefore, the adaptation of PC's to the typical requirements of professional audio handling through system expansion has largely become superfluous.

The following items in particular have contributed to this development:

- Architecture and increased efficiency of advanced CPUs
- Multimedia orientation of today's operating systems
- Standard interfaces for broad-band data transfer
- Platform-wide compatibility

The worldwide USB (Universal Interface Bus) standardization resulted in a flexible and advanced interface for simple but reliable interconnectivity. The high bandwidths and safe internal connection systems make this interface interesting for multimedia applications.

Sound cards for PC installation

The link between real-time audio and PC's requires a professional interface that fulfils corresponding demands regarding functions and quality. In addition, interface cards (sound cards) which can be operated directly in the PC (plug-in cards) have been used in PC-based sound systems in a professional environment.

The sound cards meet numerous requirements such as:

- Availability of professional audio interfaces
- Balanced studio levels
- AD/DA converters
- Encoding/decoding (MPEG, MP3 ...)
- Earphone outputs
- If appropriate, DSP power for extended signal processing

Attempts to come to terms with these requirements resulted in a de-facto standard in a professional environment. Only few manufacturers were able to offer adequate solutions, thus resulting in a strong polarisation and high card prices.

The processor efficiency of an average advanced CPU today is one of the main reasons why computing processes have been transferred to a DSP in sound cards. This primarily relates to data compression and decompression processes, the screen display of envelopes and signal processing. As a consequence, the requirement for the audio interface has to be redefined.

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Costs and efforts for system service and maintenance

A computation of costs (TCO) related to the use of sound cards discloses a variety of "side effects" and high cost factors. Apart from this, the use of plug-in cards limits operation due to a lack of flexibility, increases the downtimes in the event of repairs and is thus a general availability risk.

In addition, high installation and maintenance costs are generated for the required drivers. This mediation layer between the card hardware, operating system and application software must be adapted and updated for each change of a general variable (e.g. change to a higher operating system). This generates extreme costs and high logistic efforts for wide-ranging applications.

Summary of the reflections on the use of sound cards:

- The installation of sound cards requires manipulations in the PC
- Considerable costs and efforts for installation and commissioning
- Free and bus-compatible PC slots required
- Use of appropriate drivers required
- Release update of drivers required, e.g. when the application software is updated
- A change of PC is limited, whether in the event of a new purchase or a failure
- High costs and efforts for system service/repair which is only possible by IT experts
- Repair without interruption of operation impossible

Costs

As expected, the total costs for the use of sound cards are high. Basically, the purchase price as well

as the costs and efforts for the installation and system maintenance are considerably higher for integrated solutions than for modular approaches. A review of the operating costs over several years clearly shows that the purchase price of sound cards are only the tip of the iceberg. Please refer to the different serious studies on this topic.

Description of a new concept (PUC)

Defined objectives

The creation of a PC <-> audio interface which is independent of the PC hardware and operates with every application software that supports Windows ME is the prime objective of a new development. Other requirements on such an interface include:

- Simplest handling
- Cost-efficient price model
- Significantly reduced follow-up costs and efforts

The audio interface must be designed for professional requirements (quality, operational reliability, level standards), and must be largely independent of PC hardware and OS: In addition, the interface should no longer be integrated in the PC but should be operated externally.

The interface must allow full-duplex handling for a linear stereo input and a linear stereo output. Professional analog and digital formats are provided as real-time audio interfaces. Cascading for multichannel operation is possible.

USB as interface standard

The level of USB interface standardization that has now been achieved makes it an ideal interface for

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the objective pursued. The basic USB advantages include:

- High data transfer rates
- Automatic installation
- Hot-plug capability
- Cross Platform (Windows, MAC)
- Operational reliability
- Power supply concept
- Standard feature on PCs and laptops
- Standard cable connections with international availability

The development is based on the currently widespread USB 1.1 standard and is compatible with USB 2. The bandwidths possible in USB 1.1 permit a full-duplex transmission of more than 16 stereo channels, depending on the protocol used!

Form factor

The interface includes a compact form factor which approximately corresponds to the diameter of a CD. Thus, the PUC can be used not only for permanent installations but also for applications in the field, above all together with laptops. The simultaneous availability of analog and digital real-time audio connections requires a connector with a high component density. A D-Connector 25 was chosen due to its international coverage and wide spread availability. Permanent installations can be established just as quickly and easily as the corresponding cable solutions. In addition, the connection has coding pins jumpered in the plug accordingly. Thus, the respective “switches” are protected from an inadvertent misadjustment.

2 LEDs indicate whether the USB device is initialised and whether ZLM (Zero Latency Mode) is activated.

Reduction of efforts and costs for the system integration/TCO reflections

Apart from the low purchase price of € 300 (AES-EBU variant € 400) for the interface there are other considerable saving potentials which result in a substantial reduction of TCO (total costs of ownership). First of all, the use of the PUC eliminates the need for mechanical installations. PCs with a USB interface can be used and purchased entirely independently of compatibility considerations. The generic compatibility with MS Windows (except for NT 4.x), Apple OS 9 and OS X further eliminate software installations. This does away with any overhead to ensure that the PC, operating system, drivers and application software are compatible.

From the point of view of the system installation, PUC can be regarded as a “termination” of the real-time audio wiring. In this consideration the PUC is part of the system wiring inasmuch as it only converts an analog or digital real-time audio format to a compatible USB signal at the transfer point to the PC. A USB standard cable is used to establish the connection to the PC. There are no further installation costs and efforts for the hardware or software.

In addition, the USB interface makes a positive impression when PCs are changed. As long as the new unit (or replacement unit) is equipped with a USB interface, the replacement can be made by a rearrangement of connections. This independence, right through to the operating system used, is a great advantage and helps to save other costs.