NEXUS

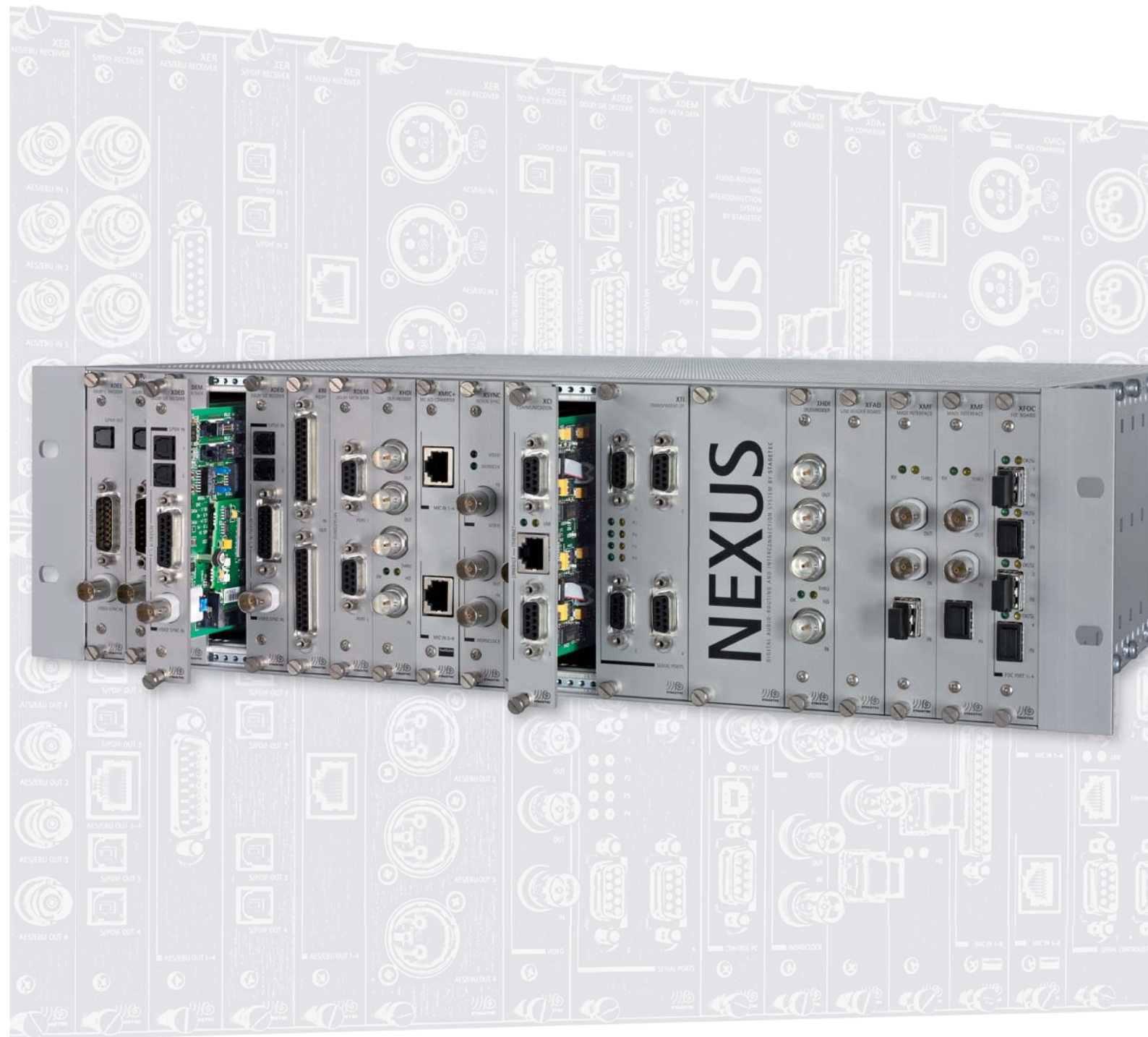## DIGITAL AUDIO ROUTING

NEXUS - Digital Audio Routing & Interconnect System

NEXUS is an audio network and a router at the same time. It also provides for audio format conversion, A/D and D/A conversion, audio processing, data transmission, loudness metering, control interfaces, multichannel metering, amplifier control, intercom, logical functions, and much more …

The basic NEXUS principle: Fibre-optic links transfer all audio and control information in a digital format. NEXUS Base Devices are installed in studios, in control rooms, and on stages. These Base Devices provide the inputs and outputs required in the appropriate format via standard connectors. Using a convenient GUI any number of inputs can be routed to the desired outputs — the physical location of the input and output resource and the format is irrelevant.

NEXUS plugs in to Dante

The new XDIP board connects NEXUS to networks running Audinate's Dante™, which enables powerful audio and media networks to be created on existing standard Ethernet infrastructure using TCP/IP. The new NEXUS XDIP module supports up to 64 bidirectional audio channels with different sampling rates. It is fully compatible with Dante's unique plug and play network integration with automatic device discovery and system configuration. A preferred field of application is installations where existing standard Ethernet-LAN's are to be used for audio signal transmission. Also significant is facilitating the integration of peripheral devices into NEXUS which already exist in local area networks. This might include DAWs or simply a standard PC, which needs to be used for simple monitoring from time to time, e.g. in a broadcasting centre.

Loudness Metering

Stage Tec is an active participant in the development of EBU R 128-compliant loudness metering. Latest-generation CPU boards for the NEXUS system (XCPU 09) implement three different metering methods on the NEXUS directly: **Momentary loudness** with an integration time of 400 ms, **Short-term loudness** with an integration time of 3 s and **Integrated loudness** with custom integration time, using a gating function.

Analogue Audio

A special approach to A/D and D/A conversion developed by Stage Tec ensures the analogue line I/O boards have exceptional dynamic range. All A/D converters utilize Stage Tec's patented TrueMatch technology.

Digital Audio

A wide range of interface boards is available for various digital audio formats. The boards convert audio and ancillary data to the NEXUS 24-bit TDM format and are also be equipped with sample-rate converters for connecting asynchronous devices. The interface boards have been officially certified for Dolby E® signal transmission by Dolby Labs.

Non Audio

The NEXUS routing and transmission features also include other signals. Different serial formats (RS 232, RS 422, RS 485, MIDI, DMX, LTC, etc.) and control signals for external devices (e.g. amplifier control, light control and machine control) are generated and distributed.

Dolby E®

Dolby E® signals are routed transparently and can also be processed discreetly on the NEXUS audio network. I/O interfaces to the NEXUS include AES/EBU, MADI and SDI formats.

Stage Tec offers two Dolby E® boards: The XDED decoder board decodes a Dolby E® stream and extracts the separate channels and forwards them to the NEXUS system as discrete audio signals. Asynchronous input signals can also be decoded. The XDEE encoder board encodes up to eight

* Dolby and the double-D symbol are registered trademarks of Dolby Laboratories.

discrete audio signals from the NEXUS system in compliance with the Dolby E® encoding specifications. Both boards use original Dolby Labs OEM modules.

SDI

The XHDI02 slide-in board provides an SDI interface and supports SD, HD and HD-3 G video formats. The board receives, generates and processes synchronous and asynchronous audio signals transported in a digital serial video stream. The following specifications have been implemented: SMPTE 259M (SD), SMPTE 292M (HD), and SMPTE 424M/425M (3 G).

The XHDI02 embeds and de-embeds metadata streams used mainly during transport and processing of multichannel audio signals.

Use in combination with Stage Tec's DolbyE® enabled components allows for de-embedding and decoding Dolby E® signals from an SDI stream, processing them in the NEXUS, and finally re-embedding them into the SDI stream. This is also supported for SDI signals clocked asynchronously. The XHDI02 is also capable of compensating for the latency intrinsic to Dolby E® decoding and encoding using a video delay of 0-15 frames (SD) or 0-8 frames (HD/3 G).

Audio Conversion

All audio boards read and write the 24-bit audio format used on the internal TDM bus. Therefore input audio of any type can be routed to any of the

NEXUS audio outputs. Thus, when using a NEXUS, complex and costly format conversion ceases to be an issue.

Signal routing does not require signal-processor boards. However, NEXUS DSP boards are available for whenever signal processing is needed. Signals can be routed to DSP boards at any point with all the important control elements for EQ, delay, dynamics, faders, etc.

Reliability

Reliable operation is a core feature of the NEXUS. Systems can be configured with a high level of redundancy, and every Base Device includes a dedicated controller board. The concept of »distributed intelligence« prevents total failure in case of malfunction. Defects are immediately indicated by the graphical alert system. Single boards can be replaced during operation without affecting other system components (hot-swap capability). Every board is available on the system within a few seconds after installation.

General Audio Specifications

- Sample rates: 44.1, 48, 88.2, 96 kHz (software-controlled)
- Analogue full-scale level: 0 dBFs = 0 to 22/24 dBu analogue (global setting)

Digital Audio

XETR AES/EBU-in/ouput Board
- 4 bidirectional AES3 signals (XLR, BNC)
- Sample rate converter on all inputs and outputs

HXETR AES/EBU-in/ouput Board
- 8 bidirectional AES3 signals (D-Sub, RJ45)
- Sample rate converter on all inputs

XDIP Dante Audio-over-IP Interface
- Asynchronous connectivity using 2 × 64 built-in sample-rate converters
- Supports 44.1/48 kHz, 88.2/96 kHz sample rates on the NEXUS side and 44.1/48 kHz, 88.2/96 kHz (synchronous connection) and 44.1 – 192 kHz sample rates (asynchronous connection using SRCs) on the Dante side

XDEE Dolby E® Encoder Board
- Provides encoding for up to 8 separate NEXUS signals into a Dolby E data stream plus a stereo linear-audio downmix

XDED Dolby E® Decoder Board
- Decodes up to 8 separate signals from a Dolby E/D data stream plus a stereo output for downmix signals (configurable downmix)

XER AES/EBU-input Board
- Formats: AES/EBU and S/PDIF (XLR, TOSLINK, BNC, RJ45)
- Sample-rate converters (standard)
- Supports legacy mode

XET AES/EBU-output Board
- Formats: AES/EBU and S/PDIF (XLR, TOSLINK, BNC, RJ45)
- Sample-rate converters (standard)
- Supports legacy mode

XAF ADAT I/O Board
- Formats: Alesis ADAT via TOSLINK
- Re-quantization to 16 or 20 bits with noise shaping and dithering Sample-rate converters (option)

XTF TDIF Board
- Formats: Tascam TDIF DB-25
- Re-quantization to 16 or 20 bits with noise shaping and dithering

XMF MADI I/O Board
- 64 channels (max.) @ 48 KHz, 32 channels (max.) @ 96 KHz
- Optical and Coax combo interface (LC, BNC)
- SRC modules (2 × XSRCA02) available optionally

XSDI I/O Board for embedded Audio
- Audio embedder/de-embedder for SMPTE-259M video (SD) for all 16 audio channels

- Independently adjustable delay (0 to 170 ms @ 48 kHz) on each output channel
- Re-quantization to 16 or 20 bits with noise shaping and dithering

XHDI I/O Board for embedded Audio
- De-embeds, embeds, replaces, and/or deletes audio compliant with SMPTE 272M-AC (SD), SMPTE 299M (HD), and SMPTE 424M/425M (3G)
- Internal DSP for audio processing
- Direct link to XDED Dolby decoder and XDEE Dolby encoder for de-embedding and embedding asynchronous Dolby E audio signals

Analogue Audio

XMIC+ Microphone-Input Board
- Balanced, galvanically isolated, transformer-isolated
- A/D converters: 32-bit, TrueMatch
- Input level: 24 dBu balanced (max.)
- Phantom power, four split outputs with independent subsonic filter, amplifier and phase inversion

XAD+ Input Board
- Balanced, galvanically isolated, transformer-isolated
- A/D converters: 24-bit, TrueMatch
- Dynamic range: 133 dB (A) @ 24 dBu (typ.)
- THD&N: 0.001 % @ 24 dBu (typ.)

XDA+ Output Board
- Balanced, galvanically isolated, transformer-isolated
- D/A converters: 24-bit Delta-Sigma
- Dynamic range: 131 dB (A) @ 24 dBu (typ.)

HXAD A/D Converter
- A/D converters: 24-bit Delta-Sigma
- Dynamic range: 112 dB(A) (typ.), THD&N: 0.001 % @ 15 dBu (typ.)

HXDA D/A Converter
- D/A converters: 24-bit Delta-Sigma
- Dynamic range: 120 dB(A) (typ.), THD&N: <0.001 % @ 4 dBu (typ.)

Control

XACI Universal Control Board
- Intricate control operation embedded in NEXUS
- ARM architecture
- Modular performance

XCI Communication Board
- Operating-panel interface for controlling the NEXUS
- Supported protocols: RS 232, RS 422 AES 15, RS 422 SMPTE/EBU, MIDI, Stage Tec protocol, Ethernet port
- SD slot for loading NEXUS status data

XRI Relay-interface Board
- Signalling and remote-start distribution
- GPIO

XTI Data-forwarding Board
- 4-channel Duplex Board
- Forwards RS 232, RS 422, RS 485, MIDI, DMX, and LTC data
- Galvanic isolation of inputs and outputs

Audio Processing

XDSP Signal-processor Board
- High signal processing power: four times that of the predecessor
- Higher crosspoint capacity in gain delay matrices
- New modules: Band filter, upmix algorithm (ISOSTEM)
- The new NEXUS XDSP board integrate the ISOSTEM method from DSPECIALISTS. It generates a proper multichannel mix from stereo input signals in real time, which is fully reversible. (option)
- Limiter, compressor, summing, and various signal-processor modules available on request

NEXUS Digital Audio Routing and Interconnect System

System Boards

The XCPU central controller module and the power-supply units are mandatory components of NEXUS Base Devices. In addition, XFOC respectively XRT fibre-optic interface boards must be implemented for networking multiple Base Devices.

XCPU Controller Board

- Base Device and routing control and monitoring
- Control-computer interface (Ethernet, USB, or serial)
- Synchronisation and clock-generation control
- Loudness metering
- Wordclock I/O, internal clock generator
- Test tone and noise generator
- Metering-information gathering

XSYNC Synchronisation Board

- Video/WCLK Sync Input board for the NEXUS with automatic detection of video formats

XFOC-LC Fibre-optic Interface Board

- Four independent ports for a total of 256-channels of transmission capacity
- Supports various SFP modules including single-mode, multimode, CWDM, long-haul, and duplex modules
- Uses multimode cabling for short distances (<500 meters) or single-mode cabling for long distances (up to 10 km)
- LC ports for multimode and single-mode connectors
- 1.25 Gbps rate, plesiochronous transmission

XRT Fibre-optic Interface Board

- 8,448 sources and 8,448 destinations on one NEXUS board
- Autonomous router board on 3RU, decouples routing from base device's backplane
- 12 SFP+ ports with 6.25 Gbps and 1.25 Gbp data rate
- Up to 2,048 channels bi directional per fibre on high speed ports
- Enables routing of both audio data and ethernet tunnels in the NEXUS fibre-optic network
- Realisation of complex audio networks
- Fibre and board redundancy supported

XPSU Power-supply Unit

- Wide-range units supplying all components; no fans
- Multiple units and/or redundant units per Base Device supported
- Space-saving backplane installation
- Output power: 100 W each

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Base Device

Base Devices are designed as 19" mainframes for NEXUS boards featuring the XBP backplane with the TDM-bus system, controller boards, and power-supply units. Optional redundant power-supply units are available on request. Interface boards are installed as requested.

Configuration

- 19" mainframe (flightcase or mounting rack on request)
- 1 to 3 front-panel rows (3 U each)
- Up to 2 extra rows without backplanes, for detached front panels
- 1 XCPU controller board
- 1 backplane power-supply unit (min.)
- Redundant power-supply units (optional)
- I/O boards as requested
- 1RU frame available, 5 free slots

Slots

- 4 HP grid (20.32 mm)
- 20 free slots per front-panel row
- 60 slots (max.) plus space for detached front panels in two extra rows (max.) per Base Device
- 1U frame available, 5 free slots

Bus System

- TDM audio bus
- 256 dynamically assigned time slots per Base Device
- 24-bit audio plus ancillary data (AES-3 compliant)

Operating Voltages

- Power supply: 90 to 264 VAC
- Line frequency: 47 to 63 Hz

Dimensions

- Height: 132.5 to 665.9 mm/5.22 to 26.22" (3/6/9/12/15 U)
- Width: approx. 482.6 mm/19", front-panel area: 84 HP
- Depth: approx. 440 mm/17.32" (without handles, ports)

Emmy® Award goes to NEXUS!

On 14 August 2010, Stage Tec Entwicklungsgesellschaft für professionelle Audiotechnik mbH was awarded with the only 2010 Emmy® Primetime Engineering Award for their NEXUS Digital Audio Routing system. The official announcement on www.emmys.com states that the NEXUS is »the finest, most versatile audio routing system available today.« In particular, the committee of the 62nd Emmy® Awards emphasized the quality of the patented True-Match™ converter. True-Match™ ensures realistic signal conversion from the analog to the digital domain.

The prestigious Emmy® Award is presented to an individual, company or organization for developments in engineering that so innovative in nature that they materially affect the transmission, recording or reception of television.