XSDI Interface for Embedded Audio

16-channel I/O Board for Audio Data Embedded into a Digital Serial Video Stream (SMPTE 259M compliant)

- Audio embedder / de-embedder for SMPTE-259M video (SDI)
- Combined I/O board for all 16 audio channels
- De-embeds, embeds, replaces, and / or deletes audio
- Free channel routing on the NEXUS
- Internal DSP for signal adaptation
- Re-quantization to 16 or 20 bits with noise shaping and dithering
- Test-pattern generator integrated
- Either BNC or LC optical ports
- Option: XSRCA01 SRC module (required for asynchronous video input, or if the system or interface rates differ from 48 kHz)
- Officially certified by Dolby® for Dolby E signal transmission

In a Nexus system, the XSDI board is provided to make available the audio embedded into an SDI digital serial video stream as specified by SMPTE-259M (SDI). In addition, any audio existing on the NEXUS system can be written to the video stream. The board features a video input and a video output. This allows any video to be transparently forwarded with no need for additional hardware components. Of course, it is also possible to use the XSDI as a pure input board for extracting (de-embedding) audio from a video signal.

Unlike competing solutions, the XSDI was designed as a generic SDI audio interface. The board was developed from scratch. (Standard applications were not accessible during the development process.) It offers a variety of options for reading the audio from a video stream, or adding it to the video signal, respectively:

› **De-embedding** Any audio can be extracted from the video stream and be used and transferred on the NEXUS audio network. As the video stream remains unaffected, the audio of the output video signal is preserved.

› **Embedding** Any audio signals on the NEXUS system can be embedded into the video stream. The data blocks and channels to be written are freely selectable. Audio data from other blocks originally contained in the video stream are preserved. Channels from the same group can be reapplied.

› **Replacing** With due regard to the numerous data structures possible in the SMPTE specifications, the XSDI board also allows new audio to be written to existing data structures. This will embed only the actual audio data. This mode provides a high degree of compatibility even for non-standard streams (for example, if only two audio channels are defined for a group).

› **Deletion** Audio groups already contained in the SDI signal or marked for deletion can be entirely deleted and overwritten.

High Flexibility

The XSDI board handles signals complying with the SMPTE-259M specification (4:2:2, component video, 270 Mbps). The line count of the video signals can be 525 or 625; the actual format is automatically detected.

The board fully supports the SMPTE-272M-A,C (audio, SD) standards specifying a maximum of four groups, each comprising of four 20-bit or 24-bit audio channels. Single or multiple channels can be de-embedded from or embedded into the data stream at the same time.

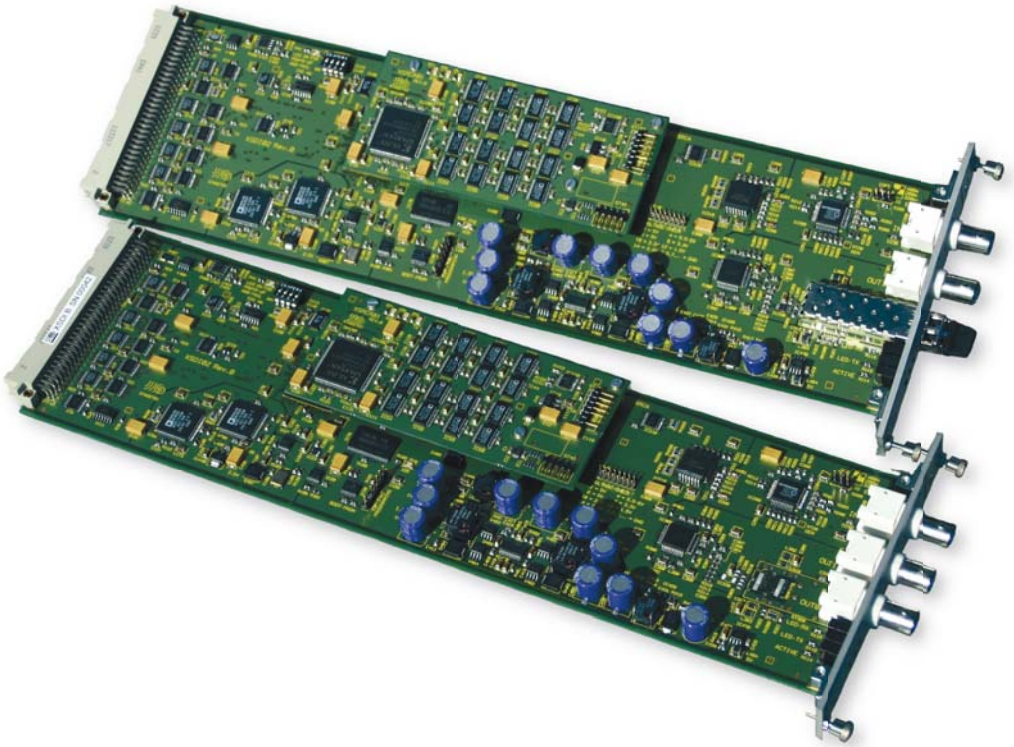
The SMPTE-272M-A,C standard supports various types of embedding audio data into the video stream. This can cause problems in extensive signal chains that might render additional incremental embedding operations impossible. In order to avoid this problem, the board allows existing data structures including the audio to be completely rearranged and rewritten – if required, including the audio to be added.

A FIFO cache is used for reconstructing the necessarily isochronous audio stream. The cache buffer can be set to either 30, 40, or 64 samples, and is thus adjustable to suit the input signal.

Signal Processor

The XSDI board features a DSP for level adjustment and signal processing without relying on other boards. The input and output levels can be individually adjusted. Reverse-polarity signals can be corrected using a phase-inversion function.

The standard audio resolution within NEXUS is 24 bit. However, if audio has to be output in 20-bit or 16-bit format, the signal quality can be kept at the highest level by performing the re-quantization with the dithering function enabled. In addition, a noise-shaping function moves the noise energy up into frequency ranges less perceivable to the human ear. The noise reduction achieved in the range below 1 kHz is approximately 15 dB.



Error Detection

To ensure reliable operation, the input-signal status is repeatedly checked. This includes the »RX Video PLL lock« and »Signal Condition OK« messages, line-count and format detection, audio/video sync, EDH status, audio-block availability and format (20/24 bits), FIFO errors (overflow/underflow), audio-block check-

sum verification, and audio-channel parity check.

Three front-panel LEDs indicate the board status. They show sync errors, the bypass mode, and the status of the I/O PLL.

The integrated test generator simplifies installation and troubleshooting. The video signal can be toggled between 525 and 625 lines, and color bars or a black screen can be selected as the image. A forensic mode supports extensive error analysis.

Incompatible Data

With incompatible formats, it is often desirable to retain existing structures in the data stream. For this purpose, the board offers a replace mode where the audio to be embedded is added to the video stream while keeping the existing structures. If the stream contains data groups that cannot be handled by the interface, these can still be transparently forwarded to the output in bypass mode.

Ancillary data

AES-3 compliant ancillary data in the data stream can also be read by the XSDI board. This data is available on the NEXUS system and can be output using suitable boards (e.g. XET AES/EBU-output boards).

Ancillary data can also be applied to the audio being embedded into the output stream. This allows data from AES-3-compliant sources to be adopted (for example, XER AES/EBU-input boards) or for having the XCPU main-controller board generate new ancillary data from scratch.

Ports

The board is equipped with BNC and / or LC optical ports (single and multimodes supported). The version featuring only BNC ports has one input and two outputs; the mixed version provides one BNC input and one BNC output plus an optical input and an optical output. An SFP module featuring an LC terminal is used for the optical port.

Various optical modules can be installed onsite. The use of two interface boards also allows for format conversion.

XSDIo2 Specifications		
Data formats	Embedded audio (SMPTE 259M and SMPTE 272M-A,C compliant)	
Audio data	16/20/24 bits	
Audio channels	16 inputs, 16 outputs	
Sample rate	48 kHz (interface), 32 to 96 kHz (system)	
Data rate	270 Mbps (typ.)	
BNC input	1 video, BNC	
	Equalizer gain	40 dB
	Jitter tolerance	0.56 UI_{pp} @ 270 Mbit (typ.)
	Impedance	75 ohm
BNC output	2 BNC, parallel	
	Jitter	220 ps @ 270 Mbit (typ.)
	Output voltage	800 mV_{PP} (typ.)
	Impedance	75 ohm
Power supply	Voltage	+4.75 to 5.25 V
	Current	600 mA
Operating conditions	Temperature range	0 to +50 °C / 32 to 122 °F
	Humidity	90% (max.), non-condensing
Storage conditions	Temperature range	-35 to +70 °C / -31 to 158 °F
	Humidity	90% (max.), non-condensing
Physical specifications	General	board for 19" module frame; 3 U, 340 mm/13.39"
	Front panel	4 HP (20.02 × 128.5 mm / 0.8 × 5.06")
	Required space	1
	Weight	0.26 kg

Versions	
XSDI-BNC	BNC version
XSDI-OM	LC, multimode, spanning distances of up to 500 m
XSDI-OS15	LC, single-mode, spanning distances of up to 15 km / 9.3 miles