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REVISION HISTORY

REVISION	DESCRIPTION	DATE
1.0	Original Version	June 99
1.1	Cable length warning removed	Aug 99
1.2	Block Diagrams added Figure 4 added showing card edge controls and jumper locations	Aug 99
1.3	Video Standard table updated to show 720P, Minor editorial changes I/O Signal descriptions added.	Sept 99
1.4	Automatic 1080i and 720p operation. Update rear panel drawing Figure 2	Nov 99
1.5	Support for 24-bit AES inputs and sample rate conversion disable when build#2 of 7700AE submodule is installed Rear panel drawing corrected to show correct numbering of AES inputs	Mar 00
1.6	Updated block diagram to show correct Standard for AES audio	May 00
1.6.1	Toggle switch and Pushbutton references removed Specifications updated	Feb 01
1.7	Support for 1080i/50, 1080p/30sF, 1080p/29.97sF, 1080p/25sF, 1080p/24sF, 1080p/23.98sF supported in software and firmware version 3.0 build 3	Jun 01
1.8	Added information on 7720AE-EO-HD version	Aug 03

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1. OVERVIEW

The 7720AE-HD series Audio Embedders insert AES audio signals into a 1.5 Gb/s HDTV video signal as specified in SMPTE 299M. The companion 7720AD-HD Audio Deembedder facilitates audio demultiplexing at the destination. The 7720AE-HD embedder features one auto-equalized coaxial input and embeds AES audio into two serial outputs.

The 7720AE-EO-HD version has an Electrical to Fiber converter and provides an economical method of embedding audio for in-plant coaxial distribution and longer distance optical distribution for SMPTE 292M (1.5 Gb/s). The companion 7720AD-OE-HD Audio Deembedder and Fiber to Electrical converter facilitates audio demultiplexing and conversion back to coaxial distribution at the destination. The 7720AE-EO-HD embedder features one auto-equalized coaxial input and embeds AES audio into with one serial outputs and one optical output.

SMPTE 299M allocates four groups of four audio channels that can be embedded into the SMPTE 292M bitstream. The 7720AE-HD has the ability to select the Audio channel group where the audio will be inserted.

There are two different hardware revisions of the 7720AE-HD modules. Figure 1 shows pictures of the 7700AE submodule for build 1 and build 2 to help you determine which version of hardware you have.

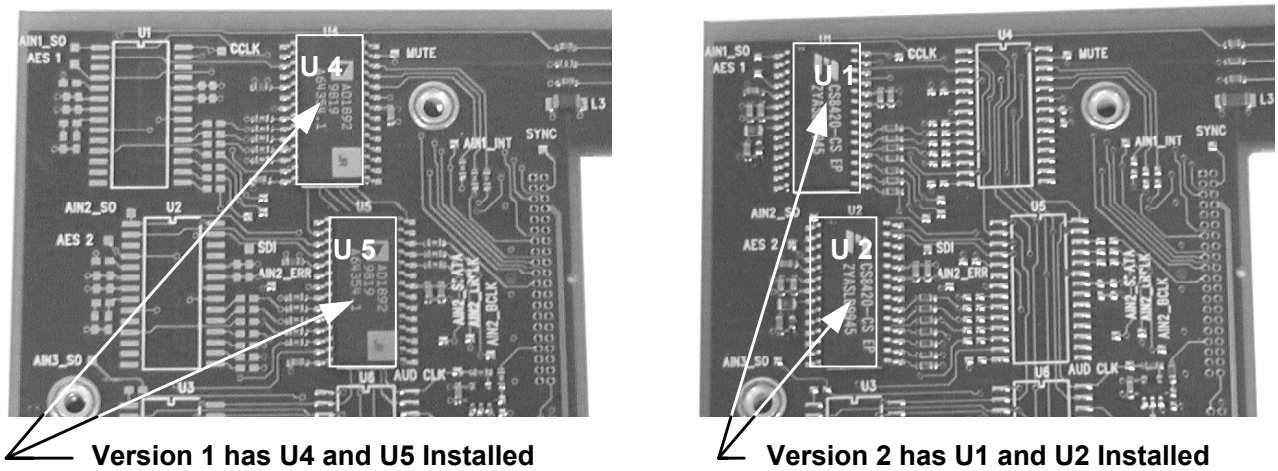

Figure 1: Identifying the Hardware Build Version

Features:

- Automatic detection of video input format
- 7720AE-EO-HD version has optical output wavelengths of 1310nm, 1550nm, and up to eight CWDM wavelengths from 1270nm to 1610nm.
- 7720AE-EO-HD version supports multi-mode and single-mode fiber.
- 24-bit AES input and audio embedding (20 bit on build 1 hardware version)
- Audio group assignment
- Sample rate conversion disable on AES inputs to permit Dolby E embedding (not available on build 1 hardware version)
- audio delays (¼ video field time resolution) can be programmed. (feature not implemented at this time)
- embedded packets can be justified or follow existing packets

- existing embedded audio may be passed or removed.
- Front panel LEDs indicate video and audio signal presence, and module fault.

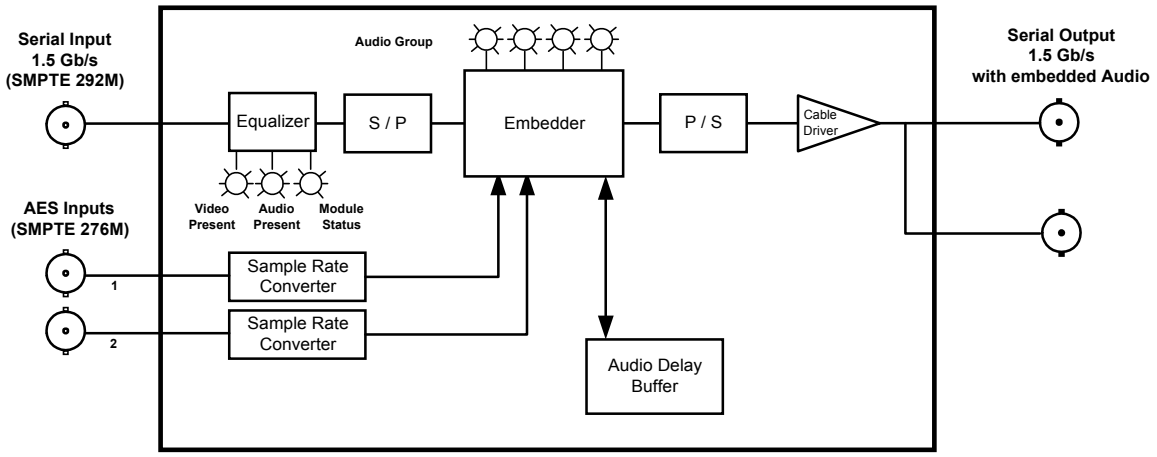

Figure 2: 7720AE-HD Block Diagram

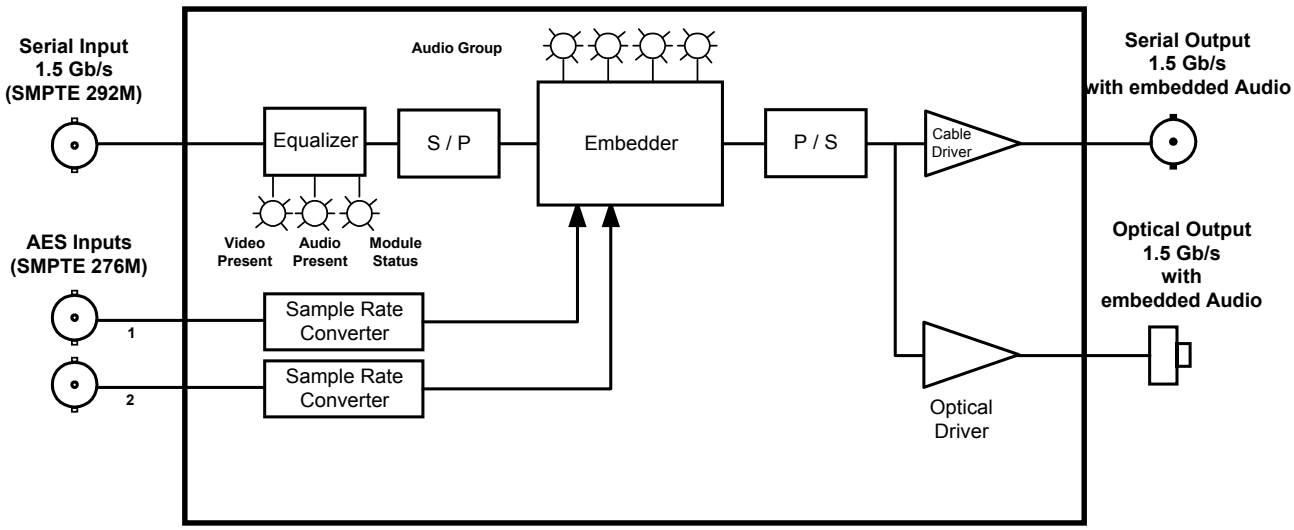

Figure 3: 7720AE-EO-HD Block Diagram

2. INSTALLATION

The 7720AE-HD series modules each come with a companion rear plate that has 5 BNC connectors. For information on mounting the rear plate and inserting the module into the frame see section 3 of the 7700FR chapter.

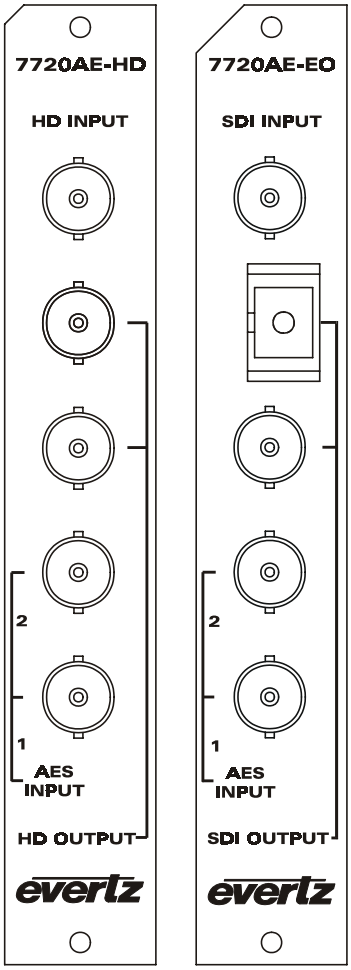

Figure 4: 7720AE-HD Rear Panels

HD INPUT Input BNC connector for 10-bit serial digital video signals compatible with the SMPTE 292M standard. The 7710AE-HD automatically selects the video standard. See Table 1 for a list of the video standards supported.

HD OUTPUT There are two BNC connectors with reclocked serial component video outputs, compatible with the SMPTE 292M standard. These outputs contain the input video with the audio present at AES inputs 1 and 2 embedded in accordance with the SMPTE 299M standard.

On the 7720AE-EO-HD there is one SC/PC (shown), ST/PC or FC/PC female connector with reclocked serial component video outputs, compatible with the SMPTE 292M standard. This connector is the optical output with embedded audio as shown in section 3.3.

AES INPUT 1 AES audio input for channel 1 and 2 of the audio group selected for embedding.

AES INPUT 2 AES audio input for channel 3 and 4 of the audio group selected for embedding.

3. SPECIFICATIONS

3.1. SERIAL VIDEO INPUT

Standard: 1.485 Gb/sec SMPTE 292M – standards supported are shown in Table 1.
Connector: 1 BNC per IEC 169-8
Equalization: Automatic to 150m @ 1.5Gb/s with Belden 1694 or equivalent cable

Common Name	Pixels / Active Lines	Frame Rate	Progressive /Interlace	SMPTE Standard
1080i/60	1920 x 1080	30	I	274M
1080i/59.94	1920 x 1080	29.97 (30/1.001)	I	274M
1080i/50	1920 x 1080	25	I	274M
1080p/30sF	1920 x 1080	30	P (sF)	RP211
1080p/29.97sF	1920 x 1080	29.97 (30/1.001)	P (sF)	RP211
1080p/25sF	1920 x 1080	25	P (sF)	RP211
1080p/24sF	1920 x 1080	24	P (sF)	RP211
1080p/23.98sF	1920 x 1080	23.98 (24/1.001)	P (sF)	RP211
720p/60	1280 x 720	60	P	296M
720p/59.94	1280 x 720	59.94 (60/1.001)	P	296M

Table 1: Video Input Formats

3.2. HD SERIAL VIDEO OUTPUTS WITH EMBEDDED AUDIO (SMPTE 299M)

Number of Outputs: 2 on 7720AE-HD
1 on 7720AE-EO-HD
Standard: same as input
Connectors: BNC per IEC 169-8
Signal Level: 800mV nominal
DC Offset: 0V ±0.5V
Rise and Fall Time: 200ps nominal
Overshoot: <10% of amplitude
Wide Band Jitter: < 0.15 UI

3.3. OPTICAL OUTPUT (7720AE-EO-HD Only)

Number of Outputs: 1
Connector: Female SC/PC, ST/PC or FC/PC
Return Loss: > 14 dB
Rise and Fall Time: 270 ps nominal
Wide Band Jitter: < 0.2UI
Fiber Size: 9 μm core / 125 μm overall
Wavelengths:
Standard 1310nm, 1550nm (nominal)
CWDM: 1270nm to 1610nm.
Output Power:
1310nm FP (Standard): -7.5dBm ± 1dB
1310nm DFB (L version): 0dBm ± 1dB
1550 nm & CWDM: 0dBm ± 1dB

3.4. AES AUDIO INPUTS

Number of Inputs: 2
Standard: SMPTE 276M, single ended synchronous or asynchronous AES (synchronous AES required when sample rate converter is disabled.)
Signal Level: 1V p-p ±0.1V
Connectors: BNC per IEC 169-8
Resolution: 24 bits (20 bits on build 1 hardware version)
Sampling Rate: 48 KHz
Impedance: 75 Ohms unbalanced

3.5. ELECTRICAL

Voltage: + 12VDC
Power: 7 Watts.
EMI/RFI: Complies with FCC regulations for class A devices.
Complies with EU EMC directive.

3.6. PHYSICAL

7700 or 7701 frame mounting:
Number of slots: 1

Stand Alone Enclosure:
Dimensions: 14 " L x 4.5 " W x 1.9 " H
(355 mm L x 114 mm W x 48 mm H)
Weight: approx. 1.5 lbs. (0.7 Kg)

4. STATUS LEDS

The location of the status LEDs is shown in Figure 5

4.1. MODULE STATUS LEDS

MODULE OK This Green LED will be On when the module is operating properly

LOCAL FAULT This Red LED makes it easy to identify one module in a frame that is missing an essential input or has another fault. The LED will blink on and off if the microprocessor is not running. The LED will be on solid when input video is missing, or audio is missing from both AES inputs or there is a fault in the module power supply.

VIDEO PRESENT This Green LED will be On when there is a valid video signal present at the module input.

AUDIO PRESENT This Green LED will be On solid when there is a valid AES audio signal present at both of the AES inputs, or flashing when there is a valid AES audio signal at one of the AES inputs. This indicator is only valid when input video is present.

4.2. AUDIO GROUP STATUS LEDS

Four LEDs located on the lower end of the module (opposite the DIP switch) indicate the status of the audio groups. Audio group LED 1 is located closest to the center of the module.

Audio Group LED	Color	Audio Group Status
1	Off	There is no group 1 audio on the video output.
	On	Group 1 audio on the video output is being passed through from the input video.
	Flashing	Group 1 audio on the video output is being embedded from AES inputs 1 and 2.
2	Off	There is no group 2 audio on the video output.
	On	Group 2 audio on the video output is being passed through from the input video.
	Flashing	Group 2 audio on the video output is being embedded from AES inputs 1 and 2.
3	Off	There is no group 3 audio on the video output.
	On	Group 3 audio on the video output is being passed through from the input video.
	Flashing	Group 3 audio on the video output is being embedded from AES inputs 1 and 2.
4	Off	There is no group 4 audio on the video output.
	On	Group 4 audio on the video output is being passed through from the input video.
	Flashing	Group 4 audio on the video output is being embedded from AES inputs 1 and 2.

Table 2: Audio Group Status LEDs

5. CARD EDGE CONTROLS

The 7720AE-HD is equipped with an 8 position DIP switch to allow the user to select various functions. All positions are assigned sequentially such that the first position is located at the top of the DIP switch (farthest from to the card ejector). Sections 5.1 to 5.5 show the assigned DIP switch functions. The On position is down, or closest to the printed circuit board.

5.1. SELECTING THE AUDIO GROUP THAT WILL BE EMBEDDED

The SMPTE 299M standard permits up to 4 groups of 4 audio channels to be embedded into the 1.5 Gb/s video bitstream. DIP switches 1 and 2 are used to select which group that the incoming audio will be embedded into.

Model 7720AE-HD will embed up to four audio channels into the audio group selected by the DIP switches.

DIP 2	DIP 1	Audio Group ID
Off	Off	1 (default)
Off	On	2
On	Off	3
On	On	4

Table 3: Audio Group Assignment Switch Settings

Channels 1 and 2 from AES input 1 will be embedded into channels 1 and 2 of the selected group. Channels 1 and 2 from AES input 2 will be embedded into channels 3 and 4 of the selected group. If audio is not present on one or both of the AES inputs, the respective channels of the selected audio group will be mute.

5.2. SELECTING THE AUDIO DELAY (feature not implemented at this time)

DIP switches 3 to 5 are used to select one of sixteen delays which can be added to the audio before it is embedded. This delay allows the user to resynchronize the audio back to the video to accommodate video processing delays. DIP switches 3, 4 and 5 are used to select the delay in 1/4 video field resolution.

DIP 5	DIP 4	DIP 3	Audio Delay
Off	Off	Off	minimum delay mode (less than 1 audio sample time or 20μs)
Off	Off	On	1/4 video field
Off	On	Off	1/2 video field
Off	On	On	3/4 video field
On	Off	Off	1 video field
On	Off	On	1 and 1/4 video field
On	On	Off	1 and 1/2 video field
On	On	On	1 and 3/4 video field

Table 4: Audio Delay Switch Settings

5.3. SELECTING SAMPLE RATE CONVERSION FOR AES INPUTS

DIP switch 6 selects whether the sample rate conversion for AES inputs is enabled or not. Note, this feature is only available for modules fitted with 7700AE build #2 submodules (see Section 1 to determine the revision of your hardware). All others are always in rate conversion mode.

DIP 6	FUNCTION	DESCRIPTION
Off	SRC Enabled (default)	AES inputs are sample rate converted at 48KHz which is synchronous to the input video. AES inputs can be either synchronous or asynchronous to the video source.
On	SRC Disabled	The content of AES inputs is preserved without any loss, and directly embedded into the input video. AES inputs must be synchronous to the video source. This setting is required when embedding Dolby E.

Table 5: Sample Rate Conversion Switch Settings

5.4. SELECTING WHERE THE EMBEDDED AUDIO WILL BE PLACED

DIP switch 7 controls how the pre-existing audio contents are re-embedded back to the video source.

DIP 7	FUNCTION	DESCRIPTION
Off	Follow	The position of all pre-existing embedded audio contents will not be moved with reference to the EAV. For incoming audio packets with the same selected audio group DID, the associated DID is replaced with "Marked Packets for Deletion" as defined in SMPTE 291M
On	Justify (default)	Pre-existing embedded audio contents will be extracted. All packets with "Marked Packet for Deletion" or containing the same selected audio group DID will be removed, and remaining packets will be re-embedded right after each EAV.

Table 6: Embedded Audio Justification Switch Settings

5.5. SELECTING WHETHER EXISTING AUDIO WILL BE REMOVED

DIP switch 8 controls whether existing audio packets will be passed or removed from the video stream.

DIP 8	FUNCTION	DESCRIPTION
Off	Clean	All incoming embedded audio data will be removed, new audio data will be embedded after EAV. The remaining H blanking period is filled with default blanking value.
On	Pass (default)	New audio data will be embedded after the last of the existing audio group packets.

Table 7: Embedded Audio Cleaning Switch Settings

6. JUMPERS

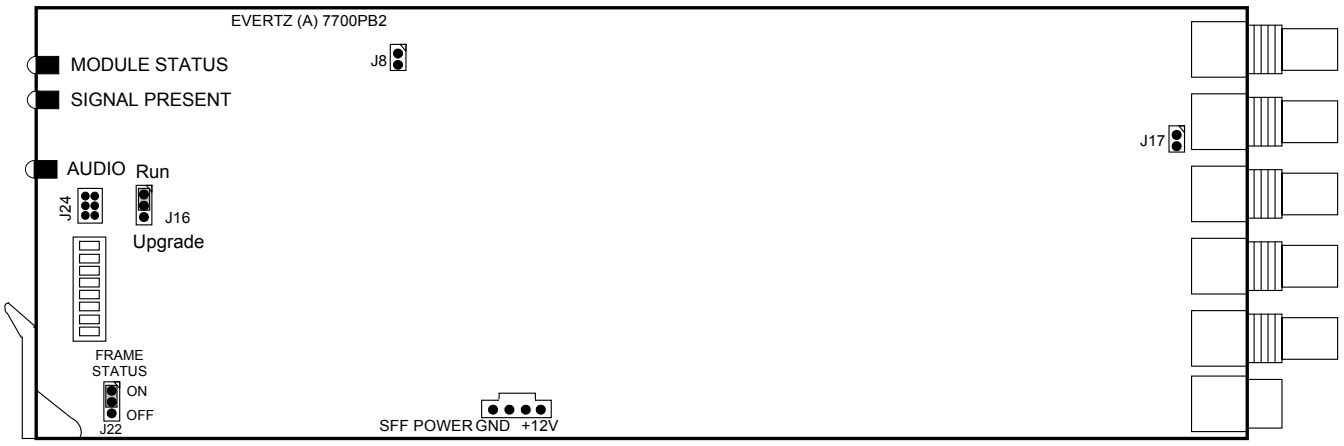

Figure 5 : Location of Jumpers on Rev A and later 7700PB Boards

6.1. SELECTING WHETHER LOCAL FAULTS WILL BE MONITORED BY THE GLOBAL FRAME STATUS

FRAME STATUS The FRAME STATUS jumper located at the front of the module determines whether local faults (as shown by the Local Fault indicator) will be connected to the 7700FR frame's global status bus. (This feature is not available on Rev 1 versions of the board)

To monitor faults on this module with the frame status indicators (on the PS FRAME STATUS LED's and on the Frame's Fault Tally output) install this jumper in the On position. (Default)

When this jumper is installed in the Off position, local faults on this module will not be monitored.

6.2. CONFIGURING THE MODULE FOR FIRMWARE UPGRADES

UPGRADE The UPGRADE jumper J16 located at the front of the module is used when firmware upgrades are being done to the module. For normal operation it should be installed in the *RUN* position. On Rev 1 versions of this board the upgrade jumper is located in another location. See the *Upgrading Firmware* chapter in the front of the binder for more information.

To upgrade the firmware in the module unit pull it out of the frame. Move Jumper J16 into the *UPGRADE* position. Install the Upgrade cable provided (located in the vinyl pouch in the front of this manual) onto header J24 at the card edge. Re-install the module into the frame. Run the upgrade as described in the *Upgrading Firmware* chapter in the front of the binder. Once the upgrade is completed, remove the module from the frame, move J16 into the *RUN* position, remove the upgrade cable and re-install the module. The module is now ready for normal operation.

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