Figures

Tables

REVISION HISTORY

REVISION	DESCRIPTION	DATE
0.1	Preliminary Version	Mar 01
1.0	First official release	July 01

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1.   OVERVIEW

The 7740DLY-AES4 quad AES digital audio delay provides independent fine or coarse delay for AES digital inputs. The module accepts either an analog composite sync or AES digital audio reference and a maximum of four asynchronous / synchronous 48KHz single ended AES inputs or eight audio channels. Each AES pair can be sample rate converted along with independent channel swap operation.
External loop-through connections can be applied for cascaded delays to achieve two, three or four times of maximum delay as specified for one AES signal.

Features:

- Automatically detect and lock to either external analog composite sync or AES digital audio reference
- Process delay for four asynchronous / synchronous 48KHz single ended AES digital audio inputs simultaneously
- Independent control for each AES input pair (AES input 1 and 2, 3 and 4)
- Support audio sample resolutions of 20 and 24 bits
- Selectable sample rate conversion or passthrough input audio processing
- Support audio channel swap operation for all AES inputs simultaneously
- Selectable fine or coarse delay in 1.04ms (50 samples) or video field, respectively
- Maximum delay of 2.13sec and 2.56sec for NTSC and PAL mode, respectively
- Bypass relay outputs at the loss of power
- Card edge LEDs indicate reference presence, audio input presence and swap mode operation.
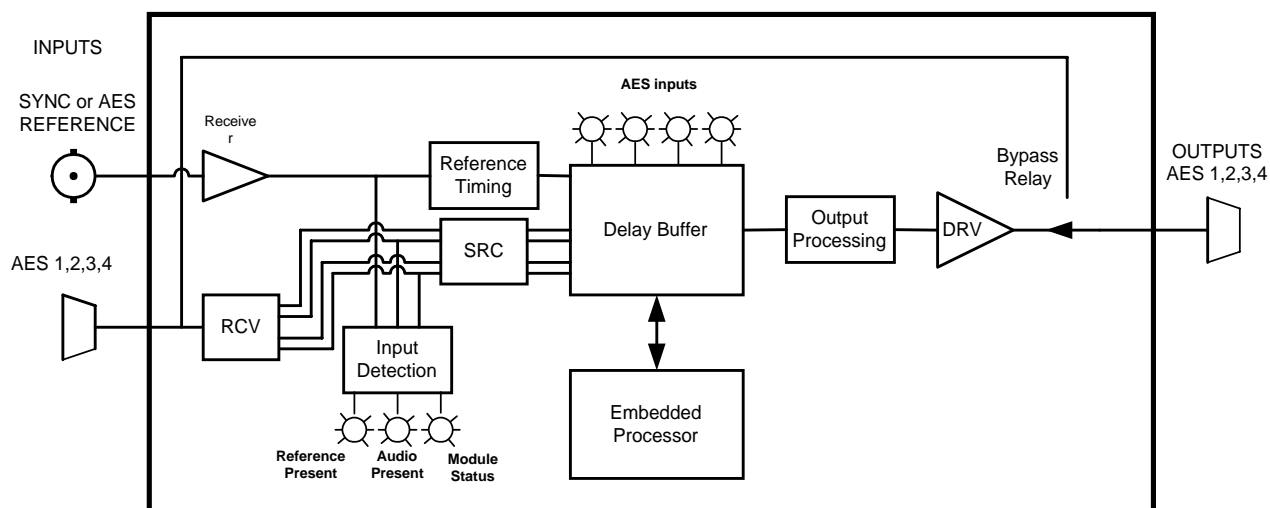
Figure 1: 7740DLY-AES4 Block Diagram

2.   INSTALLATION

The 7740DLY-AES4 modules each come with a companion rear plate that has two BNCs and a female high-density DB15 connector. For information on mounting the rear plate and inserting the module into the frame see section 3 of the 7700FR chapter.
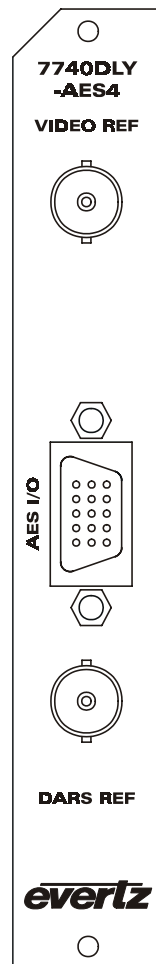
Figure 2: 7740DLY-AES4 Rear Panel

2.1.   REFERENCE INPUT

In order to properly delay the AES audio, the 7740DLY-AES4 must be references to a video or digital audio source. The 7740DLY-AES4 automatically detects which type of reference is supplied.

VIDEO REF   For a video reference connect an NTSC or PAL colour black or composite sync signal

DARS REF   For a digital audio reference connect a 48KHz single ended AES signal compatible with SMPTE 276M.

2.2.   AES DIGITAL AUDIO INPUTS AND OUTPUTS

The AES digital audio inputs consists of four asynchronous / synchronous 48KHz single ended AES signals; and AES outputs are delayed version of the associated inputs. All AES outputs are protected by

bypass relays that activates in the event of power loss to the module. All AES digital audio signals are compatible with SMPTE 276M.

The following is the pinout of the female HD DB15 connector labeled **AES I/O**

DB15	Name	Description
1	NC	Not connected
2	NC	Not connected
3	NC	Not connected
4	NC	Not connected
5	NC	Not connected
6	NC	Not connected
7	AES IN 1	Audio input 1
8	NC	Not connected
9	AES OUT 2	Audio output 2
10	AES OUT 1	Audio output 1
11	AES IN 2	Audio input 2
12	AES OUT 4	Audio output 4
13	AES OUT 3	Audio output 3
14	AES IN 4	Audio input 4
15	AES IN 3	Audio input 3
Shell	GND	Ground

Table 1: Pinout of AES I/O Connector

3. SPECIFICATIONS

3.1. VIDEO REFERENCE

Type: NTSC or PAL Colour Black nominal 1 V p-p
Composite Bi-level sync (525I or 625I) 300 mV
Connector: 1 BNC per IEC 169-8
Termination: 75 ohm (jumper selectable)

3.2. AES DIGITAL AUDIO REFERENCE

Standard: SMPTE 276M, single ended asynchronous or synchronous AES audio
Connector: BNC per IEC 169-8
Resolution: 20 or 24 bits
Sampling Rate: 48 KHz
Impedance: 75 Ohms unbalanced

3.3. AES AUDIO INPUTS

Number of Inputs: 4
Standard: SMPTE 276M, single ended asynchronous or synchronous AES audio
Connectors: 15 pin High density D
Resolution: 20 or 24 bits
Sampling Rate: 48 KHz
Impedance: 75 Ohms unbalanced

3.4. AES AUDIO OUTPUTS

Number of Outputs: 4
Standard: SMPTE 276M, single ended asynchronous or synchronous AES audio
Connectors: 15 pin High density D
Resolution: 20 or 24 bits
Sampling Rate: 48 KHz
Impedance: 75 Ohms unbalanced

3.5. DELAY RESOLUTION AND RANGE

The 7740DLY-AES4 provides either fine or coarse delay selection for each AES input pair.

Delay mode	Resolution	Maximum delay
Fine	1.04ms (50 samples)	132.08ms
Coarse	1 video field	127 video fields

Table 2: Delay Resolution and Range

Note: minimum delay for either fine or coarse delay mode is about one video line, i.e. 63.5μs for NTSC or 64μs for PAL.

3.6. ELECTRICAL

Voltage: + 12VDC
Power: 6 Watts.
EMI/RFI: Complies with FCC Part 15, class A and EU EMC directive.

3.7. 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 3.

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.

SIGNAL PRESENT   This Green LED will be ON when there is a valid analog composite sync or AES audio reference present at the module input.

AUDIO   This Green LED will be ON solid when there are valid AES audio signals present on all four AES inputs.

The LED will blink ON and OFF when there are valid AES audio signals present on at least one of the AES inputs.

4.2.   AES I/O STATUS LEDS

Four LEDs located on the lower end of the module (opposite the DIP switch) indicate the status of the audio input and associated operation. Status LED 1 is located closest to the center of the module.

AES LED	Color	Status
1	Off	There is no valid AES input 1 present
	On	AES input 1 is being delayed, and presented as AES output 1
	Flashing	AES input 1 is being delayed, channel swapped and presented as AES output 1
2	Off	There is no valid AES input 2 present
	On	AES input 2 is being delayed, and presented as AES output 2
	Flashing	AES input 2 is being delayed, channel swapped and presented as AES output 2
3	Off	There is no valid AES input 3 present
	On	AES input 3 is being delayed, and presented as AES output 3
	Flashing	AES input 3 is being delayed, channel swapped and presented as AES output 3
4	Off	There is no valid AES input 4 present
	On	AES input 4 is being delayed, and presented as AES output 4
	Flashing	AES input 4 is being delayed, channel swapped and presented as AES output 4

Table 3: Audio Status LEDs

5. CARD EDGE CONTROLS

The 7740DLY-AES4 is equipped with an 8 position DIP switch at the front of the card 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 5.3 show the assigned DIP switch functions. The ON position is down, or closest to the printed circuit board. Table 4 gives an overview of the DIP switch functions. There are also 2 DIP switches located on the 7700-AES4 submodule. These switches are used to set the delay time. Section 6 describes how to set the video delay for the module.

DIP Switch	Function
1	Sample rate conversion (SRC) for AES input 1 and 2
2	20/24-bit selection for AES input 1 and 2
3	Sample rate conversion (SRC) for AES input 3 and 4
4	20/24-bit selection for AES input 3 and 4
5	Channel swap for AES input 1
6	Channel swap for AES input 2
7	Channel swap for AES input 3
8	Channel swap for AES input 4

Table 4: Main DIP Switch Functions

5.1. SELECTING SAMPLE RATE CONVERSION ON THE AES INPUTS

The AES receivers in the 7740DLY-AES4 can perform input audio processing in either pass-through or sample rate conversion mode. DIP switch 1 (input 1 and 2) and 3 (input 3 and 4) are used to enable sample rate conversion for the AES inputs.

DIP 1 or 3	SRC Enable
OFF	Pass-through
ON	SRC

Table 5: Sample Rate Conversion Switch Settings

5.2. SELECTING 20 or 24-BIT OPERATION

DIP switch 2 (input 1 and 2) and 4 (input 3 and 4) are used to select whether the AES input has 20 or 24 bit audio samples.

DIP 2 or 4	Audio Sample Resolution
OFF	24 bits
ON	20 bits

Table 6: Audio Sample Resolution Switch Settings

5.3. SELECTING CHANNEL SWAP OPERATION

DIP switches 5 to 8 are used to select the channel swap operation for AES inputs 1 to 4, respectively. When the switch is Off, the associated AES channel pair will be delayed by the amount selected with the delay DIP switches. When the switch is ON, the left and right channels of the pair will be swapped after the delay is added.

DIP 5, 6, 7, 8	Channel Swap Enable
Off	Delay only
On	Delay with channel swap

Table 7: Channel Swap Switch Settings

6. DELAY ADJUSTMENT

The 7740DLY-AES4 is equipped with two 8-position DIP switches (located on the A7700-AES4 sub-board) to allow the user to adjust the delay that will be applied to the AES audio. Each DIP switch is used to set the delay for two AES channels and is measured with respect to the input reference. Table 8 gives an overview of the DIP switch functions. For simplicity the manual will discuss setting the delay for AES inputs 1 and 2 using DIP switch S1. Setting the delay for AES inputs 3 and 4 is identical but uses DIP switch S3.

Switch	Function
1	Fine / coarse selection ON - fine delay mode OFF- coarse delay mode
2 to 8	128 selectable delay values MSB is pin 2, LSB is pin 8

Table 8: Delay DIP Switch Functions

Minimum delay is achieved by setting switches 2 to 8 to "OFF" position. When all are "ON" position, maximum delay is set.

6.1. ADJUSTING FINE DELAY

Delay switch is set to fine mode when switch #1 is ON. Switches 2 to 8 are used as a binary number to set one of 128 possible delay values. The minimum delay when all switches are off and the Sample Rate converter is off is 145 μsec. When the Sample Rate Converter for the AES input is turned On there is an additional delay of 1.8 msec. The incremental delay value between each switch selection is 50 audio samples or approximately 1.04msec. Details are illustrated in Table 8.

Switch							Sample Rate Converter	
2	3	4	5	6	7	8	Off	On
Off	Off	Off	Off	Off	Off	Off	145us	1.92msec
Off	Off	Off	Off	Off	Off	On	1.18msec	2.96msec
Off	Off	Off	Off	Off	On	Off	2.22msec	4.00msec
							-----------	------------
On	On	On	On	On	On	Off	131.36msec	131.6msec
On	On	On	On	On	On	On	132.4msec	134.2msec

Table 8: Delay Selection in Fine Mode

6.2. ADJUSTING COARSE DELAY

Delay switch is set to fine mode when switch #1 is OFF. Switches 2 to 8 are used as a binary number to set one of 128 possible coarse delay values. The incremental delay value between each switch selection is exactly 1 video field for either NTSC (16.68msec) or PAL (20.0msec) reference. Details are illustrated in Table 9 and Table 10.

Switch							Delay		
2	3	4	5	6	7	8	Fields	SRC Off	SRC On
Off	Off	Off	Off	Off	Off	Off	0	210μs	1.95msec
Off	Off	Off	Off	Off	Off	On	1	16.89msec	18.63msec
Off	Off	Off	Off	Off	On	Off	2	33.57msec	35.31msec
								------------	-----------
On	On	On	On	On	On	Off	126	2.10sec	2.10sec
On	On	On	On	On	On	On	127	2.12sec	2.12sec

Table 9: Delay Selection in Coarse Mode with NTSC Reference

Switch							Delay		
2	3	4	5	6	7	8	Fields	SRC Off	SRC On
Off	Off	Off	Off	Off	Off	Off	0	210μs	1.95msec
Off	Off	Off	Off	Off	Off	On	1	20.2msec	21.95msec
Off	Off	Off	Off	Off	On	Off	2	40.2msec	41.95msec
								------------	-----------
On	On	On	On	On	On	Off	126	2.50sec	2.50sec
On	On	On	On	On	On	On	127	2.54sec	2.54sec

Table 10: Delay Selection in Coarse Mode with PAL Reference

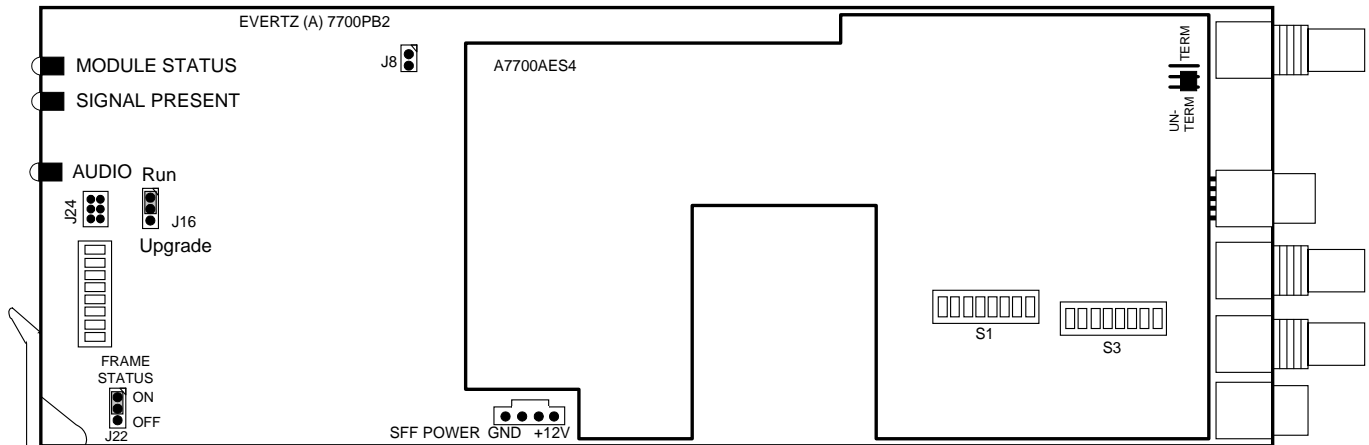# 7. JUMPERS AND USER ADJUSTMENTS

Figure 3: Location of Jumpers on 7740DLY-AES4

7.1. 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.

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.

7.2. 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. See the *Upgrading Firmware* section of this manual 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* section of this manual. 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.

7.3. SELECTING WHETHER THE GENLOCK REFERENCE INPUT IS TERMINATED

TERM/UNTERM   The TERM/UNTERM jumper J2 located on the A7700-AES4 Audio submodule is used to terminate the genlock input. When it is in the TERM position a 75 ohm terminating resistor will be connect the input to ground. When it is in the UNTERM position the genlock input will be high impedance.