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REVISION HISTORY

REVISION	DESCRIPTION	DATE
0.0	Preliminary	Nov 04
1.0	First pass complete. The drawings are missing.	Dec 04
1.0.1	Block diagram and rear panels inserted	Jan 05
	Audio installation instructions added	Oct 05
1.0.2	Audio present LEDs enabled	Mar 06
1.0.3	Added 7736CD2-A8	May 07
1.0.4	General format clean up.	May 09

1. OVERVIEW

The 7736CD2 line of composite analog video to serial digital converters are dual broadcast quality video decoders. The 7736CD2-A4 and the 7736CD2-A8 versions offer four (two per decoded channel) or eight (four per decoded channel) high quality audio analog to digital converters. Faroudja 2D adaptive comb filtering technology has been chosen so as not to introduce moving artifacts from the decoding process. This makes it ideal for use in applications where the signal is destined to enter MPEG compressors. "The low level of moving artifacts reduces the bit-rate required to digitally encode the signal for a given picture quality level by up to 20%.[1]

Traditional adaptive and non-adaptive 2D comb filters can introduce artifacts in areas of high detail. However, "by using adaptive processing incorporating Faroudja's patented H-logic and V-logic interpolation algorithms to control both the comb filter itself and the narrow and wide band chroma filters, these artifacts are substantially reduced not only on horizontal and vertical edges, but on diagonal edges too. In this way, the chroma filters reduce chroma noise without blurring the signal at sharp transitions in any direction".[2]

In addition, control of the card is via an On-Screen Display, or remotely via VistaLINK® SNMP.

Features:

- One input BNC per channel. 75 Ohm or high-Z, jumper configurable input impedance
- Two SDI 525 or 625, 270 Mb/s component digital video output per channel WITHOUT OSD text
- EDH encoding on SDI outputs
- One composite analog video output with OSD text for card control
- One composite analog reference input (NTSC or PAL-B) on BNC. 75 Ohm or high-Z, jumper configurable input impedance. One time base for both channels
- Video frame synchronizer (with +S option)
- Infinitely variable output phase (27MHz clock increments)
- Freeze modes: black, freeze
- Adjustable free running frequency via OSD. Both channels must be free-running to be able to adjust frequency
- A comprehensive On-Screen display is available to configure the various features of the module

The Features of the Decoding Process:

- 12 bit, 8fsc sampling of input video
- Internal processing to maintain 10 bit digital video quality
- Patented Faroudja adaptive 2D comb filtering technology
- Mode for support of non-time base corrected signals
- User configurable luma and chroma detail enhancement
- User selectable noise reduction
- Chroma AGC available, if desired
- User adjustable input video processing functions: black level, gain, hue, and saturation (when chroma AGC is enabled)

[1] Faroudja Laboratories Inc, FLI2000S Data Sheet

[2] Faroudja Laboratories Inc, FLI2000S Data Sheet

The Features of "-A4" and "-A8" Options:

- 4 balanced analog audio inputs (two stereo pair) on 2 removable barrier strips (7736CD2-A4)
- 8 balanced analog audio inputs (four stereo pair) on removable terminal strips (7736CD2-A8)
- High impedance inputs (user terminated for other impedances)
- Analog audio input levels are adjustable. Jumpers/switches set coarse input levels, fine input levels are set by software control
- Audio delay "tracks" video delay (with +S option)
- Additional audio delay of up to 2.5 seconds
- Audio advance of up to 1 frame less 2.5 microseconds
- 2 channels (1/2 group) of audio is multiplexed onto each of the outgoing digital video (7736CD2-A4)
- 4 channels (one full group) of audio is multiplexed onto each of the outgoing digital video (7736CD2-A8)
- 2 unbalanced AES audio outputs using BNC's (7736CD2-A4)
- 4 unbalanced AES audio outputs using DB15 connector (7736CD2-A8)
- 75Ω coaxial (unbalanced) DARS reference input on BNC
- Loss of video modes: pass audio, mute audio

1.1. FUNCTIONAL DESCRIPTION

Composite analog video is converted to 12 bit parallel data and decoded to 4:2:2 digital component using Faroudja™ patented technology. Various video processing functions (gain, saturation, noise reduction, etc) are performed during the decoding process.

In the 7736CD2-A4 version, the 4 channels of audio are converted from balanced analog to digital PCM. In the 7736CD2-A8 version, 8 channels of audio are converted from balanced analog to digital PCM. The digital audio is then delayed to match the delay experienced by the associated video in the video synchronizer (with +S option). This delayed audio (with +S option) is formatted properly and delivered to the user. For the 7736CD2-A4, audio is delivered as unbalanced 75 Ohm AES audio on BNC. For the 7736CD2-A8, audio is delivered as unbalanced AES on a DB15 connector. The same audio is also embedded on the associated SDI output video.

Program video goes to a SDI parallel to serial converter.

The hardware mixes (keys) the on-screen text control information onto one of the video streams (the stream will automatically be selected depending on which video is being controlled). This video goes through a monitoring quality composite encoder with the OSD "burn-ins".

The CPU also gets pushbutton and toggle switch commands from the card edge controls and draws extensive menus for configuring the operation of the card.

The following block diagrams illustrate the processing blocks.

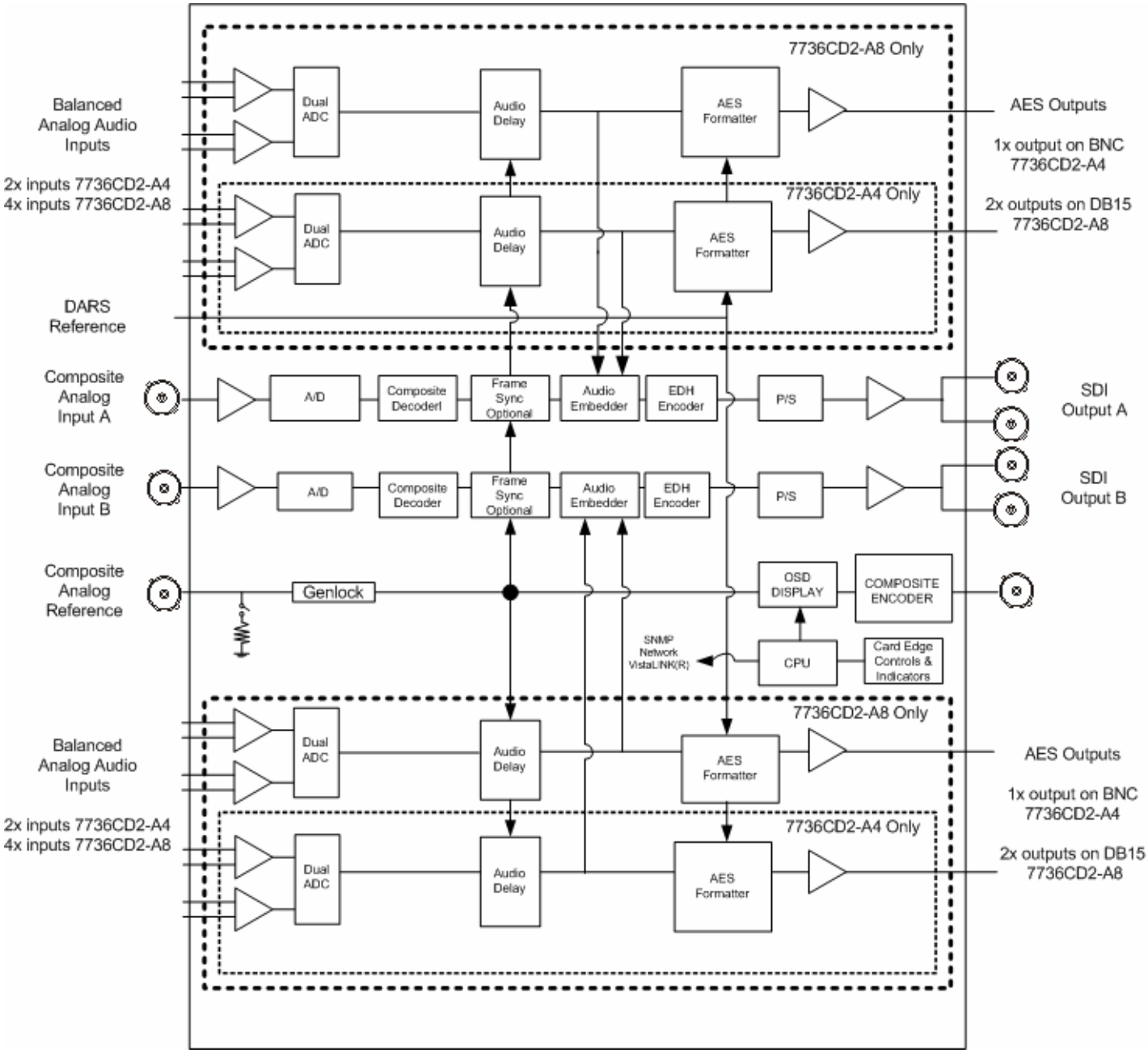


Figure 1-1: 7736CD2, 7736CD2-A4, 7736CD2-A8 Block Diagram

2. Installation

The 7736CD2 modules come with a companion rear plate and occupy one or two slots in the 7700FR frame. Figure 2-1 shows a picture of each of the rear panels. For information on mounting the rear plate and inserting the module into the frame see section 3 of the 7700FR chapter.

The 7736CD2 cards must be inserted into slots with the correct rear panel. Some cards have physical differences and some have functional differences; the associated labels will be misleading.

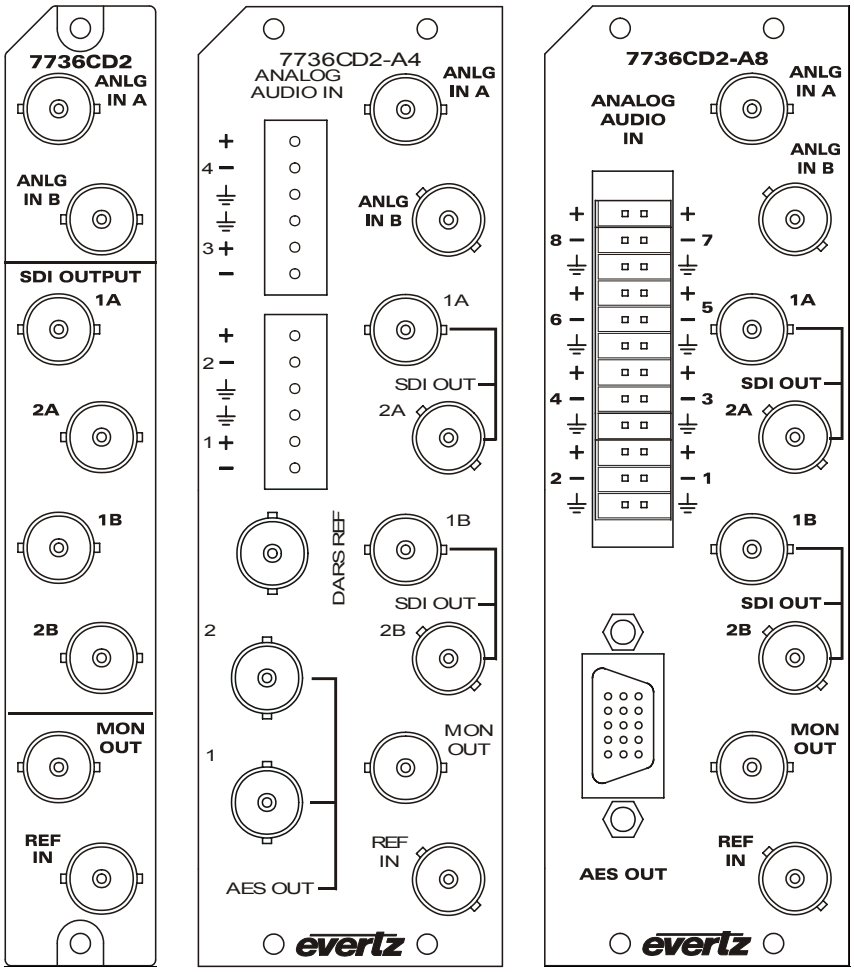


Figure 2-1: 7736CD2 Rear Panels

2.1. VIDEO IN AND OUT

Connect a source of composite analog (NTSC or PAL-B) video to the BNC's labeled ANALOG INPUT. Connect a reference black signal to the REF BNC. Decoded video with embedded audio and EDH encoding is available on the SDI OUT BNC's, two for each channel. Decoded and re-encoded analog video with control text is available on the MON OUT output BNC. If the card is not present or the power is off, there will be nothing on any of the outputs. The card is designed to support two channels of video decoding for video signals that are of the same format.

2.2. AUDIO IN AND OUT

The audio versions of the CDM (-A4 and –A8) have audio paths through the card that are delayed/synchronized with the video. The –A4 version performs A to D conversion on 4 balanced analog inputs (1 stereo pair per video channel), delays the audio to match the associated video, and outputs 1 AES channel that is synchronous to the associated video. One half group of delayed audio is embedded on the output video. The –A8 version performs A to D conversion on 8 balanced analog inputs (4 channels per video), delays the audio to match the associated video, and outputs 2 AES channels that are synchronous to the associated video. One full group of delayed audio is embedded on each video output.

The –A4 version of the CDM uses a removable terminal strip to connect audio. To connect audio, pull out the removable terminal strip and, with a small screw driver, connect bare wires following the connections on the rear panel. If the audio is unbalanced (single-ended), connect the ground to both the ground input and the –ve input while the signal is connected to the +ve input. Push the terminal strip back into the rear panel making sure there is enough slack in the cabling to not put pressure on the connector.

The –A8 version of the CDM uses a slightly different removable barrier strip to connect audio. To connect audio, pull out the removable barrier strip and insert bare audio wires following the connections on the rear plate. Audio wires are secured in the barrier strip with a mechanical spring force. If the audio is unbalanced (single-ended), connect the ground to both the ground input and the –ve input while the signal is connected to the +ve input. Push the barrier strip back into the rear panel making sure there is enough slack in the cabling to not put pressure on the connector

48kHz unbalanced 75 Ohm AES is available on the AES OUTPUT BNCs.

The AES outputs are always synchronous to the output video. This means that the AES is frequency/phase locked to the video with an exact relationship between the number of audio samples and the number of output video frames. If you also need the AES channel status bits aligned with an external source, apply a Digital Audio Reference Signal (DARS) with the reference phase information. The card will automatically align the channel status bits when any AES input signal is detected on the DARS input.

The DARS signal MUST be locked to the same genlock reference signal that the CDM hardware is using. Otherwise, the channel status bits will slip in phase, which may cause downstream AES equipment to detect a problem. When in doubt, do not apply a DARS signal.

3. SPECIFICATIONS

3.1. ANALOG VIDEO INPUT

Standard:	NTSC, SMPTE 170M PAL, ITU624-4
Number of Inputs:	2 (one per video channel)
Connector:	BNC per IEC 61169-8 Annex A
Signal Level:	1V nominal
Frequency Lock Range:	±75ppm from nominal
Input Level Control Range:	±4dB
Black Level Control Range:	±5 IRE
Chroma Level Control Range:	±20% (only available if chroma AGC enabled)
Hue Control Range:	±20 deg. (NTSC only)
Input Impedance:	75 Ohm or High impedance (jumper selectable)
Return Loss:	>35dB to 10MHz
Lock up time on a hot switch:	between 15 and 45 frames (may be longer with noisy signals)

3.2. REFERENCE VIDEO INPUT

Standard:	NTSC, SMPTE 170M PAL, ITU624-4
Number of Inputs:	1 (same reference used for both decoding channels)
Connector:	BNC per IEC 61169-8 Annex A
Signal Level:	1V nominal
Frequency Lock Range:	±75ppm from nominal
Input Impedance:	75 Ohm or High impedance (jumper selectable)
Return Loss:	>25dB to 10MHz

3.3. ANALOG MONITORING VIDEO OUTPUT

Standard:	NTSC, SMPTE 170M PAL, ITU624-4
Number of Outputs:	1
Connector:	BNC per IEC 61169-8 Annex A
Signal Level:	1V nominal
Output Impedance:	75 Ohm
Return Loss:	>35dB to 10MHz

3.4. SERIAL VIDEO OUTPUT

Standard:	SMPTE 259M-C – 525 or 625 line component.
Number of Outputs:	4 (2 per channel)
Connector:	BNC per IEC 61169-8 Annex A
Signal Level:	800mV nominal
DC Offset:	0V ±0.5V
Rise and Fall Time:	900ps nominal
Overshoot:	<10% of amplitude
Return Loss:	>15dB to 270MHz
Jitter	<0.09 UI (all outputs)
Embedded Audio:	SMPTE 272M-A

3.5. DECODER PERFORMANCE (SDI outputs only)

Frequency Response:	<±0.1dB (100kHz to 4.2MHz)
Differential Gain:	<±0.5% typical
Differential Phase:	<±0.2 deg. Typical
Noise Floor:	< -57dBrms (Y ramp, 15kHz to 5MHz) < -60dBrms (black video, 15kHz to 5MHz)
C/L Gain:	<±0.5%
C/L Delay:	<±9ns
Minimum Delay:	3.25 lines
Maximum Delay:	1 frame plus 3.25 lines
Inter-channel crosstalk:	Within noise floor measurement

3.6. ANALOG AUDIO INPUT (-A4 and –A8 versions only)

Number of Inputs:	4 (2 per video channel) for –A4 version 8 (4 per video channel) for –A8 version
Type:	Balanced analog audio
Connector:	Removable terminal strip (-A4 version) Removable barrier strip (-A8 version)
Input Impedance:	20kOhm minimum (differential)
Sampling Frequency:	48kHz
Signal Level:	0dBFS => 18 or 24dBu (jumper selectable)
Level Control Range:	+/- 10dB
Frequency Response:	+/- 0.1dB (20Hz to 20kHz) (broadcast quality)
SNR:	100dB with input at -0.5dBFS
THD+N:	<0.001% (>100dB) @ 1kHz, -0.5 dB FS (rev 2) <0.001% (>100dB) @ 20Hz to 20kHz, -0.5 dB FS (input video locked to genlock video)
CMRR	>100dB @ 1kHz

3.7. AES AUDIO OUTPUTS

Number of Outputs:	2 for –A4 version (1 per video channel) 4 for –A8 version (2 per video channel)
Output Standard:	SMPTE 276M, single ended synchronous AES
Connectors:	BNC per IEC 61169-8 Annex A for –A4 version DB15 connector for –A8 version
Resolution:	24 bits
Sampling Rate:	synchronous 48kHz
Minimum I/O Delay:	2.1msec
Maximum I/O Delay:	2.5 seconds

3.8. ELECTRICAL

Voltage:	+ 12VDC
Power:	12 Watts CD2 version 21 Watts –A4 version 19 Watts –A8 version
EMI/RFI:	Complies with FCC Part 15, class A and EU EMC directive

3.9. PHYSICAL

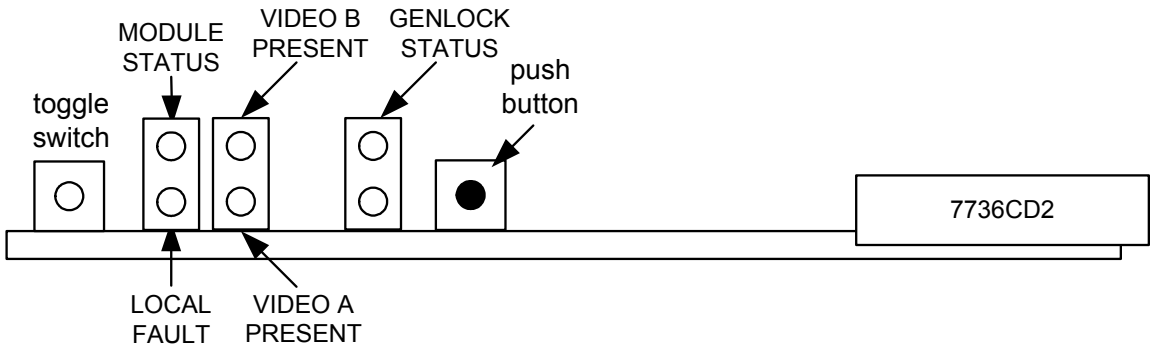
350FR:	2
7700FR-C	2
7700FR-C	2

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

4.1. MODULE STATUS LEDS



MODULE STATUS: 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 when there is a fault in the module power supply or a user configurable error condition exists.

VIDEO A, VIDEO B: The VIDEO Green LEDs (status for input A is the LED closest to the PCB and status for input B is away from the PCB). These LEDs will indicate the video presence of the composite analog inputs.

GENLOCKED: This Green LED is on solid if the user selected genlock source (either external input or from the frame) is present and the user has turned on genlocking.

It is flashing if the user has turned on genlocking and the selected genlock source is not present.

It will be off if the user has turned genlocking off.

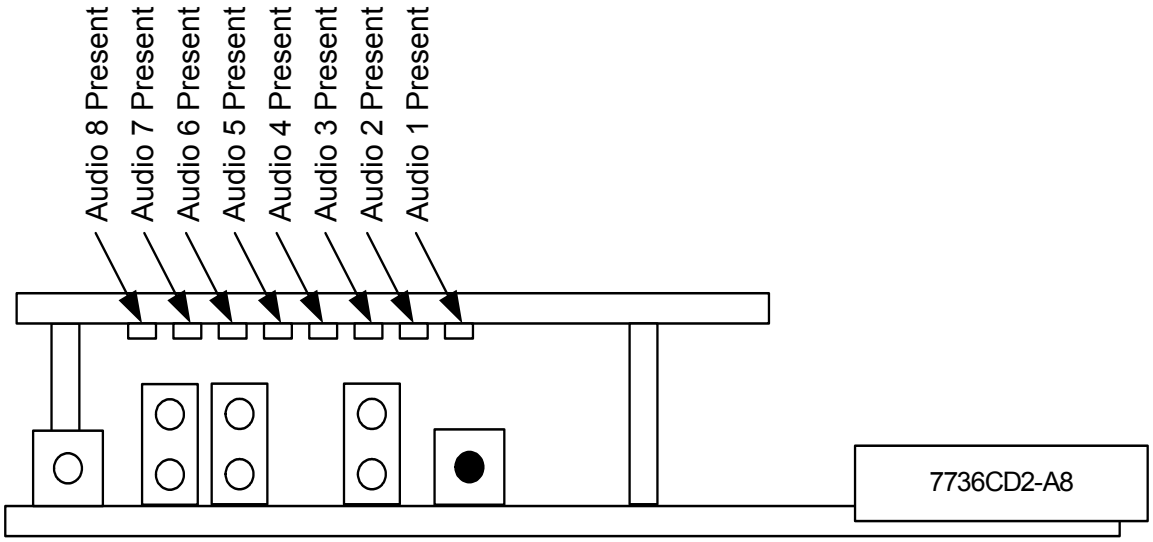
4.2. AUDIO STATUS LEDS

Four LEDs located on the lower end of the module (near the card extractor) indicate which audio channels are present. Audio channel 1 LED is located closest to the center of the module. Analog audio (on -A4 versions) presence is determined with a silence detector. If the audio is not silent, the LED will be on.

Audio LED	Colour	Audio Channel Status
1	Off	No channel 1 present.
	Green	Channel 1 present.
2	Off	No channel 2 present.
	Green	Channel 2 present.
3	Off	No channel 3 present.
	Green	Channel 3 present.
4	Off	No channel 4 present.
	Green	Channel 4 present.

Table 4-1: Audio Channel Status LEDs (-A4 Version)

Eight bi-colour (Red and Green) LEDs located on the edge of the audio sub-board indicate which audio channels are present. Audio channel 1 LED is located at the top of the sub-module. This analog audio presence is determined based on level peaks. If the converted audio peaks rise above –60 dBFS, the corresponding Green LED will be on. If the converted audio peaks reach above –1 dBFS, the corresponding Red LED will also light up to indicate clipping proximity warning.



Audio LED	Colour	Audio Channel Status
1	Off	No channel 1 present.
	Green	Channel 1 present (above –60 dBFS).
	Red+Green	Channel 1 level nears clipping (above –1 dBFS).
2	Off	No channel 2 present.
	Green	Channel 2 present (above –60 dBFS).
	Red+Green	Channel 2 level nears clipping (above –1 dBFS).
3	Off	No channel 3 present.
	Green	Channel 3 present (above –60 dBFS).
	Red+Green	Channel 3 level nears clipping (above –1 dBFS).
4	Off	No channel 4 present.
	Green	Channel 4 present (above –60 dBFS).
	Red+Green	Channel 4 level nears clipping (above –1 dBFS).
5	Off	No channel 5 present.
	Green	Channel 5 present (above –60 dBFS).
	Red+Green	Channel 5 level nears clipping (above –1 dBFS).
6	Off	No channel 6 present.
	Green	Channel 6 present (above –60 dBFS).
	Red+Green	Channel 6 level nears clipping (above –1 dBFS).
7	Off	No channel 7 present.
	Green	Channel 7 present (above –60 dBFS).
	Red+Green	Channel 7 level nears clipping (above –1 dBFS).
8	Off	No channel 8 present.
	Green	Channel 8 present (above –60 dBFS).
	Red+Green	Channel 8 level nears clipping (above –1 dBFS).

Table 4-2: Audio Channel Status LEDs (-A8 version)

4.3. Audio Break-Out Cable (7736CD2-A8 only)

AES audio is generated and output to a DB15 connector. The pin-out of this connector is as follows:

Break-out Cable Label	Description	DB-15 Pin
	Reserved for future use	1
	Reserved for future use	2
	Reserved for future use	3
	Reserved for future use	4
	Reserved for future use	5
	Reserved for future use	6
AES A2	Reserved for future use	7
	Reserved for future use	8
AES B2	AES output 2 - unbalanced	9
AES B1	AES output 1 – unbalanced	10
AES A1	Reserved for future use	11
AES B4	AES output 4 – unbalanced	12
AES B3	AES output 3 - unbalanced	13
AES A4	Reserved for future use	14
AES A3	Reserved for future use	15
GND	Ground	Shell

Table 4-3: AES Audio Breakout Cable (Evertz Part # WPAES8-BNCM-6F)

6. AUDIO BUFFER MANAGEMENT (+S OPTION ONLY)

The audio is delayed, through a large memory buffer, by the same time value as experienced by the video through the video frame synchronizer. This is done to maintain a consistent video/audio relationship. Unfortunately, when the video frame buffer drops or repeats frames of video, we cannot do the same with the audio. The rate of the ingoing audio data is changed and over a period of time, the buffer is returned to a value that matches the video. TA sample rate converter is used to change the rate of the incoming AES on the -AES version. The 48kHz sampling clock is changed slightly from its nominal value on the analog audio input (-A4 or –A8) version. This method is also used when video is first applied or there is a sudden change in either the input video phase or genlock video phase.

When the audio buffer delay needs to be changed, there are two rates used; +/- 1% and +/- 30ppm. Initially, a 1% rate change is used to quickly match the audio delay to the video delay. This correction will only take a couple of seconds but will produce a pitch change. The pitch change will be discernable, particularly on sustained musical notes. When the video/audio delays are close to each other and only small corrections are required, the audio buffer will be adjusted with a rate change of 30ppm (30 Parts-Per-Million is equivalent to 0.003%). This rate change will produce a pitch change that is near the threshold of where a human can detect it and should not be discernable with normal content.

Unfortunately, the audio buffer management relies on a sample rate converter (-AES versions only) to adjust the audio buffer size. This precludes the synchronization of non-PCM AES data (i.e. Dolby-E™). In the future, a non-sample rate converter mode may be available.

Audio A to D converters and sample rate converters have inherent delays that are much longer than what the minimum acceptable video I/O delay is. To allow the user to operate the video synchronizer with small video delays, we will hold the audio buffer delay at its minimum value when the video is less than this minimum.

7. AUDIO LEVELS, HEADROOM, AND CLIPPING (-A4 and –A8)

This section contains notes to understand how both the 7736CD2-A4 and 7736CD2-A8 relates analog audio levels, and digital audio levels.

Before you can calibrate the audio analog to digital converter, you must know a couple of system issues specific to your application. What is your analog reference level and how much headroom do you want to have in the digital audio signal? By adding these two values together, you will get the analog input level that will just begin to saturate the digital word (This is the highest level that can be represented without distortion with the digital numbers). This level is called 0dBFS (FS stands for "full scale"). For instance, if your analog program reference level is 4dBu and you want 20dB of headroom in the "digital world", then 0dB FS will correspond to an analog level of 24dBu. Once the audio input level is calibrated, when you apply a 4dBu analog signal, the digital level will be –20dBFS.

The SDI embedded audio, and the AES output audio are based on the digital quantized signal. Use either digital audio output signal to calibrate the analog input levels.

7.1. INPUT AUDIO LEVEL CALIBRATION

The analog audio input circuitry has two gain control stages before the audio is digitized; a coarse range (settable using jumpers in –A4 or miniature DIP switches in –A8), and a software (menu system) control. One of the two coarse ranges is optimized for when peak audio levels are above 18dBu and one for levels below. The jumpers, when not installed, allow input levels of up to 24dBu. When the jumpers are installed, best performance is achieved when input peak levels are below 18dBu. The OSD menu system has independent +/- 10dB audio level control of all four channels (see section 8.5.5 for OSD control details).

The following is an example calibration procedure:

1. Take your analog program reference level and add the amount of desired headroom in the digital signal (SMPTE standard is 20dB). If this number is greater than 18dBu, then remove the 8 jumpers near the rear of the 7736CD2-A4 module (on 7736CD2-A8 you would slide coarse range switches as pointed by +24dBu arrow on the module). If the number is less than 18dBu, then install the 8 jumpers (on 7736CD2-A8, slide coarse range switches as pointed by +18dBu arrow).
2. Apply an analog audio signal of the level calculated above (maximum peak level).
3. Apply composite analog video to the "ANALOG IN" BNC.
4. Monitor either the embedded audio or the output AES audio with appropriate level measuring gear.
5. Adjust the *level adjust* controls in the *audio* menu so that the digital level just starts to clip.
6. Verify by applying program reference level. The output level should read at the desired reference level.

More information:

With (the common North American) +24 dBu coarse range setting in place and 0 dB gain control, the conversion will transform +24 dBu analog input to 0 dBFS digital signal. Gain control will allow adjustment of this setting +/-10 dB in 0.5 dB increments (see section 8.5.5 for OSD control details). The user has to be aware that the front-end analog amps will saturate (clip) at +27 dBu independently of adjustable fine gain/attenuation stage and the ADC stage.

With "+18 dBu" coarse range setting in place and 0 dB gain control, the conversion will transform +18 dBu analog input to 0 dBFS digital signal. Gain control will allow adjustment of this setting +/-10 dB in 0.5 dB increments (see section 8.5.5 for OSD control details). The user has to be aware that the front-end analog amps will saturate (clip) at +21 dBu independently of adjustable fine gain/attenuation stage and the ADC stage.

8. ON SCREEN MENUS

8.1. NAVIGATING THE ON SCREEN MENU SYSTEM

A toggle switch and pushbutton allows card edge navigation of a set of On-Screen menus used to configure the card. On-Screen menus are available only on the MONITOR output for the 7736CD2 series of cards to ensure that On-Screen menus are not accidentally put on-air.

To enter the On-Screen menu system, press the pushbutton once. This will bring you to the main setup menu where you can use the toggle switch to move up and down the list of available sub-menus. An arrow (>) moves up and down the left hand side of the menu items to indicate which item you are currently choosing. Once the arrow is on the desired item, press the pushbutton to select the next menu level.

On all menus, there are two extra selectable items: *Back* and *Exit*. Selecting *Back* will take you to the previous menu (the one that was used to get into the current menu) while *Exit* will return the display to its normal operating mode. On the main menu, BACK and EXIT will both take you to the normal operating mode.

Once in a sub-menu, there may be another menu layer, or there may be a list of parameters to adjust. If there is another set of menu options, use the toggle switch to select the desired menu item and press the pushbutton.

To adjust any parameter, use the toggle switch to move up or down to the desired parameter and press the pushbutton. The arrow will move to the right hand side of the line (<) indicating that you can now adjust the parameter. Using the toggle switch, adjust the parameter to its desired value. If the parameter is a numerical value, the number will increase if you lift the toggle switch and decrease if you push down on the toggle switch. If the parameter contains a list of options, you can cycle through the list by pressing the toggle switch in either direction.

When you have stopped at the desired value, depress the pushbutton. This will update the parameter to the selected value and move the arrow back to the left side of the parameter list (>). Continue selecting and adjusting other parameters or use the BACK or EXIT commands.

8.2. ON SCREEN DISPLAY – MAIN MENU

Channel 1	Configuration of the parameters associated with channel 1 video and audio.
Channel 2	Configuration of the parameters associated with channel 2 video and audio.
Genlock	Configures genlocking items that are shared between channels.
Utilities	Card preset management, upgrading and various debug and maintenance features.
Video 1 =	Status of channel 1.
Video 2 =	Status of channel 2.
Genlock =	Status of genlock input.

The OSD menu is arranged in a layered structure that groups similar configuration items together. Selecting one of these items will take you to the next menu level. The following sections provide detailed descriptions of each of the sub-menus. The tables are arranged in an indented structure to indicate the path taken to reach the control. Menu items or parameters that are underlined indicate the factory default values.

Video 1 =, *Video 2* =, and *Genlock* = provide video presence status information for the appropriate input.

8.3. ON SCREEN DISPLAY – CHANNEL X MENU

Channel X Video	Configuration of the parameters associated with channel X video.
Channel X Audio	Configuration of the parameters associated with channel X audio.

The *Channel* X menus, for each channel, are identical. For simplicity, only one is described.

8.4. CONFIGURING THE VIDEO CONTROLS

The *Video* menus are used to configure parameters associated with the video processing functions. The chart below shows the items available in the *Video* menu. The following sections provide detailed information about each of the parameters.

Ch X Analog Video processing	Selecting this item takes you into the *Analog* Video Processing Menu.
Loss of video	Selects the action to take when the input video is missing.
525 H phase	Sets the horizontal phase of the output signal to a NTSC Genlock reference input.
625 H phase	Sets the horizontal phase of the output signal to a PAL Genlock reference input.
H Delay	Status display that shows the current horizontal input to output delay.
525 V phase	Sets the vertical phase of the output signal to a NTSC Genlock reference input.
625 V phase	Sets the vertical phase of the output signal to a PAL Genlock reference input.
V Delay	Status display that shows the current vertical input to output delay.
Audio buffer	Status of audio delay buffer.

8.4.1. Selects the Action to Take when Input Video is Missing

Video
  Loss of video
  Freeze
  Black
	The user can either have the output video go to black, or freeze the last good video picture at the input with this control.

8.4.2. Setting the Horizontal Phase of the Output Video – NTSC/525 Video

Video
525 H phase
0 to 1715 0

With this control, you can set the horizontal timing of the output video with respect to the Genlock reference input when operating in NTSC/525 video mode. Setting this control to 0, keeps the monitoring output video in time with the Genlock reference. The SDI output will be a couple of microseconds advanced to the Genlock reference. Increasing the value will delay the output video in one-sample increments.

8.4.3. Setting the Horizontal Phase of the Output Video – PAL-B/625 Video

Video
625 H phase
0 to 1727 0

With this control, you can set the horizontal timing of the output video with respect to the Genlock reference input when operating in PAL/625 video mode. Setting this control to 0, keeps the monitoring output video in time with the Genlock reference. The SDI output will be a couple of microseconds advanced to the Genlock reference. Increasing the value will delay the output video in one-sample increments.

8.4.4. Monitoring the Horizontal Delay between the Input and Output Video

Video
H Delay

This item displays the horizontal delay between the input and output video. This value is useful to monitor while you are adjusting the H phase parameters and debugging system issues. One count is equivalent to 8 clocks of 27Mhz video.

8.4.5. Setting the Vertical Phase of the Output Video – NTSC/525 Video

Video
525 V phase
0 to 524 0

With this control, you can set the vertical timing of the output video with respect to the Genlock reference input when operating in 525 video mode. Setting this control to 0 keeps the output video in time with the Genlock reference. Increasing the value will delay the output video in one-line increments.

8.4.6. Setting the Vertical Phase of the Output Video – PAL-B/625 Video

Video
625 V phase
0 to 624 0

With this control, you can set the vertical timing of the output video with respect to the Genlock reference input when operating in 625 video mode. Setting this control to 0, keeps the output video in time with the Genlock reference. Increasing the value will delay the output video in one-line increments.

8.4.7. Monitoring the Vertical Delay between the Input and Output Video

Video
V Delay

This item displays the vertical delay, measured in lines, between the input and output video. This value is useful to monitor while you are adjusting the V phase parameters and debugging system issues.

8.4.8. Monitoring the Audio Buffer Tracking

Video
Audio buffer

This item displays the status of the audio tracking buffer. It can be one of these states:

- Emptying (-1%)
- Emptying (-30 ppm)
- locked
- Filling (30 ppm)
- Filling (1%)

1% filling or emptying will have a slight pitch change that is near the edge of human perception for normal audio program material. This mode will be engaged when a large amount of delay needs to be changed quickly (video frame drops/repeats).

30ppm filling or emptying will be used to make minor delay buffer changes.

"Locked" will indicate that the video and audio buffers match.

The delay of the audio through the audio buffer always tracks the video except when the video frame synchronizer drops or repeats frames of video or the user supplies a different phase of input video. Unfortunately, at these boundary conditions, we cannot simply drop or repeat sections of audio. A rate conversion process is used to fill or empty the buffer to the desired level. The process must be spread out over a period of time so that the action is not audible.

This indicator is mainly used at the Evertz factory and may also be useful to monitor in order to help in debugging system issues.

8.5. CONFIGURING THE AUDIO CONTROLS (-A4 and -A8)

The *Audio* menu is used to configure parameters associated with the audio inputs and the audio multiplexing. The chart below shows the items available in the *Audio* menu. The following sections provide detailed information about each of the parameters. Many of the menu items are the same for the channel ½ and ¾ channel pairs (-A4 version) or channel 1/2/3/4 and channel 5/6/7/8 (-A8 version). For simplicity only the menu items for the channel 1/2/3/4 are shown in the manual.

Loss of video	Selects the action to take when input video is missing.
Audio destination	Selects the destination group of audio.
Audio delay	Additional, user desired, delay may be added to the audio.
Audio buffer	The audio buffer management status may be monitored with this item.
Ch 1 adjust	Channel 1 level control.
Ch 2 adjust	Channel 2 level control.
Ch3 adjust	Channel 3 level control.
Ch4 adjust	Channel 4 level control.
Ch1/ch2 processing	Controls whether the channel 1 and 2 (L/R) inputs will be swapped.
Ch3/Ch4 processing	Controls whether the channel 3 and 4 (L/R) inputs will be swapped.

8.5.1. Selecting the Audio Destination Group

Audio		
	Loss of video	
		Mute
		Pass

This control selects the action to take when the input video is not applied. The output audio will either be muted or processing will continue as normal. Both the AES outputs and the multiplexed audio are affected.

Warning: When set to *Pass* and input video is removed, the audio buffer will change delay creating a pitch change in the audio. Do not expect to use the audio for high quality applications when the video is removed.

8.5.2. Selecting the Audio Destination Group

Audio		
	Audio destination	
		Group 1
		Group 2
		Group 3
		Group 4
		None

Up to 4 groups of audio may be embedded on SDI video. This control selects the group ID of the multiplexed output audio. The input audio will be put in this group. When set to *None*, the audio will only be available on the AES output.

The –A4 has only one stereo pair per group. A copy of this stereo pair is placed in audio positions 3 and 4 within the group.

8.5.3. Additional Audio Delay

Audio	Audio delay	
		0
		-37ms to 2.5sec in 0.5ms increments

In addition to delaying the audio the same amount that the video is being delayed (in the video frame synchronizer), additional user requested delay may be added or removed with this control.

WARNING: Both the embedded audio AND the external AES audio are delayed by this amount.

WARNING: It takes approximately 1 minute, 40 seconds to adjust the audio delay by one second. This is required by the buffer management algorithm when changing the audio buffer size at a 1% rate without muting the audio. This long buffer adjusting will happen on power-up or when a new user supplied value is set with this control. However, the audio is still usable while the buffer is being adjusted. This is good for "On-Air" adjustment of audio delays!

NOTE: Advancing audio can only happen when video is undergoing a delay that is greater than the audio! If the system configured video delay becomes too small, the audio buffer shrinks to it's smallest delay and stays at that value.

8.5.4. Monitoring the Audio Buffer Tracking

Audio	Audio buffer

This item displays the status of the audio tracking buffer. It can be one of these states:

- Emptying (-1%)
- Emptying (-30 ppm)
- locked
- Filling (30 ppm)
- Filling (1%)

1% filling or emptying will have a slight pitch change that is near the edge of human perception for normal audio program material. This mode will be engaged when a large amount of delay needs to be changed quickly (video frame drops/repeats).

30ppm filling or emptying will be used to make minor delay buffer changes.

"Locked" will indicate that the video and audio buffers match.

The delay of the audio through the audio buffer always tracks the video except when the video frame synchronizer drops or repeats frames of video or the user supplies a different phase of input video. Unfortunately, at these boundary conditions, we can not simply drop or repeat sections of audio! A rate conversion process is used to fill or empty the buffer to the needed level. The process must be spread out over a period of time so that the action is not audible.

This indicator is mainly used at the Evertz factory and may also be useful to monitor in order to help in debugging system issues.

8.5.5. Setting the Analog Levels

There are 2 menu items to adjust the levels of each of the analog audio inputs. For simplicity only the menu for channel 1 will be shown in the manual.

Audio
Ch1 adjust
-20 to 20
0

The channel input level is adjusted with this control. It has a range of approximately +/- 10 dB with 1/2dB resolution.

For more details about setting the input level jumpers, see section 7.1

8.5.6. Audio Channels 1 and 2 Processing and Audio Channels3/4 Processing (-A8 version only)

Audio
Ch1/ch2 processing
Pass
Swap

Basic audio channel manipulation is possible with this control.

Pass, routes both input channels straight through, while *Swap*, routes the two channels to the opposite channel output of the pair.

Audio
Ch3/ch4 processing
Pass
Swap

Basic audio channel manipulation is possible with this control.

Pass, routes both input channels straight through, while *Swap*, routes the two channels to the opposite channel output of the pair.

8.6. CONFIGURING THE ANALOG VIDEO PROCESSING CONTROLS

The *Analog Video Processing* menu is used to configure parameters associated with the composite decoder video processing. The chart below shows the items available in the *Analog Video Processing* menu.

NTSC setup pedestal	Selects whether the NTSC 7.5 IRE pedestal will be removed from the composite analog input video.
Line 21	Controls line 21 processing.
Black level	Controls the input video black level.
Video level	Controls the input video level.
Chroma level	Controls the input video saturation.
Hue	Controls the input video hue.
TBC mode	On/off mode control of processing of non Time Base Corrected video.
Detail enhancement threshold	Controls when the image enhancement is enabled.
Detail enhancement level	Controls the amount of image enhancement when threshold is exceeded.
Noise reduction	Controls the amount of noise reduction.

8.6.1. Removing the NTSC Setup Pedestal

Video
Analog Video Processing
NTSC setup pedestal
Remove
Don't remove

Composite NTSC analog video may have a 7.5 IRE pedestal while 4:2:2 SDI video does not. This control, when set to *remove*, will remove the pedestal and re-scale the video accordingly. The setup pedestal should not be present on composite video when operating in Japan.

8.6.2. Line 21 Processing

- *Video*
  - *Analog Video Processing*
    - *Line 21 setup*
      - *Remove setup,*
      - *Don't remove setup,*
      - *Blank*

Closed captioning has been defined to NOT have a 7.5 IRE pedestal, but it is placed on the first active line of video where there may be a pedestal. This depends on the upstream closed captioning and/or composite encoder that generated the video. When decoding composite video with closed captioning, care must be taken to not remove a pedestal if it is not there.

This control, when set to *Don't remove setup*, will not remove 7.5 IRE pedestal from line 21. This is the default state for properly generated captioning.

When set to *Remove setup*, the 7.5 IRE pedestal will be removed from line 21. Note that this state is only valid if the preceding NTSC Setup Pedestal control is set to "Remove".

Blank is used to remove captioning from line 21. This is most useful for removing captioning when going into an up-converter.

8.6.3. Black Level

- *Video*
  - *Analog Video Processing*
    - *Black level*
      - *-128 to 127*
      - *0*

This controls the black level of the decoding process. You have greater than +/- 5 IRE range on this control.

Note: Make sure to select the proper setup pedestal removal before setting this control. Don't set the video level control until after you have set this control properly.

8.6.4. Video Level

- *Video*
  - *Analog Video Processing*
    - *Video level*
      - *-180 to 75*
      - *0*

This controls the input video level of the decoding process. You have greater than +/-4dB range on this control.

Note: Make sure to select the proper setup pedestal removal and calibrate the black level before setting this control.

8.6.5. Chroma Level

- *Video*
  - *Analog Video Processing*
    - *Chroma level*
      - *off,*
      - *-32 to 32*

The default "*off*" position of this control will, in the decoding process, correctly scale the chroma as per SMPTE-170M/125M. If you need to adjust the chroma level or want to use chroma AGC (Automatic Gain Control) to automatically adjust chroma gain based on the burst level, change the value to a numerical setting that gives you proper unity gain. The value should be near zero. You have greater than +/- 20% (+/- 1.5dB) range with this control.

8.6.6. Hue

Video	
Analog Video Processing	
Hue	
	-64 to 64 0

The hue of the decoded signal can be adjusted with this control. You have greater than +/- 20 deg. range with this control.

8.6.7. TBC Mode

Video	
Analog Video Processing	
TBC Mode	
	off, on

On/off mode control of processing of non-Time Base Corrected video input signals is affected by this menu item.

When set to *"On",* the input video processing is modified to be more tolerant of non-time base corrected signals. As a sacrifice, the freezing control of the frame synchronizer will not be as sensitive to video that suddenly changes phase or is "hot-switched" to a different signal phase.

When *"Off",* non-time base corrected signals will not allow the frame synchronizer to come out of freeze due to the line length variations created by the VTR. However, time base corrected signals, when switched, will properly freeze the frame synchronizer with a good image during the switch.

8.6.8. Detail Enhancement Threshold

Video	
Analog Video Processing	
Detail Threshold	
	very low, low, medium, high

Experimentally, set this to a level that will apply detail/edge enhancement without enhancing the input noise.

Lower thresholds will apply enhancement to smaller edge transitions thus bringing out smaller details. Unfortunately, if the threshold is set too low, input noise will eventually be enhanced making the picture look noisier.

8.6.9. Detail Enhancement Level

Video	
Analog Video Processing	
Detail Enhancement Level	
	off, 1..15

When an edge passes the threshold set with the previous control (Detail Enhancement Threshold), the amount of enhancement is selected with this control. The higher the number, the more enhancement is applied.

8.6.10. Noise Reduction

Video
Analog Video Processing
Noise Reduction
Off
On

When turned on, a small amount (~ 0.7dB RMS) of wideband noise reduction is applied to the signal. The noise reduction gracefully turns on as the signal level amplitude lowers below about –25dB RMS. Signals above this are probably image detail and not noise. Also, this graceful "turn-on" eliminates artifacts if sudden on/off application of noise reduction was applied.

8.7. CONFIGURING THE GENLOCK CONTROLS

The *Genlock* menus are used to configure parameters associated with both video processing channels. The chart below shows the items available in the *Genlock* menu. The following sections provide detailed information about each of the parameters.

Video standard	Selects the card operating video standard.
Genlock source	Selects the input source for the reference signal.
Free-run freq	Sets the VCXO free-running frequency.

8.7.1. Setting the Video Standard

Genlock
Video standard
NTSC/525
PAL-B/625

The video standard is selected with this control.

Note: Auto mode is not available. It would cause inter-channel standard selection arbitration issues.

8.7.2. Genlock Source Selection

Genlock
Genlock source
Ref. 1,
Ref. 2, card ref.
None

This control allows you to select the reference video input to the frame synchronizer. The reference must be an externally supplied colour black. Optionally, the synchronizer can be free-run if the "none" option is selected.

There are three possible sources of reference video; the *card ref*erence input BNC and two reference inputs (*Ref. 1* and *Ref. 2*) on the frame (7700FR-G only).

Make sure to adjust the video H and V output phase controls to calibrate the output phase of each of the videos.

Not available will be displayed if the +S option was not purchased.

8.7.3. Setting the Free-Running Frequency

Genlock
Free-run freq
-256 to 256
0

This control allows you to calibrate the free-running frequency of the on-board Voltage Controlled Crystal Oscillator (VCXO). This oscillator provides the time-base when either operating without a reference input (free-running) or when running with a reference and the reference video is removed.

To calibrate the free-running frequency, use this or a similar procedure:

- Turn off genlocking with the "Genlock source" control or remove reference video from the reference input. Wait for the VCXO to stabilize at its free-running frequency.
- Apply the composite analog monitoring output video to a vector scope that is externally referenced to the signal (usually plant reference black) that you are trying to frequency match.
- Adjust this control until the vectors spin slowly.
- Turn genlocking back on or apply reference video.

8.8. UTILITIES

8.8.1. Accessing Information about this Module and its Firmware

Utilities
About…

This menu item lists the particulars about this module and the firmware residing within it. It gives quick access to information about revisions that can be used to determine when upgrades are required.

8.8.2. Saving and Recalling Configurations

The CD2 modules provide two user preset areas to save the complete set of control from the On-Screen menu. The *Store preset* and *Recall preset* menu items are used to save and recall these configurations.

For simplicity the following sections of the manual show how to store and recall from Preset 1 only.

8.8.2.1. Storing Configurations to the User Presets

Utilities
Store preset 1
Store
Cancel

This control is used to initiate a store of the current card configuration into one of the user presets

After selecting the store preset operation, you must change the command to *Store* and press the pushbutton before the store will take place. You can abort the operation by pressing the pushbutton when *Cancel* is displayed.

8.8.2.2. Recall Configurations from the User Presets

Utilities
- *Recall preset 1*
  - *Recall,*
  - *Cancel*

This control is used to initiate a recall of the current card configuration from one of the user presets

After selecting the recall preset operation, you must change the command to *Recall* and press the pushbutton before the store will take place. You can abort the operation by pressing the pushbutton when *Cancel* is displayed.

Warning: there will be a slight disturbance in the operation of the card and the On-Screen display while the new preset is being recalled.

Warning: the current state of the card will be forgotten if it has not been saved to a preset before a recall is performed.

8.8.3. Initiating a Software Upgrade

Utilities
- *Upgrade*
  - *Yes*
  - *Cancel*

This menu item is used to initiate an upgrade of the module software.

In addition to the software upgrade support detailed in this manual (See the *Upgrading Firmware* section of this manual for more information), you can initiate an upgrade with this command. This will allow you to upgrade the software without unplugging the card and changing the upgrade jumper.

After selecting the upgrade operation, you must change the command to *Yes* and press the pushbutton before the upgrade can take place. You can abort the operation by pressing the pushbutton when *Cancel* is displayed.

After the upgrade has finished, the unit will automatically restart and run in normal operating mode.

8.8.4. Restoring the Factory Default Configuration

Utilities
- *Factory reset*
  - *Yes*
  - *Cancel*

This menu item is used to restore all controls back to their factory defaults.

After selecting the reset operation, you must change the command to *Yes* and press the pushbutton before the command takes place. After the command, all parameters will be set to their factory default. You can abort the operation by pressing the pushbutton when *Cancel* is displayed.

9. JUMPERS

9.1. TERMINATION JUMPERS

REF TERM: The REF TERM jumper J22 located on the rear of the 7736CD2 board near the white multi-pin connectors selects the reference video termination impedance. Either 75Ω or a high-Z (27kΩ) termination impedance can be selected by placing the jumper in the "75" (top justified) or "HI-Z" (bottom justified) positions, respectively.

CH1, 2 TERM: The CH1 and CH2 TERM jumpers located on the rear of the 7736CD2 board near the white multi-pin connectors, selects the video input termination impedance. Either 75Ω or a high-Z (27kΩ) termination impedance can be selected by placing the jumper in the "75" (bottom justified) or "HI-Z" (top justified) positions, respectively.

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

FRAME STATUS: The FRAME STATUS jumper J3, located at the bottom of the module, near the card extractor on the 7736CD2 board, 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. (Default)
When this jumper is moved to the OFF position, local faults on this module will not be monitored.

9.3. CONFIGURING THE MODULE FOR FIRMWARE UPGRADES

The following method can be used to upgrade the firmware in the card. You can also use the *UPGRADE* menu item located on the *UTILITIES* menu to upgrade the firmware.

UPGRADE: The UPGRADE jumper J2, located at the front edge of the 7736CD2 board above the card extractor, 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 J2 into the *UPGRADE* position. Install the Upgrade cable provided (located in the vinyl pouch in the front of this manual) onto header J1 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 J2 into the *RUN* position, remove the upgrade cable and re-install the module. The module is now ready for normal operation.

9.4. SETTING THE COARSE ANALOG INPUT GAIN RANGE

J13, J12, J6, J30: Eight Jumpers located near the rear of the A7735AI2 submodule are used to set a coarse gain level.

When the jumpers are not installed (or installed so that only one side is connected), the input range is optimized for when peak audio levels up to 24dBu. (Default)

When the jumpers are installed, best performance is achieved when input peak levels are below 18dBu.